CLIENT: COOLPOWRA FLEX GEN LIMITED

PROJECT NAME: COOLPOWRA

PROJECT DETAILS: DEVELOPMENT OF A RESERVE GAS-FIRED GENERATOR, ENERGY STORAGE SYSTEM FACILITY AND GIS SUBSTATION IN THE TOWNLANDS OF COOLPOWRA, COOLDORRAGHA, BALLYNAHESKERAGH, GORTLUSKY, AND SHEEAUNRUSH, CO GALWAY

DOCUMENT: ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) ADDENDUM

EIAR ADDENDUM

DATE JANUARY 2026

PROJECT REF. SEP-0398

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Document Control

Client:	Coolpowra Flex Gen Limited
Project Name	Coolpowra
Project Ref.	SEP-0398
Document Ref.	SEP-0398/WF/Reports/EIAR_Addendum

Document Checking:

Originator:	Various	Signed:	-

Checked By:	C Staunton	Signed:	CS

Approved By:	Client	Signed:	CFGL

Issue	Date	Status
v1	13.01.2026	Draft
v2	19.01.2026	Draft
v3	23.01.2026	Draft for client review
V4	30/01/2026	Final

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1 INTRODUCTION

This Environmental Impact Assessment Report Addendum (EIAR Addendum) has been prepared by Halston Environmental & Planning Limited (Halston) on behalf of Coolpowra Flex Gen Limited (the Applicant) in response to a request for further information (FI) from An Coimisiún Pleanála (hereafter referred to as the Commission), dated 09 January 2026.

This EIAR Addendum should be read in conjunction with the EIAR that accompanies and was originally lodged with the following planning applications:

i. Project 1: a Reserve Gas-Fired Generator, which was lodged with the Commission on 04 July 2024 (Case Ref.: PA07.320095) under Section 37A of the Planning and Development Act 2000 (as amended) (hereafter referred to as "the P&D Act"),

ii. Project 2: An Energy storage system (ESS) facility, which was lodged with Galway County Council (GCC) on 08 July 2024 (GCC Case Ref. 2460845) under Section 34 of the P&D Act. An appeal to the Commission (Case Ref. PL07.320916) was lodged by the applicant on 26 September 2024 following the decision of GCC to refuse permission for the development, and

iii. Project 3: a 400kV Gas Insulated Switchgear (GIS) substation, which was lodged with the Commission on 04 July 2024 (Case Ref. PA07.320094) under Section 182A of the P&D Act.

The three projects were determined by the planning authorities, to which the applications were lodged (the Commission and GCC), as being distinct in the context of applying for, and obtaining, valid planning consents under the Planning and Development Act 2000, as amended, (*"the Act")*[1] relating to the making of an application and obtaining valid planning consents. The EIAR describes all of the key elements of the construction and operation of the three projects and provides a comprehensive assessment of the likely significant effects of those elements on the environment, along with their combined effects, and the cumulative effects.

1.1 EIAR ADDENDUM

As a result of the FI request from the Commission, this EIAR Addendum has been prepared in order to respond to the EIA related matters, update the EIAR and associated appendices

[1] Reference Section 1.3 of the EIAR (Volume 2)

(as appropriate) and to allow the Commission to complete a robust environmental impact assessment of the development.

1.2 STRUCTURE OF THE EIAR ADDENDUM

The structure of this EIAR Addendum follows, as far as practicable, the layout and methodology of the July 2024 EIAR. Following this introductory chapter, which outlines the background and the rationale for the preparation of this EIAR Addendum, Chapter 2 describes the proposed changes to the development.

Chapter 3 summarises and reaffirms the overall need for the development and provides an updated assessment of the reasonable alternatives considered in relation to the proposed alternative construction access road. In recognition of the time elapsed since the July 2024 EIAR, Chapter 4 updates and confirms the alignment of the proposed development (as amended) with current national, regional and local policy and the applicable regulatory framework. Chapters 5-15 assess the project changes described in Chapter 2 under the relevant environmental disciplines and set out conclusions on the likely significant environmental effects arising from those changes. Chapter 16 identifies and summarises any cumulative effects and significant interactions associated with the proposed development (as amended). Chapter 17 provides a description of the expected significant adverse effects on the environment of the proposed development deriving from its vulnerability to risks of major accidents and /or disasters which are relevant to it. Chapter 18 provides a schedule of all mitigation measures proposed for offsetting likely significant adverse effects, as identified, for each environmental factor.

1.3 REQUIREMENT FOR AN EIAR

Environmental Impact Assessment ("EIA") in Ireland is provided for under Part X of the Planning and Development Act 2000 (as amended) ("the Act"), which gives effect to the Environmental Impact Assessment Directive within the planning consent system. In accordance with Section 172(1) of the Act, the competent authority (the planning authority or An Coimisiún Pleanála, as the case may be) is required to carry out an EIA in respect of an application for consent where the proposed development is of a class specified in Schedule 5 of the Planning and Development Regulations 2001 (as amended) ("the Regulations") and either (i) equals or exceeds a relevant threshold (or no threshold is specified) or (ii) where sub-threshold development is determined to be likely to have significant effects on the environment.

The classes of development relevant to EIA are prescribed in Schedule 5 of the Regulations. Development listed in Part 1 of Schedule 5 that meets or exceeds the

applicable threshold is subject to mandatory EIA. Development listed in Part 2 of Schedule 5 that is below the applicable threshold is subject to EIA screening, with the likelihood of significant effects assessed having regard to the criteria set out in Schedule 7 (and, where applicable, the screening information requirements in Schedule 7A).

The Proposed Development (as amended) includes a Reserve Gas-Fired Generator with a heat output of 300 MW or more and therefore falls within Part 1, paragraph 2(a) of Schedule 5 of the Regulations, i.e. *"a thermal power station or other combustion installation with a heat output of 300 megawatts or more"*. Accordingly, EIA is mandatory and an EIAR is required to accompany the application(s) for consent.

For completeness, and having regard to the nature, scale and land take of the Proposed Development (as amended), the overall project may also be characterised by reference to one or more of the Part 2, Schedule 5 *"Infrastructure Projects"* classes, in particular:

- Part 2, paragraph 10(a): *Industrial estate development projects, where the area would exceed 15 hectares*; and/or
- Part 2, paragraph 10(b)(iv): *Urban development which would involve an area greater than 2 hectares in the case of a business district, 10 hectares in the case of other parts of a built-up area and 20 hectares elsewhere.*
- *Part 2, paragraph 10 (dd)): All private roads which would exceed 2000 metres in length.*

The Proposed Development (as amended) is located on a rural greenfield site with a red-line (application site boundary) boundary of approximately 46 hectares (i.e. "elsewhere" for the purposes of paragraph 10(b)(iv) as it is not within a business district or built up area), and therefore exceeds the 20-hectare area band referenced in Part 2, paragraph 10(b)(iv). The Proposed Development (as amended) also includes private access and internal road /track infrastructure required to facilitate construction and operation of the development. The proposed private roads exceed the 2,000m threshold as set out under Class 10(dd). The relevant length is taken, for the purposes of Class 10(dd), as the aggregate centreline length of the new private road elements proposed, including any spurs/branches and internal sections that form part of the development.

Identification of these additional Part 2 categories does not affect the requirement for EIA in this case (which is already triggered by Part 1, paragraph 2(a)), but assists in ensuring that the EIAR fully describes the Proposed Development (as amended) and addresses all relevant sources of potential environmental effects across the entire project.

A single EIAR has been prepared to assess the overall Proposed Development (as amended) comprising the following interrelated components within the 46 hectare application boundary: the Reserve Gas-Fired Generator, the Energy Storage System (ESS) facility, and the 400 kV GIS Substation, together with all integral ancillary works necessary to construct, operate and (where relevant) decommission the project. This approach ensures that the likely significant effects of the overall project are identified and assessed comprehensively, including effects arising from each component on a standalone basis and from interactions between components, as well as cumulative /in-combination effects where relevant.

This EIAR accompanies each of the three planning applications and is structured such that the potential environmental impacts and effects arising from each component are assessed both individually and in combination with the other components of the Proposed Development (as amended).

1.4 COMPETENT EXPERTS & CONTRIBUTORS

This EIAR has been prepared by Halston Environmental & Planning Limited (Halston), IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162, on behalf of the applicant. The works were managed and coordinated by Mr Colm Staunton (Halston) who has over 22 years of professional consultancy experience predominantly relating to Environmental Planning, Project Management of Environmental Impact Assessments (EIA) and Environmental Due Diligence (EDD). Similar to the July 2024 EIAR, details of the author of each Chapter are provided in Table 1.1.

Table 1.1 List of EIAR Contributors

Chapter No.	EIAR Chapter	Contributor
1.	Introduction	Halston Environmental & Planning Ltd, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
2	Description of the Proposed Development[Note 1]	Halston Environmental & Planning Ltd, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
3	Need for the Development and Alternatives	Halston Environmental & Planning Ltd, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
4	Planning and Policy	Halston Environmental & Planning Ltd, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
5	Population and Human Health	Halston Environmental & Planning Ltd, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
6	Biodiversity	Moore Group and Eire Ecology 3 Gort na Rí, Athenry, Co. Galway

Chapter No.	EIAR Chapter	Contributor
7	Soils and Geology	Halston Environmental & Planning Ltd, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
8	Water Environment[Note 1]	Halston Environmental & Planning Ltd. IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
9	Air Quality	TMS Environment Ltd 53 Broomhill Drive, Tallaght, Dublin 24
10	Material Assets	Halston Environmental & Planning Ltd IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
11	Noise and Vibration	Redkite Environmental Huntersmoon, Ballykeane Road, Redcross Co. Wicklow
12	Landscape and Visual	Macroworks Hibernia House, Cherrywood Business Park, Loughlinstown, Dublin 18
13	Traffic and Transport[Note 1]	Trasky Limited 1 Dara Court, Celbridge, Co. Kildare This chapter was prepared by Mr Jason Walsh, BEng (Hons) PCert (RSA) CEng MIEI, who has over 20 years of experience in design consultancies in both Ireland and the UK.
14	Archaeology and Cultural Heritage	Archaeological Consultancy Services Unit (ACSU) 21 Boyne Business Park, Greenhills, Drogheda, Co. Louth, A92 DH99
15	Climate	TMS Environment Ltd 53 Broomhill Drive, Tallaght, Dublin 24
16	Interactions	All Contributors inputted and coordinated by Halston.

Note 1 Further information provided in Table 1.2

Other supporting specialist reports have been prepared in addition to, and in support of, certain Chapters of the EIAR.

Table 1.2 Supporting Specialist Reports

Chapter No.	EIAR Chapter	Assessment Report	Author
2	Description of the Proposed Development	Preliminary Construction Environmental Management Plan (CEMP)	Halston Environmental & Planning Ltd, IHub Building, Westport Road, Castlebar, Co. Mayo Ireland, F23 K162
8	Waters	Stage 3 Flood Risk Assessment	Envirologic Unit 49 Baldoyle Industrial Estate, Baldoyle, Dublin 13
8	Waters	Water Framework Directive Assessment	Envirologic Unit 49 Baldoyle Industrial Estate, Baldoyle, Dublin 13

Chapter No.	EIAR Chapter	Assessment Report	Author
13	Traffic and Transport	Road Safety Audit Report	PMCE Limited 17 Greenmount House, Greenmount Business Park, Harold's Cross Road, Dublin 6W, D6W VX78 Mr Alan O'Reilly Associate, Chartered Engineer, BA, BAI, MSc, RSA Cert Comp, MIEI

2 DESCRIPTION OF DEVELOPMENT CHANGES AND ALTERNATIVES

For the purposes of this EIAR Addendum, the term *"proposed development (as amended)"* by this EIAR Addendum refers to the Development as assessed in the July 2024 EIAR, together with (i) an Alternative Construction Access Road and associated temporary works, and (ii) the Revised Planning Application Boundary to incorporate these amendments.

This EIAR Addendum assesses the proposed development (as amended) where relevant changes or updates have been identified in responding to the FI request. Where updates are interrelated, the relevant assessments have been revised and updated in full. All other elements of the original proposed development remain as assessed in the July 2024 EIAR unless otherwise stated, and where topic-specific additional detail is required, it is provided within the corresponding chapter, without altering the nature of the proposed development (as amended) as set out herein.

This EIAR Addendum should be read in conjunction with the July 2024 EIAR that accompanied, and was originally lodged with, the relevant planning applications. It is not intended that this EIAR Addendum replaces the July 2024 EIAR; rather, it identifies and assesses any material changes to baseline conditions, impact assessment and conclusions presented in the July 2024 EIAR.

2.1 CIVIL AND STRUCTURAL WORKS (ADDITIONAL INFORMATION)

The following information is provided to clarify the structural requirements for the proposed development (to support Section 2.5.1.2 of the July 2024 EIAR). The infrastructure proposed requiring foundations may be categorised as follows:

1. Buildings
2. Electrical Equipment Compounds
3. Long Duration Energy Storage (LDES) Compound

4. Above Ground Gas Installation (AGI) Compound
5. Concrete Bunds

All foundation systems have been developed in accordance with the requirements of Building Regulations Part A (Structure), IS EN 1997-1 (Eurocode 7): Geotechnical Design, and relevant Irish National Annexes, and informed by the GII Ground Investigation Report (December 2024).

2.1.1 BUILDINGS

A number of buildings are proposed across the development. The structural forms and associated foundation solutions generally adopt one of the following systems:

- Loadbearing masonry construction supported on reinforced concrete strip foundations, and
- Steel portal frame construction supported on reinforced concrete pad foundations.

2.1.1.1 Loadbearing Masonry Buildings

The Fire Water Pump House, Fuel Polishing Unit, Security Cabin and IPP Building are constructed using loadbearing solid concrete blockwork walls supported on traditional reinforced concrete strip foundations extending around the full perimeter of each building. Typical strip foundations are approximately 1200mm wide × 300mm thick, subject to confirmation at detailed design stage. Strip foundations are considered appropriate for these structures due to the relatively modest applied loads and the verified ground conditions, where an allowable bearing capacity in excess of 150kN/m² has been demonstrated in the GII Ground Investigation Report (December 2024). Further details are provided on, but not limited to, drawing CPA-HAL-SB-XX-DR-PL-3210.

2.1.1.2 Steel Portal Frame Buildings

Larger buildings, including the 400 kV GIS Building, OCGT Building, Workshop / Storage Unit and SynCon Building, will be formed using steel portal frame structures supported on reinforced concrete pad foundations. Concrete pad foundations vary in plan dimensions and thickness depending on loading and verified ground bearing capacity. Typical preliminary pad sizes for industrial buildings are in the order of 1.8m × 1.8m × 0.6m, with final dimensions confirmed at detailed design stage following completion of structural analysis and geotechnical verification. Except for the OCGT building, perimeter solid block masonry walls are also provided to the building envelopes and are supported on reinforced concrete strip foundations as described above. Further details are provided on, but not limited to, drawing CPA-HAL-SB-XX-DR-PL-3220.

2.1.2 ELECTRICAL EQUIPMENT COMPOUNDS

Three electrical equipment compounds are proposed within the development, namely the 400kV AIS Compound, SynCon Compound and LDES Compound. Within each compound, electrical equipment is supported on reinforced concrete pad foundations designed to provide adequate resistance to dead, imposed and dynamic actions, including wind loading and electrical operational forces. Typical foundation dimensions for such equipment are in the order of 14m × 1.5m × 0.5m, depending on equipment size and configuration. Deep excavations are generally not required due to the relatively low applied bearing pressures and the practice of constructing the pads such that the top of concrete is at or slightly above finished ground level. Further details are provided on, but not limited to, drawing CPA-HAL-OC-XX-DR-PL-1110.

2.1.3 AGI COMPOUND

The AGI Compound comprises several proprietary lightweight kiosks supported on precast concrete pad foundations. The number, layout and dimensions of the pads are dependent on the specific kiosk type and supplier requirements. Due to the relatively low applied loads, deep excavations are generally not required. External gas equipment, such as the heat exchangers, is supported on reinforced concrete flat slabs constructed at or marginally above finished ground level. Slab plan dimensions are governed by the equipment footprint, while slab thicknesses will generally not exceed 150 mm, subject to detailed structural verification. Further details are provided on, but not limited to, drawing CPA-HAL-OC-XX-DR-PL-1810.

2.1.4 LONG DURATION ENERGY STORAGE (LDES) COMPOUND

The LDES Compound comprises 168 No. battery containers and 56 No. Medium Voltage Power Stations (MVPS). Both the battery container units and MVPS units are supported on precast concrete pad foundations, with the top of concrete typically set approximately 400mm above finished ground level. Each battery container is typically supported on five concrete pads, while each MVPS unit is supported on three concrete pads, subject to the specific equipment model and manufacturer's requirements. Further details are provided on, but not limited to, drawing CPA-HAL-SB-XX-DR-PL-3201.

2.1.5 CONCRETE BUNDS

Each of the electrical equipment compounds contains electrical transformers housed within reinforced concrete bund structures, designed to:

- Support the self-weight and operational loads of the transformer, and

- Provide secondary containment in the event of an oil spill.

Bund structures are sized to suit the transformer footprint and oil retention volume, with typical dimensions in the order of 20m × 10m × 1.5m deep. Bunds are generally constructed below finished ground level to facilitate level access to the transformer units. Further details are provided on, but not limited to, drawing CPA-HAL-OC-XX-DR-PL-1110.

Fuel storage tanks are similarly contained within a reinforced concrete bund, designed to support the tank loads, and provide spill containment. These bunds generally do not require deep excavations, with the finished slab level typically constructed approximately level with adjacent finished ground. Further details are provided on, but not limited to, drawing CPA-HAL-OC-XX-DR-PL-1300.

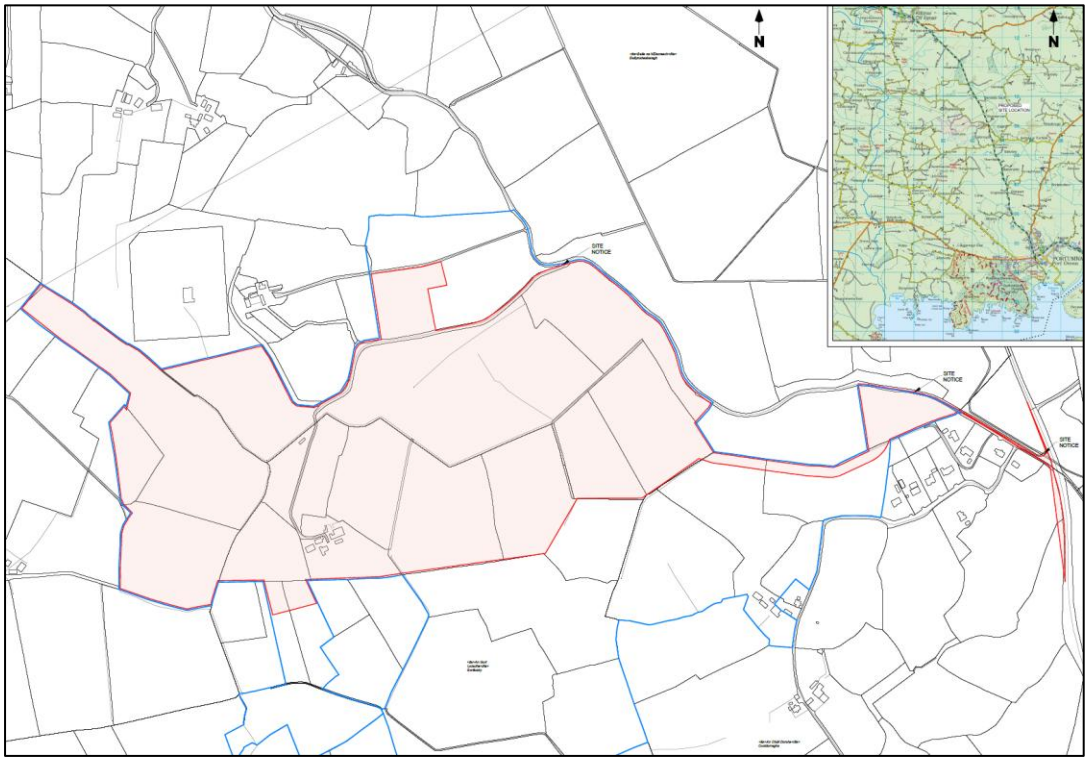
2.2 OVERVIEW OF PROPOSED DEVELOPMENT AS AMENDED

An alternative purpose-designed construction access road is proposed to connect the national road (N65) to the main works area of the development lands. The objective of the proposed alternative access is to reduce construction-stage effects (including traffic interaction with local roads, construction disturbance at sensitive receptors, and construction safety risks) by providing a direct, controlled route to the works area for HGV deliveries, abnormal loads (where required), and site traffic.

The access arrangements as originally proposed remains a reasonable and viable access option, notwithstanding the withdrawal of letters of consent[2] relating to the cutting /pushing back of the hedgerow to facilitate sightlines as per TII guidelines.

[2] Landowners west of, and immediately north and south of the junction of, the N65 with the L8763.

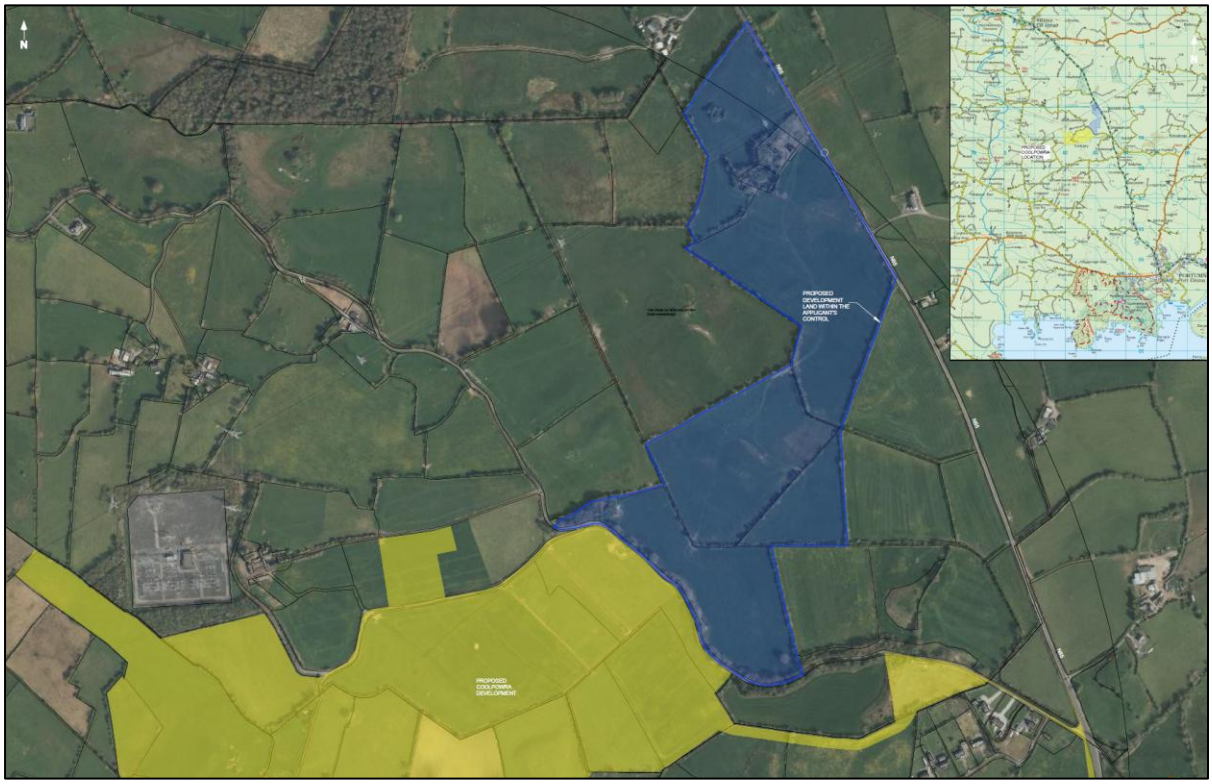
Figure 2.1 Drawing showing development lands and original proposed site access to N65



However, since lodgement and following consideration of third-party submissions, the applicant has carefully evaluated options to provide for an alternative construction access that avoids and reduces potential impacts and further enhance the overall development.

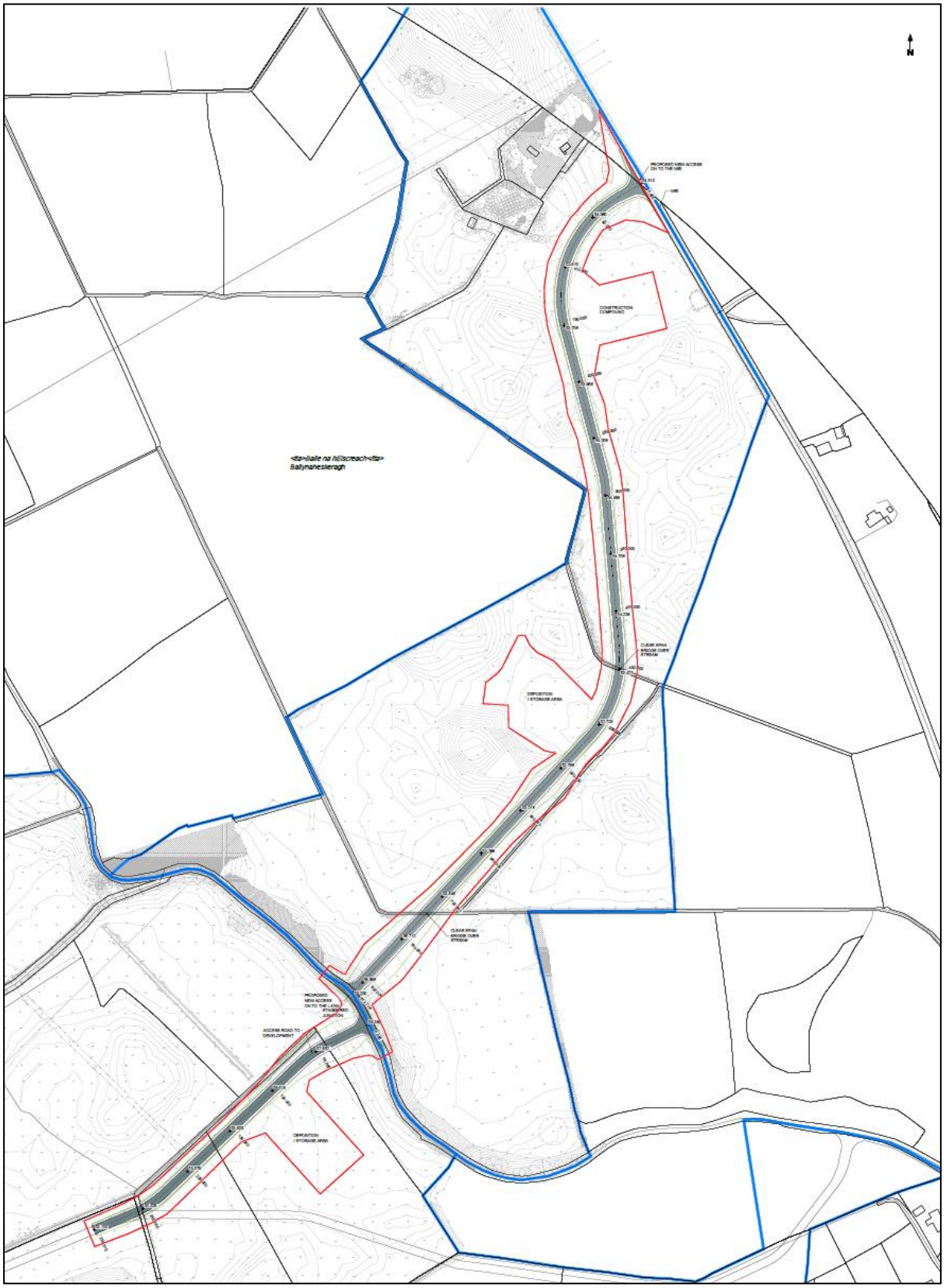
The applicant has now within their control lands which provides an alternative site access independent of third-party consent requirements to ensure sightlines can be provided to the site (see Figure 2.2).

Figure 2.2 Additional lands (shaded in blue) to provide for new construction access



The proposed access comprises approximately 810m of new carriageway with a nominal 7.0m running width on the northeastern side of the original development lands. The proposed alternative construction access road will provide vehicular access to the main development site (south of the L8763 public road). It will route from a new junction along the N65 and traverse three undulating grassed fields. The access route will then cross the L8763 by staggered junction and extend from here (a further c. 250m) into the main development works area. The proposed alternative construction access road will tie into the originally proposed site access road, which will serve the site during operation (i.e. that which was originally applied for) – see Figure 2.3. The original proposed access route south of the L8763 will be constructed towards the completion of the overall development; extending east from the main works area The development lands incorporate areas for placement of an associated construction compound and two soil deposition /storage areas.

Figure 2.3 Layout drawing showing proposed route of alternative temporary construction access from N65



The proposed new access junction at the N65 is located on a straight section of the National Road. Approximately 380m to the north of the proposed access junction the N65 bends slightly to the east and approximately 270m to the south of the proposed access junction the N65 bends slightly to the west. At the proposed access junction location, the N65 National Road has a relatively gentle downhill gradient to the south. Approximately 130m to the north of the proposed access junction, the N65 has a slight crest and approximately 120m to the south of the proposed access junction the N65 has a slight sag. The existing cross section of the N65 National Road in the vicinity of the proposed access junction is a single carriageway road with no hard shoulders of 5.8-6.0m. There is a maintained verge bounding the road to the east and verge with a mix of bushes and trees bounding the road to the west.

At the N65, the proposal will involve minor widening (300-350mm) of the N65 National Road to the north to provide a 6m carriageway in the vicinity of the proposed access junction. No amendments are proposed to be carried out to the vertical alignment of the N65 National Road to accommodate the proposed access junction. The existing gradient on the N65 National Road in the vicinity of the proposed access junction is approximate 1.3%. The access road incorporates a 1 in 200 (0.5%) approach gradient for more than 15m on the approach to the new access junction with the N65 National Road. The access road is proposed to be 7.0m wide. No change proposed to the existing cross fall on the N65 National Road. 2.5% cross fall is proposed to be provided on the access road complaint with the crossfall recommendations of Section 3.1 of TII Publication DN-GEO-03031 to assist with drainage. Visibility splays extents of 215m are provided in both directions as recommended in Section 5.6.2.2 & Table 5.5 of TII Publication DN-GEO-03060 for a 100 km/h design speed. Visibility splays are taken at a setback of 3.0m as recommended in Section 5.6.2.2 & Table 5.4 TII Publication DN-GEO-03060.

2.2.1 CONSTRUCTION METHODOLOGY

Construction will be undertaken under a Construction Environmental Management Plan (CEMP) and will generally comprise: (i) setting out and fencing of the working corridor; (ii) establishment of site environmental controls and traffic management; (iii) topsoil strip and segregation; (iv) formation preparation including proof-rolling and local improvement/capping where required; (v) placement and compaction of sub-base/base layers; (vi) surfacing; and (vii) construction of road drainage, junction tie-ins and reinstatement works at field boundaries. Topsoil and subsoil will be stripped, segregated and stored for reinstatement, with haul road construction using engineered fill where required to achieve formation levels across undulating ground. The proposed access road pavement construction is detailed below:

- Surface/Wearing Course - 25mm compacted dense bitumen macadam wearing course (10mm nominal size aggregate) to BS4987 & Table 9/3 of the DOE Specification
- Binder Course - 40mm thickness (compacted) dense bitumen macadam basecourse (20mm nominal size aggregate) to BS4987 & Table 9/1 of the DOE Specification
- Road Base - single course 150 mm thickness (compacted) dense bitumen macadam basecourse
- Sub-Base – 150mm thickness (compacted) granular material type b
- Capping Layer – If required

Construction plant movements will be confined to the access corridor and defined working areas. Where poor ground conditions are encountered, the formation will be improved using a capping layer and/or geosynthetics, subject to geotechnical verification, to maintain stability and avoid excessive excavation and off-site disposal.

2.2.2 WATERCOURSE CROSSING

The access alignment requires the crossing of two water features (watercourses/drainage ditches). In keeping with good practice and similar to proposed crossing within the main works area (south of the L8763), the design seeks to avoid or minimise culverting and maintain natural conveyance and ecological function by clear spanning these. A clear-span structure carries the road over the watercourse channel with supports set back from the banks, avoiding placement of a structure within the wetted channel. This materially reduced the extent of in-channel excavation works compared with culverting. The benefits of clear span structures allows:

- existing drainage channel profile and gradients to be maintained, and
- minimises direct disturbance to channel bed /banks

A clear-span structure will be constructed using a precast concrete deck supported on gabion abutments, such that the deck spans between abutments and no structural elements are placed within the wetted channel. The crossing will comprise stone-filled gabion baskets (to the Engineer's detailed design) forming stable abutments set back from the channel edge and founded on a cast in-situ reinforced concrete base/strip foundation. The concrete base will distribute loads to the underlying ground, provide a level bearing surface for the abutment seats, and incorporate local scour/erosion protection detailing as required. Precast concrete deck units will then be installed onto prepared bearing seats on the gabion abutments to achieve the required clear span over the watercourse, with parapet/edge protection (as required) and approach slabs or tie-ins to ensure a smooth transition between the access road and the deck.

Following installation, the approaches will be completed using compacted engineered fill and pavement layers, and surface water from the crossing and approaches will be directed to appropriate roadside drainage and treatment measures (e.g., cut-off drains and settlement controls), preventing direct discharge to the watercourse. On completion, disturbed banks will be reinstated and stabilised (e.g., with topsoil replacement and seeding/planting), maintaining the pre-existing channel alignment and bed continuity beneath the clear-span deck

2.2.3 CONSTRUCTION COMPOUND AND SOIL DEPOSITION AREAS

The lands through which the temporary construction access will incorporate: (i) an associated construction compound (for welfare, laydown, parking, and materials handling), and (ii) two soil deposition/storage areas. These areas will be surfaced/managed to prevent tracking of mud onto public roads and to control runoff. Soil storage will be segregated by type (topsoil/subsoil), placed in stable stockpiles, and protected to prevent erosion and sediment release. Stockpile locations will be set to avoid encroachment on drainage lines and to maintain access for inspection and maintenance.

It is proposed that the alternative construction access road will operate as the primary construction-stage vehicular route to the main development lands (south of the L8763), facilitating delivery of construction materials and plant and providing controlled access for site staff. It is anticipated that, on an average construction day, approximately 32 HGV movements (trucks) will access the site to deliver materials, distributed across the working day to avoid peak-time clustering. Access at the N65 will be managed in accordance with agreed traffic management arrangements (including signage, visibility requirements and any temporary measures), and HGV routing will be controlled to minimise interaction with local roads. The proposed construction programme for the overall development is estimated at 28 months, with the timing of commencement subject to planning, detailed design, procurement, and ecological constraints. Vegetation clearance and soil stripping would be seasonally constrained where necessary to avoid significant ecological effects (e.g., nesting bird season restrictions, subject to ecological supervision.

2.2.4 ROAD DRAINAGE

Surface water from the proposed alternative construction access road will be managed using continuous roadside filter drains installed on both sides of the carriageway for the operational period of the temporary access. Based on the drainage assessment, the filter drains will comprise a minimum 500mm deep × 600mm wide trench within a 2.0m wide verge, incorporating a 150mm diameter perforated carrier pipe laid to a minimum longitudinal fall of 1:500. The pipe invert will be set at a minimum depth of 500 mm below

finished ground level, with the pipe bedded and surrounded in Type B coarse (or lightweight) aggregate to provide storage and conveyance. A geotextile wrap will enclose the aggregate to prevent migration of fines and maintain long-term permeability. The upper portion of the filter drain will comprise a Type A fine aggregate surface layer to provide a stable verge finish and facilitate infiltration while maintaining trafficability adjacent to the carriageway.

Runoff will be collected via the road crossfall into the verges and will enter the filter drains by infiltration and percolation through the aggregate media, providing attenuation and treatment prior to infiltration to ground, thereby avoiding uncontrolled discharge and reducing the potential for sediment-laden runoff leaving the access corridor. The drainage design calculations are based on 1% Annual Exceedance Probability (AEP) rainfall data obtained from Met Éireann, with an adopted conservative soil infiltration rate of 2.0×10^{-5}m/s (noting that higher infiltration rates of 4.4×10^{-5}m/s and 8.9×10^{-5}m/s were recorded for the original planning applications). The required storage volumes to accommodate runoff within the filter drain system have been calculated accordingly, and the final storage requirements have been increased by 20% to account for climate change allowance.

The filter drain system will be installed early in the enabling works such that it functions throughout the construction phase. The system will incorporate appropriate access/maintenance provisions (e.g., rodding points and/or inspection chambers at low points and/or defined intervals, as set out in the detailed design) and will be subject to routine inspection and maintenance during construction, including removal of silt at inlets/verges and repair/replacement of any geotextile/aggregate where fouling is identified. This provides a robust, linear drainage solution that limits off-site runoff pathways, supports water-quality protection measures and aligns with the temporary nature of the construction access.

2.2.5 UNAUTHORISED ACCESS

To ensure that the temporary construction access functions solely as a private construction access (and does not attract public traffic through the new N65 junction or the staggered junction on the L8763), a layered package of physical, operational and signage controls will be implemented for the full period the access is in place.

- Physical access control (primary control)
  - Lockable vehicle gates installed on the at public-road interfaces and complimented with barrier.
- Controlled entry procedures (operational control)
  - Manned access control during periods when gates are open.

    - Clear site rules displayed at access points.
- Signage and road user messaging (to reduce "attractiveness")
    - Install compliant traffic signs at both junctions indicating restriction of access
    - Construction Traffic Only / Site Access Only / No Public Access
- Junction and layout measures to discourage public entry
    - Entrance functional for HGVs and oversized radii/flare avoided
- Integration with Temporary Traffic Management
    - All junction signing, barriers, and any temporary road markings will be consistent with national/TII roadworks and traffic management requirements for works affecting national roads and local roads

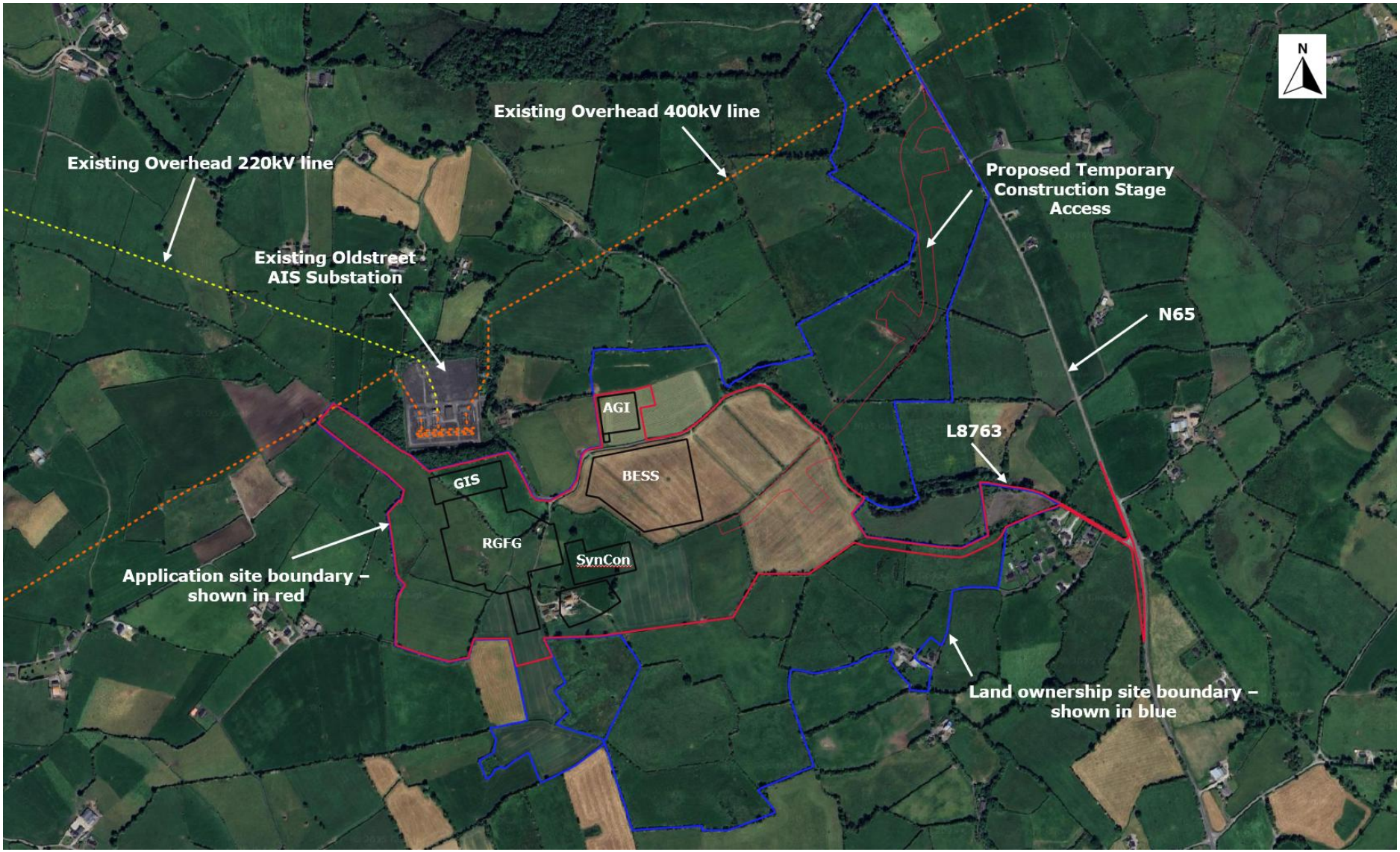
These measures will prevent the alternative construction access road becoming an unintended public shortcut, thereby avoiding additional non-project traffic through the new junctions and reducing collision risk with construction plant/HGVs and avoiding junction capacity issues arising from unplanned public use.

2.2.6 DECOMMISSIONING AND REINSTATEMENT

Following completion and commissioning of the overall development (within the main works area of the site which includes each of the project compounds), it is proposed that the temporary construction stage access road will be decommissioned and reinstated[3]. Decommissioning would typically include removal of surfacing and granular layers (as appropriate), removal of temporary drainage features not required for the operational phase, reinstatement of pre-existing field drainage (where affected), replacement of stored subsoil/topsoil, and reinstatement of agricultural land through cultivation and reseeding. Any culvert installations not required long-term would be removed where practicable, with channels reinstated to stable profiles and protected against erosion.

[3] Unless otherwise authorised by condition of any grant of permission, the temporary construction access road will be fully decommissioned and reinstated. Any authorised retention (in whole or in part) would be limited to that which is demonstrated to provide operational benefit and to be consistent with the permitted development and the environmental assessment herein.

Figure 2.4 Drawing showing aerial view



3 NEED FOR DEVELOPMENT AND ALTERNATIVES

3.1 BACKGROUND

Coolpowra Flexgen Limited submitted and lodged three planning applications on 04 July 2024 for development on lands located in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway.

The proposed Reserve Gas-Fired Generator and ESS facilities are transformative for Ireland's energy system. Ireland's decarbonisation pathway is premised on rapid electrification of heat, transport and industry alongside large-scale deployment of renewable electricity particularly wind and solar. In the All-island Resource Adequacy Assessment 2025–2034[4] EirGrid show the projected proportion of demand for each sector for 2025 and 2034 and takes into account the Government's Climate Action Plan targets. Over the next ten years, demand is forecasted to grow considerably. In the median scenario, electricity demand is forecasted to increase 45% by 2034 from 2023 levels with growth coming from new technology loads , data centres and the electrification of heat and transport.

In this context, electricity system adequacy and operability become enabling conditions for delivering national climate, energy security and socio-economic objectives. While further significant renewable energy growth is the primary objective, additional firm dispatchable "transitional"[5] generation and energy storage, such as that proposed, are essential to bridge variability and support renewable generation intermittency. Together these resources provide the adequacy and operational resilience required to keep the electricity system reliable as demand grows and electrification accelerates. Without such reliable capacity, the system remains exposed to brown-outs and black-outs.

At European level, the EU Green Deal (EGD) promotes investment in energy infrastructure that enables the transition to a climate-neutral economy by 2050. Under the EU Taxonomy Regulation, gas-fired generation is classified as a transitional activity[6] where it replaces more carbon-intensive sources, complies with lifecycle emissions thresholds, and is

[4] EirGrid and SONI (2025) *All-Island Resource Adequacy Assessment 2025–2034*. Dublin and Belfast: EirGrid and SONI.

[5] Article 10(2) of Regulation (EU) 2020/852 defines "transitional" activities. A transitional activity is an economic activity for which no technologically and economically feasible low-carbon alternative exists and which supports the transition to a climate-neutral economy on a 1.5°C pathway by cutting GHG emissions. It qualifies only if it:

- has GHG performance at the best level in its sector/industry;
- does not hamper the development/deployment of low-carbon alternatives; and
- does not lock in carbon-intensive assets over their economic lifetime

[6] European Parliamentary Research Service: EU taxonomy: Delegated acts on climate, and nuclear and gas

capable of operating on renewable or low-carbon gases. It should also be noted that the Coolpowra development has the ability to replace older and more carbon-intensive generation units[7] like the diesel fuelled temporary emergency generator (TEG) units and to operate on renewable gas in the future, ensuring clear alignment with both national policy targets and EU climate frameworks.

Ireland's Climate Action Plan 2025[6], states that we must deliver at least 2GW of new flexible gas-fired generation capacity by 2030 to facilitate the integration of renewables. Both generation capacity and energy storage are also identified as core components in meeting future reliability outcomes in the International Energy Agency (IEA) Report *"Powering Ireland's Energy Future"* which was published in December 2025[8]. The IEA report references the additional 2GW dispatchable capacity required by 2030 and concludes that Ireland's future system adequacy depends on the timely delivery of a portfolio of resources including dispatchable generation, storage, interconnection and flexibility. The report highlights that both short duration and long-duration energy storage (LDES) are system critical in high renewable energy futures providing flexibility and balancing services. IEA modelling calculates that by 2035, that energy storage will grow from 1GW today to 6GW by 2035 (an additional 5GW storage required).

The Coolpowra development will provide secure, fast, and flexible capacity to stabilise the grid during demand peaks (typically in the morning and evening), periods of low outputs from renewable energy source and unplanned outages. The development is designed to provide complimentary, quick-response dispatchable capacity and system services to the grid through the 400kV system. The proposed 400kV GIS substation will accommodate the reserve gas fired generator and energy storage connections in addition to other renewable generators in the wider region of the site.

The proposed technologies are not only a compliant transitional solution, but an essential enabler of renewable energy deployment, ensuring that decarbonisation can proceed without compromising security of supply. The Coolpowra development will support National Development Plan (NDP) major infrastructure projects, cater for anticipated economic growth, strengthen national resilience and accelerates the low-carbon transition.

[7] Based on the current portfolio trajectory, by the end of 2034 there will be approximately 1700MW of conventional capacity over 30 years of age across the island, which could be at risk of exiting the market – source: All Ireland Resource Adequacy Assessment 2025-2034.
[8] International Energy Agency (IEA) (2025) *Powering Ireland's Energy Future: Approaches for a secure, renewables-led electricity system to 2035*. France: International Energy Agency

3.2 ALTERNATIVES

3.2.1 INTRODUCTION

The *Consideration of Alternatives* is presented under Section 3.2 of the July 2024 EIAR. In addition to this, and in line with Article 5(1)(d) and Annex IV(2) of the EIA Directive, this section of the EIAR Addendum further describes the reasonable alternatives studied for the temporary construction access. Additional information regarding *"alternative location"* is also presented for the Proposed development as Amended. The section sets out main reasons for selecting the preferred option, including a comparison of environmental effects.

3.2.2 LOCATION – PROPOSED DEVELOPMENT AS AMENDED

EirGrid's network development plans and technical reports consistently describe the 400/220/110 kV grid as the *"backbone of the power system"* and set out the need to make the grid stronger and more flexible to carry the increased renewable electricity.

At the outset of this project, the applicant undertook an analysis of the electricity system which identified the 400kV transmission line as the best opportunity to connect the proposed development and *"best fit"* for providing capacity and system support. The 400kV network provides the highest transfer capacity and lowest losses moving large volumes of power from low carbon and renewable generation areas to major load centres. Connection at a lower voltage (e.g., 220kV/110kV) was considered at a conceptual level but was discounted because it would not provide the same *"system fit"* for the identified need. It was concluded that connecting the development as proposed at lower voltage (than the 400kV network) would necessitate additional transformation, interface infrastructure and potentially wider network works to achieve the same outcome. Furthermore, the applicant's own analysis identified (among other constraints) network upgrade delays and connection constraints to the 220kV network in the Greater Dublin area (GDA). This was subsequently verified in Eirgrid's *"Short Circuit Issues in Dublin – Update for Industry and Developers"*, dated 27 March 2025. In the document Eirgrid state that short-circuit issues in the GDA presents a growing challenge for grid stability and generator integration and recommend *"connecting at 400kV stations which minimises short-circuit contributions and provides greater operational flexibility".*

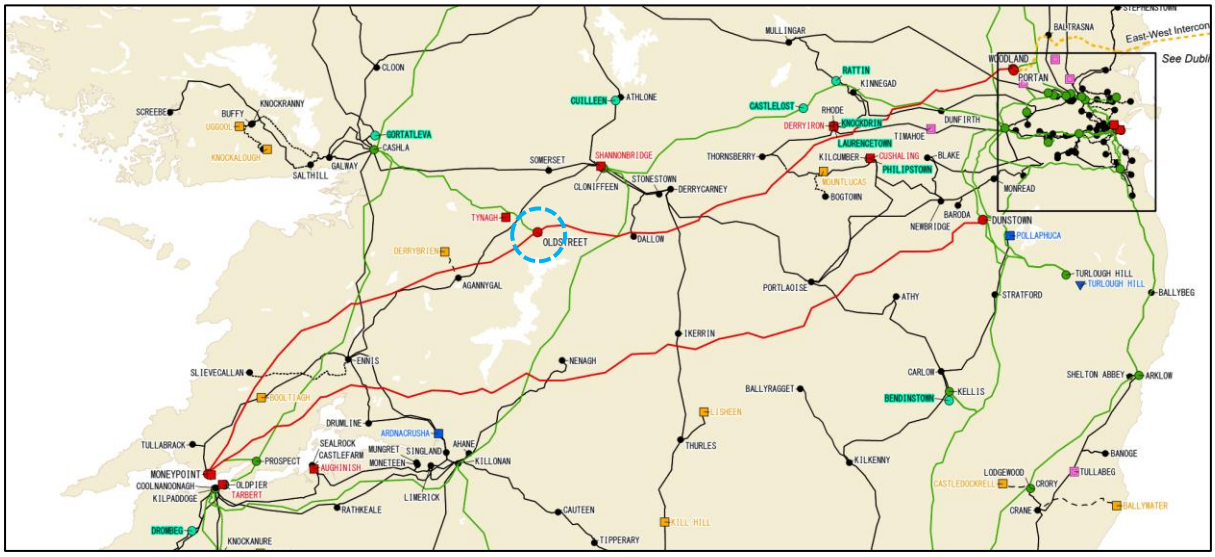
This is a defining *"specific characteristic"* of the project for EIA purposes. It is not simply a land-use choice. Rather it is a choice driven by the need to connect at a 400kV node to deliver the intended grid function. Identifying the 400kV network as the best connection option materially limits the scope for alternative sites because the development requires

an efficient, secure, and technically compliant interface to the 400kV network. Locating the proposed development away from the 400kV system would require substantial additional transmission infrastructure (new HV corridors, extended cable routes, additional switchgear /compound works, and/or additional consenting complexity), which can introduce additional environmental effects. Alternative sites along the 400kV were evaluated at high level at the outset, but due to factors including lack of available lands, lack of suitable lands, inadequate roads and access arrangement, environmental sensitivities, insufficient buffer to residential receivers, and other factors which are outside of the applicant's control, the proposed Coolpowra lands were deemed to be the best option.

This is precisely the scenario contemplated by the 2018 EIA "Guidelines *for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment" and* which was reiterated in the 2022 EPA EIA Guidelines; i.e. where a project is site-specific, alternative sites may not be relevant, and the developer may provide a broad description of the main alternatives and key issues rather than a *"mini-EIA"* for each.

The proposed 400kV GIS substation is a grid-enabling investment which will deliver material national benefit by relieving transmission bottlenecks, enabling higher renewable penetration, and strengthen security of supply at least cost to consumers. The established Oldstreet Node is the only existing intermediate substation along the route of this 400kV line (see Figure 3.1).

Figure 3.1 Eirgrid Transmission System Map (excerpt)



The EIAR findings show a low-sensitivity environmental baseline, and the development is demonstrated as being sufficiently separated from sensitive receptors. Developing the facility at this location avoids and reduces adverse environmental effects following the

mitigation hierarchy of avoid, reduce and, if possible, remedy. It ensures that the above ground development[9] is consolidated and substantially improves cost benefit analysis. Indeed, it should be noted that the local planning authority acknowledges the proposed development is of *national priority* and its strategic location. The local planning authority state that *the principle of the proposed development is generally supported by the policy objectives set out under the Galway County Council Development Plan 2022-2028*[10]. Therefore, siting the development proposal at this location conforms with the principles of proper planning and sustainable development and is compatible with the overarching framework of international, national, regional and local plans and policies as discussed in Chapter 4 of the July 2024 EIAR.

3.2.3 DO NOTHING

In the event of a "do-nothing" scenario, the site (lands north of the L8763) would remain *"as-is"* with the undeveloped nature of the site or its former agricultural use retained. A "do-nothing" scenario would result in the original construction access arrangement which was assessed within the July 2024 EIAR prevailing. Under this option, all proposed construction traffic would access the site using the existing local road network, with no new access points created to the national secondary road (N65). The access as currently proposed remains a reasonable and viable access option, notwithstanding the withdrawal of letters of consent[11] relating to the cutting/pushing back of the hedgerow to facilitate sightlines as per TII guidelines.

Chapter 13 of the July 2024 EIAR contains the traffic and transport assessment. Supporting appendices (13.1-13.5) including a Road Safety Audit (RSA) are contained in Volume 3 of the EIAR. The main haul route to the site is via the M6 motorway (Junction 1 - Kiltullagh), to the N65 and therefore does not pass through the towns of Loughrea or Portumna. The N65 then connects to the L8763 local road approximately 4km north of Portumna (see Figure 3.3).

[9] It is noted that an underground gas transmission line will be extended to serve the proposed development. However, extension of the gas transmission network in the region conforms with development policy as outlined in Chapter 3 of the EIAR
[10] Galway County Council's report to the Commission dated 18 September 2024
[11] Landowners west of, and immediately north and south of the junction of, the N65 with the L8763.

Figure 3.2 Layout map showing access point from public road

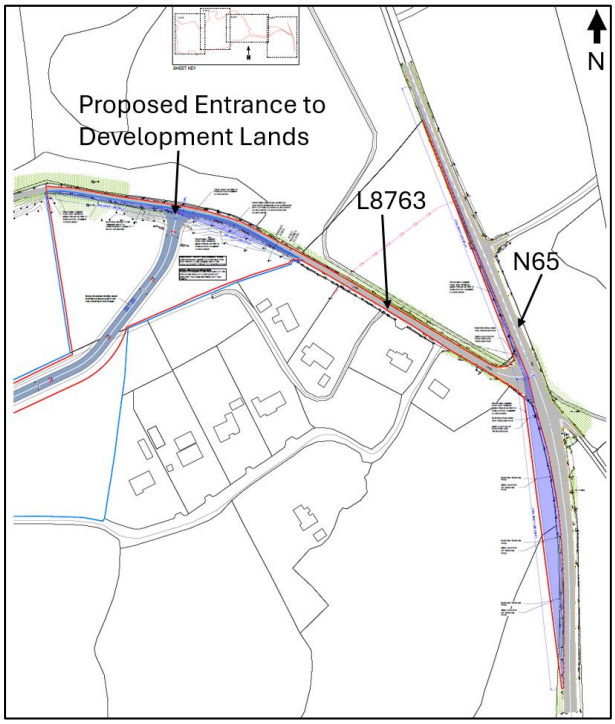
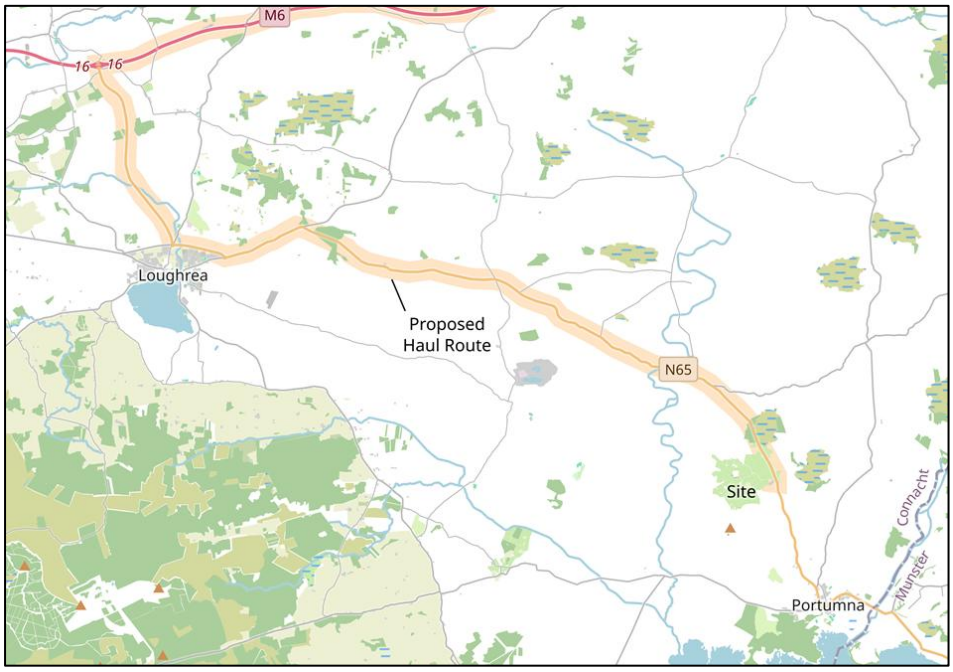


Figure 3.3 Site location map showing proposed haul route



Following a review of submissions related to traffic, road structure and road safety, concerns were expressed relating to conflicts with national roads policy, suitability of the access road, additional turning movements and sight distances at (a) the junction of the L8763 with the N65 and (b) the junction of the L8763 with the proposed entrance to the development lands. Details of the internal report from the Roads and Transportation

Section of Galway County Council dated 05 September 2024[12] contained within Galway County Council's report, dated 18 September 2024, to the Commission as required by Section 37E (4) & (5) of the Planning and Development Act 2000 (as amended).

The report sets out the views of the Galway County Council regarding the effects of the proposed development on the environment and the proper planning and sustainable development of the area. Galway County Council's Roads & Transportation Engineer's states the following:

> *Having regard to National Policy and the existing local public road network intended to serve the proposed development, whilst including considerations of public road capacity, width and alignment, the surface or structural condition of the pavement, and future maintenance requirements, and in the absence of complete and sufficient details pertaining to the same including relevant third party agreements and consents, that would render the network, or any part of it, unsuitable to carry the additional road traffic. It is considered, the proposed development would endanger public safety by reason of traffic hazard because of the additional traffic turning movements the development would generate at a point where the proposed site entrance on to the road network is also deemed unsatisfactory, owing to the restricted forward sight distances available at the road frontage, precluding the provision, and maintenance of, a safe and satisfactory means of vehicular access. It is further considered the scale of remedial works required to provide public road widening and acquired sightlines from the proposed entrance of the development site onto the L-8763 and as proposed from the N65 Junction, would constitute significant roadside intervention on National and Local routes in contravention of DM Standard 28, DM standard 33a and Policy Objective NR 1, NNR 2 of the Galway County Development Plan 2022 – 2028, which seeks to safeguard national, regional and local roads. It is therefore considered that the proposed development would be at variance with National Roads Policy in relation to control of development on/affecting national roads and would interfere with the safety and free flow of traffic and endanger public safety by reason of traffic hazard, obstruction of road users or otherwise and therefore would be contrary to the proper planning and sustainable development of the area* [13]

[12] The Roads Section of Galway County Council provided a report dated 06 September 2024, which set out conditions to be applied should An Bord Pleanála ["the Commission"] decide to grant planning permission, which are reflected in Condition No.'s 19 to 25 inclusive in Section 24 of Galway County Council's report dated 18 September 2024.

[13] Galway County Council also refer to its decision on Planning Ref No. 24/60845 for the BESS application, which was refused planning permission on the basis of traffic safety and associated considerations. The wording presented at Item 1 in the Schedule to the refusal decision (Ref No.24/60845) is noted as being the same.

In terms of the withdrawal of relevant third-party agreements and consents referred to in some submissions, we are advised that the subject application required confirmation of landowner consent at the time of the submission of the application (Ref. Article 22(2)(g) of the Planning and Development Regulations 2001 (as Amended)). This requirement was met and evidenced within the application at that time and the application complies with the requirements of planning legislation.

It remains appropriate for the application to include the current access, as it remains open to the Commission to address any issues regarding maintenance of the hedgerow as per the submitted proposals on the basis that:

(a) The applicant will continue to liaise with the landowner(s) to the north to ensure the maintenance of the sightlines, which provide visibility to all users of this lane.

(b) Maintenance of the sightlines are required irrelevant of the granting or construction of the proposed development as this lane is currently used by numerous residents of the lane itself. The applicant requires visibility on an intermittent basis for the 24 to 30 month construction period, while residents of the lane require this visibility in perpetuity. Therefore, the arrangements that the applicants had been proposing resulted in a long-term positive impact, and while we will continue to strive to deliver this, were this not achievable the potential impact is a temporary (sporadic short-term) adverse impact, and with traffic management would be predicted to be of a minor nature.

(c) In should also be noted that where sightlines cannot be achieved or maintained, it is emphasised that this is an existing access for all residents on the L8763 and as such we wish to note that in the event of a failure to maintain the hedgerow by the current landowner (irrelevant of the proposed development) the Local Authority has the powers to compel that the required maintenance be undertaken.

Significantly and for context it is worth noting that Eirgrid plc was granted planning permission (Galway County Council Ref. 23/60849) to construct *"Series Compensation Equipment"* on a 12.5ha site directly east of the existing Oldstreet substation. ESBN, in its capacity as Transmission Asset Owner (TAO) has commenced construction of this project. The L8763 public road running from the development site beside the existing 400kV AIS substation to its junction with the N65 are being used by those constructing on their behalf. The use of the L8763 by ESBN for their construction traffic was permitted by Galway County Council and establishes a precedent and permissibility in principle for use of the L8763 and junction with the N65 in its current form.

The Road Safety Authority of Ireland advise that Section 70 of the Roads Act 1993 places responsibility for the maintenance of roadside hedges on the owners/occupiers of the adjoining lands. The responsibility for the maintenance of roadside verges rests with the Local Authority. The season for hedge cutting under the Wildlife Acts starts from the 01 September to the 28 February the following year. It is not permitted to cut hedgerows outside of these dates. The only exception to this is if there are grounds to act for road safety reasons. County Councils can and do, either take direct action themselves or serve a notice on the landowner to do something in such instances.

(d) In circumstances where the existing access on to the national road may be considered to represent a traffic hazard (due to the limited sightlines), there is potential for further mitigation to improve road safety in this area by reducing the operating speed to 80/60kph (and the sightline requirement) accordingly, in line with Government objectives. There is clear precedent for this on national roads across Ireland including roads within Galway County Council's jurisdiction.[14]

Traffic calming, additional /amended road signage and road marking arrangements/permanent or temporary changes to the speed limit could also be used to aid improvements to the road network in the area and the applicant can assist in the delivery of such measures by way of condition. The above measures would allow reduced sightline requirements, facilitate the measuring of sightlines to the centre of the road when measured to the south and therefore significantly reduce the extent of hedging to be maintained as part of the development. It should be emphasised that these measures are required by the applicant only for the construction period at managed and pre-arranged times.

As mentioned above, in their report to the Commission as required by Section 37E (4) & (5) of the Planning and Development Act 2000 (As amended), Galway County Council set out conditions which could be applied should the Commission decide to grant planning permission for the subject application. <u>These are detailed in Condition No.'s 19 to 25 inclusive in Section 24 of Galway County Council's report dated 18 September 2024</u>.

3.2.3.1 <u>Road Safety – Pavement Condition</u>

Road structure impact is initially assessed by a simple visual inspection for cracking, deformation and disintegration in the vicinity of the site. If following this visual assessment, (taking account of the types and volumes of traffic likely to be generated

[14] https://www.galway.ie/en/media/Road%20Traffic%20%28Special%20Speed%20Limits%29%20Bye-laws%20No.1%20-%202021%28signed%29.pdf

from a proposed development) the structural ability of the road to carry the traffic is in question, tests can be undertaken to determine the structural strength of the carriageway. Current guidance for such testing is detailed in the TII publication, *Pavement Assessment, Repair and Renewal Principles (AM-PAV-06050), published in March 2020.*

We wish to reiterate that full consideration to the public road capacity, width and alignment, the surface and structural condition of the pavement has been given within Chapter 13 of the EIAR and associated appendices (volume 3 of the EIAR). As stated within the EIAR, and in common with virtually all local roads, *"The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway and bordering residential frontage strips".* Under such circumstances, and particularly in relation to the construction of infrastructure related projects where additional heavy traffic is limited in duration, it is normal practice for a local authority to condition inspections of road condition: prior to the commencement of construction; during construction; and, at the completion of construction; with any damage to the local road being made good by the applicant. It is also normal practice for a bond to be requested from the applicant to cover the cost of any additional works to the local road should they need to be undertaken by the local authority.

Accordingly, prior to commencement a machine road condition survey will be undertaken for all surrounding local roads and bridges along haul routes. The exact scope and details of this work will be submitted and agreed with the area engineer and planning authority. A post construction survey will be completed within three months of cessation of the use of each public road /haul route and any remedial measures arising from project construction stage works shall be completed to the satisfaction of the area engineer. The aforementioned financial bond will be used to cover the costs of such works as deemed necessary

3.2.3.2 Road Safety - Traffic Hazard – Additional Turning Movements

Traffic impact is typically assessed in terms of the impact of the traffic generated by a development on the operation of the local road network. A *'material increase'* is considered to have occurred where a development exceeds threshold values including where: traffic to and from the development exceeds 10% of the traffic flow on adjoining local and regional roads; and traffic to and from the development exceeds 10% of turning movements at junctions with and on National Roads. Exceeding these threshold values does not mean that the development results in a significant traffic or environmental impact but does mean that the impact of the development requires further assessment using traffic modelling software.

Road safety impact is typically assessed in terms of the collision record on the local road network in the vicinity of a development. Safety related geometric measurements are also assessed, for example, visibility to and from access points and junctions. In certain circumstances, such as the alterations to visibility splays at the N65/L8763 junction and proposed new access junction onto the L8763 local road, a Road Safety Audit can also be undertaken. Current guidance is detailed in the TII publication *"Road Safety Audit"* (standard) Ref. GE-STY-01024 published in May 2025.

The Halston Environmental and Planning Ltd. design drawing entitled *"Proposed Site Layout",* reference CPA-HAL-OC-XX-DR-PL-1010D Rev P01, dated 30 May 2024 was fully reviewed by TTRSA Limited (the traffic and transport consultant working on the project on behalf of the applicant) when undertaking the RSA. The Transport Infrastructure Ireland (TII) Standard Construction Details (SCDs) referenced on the drawing are current as per the [www.tiipublications.ie] website.

This drawing shows proposed egress visibility from the site access onto the L8763 local road of 2.4m x 90m and from the L8763 local road on to the N65 of 2.4m x 215m. Whilst not dimensioned on the aforementioned design drawing, the proposed forward visibility to vehicles turning at the junction, referred to in the Galway County Development Plan 2022-2028 DM Standard 28 as an "*entry visibility check*" would be for similar distances. Whilst the RSA is not a design check visibility splays of 90m are normally considered to be adequate for vehicle speeds of up to 60km/h, and of 215m are normally considered to be adequate for vehicle speeds of up to 100km/h, consistent with the design speeds provided within the RSA Audit Brief.

The observed operational *'traffic speed'* on the L8763 was recorded at the time of the RSA site visit (using GPS tracking) as being between 30km/h and 40km/h. The RSA Audit Team fully considered the proposed visibility splays in relation to road user safety in preparing the Stage 1 RSA report issued on 05 June 2024 under TTRSA reference T240315. The Stage 1 RSA report identified seven problems and recommendations in relation to the highway design, all of which were accepted by the scheme Design Team and applicant (scheme client). The aforementioned drawing also indicates that Temporary Traffic Management will be provided on the L8763, "*to be agreed with the Local Authority prior to construction"*.

Both road works (construction and maintenance) and temporary traffic management are covered by a range of primary and secondary legislation, and associated guidance. The design, implementation, operation and removal of the Temporary Traffic Management would need to comply (as far as practicable) with: Chapter 8 of the (2024) Traffic Signs

Manual; the Temporary Traffic Management Design Guidance document; and, the Temporary Traffic Management Operations Guidance (Part 0 and Part 2 – Level 2 Roads Rural Single Carriageway Roads) documents.

3.2.3.3 Conformance with Galway County Development Plan (CDP) 2022-2028 – DM Standard 28, DM Standard 33a and Policy Objective NR1 and NNR2 (which seeks to safeguard national, regional and local roads)

Policy Objective NR1 covers the *"Protection of Strategic Roads"*, specifically protecting the strategic transport function of national roads and associated national road junctions, through the implementation of the *"Spatial Planning and National Roads Guidelines for Planning Authorities"*. In the context of these guidelines, construction traffic related to the proposed development is consistent with the definition of strategic traffic within the guidelines in that it is *"contributing to socio-economic development and the transportation of goods and products"*. The traffic survey undertaken on the N65 as part of preparing Chapter 13 of the EIAR recorded a two-way traffic flow of 3172 vehicles on 28 May 2024, which broadly approximates Annual Average Daily Traffic (AADT) at this location. Existing vehicle turning movements at the N65/L8763/L8760 junction are estimated (based on the traffic survey count data appended to the EIAR) to be approximately 130 per day. As detailed within the EIAR, the operational phase of the LDES development covered by the planning application is not anticipated to generate a measurable number of trips (15-20 operatives over three shifts). The development covered by the planning application does not therefore materially impact on the N65 or L8763 and is not therefore at variance with the National Policy or Policy Objective NR1. This is also of relevance to the TII submission of 09 August 2024 in relation to the planning application.

Policy Objection NNR2 seeks to *"Safeguard Regional and Local Roads"*, specifically related to the carrying capacity and safety of these roads. In relation to a road, the concept of carrying capacity refers to the maximum number of vehicles that a road network can accommodate before it becomes congested and inefficient. The impact of the proposed development on the carrying capacity of the local road network, in this case limited to the L8763 is fully covered within the EIAR Chapter and associated appendices. The proposed development has been shown to not impact on the carrying capacity of the L8763. Details in relation to the safety of the proposed development in relation to the L8763 has been previously covered above in relation to the RSA.

DM Standard 28 covers *"Sight Distances Required for Access onto National, Regional, Local and Private Roads"*. The design proposed as part of the planning application addresses existing substandard sight distances at both the L8763/site access and N65/L8673, and

will bring the sight distances into line with the requirements of DM Standard 28 based on the specified design speeds.

The design of junctions, as submitted by the Applicant, provided for the full implementation of the recommendations of the RSA. The proposals will result in a safer junction for all users. The junction will be subject to a Stage 2 audit prior to construction and a Stage 3 audit on completion of the development.

DM Standard 33(a) covers *"Traffic and Transport Assessment (TTA), Road Safety Audit (RSA) & Road Safety Impact Assessments (RSIA)"*. As outlined above, a TTA and RSA were undertaken in relation to the proposed development. RSIA applies to Major Schemes on national roads as defined in PE-PMG-02041 Project Management Guidelines, which result in a substantial modification to the existing national road network. A major scheme is defined in PE-PAG-02021 as being where the highway scheme has a project value >€20 million. Setting back a fence-line at a junction does not fall within the definition of a major scheme.

The information presented above, along with that contained in Chapter 13 of the EIAR and the associated appendices, demonstrates that the proposed development is not at variance with National Roads Policy in relation to the control of development, and will not interfere with the safety and free flow of traffic.

3.2.3.4 Design Report

In addition to the above, the TII submission of 09 August 2024 in relation to the planning application for the BESS application (Planning Ref No. 24/60845) indicated that TII had *"not received nor approved a design report for the proposed alterations to the National Road Network"*.

The requirement for design reports is covered within the TII publication '*Design Phase Procedure for Road Safety Improvement Schemes, Urban Renewal Schemes and Local Improvement Schemes*' (DN-GEO-03030). No change is proposed to the design of the N65 (for example in terms of the cross-section, road markings, signing, horizontal and/or vertical alignment or drainage); proposed works are limited to setting back of the existing fence-line outside of the required visibility splay and replacing it with a fence-line in accordance with the TII CC-SCD-00320 standard detail; and, existing road signing is to be relocated outside of the required visibility splay. As such, and in the context of DN-GEO-03030, the design team consider the scheme to be *"Type C"* which does not require the preparation of a Design Report.

3.2.4 ALTERNATIVE LOCATION AND LAYOUT

The proposed development (as amended) will include a purpose-designed construction stage access road formed directly onto the N65 national secondary road. While national policy on development access to national roads (Section 2.5 of the *Spatial Planning and National Roads Guidelines for Planning Authorities*, DoECLG, 2012) is to avoid the creation of additional access points, or the intensification of existing accesses, to national roads where speed limits greater than 60 km/h apply, Section 2.6 of those Guidelines explicitly recognises that, in exceptional circumstances, a less restrictive approach may be adopted in the case of developments of national and regional strategic importance.

The EIAR and EIAR Addendum has been prepared to support a reserve gas-fired generator nominal capacity of 1,155MWe (a Strategic Infrastructure Development (SID) under Section 37A of the Planning and Development Act 2000, as amended) together with a grid-connected energy storage system (comprising a Battery Energy Storage System (BESS) and synchronous condenser), which will connect to the national grid via a proposed 400kV GIS substation qualifying as electricity transmission infrastructure and a separate Section 182A SID. Collectively, these elements fall within the Energy Infrastructure classes listed in the Seventh Schedule for the purposes of Sections 37A and 182A and therefore constitute strategic electricity infrastructure of national and regional importance, contributing materially to security of supply, system stability and the integration of renewable generation on the national grid.

Having regard to the above, the development proposed is considered to clearly meet the criteria for a development of national and regional strategic importance within the meaning of Section 2.6 of the Spatial Planning and National Roads Guidelines. In this context it is appropriate to consider a less restrictive policy stance in respect of access to the adjoining national secondary road, while still ensuring that the design of any junction or access arrangement safeguards the safety, capacity and strategic function of the national road network in accordance with the Guidelines.

The proposed alternative construction access road is designed in accordance with relevant TII geometric design and safety standards for rural single carriageway roads, including appropriate taper lengths, radii, visibility splays, drainage, surface construction and provision for safe turning of HGVs. Accordingly, the proposed temporary construction access arrangement represents an acceptable application of the *"exceptional circumstances"* provision in Section 2.6.

The applicant also considered widening the existing L8763 public road as it routes from the N65 to the development boundary. This option does reduce private land take but was not considered a viable option due to third-party land ownership constraints.

3.2.5 ALTERNATIVE DESIGNS

3.2.5.1 Temporary unbound stone haul road

A temporary unbound haul road would comprise a granular running surface (crushed rock) constructed over a prepared formation, typically with geotextile separation and/or capping where ground conditions are weak. This option is commonly used for temporary construction access where rapid installation and straightforward reinstatement are priorities. This option is a more cost-effective option and allows for easier decommissioning, however it was omitted based on the potential of environmental effects such as dust generation in dry weather, noise from HGV vehicles (such as tipper trucks bodies travelling over a relatively uneven surface and sediment mobilisation during weather. A bound surface generally provides a cleaner running surface (reduced dust /track-out onto public roads) and more predictable HGV performance.

3.2.5.2 Watercourse crossings

The proposed alternative construction access road will cross two watercourses /drainage features within the development lands. At the outset of the design process, the preference was to avoid in-stream works, maintain hydromorphology, and provide unrestricted passage of water, sediment and biota, while meeting flood/hydraulic requirements and relevant consents. Alternative crossing options considered included bottomless arch and closed culvert. Both options were disregarded following evaluation of the favoured clear span option which was also adopted for watercourse crossings within the main development works area of the site.

4 PLANNING POLICY CONTEXT

4.1 INTRODUCTION

The original proposed development as presented in the July 2024 EIAR is demonstrably consistent with national and regional policy, including the National Planning Framework (first revision), the Climate Action Plan 2025, and Regional and Local Development Plans. Due to the passage of time and for completeness, the following information is submitted to reaffirm the need for the development and confirm alignment with the latest national policy and regulatory frameworks. This includes:

- Department of Climate, Energy and the Environment. (2025) *Climate Action Plan 2025*[15].
- Government of Ireland. (2025) *National Development Plan 2021–2030*[16].
- Department of Housing, Local Government and Heritage. (2025) *National Planning Framework: First Revision*.[17]
- EirGrid plc and SONI Ltd. (2025) *All-Island Resource Adequacy Assessment 2025–2034: Main Report*[18].
- EirGrid plc and SONI Ltd. (2023) *Shaping Our Electricity Future: Roadmap, Version 1.1 (July 2023)*[19].
- Commission for Regulation of Utilities (CRU). (2021) *Security of Electricity Supply – Programme of Actions (CRU/21/115)*[20].

The general policy direction in Ireland is to enable a growing electrical demand through enhanced electricity infrastructure which shall be supplied by a diversified energy portfolio, predominantly indigenous renewables and backed up by flexible gas generation (for energy security).

EirGrid, Irelands Transmission System Operator (TSO), is responsible for the planning, management and development of Irelands electricity grid to ensure that there is a secure and sustainable supply of electricity to meet demand. To determine this, EirGrid conducts

[15] Available at: https://www.gov.ie/en/department-of-climate-energy-and-the-environment/publications/climate-action-plan-2025
[16] Available at: https://www.gov.ie/en/department-of-public-expenditure-infrastructure-public-service-reform-and-digitalisation/campaigns/project-ireland-2040/
[17] Available at: https://cdn.npf.ie/wp-content/uploads/National-Planning-Framework-First-Revision-April-2025.pdf
[18] Available at: https://cms.soni.ltd.uk/sites/default/files/publications/All-Island%20Resource%20Adequacy%20Assessment%202025-2034%20Main%20Report.pdf.
[19] Available at: https://cms.eirgrid.ie/sites/default/files/2023-07/Shaping-Our-Electricity-Future-Roadmap_Version-1.1_07.23.pdf
[20] Available at: https://cruie-live-96ca64acab2247eca8a850a7e54b-5b34f62.divio-media.com/documents/CRU21115-Security-of-Electricity-Supply--Programme-of-Actions.pdf

assessments annually, the results of which inform their recommended volume of generation capacity to be procured in upcoming capacity auctions.

4.2 DEMAND VERSUS GENERATION

Irelands electricity demand is expected to grow considerably over the next decade, driven by the electrification of heat and transport and build out of data centres (LEU) and new technology loads. EirGrid's Resource Adequacy Assessment 2025-2034 considers the balance between electricity supply and demand for the next 10 years. EirGrids median scenario shows that by 2034 electricity demand is expected to increase by 45% relative to 2023 levels[21]. This figure is conservative, particularly for datacentres (the predominant demand) which are assumed to continue to grow linearly but are experiencing rapid growth driven by artificial intelligence and intensifying density.

On the generation side, the report notes that 1,700MW of conventional generation capacity will be over 30 years old in 2034 and at risk of exiting the market which would add to the requirement. EirGrid Generation Capacity Statement 2021 (predecessor to Resource Adequacy Assessment) identified a supply deficit for winters 2022/23 to 2025/26[22] which led to the development of the Commission for Regulation of Utilities (CRU) Security of Electricity Supply – Programme of Actions. The programme of actions (which is supported by the Government Policy Statement on Security of Electricity Supply) included the procurement of new flexible gas plant, procurement of Temporary Emergency Generation (TEG), and extending the availability of old generation on a temporary basis[2324]. The temporary emergency measures, which have been implemented, include and additional 653MW of TEG (191MW at North Wall, 50MW at Huntstown, *"TEG 1"*; and 262MW at Shannonbridge and 150MW at Tarbert *"TEG 2"*) and retaining 820MW at Moneypoint which was scheduled to close in 2025[25]. The 1,473MW of temporary emergency measures must be replaced by 2029 with new flexible gas plant.

The CRU notes the General Policy Directive[26], pursuant to Section 79 of the Environmental Protection Act, from January 2023, which calls for the prioritisation of *"the consideration of applications which impact on the State's energy security of supply."*

[21] EirGrid plc and SONI Ltd., 2025: Resource Adequacy Assessment 2025-2034
[22] EirGrid. 2021: Generation Capacity Statement
[23] Commission for Regulation of Utilities, 2021: Security of Electricity Supply – Programme of Actions
[24] DECC, 2021: Policy Statement on Security of Electricity Supply
[25] EirGrid 2025: Information Note Temporary Emergency Generation
[26] General Directive pursuant to Section 79 of the Environmental Protection Act, 1992

4.3 TRANSMISSION INFRASTRUCTURE

Shaping Our Electricity Future is EirGrid's roadmap to make the grid ready to carry 80% of Irelands electricity from renewable sources by 2030, as set out in Ireland's Climate Action Plan[27]. The roadmap lists several targets for electricity, including "*at least 2GW new flexible gas plant*"[28], which can provide fast-response capacity that reduces curtailment and supports grid stability (key to enabling renewables). The updated National Development Plan (NDP) has allocated €3.5 billion to support investment in electricity grid infrastructure over 2026-2030[29]. National Policy Objective 69 contained in the NPF (DHLGH, 2025) aims to integrate climate action into the planning system in support of national targets[30].

The lack of grid development, particularly in Dublin, has led to constraints which limit the ability to connect additional generation and demand in the region. In March 2025 EirGrid published a note on *Short Circuit Issues in Dublin* stating that it would not be prudent to allow more conventional generation connect on the 220kV system in Dublin. EirGrid recommends that generator developers consider connecting at 400kV stations when selecting sites[31].

The 400kV transmission circuits are the backbone of Ireland's power system which connects the demand in the East (Dublin) to the generation in the West and South. According to the NPF (DHLGH, 2025), the western and southern region will contribute 75% of wind generation and 55% of solar generation by 2030 (National Policy Objective 74).

The combination of rapidly growing electricity demand (which has been pent-up due to a lack of infrastructure development) and shortage of suitable generation capacity (which must be new flexible gas generation) demonstrates that there is a need for the proposed development in terms of the location, the type of plant, and the scale.

[27] DCEE, 2025 Climate Action Plan
[28] EirGrid plc and SONI Ltd., 2023: Shaping Our Electricity Future
[29] DHLGH 2025: National Development Plan Review
[30] DHLGH, 2025: National Planning Framework
[31] EirGrid, 2025: Short Circuit Issues in Dublin Update for Industry and Developers

5 POPULATION AND HUMAN HEALTH

This Chapter of the Environmental Impact Assessment Report (EIAR) Addendum provides supplementary information in relation to the Population and Human Health Chapter and is to be read in conjunction with Chapter 5 of the July 2024 EIAR.

While there are a range of issues which may impact on human beings many of these have been considered within other disciplines within the EIAR, including Planning Policy (Chapter 4), Water Environment (Chapter 8), Air Quality (Chapter 9), Noise and Vibration (Chapter 11), Landscape and Visual (Chapter 12), Traffic and Transport (Chapter 13). Cultural Heritage (Chapter 14) and Climate (Chapter 15). This approach is consistent with the EPA EIAR Guidelines (2022)[32].

This Chapter is therefore focused on potential impacts which have not been assessed elsewhere within the EIAR. In accordance with the Health and Safety Authority (HSA) requirements, a Technical Land Use Plan (TLIUP) Assessment has been carried out for the development and is included as Appendix 17.1 to this EIAR Addendum.

5.1 ASSESSMENT METHODOLOGY & SIGNIFICANCE CRITERIA

5.1.1 METHODOLOGY

A desk-based assessment was undertaken to examine relevant information pertaining to the population impact assessment. Information on population statistics, employment and social data for the relevant Electoral Division (Eds) was obtained from the Central Statistics Office (CSO) for census years 2022. Fáilte Ireland's EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects and specifically the potential impact of the proposed development (as amended) on Tourism is considered. Given the rural setting, much of the potential for impacts is addressed in Chapters 6 (Biodiversity) and 12 (Landscape and Visual) of the EIAR.

The Study Area for the assessment of *"Population and Human Health"* includes a review of relevant information on a county and national scale but is mainly concentrated on the Electoral Districts (EDs) and Small Areas (Small Area Population Statistics (SAPS)) within which the proposed development (as amended) is located. A desk study was undertaken to assess the baseline environment. The desk study involved the assessment and review of data from the Central Statistics Office (CSO) and a review of the Galway County

[32] EPA, Guidelines of the Information to be contained in Environmental Impact Assessment Report, 2022

Development Plan (CDP) 2022-2028. Information was also obtained from the following sources:

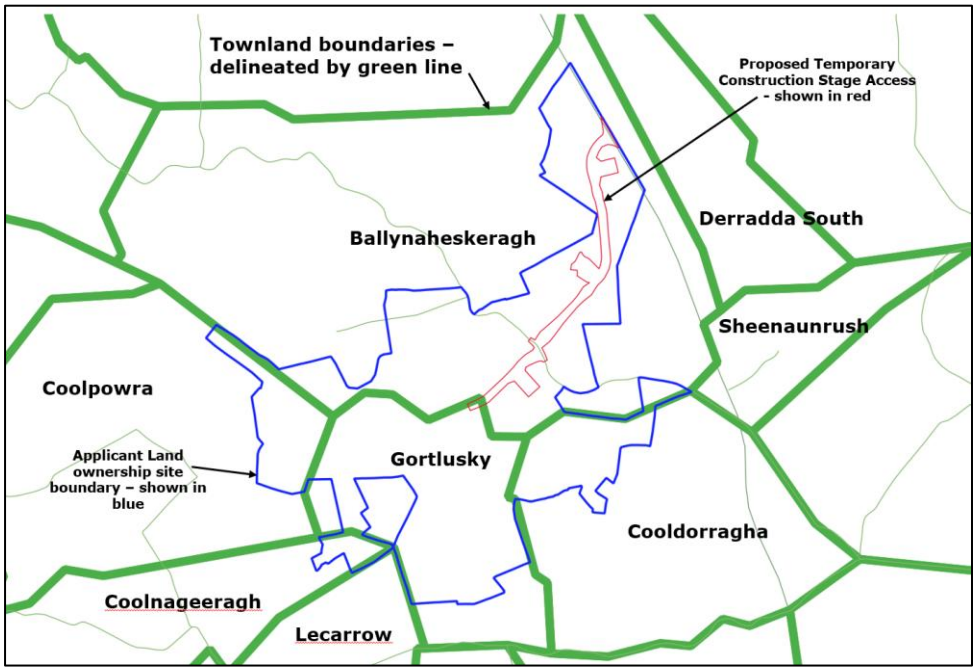
- Environmental Protection Agency (www.epa.ie);
- Galway County Council (https://www.galway.ie/en/
- Central Statistics Office (http://www.cso.ie);
- Geohive (https://airomaps.geohive.ie/ESM);
- Pobal (https://maps.pobal.ie/WebApps/DeprivationIndices/index.html);
- All-Island Research Observatory (AIRO) (https://airo.maynoothuniversity.ie/).

As there is no loss of residential or community lands as a result of the proposed development (as amended), the impacts from the loss of private property are not further considered. Similarly, the development of either or all of the proposed projects will not result in negative adverse impact to the local economy. Positive effects on the local economy, supply chains, and employment opportunities (particularly) during construction is anticipated.

5.2 DESCRIPTION OF RECEIVING ENVIRONMENT

The lands in which the proposed alternative access road is situated adjoins the main Coolpowra project development works site to the north-east. The development lands are predominately located in the townland of Ballynaheskeragh with the most westerly section of the access road within the townland of Gortlusky (see Figure 5.1).

Figure 5.1 Map showing proposed alternative access road within applicant ownership boundary along with townland boundaries



5.3 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

5.3.1 DO NOTHING SCENARIO

If the proposed alternative construction access road is not constructed, then the site remain in agricultural use and the originally proposed access to the site will pertain.

5.3.2 POPULATION AND SETTLEMENT PATTERNS

The proposed development (as amended) does not include a housing or community services element and, as such, is not predicted to result in a direct change to local or regional population levels or settlement patterns. During construction and operation, the development will generate employment which may support limited inward commuting and, for some roles, the relocation of staff to nearby settlements to reduce commuting distances; any such demographic change is expected to be minor and not significant in EIAR terms.

The proposed alternative construction access road provides a clear population and human health benefit during construction by reducing the interaction of construction traffic with the local road network. By providing a direct, purpose-designed route for construction vehicles and HGV deliveries between the N65 and the main works area, the alternative construction access route reduces reliance on the L8763 local road network and therefore reduces the frequency and intensity of HGV pass-bys at residential receptors and other sensitive properties fronting the L8763. This reduces the potential for traffic-related nuisance (noise, vibration, dust/track-out) and improves local amenity during the construction period, while also reducing the potential for delay, driver frustration and conflict between construction traffic and local access movements at constrained sections of the minor road network.

5.3.3 SEVERENCE

No significant severance effects are predicted to arise in respect of population and human health. The proposed alternative construction access road is located within lands owned by the applicant and is designed as a private, temporary construction route, thereby avoiding the creation of new barriers to movement for local residents or changes to existing public access arrangements. Where the proposed alternative access road interfaces with the public road network (including the staggered junction arrangement across the L-8763), traffic management and access control measures will be implemented to ensure that the proposal does not function as a public through-route. Consequently, the proposal is not anticipated to result in material severance of communities, services or

amenities, and, by reducing construction traffic along the L8763 frontage, it will reduce the potential for temporary perceived severance arising from frequent HGV movements on minor roads.

The effect of the impact associated with development or in combination is considered as neutral and long-term. The proposed improvement will have a positive long term moderate effect.

5.3.4 HEALTH AND SAFETY

5.3.4.1 Alternative Construction Access Road

The proposed alternative construction access road provides a positive construction-phase health and safety outcome by reducing the need for heavy construction vehicles to travel along the L8763 local road network in proximity to sensitive receptors. Diverting HGVs to a purpose-designed access route reduces potential interactions between construction vehicles and vulnerable road users (pedestrians, cyclists) and reduces conflicts with local traffic, agricultural machinery and residential access movements on the minor road. In addition, the provision of a dedicated construction access enables better management of site traffic through controlled entry, signage and site rules, thereby reducing the risk of collisions at junctions, within the site approach, and at accesses serving dwellings fronting the L8763. Overall, the alternative access option supports the EIAR objective of minimising construction-stage effects on human health by reducing exposure pathways associated with construction traffic (noise, dust, vibration, safety risk and stress associated with congestion and delay).

In accordance with the Health and Safety Authority (HSA) requirements, a Technical Land Use Plan (TLIUP) Assessment has been carried out for the development and is included as Appendix 17.1 to this EIAR Addendum. The TLUP is prepared in accordance with HSA guidance[33] and interprets the HSA policy on the technical land-use planning (TLUP) advice requirements of the Seveso-III Directive (Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC), as implemented by the Chemicals Act (Control of Major Accidents Involving Dangerous Substances) Regulations 2015.

[33] HSA, Guidance on Technical Land Use Planning, 2023

5.3.4.2 LDES/BESS - Safety

Grid-scale battery energy storage systems have become a key component for balancing renewable electricity in modern power networks. The proposed BESS will comprise a series of (i) battery and (ii) medium voltage power system (MVPS) enclosures.

The major safety aspects which are considered in the design of the proposed BESS facility are categorised as electrical and electrochemical. Hazards are controlled through design, spacing, fixed protection and an evidence-based fire-fighting strategy that aligns with internationally recognised standards. There are numerous international standards which regulate the design, manufacture and distribution of lithium-ion batteries to ensure they are adequately tested for safety, reliability and durability. The proposed BESS has been designed in accordance with the following regulatory and standardisation framework and has layered controls built in for its fire-fighting strategy.

- UL 9540A (2019); *"Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems"*
- NFPA 855 (2026); Standard for the Installation of Stationary Energy Storage Systems
- NFCC (2024) *"Grid-scale BESS Planning – Guidance for FRS"*
- Energy Storage Ireland, (July 2021) *Safety of Grid-Scale Battery Energy Storage Systems - Information Paper*

The proposed BESS facility is designed as a series of independent enclosures. The steel ISO compliant enclosures incorporate deflagration vents sized by the installation-level UL 9540A test so that an internal over-pressure event jets upwards and away from walkways. Fixed inert gas suppression systems will be provided within enclosures in order to help prevent or limit propagation between modules. Upon detection of abnormal cell temperature, smoke, or vapour concentrations, the BMS will:

- Initiate an immediate safety-shutdown sequence by opening charge and discharge contactors and de-energising the power-conversion system, thereby preventing further energy flow into the affected string.
- Transmit a suppression-release command to the fixed gaseous-agent system, ensuring agent discharge occurs only after electrical isolation is confirmed.
- Close all motorised dampers and halt mechanical ventilation to preserve the agent's design concentration and comply with NFPA 855 in conjunction with the parent suppression standard (e.g., NFPA 2001 or NFPA 2010).
- Activate audible and visual alarms locally and via SCADA to notify plant operators and first responders of the event sequence and container status.

- Log all parameters and event timestamps for post-incident analysis and verification of compliance with the site's Hazard-Mitigation Analysis.

This fully integrated control logic ensures that detection, electrical isolation, ventilation shutdown and agent discharge occur in the correct order and timeframe, satisfying both the functional requirements of NFPA 855 (2026) and the performance criteria of the applicable clean-agent standard. A Fire Risk Assessment and Emergency Response Plan Report for the purposes of planning is provided in Appendix 17.3 of this EIAR Addendum

All enclosures (BESS and MVPS) will be UL9540A (2024) tested and certified. Spacing between battery (battery to battery) and MVPS (battery to MVPS) enclosure is 4.4m which is greater than the 0.9m minimum spacing specification detailed in NFPA 855. Accordingly, the BESS facility will be NFPA 855 (2026) compliant.

A 500m^3 sectional steel fire-water tank and pump set is positioned within the BESS facility which will serve hydrants thereby providing water for cooling of nearby enclosures and boundary areas in the event of a fire. The water tank will be capable of delivering a minimum of 1,900 litres per minute for just over 4 hours (minimum 2 hours normally required). The additional capacity provides for automatic refill and reduces instantaneous pressure on water supplies (i.e. the reserve can be refilled over a longer time period than 8 hours as the stored water volume will be greater than the required water volume).

5.4 MITIGATION MEASURES

To control and minimise potential adverse impacts during construction, a Construction Environmental Management Plan (CEMP) is prepared for the development. The CEMP will be further developed and implemented by the appointed Contractor in advance of construction works and agreed with the Planning Authority. Mitigation measures set out within the EIAR Addendum (including traffic management, dust and mud control, restrictions on working practices where required, and access-control measures to prevent unauthorised public use of the temporary alternative construction access road) will be incorporated into the CEMP, together with any planning conditions. With these measures in place, effects on population and human health during the construction (and decommissioning) phases are predicted to comprise temporary/short-term, direct and indirect, slight adverse effects at worst. Given the setting and sensitivity of the identified receptors, potential effects associated with operation of the proposed development (as amended) are assessed as neutral.

5.5 RESIDUAL IMPACTS OF THE DEVELOPMENT

Following implementation of the mitigation measures secured through the CEMP, the residual effects on population and human health during construction are expected to be slight adverse, temporary/short-term, and within acceptable bounds. The alternative temporary construction access road is expected to deliver a measurable benefit by reducing HGV movements along sections of the L8763 with frontage residences, thereby reducing potential nuisance and improving road safety conditions for local users for the duration of construction. Following completion of construction and decommissioning of the temporary access (as applicable), residual effects are expected to be neutral, with no long-term severance or amenity impacts predicted.

5.6 CUMULATIVE EFFECTS

Cumulative population and human health effects could arise where the construction programme overlaps with other developments or background roadworks in the area, potentially increasing overall construction traffic and pressure on the local road network. The proposed alternative construction access road reduces the potential for such cumulative effects by concentrating project-related HGV movements onto a managed, purpose-designed route between the N65 and the works area, thereby limiting additional traffic on the L8763 local road network and reducing combined nuisance and safety effects at residential frontages. Subject to implementation of the CEMP (including delivery scheduling, traffic management measures and ongoing monitoring), cumulative effects on population and human health are expected to remain not significant, with any residual effects likely to be temporary and slight.

6 BIODIVERSITY

6.1 INTRODUCTION

This chapter provides an assessment of the impacts of the proposed development (as amended) on the ecological environment, i.e. biodiversity, flora and fauna. It has been compiled in compliance with the European Communities Legal requirements with regard to Environmental Impact Assessment and follows the Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2022).

6.2 METHODOLOGY

This chapter concentrates on ecological features within the development area of particular significance, primarily designated habitats and species. This includes habitats/species listed in Annex I, II and IV of the EU Habitats Directive, rare plants listed in the Flora Protection Order and other semi-natural habitats of conservation value.

A Report for the purposes of Appropriate Assessment Screening was undertaken by Moore Group for the proposed alternative access road which is presented as a standalone report. In order to screen out a project, it must be excluded, on the basis of objective information, that the proposed development (as amended), individually or in combination with other plans or projects, will have a significant effect on a European site.

A Natura Impact Statement (NIS) has been prepared in respect of the proposed alternative construction access road serving the proposed energy projects at Coolpowra, Ballynaheskeragh, Coolnageeragh, Sheeaunrush and Gortlusky, Co. Galway. This is also submitted to the planning authority as a standalone report. The NIS contains information to assist the competent authority in carrying out an Appropriate Assessment (AA) for the purposes of Article 6(3) of the Habitats Directive and Section 177V of the Planning and Development Act 2000, as amended.

6.2.1 LEGISLATION

6.2.1.1 EU Habitats Directive

The "Habitats Directive" (Council Directive 92/43/EEC) on the Conservation of Natural Habitats and of Wild Flora and Fauna) is the main legislative instrument for the protection and conservation of biodiversity within the European Union. The Habitats Directive provides for the designation, conservation and protection of sites comprising Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), collectively forming the Natura 2000 network of "European sites". Article 3 of the Habitats Directive obliges

Member States to designate as SACs sites hosting the natural habitat types listed in Annex I and habitats of the species listed in Annex II of the Habitats Directive. Article 10 of the Habitats Directive requires that Member States endeavour to improve the ecological coherence of the Natura 2000 network to manage and conserve features of the landscape which are of major importance for wild fauna and flora, for example ecological corridors or stepping-stones which are important for the migration, dispersal and genetic exchange of species.

Article 6(2) obliges Member States to take the necessary measures to avoid the deterioration of an SAC, or disturbance of a species for which the site is designated. Article 6(3) sets out the requirement for an "Appropriate Assessment", to ensure that a proposed plan or project will not have an adverse effect on the integrity of a SAC. Article 7 applies the requirements of Article 6(2) and 6(3) of the Habitats Directive to SPAs designated under the Birds Directive.

In addition, and separate to the Appropriate Assessment requirements, Article 12 of the Habitats Directive obliges Member States to establish a regime of strict protection for certain species listed in Annex IV of the Directive, wherever they occur within their natural range. The protection for species under Article 12 of the Habitats Directive is not confined to the boundary of SACs. Species listed in Annex IV include the otter and certain species of bat.

6.2.1.2 EU Birds Directive

The "Birds Directive" (European Council (2009) Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds) confers legal protection to all naturally occurring wild birds within the EU territory. Member States are obliged to adopt the necessary measures to maintain the population of bird species, and that includes, in accordance with Article 3, an obligation to create, maintain and manage habitats for birds, and specifically for the species of Bird listed in Annex I of the Directive, Article 4 requires Member States to create SPAs which, by virtue of Article 7 of the Habitats Directive, form part of the Natura 2000 network of European sites and are subject to the Appropriate Assessment requirements under Article 6(3) of the Habitats Directive.

Additionally, Article 5 of the Birds Directive requires that Member States establish a general system of protection for all naturally occurring wild birds within the EU territory, similar to the system of strict protection required for Annex IV species under the Habitats Directive.

6.2.1.3 Wildlife Acts (1976 - 2024)

The primary domestic legislation providing for the protection of wildlife in general, and wild birds in particular, and the control of some activities adversely impacting upon wildlife is the Wildlife Act of 1976, as amended. The aims of the Wildlife Act, according to the National Parks and Wildlife Service (NPWS) are *"... to provide for the protection and conservation of wild fauna and flora, to conserve a representative sample of important ecosystems, to provide for the development and protection of game resources and to regulate their exploitation, and to provide the services necessary to accomplish such aims."* All wild bird species are protected under the Act. The European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) made significant amendments to the Wildlife Acts to ensure consistency with the Habitats and Birds Directives.

6.2.2 METHODOLOGY AND GUIDANCE

The biodiversity survey was carried out in three stages, firstly through desktop assessment to determine existing records in relation to habitats and species present in the potential Zone of Influence of the proposed development (as amended). This included research on the NPWS metadata website, the National Biodiversity Data Centre (NBDC) database and a literature review of published information on flora and fauna occurring in the development area.

Sources of information that were used to collate data on biodiversity in the potential Zone of Influence are listed below:

- The following mapping and Geographical Information Systems (GIS) data sources, as required:
  - National Parks & Wildlife (NPWS) protected site boundary data;
  - Ordnance Survey of Ireland (OSI) mapping and aerial photography;
  - OSI/ Environmental Protection Agency (EPA) rivers and streams, and catchments;
  - Open Street Maps;
  - Digital Elevation Model over Europe (EU-DEM);
  - Google Earth and Bing aerial photography 1995-2025;
- Online data available on Natura 2000 sites as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie including:
  - Natura 2000 - Standard Data Form;
  - Conservation Objectives;
  - Site Synopses;
- National Biodiversity Data Centre records;

  - Online database of rare, threatened and protected species;
  - Publicly accessible biodiversity datasets.
- Status of EU Protected Habitats in Ireland. (National Parks & Wildlife Service, 2019); and
- Relevant Development Plans in neighbouring areas:
  - Galway County Development Plan 2022-2028

Other environmental information for the area was reviewed, e.g. in relation to soils, geology, hydrogeology and hydrology. Interactions in terms of the chapters on these topics presented in this EIA Report were important in the determination of source vector pathways and links with potentially hydrologically connected areas outside the proposed development site.

The second phase of the survey involved a site visit on 26 August 2025 to establish the existing environment in the footprint of the proposed development area. Areas which were highlighted during desktop assessment were investigated in closer detail according to the Heritage Council Best Practice Guidance for Habitat Survey and Mapping (Smith et al., 2011). Habitats in the proposed development area were classified according to the Heritage Council publication *"A Guide to Habitats in Ireland"* (Fossitt, 2000). This publication sets out a standard scheme for identifying, describing and classifying wildlife habitats in Ireland. This form of classification uses codes to classify different habitats based on the plant species present. Species recorded in this report are given in both their Latin and English names. Latin names for plant species follow the nomenclature of "An Irish Flora" (Parnell & Curtis, 2012).

Habitats were surveyed by conducting study area walkovers covering the main ecological areas identified in the desktop assessment. The survey dates are within the optimal survey periods for botanical species.

Signs of mammals such as badgers and otters were searched for while surveying the study area noting any sights, signs or any activity in the vicinity especially along adjacent boundaries.

Birds were surveyed using standard transect methodology and signs were recorded where encountered during the field walkover surveys.

Trees are a highly important feature of landscapes in that they provide roost sites throughout the year as well as being essential sources of insect prey. Therefore, the removal of such trees reduces the availability of shelter and feeding sites for bats (NRA 2005). The use of trees as roost sites is well established. Discovery of such roosts may be

established by a variety of means including the use of a bat detector survey or alternatively by examination of all suitable crevices and cavities; commonly referred as Potential Roost Features (PRF's). Trees most likely to serve as bat roosts should be identified by a bat specialist from a walk-through of the route, from aerial photography or from a tree survey report.

Trees were examined for potential to host bat roosts on 26 August 2025 following guidelines set out in the Bat Tree Habitat Key (Andrews, 2016) and BCT Guidelines for professional ecologists Editions 2 and 3. All trees were assessed from ground level using binoculars.

Examples of crevice features include:

- Natural holes;
- Cracks/splits in major limbs;
- Loose bark; and
- Hollows/cavities.

Each tree was assessed and ranked from category 1 – 4 according to Bat Conservation Trust 2 ed. (Hundt et al, 2012):

Tree Category	Description
1	Trees with multiple, highly suitable features capable of supporting larger roosts
2	Trees with definite bat potential but supporting features suitable for use by singleton bats;
3	Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats;
4	Trees have no potential

The final part of the assessment involves an evaluation of the study area and determination of the potential impacts on the habitats of the study area. This part of the assessment forms the basis for Impact Assessment and is based on the following guidelines and publications:

- Guidelines for Ecological Impact Assessment in the UK And Ireland Terrestrial, Freshwater, Coastal and Marine Version 1.3 - Updated September 2024 (CIEEM, 2024);

- EPA Guidelines on Information to be contained in an EIAR (EPA, 2022);
- Best Practice Guidance for Habitat Survey and Mapping (Heritage Council, 2011);
- Ecological Surveying Techniques for Protected Flora & Fauna (NRA, 2008);
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009);
- Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DEHLG, December 2009, Rev 2010);
- Guidance document on Article 6(4) of the Habitats Directive 92/43/EEC (EC, 2007).

While prepared for linear projects the TII Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009) are still relevant and outlines the methodology for evaluating ecological impacts of the project in the present report. According to the TII Guidelines, the Ecological Study should address:

- Designated conservation areas and sites proposed for designation within the zone(s) of influence of any of the Project options,
- All the main inland surface waters (e.g. rivers, streams, canals, lakes and tanks) that are intersected by any of the route corridor options, including their fisheries value and any relevant designations,
- Aquifers and dependent systems and turloughs and their subterranean water systems,
- Any known or potentially important sites for rare or protected flora or fauna that occur along or within the zone(s) of influence of any of the route options,
- Any other sites of ecological value, that are not designated, along or in close proximity to any of the route corridor options,
- Any other relevant conservation designations or programmes (e.g. catchment management schemes, habitat restoration or creation projects, community conservation projects, etc.),
- Any other features of particular ecological or conservation significance along any of the route options.

The TII Guidelines set out a method of evaluating the importance of sites identified and in turn the evaluation of the significance of impacts. The Evaluation Scheme is presented in Appendix 1 for reference.

Impact Assessment is then based on CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland, 2019.

6.2.3 DESCRIPTION OF PROJECT

A detailed description of the proposed alternative access road as amended is provided in Chapter 2 of this EIAR Addendum. Where relevant to a topic-specific assessment, any additional detail is provided in the corresponding chapter, however the scope and nature of the proposed development (as amended) remain as set out in Chapter 2.

6.3 EXISTING ENVIRONMENT

6.3.1 GENERAL NOTES

The site comprises a mosaic of open farmland fields (GA1) which are cattle grazed. The fields are bordered by low Hedgerows with a treeline along the esker road. The following is a description of the flora and fauna of the existing environment in the study area.

6.3.2 DESIGNATED CONSERVATION AREAS

The Zone of Influence may be determined by considering the Proposed Development's potential connectivity with European sites, in terms of:

- Nature, scale, timing and duration of all aspects of the proposed works and possible impacts, including the nature and size of excavations, storage of materials, flat/sloping sites;
- Distance and nature of potential pathways (dilution and dispersion; intervening 'buffer' lands, roads etc.); and
- Location of ecological features and their sensitivity to the possible impacts.

The potential for source pathway receptor connectivity is firstly identified through GIS interrogation and detailed information is then provided on sites with connectivity. European sites that are located within a potential Zone of Influence of the Proposed Development are listed in Table 6.1 and presented in Figure 6.1 and Figure 6.2, below. Spatial boundary data on the Natura 2000 network was extracted from the NPWS website (www.npws.ie) on 25 November 2025. This data was interrogated using GIS analysis to provide mapping, distances, locations and pathways to all sites of conservation concern including pNHAs, NHA and European sites.

Table 6.1 European Sites located within the potential Zone of Influence of the Proposed Development.

Site Code	Site name	Distance (km)
000231	Barroughter Bog SAC	6.12
002241	Lough Derg, North-east Shore SAC	5.63

Site Code	Site name	Distance (km)
000216	River Shannon Callows SAC	5.14
004058	Lough Derg (Shannon) SPA	5.63
004096	Middle Shannon Callows SPA	5.16
004168	Slieve Aughty Mountains SPA	8.33

The proposed alternative access road is almost entirely located in the townland of Ballynaheskeragh, between Killimor and Portumna, in southeast Co. Galway. It is drained by field boundary ditches which lead to a conjoined water course identified by the EPA and the Ballynaheskeragh Stream and the Sheeaunrush Stream. However, the topography of this area has been altered over the last 20 years and the Ballynaheskeragh Stream does not exist at the base of the esker road leading to the Coolpowra site (entrance as proposed within the July 2024 EIAR). The Sheeaunrush Stream was observed to be a dry ditch originating from the south in the vicinity of recently developed dwelling in that area. After rainfall, it flows east toward the N65 and joins the Gortaha River which lows south to the River Shannon 6.5 river km downstream and thus has connectivity with the River Shannon Callows SAC (Site Code 000216), the Middle Shannon Callows SPA (Site Code 004096) along with the Lough Derg, North-east Shore SAC (Site Code 002241) and the Lough Derg (Shannon) SPA (Site Code 004058) both over 10 river km downstream in Lough Derg.

The western portion of the proposed alternative access road is drained by large deep cut drainage ditches which convey water to the Treananearla Stream, which runs northwest from the site, and enters the Kilcrow River. The Kilcrow flows generally south, discharging into Lough Derg at Stonyisland Bay. The Treananearla Stream has connectivity to two European sites at Lough Derg, the Lough Derg, North-east Shore SAC (Site Code 002241), and the Lough Derg (Shannon) SPA (Site Code 004058).

Barroughter Bog SAC (Site Code 000231) also lies close to the Kilcrow River, 6.1km to the southwest. The Kilcrow River runs along the eastern edge of the SAC boundary before it outfalls into Lough Derg.

However, given the location of the SAC in relation to the original proposed development and the nature of the qualifying interests for which it is designated (terrestrial habitats) no viable source pathway receptor links are identified and therefore no potential for significant effects to this European site, and it is screened out.

The Slieve Aughty Mountains SPA (Site Code 004168) lies 7.4km to the southwest. The footprint of the proposed alternative access road has not been identified as an ex-situ foraging, roosting or breeding area for any SCI species, and it is screened out.

Figure 6.1 Showing European sites and NHAs/pNHAs within the wider Potential Zone of Influence of the Proposed Development.

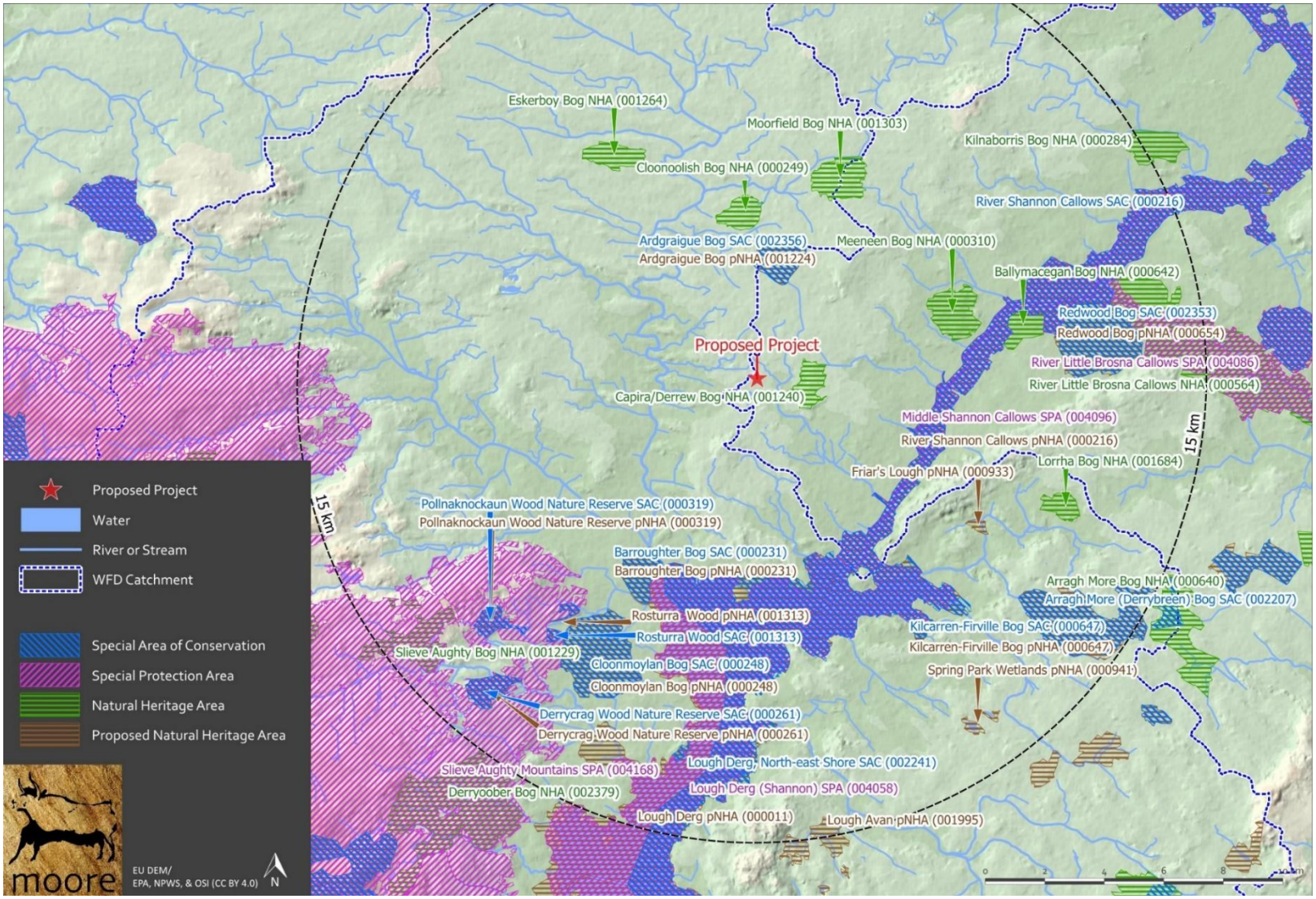
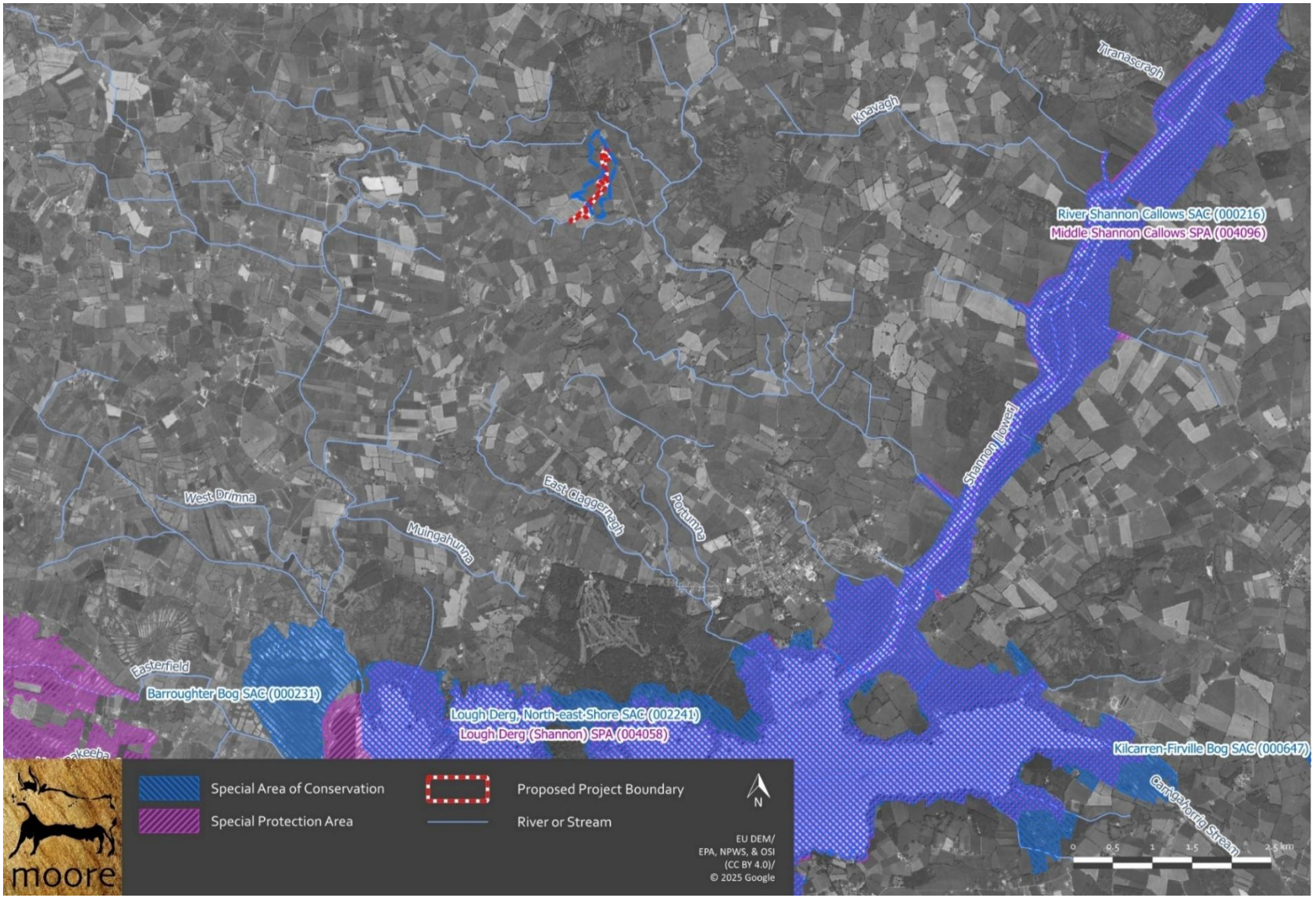


Figure 6.2 Detailed view of European sites in the nearer Potential Zone of Influence of the Proposed Development



6.3.3 NON-DESIGNATED HABITATS

The proposed alternative access road consists of two areas of agricultural grassland (GA1), as well as the road separating these areas. One section of grassland lies to the southwest of the L8763 local road, with the larger section extending from this road to the N65 national road.

The existing road is classed as Buildings and Artificial structures (BL3). There are no records of rare plants in the 1km squares in which the Project site is located (M8209 & M8309).

The main habitats are presented on the recent aerial photography in Figure 6.3. A list of habitats recorded, and their corresponding Fossitt codes is presented in Table 6.2.

Table 6.2 Details of habitats recorded and their corresponding Fossitt codes

Habitat	Habitat Category	Habitat Type
(F) Freshwater	(FW) Watercourses	(FW4) Drainage ditches
(G) Grassland	(GA) Improved grassland	(GA1) Improved agricultural grassland
	(GS)	(GS2) Dry meadows and grassy verges
(W) Woodland and Scrub	(WS) Scrub and transitional woodland	(WS1) Scrub
	(WL) Linear woodland	(WL1) Hedgerows
		(WL2) Treelines
(B) Cultivated and Built land	(BL) Built land	(BL3) Buildings and artificial surfaces
(E) Exposed rock and disturbed ground	(ED) Disturbed ground	(ED3) Recolonising bare ground

6.3.3.1 (FW4) Drainage ditches

This habitat classification applies to drainage ditches within the site associated with low gappy hedgerows. These ditches are generally shallow and stagnant being self-contained draining to ground during drier weather with no fisheries value.

The Kilcrow River further downstream was assessed as part of the WFD surveillance monitoring programme in rivers 2012. The survey site was located upstream of Ballyshrule Bridge, approximately 6km west of Portumna, Co. Galway. Three electric-fishing passes were conducted using two boat-based electric fishing units on the 14 September 2012, along a 154m length of channel. Glide dominated the habitat, while the substrate consisted mainly of cobble and gravel. Vegetation at this site consisted of tall emergent, and small, marginal, aquatic and semi-aquatic species. A total of nine fish species were recorded in the Kilcrow River Ballyshrule Bridge site. Brown trout was the most abundant species, followed by perch, roach, minnow, gudgeon, salmon, pike, European eels and stone loach.

6.3.3.2 (GA1) Improved agricultural grassland

All of the farmland within the redline boundary is laid out in Improved agricultural grassland (GA1). Areas recently re-seeded form a Perennial Rye Grass (*Lolium perenne*) monoculture; most fields have a number of common weedy species in addition, such as Broad-leaved Dock (*Rumex obtusifolius*), Creeping Thistle (*Cirsium arvense*), Dandelion (*Taraxacum* agg.) and Common Mouse-Ear (*Cerastium fontanum*). Small areas in lower lying parts of the fields have wet, but still improved grassland, with Soft Rush (*Juncus effusus*) dominant.

6.3.3.3 (GS2) Dry meadows and grassy verges

The L8763 road, where the new access road will cross, has some areas of Dry meadows and grassy verges (GS2) along its verges, with species such as Wood Avens (*Geum urbanum*), Crested Dog's Tail (Cynosurus cristatus), Cowslip (*Primula veris*), False Brome (*Brachypodium sylvaticum*), and Wild Strawberry (*Fragaria vesca*).

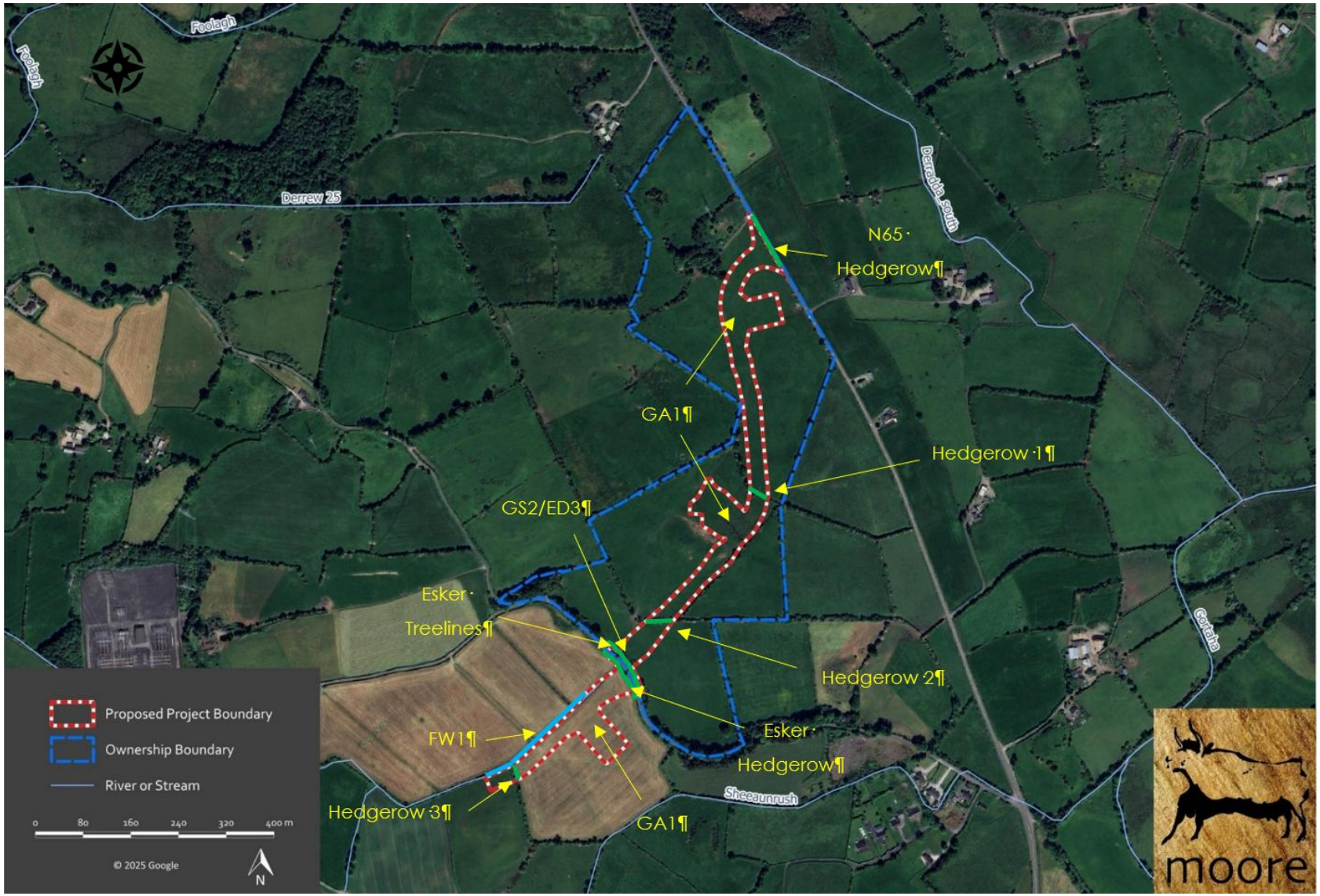
6.3.3.4 (ED3) Recolonising bare ground

Small areas of land on the field margins adjacent to the esker road have areas of barish soil where slippage and clearance has occurred recently. Recolonisation is patchy, with Nettle (*Urtica dioica*), Hairy Bitter Cress (*Cardamine hirsuta*) and Willowherbs (Epilobium sp.) all recorded.

6.3.3.5 (WS1) Scrub

Scrub (WS1) was recorded along the field boundary northwest of the L8763 road at the new crossing point, with Gorse (*Ulex europaeus*), and Nettle and Brambles (*Rubus fruticosus*).

Figure 6.3 Habitats recorded during survey



6.3.3.6 (WL1/WL2)) Hedgerows/Treelines

This habitat refers to the internal dividing field boundaries as well as roadside boundaries along the L8763 /N65 roads. Species present include Hawthorn (*Crataegus monogyna*) and Ash (*Fraxinus excelsior*) along with Willow (*Salix* spp) and frequent Elder (*Sambucus nigra*). A hedgerow survey and assessment were undertaken of those hedgerows and treelines which need to be crossed by the new access road, see Figure 6.3 for locations described below.

N65 boundary hedgerow

This section lies alongside the N65, and is dominated by Hawthorn and Ash, with some Wild Privet (*Ligustrum vulgare*), Blackthorn (*Prunus spinosa*), and abundant Bramble throughout. As a roadside hedgerow, it is regularly flailed but retains moderate local biodiversity value.

Hedgerow 1

This hedgerow section is short, and composed of Hawthorn, Grey Willow, Ash and some scrubby Gorse. Despite little floristic diversity, it has value for its connectivity role.

Hedgerow 2

This is a section of a longer dog-legging hedgerow and has a similar species composition to the previous hedgerow, but greater structural diversity, with more outgrowth. A relatively deep drainage ditch forms an integral part of the row, with stagnant water in parts, but dry elsewhere. Fool's Water Cress (*Apium nodiflorum*) and Brooklime (*Veronica beccabunga*) were both recorded in damper parts.

Hedgerow 3

This is a short section of the hedgerow which forms part of the historic townland boundary between Gortlusky and Ballynaheskeragh. It has modest species diversity with Hawthorn the predominant tree. The structure of the row is considered good, with some management evident in the face, while parts of the top have grown out. This hedgerow is assessed as having low local biodiversity value, largely due to its connectivity to other hedgerows.

Esker Hedgerow Northwest

The eastern boundary of the site lies along the L8763 road, which runs along an esker. The boundary is lined by a roadside hedgerow with stone wall, with a steep bank dropping to the fields of the site: this bank has been cleared of vegetation. The hedgerow contains a good mixture of species typical of calcareous soils on eskers, including Hazel, Blackthorn and Ash, with Hogweed, Cleavers, Primrose, and Bush Vetch comprising the ground flora. This hedgerow is assessed as having low local biodiversity value, due to its connectivity and floristic diversity.

Esker Treeline Northwest

The northwestern side of the road features a rather impressive treeline, mostly of Beech (*Fagus sylvatica*), including some veteran specimens, as well as frequent Hazel, Grey Willow, Hawthorn, Gorse and Dog Rose (*Rosa canina*). The heavily shaded field margin below supports some Primrose, Pignut (*Conopodium majus*), Red Fescue (*Festuca rubra*) and Glaucous Sedge (*Carex flacca*). This treeline forms a significant landscape feature and has a diverse suite of species indicative of good quality calcareous habitat, and this linear feature is assessed as of high local biodiversity value.

6.3.4 INVASIVE SPECIES

No invasive species were recorded during surveys.

6.3.5 FAUNA

6.3.5.1 Badgers

There were no badger setts along field boundaries which would be disturbed and no signs of badgers in the study area.

6.3.5.2 Otters

There were no signs of otters in the site or along the stream or drainage ditches which have no fisheries value.

6.3.5.3 Bats

Trees within the site were also assessed with reference to (Andrews H., 2018) Bat Roosts in Trees. None were found to have bat roosting potential being either mature with no available roosing features or semi/immature with no available roosing features.

The NBDC database was consulted for details on bat records held for the site and the surroundings. The database was consulted on the 25/11/2025 for details on historical records from the site and the surrounding 6km given this is the furthest likely zone of influence for Irish bat roosts. No bat species were recorded within 2km, however six of the nine confirmed resident bat species known to occur in Ireland have been recorded within 6km of the subject site.

6.3.5.4 Other Mammals

There were signs of foxes in the grassland fields. Hares were observed in the Coolpowra parent applications (as detailed in the July 2024 EIAR) area during previous surveys and are likely to pass through the subject fields. These species are of relatively low ecological concern and being highly mobile will not be affected.

6.3.5.5 Birds

All birds are protected under the Wildlife Acts. A list of breeding bird species recorded during fieldwork in 2018 is presented in Table 6.3 below.

Table 6.3 Birds recorded during fieldwork in August 2025

Birds	Scientific name	BWI Status	Habitat Type
Magpie	*Pica pica*	Green	Anywhere in lowland areas
Woodpigeon	*Columba palumbus*	Green	Gardens, woods, hedges
Wren	*Troglodytes troglodytes*	Green	Gardens, woods, hedges

6.3.6 HABITAT EVALUATION

The ecological value of the site was assessed following the guidelines set out in the Institute of Ecology and Environmental Management's Guidelines for Ecological Impact Assessment (2019) and according to the Natura Scheme for evaluating ecological sites (after Nairn & Fossitt, 2004). Additionally, the TII Guidelines (formerly NRA) for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009) outlines the methodology for evaluating ecological impacts Judgements on the evaluation were made using geographic frames of reference, e.g. European, National, Regional or Local, see Table 6.4 below.

Due cognisance of features of the landscape which are of major importance for wild flora and fauna, such as those with a *"stepping stone"* and ecological corridors function, as referenced in Article 10 of the Habitats Directive were considered in this assessment.

Table 6.4 Details of TII Guidelines (formerly NRA) for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009.

Ecological valuation: Examples

International Importance:

- 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation.
- Proposed Special Protection Area (pSPA).
- Site that fulfills the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).
- Features essential to maintaining the coherence of the Natura 2000 Network.[4]
- Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
- Resident or regularly occurring populations (assessed to be important at the national level)[5] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
- Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
- World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).
- Biosphere Reserve (UNESCO Man & The Biosphere Programme).
- Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
- Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
- Biogenetic Reserve under the Council of Europe.
- European Diploma Site under the Council of Europe.
- Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).[6]

National Importance:

- Site designated or proposed as a Natural Heritage Area (NHA).
- Statutory Nature Reserve.
- Refuge for Fauna and Flora protected under the Wildlife Acts.
- National Park.
- Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
- Resident or regularly occurring populations (assessed to be important at the national level)[7] of the following:
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing 'viable areas'[8] of the habitat types listed in Annex I of the Habitats Directive.

County Importance:

- Area of Special Amenity.[9]
- Area subject to a Tree Preservation Order.
- Area of High Amenity, or equivalent, designated under the County Development Plan.
- Resident or regularly occurring populations (assessed to be important at the County level)[10] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.
- County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP,[11] if this has been prepared.
- Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.
- Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.

Local Importance (higher value):

- Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;
- Resident or regularly occurring populations (assessed to be important at the Local level)[12] of the following:
  - Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
  - Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;
  - Species protected under the Wildlife Acts; and/or
  - Species listed on the relevant Red Data list.
- Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;
- Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.

Local Importance (lower value):

- Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;
- Sites or features containing non-native species that are of some importance in maintaining habitat links.

The proposed alternative access road is predominantly located in the townland of Ballynaheskeragh, between Killimor and Portumna, in southeast Co. Galway. It is drained by field boundary ditches which lead to a conjoined water course identified by the EPA and the Ballynaheskeragh Stream and the Sheeaunrush Stream. However, the topography of this area has been altered over the last 20 years and the Ballynaheskeragh Stream does not exist at the base of the esker road leading to the Coolpowra site. The Sheeaunrush Stream was observed to be a dry ditch originating from the south in the vicinity of recently developed dwelling in that area. After rainfall, it flows east toward the N65 and joins the Gortaha River which lows south to the River Shannon 6.5 river km downstream and thus has connectivity with the River Shannon Callows SAC (Site Code 000216), the Middle Shannon Callows SPA (Site Code 004096) along with the Lough Derg, North-east Shore SAC (Site Code 002241) and the Lough Derg (Shannon) SPA (Site Code 004058) both over 10 river km downstream in Lough Derg.

There will be no direct negative effects on sites of conservation concern of annexed habitats or species of conservation concern.

However, in the absence of mitigation measures during construction to control potential pollution of surface water, the potential effects water quality in the Gortaha River leading to Lough Derg and on the River Shannon Callows SAC (Site Code 000216), the Middle Shannon Callows SPA (Site Code 004096), the Lough Derg North-east Shore SAC (Site Code 002241), and the Lough Derg (Shannon) SPA (Site Code 004058) is uncertain.

It cannot be excluded, on the basis of objective information, that the Proposed Development, individually or in combinationn with other plans or projects, will have a significant effect on a European site.

6.4 POTENTIAL EFFECTS ON BIODIVERSITY

6.4.1 POTENTIAL DIRECT EFFECTS -HABITATS

The open field habitats are considered of low biodiversity value at a local level while internal and boundary hedgerows range from low to moderate local value.

There are no rare or protected habitats recorded in the study areas inside the licenced areas. Overall, the proposed development area is of Low Local Ecological Value, with the exception of the esker hedgerows and treelines.

In the absence of mitigation measures during diversion and overall site development near water courses, the potential for pollution for elevated suspended solids and/or chemical spills or hydrocarbons is uncertain in the absence of construction management measures.

The potential direct effects on habitats will be imperceptible and neutral.

6.4.2 POTENTIAL DIRECT EFFECTS - BIRDS

Potential direct effects on breeding birds through loss of internal hedgerow can be avoided by appropriate timing.

6.4.3 POTENTIAL DIRECT EFFECTS - BATS

The proposed works will have a Moderate effect on receptors of Local Importance (Low Value). The loss of trees within the site is not significant at a county, national or international scale.

6.4.4 POTENTIAL INDIRECT EFFECTS

The proposed alternative access road will involve crossing and culverting of two water courses /drainage ditches and the banking of support material to the northern side of the esker road.

Standard road construction activity involves earth movement and the use of plant and machinery that will require refuelling in addition there will be small amounts of cement delivered for local use in small batches.

In the absence of mitigation measures during construction to control potential pollution of surface water, the potential effects water quality in the Gortaha River leading to Lough Derg and on the River Shannon Callows SAC (Site Code 000216), the Middle Shannon Callows SPA (Site Code 004096), the Lough Derg North-east Shore SAC (Site Code 002241), and the Lough Derg (Shannon) SPA (Site Code 004058) is uncertain.

Guidance on lighting has been based on the Bats & Lighting document; (BCI , 20 the Bats and artificial lighting in the UK Guidance Note 08/18 (BC T, 2018) and Guidelines for consideration of bats in lighting projects. EUROBATS Publication Series No. 8 (Voigt, 2018). Lighting can alter the behaviour of bats and the insects they prey on.

The potential indirect effects on Biodiversity relate to the conveyance of pollutant emissions downstream to the River Shannon and/or Lough Derg. The predicted effect is unlikely to be significant, however, construction management will be included under the Precautionary Principle.

6.5 MITIGATION MEASURES

6.5.1 MITIGATION MEASURES FOR HABITATS

Some tree felling and hedgerow removal is planned, as well as removal of species poor agricultural grassland and arable land. New native hedgerows along the access road will provide significant net gain of high-quality habitat with improved connectivity for species in the wider landscape.

6.5.2 MITIGATION MEASURES FOR BATS

The landscape plan will see a large quantity of tree planting providing more landscape features usable by bats.

In order to minimise the extent of light spill onto perimeter habitats, all lights that are pole mounted will be directional and/or cowled to ensure that light is directed downward and inwards. Lights will be programmed or otherwise to be off unless required.

6.5.3 MITIGATION MEASURES FOR BIRDS

Potential impacts on birds will be avoided by cutting of vegetation outside the bird nesting season March to August.

Planting of native tree species in linear features as well as woodland patches will provide ecological corridors, nest sites and will compensate for the loss of hedgerows as part of the development.

6.6 RESIDUAL IMPACTS

Specific local mitigation measures include the avoidance of cutting of vegetation during the bird nesting season with regard to the construction phase. The planting of new hedgerow habitat will negate the loss of relatively short sections of low value gappy hedgerow, scrub, grassland and overgrown drainage ditches. The overall effect is considered neutral, imperceptible, and long-term.

With the employment of appropriate mitigation measures with regard to local biodiversity, the proposed alternative access road will have a neutral, imperceptible and long-term effect on biodiversity.

6.7 CUMULATIVE EFFECTS

The parent application for which the new access road is required are currently under consideration by An Coimisiún Pleanála are listed below. All three applications are supported by the July 2024 EIAR and this EIAR addendum.

- Project 1: Reserve Gas Fired Generator
- Project 2: Energy Storage System (ESS)
- Project 3: Gas Insulated Switchgear (GIS) Electricity Substation

These Projects were considered under the EIA Directive and Habitats Directive and supporting reports have demonstrated that with appropriate mitigation during construction, operation and landscaping that these Projects would have no significant effects on Biodiversity or on the Natura 2000 Network under the Habitats Directive. The Proposed Development will include a CEMP and environmental commitments in order to avoid potential negative effects on all European sites considered in the potential zone of

influence and to avoid negative effects on an and improve Biodiversity. Provided that mitigation is implemented, there are no predicted in-combination effects from the parent applications and the subject Proposed Development.

Potential routes for the underground transmission gas pipeline which will serve the reserve gas-fired generator project are being considered by Gas Networks Ireland. This connection will form a separate planning application. There is potential for the route of the pipelines to impact on unknown habitats and fauna such as badgers will be mitigated by appropriate avoidance measures to ensure no cumulative effects occur.

The Galway County Development Plan in complying with the requirements of the Habitats Directive requires that all Projects and Plans that could affect the Natura 2000 sites in the same zone of influence of the Development site would be initially screened for Appropriate Assessment and if requiring Stage 2 AA, that appropriate employable mitigation measures would be put in place to avoid, reduce or ameliorate negative impacts. In this way any, in-combination impacts with Plans or Projects for the proposed development area and surrounding townlands in which the development site is located, would be avoided.

A review of developments granted permission in the vicinity in most cases have been granted with conditions relating to sustainable development by the consenting authority in compliance with the relevant Local Authority Development Plan and in compliance with the Local Authority requirement for regard to the Habitats Directive. Any consented development cannot have received planning permission without having met the consenting authority requirement in this regard. There are no predicted in-combination or cumulative effects given that it is predicted that the development will have no effect on any European site.

6.8 MONITORING AND FURTHER WORKS

No ecological monitoring is required. Post-construction and following decommissioning/reinstatement, monitoring /inspection will confirm (i) reinstatement of bank profiles and drainage function where relevant, (ii) stabilisation of disturbed ground and absence of erosion/sediment pathways, and (iii) establishment and survival of planted hedgerows/trees, with remedial actions implemented as required.

6.9 SUMMARY OF SIGNIFICANT EFFECTS

There will be no significant effects on designated sites in the potential Zone of Influence of the proposed alternative access road. Mitigation measures proposed will reduce the impact on all bird species while enhancement measures should result in a net overall

benefit for the local bird population. The proposed alternative access road will not have a significant impact on any bird species on a local or county basis.

There will be no significant effects on overall low value local biodiversity.

6.10 REFERENCES

- Guidelines for Ecological Impact Assessment in the UK And Ireland Terrestrial, Freshwater, Coastal and Marine Version 1.3 - Updated September 2024 (CIEEM, 2024).
- Department of the Environment, Heritage and Local Government (2010) Guidance on Appropriate Assessment of Plans and Projects in Ireland (as amended February 2010).
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7 SOILS AND GEOLOGY

7.1 INTRODUCTION

This section provides an update of Chapter 7 of the July 2024 EIAR which assesses the potential effects associated with the Proposed Development as Amended on Soils and Geology. The chapter considers the proposed alternative construction access road (and associated revised planning application boundary) to allow for construction of the three Coolpowra Energy Projects – Reserve Gas Fired Generator (An Coimisiún Pleanála; Ref. 320095), GIS Generator (An Coimisiún Pleanála; Ref. 320094), and ESS (An Coimisiún Pleanála; Ref 32091).

Additional information is also provided within this Chapter of the EIAR Addendum to further describe and provide a comprehensive consideration of the baseline environment. Baseline and assessment findings of the Soils and Waters Environment Chapter contained in the July 2024 remain valid except where updated in this EIAR addendum chapter.

7.2 ASSESSMENT METHODOLOGY & SIGNIFICANCE CRITERIA

7.2.1 INTRODUCTION

This updated assessment uses the same methodologies outlined in Chapter 8 of the EIAR. The report meets the requirements of the relevant regulations and has been prepared in accordance with the EPA Guidelines on Information to be contained in Environmental Impact Assessment Reports (EPA, 2022).

7.3 DESCRIPTION OF THE RECEIVING ENVIRONMENT

7.3.1 BACKGROUND

As set out in the July 2024 EIAR, the proposed development is located in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway. The development lands are accessed via the N65 and the L8763 local road network in the vicinity of the site. Lands within the development site boundary of the Proposed Development as Amended are in agricultural use (grassed and arable) and include a farmhouse and outbuildings. The proposed lands are situated at an elevation of c. 51-54m AOD and are accessed by road via the N65 (National Road which connects the towns of Loughrea and Portumna) and the L8763 (local road). The study area for the geology and soils assessment is focused on land within the site boundary and outward to 2km.

The study area for the Waters assessment is focused on surface water and groundwater bodies within the development boundary and outward to 2km. Downstream waterbodies and protected waterbodies within 5km have also been considered.

7.3.2 SOILS AND GEOLOGY

7.3.2.1 Historical Land Use

Review of historical maps[34] and aerial imagery show that the lands on which the the proposed alternative construction access road was historically used as agricultural lands containing open grassland, pockets of woodland and scrub. In more recent years (last 30 years), aerial imagery shows lands as arable and grazing pastures.

7.3.2.2 Geology

Bedrock formation beneath the site is Lucan Formation (Dark limestone & shale (calp)) comprising dark grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey.

7.3.2.3 Soils and Subsoils

Soils on the site are described as Mullabane (Teagasc Code 1100q) and described as mostly Brown Earths and Calcareous Brown Earths on drift with limestones, associated with Luvisols and some inclusions of Rendzinas and peat. The soils are classed as well drained (Type BminSW).

The majority of the site is underlain by glacial till derived from limestone. Some isolated mounds of limestone gravels are present in the area along with a graded ridge of esker sands and gravels which underlie part of the local road (L8763) which routes in a north-western direction from the proposed "operational-stage" entrance to the site. This combination of deposit type is characteristic of sub-glacial mechanisms resulting in well drained soils of homogenous nature.

7.3.2.4 Ground Investigation - August to October 2024

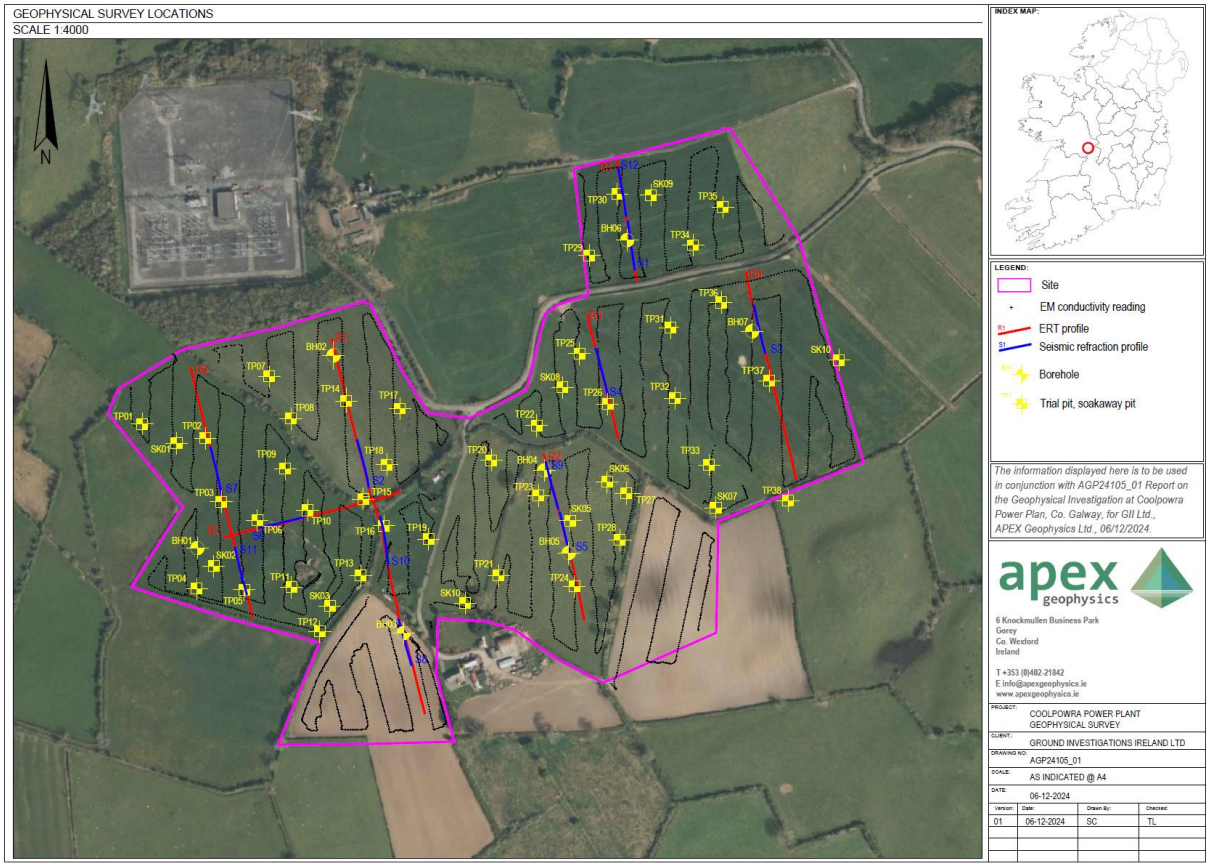
A ground investigation was carried out within the original planning site boundary (July 2024) on behalf of the applicant between August and October 2024 (see attached in Appendix 7.1). Thirty-eight trial pits, ten soakaway pits and seven rotary boreholes were completed between 10 September and 02 October 2024. A geophysical survey consisted of EM ground conductivity, 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction profiling was carried out over a number of sessions between the 12 August and

[34] 6" (dated 1829-1841) and 25" (1897-1913)

the 23 of October 2024. A drawing showing survey locations is presented in Figure 7.1 and a summary of the combined geophysical and direct investigation findings is as follows:

- Layer 1 - thin upper layer of predominantly soft sandy gravelly clay or loose clayey sand/gravel soils ranging from 0.3 to 1.8 m thick (average 1.0m)
- Layer 2 - a layer of predominantly firm to stiff sandy gravelly clay and/or medium dense to dense clayey and/gravel to depths ranging from 0.8 to 9.0 m bgl (average 3.5 m). No distinct weathered rock layer could be interpreted from the geophysical data however two trial pits (TP17 and SK04) encountered 0.9 to 1.2 m of weathered rock returned as clayey sandy gravel and one borehole (BH06) encountered 1.0m of possible weathered bedrock. As such, the base of Layer 2 may comprise of highly to moderately weathered rock which the seismic velocities indicate would be diggable to marginally rippable.
- Layer 3 - slightly weathered to fresh rock at elevations ranging from 41.8 to 52.8mOD. The seismic velocities indicate that the rock is of good quality.

Figure 7.1 Ground Investigation Survey Locations



The interpreted soil thickness (Layers 1 and 2 combined) ranges from 0.8m in the south of the site to 9.0m in the northwest, where there is a localised thickening of sandy gravelly

clay soil. The top of the slightly weathered to fresh rock has been interpreted at elevations ranging from 41.8mOD in the northwest to 52.8mOD in the northeast.

While there is generally a good correlation between the geophysical data and depth to bedrock encountered in the boreholes, the geophysical data indicates the diggable weathered rock encountered in the trial pits (TP17 and SK04) generally lies within Layer 2 material. Two bedrock types were interpreted; predominantly high resistivity dark limestone with thin interbedded shales with some areas of low resistivity rock interpreted as mudstone/shale.

A number of zones of lower bedrock resistivities are present on NW-SE trending ERT profiles. These zones could be indicative of a change in rock lithology (i.e. an increase in shale content) or increased weathering/fracturing/ faulting. These zones have been interpreted as indicating possible NE-SW faulting as the seismic data across these zones does not indicate the presence of lower velocity zones indicative of weathered/fractured rock.

Shallow groundwater in parts of the site was measured in temporary standpipes installed BH01, BH03, BH04, BH05, and BH06) as part of ground investigation works in October /November 2024. From the data general groundwater flow direction (indicative[35]) beneath the site is from the eastern /north-eastern part of the site (around BH06/BH05) toward the western /west-north-western part of the site, i.e. toward BH01.

No karst features were identified (e.g. voids) within the lands as part of the ground investigation works and the karst features is not supported by the evidence and findings from the ground investigation carried out. Findings of the ground investigation are consistent with the original EIAR findings. The GI report is provided in Appendix 7.1 of the EIAR Addendum.

7.3.2.5 Karst

Karst landscapes develop through the process of karstification, this occurs primarily in soluble rocks such as limestone and dolomite. Karstification takes place due to calcite dissolution from meteoric water. As rain descends through the atmosphere it picks up additional CO2 causing a chemical reaction within the soluble limestone, leading to the development of numerous surface and subsurface features. There are no karst features within or near (within 2.5km) the site. The closest karst features to the site are a spring (Karst Feature Unique ID IE_GSI_Karst_40K_8186) and an Enclosed Depression (Karst

[35] This is based on a small number of monitoring points and a short monitoring window (October to November 2024). Heads may reflect local shallow groundwater conditions (and standpipe installation depths – BH01 (6.7m), BH03 (6.7m), BH04 (6.7m) and BH05(6.5m).

Feature Unique ID IE_GSI_Karst_40K_2815), which are located approximately 3km from the southern redline boundary of the site.

7.3.2.6 Geological Heritage

The GSI in conjunction with the Geoparks network and GSNI have undertaken the programme *"Geoheritage"* dedicated to the protection and promotion of regions and features of geological importance throughout the country. The sites are identified as County Geological Sites for inclusion in County Development and Heritage Plans. According to the GSI There are no recorded sites of geological interest within or close to the development boundary. The Killimor Esker (Code GY078), a moderate-sized ridge comprised of esker sands and gravels, deposited under the ice sheet and trending east west is located 2.1km north of the proposed development (as amended) at its nearest point.

7.3.2.7 GSI wells and Springs

There are no GSI recorded wells or springs within the study area. There are no group schemes or public supply source protection areas within 2km of the development lands. A groundwater abstraction well is located within the development lands to the east of the house which is to be demolished as part of the proposed development. The existing abstraction well historically supplied potable water to the residence and farm. Field measurements of the well were completed in October 2024. The well depth was recorded as being 24.0m deep and depth to groundwater was recorded as being 3.99m bgl.

7.3.2.8 Landslide /Ground Stability

There is no risk of landslide within the development lands (GSI classification of susceptibility is *"low"*). A small section of the public road to the east of the site which runs along the raised ridge is classed as *"moderately low"*.

7.3.2.9 Geotechnical Site Records

There are no Geotechnical Site Records recorded by GSI within 2km of the proposed development lands.

7.3.2.10 Radon

According to the EPA, approximately 1 in 10 homes in this area is likely to have high radon levels.

7.3.3 EARTHWORKS ASSESSMENT

The estimation of earthworks associated with the Proposed Development has been undertaken to quantify the volumes of cut and fill required to achieve the proposed finished ground levels across the site. The proposed levels have been developed based on available

topographical survey data, interpreted ground conditions, and the functional and operational requirements of the proposed infrastructure and associated ancillary equipment.

The assessment has been carried out in accordance with recognised civil engineering practice and with reference to:

- IS EN 1997-1 (Eurocode 7): Geotechnical Design,
- The principles of volume measurement set out in the Civil Engineering Standard Method of Measurement (CESMM).

7.3.3.1 Earthworks Zoning

For the purposes of earthworks assessment and volumetric analysis, the site has been subdivided into the following five distinct zones:

1. 400kV GIS, OCGT and Fuel Storage Area
2. SynCon Area and Adjacent Parking Area
3. Long Duration Energy Storage (LDES) Area
4. AGI Area
5. Access Road (Original Alignment)

The following tables indicate the preliminary unfactored bulk volumes associated with each zone.

Table 7.1 400kV GIS, OCGT & Fuel Storage Area

Volume Summary							
Name	**Type**	**Cut Factor**	**Fill Factor**	**2d Area (sq.m)**	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
400kV GIS OCGT Fuel Storage Area	full	1.200	1.200	59049.15	43340.37*	37886.99*	5453.38*

Totals				
	2d Area (sq.m)	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
Total	59049.15	43340.37*	37886.99*	5453.38*

Table 7.2 Syncon and Adjacent Parking Area

Volume Summary							
Name	**Type**	**Cut Factor**	**Fill Factor**	**2d Area (sq.m)**	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
Parking Area	full	1.200	1.200	3644.80	3370.83*	225.13*	3145.70*
SynCon	full	1.200	1.200	10934.85	5251.80*	307.97*	4943.82*

Totals				
	2d Area (sq.m)	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
Total	14579.66	8622.63*	533.10*	8089.52*

Table 7.3 LDES

Volume Summary							
Name	**Type**	**Cut Factor**	**Fill Factor**	**2d Area (sq.m)**	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
LDES	full	1.200	1.200	37159.75	15044.02*	20055.52*	5011.50*

Totals				
	2d Area (sq.m)	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
Total	37159.75	15044.02*	20055.52*	5011.50*

Table 7.4 AGI

Volume Summary							
Name	**Type**	**Cut Factor**	**Fill Factor**	**2d Area (sq.m)**	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
AGI	full	1.200	1.200	8138.25	1829.70*	579.90*	1249.81*

Totals				
	2d Area (sq.m)	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
Total	8138.25	1829.70*	579.90*	1249.81*

Table 7.5 Access Road (Original)

Volume Summary							
Name	**Type**	**Cut Factor**	**Fill Factor**	**2d Area (sq.m)**	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
Original Access Road	full	1.200	1.200	7596.42	906.80*	2124.28*	1217.48*

Totals				
	2d Area (sq.m)	**Cut (Cu. M.)**	**Fill (Cu. M.)**	**Net (Cu. M.)**
Total	7596.42	906.80*	2124.28*	1217.48*

7.3.3.2 Earthworks Quantities and Material Reuse

The results of the preliminary volumetric analysis indicate a combined unfactored cut volume of approximately 69,700m³ across the proposed development. For the purposes of this assessment, and on a conservative basis, it has been assumed that the excavated cut material is unsuitable for direct reuse as structural fill beneath buildings or pavements. Accordingly, the excavated material is proposed to be reused on site to form three landscaped berms, as indicated on drawing number CPA-HAL-MP-XX-DR-PL-1000, thereby avoiding off-site disposal, and associated environmental impacts.

7.3.3.3 Berm Earthworks Assessment

The proposed undulating berms have a combined footprint with an approximate plan area of 32,000m², a maximum height of approximately 5.0m, and side slopes of 3H:1V. Based on these parameters, and assuming a linear variation in height from the berm perimeter to the crest, the total volume of earthworks associated with the berms is estimated to be in the order of 80,000m³. This estimate is derived using an average berm height of approximately 2.5m and is considered appropriate for planning phase design and

associated environmental assessment purposes. The berm geometry and associated volumes will be refined at detailed design stage following completion of detailed topographical modelling and confirmation of final slope profiles and crest configurations.

7.3.4 BASELINE SCENARIO - WITHOUT DEVELOPMENT

Soils and subsoils support would continue in agricultural land use. The ground profile is generally well drained with localised pockets of made ground and peat. Shallow groundwater in parts of the site was measured in temporary standpipes installed as part of ground investigation works in October /November 2024.

Without development, the lan use is expected to remain predominantly agricultural in the short to medium term. Routine farming and maintenance of field drains would continue to influence soil structure and runoff generation. Periodic maintenance of the arterial drainage network would continue to influence local drainage efficiency and channel form.

7.4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

7.4.1 CONSTRUCTION PHASE

The Construction Phase Potential Environmental Effects are presented in Table 7.6 of the July 2024 EIAR. Construction of the proposed alternative construction access road does not alter the type, extent, or likely significance of construction-phase effects on the water environment as previously assessed. Accordingly, there is no change to the impact significance ratings or the supporting discussion presented in the original EIAR.

7.4.2 OPERATIONAL PHASE

The proposed alternative construction access road is required for construction-stage activities only and will be removed following completion of the relevant works. As such, there are no operational phase impacts associated with the proposed alternative construction access arrangement.

7.5 MITIGATION MEASURES

7.5.1 CONSTRUCTION PHASE

Mitigation is presented in Table 7.10 of the July 2024 EIAR for the construction phase. No additional mitigation measures are proposed specifically in respect of the construction, use, and removal of the proposed alternative construction access road. The construction-phase mitigation set out in the July 2024 EIAR (including pollution prevention measures,

runoff management, sediment control, materials handling, and inspection/maintenance procedures) will apply equally to the alternative access works.

7.5.2 DECOMMISSIONING

Where decommissioning is undertaken following commissioning of the overall development, the proposed alternative construction access road will be removed and the lands reinstated. For the purposes of soils and geology, decommissioning would typically comprise:

- removal of surfacing and granular layers, as appropriate, and off-site disposal/reuse in accordance with waste management requirements;
- removal of temporary drainage features not required in the long term, reinstatement of any affected field drainage, and restoration of pre-existing drainage pathways where practicable; and
- replacement of stored subsoil and topsoil in the correct order and thickness, followed by reinstatement of agricultural use through cultivation, reseeding and/or equivalent land management measures.

Agricultural lands and associated field infrastructure, including drainage functionality, are considered to be of medium sensitivity. The magnitude of change is assessed as slight, reflecting the short-term and localised nature of disturbance associated with removal and reinstatement works, and the objective to restore pre-existing ground conditions. The likely significant effect is therefore assessed as minor adverse (short term) during decommissioning works. Residual effects are anticipated to be negligible, subject to implementation of an appropriate reinstatement method statement (including soil handling, protection of subsoil/topsoil structure, and erosion/sediment control) and post-works verification of surface condition and drainage performance.

7.6 RESIDUAL IMPACTS OF THE DEVELOPMENT

With implementation of the mitigation measures identified in the July 2024 EIAR (and applied to the alternative access works), the proposed development (as amended) is not predicted to give rise to significant residual effects on soils and geology. The alternative construction access arrangement is temporary and will be removed and the area reinstated; therefore, any effects arising during construction—such as localised soil disturbance/compaction, minor excavation and handling of superficial deposits, and short-term potential for sediment mobilisation—will be short-term and reversible.

Following reinstatement, ground levels and surface conditions will be restored as far as practicable, including replacement of soils/subsoils where relevant, stabilisation of exposed surfaces, and restoration of drainage controls. As a result, no long-term alteration to the geological or soil environment, and no enduring pathway for effect (e.g., persistent erosion or long-term contamination risk), is introduced beyond that already assessed in the original EIAR.

7.7 CUMULATIVE EFFECTS

Cumulative effects on soils and geology were assessed in the July 2024 EIAR in the context of the overall development and other relevant plans/projects. The proposed alternative construction access road results in a revised red-line boundary and introduces an additional temporary area of construction activity; however, it does not alter the operational characteristics of the development and does not introduce new operational emissions or discharges relevant to soils and geology.

Accordingly, any potential cumulative interactions are confined to the construction phase and relate primarily to temporary soil disturbance (including stripping/stockpiling/handling), localised excavation and earthworks, and the potential for increased runoff and mobilisation of fine sediment in combination with other construction activities associated with the overall development and any concurrent third-party works in the locality. These potential interactions are of the same nature as those assessed for the construction phase in the original EIAR and are managed through the established mitigation and control framework, including surface water and sediment management measures, pollution prevention procedures, and routine inspection and maintenance.

On this basis, the proposed alternative construction access arrangement is not predicted to materially alter the cumulative effects conclusions of the July 2024 EIAR for soils and geology. With implementation and monitoring of the construction-phase mitigation measures, residual cumulative effects are anticipated to remain not significant.

7.8 MONITORING AND FURTHER WORK

Monitoring commitments set out in the July 2024 EIAR will apply to the proposed alternative access works. In addition, the following measures shall be incorporated (as applicable) within the Construction Environmental Management Plan for the amended works, to manage potential cumulative interactions arising from concurrent construction activities in the locality:

Pre-works walkover: A walkover survey of the proposed alternative access route and adjacent drainage features to confirm the location and condition of field drains, ditches and any nearby water features, and to inform protection, set-back and temporary drainage/control measures.

- Inspection and maintenance: Routine inspection and maintenance of surface water controls and any temporary drainage measures along the access route, with increased frequency during and following heavy rainfall and where other nearby works may elevate sediment/runoff risk.
- Construction-stage observations /monitoring: Water quality observations at agreed locations where relevant (e.g., visual checks for discoloration /sediment and hydrocarbons; and, where required, basic parameters such as turbidity /suspended solids and pH), supported by clear trigger levels and action /response procedures in the event of exceedances or incidents.
- Reinstatement verification: Decommissioning /reinstatement verification to confirm reinstated ground levels, surface condition and drainage performance (including field drain functionality), with prompt remedial works where deficiencies are identified.

8 WATER ENVIRONMENT

8.1 INTRODUCTION

This section provides an update of Chapter 8 of the July 2024 EIAR which assesses the potential effects associated with the Proposed Development as Amended on the Water Environment. The chapter considers the proposed alternative construction access road (and associated revised planning application boundary) to allow for construction of the three Coolpowra Energy Projects – Reserve Gas Fired Generator (An Coimisiún Pleanála; Ref. 320095), GIS Generator (An Coimisiún Pleanála; Ref. 320094), and ESS (An Coimisiún Pleanála; Ref 32091).

All other elements of the proposed development remain as assessed in the July 2024 EIAR unless otherwise stated. Baseline and assessment findings of the Water Environment Chapter contained in the July 2024 remain valid except where updated in this EIAR addendum chapter.

The Stage 3 Flood Risk Assessment (FRA) prepared and lodged with the three planning applications has been revised and updated to reflect the proposed changes and is provided in Appendix 8.3 to this EIAR Addendum. The FRA considers the Proposed Development as Amended including rerouting of part of an existing stream (Treananearla) which traverses the site (decommissioning of 370m of existing channel and creation of 170m of new channel) and new crossings of the stream with internal roads within the development lands.

8.2 ASSESSMENT METHODOLOGY & SIGNIFICANCE CRITERIA

8.2.1 INTRODUCTION

This updated assessment uses the same methodologies outlined in Chapter 9 of the EIAR. The report meets the requirements of the relevant regulations and has been prepared in accordance with the EPA Guidelines on Information to be contained in Environmental Impact Assessment Reports (EPA, 2022).

8.3 DESCRIPTION OF THE RECEIVING ENVIRONMENT

8.3.1 BACKGROUND

As set out in the July 2024 EIAR, the proposed development is located in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway. The development lands are accessed via the N65 and the L8763 local road network in the

vicinity of the site. Lands within the development site boundary are in agricultural use and include a farmhouse and outbuildings. The proposed lands are situated at an elevation of c. 51-54m AOD and are accessed by road via the N65 (National Road which connects the towns of Loughrea and Portumna) and the L8763 (local road). The study area for the Waters assessment is focused on surface water and groundwater bodies within the development boundary and outward to 2km. Downstream waterbodies and protected waterbodies within 5km have also been considered.

8.3.2 SOILS AND GEOLOGY

8.3.2.1 Historical Land Use

Review of historical maps[36] and aerial imagery show that the lands on which the the proposed alternative construction access road was historically used as agricultural lands containing open grassland, pockets of woodland and scrub. In more recent years (last 30 years), aerial imagery shows lands as arable and grazing pastures.

8.3.2.2 Geology

Bedrock formation beneath the site is Lucan Formation (Dark limestone & shale (calp)) comprising dark grey to black, fine-grained, occasionally cherty, micritic limestones that weather paler, usually to pale grey.

8.3.2.3 Soils and Subsoils

Soils on the site are described as Mullabane (Teagasc Code 1100q) and described as mostly Brown Earths and Calcareous Brown Earths on drift with limestones, associated with Luvisols and some inclusions of Rendzinas and peat. The soils are classed as well drained (Type BminSW).

The majority of the site is underlain by glacial till derived from limestone. Some isolated mounds of limestone gravels are present in the area along with a graded ridge of esker sands and gravels which underlie part of the local road (L8763). This combination of deposit type is characteristic of sub-glacial mechanisms resulting in well drained soils of homogenous nature.

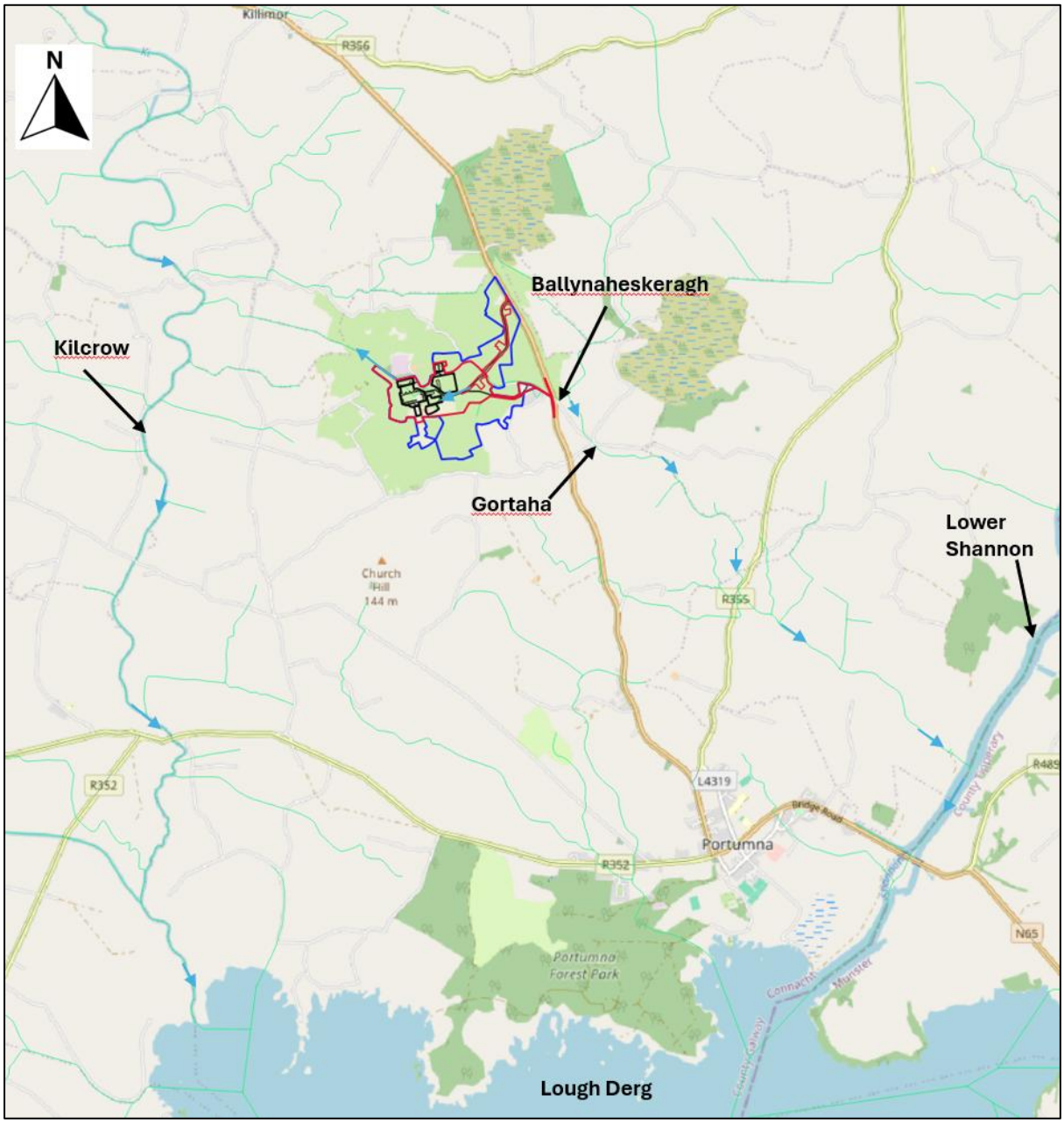
8.3.3 HYDROLOGY

Surface water features within the study area are shown in Figure 8.1. The main watercourse within the main works site of the proposed development (as amended) is the Treananearla stream, which flows west and northwest through the development lands[37]

[36] 6" (dated 1829-1841) and 25" (1897-1913)
[37] The EPA map viewer (https://gis.epa.ie/EPAMaps/Water) incorrectly shows the watercourse as the Gortaha_010 and to be flowing east and southeast.

before discharging to the Kilcrow River (1.9km to the west). The Kilcrow River then flows south for approximately 11km and enters Lough Derg close to Stoneyisland. Benefitting land maps show that The Treananearla stream flowing through the site is maintained as part of the Killimor/Cappagh arterial drainage scheme. The Sheeaunrush stream flows east beyond the main development area of the proposed development (as amended) before its confluence with the Ballynaheskeragh stream on the northern side of the L8463. The waterbody then flows into the Gortaha River and southeast for 6.1km before merging with the Lower Shannon, 1km north of Portumna Bridge.

Figure 8.1 Local Hydrology



8.3.3.1 Catchment Description

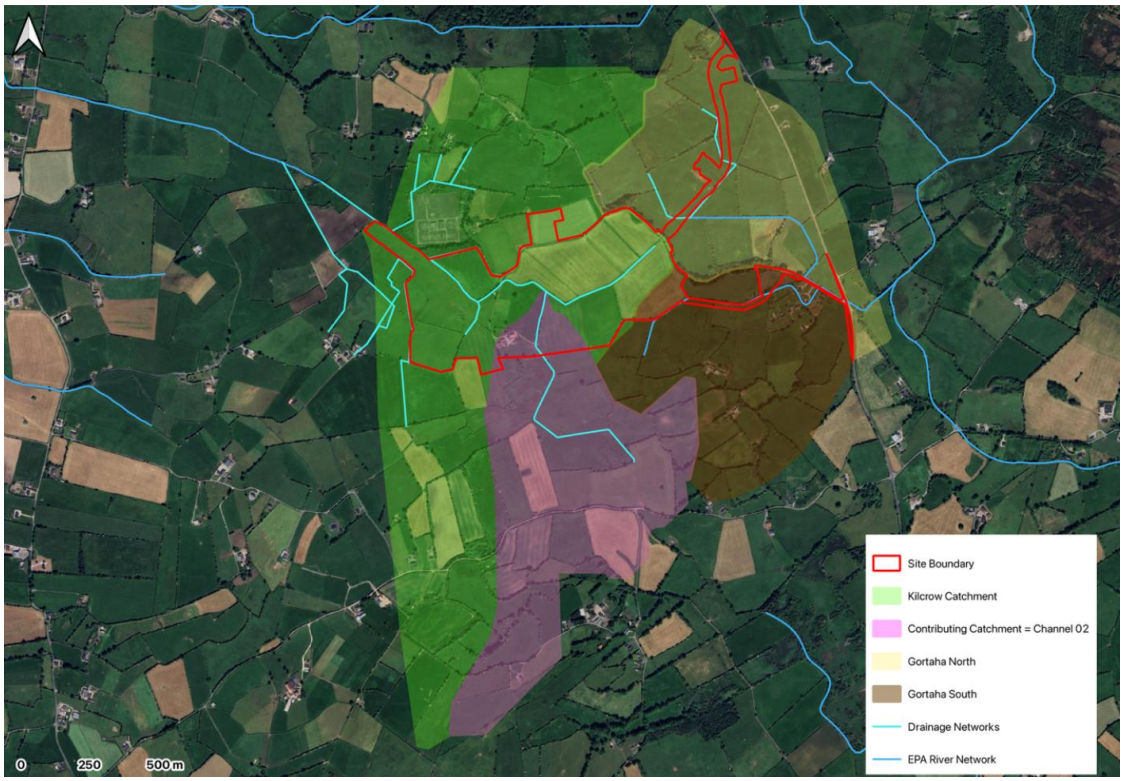
The two dominant sub-catchments in the area are the Gortaha (Catchment 025B), which drains to the east, and the Kilcrow (Catchment 025C), which drains to the west. These rivers are both part of the Lower Shannon Hydrometric Area.

The EPA River Network database suggests that the divide between the Gortaha and Kilcrow river catchments lies within the site boundary, near the current Oldstreet Substation. Subsequent ground truthing and consultation of the OPW Drainage Maps indicate however that the catchment divide is just east of the main site area and that all rainfall-runoff generated on the site drains westwards, outfalling to the Kilcrow River, 2km to the west.

8.3.3.2 Kilcrow Catchment

The drainage network serving the site is dominated by an east to west flowing central channel which itself becomes the Treananearla Stream (first order stream) a short distance downstream of the site. This central channel originates at the eastern end of the central site area, stopping just short of the local road. This catchment was delineated by topographical contours, reference to the OPW and EPA drainage network maps, and ground truthing as part of the site walkover. The catchment area contributing run-off to the downgradient site boundary has an area of 2.0km^2 (see Figure 8.2).

Figure 8.2 Contributing Catchments to Local Watercourses



8.3.3.3 Gortaha Catchment

The eastern extents of the site (through which the proposed alternative construction access road will route) lie within the Gortaha catchment (see Figure 8.2), which has an area of 1.06km^2.

There are two EPA mapped streams within this area. The Sheeaunrush stream, which drains what will be referred to as the Gortaha South catchment, flows from agricultural land to the south of the application site and joins the Ballynaheskeragh Stream as it flows along the original site access route. The Ballynaheskeragh network is mapped incorrectly on the EPA database. The correct flow network following groundtruthing is presented in Figure 8.2. It will be referred to herein as draining the Gortaha North catchment.

There are two structures present in the Gortaha North catchment. The culvert which crosses the N65 and a small field crossing culvert along the Ballynaheskeragh Stream which consists of a 0.3m diameter pipe. A 0.45 m diameter circular culvert transmits water under the L8763 road and marks the confluence of the Sheeaunrush and Ballynaheskeragh streams.

There are several field boundary drains present in the Gortaha North catchment. During the site walkover it was noted that the upper reaches had no discernible flow direction, with standing water noted at multiple locations. Blockages were common, either from silted up channels or infilled areas allowing field crossings.

8.3.4 HYDROGEOLOGY

Similar as to what is presented in Chapter 8 of July 2024 EIAR, the catchments falls within the Tynagh groundwater body (European Code IE_SH_G_236). According to the EPA, the GWB is classed as *"not a risk"* and of *"Good"* status (EPA 2022). The Tynagh GWB is bounded to the west, north and northeast by surface water catchments, to the southeast and south by Lough Derg.

The Geological Survey of Ireland (GSI) Quaternary sediments map for the area (GSIa, 2019) indicates the site is in an area of till derived from limestones. An area of eskers comprised of gravels is shown to the east of the site and an area of bedrock outcrop or subcrop is shown to the southwest

The GSI 1:100k Bedrock Geology map (GSI, 2018) indicates that the site is underlain by dark grey to black bedded limestone and shale of the Lucan Formation ('Calp'). Though karst features are atypical in the Lucan Formation, the GSI Karst Database indicates the nearest karst feature within this formation is a spring >13 km north of the site.

The groundwater vulnerability rating (GSIb, 2019) for the site is classified "Moderate" to "High" across the proposed development (as amended). The Lucan Formation is classified (GSIc, 2019) as a "locally important aquifer – bedrock which is moderately productive only in local zones".

8.3.4.1 Ground Investigation - August to October 2024

A ground investigation was carried out within the original planning site boundary on behalf of the applicant between August and October 2024. Further summary details are presented in Chapter 7 of this EIAR Addendum. Findings of the ground investigation carried out are consistent with the original EIAR findings.

8.3.5 GEOLOGICAL HERITAGE

There are no sites of geological interest within or close to the development boundary. The Killimor Esker (Code GY078), a moderate-sized ridge comprised of esker sands and gravels, deposited under the ice sheet and trending east west is located 2.1km north of the proposed development (as amended) at its nearest point.

8.3.6 FLOODING

The Stage 3 Flood Risk Assessment (FRA) prepared and lodged with the three planning applications has been revised and updated to reflect the proposed development (as amended) and is provided in Appendix 8.3 to this EIAR Addendum. The FRA considers the Proposed Development as Amended including rerouting of part of an existing stream (Treananearla) which traverses the site (decommissioning of 370m of existing channel and creation of 170m of new channel) and new crossings of the stream with internal roads within the development lands.

8.4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

8.4.1 CONSTRUCTION PHASE

The Construction Phase Potential Environmental Effects are presented in Table 8.7 of the July 2024 EIAR. Construction of the proposed alternative construction access road does not alter the type, extent, or likely significance of construction-phase effects on the water environment as previously assessed. Accordingly, there is no change to the impact significance ratings or the supporting discussion presented in the original EIAR.

8.4.2 OPERATIONAL PHASE

The proposed alternative construction access road is required for construction-stage activities only and will be removed following completion of the relevant works. As such, there are no operational phase impacts associated with the proposed alternative construction access arrangement.

8.5 MITIGATION MEASURES

8.5.1 CONSTRUCTION PHASE

Mitigation is presented in Table 8.11 of the July 2024 EIAR for the construction phase. No additional mitigation measures are proposed specifically in respect of the construction, use, and removal of the proposed alternative construction access road. The construction-phase mitigation set out in the July 2024 EIAR (including pollution prevention measures, runoff management, sediment control, materials handling, and inspection/maintenance procedures) will apply equally to the alternative access works.

Agricultural lands and field infrastructure, including drainage functionality, are considered of medium sensitivity. The magnitude of change is assessed as slight, reflecting short-term disturbance associated with the works and the intended reinstatement of pre-existing conditions. The likely significant effect is therefore assessed as minor adverse (short term) during decommissioning works, with negligible residual effects anticipated subject to implementation of an appropriate reinstatement method statement and post-works verification of surface condition and drainage performance.

The following method statement is presented to mitigate potential effects associated with realignment of the local drainage network near the main works area.

8.5.1.1 Stream Realignment (Refer to EIAR Addendum Appendix 8.3, Envirologic Stage 3 FRA, dated 17 December 2025)

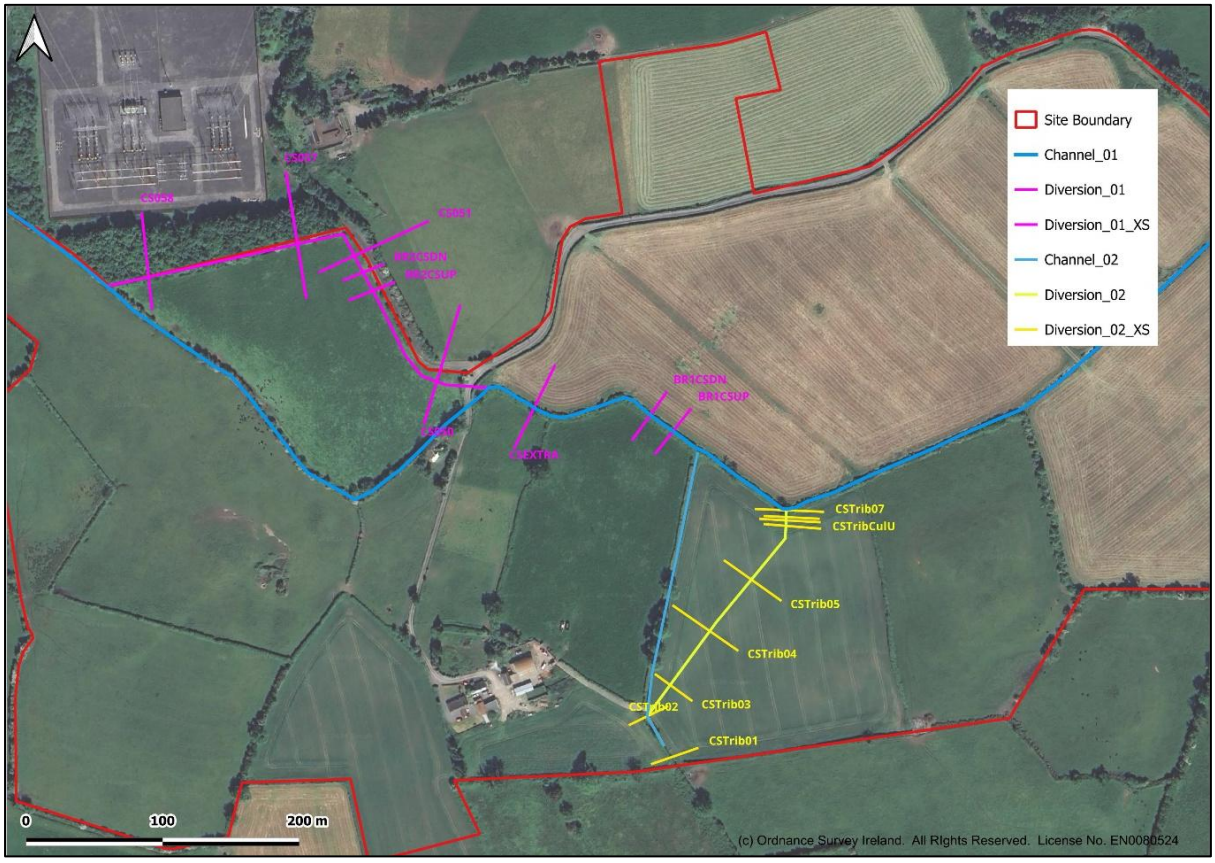
In order to facilitate the site layout (for the Proposed Development as Amended). realignment of the local drainage network is required at two separate channel reaches (see Figure 8.3). This is described as follows:

1. Realignment 01 – Channel 01. The reach between CS016 and CS020 will be diverted north and then west for 350 m. The culvert currently in place at CS016 shall be decommissioned.
2. Realignment 02 – Channel 02. The southern drainage tributary will be diverted north-eastwards from where it currently flows past the on-site dwelling. The culverts currently in place at CS102 and CS110 shall be decommissioned. A new

culvert will be installed to facilitate a proposed access road just before the southern tributary outfalls to the central channel.

3. Invert levels along the realigned drainage channels have been derived at the cross sections shown in Figure 9, based on a uniform bed gradient between the start and end of each realigned channel reach.

Figure 8.3 Location of diverted channels and cross sections



As part of the Proposed Development as Amended, the Treananearla Stream will be realigned, with a new channel dug, prior to the diversion of the watercourse. The Treananearla Stream is of relatively low biodiversity value in terms of its topography being a relatively shallow watercourse with no potential for fisheries value. It has a variable course ranging from drainage ditch type to semi-natural. The realignment of the stream will be achieved by constructing a new landscaped watercourse with a more naturalised bed and enhancement features such as pea-gravel and increased meandering to create riffle and glide areas. The old water course will be diverted to the newly landscaped course with no significant loss of aquatic habitat. The diversion will be carried out having regard to the pathway to the Kilcrow River.

As specified in the July 2024 EIAR (Table 8.11), realignment of the water channel will be undertaken at the start of development work. Works will be sequenced, i.e. the new channel will be dug in accordance with an agreed specification and best practice, and the

water will be rediverted. The redundant channel (once isolated from the downstream watercourse) will then be infilled. As the stream is a part of an arterial drainage scheme, OPW will be consulted in advance of the proposed works. The method statement will be further developed and agreed with all stakeholders. Silt fencing and other controls will be installed to prevent any impact on the downstream receptor.

In the absence of mitigation measures during diversion and overall site development near watercourses, the potential for pollution for elevated suspended solids and/or chemical spills or hydrocarbons is uncertain in the absence of construction management measures.

As a mitigation measure, a method statement is provided below to describe the programme of works relating to two drainage channel diversions and the subsequent infilling of existing drainage channels. The statement outlines in broad terms the manner in which the different aspects of the work will be undertaken. The method statement shall be made available to Galway County Council, National Parks and Wildlife Service, and Inland Fisheries Ireland for review prior to works commencing.

The aim of this programme of works are as follows:

a. Excavate proposed realignment channels;
b. Decommission redundant stretches and structures;
c. Construction of two bridges along Channel 01
d. Installation of a new culvert on Channel 02;
e. Maximise potential for development of ecological habitat in the recommissioned channels. This will include suitability for fish passage, and provision of areas suitable for spawning;
f. Minimise the amount of damage to existing habitat when diverting flow from channel currently in use to new channel reach.

<u>Cleaning original channels</u>

The banks and bed of the original channel are heavily overgrown and require cleaning. This is necessary to ensure the cross-sectional area provides adequate conveyance capacity to transmit flood flows. All vegetation and excess silt in the original channel will be removed using an excavator.

It is acknowledged that there will be a temporary adverse impact to habitat associated with the removal of this vegetation. Once new vegetation is established, the longer-term impact will be positive.

Channel 01 Realigned Section Invert Levels

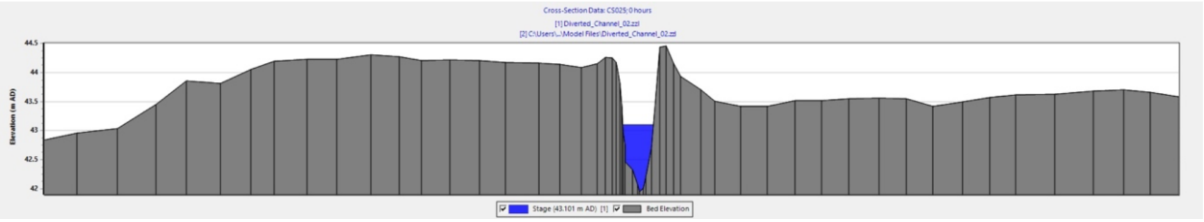
The gradient for the realigned channel in Channel 01 is 1.4%. Proposed inverts for each cross section along this reach are shown in Table 8.1.

Table 8.1 Proposed Invert Levels on Specified Sections on Channel 01 Realigned Reach

Cross Section	Proposed Invert Elevation (mOD)
CS014	53.18
CS050	52.85
BRCSUP	52.46
BR2CSDN	52.09
CS051	52.04
CS057	51.94
CS058	51.93
CS020	51.93

The realigned Channel 01 will have a general cross section profile as shown in Figure 8.4.

Figure 8.4 Proposed cross section dimensions in realigned section of Channel 01



Channel 02 Realigned Section Invert Levels

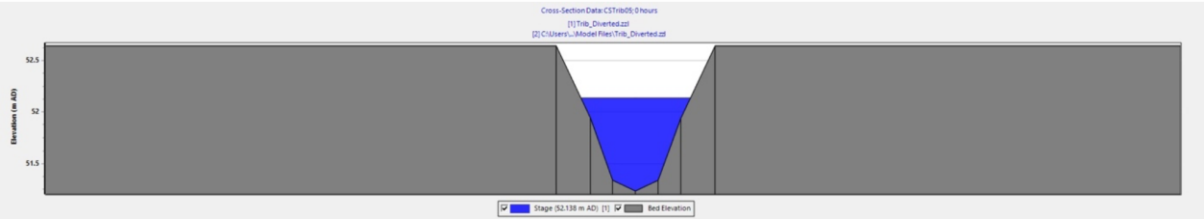
Proposed inverts for each cross section along Channel 02 reach are shown in Table 8.2

Table 8.2 Proposed Invert Levels on Specified Sections on Channel 01 Realigned Reach

Cross Section	Proposed Invert Elevation (mOD)
CSTrib01	52.80
CSTrib02	52.49
CSTrib03	52.10
CSTrib04	51.70
CSTrib05	51.25
CSTribCulUP	51.25
CSTribCulDN	51.25
CSTrib07	51.24

The realigned Channel 02 will have a general cross section profile as shown in Figure 8.5

Figure 8.5 Proposed cross section dimensions in realigned section of Channel 02



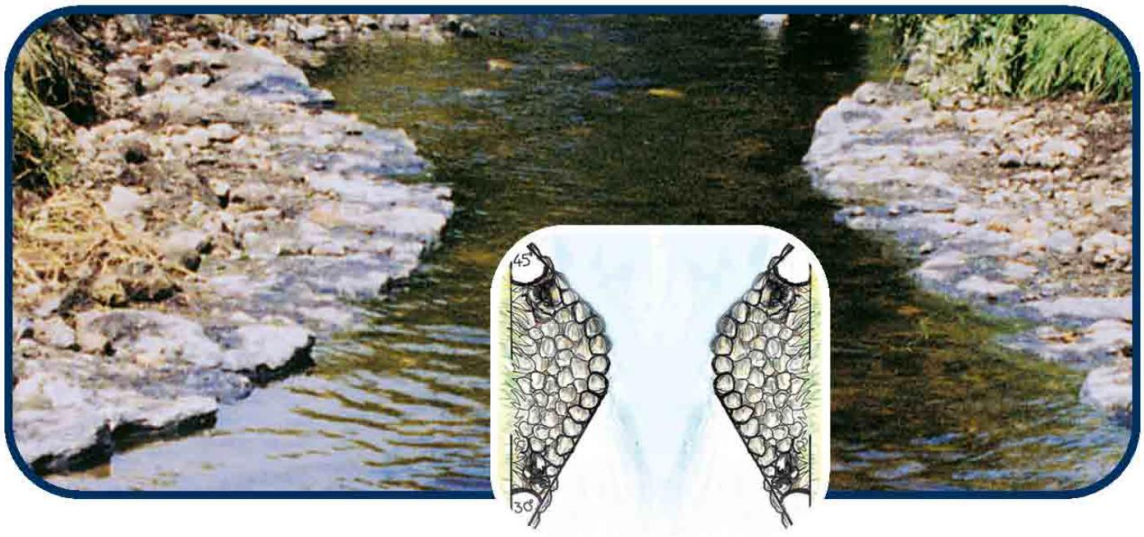
General Channel Modifications

The gradient across the Channel 01 route is moderate to high which means there is potential for introducing oxygen to the stream by way of cascades and turbulent zones. Velocity, and turbulence, can be increased slightly at minor narrowed sections in a low flow channel, as per Plate 8.1.

Rows of larger stones/boulders will be placed on the stream bed in flatter sections to create riffles. Where possible, the channel will be deepened on the outer side of any bends to create pools.

Plate 8.1 Narrow river channel in low flow (IFI & OPW, 2010)

Plate 8.1



Channel Cross Sections

The width of the river channel will be reduced from the river bed to a height of 300 mm. This reduced width will be around 0.5 – 1.0 m. This has the effect of maintaining higher velocities in the wetted channel during normal and low flow regimes. The upper section of the profile will be wider, to provide a conveyance capacity capable of transmitting flood flows. A schematic is presented in Plate 8.2. The inside of any channel bends will be landscaped with sloping marginal benches as show in Plate 8.3.

Plate 8.2 Schematic of stream cross sectional profile (ERFB, 2011)

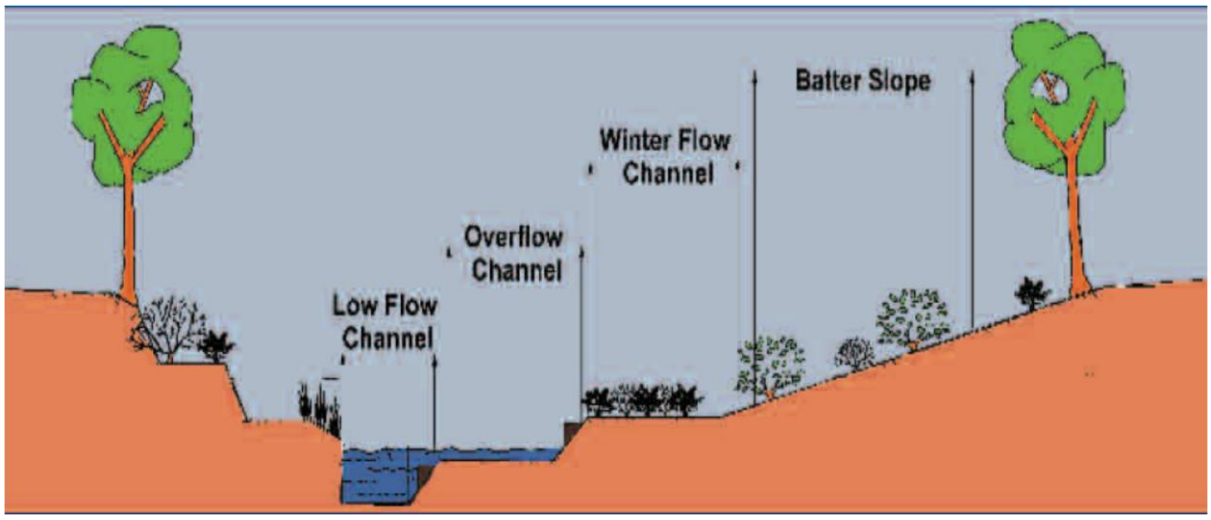


Plate 8.3 Example of stepped bend of river bend

Channel Bank Vegetation

Any excavated soils will be stockpiled temporarily and used to cap the banks of the rehabilitated channel. This will promote establishment of vegetation.

The rehabilitated channel bank will be planted with native species that can be controlled/maintained to ensure conveyance capacity of channel is not significantly reduced by overgrowth in future. Grass and juvenile, native trees are deemed suitable. Trees will provide cover to pooled sections of the river channel. Bank gradients should be such that no bank failure or slippages will occur in future.

Channel Opening

Works on the diverted channels will commence from the downstream end. Once the diverted channels and structures are fully complete, the existing channels can then be diverted and sealed off from any flow and infilled. Upon flow entering the diverted

channels, a cofferdam should be placed at the downstream end of each diverted channel to trap excess sediment and prevent it entering the watercourses downstream of the site. Straw bales can be placed at increments along each diverted channel to trap sediment. Sediment removal can occur periodically over the first number of weeks following flow entering the diverted channels.

Hydrocarbons

Hydrocarbon spill kits will be on-site during works. Any fuels and lubricants will be stored in bunded compounds. Refuelling will be carried out safely and securely away from the river environs. Machinery will be fully inspected prior to, and during, the course of works for suitability. Support vehicles will remain on the tarmac / hard-core roadway.

Timing of Works

All works within the river channel shall be carried out between the months of August to September, to coincide with low stream flows and to avoid interference with spawning runs. Bank maintenance works on existing sections, primarily involving the removal of scrub, should take place between October and March.

Following opening of the diverted channels, water flow will be maintained in the existing channels for a minimum period of 24 hours, to facilitate downstream migration of any insects/fish.

Invasive Species

Standard precautionary measures to be practiced for protection against risk of invasive species. Any machinery, including excavator and dumper will be cleaned with a pressure washer prior to arriving on site, and upon leaving site.

8.5.2 OPERATIONAL MITIGATION

No additional proposed.

8.5.3 DECOMMISSIONING

Where decommissioning is undertaken following commissioning of the overall development, the proposed alternative construction access road would be removed and the lands reinstated. This would typically involve:

- removal of surfacing and granular layers as appropriate;
- removal of temporary drainage features not required in the long term, reinstatement of any affected field drainage, and

- replacement of stored subsoil and topsoil and reinstatement of agricultural use through cultivation and reseeding.

8.6 RESIDUAL IMPACTS OF THE DEVELOPMENT

With implementation of the mitigation measures identified in the July 2024 EIAR (and applied to the alternative access works), the proposed development (as amended) is not predicted to give rise to significant residual effects on the water environment. The alternative construction access arrangement is temporary and will be removed and reinstated; therefore, any construction-stage effects are short-term and reversible. Following reinstatement, the receiving environment and existing drainage regime will be restored as far as practicable, and no long-term pathway for effect is introduced beyond that already assessed in the original EIAR.

8.7 CUMULATIVE EFFECTS

Cumulative effects were assessed in the July 2024 EIAR with regard to the overall development and other relevant plans/projects. The proposed alternative construction access road introduces an additional, temporary area of construction activity and a revised red-line boundary, but it does not change the operational characteristics of the development or introduce new operational emissions or discharges.

Potential cumulative interactions are therefore limited to the construction period, primarily relating to temporary disturbance, runoff generation, and the risk of sediment-laden runoff in combination with other construction activities associated with the overall development and any concurrent third-party works in the locality. These interactions are of the same nature as those already assessed for the construction phase in the original EIAR and are controlled through the existing suite of mitigation measures (including management of surface water, sediment control, pollution prevention, and inspection/maintenance).

Therefore, the proposed alternative construction access arrangement is not predicted to materially alter the cumulative effects conclusions of the July 2024 EIAR. Residual cumulative effects on the water environment are anticipated to remain not significant, subject to the implementation and monitoring of construction-phase mitigation measures.

8.8 MONITORING AND FURTHER WORK

Monitoring commitments set out in the July 2024 EIAR will apply to the proposed alternative access works. In addition, the following shall be incorporated (as applicable) within the Construction Environmental Management framework for the amended works:

- Pre-works walkover of the proposed alternative access route and adjacent drainage features to confirm locations /condition of field drains, ditches, and any nearby water features, and to inform protection measures.
- Routine inspection and maintenance of surface water controls and any temporary drainage measures along the access route, with increased frequency during /after heavy rainfall events.
- Construction-stage water quality observation/monitoring at agreed locations where relevant (e.g., visual checks for discoloration/sediment and hydrocarbons; and, where required, basic parameters such as turbidity/SS, pH), with clear trigger/action procedures in the event of exceedances or incidents.
- Decommissioning /reinstatement verification, including inspection of reinstated ground levels, surface condition, and drainage performance (including field drain functionality) and rectification where required.

9 AIR QUALITY

9.1 INTRODUCTION

This section provides an update of Chapter 9 of the July 2024 EIAR which considers the potential air quality impacts associated with the proposed development. The chapter considers a proposed alternative construction access road to allow for construction of the three Coolpowra Energy Projects – Reserve Gas Fired Generator (An Coimisiún Pleanála; Ref. 320095), GIS Substation (An Coimisiún Pleanála; Ref. 320094), and ESS (An Coimisiún Pleanála; Ref 32091).

This report does not replace the EIAR it is an updated assessment of the potential air quality impacts of the proposed alternative construction access road.

9.2 DESCRIPTION OF THE PROPOSED DEVELOPMENT AS AMENDED

The overall proposed development (as amended) for which planning permission is sought comprises three elements – the Reserve Gas-Fired Generator, the GIS Electrical Substation and the proposed Energy Storage System (ESS) using long duration energy storage (LDES) battery technology and synchronous condenser technology. A single Environmental Impact Assessment Report (EIAR) has been prepared for all three projects proposed as part of the development. The potential environmental impacts from each project are assessed individually and cumulatively (with each other and with any other identified projects) within the EIAR.

The proposed development (as amended) includes a proposed alternative construction access road which will route through lands under the control of the applicant. The alternative construction access will route from the N65 and provide vehicular access to the main development site (south of the L8763). From a new junction along the N65, the proposed alternative construction access road will traverse three undulating grassed fields. The access route will cross the L8763 by staggered junction and extend from here into the main development lands, before connecting to the proposed access lane which will serve the site during operation (i.e. that which was originally applied for).

9.3 METHODOLOGY

9.3.1 INTRODUCTION

This updated assessment uses the same methodologies outlined in Chapter 9 of the EIAR. The report meets the requirements of the relevant regulations and has been prepared in

accordance with the EPA Guidelines on Information to be contained in Environmental Impact Assessment Reports (EPA, 2022).

9.3.2 STUDY AREA

The Study Area for the assessment is shown in Figure 9.1 of the July 2024 EIAR. The study area includes all areas that could potentially be affected by the emissions from the proposed development. The study area was determined using professional judgement and from a consideration of the potential impacts on receptors located near the proposed development. Construction Phase impacts are assessed in accordance with guidance at distances up to 250m from the proposed site boundary.

In addition to the general description of the Study Area, specified Receptors are selected for detailed study as representative receptors to assess impacts of the proposed development. Sensitive receptors across the study area were identified for detailed study as shown in Figure 9.2 (human receptors) and in Figure 9.3 (ecological receptors) of the July 2024 EIAR.

There is no change to the Study Area or to the receptors assessed since the proposed alternative access route lies well within the boundaries of the Study Area selected for the original proposed access route.

9.3.3 CONSTRUCTION PHASE IMPACT ASSESSMENT METHODOLOGY

The Institute of Air Quality Management (IAQM, 2024) *Guidance on the Assessment of Dust from Demolition and Construction* was used for the assessment of potential construction phase air quality impacts of the proposed development. A detailed assessment was carried out and there is no new requirement introduced as a result of the proposed new access route.

The threshold distance for ecological sensitivity to dust is within 50m of the site boundary or 50m of the routes of construction vehicles on the public road within 250m of the site entrance. There are no European or Designated Sites within 50m of the site boundary or 50m of the routes of construction vehicles on the public road within 250m of the site entrance. Therefore, there are no significant Construction Phase air quality impacts predicted for ecological sites from the construction works, and this element is not assessed further. This is the same finding as determined in the EIAR.

9.3.4 OPERATIONAL PHASE IMPACT METHODOLOGY

The proposed alternative construction access road is for construction phase only so there is no associated operational phase air quality impact.

9.3.5 METHODOLOGY FOR ASSESSING IMPACTS DUE TO ASPERGILLUS

There is no change in this section of the EIAR.

9.3.6 METHODOLOGY FOR ASSESSING CUMULATIVE IMPACTS

The cumulative impacts of known permitted and proposed developments with the proposed development were considered using the same methodologies outlined in the EIAR and the same considerations are applied here.

9.3.7 AIR QUALITY IMPACT ASSESSMENT CRITERIA

There is no change to this section of the EIAR.

9.4 AIR QUALITY IMPACT IDENTIFICATION

9.4.1 AIR QUALITY IMPACTS OF EXISTING ACTIVITIES

The subject site is currently a greenfield site and in agricultural use. There is no change to this element of the assessment relative to the information presented in the EIAR.

9.4.2 AIR QUALITY IMPACT IDENTIFICATION OF PROPOSED ACTIVITIES

9.4.2.1 Construction Phase Air Quality Impacts

The potential air quality impacts during Construction were detailed in Section 9.4.2.1 of the July 2024 EIAR. There is no change to the type of emissions or air quality impacts that could arise as a result of the proposed alternative route relative to the proposal in the EIAR.

9.4.2.2 Operational Phase Air Quality Impacts

The proposed alternative access route will not be in place during the Operation Phase so there is no change in the operational phase air quality impact assessment presented in the July 2024 EIAR.

9.4.2.3 Transport Air Quality Impacts

The traffic associated with the proposed development during construction will lead to emissions to atmosphere which are considered in the assessment. There is no change to either the nature or quantity of the emissions associated with the alternative access route.

9.5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

There is no change to this section of the July 2024 EIAR.

9.6 ASSESSMENT OF LIKELY SIGNIFICANT IMPACTS

9.6.1 EXISTING ACTIVITIES

There is no change to this section of the July 2024 EIAR.

9.6.2 CONSTRUCTION PHASE IMPACTS

The proposed alternative access route will generate the same type of emissions as for the original proposed access route and there is no quantifiable difference in either the nature or quantum of emissions associated with the alternative proposal.

9.6.3 OPERATION PHASE IMPACT ASSESSMENT

The proposed alternative construction access road is for construction phase only so there is no associated operational phase air quality impact.

9.7 MITIGATION MEASURES

A Dust Management Plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The principal objective of the Plan is to ensure that dust emissions do not cause significant nuisance at receptors in the vicinity of the site. The most important features of the Dust Management Plan are summarised in Table 9.24 Table of Mitigation Measures in the July 2024 EIAR and these remain unchanged for the proposed alternative access route.

9.8 CUMULATIVE IMPACTS

The cumulative impacts of the proposed development in conjunction with current and future developments in the vicinity of the subject site were considered. There is no discernible difference in the emissions or potential air quality impacts associated with the proposed alternative construction access road and therefore there is no difference in this section of the assessment relative to the July 2024 EIAR.

9.9 DO NOTHING SCENARIO

There will be no significant change in air quality impacts if the proposed development does not proceed.

9.10 HUMAN HEALTH IMPACTS

There is no change to this section of the July 2024 EIAR.

9.11 RESIDUAL IMPACTS

There is no change to this section of the July 2024 EIAR.

9.12 INTERACTIONS ARISING

There is no change to this section of the July 2024 EIAR.

9.13 MONITORING

There is no change to this section of the July 2024 EIAR.

9.14 ACCIDENTS OR UNPLANNED EVENTS

There is no change to this section of the July 2024 EIAR R.

9.15 REFERENCES

There is no change to this section of the July 2024 EIAR.

10 MATERIAL ASSETS

10.1 INTRODUCTION

This chapter assesses the likely significant effects, if any, of the Proposed Development (as amended) on Material Assets, and sets out mitigation and residual effects.

For the purposes of this EIAR Addendum, the Proposed Development (as amended) refers to the development assessed in the July 2024 EIAR together with:

1. The alternative construction access road and associated temporary works; and
2. The revised planning application boundary to incorporate these amendments.

Only sections of the EIAR where relevant changes or updates have been identified are provided in this EIAR Addendum. All other elements of the Proposed Development remain as assessed in the July 2024 EIAR unless otherwise stated. The baseline and assessment findings contained in the July 2024 EIAR Material Assets chapter remain valid except where updated below.

10.2 DEFINITIONS AND SCOPE

In accordance with the EPA EIAR Guidelines (2022), *"material assets"* are taken primarily to mean built services and infrastructure, including the transport network (as traffic consumes transport infrastructure). Natural resources (air, water, biodiversity, soils, landscape etc.) are addressed in the relevant specialist EIAR chapters; similarly, population and human health topics are addressed elsewhere.

Accordingly, this chapter focuses on material assets that could realistically be affected by the amendment, including:

- Transport infrastructure (national and local roads, junctions, and construction access arrangements),
- Built services / utilities infrastructure (electricity, water supply, wastewater arrangements, communications, and any other buried/overhead services where relevant),
- Drainage and flood-related assets insofar as they are built components associated with infrastructure (not hydrology/ecology, which are addressed in the relevant chapters), and
- Ownership, access and rights-of-way where they relate to the functioning and use of built assets.

The objective of the assessment is to ensure that these assets are used in a sustainable manner, so that they will be available for future generations, after the development of the project.[38]

10.3 METHODOLOGY

The assessment is based on:

- Review of the July 2024 EIAR baseline and assessment for Material Assets,
- Review of the amendment description and design information for the proposed alternative construction access road as presented in Chapter 2 of this report, and
- Professional judgement informed by site context described in the July 2024 EIAR.

10.3.1 SIGNIFICANCE CRITERIA

The assessment describes effects by reference to:

- Sensitivity of the material asset receptor (very low to high),
- Magnitude of change (no change to substantial),
- Resulting significance (negligible to major), consistent with the EPA (2022) approach adopted in the July 2024 EIAR chapter.

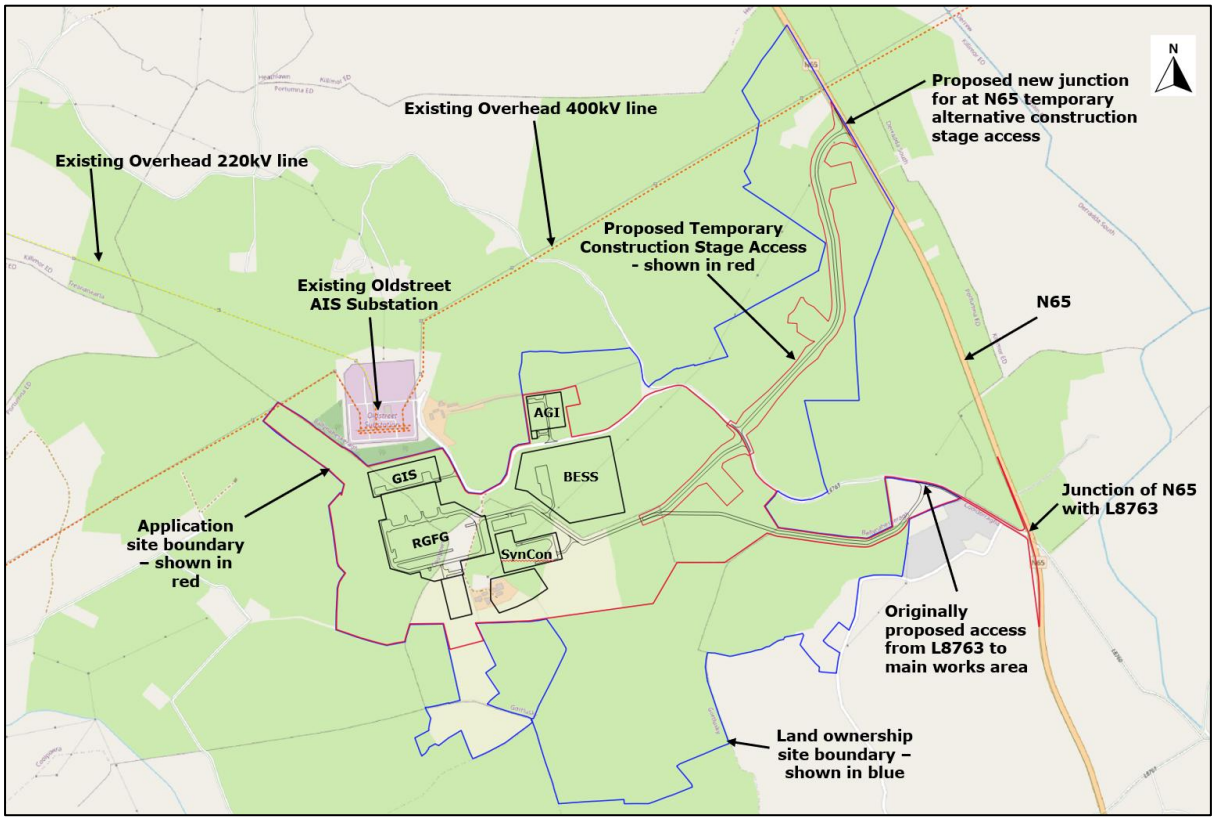
10.4 DESCRIPTION OF THE RECEIVING ENVIRONMENT

10.4.1 OVERVIEW

As set out in the July 2024 EIAR, the development is located in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway. The development lands are accessed via the N65 and the L8763 local road network in the vicinity of the site. The development lands are privately owned and the proposed location for the energy related development was chosen due to type of development (grid connected electricity generation and electricity storage) and the existence of the existing Oldstreet 400kV AIS substation adjacent to the site (see Figure 10.1). Existing on-site services associated with the former farm holding include a groundwater well and on-site wastewater arrangements (relevant for baseline context, though the Proposed Development as Amended primarily relates to changes to construction stage access arrangements.

[38] Note: This Addendum chapter corrects a minor drafting issue in the original text (which inadvertently referred to a "population assessment" in the significance section) and applies the same criteria specifically to material assets

Figure 10.1 Proposed Development Layout as amended



10.4.2 MATERIAL ASSETS RELEVANT TO THE AMENDMENT

The Proposed Development as Amended introduces a new alternative construction access road corridor and new interfaces with existing infrastructure. The key material assets relevant to the Addendum assessment are therefore the following:

- N65 national road (and the proposed new temporary construction access junction),
- L8763 local road (and the proposed staggered junction arrangement / crossing and tie-in),
- Existing internal access arrangements south of the L8763 (connection to the originally proposed site access road that will serve operation), and
- Any existing field drainage / water feature crossings requiring temporary bridge/clear-span structures and associated temporary drainage measures (as built components).

An alternative, purpose-designed construction access road is proposed to connect the N65 to the main development works area (see Figure 10.1). The objective is to reduce construction-stage effects by providing a direct, controlled route for HGV deliveries, abnormal loads (where required), and site traffic, reducing interaction with local roads and

reducing construction disturbance at sensitive receptors. Notwithstanding the fact that the access as originally proposed remains a reasonable and viable access option, the Proposed Development as Amended also address the withdrawal of relevant third-party agreements and consents by private landowners beside the N65/L8763 junction to facilitate sightlines as per TII guidelines.

10.5 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

10.5.1 DO-NOTHING SCENARIO

If the proposed alternative access road is not implemented, the construction of it along with associated junctions works would not occur. The baseline transport network and built services would remain unchanged, and the construction traffic would continue to rely on the access strategy assessed in the July 2024 EIAR. The overall effect is neutral / no change.

10.5.2 CONSTRUCTION PHASE

During the construction phase, the formation of the temporary construction access road and the associated junction interfaces will necessitate short-term works on and in the vicinity of the N65 and the L8763. These works will introduce temporary disturbance to the operation of the public road network, including localised disruption during tie-in activities. This will necessitate traffic management measures and short-term construction safety interfaces for road users.

Setting aside these temporary effects, the provision of a purpose-designed, controlled access route will deliver a clear construction-period benefit for the proposed development by routing HGV movements and site traffic onto a dedicated access road to the main development site and thereby removing, or substantially reducing, interactions with more sensitive local routes and receptors.

In this context, the transport infrastructure is considered a high-sensitivity receptor, given the importance of maintaining the safety and functionality of both the national and local road network. The magnitude of change is assessed as slight to moderate adverse in the short term during junction construction and commissioning, but moderate beneficial during the construction period once the temporary access is operational. The proposed alternative construction access road will improve routing to the site and deliver greater control over construction traffic movements and reduced reliance on alternative local roads. Overall, the likely significant effect on transport infrastructure is assessed as minor

adverse in the short-term during tie-in works and commissioning, reducing to moderate beneficial on a temporary basis during construction-stage operation of the access road

The revised planning application boundary incorporates the temporary access corridor across agricultural fields and includes new interfaces with the public road network. Temporary control of the access corridor and junction tie-in areas will be required to facilitate construction and operation of the temporary access. The works will not remove any public rights of way or permanently sever access to third-party lands, subject to detailed design, appropriate construction management and agreement with the landowners where required. In material asset terms, private property and access arrangements are considered of medium sensitivity, as there is limited tolerance for disruption. Any impacts can generally be managed through agreed working methods and reinstatement. The magnitude of change is assessed as slight, reflecting the temporary nature of the works and the potential for short-term access disruption during construction only. The likely significant effect is therefore assessed as minor adverse in the short term, reducing to negligible with the implementation of mitigation and reinstatement measures.

Buried or overhead services (such as rural LV electricity, telecommunications water supplies, or service crossings) maybe encountered where the access route intersects with the public roads. The principal risk relates to accidental damage to services, which could result in temporary outages, alongside the potential for temporary constraints on access for routine maintenance during construction. Service continuity is considered important and therefore sensitivity is assessed as medium to high. With appropriate service searches, verification and protection measures, the magnitude of change is expected to be negligible to slight, noting that unmitigated service strikes could otherwise result in more pronounced effects. On this basis, the likely significant effect is assessed as minor adverse in the short term at worst, and negligible where standard management controls are implemented.

The proposed alternative construction access road requires the crossing of two water features and the installation of roadside filter drains. The proposed clear-span crossing approach reduces in-channel works relative to culverting and therefore reduces the risk of damage to drainage conveyance and flood-related functions associated with the channels.

The filter drains are designed to provide treatment and attenuation of runoff and promote controlled infiltration. This will reduce the potential for uncontrolled discharge from the access corridor and associated risks to local drainage features. Drainage conveyance features and built crossing elements are considered of medium sensitivity due to their susceptibility to blockage or damage during construction. The magnitude of change is

assessed as slight adverse in the short-term during installation, with a slight to moderate beneficial effect during construction-period operation arising from improved runoff management and reduced reliance on culverting. Overall, the likely significant effect is assessed as minor adverse in the short term during the construction works, and minor beneficial during construction-period operation of the temporary access, subject to appropriate inspection and maintenance of the drainage features.

10.5.3 OPERATIONAL PHASE

The proposed alternative construction access road will be used for construction-stage use only. Operational access arrangements for the main development remain as assessed in the July 2024 EIAR, via the originally proposed site access[39]. Where the temporary road is decommissioned following completion and commissioning of the overall development, no long-term operational effects on material assets are anticipated to arise from the temporary access. Where retention is proposed, any operational implications for material assets, such as ongoing maintenance responsibility for the road and drainage features and the performance of the junction arrangements from a road safety perspective, would require confirmation against the permitted development and would be managed through operational procedures. In that scenario, the operational effect is anticipated to be neutral to minor beneficial, depending on the demonstrated operational benefit and the final arrangement.

10.5.4 DECOMMISSIONING

Where decommissioning is undertaken following commissioning of the overall development, the alternative construction access road would be removed and the lands reinstated. This would typically involve

- the removal of surfacing and granular layers as appropriate,
- the removal of temporary drainage features not required in the long term, reinstatement of any affected field drainage, and
- replacement of stored subsoil and topsoil and reinstatement of agricultural use through cultivation and reseeding.

Agricultural and field infrastructure, including drainage functionality, is considered of medium sensitivity. The magnitude of change is assessed as slight, reflecting short-term disturbance associated with the works and the intended reinstatement of pre-existing

[39] unless the alternative construction access road, as is proposed and pending detailed design and agreement with governing bodies (GCC or TII), is retained in a manner consistent with a planning permission consent (e.g. a condition of consent issued by the planning authority)

conditions. The likely significant effect is therefore assessed as minor adverse in the short term during decommissioning works, with negligible residual effects anticipated subject to appropriate.

10.6 MITIGATION

Mitigation measures are focused on avoiding damage to infrastructure, maintaining the safe operation of the public road network, protecting utilities and drainage assets and ensuring full reinstatement where works are temporary.

Transport-related mitigation will be delivered through the preparation and implementation of a Construction Traffic Management Plan which shall be prepared and agreed with the planning authority in advance of construction. The Construction Traffic Management Plan The will address traffic control and signage, delivery scheduling, driver management requirements and temporary speed management at tie-in locations, together with protocols for abnormal loads where required. Junction design, visibility, geometry and associated road safety measures for the N65 junction and the L8763 staggered junction will be delivered to the appropriate standards and agreed with the relevant road authority. Road condition surveys will be undertaken, as appropriate, prior to and following construction, and any damage attributable to construction activities will be made good.

Utilities protection will be achieved through desk based utility searches, consultation with statutory undertakers, supported by on-the-ground verification using CAT and Genny or ground penetrating radar (GPR) tools where appropriate, in advance of intrusive works. A permit-to-dig system will be implemented, with service exclusion zones and trial holes used where required to confirm service location and depth. Any protection or diversion measures will be agreed in advance with the relevant utility owners and implemented in accordance with their requirements.

Drainage infrastructure and crossing measures will include construction of the clear span crossings in accordance with supports set back from banks where feasible, and with temporary works designed to avoid blockage and maintain channel conveyance. Filter drains will be installed for the construction-period operation of the temporary access and will be subject to inspection and maintenance, including targeted checks following heavy rainfall events and during periods of heightened construction traffic. Erosion and sediment control measures will be implemented at crossings and drainage interfaces to protect drainage assets, with detailed measures addressed in the relevant water and environmental chapters but applied in a manner that safeguards built drainage infrastructure.

Upon completion of construction activities associated with the Coolpowra development, a Decommissioning and Reinstatement Method Statement will be prepared and implemented. This will address removal of temporary structures (where necessary and appropriate), reinstatement of drainage and the restoration of soils and land use. Reinstatement will be confirmed through post-decommissioning inspection and, where applicable, landowner sign-off.

10.7 RESIDUAL EFFECTS

With the above mitigation measures in place, residual effects on transport infrastructure are expected to comprise a minor adverse short-term effect during junction tie-ins and road construction activities, together with a moderate beneficial temporary effect during the construction period as a result of improved routing and control of construction traffic.

Residual effects on utilities are anticipated to be negligible to minor adverse in the short term, reflecting the controlled risk of service interactions where utility management measures are implemented. Residual effects on drainage infrastructure and crossings are expected to be minor adverse in the short-term during installation works and minor beneficial during construction-period operation due to controlled runoff management and reduced reliance on culverting. In the long-term, residual effects are anticipated to be negligible where the temporary access is decommissioned and reinstated as described.

10.8 CUMULATIVE EFFECTS

Cumulative effects on material assets remain as assessed in the July 2024 EIAR. The amended construction access strategy is specifically intended to reduce construction-stage interaction with local roads and sensitive receptors. Therefore, cumulative construction traffic pressures on the local road network are reduced. Other cumulative considerations identified in the July 2024 EIAR, including other enabling works or nearby consented infrastructure activities, remain applicable unless altered by the revised boundary and the temporary access works.

10.9 SUMMARY OF SIGNIFICANT EFFECTS

Overall, the proposed development (as amended) is not predicted to give rise to significant adverse long-term effects on material assets. The principal outcomes are short-term, localised adverse effects during construction of the temporary access and junction tie-ins, generally within the range of minor to moderate adverse and temporary in nature, and a temporary beneficial effect during the construction stage arising from the provision of a purpose-designed construction access route that reduces pressure and interaction on other

local roads and receptors.. This is assessed as a moderate beneficial impact for the construction period. Long-term effects on material assets are anticipated to be negligible where the temporary access is decommissioned and reinstated as proposed, or neutral to minor beneficial, if the alternative construction access road is retained in a manner consistent with consented development.

11 NOISE

11.1 INTRODUCTION

This chapter identifies and assesses the potential noise and vibration impacts and related effects arising from both the construction and short-term operational phase of the proposed development i.e. the construction of an alternative access road to allow for the construction of the three Coolpowra energy projects.

Key issues to be addressed in this chapter include identification and assessment of potential temporary to short-term noise and vibration impacts and effects arising from the construction and use of the temporary access route at nearby Noise Sensitive Receptors (NSRs). The in-combination and cumulative impacts and effects have also been assessed.

11.2 ASSESSMENT METHODOLOGY & SIGNFICANCE CRITERIA

11.2.1 CHARACTERISATION OF THE RECEIVING ENVIRONMENT

The receiving sound environment or existing soundscape in the study area has been characterised by field survey using standard methodology. Refer to the July 2024 EIAR for a detailed description of the field survey methodology.

In addition, existing road traffic noise has been predicted for NSRs along the N65 potentially affected by the proposed alternative construction access route using existing road traffic flow data as provided by the traffic consultants and the Single Exposure or Event Level (SEL) for vehicle type as shown in Table 11.1 below.

Table 11.1 SELs at 5m used to Predict Road Traffic Noise

	Car	LGV	HGV
SEL (dB(A))	72	75	85

The following equation has been used to predict traffic noise at roadside NSRs:

$$L_{Aeq} = 10\log_{10}\left(\sum_{i=1}^{n} 10^{\frac{SEL_i}{10}}\right) - 10\log_{10}(T)$$

Where:

- L_{Aeq} is the equivalent continuous sound level over the measurement period.
- SEL is the Sound Exposure Level, which is the total sound energy of the event normalized to a 1-second duration.
- T is the total duration of the measurement in seconds. Since the reference duration (T_0) is 1 second, the formula simplifies to $10\log_{10}(T/1)$, or $10\log_{10}(T)$
- n is the number of events.

11.2.2 IMPACT ASSESSMENT

Refer to Section 11.2.3.1 of the July 2024 EIAR for a list of the standards used to assess short-term site development and construction impacts and effects. Short-term construction traffic related noise on the N65 has been predicted using the SEL values and equation described in 11.2.1 above and proposed traffic flow data provided by the traffic consultants. Refer to Appendix 13 of the July 2024 EIAR.

11.2.3 DEFINITIONS

Refer to the July 2024 EIAR for definitions with the following addition:

- **SEL** – Sound Exposure (Event) Level, which is the total energy of a noise event normalized to a 1-second duration. Also known as L_{Ae}.

11.3 DESCRIPTION OF RECEIVING ENVIRONMENT

11.3.1 SITE CONTEXT

Refer to the July 2024 EIAR for a description of the site context in terms of overall soundscape. In summary, the study area is a quiet rural location. The N65 is the main anthropogenic noise source affecting the area. The proposed construction route is distant from the NSRs listed in Table 11.4 and Figure 11.2 of the July 2024 EIAR. The nearest NSRs identified in Table 11.4 and Figure 11.2 of the July 2024 EIAR are 37/38 to the west and 28-36 to the southeast at approximately 500m distance. However, there are several additional NSRs located on the eastern side of the N65 which are in closer proximity to the proposed route as indicated on Figure 11.1 below.

Figure 11.1 Nearest Noise Sensitive Receptor Locations to the Proposed Construction Route

NSR43, a dormer bungalow, is located approximately 145m from the proposed alternative construction access road at its nearest point and approximately 72m from the N65. It is located approximately 118m from the proposed construction compound which will be the hub for management of the site and staff parking.

NSR44, a bungalow, is located approximately 17m from the N65 roadside and 225m from the proposed route.

NSR45, also a dormer bungalow is located approximately 90m from the N65 and >300m from the proposed route.

NSR46, a dormer bungalow, is partially screened from the N65 by a hillock and >300m from the proposed route.

11.3.2 AMBIENT SOUND SURVEY SUMMARY RESULTS

Refer to the July 2024 EIAR for details of the overall field survey results. Baseline noise levels at the nearest representative NSR 43 and NSRs within 20m of the N65 potentially affected by the proposed alternative construction route have been predicted using SELs and traffic flow data and are presented in the following section.

11.4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

The development of the proposed alternative construction access road can potentially give rise to significant noise and vibration impact and effects at the nearest NSRs through the use of mobile and non-mobile heavy machinery and equipment during site development and construction and secondly, through use in the short-term by construction traffic accessing the overall project development area via the route/ N65. Sections 11.4.5.1 and 11.4.5.2 of the July 2024 EIAR describe the criteria used to assess noise and vibration impacts associated with construction activities and traffic.

11.4.1 NOISE

The proposed short-term alternative construction access route will be constructed initially. (This is distinct from the assessment of the long-term access route which will also be built out and was assessed in the July 2024 EIAR). Refer to Chapter 2 indicating the location of the alternative construction route to the north of the site, linking it directly to the N65.

Typical stages of road construction include earthworks, laying of sub-base and base, paving and landscaping. The development of the short-term access route and associated construction compound will typically only involve the first two steps of road construction, namely;- earthworks and the laying of base for construction traffic access.

Equipment needs can include the following:

- Earthworks - excavators, crawler loaders, dozers, scrapers, dump trucks and motor graders.
- Aggregate (laying of sub and base layers) – truck delivery of aggregate, motor graders, crawler loaders, dump truck, dozer.

Table C.5. of BS5228 provides sound level data on equipment in use for road construction. As some of data in Table C.5. is provided only as an L_{Amax} values arising from vehicle pass-bys, other values are also used from Table C.2 on site preparation and Table C.4. on general site activities. Refer to Table 11.1Table 11.2 below for source details used in the prediction of construction noise impact.

Table 11.2 Source Data Used for Road Construction Noise Impact

Source	Frequency (Hz)								SPL@ 10m
	63	125	250	500	1k	2k	4k	8k	
	dB(A)								
Earthworks									
Tracked Excavator	50	63	66	72	76	74	71	64	80
Tracked Excavator loading lorry	54	63	67	74	73	71	67	58	78
Articulated Dump Truck Tipping Fill	54	60	64	67	69	67	64	57	74
Spreading Aggregate									
Dozer Spreading Fill	56	68	67	72	78	77	71	61	82
Articulated Dump Truck Tipping Fill	54	60	64	67	69	67	64	57	74

The proposed alternative construction access route is a single carriageway and the footprint of the proposed route is small (>500m < 1km). It should therefore be noted that not all of the above equipment will be used or be in use at the same time for each stage. Due to logarithmic noise calculation methodology, predicted noise levels at NSRs will generally be as a result of the closest and/or noisiest piece of equipment for that activity.

The calculated noise levels at NSR43, using the data above from BS5228:1, taking account of geometric divergence or distance attenuation, are presented in Table 11.3 for each phase during a typical 1-hour period and without mitigation. It is important to note that the construction process is subject to change e.g. through a tendering process. Therefore, with regards to prediction of construction noise at NSRs the following factors are relevant:

The sound power ratings (or sound pressure levels at known distance) used in the assessment may vary from the ratings for the actual equipment chosen by the contractor and used on site;

Depending on conditions encountered in real-time, different types of equipment may be chosen and the number of units may vary. Usage may also vary in terms of length of time operating or in terms of intensity, character and location.

The predicted values are conservative as only geometric divergence (attenuation with distance) is considered.

Table 11.3 Calculated noise levels at NSR43

NSR43		
Source & Assumptions	**Source Data from BS5228 $L_{Aeq,t}$ @10m**	**Predicted $L_{Aeq,1hour}$ (dB)**
Earthworks		
Tracked Excavator, 66% of time on @30m	80	58
Articulated Dump Truck, tipping fill, 20% of time on @60m	74	
Tracked excavator loading a lorry, 10% of time on @30m	78	
Spreading Aggregate		
Dozer spreading aggregate, 66% of time on @30m	82	59
Articulated Dump Truck, tipping fill, 20% of time on @30m	74	

As can be seen from **Error! Reference source not found.**, the TII acceptable limit of 70 d B ($L_{Aeq,1hr}$) will not be exceeded during works associated with the construction of the alternative short-term route for construction traffic. The impact magnitude rating, based on the criteria in the July 2024 EIAR is temporary minor negative and therefore not significant.

11.4.1.1 Construction Phase Traffic

The estimated number of HGVs accessing the construction site is 30 per day or 60 trips on the N65 to and from the direction of Loughrea (located to the northwest). Construction worker cars are expected to arrive to the site from the opposite direction (southeast) off the N65. The proposed alternative construction route will support the construction of subsequent phases of development, i.e. Projects 1 -3 as described in the July 2024 EIAR. Project 1 is expected to generate the largest volume of construction traffic and is therefore assessed as a worst-case scenario.

The total number of cars and HGVs expected to arrive during the AM peak and during the busiest time in the construction of Project 1 is 50 and 9 respectively.

Weekday peak hour traffic (refer to Appendix 13.1 of the July 2024 EIAR) was measured in 2024 at the existing N65/L8760/L8763 junction. The total number of cars/LGV and HGV/PSV on the N65 during the AM and PM peaks were recorded as 259 and 284 respectively with approx. 10 and 6% HGV/PSV content. As noted earlier, ambient monitoring was not completed along the N65. However, an estimate of traffic noise levels can be calculated based on AM peak hour flows using typical SEL values of 85 dB(A) and

72 dB(A) for HGV and car pass-bys respectively at 5m. The predicted $L_{Aeq,1hr}$ for baseline traffic noise at a set-back distance of 20m from the carriageway is 53 dB.

The predicted $L_{Aeq,1hr}$ value for construction related HGVs at roadside NSRs (located between Loughrea and the construction site entrance and at 20m from roadside) plus baseline is 54 dB and therefore short-term negligible negative and the effect is deemed to be insignificant.

The predicted $L_{Aeq,1hr}$ value for construction related cars at roadside NSRs (located southeast of the construction site entrance and at 20m from roadside) plus baseline is 53 dB and therefore short-term negligible negative and the effect is deemed to be insignificant.

Overall, construction traffic noise on the N65 is considered negligible in the context of existing traffic flows on the N65 where the total number of vehicles in a 24-hour period is 3,172 (refer to Chapter 13).

11.4.2 VIBRATION

No potential vibration impacts are expected due to the intervening distance between the proposed alternative construction route and NSRs.

11.5 MITIGATION MEASURES

There are no additional mitigation measures proposed for the alternative construction route. The general measures for all site development and construction works listed under Section 11.5.1 of the July 2024 EIAR shall apply.

11.6 RESIDUAL IMPACTS OF THE DEVELOPMENT

The residual impacts and effects are as described earlier in Sections 11.4.1 and 11.4.2.

11.7 CUMULATIVE EFFECTS

11.7.1 CONSTRUCTION PHASE

Potential construction impacts at NSRs are greatest within 40m of development works, after which they reduce as noise attenuates over distance. As addition of sources is logarithmic, the highest contributing sources i.e. generally those at close distances to NSRs predominate and tend to define the noise impact magnitude. The proposed alternative construction traffic route is expected to be built out first and separately to the development

of the 3 projects described in the July 2024 EIAR. Therefore, there are no cumulative impacts to consider with the construction of the alternative route.

Cumulative HGV traffic is expected to increase to 15 arrivals during the peak hour. The predicted $L_{Aeq,1hr}$ value for HGVs at roadside NSRs (located between Loughrea and the construction site entrance and at 20m from roadside) plus baseline is 55 dB and therefore short-term minor negative based on the ratings in Table 11.13. The effect is deemed to be insignificant.

Cumulative car traffic is expected to increase to 95 arrivals during the peak hour. The predicted $L_{Aeq,1hr}$ value for cars at roadside NSRs (located south of the construction site entrance and at 20m from roadside) plus baseline is 54 dB and therefore short-term negligible negative and the effect is deemed to be insignificant.

11.8 MONITORING AND FURTHER WORKS

No additional monitoring requirements are proposed to those listed in the July 2024 EIAR.

11.9 SUMMARY OF SIGNIFICANT EFFECTS

11.9.1 SHORT-TERM CONSTRUCTION PHASE

No significant adverse effects are expected during the short-term construction phase of the proposed alternative construction access road or through it's use in the short-term by construction traffic.

11.10 REFERENCES

As described in the July 2024 EIAR, Chapter 11.0.

12 LANDSCAPE AND VISUAL

12.1 INTRODUCTION

This chapter has been prepared in response to modifications to the proposed development located in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, Co. Galway.

12.2 SITE CONTEXT

The surrounding local landscape comprises relatively flat terrain intersected by small, shallow, winding river valleys. However, there is one moderately sized hillock, Church Hill, in the southern half of the study area, which peaks at 91m AOD. Otherwise, elevations begin to gradually decline in the western half of the study area, in the direction of the river valley associated with the Kilcrow River, which skirts past the study area in a north/south direction some c. 1.8km west of the site at its nearest point. In terms of land use, the principal form of land cover within the study area and wider landscape is pastoral farmland bound by mixed mature hedgerow vegetation. Small blocks of forestry are dotted throughout the study area, whilst small pockets of mature woodland are also located throughout the surrounding local landscape. Some of the most notable areas of vegetation occur along the periphery of the existing peat bogs within the study area, which are also prominent land uses within the study area and are contained to the north and east of the site. The existing Oldstreet 400kV substation is one of the more notable single land uses within the study area and is located on lands immediately north of the proposed development.

The principal settlements in the study area are located along its periphery. Portumna is some 4km to the south of the site, whilst Killimor is situated some 3.5km north of the site. Aside from these two settlements, the study area comprises a modest but dispersed rural population that comprises a combination of linear clusters of residential dwellings, small cross-road settlements and isolated farmsteads. The most notable transport route within the study area is the N65, which passes through the eastern half of the study area at a distance of approximately c. 150m east of the main site entrance. All other major routes within the study area are located in its wider periphery. The nearest local road to the proposed development is the L8763 local road, which is situated immediately east and north of the site. The L8805 local road also occurs a short distance to the south of the site, whilst an unnamed local road is situated just over 200m to the west of the site.

Whilst the central study area is not highly synonymous with tourism or outdoor recreation, some aspects of the wider study area encompass some notable tourism values and assets.

Due to the location of the settlement of Portumna to Lough Derg and the River Shannon, it is a popular destination for boating enthusiasts and encompasses several harbours and marinas in addition to local swimming areas.

Within the current Galway County Development Plan the proposed development is contained within the 'Eastern Plains Region' whilst the proposed development is entirely contained within the 'Central Galway Complex Landscape' landscape type. In terms of landscape units, the proposed development is contained within 'Kilcrow Basin' unit where the character is described as a "working landscape, locally elevated. Larger areas of bog and forestry. Elevated concentrations of settlements and infrastructure".

With regard to landscape sensitivity, the 'Kilcrow Basin' landscape unit are classified with a ''Low' landscape sensitivity highlighting the robust and settled nature of much of the surrounding landscape.

In terms of scenic designations, two scenic views are located on the wider periphery of the study area but are oriented in the opposite direction to the site. Similarly, a scenic route designation occurs in the southwest periphery of the proposed development, however, there is little clear visibility in the site's direction from sections of this scenic route within the study area.

12.2.1 SUBMITTED LVIA ASSESSMENT SUMMARY

A landscape and visual impact assessment is provided in Chapter 12 of the EIAR. Supporting information including the Landscape Mitigation Plan and Photomontages are presented in Appendix 12.1 and 12.2 in Volume 3 of the EIAR.

Overall, due to the sizable scale and intensity of the proposed development, the operational phase significance of residual effect was deemed *Substantial*, which is considered *"significant"* in EIA terms. Nevertheless, it is important to note that these effects are heavily localised to the site and its immediate surrounding landscape. Indeed, the significance of landscape effects reduces considerably to below significant beyond 200m from the site as the surrounding existing and proposed screening will heavily dimmish its perceived effect on the character of the surrounding landscape.

As per the Notes and Clarifications on aspects of the 3rd Edition Guidelines on Landscape and Visual Impact Assessment (GLVIA3), it states, *"It should be noted that judgements of significance are not judgements of acceptability considering the policy context, which is a matter for decision-makers. For example, it may be the case that the LVIA concludes that a proposal would result in 'significant' adverse effects on a receptor, but the proposal could still be consistent with policy"*. In this instance, it is considered that the proposed

development is suitably sited in this landscape context and is not contrary to landscape and visual-related policies in the current Galway County Development Plan.

In terms of Visual Impacts, the proposed development was assessed at 15 no. viewpoint locations throughout the study area, representing a range of viewing angles, distances, and visual receptors. The majority of views were contained in the near and immediate local surroundings of the development, as this is where the most potential for significant visual effects are likely to occur. The sensitivity of visual receptors ranged from Medium to Medium-low, which reflects the robust nature of the study area. Those receptors identified with a Medium-low sensitivity represent typical rural views, whereas views identified with Medium sensitivity are typically related to slightly elevated or more open views across the rolling countryside. The most notable residual effects will occur along the local road that traverses the rolling lands immediately east and north of the site. Indeed, whilst visibility from this local road is heavily contained in some areas, it also affords open, near-distant views of the proposed development. Viewpoint VP5 affords one of the clearest and nearest views of the proposed development, where a considerable extent of the site will be visible in the pre-mitigation scenario. It is important to note that this view does not represent any local residential dwelling but represents local community receptors travelling along this local road context. Due to the extensive scale and intensity of the development, which represents a marked degree of visual change in comparison to the baseline scenario, the significance of effect was deemed Substantial, which is considered 'significant' in EIA terms.

Nevertheless, once the proposed mitigation screen planting has full established, the intensity and perceived scale of the development will notably reduce. Thus, the residual significance of visual effect will reduce to *'Substantial-moderate'* (below EIA significant effect threshold) once the proposed mitigation has fully established. The residual significance of effect at viewpoint VP8 was also deemed *'Substantial-moderate'* due to its near distance to the proposed energy centre. Nonetheless, the perceived scale and extent of the development are heavily diminished from this landscape context as the entire eastern extent of the development will be entirely screened. The residual significance of effect ranged between Moderate to Imperceptible at all other representative viewpoints within the study area. Indeed, what is most notable is that effects will reduce considerably beyond 500-1000m from the site, and in many instances, receptors in the wider surrounds of the study area will have very little clear visibility of the proposed development.

12.2.1.1 Response to Third Party Submissions

As part of the proposed application, numerous mitigation measures were employed to diminish the visual effect of the development. The main mitigation by avoidance measure

utilised is the selection of the proposed site and siting of the proposed development in a robust landscape context classified with a *"low"* landscape sensitivity in the current Galway County Development Plan. Other mitigation-by-design measures include the design and form of the development, the materiality, tone, and texture of the proposed structures, and comprehensive landscape mitigation measures, which screen and soften the development.

The LVIA assessment notes that existing Oldstreet 400kV substation is one of the more notable single land uses within the study area and is located on lands immediately north of the proposed development. It should also be noted that Eirgrid plc was granted planning permission (Galway County Council Ref. 23/60849) to construct *"Series Compensation Equipment"* on a 12.5ha site to the east of the existing Oldstreet substation. Works include for demolition of the existent vacant farmhouse and all associated farm outbuildings. The proposed development does not affect or impact this consented development but does further underline the ability of the site to accommodate complimentary electricity infrastructure at the site. We understand that ESBN, in its capacity as Transmission Asset Owner (TAO) has commenced construction of this project.

Within the current Galway County Development Plan the proposed development is contained within the *"Eastern Plains Region"* whilst the proposed development is entirely contained within the *"Central Galway Complex Landscape"* landscape type. In terms of landscape units, the proposed development is contained within *"Kilcrow Basin"* unit where the character is described as a *"working landscape, locally elevated. Larger areas of bog and forestry. Elevated concentrations of settlements and infrastructure*".

With regard to landscape sensitivity, the "Kilcrow Basin" landscape unit is classified with a *''Medium-Low"* landscape sensitivity highlighting the robust and settled nature of much of the surrounding landscape.

The submitted LVIA notes the presence of designated scenic amenity within the wider study area, most notably the protected view in the northern extent of the study area and the scenic route in the wider southern extent. It also notes, in Section 12.3.3.1 of the submitted assessment, that the current Galway CDP states:

> *"A scenic route is not and cannot be a comprehensive protection for the entire landscape. It does provide an instrument for predicting and assessing representative measurement of what effects would be experienced by the majority of potential public viewers in the majority of circumstances."*

Both scenic designations within the study area were investigated during fieldwork in 2024. With regard to the scenic view to the north, the view is a localised view of a cemetery from the N65 overbridge of the River Kilcrow. It is a pleasant but heavily contained view of a local cemetery, oriented to the southwest, and is described in the current CDP as a view of "*Killimor Old Graveyard and church ruins. The River Kilcrow is an important feature of the view*". Due to its localised and contained nature, and its orientation offset from the proposed development, it was not considered relevant to the assessment, and therefore a view was not included for assessment in the visual impact appraisal.

With regard to the scenic route in the wider southern extent of the study area[40], located approximately 3.5 km south of the site at its nearest point, the bare-ground Zone of Theoretical Visibility (ZTV) mapping indicated that large sections of this route within the study area (its nearest sections to the site) would be fully screened by intervening terrain. Nonetheless, as noted Galway County Council[28], the ZTV also indicated some potential for visibility of the proposed structures in both the southeast and southwest periphery of the study area. As with the protected view to the north, this scenic route was investigated during fieldwork, and it was noted that there was very limited potential for any visibility of the proposed development, even where the bare-ground ZTV identified potential for theoretical visibility.

To the southeast, much of this scenic designation along the R352 regional route is located on the outskirts of the settlement of Portumna, where the road is bound by linear clusters of residential development that enclose views to the north. While some sections of this route within the ZTV pattern pass adjacent to pastoral fields, even here it was noted that the low, rolling nature of the terrain combined with layers of intervening vegetation in the direction of the site would result in very limited potential for any visibility of the proposed development. In fact, as evidenced by VP14, which is located further to the north of the scenic route and just under 2 km from the proposed development, the degree of intervening screening heavily limits visibility of the proposed development even at relatively close distances to the site, with VP14 classified as having a residual Slight visual effect.

Similarly, to the southwest, the degree of intervening screening results in very limited potential visibility of the proposed development at distances of over 4 km. It is also important to note that the sections of this scenic route designation within the study area

[40] Galway County Council's report, dated 18 September 2024, to the Commission as required by Section 37E (4) & (5) of the Planning and Development Act 2000 (as amended) "*A viewshed reference point along the scenic route to the south of the site was not considered, notwithstanding the Bare Ground ATV Map indicated that structures up to 45m may be visible from some areas of this route that fell within the 5km radius from the site.*"

do not present any strong sense of scenic amenity, with visibility often limited to the nearest surrounding pastoral fields. Views from the scenic route within the study area tend to be typical rural views with no strong sense of openness, naturalness, or other highly susceptible visual qualities. As a result of the overall limited potential for visibility from this scenic route, no representative viewpoint was included for assessment within the visual impact appraisal.

Supporting Photomontages and Viewpoints

The assessment of visual impacts was aided by preparation of photomontages from representative viewpoints (see Figure 12.1). The LVIA recorded some localised high effects at a small number of near-road viewpoints, but these are almost entirely confined to short stretches of local roads used by local community receptors (Medium to Medium-low sensitivity), not homes or designated scenic vantage points. With mitigation, residual visual effects are substantial-moderate at VP5, VP8 and VP12; all other assessed viewpoints are moderate to imperceptible, and effects diminish markedly beyond 500-1,000m from the site, and in many instances, receptors in the wider surrounds of the study area will have very little clear visibility of the proposed development. In terms of landscape character, the residual effect is substantial (at site level /immediate surrounds) but drops below significant beyond c.200m from the site as the surrounding existing and proposed screening will heavily dimmish its perceived effect on the character of the surrounding landscape.

It should be noted that VP5 (see Figure 12.2) provides one of the clearest near views from a brief open section of an otherwise contained local road northeast of the site. However, it should be noted that this is not from a residence. The view from VP8 (local road approximately 300m west of the site, see Figure 12.3) is partially screened, side-on appreciation with the eastern extent of the site entirely screened. The view from VP12 (Figure 12.4) is prominent but not spatially dominant with many lower-lying elements entirely screened, so the perceived overall scale is diluted.

Figure 12.1 Viewpoint Location Map

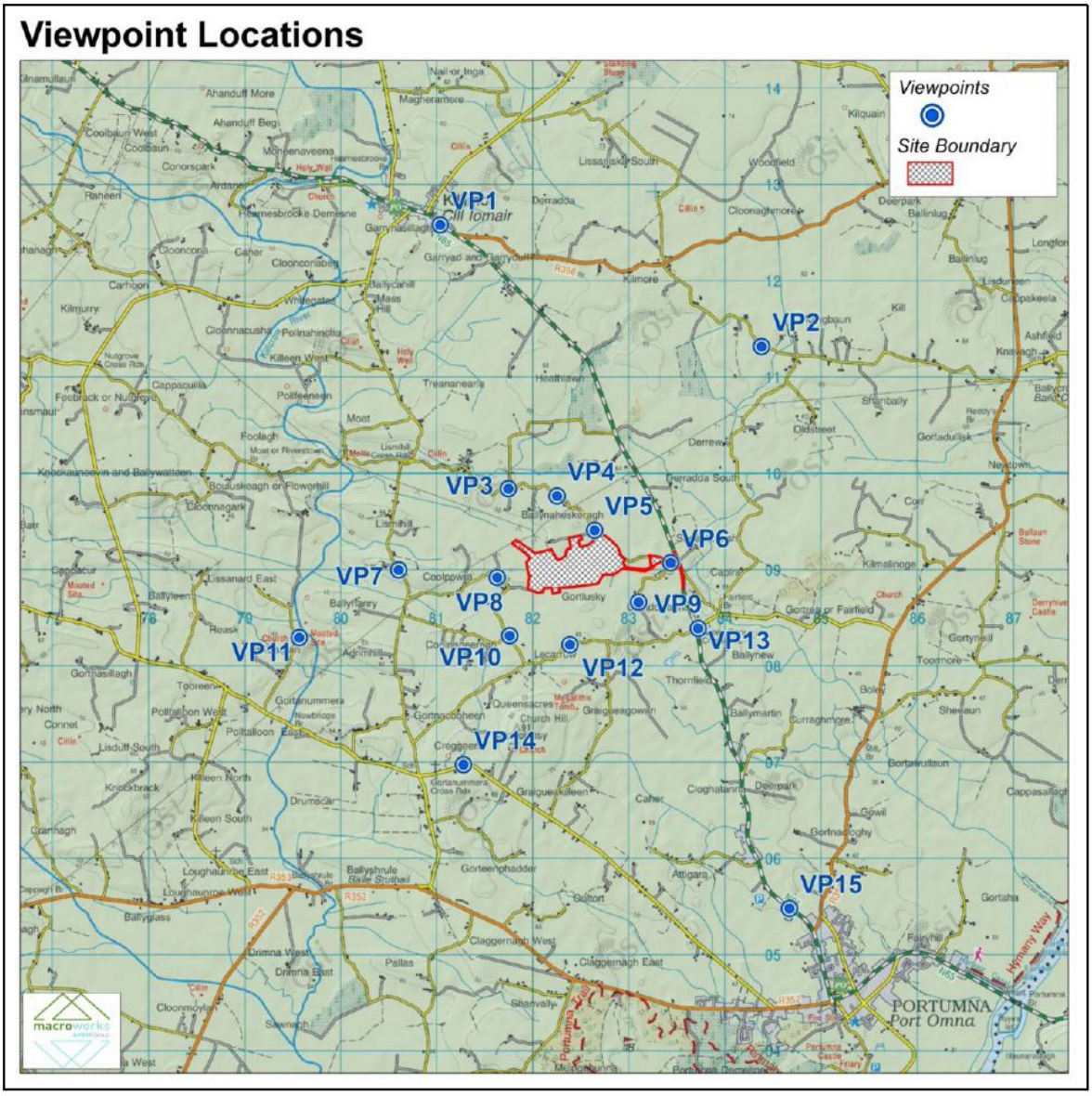


Figure 12.2 Viewpoint VP5

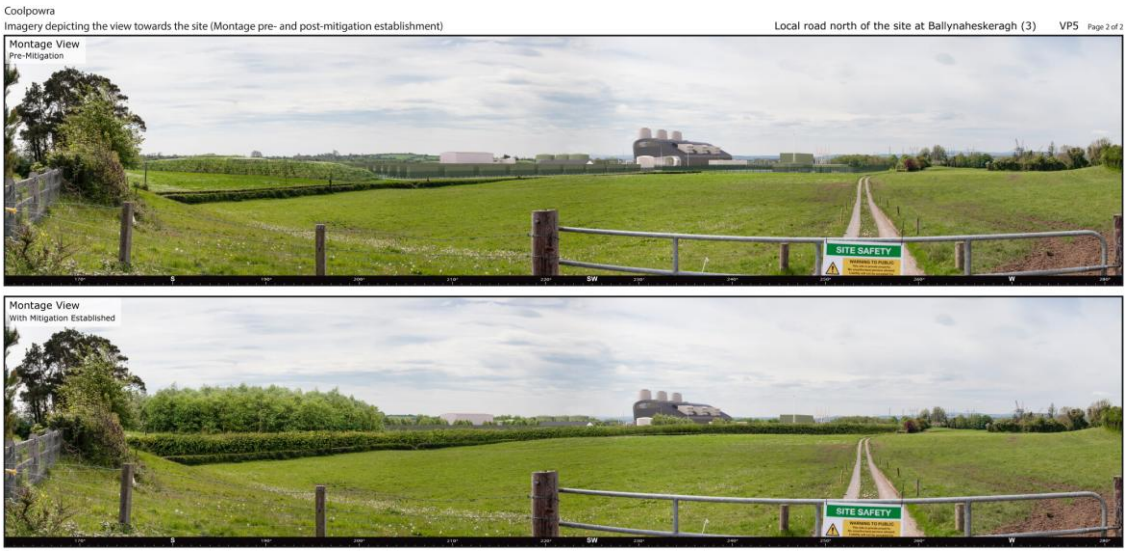


Figure 12.3 Viewpoint VP8

Figure 12.4 Viewpoint VP12

The characterisation of widespread *"significant and moderate"* visual impact on sensitive receptors in third-party observation submitted and suggestions that the development will be visible from a host of landmarks, including Lough Derg, River Shannon, Terryglass Harbour, Portumna Forest Park and Castle, is therefore not aligned with the evidence presented in the LVIA chapter of the EIAR.

The proposed development is well offset from some of its nearest surrounding visual receptors and avails of a notable degree of screening in the form of surrounding rolling terrain and dense layers of intervening hedgerow vegetation. In addition to retaining the existing hedgerows within and around the site, it is also proposed to bolster existing perimeter and internal hedgerows with under-planting and inter-planting of whip transplants in order to ensure dense and consistent screening of the site in perpetuity. This will be undertaken where required to thicken and fill gaps in the existing hedgerow network prior to the construction phase, thus allowing for any growth in the period between a grant of planning permission and construction of the development.

Building Materials

The proposed development will also utilise an array of contemporary building materials and finishes that move away from the typical industrialised presentation of other older industrial developments. The array of proposed cladding textures will be finished in varied

muted tones of green/grey, whilst the proposed energy centre building incorporates curved forms to mimic the low rolling nature of the surrounding landscape. Furthermore, the proposed OCGT stacks will be finished in a much lighter tone than the main building as they are predominately viewed against the sky and will present against it with a low degree of visual contrast. The variations in tone and texture, in addition to the variation in the built form of the proposed development, will all help diminish its perceived height and massing. When feasible, ancillary structures and buildings will be finished in a green tone or muted shades to help blend them in with the surrounding pastoral landscape context.

We do not believe that any changes to the subject application are required in response to the landscape and visual concerns raised, however, during our consideration of alternatives/alternative mitigation, we did explore different options regarding the use of materials and finishes as a means of either breaking up the mass of the structure/buildings or selecting a singular colour palette so that no one element stood out. The studies were undertaken to help diminish the perceived scale of the reserve gas-fired generator building and extent when viewed from the surrounding landscape. Whilst the more organic form of the building aids in assimilating the development into the low, rolling surrounding landscape, a varied mix of tones and textures was incorporated into the building's design to further reduce its perceived scale.

In this regard, several concepts were assessed to understand how the development would present within the receiving landscape context (refer to the submitted comparative photomontage booklet attached as Appendix B to this submission). This is provided as information to assist with understanding of our analysis and selection of mitigation. The Commission may consider that these alternatives result in a less visually obtrusive intrusion in this rural landscape and may wish to seek further information or a revision to the EIAR and design proposal to reflect this view.

Initially, the proposal included finishing the entire Reserve Gas-Fired Generator Building and its stacks in the same grey tone (Option 2 in the submitted comparative photomontage booklets). However, on review, it was considered that introducing further variations in tone and texture could help reduce its perceived visual mass, particularly as the development would most often be viewed against the skyline. In this regard, two further options were presented: a gradated lighter grey/off-white tone applied to the uppermost portions of the proposed stacks (Option 1 in the submitted comparative photomontage booklets), and an alternative option of finishing the entire stacks in a lighter grey/off-white tone.

Following this review, it was decided to proceed with finishing the entire stacks in an off-white/grey tone. This approach ensured that, when the uppermost portions of the stacks were viewed against the sky, they presented a low degree of contrast, thereby reducing the overall perceived visual mass of the development. Furthermore, when viewed from the south, the variation in tone and texture of the full stacks finished in an off-white/grey, contrasted against the darker grey tones of the reserve gas-fired generator building, helps to further break up the perceived visual mass of the development.

Overall, the combined mitigation measures employed help to assimilate the development into the receiving landscape context and reduce its visual presence at surrounding visual receptors. In this regard, whilst there will still be some notable residual visual effects in the immediate surrounding landscape, these effects are highly localised and are deemed to be *Not Significant* once the proposed mitigation measures are implemented and the proposed screen planting has fully established.

12.3 SUMMARY OF THE PROPOSED DEVELOPMENT AS AMENDED

The overall proposed development (as amended) for which planning permission is sought comprises three elements – the Reserve Gas-Fired Generator, the GIS Electrical Substation and the proposed Energy Storage System (ESS) using long duration energy storage (LDES) battery technology and synchronous condenser technology. A single EIAR has been prepared for all three projects proposed as part of the development. The potential environmental impacts from each project are assessed individually and cumulatively (with each other and with any other identified projects) within the EIAR.

The proposed development (as amended) includes a proposed alternative construction access road which will route through lands under the control of the applicant. The alternative construction access will route from the N65 and provide vehicular access to the main development site (south of the L8763). From a new junction along the N65, the proposed alternative construction access road will traverse three undulating grassed fields. The access route will cross the L8763 by staggered junction and extend from here into the main development lands, before connecting to the proposed access lane which will serve the site during operation (i.e. that which was originally applied for).

12.4 ASSESSMENT OF POTENTIAL EFFECTS

The proposed new access track will extend outside the existing boundary of the development and traverse predominantly rural lands, connecting the N56 to the eastern extent of the current site compound. It will intersect the local road that traverse along sections of the eastern boundary of the site. The landscape in this area is defined by

agricultural fields, established hedgerow patterns, and a generally open rural character with limited residential presence. The primary physical alteration associated with the works is the removal of several sections of existing hedgerow where the access track intersects field boundaries and the local road. Although these removals introduce a change to the established linear vegetation structure, the access road has been positioned at a substantial offset from surrounding dwellings, and the proposed planting of new native hedgerows along its full extent will assist in re-establishing vegetative continuity. Over time, this planting will contribute to restoring the characteristic field pattern and integrating the new access route into the receiving landscape.

At the landscape level, the introduction of the new access track represents a localised modification to the existing rural environment due mainly to the removal of hedgerow sections and stripping of existing ground covers. These hedgerows contribute to the landscape structure by defining fields and reinforcing the prevailing pattern of enclosure. Whilst the removal of these brief sections of hedgerow will interrupt the current localised structure of the landscape, the overall rural character will remain intact due to the limited spatial extent of the proposed access tracks and the avoidance of significant landform alteration. The incorporation of new native hedgerow planting along the full length of the access road will, as it matures, re-establish the linear vegetation framework characteristic of the area. This will reduce the magnitude of landscape change in the medium to long term and ensure that the development becomes increasingly assimilated into the surrounding context. Indeed, this part of the surrounding landscape is not highly visible, which further diminishes the proposed development from generating any undue landscape effects on the local rural character.

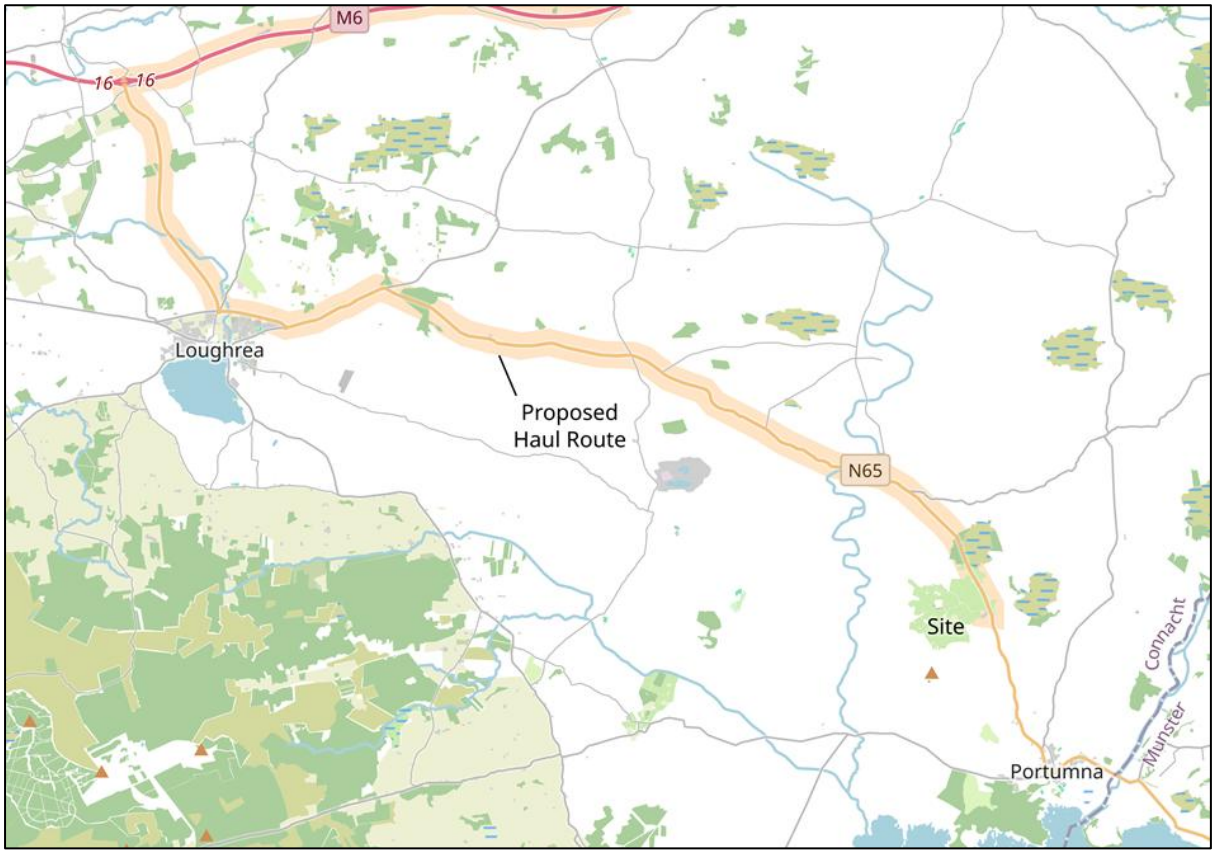
In terms of visual effects, the effects are restricted by the access road's separation from residential properties and by intervening landform and vegetation. Views from surrounding dwellings are expected to be limited or almost screened, resulting in only slight or negligible magnitude of visual change for most local receptors. Road users along the local road that the new access intersects will experience noticeable short-term change due to the removal of hedgerows and the introduction of the new junction. These effects will diminish over time as the replacement hedgerow planting establishes and softens the appearance of the access route. Indeed, it should be noted that there is no residential dwellings located within the immediate context of the proposed access road intersection. Wider public views from the N56 and surrounding rural roads will likely register only minor visual change due to distance, existing screening, and the small scale of the intervention within the broader landscape. Overall, visual effects are expected to be low and further reduced in the long term with the maturation of native planting intended to integrate the access track into its rural surroundings.

On balance of the reasons outlined above, it is not considered that the proposed new access tracks will generate landscape and visual effects any greater than Slight. Indeed, for most surrounding local receptors, there will be little to no residual visibility of the proposed access tracks. In this regard, the landscape and visual effects associated with the proposed access tracks are assessed as Not Significant.

13 TRAFFIC AND TRANSPORT

This chapter provides an assessment of the traffic and transport related impacts of the proposed development (proposed alternative construction access road) in the townlands of Ballynaheskeragh and Gortlusky Co. Galway. The proposed development site (Figure 13.1) is located off the L8763 local road to the west of the N65 national road approximately 5km to the north of Portumna and 25km to the south-east of Loughrea.

Figure 13.1 Site Location



13.1 OVERVIEW OF THE COOLPOWRA DEVELOPMENT

The proposed development consists of three separate projects that are considered individually, and in combination, within this chapter:

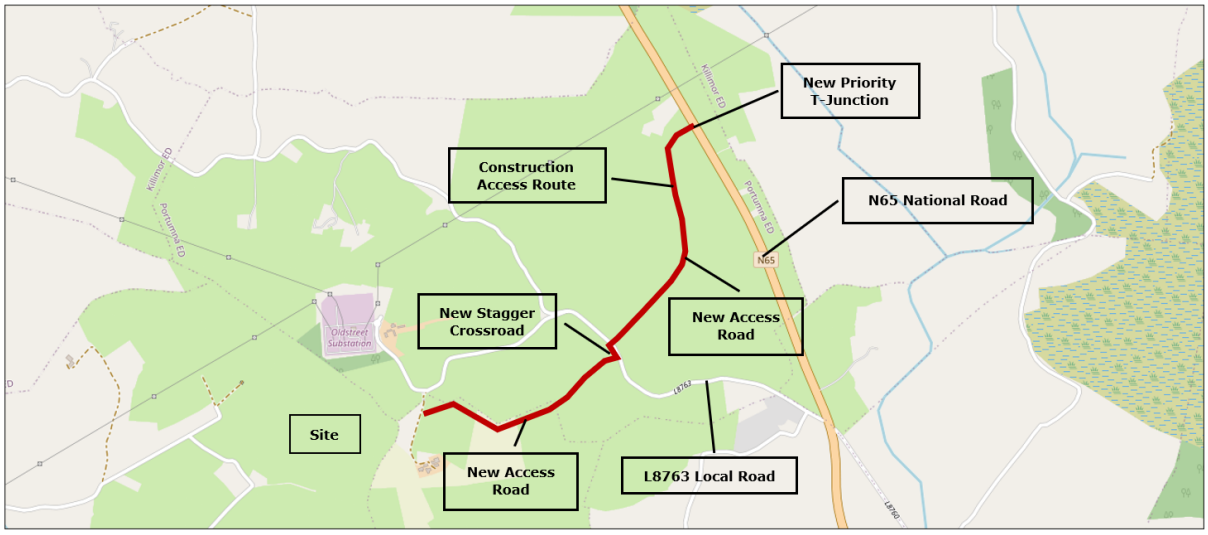
- a Reserve Gas-Fired Generator (hereafter Generator) (Project 1),
- a grid-connected Energy Storage System (ESS) facility (Project 2), and
- a Gas Insulated Switchgear (GIS) Electricity Substation (Project 3).

13.2 DEVELOPMENT OVERVIEW

A detailed description of the proposed development is provided in Chapter 2 of this EIAR Addendum. For ease of reference, and to avoid repetition in subsequent chapters, the term "Proposed Development" used throughout this EIAR refers to the project as described in Chapter 2, together with all associated and ancillary works, enabling works, temporary works, construction activities, operational components, and any mitigation measures that form part of the project design. Where relevant to a topic-specific assessment, any additional detail is provided in the corresponding chapter, however the scope and nature of the Proposed Development remain as set out in Chapter 2.

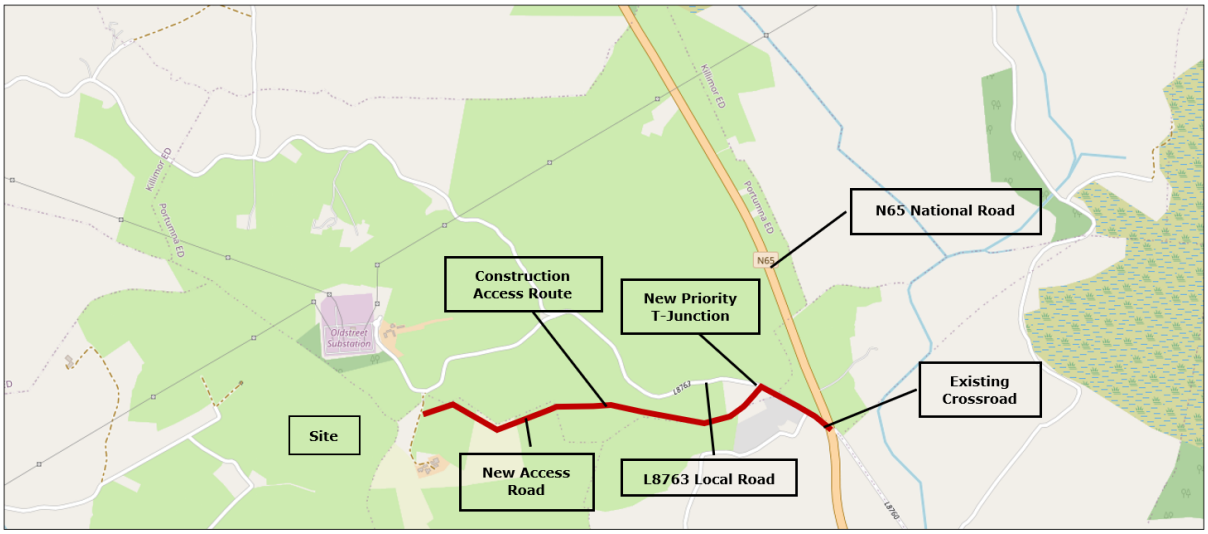
In summary, the proposed development consists of a temporary access arrangement via a new access road from a new priority T-junction off the N65 national road via a new staggered crossroad of the L8763 local road and along new access road into the proposed development site – see Figure 13.2.

Figure 13.2 Proposed Alternative Construction Access Road



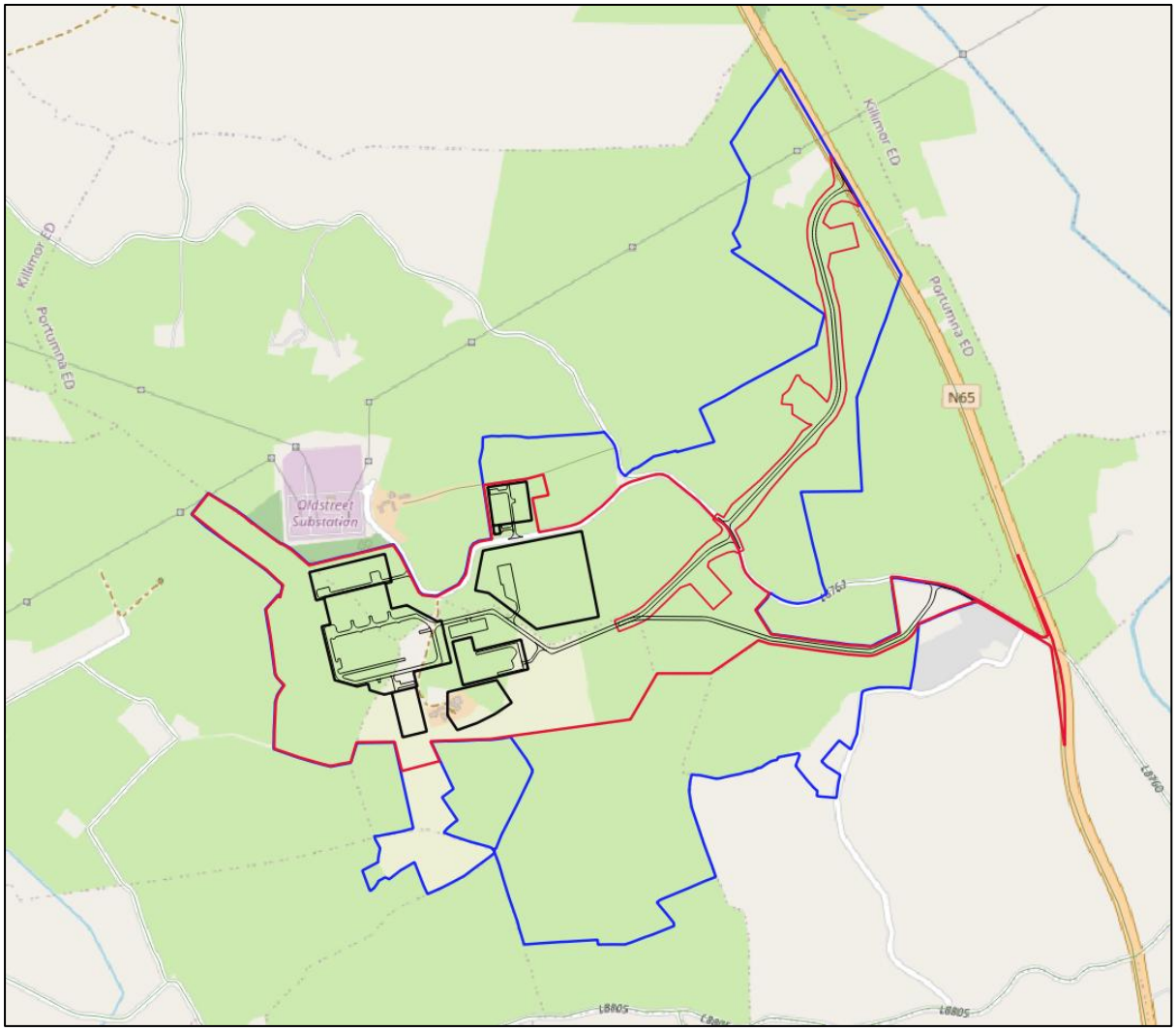
The original construction and operation stage access proposed was via the existing N65 national road priority crossroad junction with the L8763 & L8760 local roads, along the L8763 Local Road, and along a new access road off a new priority T-junction with the L8763 local road into the proposed development site (see Figure 13.3).

Figure 13.3 Original Access Arrangements



Note 1 It is proposed that the operational stage access route follows the same route as that depicted above (Figure 13.3)

Figure 13.4 Layout showing both Access Arrangements to the Development



13.3 ASSESSMENT METHODOLOGY & SIGNIFICANCE CRITERIA

This chapter includes an assessment of the construction phase impacts associated with:

(i) the Access Route [N65/L8763] as originally proposed and detailed in the July 2024 EIAR,
(ii) construction phase impacts Impact of the Alternative Construction Access Road as described in Chapter 2 of this EIAR addendum, and
(iii) operational phase impacts of development proposals.

The methodology adopted for the preparation of this chapter is detailed below.

13.3.1 LEGISLATION AND GUIDANCE

Relevant guidance on assessing the impact of a development on roads, traffic and transport is contained within: the TTA guidelines produced by Transport Infrastructure Ireland (TII)[41] and, the Environmental Protection Agency (EPA) Guidelines on the information to be contained in Environmental Impact Assessment Reports[42]. The latter states that traffic impact should be assessed for the construction phase, operational phase, and for unplanned events such as traffic collisions (road safety).

13.3.2 APPROACH TO ASSESSMENT

The roads, traffic and transport impacts of the proposed development have been assessed by utilising the following approach based on the prevailing (TII) guidelines on Traffic and Transport Assessment (TTA) (May 2014). The assessment combines:

- Desktop study, for example, reviewing any neighbouring development;
- Undertaking site-based field work including traffic count surveys;
- Undertaking traffic modelling of the operation of the potentially impacted junctions during construction and operational phases of the proposed development;
- Reviewing the environmental impact of traffic related to the construction and operation of the proposed development, including road safety, against significance criteria; and,
- Considering whether mitigation measures are required to ensure that any potential roads, traffic and transport effects are kept to a minimum.

[41] Transport Infrastructure Ireland (2014) PE-PDV-02045 Traffic and Transport Assessment Guidelines
[42] Environmental Protection Agency (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports

13.3.3 CONSULTATIONS

An informal request in relation to the intended content of this chapter was issued to Galway County Council on 30 April 2024 and agreed with Galway County Council Infrastructure and Operations Units on 16 May 2024. The content of the chapter is consistent with this. No additional technical scoping was undertaken in relation to the proposed development.

13.3.4 SIGNIFICANCE CRITERIA

The main significance criteria when assessing traffic and transport impacts of a proposed development is the impact of the development on the operation of the road network in the vicinity of the development. Other criteria include, for example: any increase in road traffic collisions (which may result in environmental impacts due to spillage); likely damage to the road structure; and measurable increases in atmospheric pollutants and noise.

13.3.4.1 Traffic Impact

Traffic impact is typically assessed in terms of the impact of the traffic generated by a development on the operation of the local road network. A *'material increase'* is considered to have occurred where a development exceeds threshold values including where: traffic to and from the development exceeds 10% of the traffic flow on adjoining local and regional roads; and traffic to and from the development exceeds 10% of turning movements at junctions with and on National Roads. Exceeding these threshold values does not mean that the development results in a significant traffic or environmental impact but does mean that the impact of the development requires further assessment using traffic modelling software.

The traffic modelling software predicts Ratio of Flow to Capacity (RFC) values which are a measure of junction performance in terms of saturation. A value of 1.00, which can also be considered as 100% saturation, represents an arm of the junction operating at maximum capacity, in that any increase in the rate of vehicles arriving on the link will result in significant additional queue lengths. Traditionally a figure of 0.85 or 85% is the maximum acceptable degree of saturation when assessing priority junctions, with anything above this level considered to be congested. The assessment also takes account of queue lengths, measured in Passenger Car Units (PCUs) which are primarily used to check for blocking back through, and therefore impact on, adjacent junctions.

13.3.4.2 Road Structure Impact

Road structure impact is initially assessed by a simple visual inspection for cracking, deformation and disintegration in the vicinity of the site.[3][4] If following this visual assessment, (taking account of the types and volumes of traffic likely to be generated

from a proposed development) the structural ability of the road to carry the traffic is in question, tests can be undertaken to determine the structural strength of the carriageway. Current guidance for such testing is detailed in the TII publication 'Pavement Assessment, Repair and Renewal Principles' Ref. AM-PAV-06050[5] published in March 2020.

13.3.4.3 Road Safety Impact

Road safety impact is typically assessed in terms of the collision record on the local road network in the vicinity of a development. Safety related geometric measurements are also assessed, for example, visibility to and from access points and junctions. In certain circumstances, such as the provisions of alterations to existing roads and provision of new junctions, a Road Safety Audit can also be undertaken. Current guidance is detailed in the TII publication *"Road Safety Audit"* (standard) Ref. GE-STY-01024 [6] published in December 2017.

13.3.4.4 Traffic Noise Impact

Traffic noise is generated by a combination of noise sources including vehicle engines and the interactions between vehicles and the road surface. Noise and vibration impacts related to the proposed development are covered in more detail in Chapter 11 of the EIAR.

13.3.4.5 Traffic Related Air Quality and Climate Impact

Traffic related atmospheric pollutant emissions cause impacts at both the local and national/ international level. TII state in their publication "*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*" that "*empirical evidence has shown that there is no risk of emissions from road traffic leading to exceedances of the relevant air quality standards for any other pollutants, at even the most heavily-trafficked locations*". The impact of the increased traffic volume from the proposed development is not significant in terms of traffic volume required to cause exceedances of these critical levels. Air quality and Climate impacts related to the development are covered in more detail in Chapters 9 and 15 of the EIAR.

13.4 DESCRIPTION OF RECEIVING ENVIRONMENT

The construction and operational access routes are described within Section 13.2 of the EIAR. In the vicinity of the N65/L8763/L8760 junction, the N65 is formed from a single carriageway with a width of approximately 7.2m, bounded by shoulders. The posted speed limit on this section of the N65 is 100km/h which is consistent with current national guidelines on setting speed limits [9], but as a national secondary road may be reduced to 80km/h following the implementation of the Road Traffic Act 2024 [10].

In the vicinity of the proposed N65 new priority T-junction with the access road, the N65 is formed from a single carriageway with a width of approximately 6m, bounded by verges. The posted speed limit on this section of the N65 is 100km/h which is consistent with current national guidelines on setting speed limits [9], but as a national secondary road may be reduced to 80km/h following the implementation of the Road Traffic Act 2024 [10].

In the vicinity of the L8763 new priority T-junction with the access road, the L8763 is formed from a single carriageway with a width of approximately 3.5m, bounded by narrow verges. The posted speed limit on the L8763 is currently 60km/h, as implemented on 7th February 2025 in accordance with provisions of the Road Traffic Act 2024.

Loughrea is located approximately 25km to the north-west of the Coolpowra site and Portumna is located approximately 5km to the south of the proposed development lands. The traffic consultant was informed that the intended haul route (as shown on Figure 13.1) is via the M6 to Junction 16 (Kiltullagh) and N65 and therefore does not pass through either Loughrea or Portumna. Should permission be granted for the development, a specialist haulage contractor will be engaged to liaise with relevant highway authorities and secure appropriate permits for the transport of any abnormal loads.

13.4.1 TRAFFIC VOLUMES

An automatic traffic count survey was undertaken on 28 May 2024 on the N65 immediately to the south of the N65/L8763/L8760 junction. This traffic count survey was undertaken by TTRSA using a Metrocount RoadPodVT vehicle classifier. In a 24-hour period, the traffic count recorded 1588 vehicles in a northbound direction and 1584 vehicles in a southbound direction.

A video-based manual classified turning count survey was also undertaken on the same day at the N65/L8763/L8760 junction, for the AM traffic peak hour of 08:30-09:29 and PM traffic peak hour of 17:15-18:14.

The Traffic count data is provided within Appendix 13.1 of the July 2024 EIAR.

Figure 13.5 The N65 National Road at the N65/L8763/L8760 Junction

13.4.2 COMPARISON OF PERMANENT TRAFFIC COUNT DATA FOR FACTORING PURPOSES

Data from the permanent Transport Infrastructure Ireland (TII) traffic counter site (TII traffic counter reference TMU N65 050.0 W) located on the N65 at Ballycasey, Co. Tipperary (13km to the south of Portumna) was compared for the traffic survey date of 28 May 2024, and average weekday traffic volumes over the previous 12 months (May 2023 to April 2024 inclusive). Traffic levels recorded on 28 May 2024 were approximately 1.8% higher than the average weekday traffic. On this basis, the data collected on 28 May 2024 is considered to be robust and no additional factoring has been applied to take account of seasonality.

13.4.3 BACKGROUND TRAFFIC GROWTH

The peak construction traffic impact for the Generator and GIS projects is predicted to be in December 2027, and for the ESS project is predicted to be in April and May 2028. Whilst it is predicted that the reserve gas-fired generator and GIS projects will be operational in the second half of 2028, the ESS would not be operation until Q1 of 2029. Traffic count survey data has been factored from the base year of 2024, to peak construction years of 2027 and 2028, the opening year of 2029, and future assessment years of 2034 and 2044, using central growth rates for County Galway, taking account of 10.2% heavy commercial vehicles, as included within the TII publication 'Travel Demand Projections' Ref. PE-PAG-02017 [11] published in October 2021. The growth rates applied being:

- 2024 to 2027, a growth factor of 1.086;
- 2024 to 2028, a growth factor of 1.116;
- 2024 to 2029, a growth factor of 1.147;
- 2024 to 2034, a growth factor of 1.217; and,

- 2024 to 2044, a growth factor of 1.372.

13.5 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

13.5.1 RESERVE GAS-FIRED GENERATOR (PROJECT 1)

This section assesses the impact of the reserve gas fired generator (Project 1) in isolation from the ESS (Project 2) and GIS (Project 3).

13.5.1.1 Construction Phase Impact - Access Route [N65/L8763 as per July 2024 EIAR]

Traffic Impact

Construction and related personnel vehicle movements associated with the Reserve Gas Fired Generator project have been assigned 100% to/from the east at the Coolpowra Flex Gen site access onto the L8763 and assigned at the N65/L8763/L8760 junction based on existing proportional traffic movements on the N65. A vehicle occupancy of 1.5 persons per vehicle has been assumed for construction related personnel and 75% of arrivals and departures have been assumed to occur within the peak hour. Heavy goods vehicle movements have been assigned as per the intended haul route depicted in Table 13.1, and 15% of such movement have been assumed to occur within the peak hour. As the traffic modelling is based on PCUs, heavy goods vehicles are factored by 2.3 within the data input into the traffic model. The trip generation of the construction and operational phases of the Generator project are detailed in Appendix 13.2 of the July 2024 EIAR, and the assigned peak hour turning movements are detailed in Appendix 13.3 of the July 2024 EIAR. The modelling output for the site access junction in the 2027 AM and PM peak hours with Reserve Gas-Fired Generator construction is summarised in Table 13.1, and for the N65/L8763/L8760 junction is summarised on Table 13.2 below. Traffic modelling output files are included within Appendix 13.4 of the July 2024 EIAR. The output shows that the proposed Generator project construction will have no material impact on the operation of the L8763 or N65 at these junction locations, and that both junctions will operate with a large amount of spare capacity and minimal queuing.

Table 13.1 L8763/access junction operation in 2027 with Generator construction traffic

	AM				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2027 with Max Generator Construction Trips							
Stream B-AC	D1	0.0	0.00	0.00	D5	0.2	9.21	0.10
Stream C-AB		0.0	0.00	0.00		0.0	0.00	0.00

Table 13.2 N65/L8763/L8760 junction operation in 2027 with Generator construction traffic

	AM				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2027 with Max Generator Construction Trips							
Stream B-ACD	D1	0.0	0.00	0.00	D5	0.0	0.00	0.00
Stream AB-CD		0.1	7.18	0.06		0.0	6.80	0.01
Stream D-AB		0.0	7.15	0.01		0.1	7.35	0.05
Stream D-C		0.0	9.57	0.01		0.1	10.13	0.07
Stream CD-AB		0.0	0.00	0.00		0.0	6.44	0.00

Road Structure Impact

The N65 national road has been constructed to be capable of withstanding higher than current traffic volumes. No significant visual defects within the immediate vicinity of the N65/L8763/L8760 junction were observed during a site visit on 29 May 2024. The level of traffic anticipated to be generated by the Generator project would not be anticipated to result in a measurable impact on the road structure of the N65. The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway and bordering residential frontage strips.

Road Safety Impact

Collision data is not currently publicly available due to ongoing issues in relation to GDPR and associated data-sharing agreements between An Garda Síochána and the Road Safety Authority. A Stage 1 Road Safety Audit (Appendix 13.5 of the July 2024 EIAR) has been undertaken on the highway related works related to Construction Access Route including the Coolpowra Flex Gen project L8763 site access and alterations to the N65/L8763/L8760 junction. The main recommendations included within this Road Safety Audit report and agreed by the design team and client for the Coolpowra Flex Gen project are:

- Control of the speed of vehicles entering the L8763 from the proposed site access junction;
- Ensuring appropriate construction, widening and drainage of the L8763;
- Ensuring road user awareness of the revised alignment of the L8763 at the tie-in with the widened section of this local road; and,
- Minimising the impact of construction traffic on the residential frontage strips on the southern side of the L8763.

Following implementation of the recommendations of the Stage 1 Road Safety Audit and following subsequent completion of Stage 2 and Stage 3 Road Safety Audits, the impact of the proposed development on road safety is predicted to be not significant.

Traffic Noise Impact

The noise impact associated with Project 1 has been considered and is detailed in Chapter 11 of the July 2024 EIAR.

Traffic Related Air Quality and Climate Impact

Due to the relatively low traffic volumes generated by the project during the construction phase, and the dispersed nature of access over the road network, no measurable impact is anticipated in relation to atmospheric pollutants from traffic.

13.5.1.2 Construction Phase Impact – Alternative Construction Access Road

Traffic Impact

Construction and related personnel vehicle movements associated with the Reserve Gas Fired Generator project have been assigned 100% from the Coolpowra Flex Gen site to/from the north through the proposed new L8763/Access Road stagger junction and assigned at the proposed new N65/Access Road T-junction based on existing proportional traffic movements on the N65. A vehicle occupancy of 1.5 persons per vehicle has been assumed for construction related personnel and 75% of arrivals and departures have been assumed to occur within the peak hour. Heavy goods vehicle movements have been assigned as per the intended haul route depicted in Figure 13.1, and 15% of such movement have been assumed to occur within the peak hour.

As the traffic modelling is based on PCUs, heavy goods vehicles are factored by 2.3 within the data input into the traffic model. The trip generation of the construction and operational phases of the Generator project are detailed in Appendix 13.2 (of the July 2024 EIAR), and the assigned peak hour turning movements are detailed in Appendix 13.6 (included with this EIAR Addendum). The modelling output for the proposed L8763/Access Road stagger junction in the 2027 AM and PM peak hours with Reserve Gas-Fired Generator construction is summarised in Table 13.3, and for the proposed N65/Access Road T-junction is summarised on Table 13.4 below. Traffic modelling output files are included within Appendix 13.7 (of the July 2024 EIAR). The output shows that the proposed Generator project construction will have no material impact on the operation of the L8763 or N65 at these junction locations, and that both junctions will operate with a large amount of spare capacity and minimal queuing.

Table 13.3 L8763/Access Road stagger junction operation in 2027 with Generator construction traffic

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
	2027 - Generator Construction																	
Stream B-ACD	D1	0.0	~1	0.00	0.00	A	6.94	A	770 % [Stream CD-AB]	D5	0.1	0.5	5.75	0.09	A	5.27	A	810 % [Stream AB-CD]
Stream AB-CD		0.0	~1	0.00	0.00	A					0.1	~1	6.34	0.09	A			
Stream D-ABC		0.1	0.6	6.58	0.09	A					0.0	~1	0.00	0.00	A			
Stream CD-AB		0.1	~1	7.30	0.09	A					0.0	~1	0.00	0.00	A			

Table 13.4 N65/Access Road T-junction operation in 2027 with Generator construction traffic

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
	2027 - Generator Construction																	
Stream B-AC	D1 *	0.0	~1	0.00	0.00	A	0.52	A	671 % [Stream C-AB]	D5	0.1	0.6	8.33	0.09	A	1.02	A	310 % [Stream B-AC]
Stream C-AB		0.1	0.6	6.62	0.05	A					0.0	0.5	6.36	0.01	A			

Road Structure Impact

The N65 national road has been constructed to be capable of withstanding higher than current traffic volumes. No significant visual defects within the immediate vicinity of the proposed N65/Access Road T-junction were observed during a site visit on 28 October 2025 by Trasky. The level of traffic anticipated to be generated by the reserve gas-fired generator project would not be anticipated to result in a measurable impact on the road structure of the N65. The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway in the vicinity of the proposed L8763/Access Road stagger junction.

Road Safety Impact

Collision data is not currently publicly available due to ongoing issues in relation to GDPR and associated data-sharing agreements between An Garda Síochána and the Road Safety Authority. A Stage 1 Road Safety Audit (Appendix 13.8 and included with this EIAR Addendum) has been undertaken on the highway related works related to the proposed alternative construction access road) including the proposed access road, the proposed L8763/Access Road stagger junction, and the proposed N65/Access Road priority T-junction related. The main recommendations included within this Road Safety Audit report and agreed by the design team and client for the Coolpowra Flex Gen project are provided within this report:

Following implementation of the recommendations of the Stage 1 Road Safety Audit and following subsequent completion of Stage 2 and Stage 3 Road Safety Audits, the impact of the proposed development on road safety is predicted to be not significant.

Traffic Noise Impact

The noise impact associated with Project 1 has been considered and is detailed in Chapter 11 of the EIAR.

Traffic Related Air Quality and Climate Impact

Due to the relatively low traffic volumes generated by the project during the construction phase, and the dispersed nature of access over the road network, no measurable impact is anticipated in relation to atmospheric pollutants from traffic related to Project 1.

13.5.1.3 Operational Phase Impact

As there will be minimal traffic movements associated with the 15-20 operatives (employed over three shifts) related to the operation of the reserve gas-fired generator project (assuming that the access road and access junction are maintained), there will be no measurable traffic related environmental impacts during the operational phase of the project. This level of trip generation would not result in a measurable traffic capacity impact at either the L8763 site access or N65/L8760/L8763 junctions.

13.5.2 ESS ASSESSMENT (PROJECT 2)

This section assesses the impact of the ESS project (Project 2) in isolation from Projects 1 and 3.

13.5.2.1 Construction Phase Impact - Access Route [N65/L8763 as per July 2024 EIAR]

Traffic Impact

Construction related personnel vehicle movements associated with the ESS project have been assigned 100% to/from the east at the proposed development site access onto the L8763 and assigned at the N65/L8763/L8760 junction based on existing proportional traffic movements on the N65. A vehicle occupancy of 1.5 persons per vehicle has been assumed for construction related personnel and 75% of arrivals and departures have been assumed to occur within the peak hour. Heavy goods vehicle movements have been assigned as per the intended haul route depicted in Figure 13.1 , and 15% of such movement have been assumed to occur within the peak hour. As the traffic modelling is based on PCUs, heavy goods vehicles are factored by 2.3 within the data input into the traffic model. The trip generation of the construction and operational phases of the ESS project are detailed in Appendix 13.2 (of the July 2024 EIAR), and the assigned peak hour turning movements are detailed in Appendix 13.3 (of the July 2024 EIAR). The modelling output for the Coolpowra Flex Gen project site access junction in the 2028 AM and PM peak hours with ESS construction is summarised in Table 13.5 below, and for the N65/L8763/L8760 junction is summarised on Table 13.6 below. Traffic modelling output files are included within Appendix 13.4 (of the July 2024 EIAR). The output shows that

the proposed ESS project construction will have no material impact on the operation of the L8763 or N65 at these junction locations, and that both junctions will operate with a large amount of spare capacity and minimal queuing.

Table 13.5 L8763/access junction operation in 2028 with ESS

	AM				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2028 with Max ESS Construction Trips							
Stream B-AC	D3	0.0	8.37	0.01	D7	0.1	8.85	0.07
Stream C-AB		0.0	0.00	0.00		0.0	0.00	0.00

Table 13.6 N65/L8763/L8760 junction operation in 2028 with ESS construction traffic

	AM				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2028 with Max ESS Construction Trips							
Stream B-ACD	D3	0.0	0.00	0.00	D7	0.0	0.00	0.00
Stream AB-CD		0.1	7.05	0.05		0.0	6.79	0.01
Stream D-AB		0.0	7.13	0.01		0.0	7.16	0.03
Stream D-C		0.0	9.58	0.01		0.1	10.04	0.05
Stream CD-AB		0.0	0.00	0.00		0.0	6.47	0.00

Road Structure Impact

The N65 national road has been constructed to be capable of withstanding higher than current traffic volumes. No significant visual defects within the immediate vicinity of the N65/L8763/L8760 junction were observed during a site visit on 29 May 2024. The level of traffic anticipated to be generated by the ESS project would not be anticipated to result in a measurable impact on the road structure of the N65. The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway and bordering residential frontage strips.

Road Safety Impact

The road safety impact of the ESS project in isolation will be as detailed in relation to Project 1 construction route option 1,no measurable road safety impact is predicted to result from the ESS project subject to implementation of the recommendations of the Stage 1 Road Safety Audit (APPENDIX 13.5) and following subsequent completion of Stage 2 and Stage 3 Road Safety Audits.

Traffic Noise Impact

The noise impact associated with Project 2 has been considered and is detailed in Chapter 11 of the EIAR.

Traffic Related Air Quality and Climate Impact

Due to the relatively low traffic volumes generated by the project during the construction phase, and the dispersed nature of access over the road network, no measurable impact is anticipated in relation to atmospheric pollutants from traffic related to Project 2.

13.5.2.2 Construction Phase Impact - Alternative Construction Access Road

Traffic Impact

Construction and related personnel vehicle movements associated with the ESS project have been assigned 100% from the ESS project site to/from the north through the proposed new L8763/Access Road stagger junction and assigned at the proposed new N65/Access Road T-junction based on existing proportional traffic movements on the N65. A vehicle occupancy of 1.5 persons per vehicle has been assumed for construction related personnel and 75% of arrivals and departures have been assumed to occur within the peak hour. Heavy goods vehicle movements have been assigned as per the intended haul route depicted in Figure 13.1 , and 15% of such movement have been assumed to occur within the peak hour. As the traffic modelling is based on PCUs, heavy goods vehicles are factored by 2.3 within the data input into the traffic model. The trip generation of the construction and operational phases of the ESS project are detailed in Appendix 13.2 (of the July 2024 EIAR), and the assigned peak hour turning movements are detailed in Appendix 13.6 (included with this EIAR Addendum). The modelling output for the proposed L8763/Access Road stagger junction in the 2028 AM and PM peak hours with ESS project construction traffic is summarised in Table 13.7, and for the proposed N65/Access Road T-junction is summarised on Table 13.8 below. Traffic modelling output files are included within Appendix 13.7 (included with this EIAR Addendum). The output shows that the proposed ESS project construction will have no material impact on the operation of the L8763 or N65 at these junction locations, and that both junctions will operate with a large amount of spare capacity and minimal queuing.

Table 13.7 L8763/Access Road stagger junction operation in 2028 with ESS construction traffic

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
	2028 - ESS Construction																	
Stream B-ACD	D3	0.0	0.5	5.27	0.01	A	5.80	A	900 % []	D7	0.1	0.5	5.56	0.06	A	4.84	A	900 % []
Stream AB-CD		0.0	~1	5.80	0.01	A					0.1	~1	6.12	0.06	A			
Stream D-ABC		0.1	0.5	5.54	0.06	A					0.0	0.5	5.27	0.01	A			
Stream CD-AB		0.1	~1	6.13	0.06	A					0.0	~1	5.82	0.01	A			

Table 13.8 N65/Access Road T-junction operation in 2028 with ESS construction traffic

	AM									PM							
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
	2028 - ESS Construction																	
Stream B-AC	D3	0.0	0.5	6.41	0.01	A	0.45	A	793 %	D7	0.1	0.6	7.84	0.07	A	0.79	A	359 %
Stream C-AB		0.0	0.5	6.53	0.03	A			[Stream C-AB]		0.0	0.5	6.38	0.01	A			[Stream B-AC]

Road Structure Impact

The N65 national road has been constructed to be capable of withstanding higher than current traffic volumes. No significant visual defects within the immediate vicinity of the proposed N65/Access Road T-junction junction were observed during a site visit on 28th October 2025. The level of traffic anticipated to be generated by the ESS project would not be anticipated to result in a measurable impact on the road structure of the N65. The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway in the vicinity of the proposed L8763/Access Road stagger junction.

Road Safety Impact

The road safety impact of the ESS project in isolation will be as detailed in relation to Project 1 construction route option 2, no measurable road safety impact is predicted to result from the ESS project subject to implementation of the recommendations of the Stage 1 Road Safety Audit (Appendix 13.8 and included with this EIAR Addendum) and following subsequent completion of Stage 2 and Stage 3 Road Safety Audits.

Traffic Noise Impact

The noise impact associated with Project 2 has been considered and is detailed in Chapter 11 of the EIAR.

Traffic Related Air Quality and Climate Impact

Due to the relatively low traffic volumes generated by the project during the construction phase, and the dispersed nature of access over the road network, no measurable impact is anticipated in relation to atmospheric pollutants from traffic related to Project 2.

13.5.2.3 Operational Phase Impact

As there will be minimal traffic movements associated with the single operative (person) involved in the operation of the ESS project (assuming that the access road and access junction are maintained), there will be no measurable traffic related environmental impacts during the operational phase of the project.

13.5.3 GIS ELECTRICITY SUBSTATION ASSESSMENT (PROJECT 3)

This section assesses the impact of the GIS project in isolation from the Project 1 and Project 2.

13.5.3.1 Construction Phase Impact - Access Route [N65/L8763 as per July 2024 EIAR]

Traffic Impact

Construction related personnel vehicle movements associated with the GIS project have been assigned 100% to/from the east at the proposed development site access onto the L8763 and assigned at the N65/L8763/L8760 junction based on existing proportional traffic movements on the N65. A vehicle occupancy of 1.5 persons per vehicle has been assumed for construction related personnel and 75% of arrivals and departures have been assumed to occur within the peak hour. Heavy goods vehicle movements have been assigned as per the intended haul route depicted in Figure 13.1, and 15% of such movement have been assumed to occur within the peak hour. As the traffic modelling is based on PCUs, heavy goods vehicles are factored by 2.3 within the data input into the traffic model. The trip generation of the construction and operational phases of the GIS project are detailed in Appendix 13.2 (of the July 2024 EIAR), and the assigned peak hour turning movements are detailed in Appendix 13.3 (of the July 2024 EIAR). The modelling output for the project site access junction in the 2027 AM and PM peak hours with GIS construction is summarised in Table 13.9 below, and for the N65/L8763/L8760 junction is summarised on Table 13.10 below. Traffic modelling output files are included within Appendix 13.4 (of the July 2024 EIAR). The output shows that the proposed GIS construction will have no material impact on the operation of the L8763 or N65 at these junction locations, and that both junctions will operate with a large amount of spare capacity and minimal queuing.

Table 13.9 L8763/access junction operation in 2027 with GIS construction traffic

	AM				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2027 with Max GIS Construction Trips							
Stream B-AC	D2	0.0	0.00	0.00	D6	0.1	8.72	0.05
Stream C-AB		0.0	0.00	0.00		0.0	0.00	0.00

Table 13.10 N65/L8763/L8760 junction operation in 2027 with GIS construction traffic

	AM				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2027 with Max GIS Construction Trips							
Stream B-ACD	D2	0.0	0.00	0.00	D6	0.0	0.00	0.00
Stream AB-CD		0.1	7.02	0.04		0.0	6.80	0.01
Stream D-AB		0.0	7.24	0.01		0.0	7.12	0.03
Stream D-C		0.0	9.29	0.01		0.1	9.86	0.04
Stream CD-AB		0.0	0.00	0.00		0.0	6.49	0.00

Road Structure Impact

The N65 national road has been constructed to be capable of withstanding higher than current traffic volumes. No significant visual defects within the immediate vicinity of the N65/L8763/L8760 junction were observed during a site visit on 29 May 2024. The level of traffic anticipated to be generated by the GIS project would not be anticipated to result in a measurable impact on the road structure of the N65. The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway and bordering residential frontage strips.

Road Safety Impact

The road safety impact of the GIS project in isolation will be as detailed in Section 13.5.1 in relation to Project 1, no measurable road safety impact is predicted to result from the GIS project subject to implementation of the recommendations of the Stage 1 Road Safety Audit and following subsequent completion of Stage 2 and Stage 3 Road Safety Audits.

Traffic Noise Impact

The noise impact associated with Project 3 has been considered and is detailed in Chapter 11 of the EIAR.

Traffic Related Air Quality and Climate Impact

Due to the relatively low traffic volumes generated by the project during the construction phase, and the dispersed nature of access over the road network, no measurable impact is anticipated in relation to atmospheric pollutants from traffic related to Project 3.

13.5.3.2 Construction Phase Impact - Alternative Construction Access Road

Traffic Impact

Construction and related personnel vehicle movements associated with the GIS project have been assigned 100% from the GIS project site to/from the north through the proposed new L8763/Access Road stagger junction and assigned at the proposed new N65/Access Road T-junction based on existing proportional traffic movements on the N65.

A vehicle occupancy of 1.5 persons per vehicle has been assumed for construction related personnel and 75% of arrivals and departures have been assumed to occur within the peak hour. Heavy goods vehicle movements have been assigned as per the intended haul route depicted in Figure 13.1, and 15% of such movement have been assumed to occur within the peak hour. As the traffic modelling is based on PCUs, heavy goods vehicles are factored by 2.3 within the data input into the traffic model. The trip generation of the construction and operational phases of the GIS project are detailed in Appendix 13.2 (of the July 2024 EIAR), and the assigned peak hour turning movements are detailed in Appendix 13.6 (included with this EIAR Addendum). The modelling output for the proposed L8763/Access Road stagger junction in the 2027 AM and PM peak hours with GIS project construction traffic is summarised in Table 13.11, and for the proposed N65/Access Road T-junction is summarised on Table 13.12 below. Traffic modelling output files are included within Appendix 13.7 (included with this EIAR Addendum). The output shows that the proposed GIS project construction will have no material impact on the operation of the L8763 or N65 at these junction locations, and that both junctions will operate with a large amount of spare capacity and minimal queuing.

Table 13.11 L8763/Access Road stagger junction operation in 2027 with GIS construction traffic

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2027 - GIS Construction																		
Stream B-ACD	D2	0.0	~1	0.00	0.00	A	5.76	A	900 % []	D6	0.0	0.5	5.50	0.04	A	4.49	A	900 % []
Stream AB-CD		0.0	~1	0.00	0.00	A					0.1	~1	6.04	0.05	A			
Stream D-ABC		0.0	0.5	5.48	0.04	A					0.0	~1	0.00	0.00	A			
Stream CD-AB		0.1	~1	6.05	0.05	A					0.0	~1	0.00	0.00	A			

Table 13.12 N65/Access Road T-junction operation in 2027 with GIS construction traffic

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2027 - GIS Construction																		
Stream B-AC	D2	0.0	~1	0.00	0.00	A	0.31	A	900 % []	D6	0.1	0.6	7.69	0.05	A	0.64	A	401 % [Stream B-AC]
Stream C-AB		0.0	0.5	6.46	0.03	A					0.0	0.5	6.36	0.01	A			

Road Structure Impact

The N65 national road has been constructed to be capable of withstanding higher than current traffic volumes. No significant visual defects within the immediate vicinity of the proposed N65/Access Road T-junction junction were observed during a site visit on 28 October 2025 by Trasky. The level of traffic anticipated to be generated by the ESS project would not be anticipated to result in a measurable impact on the road structure of the

N65. The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway in the vicinity of the proposed L8763/Access Road stagger junction.

Road Safety Impact

The road safety impact of the ESS project in isolation will be as detailed in relation to Project 1 construction route option 2, no measurable road safety impact is predicted to result from the ESS project subject to implementation of the recommendations of the Stage 1 Road Safety Audit (Appendix 13.8 and included with this EIAR Addendum) and following subsequent completion of Stage 2 and Stage 3 Road Safety Audits.

Traffic Noise Impact

The noise impact associated with Project 3 has been considered and is detailed in Chapter 11 of the EIAR.

Traffic Related Air Quality and Climate Impact

Due to the relatively low traffic volumes generated by the project during the construction phase, and the dispersed nature of access over the road network, no measurable impact is anticipated in relation to atmospheric pollutants from traffic related to Project 3.

13.5.3.3 Operational Phase Impact

As there will be negligible traffic movements associated with the operation of the GIS project, there will be no measurable traffic related environmental impacts during the operational phase of the project.

13.6 MITIGATION MEASURES

As the proposed project site access and project access junction are common to all projects presented as part of the proposed development, the mitigation measures proposed are also consistent between the individual projects.

13.6.1 RESERVE GAS-FIRED GENERATOR (PROJECT 1)

The following mitigation measures are proposed should the Generator project be granted permission:

- The recommendations contained with the Stage 1 Road Safety Audits contained in Appendix 13.5 (of the July 2024 EIAR) and Appendix 13.8 (of this EIAR Addendum) should be implemented in full; and,
- Undertaking visual inspections prior to, during and post construction, and make good any localised degradation observed.

13.6.2 ENERGY STORAGE SYSTEM (PROJECT 2)

The following mitigation measures are proposed should the ESS project be granted permission:

- The recommendations contained with the Stage 1 Road Safety Audits contained in Appendix 13.5 (of the July 2024 EIAR) and Appendix 13.8 (of this EIAR Addendum) should be implemented in full; and,
- Undertaking visual inspections prior to, during and post construction, and make good any localised degradation observed.

13.6.3 GIS SUBSTATION (PROJECT 3)

The following mitigation measures are proposed should the GIS project be granted permission:

- The recommendations contained with the Stage 1 Road Safety Audits contained in Appendix 13.5 (of the July 2024 EIAR) and Appendix 13.8 (of this EIAR Addendum) should be implemented in full; and,
- Undertaking visual inspections prior to, during and post construction, and make good any localised degradation observed.

13.7 RESIDUAL TRAFFIC IMPACTS OF THE PROPOSED DEVELOPMENT

Assuming that the mitigation measures detailed in Section 13.6 are implemented, no residual traffic impact is anticipated from the development of:

- the Reserve Gas-Fired Generator (hereafter Generator) (Project 1)
- the Energy Storage System (ESS) facility (Project 2); or,
- the Gas Insulated Switchgear (GIS) Electricity Substation (Project 3)

13.8 CUMULATIVE EFFECTS INCLUDING GAS PIPELINE CONNECTION

This section assesses the cumulative impact of all of the elements of the proposed development progressing simultaneously, including the gas pipeline connection to Project 1.

13.8.1 CONSTRUCTION PHASE IMPACT (ACCESS ROUTE [N65/L8763 AS PER JULY 2024 EIAR]

13.8.1.1 Gas Pipeline Connection

As part of the Reserve Gas-Fired Generator project, natural gas will be supplied to the site from the Gas Networks Ireland (GNI) transmission system. GNI will separately manage the process of delivering the underground natural gas pipeline to the proposed site. The traffic and transport impact of the delivery of the pipeline (utility works) is considered to be negligible as any utility works of this type involving for example road crossings, would be undertaken in accordance with the terms of an agreed road opening licence, and appropriate Temporary Traffic Management, which should be designed and operated in accordance with prevailing national guidance.[12, 13, 14]

Traffic Impact

The modelling output for the proposed development site access junction in the 2027 AM and PM peak hours with cumulative construction is summarised in Table 13.13 below, and for the N65/L8763/L8760 junction is summarised on Table 13.14 below. Traffic modelling output files are included within Appendix 13.4 (of the July 2024 EIAR). The output shows that the proposed cumulative construction will have no material impact on the operation of the L8763 or N65 at these junction locations, and that both junctions will operate with a large amount of spare capacity and minimal queuing.

Table 13.13 L8763/access junction operation in 2027 with cumulative construction traffic

	AM				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2027 with Max Cumulative Construction Trips							
Stream B-AC	D4	0.0	8.65	0.03	D8	0.3	10.48	0.21
Stream C-AB		0.0	0.00	0.00		0.0	0.00	0.00

Table 13.14 N65/L8763/L8760 junction operation in 2027 with cumulative construction traffic

	AM				PM			
	Set ID	Queue (PCU)	Delay (s)	RFC	Set ID	Queue (PCU)	Delay (s)	RFC
	2027 with Max Cumulative Construction Trips							
Stream B-ACD	D4	0.0	0.00	0.00	D8	0.0	0.00	0.00
Stream AB-CD		0.2	7.63	0.12		0.0	6.76	0.00
Stream D-AB		0.0	7.03	0.02		0.1	7.71	0.09
Stream D-C		0.0	10.78	0.01		0.2	10.70	0.11
Stream CD-AB		0.0	0.00	0.00		0.0	6.34	0.00

Road Structure Impact

The N65 national road has been constructed to be capable of withstanding higher than current traffic volumes. No significant visual defects within the immediate vicinity of the N65/L8763/L8760 junction were observed during a site visit on 29 May 2024. The level of traffic anticipated to be generated cumulatively by the project would not be anticipated to result in a measurable impact on the road structure of the N65. The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway and bordering residential frontage strips.

Road Safety Impact

No measurable road safety impact is predicted to result from the combination of the elements of the proposed development subject to implementation of the recommendations of the Stage 1 Road Safety Audit and following subsequent completion of Stage 2 and Stage 3 Road Safety Audits.

Traffic Noise Impact

The noise impact associated with proposed development has been considered and is detailed in Chapter 11 of the EIAR.

Traffic Related Air Quality and Climate Impact

Due to the relatively low traffic volumes generated by the project during the construction phase, and the dispersed nature of access over the road network, no measurable impact is anticipated in relation to atmospheric pollutants from traffic related to the proposed development.

13.8.2 CONSTRUCTION PHASE IMPACT - ALTERNATIVE CONSTRUCTION ACCESS ROAD

13.8.2.1 Gas Pipeline Connection

As part of the Reserve Gas-Fired Generator project, natural gas will be supplied to the site from the Gas Networks Ireland (GNI) transmission system. GNI will separately manage the process of delivering the underground natural gas pipeline to the proposed site. The traffic and transport impact of the delivery of the pipeline (utility works) is considered to be negligible as any utility works of this type involving for example road crossings, would be undertaken in accordance with the terms of an agreed road opening licence, and appropriate Temporary Traffic Management, which should be designed and operated in accordance with prevailing national guidance.[12, 13, 14]

Traffic Impact

The modelling output for the proposed L8763/Access Road stagger junction in the 2027 AM and PM peak hours with cumulative construction traffic is summarised in Table 13.15, and for the proposed N65/Access Road T-junction is summarised on Table 13.16 below. Traffic modelling output files are included within Appendix 13.7 (included with this EIAR Addendum). The output shows that the proposed cumulative construction will have no material impact on the operation of the L8763 or N65 at these junction locations, and that both junctions will operate with a large amount of spare capacity and minimal queuing.

Table 13.15 L8763/Access Road stagger junction operation in 2027 with cumulative construction traffic

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2027 - Cumulative Construction																		
Stream B-ACD	D4	0.0	0.5	5.35	0.02	A	6.60	A	344 % [Stream CD-AB]	D8 *	0.2	0.7	6.36	0.17	A	6.21	A	347 % [Stream AB-CD]
Stream AB-CD		0.0	~1	5.89	0.02	A					0.2	~1	7.09	0.19	A			
Stream D-ABC		0.2	0.7	6.33	0.17	A					0.0	0.5	5.35	0.02	A			
Stream CD-AB		0.2	~1	7.11	0.19	A					0.0	~1	5.92	0.02	A			

Table 13.16 N65/Access Road T-junction operation in 2027 with cumulative construction traffic

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
2027 - Cumulative Construction																		
Stream B-AC	D4	0.0	0.5	6.54	0.02	A	1.11	A	415 % [Stream C-AB]	D8	0.3	1.5	9.39	0.21	A	2.43	A	170 % [Stream B-AC]
Stream C-AB		0.1	0.6	6.93	0.10	A					0.0	0.5	6.42	0.02	A			

Road Structure Impact

The N65 national road has been constructed to be capable of withstanding higher than current traffic volumes. No significant visual defects within the immediate vicinity of the proposed N65/Access Road T-junction junction were observed during a site visit on 28th October 2025. The level of traffic anticipated to be generated by the project would not be anticipated to result in a measurable impact on the road structure of the N65. The pavement formation on the L8763 is unknown, and as such construction traffic may result in short term localised degradation to the L8763 carriageway in the vicinity of the proposed L8763/Access Road stagger junction.

Road Safety Impact

No measurable road safety impact is predicted to result from the project subject to implementation of the recommendations of the Stage 1 Road Safety Audit (Appendix 13.8 included with this EIAR Addendum) and following subsequent completion of Stage 2 and Stage 3 Road Safety Audits.

Traffic Noise Impact

The noise impact associated with proposed development has been considered and is detailed in Chapter 11 of this EIAR.

Traffic Related Air Quality and Climate Impact

Due to the relatively low traffic volumes generated by the project during the construction phase, and the dispersed nature of access over the road network, no measurable impact is anticipated in relation to atmospheric pollutants from traffic related to the proposed development.

13.8.3 OPERATIONAL PHASE

The traffic impact of the combination of all projects of the proposed development is considerably reduced during the operational phase of the project when compared to the construction phased of the project. Therefore, no significant traffic and transport related environmental impacts are predicted.

13.9 MONITORING AND FURTHER WORKS

13.9.1 MONITORING

No specific monitoring is recommended beyond mandatory health and safety monitoring required for any workplace. Depending on the axle loading of construction related vehicles and/or abnormal loads, further tests to determine the structural strength of the L8763 carriageway, or further visual inspections prior to and post construction, should be undertaken, if necessary, in agreement with Galway County Council.

13.10 SUMMARY OF SIGNIFICANT EFFECTS AND RESIDUAL IMPACTS

Based on the predicted trip generation, assessment contained within this chapter, and implementation of the recommended mitigation measures, no significant environmental effects or residual impacts are predicted as a result of the traffic and transport associated with the proposed development.

13.11 TRANS-BORDER/INTERNATIONAL IMPACTS

Whilst all traffic and transport related activity generates emissions in terms of exhaust gases and particulate matter (including trans-border emissions), due to the small number of such additional daily trips resulting from the proposed development, the traffic related environmental impact is not anticipated to be at measurable level.

13.12 DIFFICULTIES ENCOUNTERED IN COMPILING INFORMATION

No difficulties (technical deficiencies or lack of know-how) were encountered in compiling this chapter. The traffic assessment contained within this chapter uses a fixed demand matrix which reflects current travel behaviour. Changes in the nature of existing trips such as re-timing, re-routeing, and/or changes in the mode of transport used, may result in a lesser impact than stated within this chapter.

13.13 REFERENCES

- [1] Transport Infrastructure Ireland (2014) PE-PDV-02045 Traffic and Transport Assessment Guidelines [https://www.tiipublications.ie/library/PE-PDV-02045-01.pdf]
- [2] Environmental Protection Agency (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports [https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf]
- [3] DTTAS (2013) Urban Flexible Roads Manual : Pavement Surface Condition Index Volume 2 of 3 [https://www.rmo.ie/uploads/8/2/1/0/821068/psci_manual_urban_flexibleroads_04112013_lowres.pdf]
- [4] DTTAS (2014) Pavement Asset Management Guidance Section 5.0: Condition Surveying and Rating – Overview [https://www.rmo.ie/uploads/8/2/1/0/821068/ipag_-_pamg_-_section_5.0_-_condition_surveying_and_rating_-_overview.pdf]
- [5] Transport Infrastructure Ireland (2020) AM-PAV-06050 Pavement Assessment, Repair and Renewal Principles
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- [7] Transport Infrastructure Ireland (2011) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes
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- [9] DTTAS (2015) Guidelines for Setting and Managing Speed Limits in Ireland [https://www.speedlimits.ie/_files/ugd/971679_1d14f0eefdcc426785d3dd1058a33ae6.pdf]
- [10] Road Traffic Act 2024 [https://www.irishstatutebook.ie/eli/2024/act/10/enacted/en/html]

- [11] Transport Infrastructure Ireland (2021) PE-PAG-02017 Travel Demand Projections [https://www.tiipublications.ie/library/PE-PAG-02017-03.pdf]
- [12] DTTAS (2024) Traffic Signs Manual - Chapter 8 Temporary Traffic Measures and Signs for Roadworks [https://bit.ly/4c112VI]
- [13] DTTAS (2019) Temporary Traffic Management Design Guidance [https://dttassupportoffice.sharepoint.com/:b:/s/DTTASSupportOffice/EVkg7eHZV4FCj2kpCwFfP-IBrhi8Euqu14TQFrF3G3oFKA]
- [14] DTTAS (2019) Temporary Traffic Management Operations Guidance (Part 2) [https://www.trafficsigns.ie/_files/ugd/f378bf_9f2342a1a0074b71a0e530d2b5d5d8ce.pdf]

14 ARCHAEOLOGICAL AND CULTURAL HERITAGE

14.1 INTRODUCTION

This Chapter presents the findings of an Archaeological and Cultural Heritage Impact Assessment for development which will provide construction stage vehicular access to the development located within the townlands of Coolpowra, Cooldorragha Ballynaheskeragh, Gortlusky and Sheeaunrush.

Originally, the proposed access to the site was to be via the existing L8763 road located in the townlands of Sheeaunrush and Cooldorragha. Following an invitation from An Coimisiún Pleanála (the Commission) regarding third-party submissions received on the planning file, the client has acquired land adjacent to and east of the application site, allowing for alternative access to facilitate the construction traffic.

The new land acquired for the vehicular access is located to the east of the site. The new vehicular access is to the east of the existing L8763 road. It traverses three undulating grassed fields, and will connect to L8763 road to N65 (National Road), which runs between Portumna and Killimor in County Galway. This section of the route measures c. 813m in length and 7.0m in width and traverses two streams.

The corridor of the vehicular access does not traverse within or in the proximity of any archaeological monuments as listed in the Record of Monuments and Places for Galway (1997), or Sites and Monuments Record. There are no Protected Structures as listed in the Galway County Development Plan 2022-2028. There are no Architectural or Cultural Heritage sites located within the proposed vehicular access route.

14.1.1 SIGNIFICANCE CRITERIA

The main purpose of this chapter is to identify, describe and present an assessment of the likely significant effects of the proposed vehicular access on archaeological and cultural heritage remains (known and unknown if present). An effect can be positive, negative, or neutral/none, direct and indirect. The effect may result from the construction phase and/or the operation phase of the project.

The potential effects will be assessed for the access route only (Section 14.1).

This chapter aims to present a precise, concise, accurate, and credible description of the likely and significant effects of archaeological and cultural heritage and offer mitigation measures where a likely significant effect is predicted. The description of effects follows the EPA Guidelines (2022, table 3.4, fig. 3.4), whereby comparing the character of the

predicted effect to the sensitivity of the receiving environment can determine the significance.

14.2 DESCRIPTION OF RECEIVING ENVIRONMENT

14.2.1 INTRODUCTION

The proposed vehicular route corridor is located in the townland of Ballynaheskeragh. The proposed road will connect the proposed development with the N65 road, using a small section of the existing L8763 road, with the new route measuring c. 813m in length and 7.0m in width, traversing three undulating grassed fields and two streams

The primary purpose of this vehicular route is to serve the construction traffic during the development of a site that is principally located within three townlands: the east side of Coolpowra, the south side of Ballynaheskeragh and the north side of Gortlusky. This newly proposed access will replace the previously proposed access using the existing road (L8763).

The vehicular road corridor has an elevation of c. 54–57m Ordnance Datum (O.D.). The underlying geology consists of dark limestone and shale and is part of the Lucan Formation. It is covered by deep, well drained mineral (mainly basic) soils (Geological Survey of Ireland). The road traverses two minor streams, and the terrain is undulating as it includes several drumlins.

Cultural Heritage is considered here to include all recorded monuments listed in the *Record of Monuments and Places* (RMP) and in the *Sites and Monuments Record* (SMR), National Monuments (i.e. those in the ownership/guardianship of the state), Protected Structures, National Inventory of Architectural Heritage (NIAH) sites, previously unrecorded sites, sites reported in the Excavations Database if not included in the RMP/SMR, find spots or sites listed in the Topographical Files of the National Museum of Ireland, and finally sites identified during a site visit, through examination of cartographic sources and aerial imagery (for full methodology see the original chapter).

14.3 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

14.3.1 ARCHAEOLOGICAL HERITAGE

There will be no effects, direct or indirect, on recorded archaeological monuments as no such monuments are located within the proposed vehicular access road corridor.

A potential direct effect on the archaeological resource lies in the uncovering of sub-surface archaeological features during groundworks associated with the proposed development and related infrastructure within all undisturbed areas of the site.

The road traverses two minor streams and portions of the site are indicated as wetland with rushes shown. Such locations, where there is a readily available water source but also an adjacent area of dry ground, frequently contain the remains of fulacht fia, also known as burnt mounds. They are usually identified as charcoal-rich mounds or spreads of heat-shattered stones; however, in many cases the sites have been disturbed by later agricultural activity and are no longer visible on the field surface. Disturbed spreads will nonetheless often preserve underlying associated features, such as troughs, pits, post/stake-holes and gullies. They represent the remains of prehistoric water heating sites, where people mainly gathered to cook food, although they could also have been used for bathing/sauna, brewing, textile working, etc. Burnt mounds are most commonly dated to the Bronze Age (c. 2200–800 BC), largely to the Middle–Late Bronze Age (Brindley et al. 1990; Corlett 1997), however, many examples are now also known to date from the Neolithic, Chalcolithic and Iron Age (Hawkes 2018, chapter 5).

Should previously unknown archaeological features be present, the proposed development will have a direct, negative, permanent and profound or very significant effect on such remains.

14.3.2 ARCHITECTURAL AND CULTURAL HERITAGE

There will be no effects, direct or indirect, on recorded architectural heritage as no Protected Structures or sites listed within the National Inventory of Architectural Heritage (NIAH) are located within the proposed development site.

The road corridor was designed to avoid any upstanding structures and any structures depicted on the examined mapping. The site traverses two field boundaries in the form of streams/wet ditches and hedges. No upstanding structures are located within the proposed road corridor. The 6-inch map of 1837 depicts a number of structures, including houses, wells and kilns. None of the structures are located within the corridor, and these are no longer shown on the subsequent 25-inch map of 1892. A number of field boundaries were removed by the 1892 map. Both maps depict the southern stream/wet ditch clearly, and the 1892 map clearly illustrates them both, with the southern indicated as more substantial. These are the only currently present field boundaries that the proposed vehicular access will impact upon. While an access road/path just off the local road is depicted within the very southwestern extent of the corridor on both maps, it appears that

by the 1892 map, it went out of use. This is likely due to the fact that the previously depicted farmyard is no longer illustrated.

A potential direct effect on any cultural heritage sites lies in the uncovering of sub-surface remains during groundworks associated with the vehicular access. However, none were identified as a result of this assessment within the corridor of the proposed route.

Should previously unknown cultural heritage features be present, the proposed vehicular access will have a direct, negative, permanent and profound or very significant effect on such remains.

14.3.3 INDIRECT EFFECTS

Indirect effects are those whereby the proposed development may have a negative (or positive) effect on the wider archaeological landscape or surrounding architectural and cultural heritage. Indirect effects may include a visual impact on the surrounding archaeological and/or architectural landscape.

The introduction of the proposed development to the area will not result in a change to the general setting of any recorded monuments, protected structures or architectural heritage as none are present within or in the immediate environs of the site.

The proposed development will therefore have no indirect effects, either temporary or permanent, on the wider cultural heritage of the area.

14.4 ADDITIONAL MITIGATION MEASURES

14.4.1 ARCHAEOLOGICAL HERITAGE

The predicted effects on the known archaeological heritage are regarded as being none. No effects on the recorded archaeological resource (SMRs/RMPs) were identified, and no indirect or visual effects on the nearest recorded monument outside the proposed development site boundary were noted.

A potential direct effect on previously unknown archaeological heritage lies in the uncovering of sub-surface remains. Accordingly, the following mitigation measures will be carried out subject to the approval of the National Monuments Service (NMS) of the Department of Housing, Local Government and Heritage (DHLGH) and further mitigation may be sought by the NMS.

Archaeological test trenching (minimum of 12% of the lands available/vehicular access route measuring 813m in length and 7.0m in width) will be carried out prior to any

groundworks commencing and will be undertaken by an experienced, licence-eligible archaeologist working under licence from the Department of Housing, Local Government and Heritage. If archaeological features or deposits are exposed, these shall be sufficiently sectioned in order to assess their extent, nature and significance. Once test trenching is complete, further mitigation might include preservation in situ (avoidance), excavation (preservation by record) and/or monitoring of topsoil stripping.

Adequate time and resources will be provided by the developer for the resolution of any archaeology identified within the development site and which will be directly impacted by groundworks. Time and resources will also be allowed for any post-excavation work and specialist analysis necessary following any archaeological excavation that takes place.

A report is required to be compiled on completion of any archaeological excavation and will be submitted to the relevant authorities.

14.4.2 ARCHITECTURAL AND CULTURAL HERITAGE

The predicted effects on the known architectural heritage are regarded as being none. No effects on Protected Structures (RPS) or sites in the National Inventory of Architectural Heritage (NIAH) were identified, and no indirect or visual effects on the nearest such site outside the proposed development site boundary were noted.

No potential direct effects on previously unknown architectural/cultural heritage were identified. However, should any previously unknown cultural heritage sites be present, the impact on these will be mitigated through the proposed test trenching of the corridor, which will allow for appropriate mitigation measures to be employed. These might include excavation and/or monitoring of groundworks.

14.4.3 RESIDUAL IMPACTS OF THE DEVELOPMENT

The residual impacts are likely to be neutral and none to imperceptible if the mitigation measures are implemented. Table 14.1 below summarises the residual effects of the proposed development on the archaeological and cultural heritage landscape. Residual impacts are defined as the overall effect of the development on archaeology and cultural heritage, on the basis of implementing the mitigation measures outlined in this report.

Table 14.1 Summary of Residual Effects

Potential Effects	Mitigation strategy	Residual impacts
Construction Effects		
Effects to Recorded Monuments and Protected Structures/NIAH sites - none	No mitigation required.	None
Effects to previously unknown archaeological and cultural heritage sites – Topsoil removal associated with development. Any groundworks, drainage, etc.	Assessment and photographic survey prior to building demolition. Archaeological test trenching of the footprint of the proposed vehicular access corridor. Consultation with Licensing Section of National Monuments Service should archaeological sites or features be uncovered. Excavation and recording of any archaeological features identified, thus preserving them by record.	None
Effects to Recorded Monuments - none	No mitigation required.	None
Operational Effects		
Effects to nearby Recorded Monuments and Protected Structures/NIAH sites - none	No mitigation required.	None

14.5 CUMULATIVE EFFECTS

There are no significant cumulative effects on the archaeological and cultural heritage resource of the area as a result of the proposed development of the vehicular access route. There are no predicted effects on the known archaeological, architectural and cultural heritage of the site and the surrounding landscape. Furthermore, an existing operational 400kV AIS electricity substation (Oldstreet) is already located directly adjacent and west of the proposed vehicular access route.

The indicative route for an associated gas pipeline has also been designed to avoid any known archaeological and architectural heritage constraints. All related due diligence will be undertaken by Gas Networks Ireland (GNI), who will complete an associated archaeological and cultural heritage assessment.

14.6 MONITORING AND FURTHER WORKS

Monitoring may be required during the construction phase and will be informed by archaeological test trenching that will be carried out prior to any groundworks

commencing. Following this, further mitigation may be required in the form of preservation in situ (avoidance), excavation (preservation by record) and/or monitoring of topsoil stripping. Such mitigation measures (as outlined in Section 14.5) should be conditioned within any planning permission for the site.

No monitoring is required during the operation phase.

14.7 SUMMARY OF SIGNIFICANT EFFECTS

Should previously unknown archaeological, architectural and cultural heritage features be present within the footprint of the proposed development, it will likely result in the permanent loss of these remains and, as such, the magnitude of the effect is profound or very significant.

14.8 REFERENCES

- Galway County Development Plan 2022–2028 https://consult.galway.ie/en/consultation/adopted-galway-county-development-plan-2022-2028, accessed November 2025).
- Geological Survey Ireland Spatial Resources, Department of the Environment, Climate and Communications(https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228, accessed May 2024).
- Historic Environment Viewer (https://heritagedata.maps.arcgis.com/apps/webappviewer/, accessed November 2025).
- Irish Townland and Historical Map Viewer (https://osi.maps.arcgis.com/apps/webappviewer/, accessed November 2025).
- National Inventory of Architectural Heritage Database (https://www.buildingsofireland.ie/, accessed November 2025).
- National Monuments Service (www.archaeology.ie, accessed November 2025).
- Record of Monuments and Places for County Galway (1997) (https://www.archaeology.ie/sites/default/files/media/pdf/Archaeology-RMP-Galway-Manual-(1997)-0015.pdf, accessed May 2024).

Figure 14.1 Location of proposed vehicular access (orange) and site (blue) and nearby Recorded Monuments.

Figure 14.2 Aerial imagery, showing the proposed vehicular access.

Figure 14.3 Extract from first edition OS 6-inch map (surveyed 1837 – published 1841), showing locations of the proposed vehicular access road (orange).

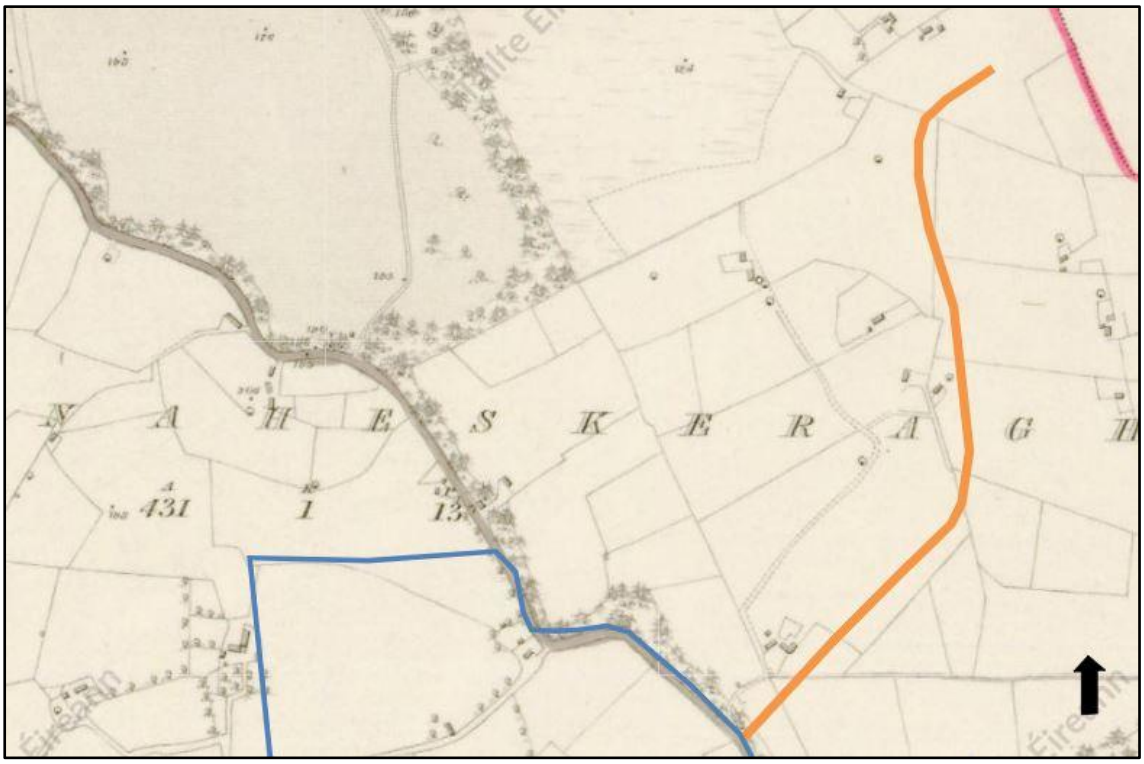


Figure 14.4 Extract from third edition OS 25-inch map (surveyed 1892 – published 1894), showing locations of the proposed vehicular access road (orange)

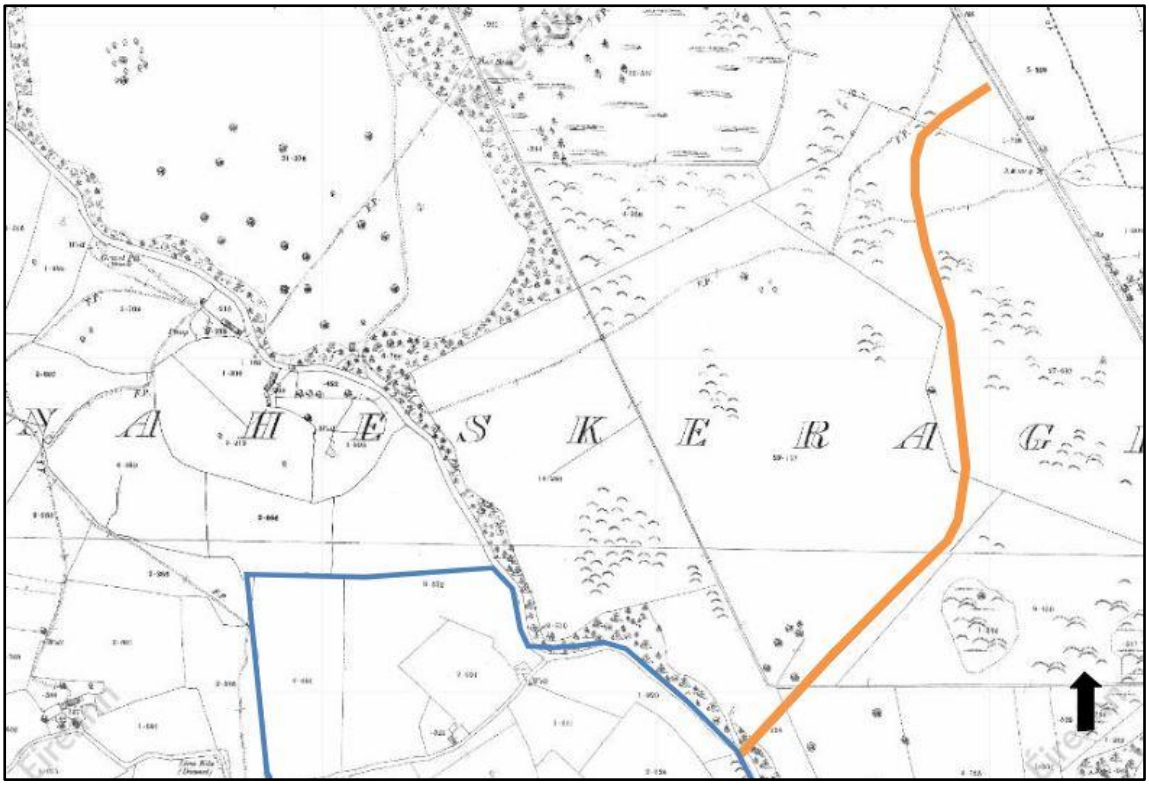


Plate 14.1 Aerial view of the proposed vehicular access

Plate 14.2 View from N65 facing southwest (Google Street Imagery)

15 CLIMATE

15.1 INTRODUCTION

This section provides an update of Chapter 15 of the Environmental Impact Assessment Report (EIAR) which considers the likely significant effects from the proposed development on climate change as well as the likely significant effects of climate change on the proposed development. This addendum report considers a proposed alternative construction access road to allow for construction of the three Coolpowra Energy Projects – Reserve Gas Fired Generator (An Coimisiún Pleanála; Ref. 320095), GIS Generator (An Coimisiún Pleanála; Ref. 320094), and ESS (An Coimisiún Pleanála; Ref 32091). This report does not replace the EIAR it is an updated assessment of the potential climate impacts of the proposed temporary access route.

15.2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The overall proposed development for which planning permission is sought comprises three elements – the Reserve Gas-Fired Generator, the GIS Electrical Substation and the proposed Energy Storage System (ESS) using long duration energy storage (LDES) battery technology and synchronous condenser technology. A single Environmental Impact Assessment Report (EIAR) has been prepared for all three projects proposed as part of the development. The potential environmental impacts from each project are assessed individually and cumulatively (with each other and with any other identified projects) within the EIAR.

The proposed development which is the subject of this assessment is an alternative construction access which will route through lands under the control of the applicant. It is proposed to construct a temporary road from the N65 which will provide vehicular access to the main development site (south of the L8763). The road will be used for the construction stages of the projects. The proposed alternative construction access road will route from a new junction along the N65 and traverse three undulating grassed fields. The access route will cross the L8763 by staggered junction and extend from here into the main development lands, before connecting to the proposed access lane which will serve the site during operation (i.e. that which was originally applied for).

15.3 IMPACT ASSESSMENT METHODOLOGY

The impact assessment methodology is based on the Institute for Environmental Assessment and Management (IEMA) Guidance (2017, 2020, 2022) on the assessment of Greenhouse Gas Emissions and Climate Impacts. The EPA Guidelines on the Information

to be Contained in Environmental Impact Assessment Reports were published in May 2022 and are considered in this assessment. The assessment in this updated report of a temporary access route uses the same methodologies employed in the EIAR. Since the proposed alternative access route is intended only for construction phase access, the updated assessment only considers potential construction phase impacts.

15.4 LEGISLATION, POLICY AND GUIDANCE

There are no changes or updates to this section of the EIAR.

15.5 GREENHOUSE GAS ASSESSMENT

15.5.1 CONSTRUCTION PHASE GREENHOUSE GAS ASSESSMENT

Construction phase Greenhouse Gas Emissions were estimated in the EIAR using currently available information about the duration and scale of the construction works and the design of the facility as currently developed. The total GHG emissions for the construction phase of the project were estimated as set out in Section 15.5.1 and Table 15.1 of the EIAR. The only change to the development is to consider a proposed alternative construction access road to the site for the construction phase. The scale of it is indistinguishable from the scale of the original access route assessed as part of the EIAR, and there is no quantifiable difference in the magnitude of the potential impacts of the proposed alternative access route relative to the original access route proposal. When the GHG emissions are compared to the Irish carbon budgets, the construction phase emissions contribute significantly less than 1% of the annual carbon budget during the projected construction period, and this is unchanged for the proposed alternative construction access road.

15.5.2 OPERATION PHASE GREENHOUSE GAS ASSESSMENT

The proposed alternative construction access road is for construction phase only so there is no Operational Phase climate impact associated with the proposed development.

15.6 CLIMATE CHANGE RESILIENCE ASSESSMENT

The principal potential climate change impacts on the Proposed Development and the adaptation methods to increase the resilience of the Proposed Development are detailed in Table 15.4 of the EIAR. None of the identified risks are deemed significant. The potential impact of the proposed alternative construction phase access route were considered and there is no change to the findings presented in the EIAR. Climate change resilience effects

during construction are deemed to be minimal and indistinguishable relative to the original proposed access route.

15.7 REFERENCES

There are no new References cited.

16 CUMULATIVE EFFECTS AND INTERACTIONS

16.1 INTRODUCTION AND SCOPE

This section considers cumulative effects and interaction arising from the Proposed Development (as amended), and other plans or projects that could reasonably interact with the works during construction, operation or decommissioning.

The assessment addresses the potential for cumulative effects to occur where there is temporal overlap between construction activities, additional demands on shared infrastructure (in particular the local and national road networks), and combined nuisance effects at sensitive receptors, and also considers the interaction of environmental factors in line with the EPA EIAR Guidelines (2022).

16.2 COOLPOWRA PLANNING APPLICATIONS

The planning applications are currently under consideration by An Coimisiún Pleanála and comprise a reserve gas-fired generator, an energy storage system and a gas insulated switchgear electricity substation. These projects have been assessed under the EIA Directive and the Habitats Directive, and supporting reports have demonstrated that, with appropriate mitigation during construction, operation and landscaping, the projects would have no significant effects on biodiversity or on the Natura 2000 Network.

The Proposed Development will include a Construction Environmental Management Plan and associated environmental commitments designed to avoid potential negative effects on European sites within the potential zone of influence and to avoid and, where practicable, enhance biodiversity. On this basis, and provided the identified mitigation measures are implemented, no in-combination effects are predicted to arise from the Proposed Development (as amended).

16.3 GAS PIPELINE CONNECTION

The Proposed Development (as amended) will require a connection to the national gas transmission system. Gas Networks Ireland ("GNI") is the developer and competent applicant in respect of the gas transmission connection, and that connection will be subject to a separate statutory consent process under the relevant legislative code applicable to GNI's works. Potential routes for the underground transmission gas pipeline required to serve the reserve gas-fired generator are currently being considered by GNI. There is potential for the route to traverse areas containing habitats or fauna not currently confirmed, including badger activity. Any such risks will be managed through appropriate

routing, avoidance and mitigation measures to ensure that cumulative effects do not arise. The detailed environmental assessment of the final pipeline alignment will be undertaken as part of the separate consent process for the gas transmission connection. The EIAR has also considers the potential for cumulative effects with other known enabling or related projects necessary for the operation of the development. In addition, the Galway County Development Plan requires that plans and projects which could affect Natura 2000 sites within the same zone of influence are screened for Appropriate Assessment and, where Stage 2 Appropriate Assessment is required, that suitable mitigation measures are applied to avoid, reduce or ameliorate negative effects. This approach provides a framework through which potential in-combination effects with other plans or projects in the surrounding townlands would be identified and avoided.

16.4 CONSENTED DEVELOPMENT IN THE VICINITY

A review of developments granted permission in the vicinity indicates that permissions have generally been conditioned to secure sustainable development outcomes in compliance with the relevant Development Plan and the requirements of the Habitats Directive. In that context it is not predicted to have effects on any European site, in-combination or cumulative effects with other consented development are not anticipated.

16.5 CUMULATIVE EFFECTS

16.5.1 POPULATION AND HUMAN HEALTH

Cumulative population and human health effects could arise where the construction programme overlaps with other developments or background roadworks in the area, potentially increasing overall construction traffic and pressure on the local road network. The proposed alternative construction access road reduces the potential for such cumulative effects by concentrating project-related HGV movements onto a managed, purpose-designed route between the N65 and the works area, thereby limiting additional traffic on the L8763 local road network and reducing combined nuisance and safety effects at residential frontages.

Subject to implementation of the Construction Environmental Management Plan, including delivery scheduling, traffic management measures and ongoing monitoring, cumulative effects on population and human health are expected to remain not significant, with any residual effects likely to be temporary and slight.

16.5.2 CUMULATIVE AIR QUALITY EFFECTS

The cumulative impacts of the Proposed Development on air quality, in conjunction with current and future developments in the vicinity of the site, have been considered. There is no discernible difference in emissions or the potential for air quality impacts associated with the proposed alternative construction access road compared with the position assessed in the July 2024 EIAR. Accordingly, there is no change to the air quality cumulative assessment relative to the EIAR, and cumulative air quality effects remain not significant, subject to good practice construction management and dust control measures implemented through the Construction Environmental Management Plan.

16.5.3 CUMULATIVE NOISE EFFECTS

Potential construction impacts at noise sensitive receptors are greatest within approximately 40 metres of works, after which they reduce as noise attenuates with distance. As noise addition is logarithmic, the dominant contributors are generally those closest to receptors and these tend to define the overall impact magnitude.

The proposed alternative construction traffic route is expected to be built out first and separately to the development of the three projects described in the EIAR; therefore, no cumulative construction noise impacts arise from the construction of the alternative route itself.

With regard to traffic-related noise, cumulative HGV movements are expected to increase to approximately 15 arrivals during the peak hour. The predicted $L_{Aeq,1hr}$ value for HGV traffic at roadside noise sensitive receptors located between Loughrea and the construction site entrance, at 20 metres from the roadside and inclusive of baseline, is 55dB and is therefore assessed as short-term minor negative and insignificant. Cumulative car movements are expected to increase to approximately 95 arrivals during the peak hour. The predicted $L_{Aeq,1hr}$ value for cars at roadside noise sensitive receptors located south of the construction site entrance, at 20 metres from the roadside and inclusive of baseline, is 54dB and is therefore assessed as short-term negligible negative and insignificant.

16.5.4 CUMULATIVE ARCHAEOLOGY AND CULTURAL HERITAGE EFFECTS

No significant cumulative effects on archaeological or cultural heritage resources are predicted as a result of the proposed vehicular access route. No effects are anticipated on known archaeological, architectural or cultural heritage features within the site or the surrounding landscape. An existing operational 400kV AIS electricity substation (Oldstreet) is already located immediately adjacent to and west of the proposed access route, which contributes to an established baseline of strategic infrastructure in the area.

The indicative route for an associated gas pipeline has also been designed to avoid known archaeological and architectural heritage constraints, and Gas Networks Ireland will undertake appropriate due diligence, including an archaeological and cultural heritage assessment, as part of any separate consenting process.

16.6 INTERACTION OF ENVIRONMENTAL FACTORS

The Proposed Development has the potential to interact across environmental topics, particularly through construction activity and construction traffic. Construction-related air quality effects have potential to interact with population and human health; however, these effects are predicted to be short term and to range from not significant to slight, with predicted concentrations at the nearest residential receptors below relevant air quality limit values, resulting in negligible effects. On the ecological side, effects on protected sites and biodiversity are not significant, and therefore no significant interaction is predicted.

Noise has the potential to interact with population and human health, and with biodiversity, particularly where ecological receptors are located in proximity to the development lands. Construction-phase noise controls and mitigation will be set to ensure applicable construction noise targets are achieved, with measures further detailed within the construction management plan. Operational noise associated with the projects has been assessed as compliant with lower limits appropriate to areas of low background noise. In that context, and given the nature of ecological receptors and the predicted levels, noise interaction effects on biodiversity are not considered significant.

Landscape and visual effects can interact with population and human health and with biodiversity. No designated scenic views are affected. Proposed mitigation planting will increase the variety of native tree and shrub species and will deliver positive effects through enhanced screening and ecological benefit over time. Residual visual effects range from substantial-moderate to imperceptible, with effects reducing considerably beyond the immediate context of the site. Having regard to the receiving landscape's low sensitivity classification within the Galway County Development Plan and compliance with relevant policy objectives, interaction effects are not considered to give rise to significant cumulative impacts.

There is a recognised interaction between soils and geology and the water environment, in that soil disturbance during construction can affect water quality if sediment-laden runoff reaches water features or drains. Construction activities that disturb or expose soils, including any works in proximity to drainage features, have the potential to increase suspended solids. This interaction is managed through construction mitigation measures,

including sediment control and prevention of polluted discharges, implemented through the Construction Environmental Management Plan framework. During operation of the access road, there will be no direct process discharges to soils or surface waters; stormwater will be managed in accordance with sustainable drainage best practice as presented in the drainage assessments, and no significant in-combination effects are predicted.

Traffic and transport effects can interact with population and human health, air quality, noise and vibration and biodiversity, particularly during construction. These interactions are addressed within the relevant EIAR chapters. Importantly, the proposed alternative construction access road is intended to reduce these interactions by providing a direct, controlled route between the N65 and the works area, limiting use of local roads and thereby reducing the potential for combined impacts at receptors. Overall, traffic-related interaction effects are short term during construction, not significant (depending on the activity and proximity), and imperceptible during operation.

16.7 CONCLUSION

Having regard to the separation and sequencing of works, the implementation of the Construction Environmental Management Plan and topic-specific mitigation, and the function of the proposed alternative construction access road in reducing construction traffic interaction with the local road network and sensitive receptors, cumulative effects associated with the Proposed Development (as amended) are not predicted to be significant. Residual effects, where they arise, are expected to be temporary and slight.

17 MAJOR ACCIDENTS AND DISASTERS

17.1 INTRODUCTION

This chapter has been prepared for inclusion in the Environmental Impact Assessment Report (EIAR) to provide a dedicated assessment of the vulnerability of the Proposed Development to the risks of major accidents and/or disasters relevant to it and, where appropriate, the expected significant adverse effects on the environment arising from such events. The assessment has been prepared having regard to the EIA Directive (as amended) and the EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EIAR) (2022).

A full description of the development can be found in Chapter 2 of the July 2024 EIAR (Proposed Development) and Chapter 2 of the EIAR Addendum (Description of Development Changes and Alternatives).

17.2 BACKGROUND AND PURPOSE

The EIA Directive requires that EIARs consider the likely significant effects of the project on the environment, including effects deriving from the vulnerability of the project to risks of major accidents and /or disasters that are relevant to it. In this context, the term *"major accident"* includes low-likelihood, high-consequence events such as fires, explosions, loss of containment and associated secondary effects (for example, contaminated firewater/runoff), whilst *"disasters"* may include natural hazards (for example, extreme rainfall events) and other external events.

This chapter focuses on those accident /disaster scenarios that are credible for the Proposed Development as Amended and that could give rise to environmental effects beyond normal operational emissions and discharges. The assessment is proportionate to the nature and scale of the Proposed Development as Amended and makes use of risk assessment work completed for the project, including the Environmental Risk Assessment[43] (see Appendix 17.1) and Consequence Study and Technical Land Use Planning (TLUP) Assessment[44] (see Appendix and 17.2).

[43] DNV, Project Coolpowra Environmental Risk Assessment (ERA), Document No. 2246099, Rev 2, 27 January 2025. This report supersedes the original ERA contained in Appendix 4.1 of the July 2024 EIAR.
[44] DNV, Consequence Study and TLUP Assessment Report, Document No. 2246462, Rev 2, 27 January 2025. This report supersedes the original ERA contained in Appendix 4.2 of the July 2024 EIAR.

17.3 ASSESSMENT APPROACH

The EPA EIAR Guidelines (2022) recognise that EIARs may draw upon established risk assessment work undertaken for other regulatory regimes, where relevant, while ensuring that the EIAR clearly identifies the potential environmental effects and the mitigation that avoids or reduces significant adverse effects. The assessment in this chapter therefore:

- identifies major accident and disaster hazards relevant to the Proposed Development as Amended;
- considers credible source-pathway-receptor linkages for environmental effects;
- summarises likelihood /risk context in a proportionate manner, drawing on available quantitative and semi-quantitative assessments;
- identifies mitigation (embedded design measures and additional measures where required) and provides a conclusion on residual effects.

The principal project-specific information sources used in preparing this chapter comprise:

- DNV, Project Coolpowra Environmental Risk Assessment (ERA), Document No. 2246099, Rev 2, 27 January 2025. This report supersedes the original ERA contained in Appendix 4.1 of the July 2024 EIAR.
- DNV, Consequence Study and TLUP Assessment Report, Document No. 2246462, Rev 2, 27 January 2025. This report supersedes the original ERA contained in Appendix 4.2 of the July 2024 EIAR.

17.4 ELEMENTS OF THE PROPOSED DEVELOPMENT AS AMENDED RELEVANT TO MAJOR ACCIDENTS AND DISASTERS

For the purposes of this chapter, the elements considered most relevant to major accidents and /or disasters include (non-exhaustive):

- secondary fuel storage and handling infrastructure (diesel storage tanks, associated pipework and road tanker unloading).
- natural gas infrastructure (underground pipeline within the site and the Above Ground Installation (AGI)).
- long duration energy storage / battery energy storage system (LDES/BESS) compound and associated electrical infrastructure.
- transformers, switchgear and other electrical equipment where fire and /or insulating fluid release could occur.

- site drainage, interceptors, isolation features and firewater retention infrastructure, which are relevant to preventing off-site pollution in the event of a spill or fire.

17.5 RECEIVING ENVIRONMENT AND KEY ENVIRONMENTAL RECEPTORS

The baseline receiving environment is described within the EIAR (refer to relevant topic chapters). For major accident and disaster assessment purposes, the key receptors and pathways of relevance include:

- Surface water features within the site (including field drains and the Ballynaheskeragh Stream) and the downstream receiving environment including the Kilcrow River and Lough Derg.
- Soils and subsoils within the site and along potential overland flow pathways.
- Groundwater beneath the site (aquifer and vulnerability context as described in baseline).
- Agricultural land within and adjacent to the site.
- Designated sites and sensitive ecological receptors downstream of the site (where pathways could exist).

17.6 IDENTIFICATION OF MAJOR ACCIDENT AND DISASTER SCENARIOS

Table 17.1 identifies the principal major accident and disaster scenarios considered for the Proposed Development as Amended. The screening has focused on scenarios that could give rise to environmental effects (for example, pollution of surface waters or soils, smoke deposition and contaminated runoff), rather than those that are solely occupational safety matters.

Table 17.1 Identification of Major Accident and Disaster Scenarios

Scenario group	Representative event	Primary environmental pathway	Key receptors	Screening outcome
Fuel storage /handling	Catastrophic loss of containment from a diesel storage tank	Overland flow / drainage to surface waters; soil infiltration	Kilcrow River / Lough Derg; soils; groundwater	Potential MATTE scenario identified in ERA; assessed quantitatively
Fuel storage /handling	Diesel spill during tanker unloading /hose failure	Local containment; potential drainage entry if controls fail	Soils; surface waters (via drainage)	Localised; assessed qualitatively with controls
Fire and firefighting	Diesel pool fire and contaminated firewater/runoff	Runoff to drainage; interception and retention	Surface waters; soils	Assessed qualitatively; managed via drainage isolation and retention
Natural gas systems	AGI or on-site pipeline rupture/leak leading to jet fire /flash fire /explosion	Smoke and soot deposition; contaminated firewater/runoff; debris	Local receiving environment; on-site soils/surface waters	Off-site population risk not anticipated; environmental effects primarily secondary
LDES /BESS	Thermal runaway/fire within LDES /BESS container(s), potential propagation	Smoke and evolved gases; deposition; contaminated runoff	Air quality locally; soils/surface waters via runoff	Off-site smoke effects possible only in unlikely large-scale event; mitigation required
Electrical infrastructure	Transformer or switchgear fire (incl. insulating fluids)	Local spill and runoff to drainage if not contained	Soils; surface waters	Localised; managed via containment and drainage controls
External/natural hazards	Extreme rainfall/flooding affecting containment and drainage performance	Overtopping and bypass of containment; mobilisation of contaminants	Surface waters; soils	Baseline flood risk low; resilience measures required
External/natural hazards	Lightning strike or external fire /wildfire affecting site compounds	Fire initiation; contaminated runoff	Air; soils; surface waters	Qualitative; addressed through emergency planning and design measures

17.7 ASSESSMENT OF VULNERABILITY AND POTENTIAL ENVIRONMENTAL EFFECTS

17.7.1 CATASTROPHIC DIESEL TANK FAILURE (POTENTIAL MATTE TO KILCROW RIVER / LOUGH DERG)

The DNV ERA. catastrophic failure of a diesel fuel tank, with a release of approximately 6,196 tonnes of diesel identifies a single source-pathway-receptor linkage with Major Accident to the Environment (MATTE) potential, i.e (based on a tank capacity of 7,333m^3) and a pathway to the Kilcrow River / Lough Derg receptor. The ERA classifies this as a MATTE consequence Level B.

In the absence of effective containment, a release reaching surface waters could result in an oil slick with the potential to cause significant harm to aquatic habitats over a prolonged duration, with consequent effects on biodiversity and ecosystem function. Such effects would be significant, long-term and could require extensive remediation.

The ERA reports that the unmitigated frequency for the relevant MATTE scenario is 3.3 x 10^{-4} events per year, which plots within the ***'tolerable if ALARP'*** region of the CDOIF risk matrix. Following consideration of the protection layers in place (and associated probabilities of failure on demand), the mitigated MATTE frequency is reported as 1.65 x 10^{-7} events per year, which plots within the ***'Broadly Acceptable'*** region.

Key embedded protection layers identified include the following:

- Diesel tank bunding (designed to contain at least 150% of the contents of a single tank and includes level monitoring and CCTV coverage).
- Below-ground fire wastewater retention tank with collection via infiltration points and oil/water interceptors routed to the retention tank.

With these measures in place, and subject to detailed design confirmation, inspection /maintenance and operational management (including bund valve management and spill response readiness), the risk of significant adverse environmental effects associated with catastrophic diesel tank failure is assessed as ***"not likely to be significant"*.**

17.7.2 TANKER UNLOADING

Diesel delivery and unloading is identified, and represents, a credible spill scenario. Potential effects would be localised contamination of made ground /soils and, in the absence of containment, entry to the site drainage system and onward migration to surface waters.

The Proposed Development incorporates oil /water interceptors and drainage collection features that are intended to prevent uncontrolled off-site migration of hydrocarbons. In addition, operational management (delivery procedures, supervision, hoses /connection standards, and spill response provisions) will be put in place to ensure that any spill is rapidly contained and recovered. With these measures, significant adverse environmental effects are not anticipated.

17.7.3 FIRE EVENTS AND CONTAMINATED FIREWATER

Fire scenarios (including diesel pool fires and potential escalation between fuel inventories) may lead to secondary environmental effects arising from smoke /soot deposition and contaminated firefighting water. The consequence work undertaken by DNV highlights that, while off-site impacts are not identified for the modelled natural gas and diesel hazards, pool fires may create high thermal radiation levels on-site and may threaten critical infrastructure (including firewater tanks) in worst-case scenarios.

The engineering design of the Proposed Development as Amended includes measures to intercept and retain contaminated fire wastewater from the reserve gas-fired generator, and to enable for controlled testing and disposal. These measures are critical to preventing significant adverse effects on surface waters and will be detailed and confirmed at detailed design stage (including isolation strategy, capacities, discharge controls and maintenance).

17.7.4 NATURAL GAS LOSS OF CONTAINMENT AND IGNITION

Credible major accident scenarios associated with the natural gas infrastructure include pipeline or AGI leaks /ruptures leading to jet fires, flash fires and, under certain conditions, explosion overpressures. While these events are primarily safety-related, secondary environmental effects could arise through smoke deposition, debris and the generation of contaminated runoff during response actions.

The consequence study and TLUP assessment undertaken indicates that no off-site impacts were identified for the modelled natural gas hazards. The TLUP assessment indicates that land use planning risk contours are not expected to impact local populations and that no off-site fatalities are anticipated. Nevertheless, the hazard contour results identify layout sensitivities, including the potential for escalation and the need to ensure that occupied buildings and assembly points are located outside relevant hazard zones.

The Proposed Development as Amended will implement appropriate design standards for gas systems, incorporates effective isolation and detection systems, and adopts layout and emergency response measures consistent with good practice and ALARP. This will

ensure that significant adverse environmental effects from gas accident scenarios are not anticipated.

17.7.5 LDES/BESS INCIDENTS

Grid connected battery systems introduce hazards associated with stored electrical energy, including thermal runaway and fire. The consequence study notes that the risk posed by the LDES system must not be underestimated and that, in the unlikely event of a large-scale compound fire with propagation across multiple containers, there is potential for off-site impacts associated with smoke and evolved gases.

Potential environmental effects include temporary degradation of local air quality due to smoke and evolved gases, deposition of particulates on land/water and contaminated firefighting runoff. The significance of effects would depend on event scale, meteorological conditions, duration and the effectiveness of containment and response measures.

Accordingly, a fire risk management plan (FRMP) and Emergency Response Plan (ERP) containing clear procedures to be followed in the event of a fire, or similar emergency is provided in Appendix 17.3. The document put shall be further considered and revised as applicable to the final technology selection and agreed with the fire services authority in advance of operation. The primary purpose of this assessment is to identify and evaluate potential fire hazards associated with the design, installation, and operation of the facility and to propose appropriate fire risk mitigation measures.

BESS safety and environmental protection measures include: all enclosures (battery and MVPS) will be UL9540A (2024) tested and certified, enclosure segregation and spacing, early detection and automatic isolation, measures to prevent propagation, local inert gas suppression, BESS compound 500m^3 static water tank supplying hydrants for cooling adjacent structures if needed) which exceeds requirements as set out under NFPA 855 (2026)[45]. With these measures, significant adverse environmental effects are not anticipated.

17.7.6 ELECTRICAL EQUIPMENT AND TRANSFORMER FIRE /INSULATING FLUID RELEASE

Electrical fires (including transformer fires) could result in localised release of insulating fluids and/or combustion products, with potential for soil contamination and pollution of surface waters if not contained. The Proposed Development as Amended includes drainage controls and interception /retention measures that are intended to prevent off-site

[45] NFPA 855, Standard for the Installation of Stationary Energy Storage Systems (2026)

migration. HV transformers will be located outdoors and will be the oil immersed design type. All HV transformers will be bunded and the high voltage (HV) transformers include blast walls. Transformers bunds will be designed utilising a water displacement system which negates the requirement for a pump to remove stormwater from within the bund. This system will be connected directly to the piped underground gravity drainage system upstream of the SUDS management train elements. This bund design can accommodate a pumped solution if required. Within the LDES, MVPS (or Power Control System (PCS)) units and small transformers will also be positioned in self-contained weather-proof enclosures. Detailed design will confirm the specific containment arrangements (including transformer bunding, interceptors and isolation provisions) and maintenance regimes.

17.7.7 DISASTERS AND EXTERNAL HAZARDS

Disaster scenarios considered include extreme rainfall events and flooding, as well as lightning and external fire. The baseline assessment indicates that the site is within an area of low probability of flooding; however, climate resilience requires that drainage, bunding and containment measures are designed and maintained to perform under relevant design storm conditions and that operational preparedness is maintained.

With appropriate resilience measures (including inspection and maintenance, emergency procedures, and protection of critical environmental containment systems), significant adverse environmental effects arising from disasters and external hazards are not anticipated.

17.8 TLUP AND ENVIRONMENTAL RISK CONTEXT

A TLUP assessment has been carried out in accordance with Health and Safety Authority (HSA) guidance to determine land use planning zones based on individual risk and to provide additional context for on-site and off-site risks. Key conclusions include:

- No individual risk contours are expected to impact local populations; the maximum tolerable risk of fatality to a member of the public (1×10^{-6} per year) and to a person at an off-site work location (5×10^{-6} per year) is not foreseen to be exceeded.
- Consultation distances (Zones 1 to 3) extend beyond the site boundary in the vicinity of the AGI and diesel storage area, but are unlikely to affect local populations; no Level 1, 2, 3 or 4 developments are located within the contours.
- The 1×10^{-9} (one in a billion) fatality risk contour does not include off-site populations or the neighbouring existing substation.

- Societal risk analysis indicates no intolerable risks and no off-site fatalities are anticipated.

In environmental TLUP context, the prevention of Major Accidents to the Environment (MATTEs) is a primary objective. The TLUP assessment references the ERA undertaken, which identifies catastrophic diesel tank failure reaching the Kilcrow River as the only MATTE scenario (Type B). The ERA demonstrates that, with identified protection layers, the risk is reduced to broadly acceptable levels consistent with criteria for new COMAH establishments.

17.9 MITIGATION MEASURES AND COMMITMENTS

Mitigation in relation to major accidents and disasters comprises embedded design measures and additional commitments. The following measures are required to avoid or reduce the potential for significant adverse environmental effects:

- During detailed design, bund capacity, integrity and management (including freeboard, penetrations, and bund drain valve controls) will be confirmed at detailed design stage. A documented inspection and maintenance regime will be implemented.
- Site drainage controls are provided and will be maintained, including oil /water interceptors, isolation arrangements and a firewater retention system. Procedures for retention, sampling /testing and authorised disposal of contaminated waters will be developed during detailed design.
- Fuel delivery and unloading procedures will be developed and implemented. This will include supervision, connection standards, emergency shut-off where appropriate, and readily accessible spill response equipment and training.
- Detailed fire protection strategies for diesel storage and unloading areas will be developed and implemented.
- Occupied buildings and assembly points will be sited outside relevant hazard zones informed by the consequence and TLUP outputs.
- Where practicable, separation between natural gas systems (underground pipelines and AGI) and the BESS /LDES compound will be maximised to reduce escalation potential.
- A safety and emergency response strategy will be developed for the BESS /LDES compound to prevent propagation and to manage smoke and runoff, aligned with applicable standards /guidance.
- Further risk assessment will be undertaken at detailed design stage (including a quantitative risk assessment as appropriate).

17.10 RESIDUAL EFFECTS AND CONCLUSION

The assessment identifies that the principal scenario with Major Accident to the Environment (MATTE) potential is a catastrophic diesel tank failure with a pathway to the Kilcrow River / Lough Derg receptor. The ERA demonstrates that, with the identified layers of protection, the mitigated risk is within the broadly acceptable region.

The DNV consequence and TLUP assessment indicates that off-site population impacts are not anticipated for the modelled natural gas and diesel hazards, while noting layout sensitivities (including occupied buildings and assembly points) and the importance of robust design and emergency response for the LDES /BESS compound.

Having regard to the nature and extent of the Proposed Development as Amended, and subject to implementation of the embedded design measures and mitigation commitments identified in this chapter, significant adverse environmental effects deriving from the vulnerability of the Proposed Development as Amended to major accidents and /or disasters are not anticipated.

18 SCHEDULE OF MITIGATION

18.1 INTRODUCTION

This consolidated schedule has been prepared to provide a clear description of (i) the features (if any) of the proposed development (as amended) and (ii) the measures (if any) envisaged to avoid, prevent or reduce and, where feasible, offset likely significant adverse effects on the environment.

For the purposes of this schedule, *"mitigation"* includes: (i) measures embedded in the project design and layout (mitigation by avoidance and reduction) and (ii) management, procedural and monitoring measures to be implemented during construction, operation, decommissioning and reinstatement (as applicable).

All mitigation and management measures shall be incorporated into the Contractor's final Construction Environmental Management Plan (CEMP), together with any planning conditions and any additional method statements required to implement the controls described herein. The CEMP is a live document and will be reviewed and updated as required.

18.2 STRATEGY AND IMPLEMENTATION

Mitigation measures are incorporated at various stages of the proposed development. The preferred hierarchy of mitigation applied is:

- Prevention: at design stage – avoid, relocate or modify the design and/or do not proceed with the development.
- Reduction: introduce design modification or additional structures (e.g. screens), reduce size and scale of development, etc.
- Compensation or remediation: provide like-for-like replacement for any lost environmental elements, where feasible.

During construction, environmental protection measures will be implemented through the CEMP and associated plans and method statements (including, as relevant, a Construction Traffic Management Plan and Dust Management Plan). Operational controls will be implemented through applicable standards and management systems, including licensing requirements where relevant. Decommissioning and reinstatement will be implemented through a site closure /decommissioning plan and, in the case of the temporary construction access road, a decommissioning and reinstatement method statement.

18.3 FEATURES OF THE PROPOSED DEVELOPMENT AS AMENDED

The design and layout of the Proposed Development as Amended incorporate a range of embedded measures intended to avoid or reduce potential effects. In addition the proposal includes an alternative purpose-designed temporary construction access road and associated temporary works to avoid construction impacts on nearest receptors.

Key embedded features of the Proposed Development as Amended include the following:

- The chosen location avoids the need to route HV overhead lines to a location *"removed or distant"* from the existing HV electricity network (i.e., concentrating development adjacent to existing grid infrastructure). Consolidating the development proposed at an existing node, reducing the extent of new infrastructure spread and associated environmental effects.
- Selection of OCGT technology (rather than diesel-only) aligned with environmental requirements and operational need; primary fuel being natural gas fuel with bunded secondary fuel storage and potential future conversion for biomethane /hydrogen blends.
- Selection of grid connected energy storage technologies (BESS and synchronous condenser) with no combustion /air emissions, and which support a wide range of "*ancillary services*".
- Selection of a GIS substation over an AIS substation due to the smaller compound footprint and lesser potential impact on the receiving environment in terms of noise and landscape/visual effects.
- Provision of an alternative purpose-designed temporary construction access road routing from a new junction on the N65, traversing three fields, crossing the L8763 by staggered junction and extending into the main works area.
- Located on lands with low environmental sensitivities and adequate receptor separation as an avoidance measure.
- Suitably positioning the development within the subject site whilst allowing maximum and sufficient distance to receptors.
- Determination of compound finished levels following consideration of cut and fill requirements and local topography, to reduce overall perceived height within its setting.
- Realignment of a portion of the Treananearla Stream and incorporation of SuDS principles within the stormwater drainage scheme.
- Creation of an undulating berm (approximately 4–5m high and approximately 1.4km long) using soils arising from excavation works on site, to minimise potential landscape/visual and noise effects at sensitive receivers.

- Provision of new and enhanced hedgerow planting and new woodland planting with native broadleaved species (including SuDS features designed to increase biodiversity value).
- Wherever possible, existing roads with the site are utilised and follow existing topography to minimise ground disturbance (e.g. access to the AGI) and alteration of physical landscape character.
- Crossing of water features (watercourses/drainage ditches) using clear-span structures (precast concrete deck units supported on gabion abutments set back from banks), to reduce in-channel works.
- Temporary access road drainage via continuous roadside filter drains on both sides, incorporating perforated carrier pipes within aggregate and geotextile-wrapped trench systems designed for attenuation, treatment and infiltration.
- Layered access control measures to prevent unauthorised public use of the temporary access route (including lockable gates/barriers, controlled entry procedures and signage).
- Decommissioning and reinstatement of the temporary construction access road following completion and commissioning of the overall development, including removal of temporary road layers/drainage features as appropriate and reinstatement of soils, field drainage and agricultural land use.
- Provision of a purpose-built wildlife tower /roost house within the site to support nesting/roosting features and provide nesting for birds. The roost house will also incorporate an integrated bat roost/hibernation area (permanently dark, cool and damp with an earth floor) and bat boxes within a dedicated lower section, with bat access via a horizontal slot (15 mm high by 40 mm wide) located at approximately 2m above ground level. The location will be in an area of the site with no artificial lighting.
- Provision of SuDS attenuation ponds designed with gentle sloping side slopes and native wetland planting to provide still water habitat (including breeding/roosting opportunities for waterbirds) and increased invertebrate prey availability.
- Implementation of a bat-sensitive external lighting strategy with lighting confined to entrance roads and built habitats; battery storage areas, treelines/hedgerows and attenuation ponds to remain unlit where feasible and to achieve light spill on treelines/hedgerows of below 0.1 lux except where access roads require entrances. Luminaires to include integral rear shields and a mounting tilt of 0 degrees to minimise back-spill and upward light; specify warm colour temperature not exceeding 3000K; provide photocell control (dusk/dawn) with lights programmed off during the months May to September inclusive unless required for safety/security.

18.4 SCHEDULE OF MEASURES BY ENVIRONMENTAL FACTOR

The measures below are grouped by environmental factor and include mitigation by design, construction management measures, monitoring provisions and reinstatement commitments, as relevant to the proposed development (as amended). Measures apply to construction, operation and decommissioning/reinstatement phases as applicable.

18.4.1 POPULATION AND HUMAN HEALTH

Phase	Measures / features
Design / Embedded features	Provision of a direct, purpose-designed temporary construction access route between the N65 and the main works area, reducing HGV movements along the L8763 in proximity to sensitive receptors; layered access control measures to prevent unauthorised public use of the temporary access route.
Construction	Prepare and implement a CEMP in advance of construction works; incorporate mitigation measures and any planning conditions. Implement construction traffic management (including Road Safety Audit recommendations), dust management and noise management measures to minimise nuisance and safety risks at nearby dwellings. Implement external communications and complaint management procedures, including logging and responding to complaints. Standard working hours: Monday to Friday 07:00–19:00; Saturday 07:00–13:00; site closed Sundays and Bank Holidays (subject to agreement where otherwise required).
Operation	Operate the development in accordance with relevant standards and licensing requirements (including Industrial Emissions licensing for Project 1, where applicable), with associated environmental controls and monitoring.

18.4.2 BIODIVERSITY

Phase	Measures / features
Design / Embedded features	Realignment of a portion of the Treananearla Stream with enhancement features (including meanders and fringing vegetation) and incorporation of SuDS features designed to increase biodiversity value. Replacement and enhancement planting including native woodland, hedgerows and wildflower /

	meadow establishment (including along the temporary access road corridor) to maintain and strengthen ecological connectivity. Provide a purpose-built wildlife tower / roost house within a dark zone (no artificial lighting) to provide nesting and roosting opportunities for Barn Owl, Kestrel and other bird species, together with integrated bat roost/hibernation provision (including bat boxes). Implement a bat-sensitive lighting strategy, including confining lighting to entrance roads and built habitats, maintaining treelines/hedgerows and attenuation ponds unlit where feasible, and incorporating shielding and control measures to minimise light spill. For bat-sensitive lighting, target light spill on treelines/hedgerows of below 0.1lux except where access roads require entrances; provide luminaires with integral rear shields and 0 degree tilt, warm colour temperature not exceeding 3000K, and photocell controls with seasonal programming (lights off May to September inclusive unless required). Ensure the battery storage area and attenuation ponds remain unlit. Design and construct the wildlife tower / roost house to include (as a minimum) a 2m x 2m block faced in stone with a minimum height of 4.5m, an A-frame roof with overhang to the east and a Barn Owl entrance at approximately 3.5m height; provide a shallow open-fronted cavity on the west-facing wall suitable for Kestrel; incorporate numerous cavities in mortar on the south-facing wall for invertebrates and nesting passerines; provide sparrow-sized openings for hole-nesting birds; provide a dedicated lower, permanently dark bat hibernation area with earth floor and bat access via a horizontal slot positioned at approximately 2m height.
Construction	Avoid potential impacts on nesting birds by cutting vegetation outside the bird nesting season (01 March to 31 August). If vegetation removal must occur within this period, undertake pre-clearance surveys for nesting birds/nests; where none are recorded, vegetation may be removed within 48 hours. Implement construction management measures to avoid impacts on hydrologically connected European sites; control silt and prevent pollution during works near watercourses and during any stream diversion/realignment. Minimise light spill onto perimeter habitats

	by using directional and/or cowled lighting and programming lights to be off unless required; lighting plan to be reviewed by a bat ecologist and may require additional surveys/monitoring. Employ an Ornithologist Ecological Clerk of Works (ECoW) during the construction phase to micromanage construction locations and avoid disturbance to key bird species; based on ongoing surveys, implement micro exclusion zones / buffer distances and, where necessary, temporarily halt works in affected areas in cooperation with the overseeing ornithologist, site manager and NPWS / Local Authority representatives. Tree felling to avoid sensitive periods for bats and, where practicable, undertake felling in October to November or January to February. Any tree ranked category 1 or 2 for bat roost potential will be examined 'at height' prior to felling to confirm absence of bats. For precautionary felling of category 3 trees, adopt a soft-felling approach whereby trees are nudged lightly two to three times with pauses of approximately 30 seconds between nudges before being pushed to the ground slowly; felling works to be overseen by an Ecological Clerk of Works. Category 4 trees can be felled and removed immediately. Undertake pre-demolition bat surveys of the dwelling and associated sheds prior to demolition; if bats or bat roosts are identified, obtain the required derogation licence and implement species-specific measures prior to works proceeding. During SuDS pond establishment, minimise runoff from bare soils through rapid establishment of green cover on slopes and use of base-of-slope trenches to intercept runoff and sediments; where practicable, time works to avoid autumn and winter periods when higher runoff rates are expected. Ensure contractors are instructed that non-native aquatic or marginal species are not to be included in planting schemes; avoid planting schemes that require biocide or fertiliser treatment. Where soft-felling is required, allow a period of at least 24 hours and preferably 48 hours to elapse following initial disturbance/loosening prior to final felling operations, to allow any bats present to escape; felling works to be overseen by an Ecological Clerk of Works.

Operation	Replace hedgerow loss with a linear band of woodland and wildflower meadow (approx. 1.4km) to the south of the site; provide additional hedges around the AGI area (approx. 100 m) to strengthen ecological connectivity. Plant approximately 7,500m^2 of native woodland along the southern boundaries and apply biodiversity-friendly management of retained hedgerows. Install bird nesting features to compensate for loss of existing nesting structures, including barn swallow ledges/structures within a suitable shed building and provision of house martin and swift nest boxes on suitable proposed buildings. Implement SuDS pond planting and management to support biodiversity, including avoiding the use of nutrient-rich topsoil in the catchment area and pond margins and focusing on suitable native wetland species; undertake a check by an experienced botanist prior to sign-off to confirm what has been planted, and re-check for invasive species after one year.
Decommissioning /Reinstatement	Decommission and reinstate the temporary construction access road following completion and commissioning of the overall development. Reinstate soils and agricultural land and implement remedial planting/ground stabilisation as required. Undertake post-decommissioning inspections to confirm reinstatement and establishment/survival of planted hedgerows/trees/meadows, with remedial actions undertaken where required.

18.4.3 SOILS AND GEOLOGY

Phase	Measures / features
Construction	Locate construction compounds at least 30m from watercourses where applicable; provide hardstanding for deliveries and vehicle wash-out areas. Segregate topsoil and subsoil; stockpile stably and protect stockpiles (including smoothing, silt fencing, covering or seeding for longer-term storage) to prevent erosion and sediment mobilisation. Mix concrete off-site and import to site; provide specific areas for oil storage and refuelling, separated at least 10m from adjacent watercourses and with bunding to contain 110% of on-site fuel storage capacity. Provide spill kits, drip trays, bunded pallets and secondary containment; implement a site-specific Incident Response Plan and good housekeeping. Retain excavated

	material on site for landscaping berming where feasible, ensuring original material remains available for decommissioning works.
Operation	Drain roads to filter drains to provide filtering, delay and storage action; use permeable membrane-wrapped stone media to facilitate infiltration and reduction action. Provide dedicated indoor chemical storage areas; store fuels and oils in bunds (greater of 110% of the largest tank/drum within the bund or 25% of total stored volume). Bund floors to fall to internal sumps for controlled emptying via pump only following manual inspection. Route "dirty" area stormwater through oil interceptors prior to infiltration; maintain separation and isolation of contaminated and uncontaminated surface water; export interceptor contents containing oil-contaminated rainwater off-site for suitable disposal.
Decommissioning / Reinstatement	Prepare a site closure and decommissioning plan prior to decommissioning to identify and mitigate effects present at that time and demonstrate successful clean closure via completion of an independent closure audit. For the temporary construction access road, update and implement a Decommissioning and Reinstatement Method Statement including removal of temporary road materials as appropriate, reinstatement of field drainage, replacement of subsoil/topsoil in correct order and thickness and reinstatement of agricultural land use through cultivation and reseeding; undertake verification inspections and rectify defects as required.

18.4.4 WATER ENVIRONMENT

Phase	Measures / features
Design / Embedded features	Realignment of a portion of the Treananearla Stream (method statement provided) and adoption of SuDS principles within the stormwater drainage scheme. Clear-span crossings of two water features/drainage ditches on the temporary access road, with abutments set back from banks, avoiding placement of structural elements within the wetted channel. Temporary access road drainage based on continuous filter drains providing attenuation, treatment and infiltration. Design finished floor levels to satisfy the Flood Risk Guidelines freeboard requirement of 300 mm above Q1000 flood levels (adjusted for climate change); amend finished floor levels where

	required, including raising the proposed finished floor levels at Structures 3, 4, 5 and 6 to 51.22mOD and raising the proposed finished floor level at Structure 22 to 51.22mOD. Design the two proposed bridges and associated crossings to meet OPW criteria for channels maintained as part of an arterial drainage scheme, including capacity to transmit Q100 with a 1.6 drainage factor applied, plus climate change; provide the proposed 1,200 mm diameter culvert along Realignment 02 to achieve a 300 mm freeboard under Q100 x 1.6.
Construction	Locate construction compounds at least 30m from watercourses where practicable; provide hardstanding for deliveries and vehicle wash-out; mix concrete off-site and import to site. Provide designated fuel /chemical storage and refuelling areas (at least 10m from watercourses) with bunding to contain 110% of on-site fuel storage capacity; provide spill kits and secondary containment; secure storage areas; implement an Incident Response Plan. Sequence stream realignment works such that the new channel is constructed to an agreed specification, water is re-diverted and the redundant channel is infilled once isolated; consult OPW in advance and develop an agreed method statement; install silt fencing and other controls to prevent downstream impacts. Manage silt-laden runoff by minimising exposed ground, locating stockpiles away from watercourses, using buffer zones, silt traps/settlement controls, wheel washing in designated areas with runoff directed to soakaways, and re-vegetating disturbed areas as soon as possible. Undertake a pre-works walkover of the access route and adjacent drainage features to confirm the location/condition of drains and ditches and inform final protection measures; increase inspection frequency during and after heavy rainfall events. Obtain permission from the OPW by way of a Section 50 application for works affecting channels maintained as part of the arterial drainage scheme, including the two proposed bridge crossings. Update Stream Realignment Method Statement as part of detailed design work and make it available to Galway County Council, National Parks and Wildlife Service and Inland Fisheries Ireland for review prior to works commencing. Sequence channel diversion works from the downstream end; construct diverted channels and associated structures prior to

	diverting flow from the existing channels and infilling redundant channels. Following opening of the diverted channels, maintain water flow in the existing channels for a minimum period of 24 hours to facilitate downstream migration of any insects/fish. Undertake in-channel works between August and September to coincide with low stream flows and to avoid interference with spawning runs; schedule bank maintenance works on existing sections (primarily removal of scrub) between October and March. Implement sediment and pollution controls during channel opening, including placement of a cofferdam at the downstream end of each diverted channel to trap excess sediment and prevent discharge downstream; place straw bales at increments along diverted channels to trap sediment and undertake periodic sediment removal over the initial weeks following flow entering the diverted channels. Use excavated soils stockpiled temporarily to cap the banks of the rehabilitated channels to promote vegetation establishment; plant banks with native species that can be controlled/maintained to ensure channel conveyance capacity is not significantly reduced by overgrowth, and ensure bank gradients are stable to avoid bank failure or slippage. Apply standard precautionary measures for invasive species management, including cleaning machinery (including excavator and dumper) with a pressure washer prior to arriving on site and upon leaving site.
Operation	Operate SuDS-informed drainage with oil interception for "dirty" areas; ensure separation of contaminated and uncontaminated drains; contain and export interceptor contents off-site for suitable disposal. Maintain a site-specific Incident Response Plan and spill response provisions.
Monitoring	Undertake water monitoring downstream of the site during construction. For the temporary access road, undertake daily checks of downstream watercourses for visual indicators (discolouration, oily sheen, scums/foams, dead biota) and monitor basic parameters (turbidity, pH, temperature, dissolved oxygen and conductivity) at agreed locations, with records maintained in a sampling register. Project 1 will require an Industrial Emissions Licence which will prescribe monitoring requirements to protect receiving waters and

	require preparation of a baseline site report to inform closure planning and ELRA requirements.
Decommissioning / Reinstatement	Prepare a site closure and decommissioning plan prior to decommissioning. For the temporary access road, remove temporary drainage features not required long-term, reinstate pre-existing field drainage pathways and restore soils and land use.

18.4.5 AIR QUALITY

Phase	Measures / features
Design / Embedded features	Routing of construction traffic via a managed, purpose-designed temporary access route and provision of hardstanding/defined traffic routes within the site to reduce dust generation and track-out.
Construction	Formulate and implement a Dust Management Plan for the construction phase; designate a Site Agent with responsibility for dust management and provide an effective training programme for site personnel. Implement dust minimisation and control measures, including locating dusty activities as far as possible from receptors, using hard-surfaced /compressed ground haul routes, hardstanding in construction compounds and orienting material storage away from dominant wind direction. Use fixed and mobile water sprays on stockpiles and road/yard surfaces as necessary during dry and/or windy weather. Implement wheel washing at site entrances (without detergents) with appropriate containment to prevent transfer of mud onto public roads. Implement daily inspection of dust controls and a dust deposition monitoring programme at site boundaries for the duration of construction. Apply national guidance for Aspergillus risk management during construction.
Operation	The proposed OCGT units (Reserve Gas Fired Generator) are fitted with Dry Low NOx combustion (DLN), a technology that uses staged combustion and lean-premixed fuel-air mixtures practices and the use of natural gas fuel as its primary fuel[46] (in this instance DLN is also referred to as Dry Low Emissions (DLE) technology). Particulate emissions (PM_{10} and $PM_{2.5}$) is controlled through the use of best available control techniques (BAT) and using natural gas as the primary fuel source. BAT was introduced as a key principle in

[46] Best available control techniques for particulate emissions from combustion sources is the use of natural gas.

	the IPPC Directive, 96/61/EC and in the identification of BAT, emphasis is placed on pollution prevention techniques rather than end-of-pipe treatment. In addition to natural gas being the primary fuel and it generating low particulate emissions, particulate emissions will be further limited by the use of a high-efficiency inlet air filtration system, which would remove particulates in the ambient air prior to entering the combustion turbine generator processes. The exhaust stacks will be fitted with continuous emissions monitoring systems which continuously sample the stack concentrations of controlled emissions to ensure that the exhaust parameters remain within permitted parameters.

18.4.6 MATERIAL ASSETS

Phase	Measures / features
Design / Construction	Provide required connections to infrastructure and services within the proposed development land boundary only. Incorporate improvements to the N65/L8763 junction in accordance with TII design standards; provide a purpose-designed temporary construction access road from the N65 for construction-stage traffic. Retain soils arising from earthworks on site for use in boundary berm construction.
Construction	Prepare and implement a Construction Traffic Management Plan addressing traffic control and signage, delivery scheduling, driver management requirements, temporary speed management at tie-in locations and protocols for abnormal loads, agreed with the relevant road authority. Undertake visual inspections of the relevant road network prior to, during and post construction and make good any localised degradation observed, in agreement with Galway County Council where relevant. Utilities protection measures including desk-based utility searches/consultation with statutory undertakers, verification (e.g., CAT and Genny / GPR where appropriate) and implementation of a permit-to-dig system with service exclusion zones and trial holes as required. Inspect and maintain temporary access road drainage, crossings and environmental controls, including targeted checks following heavy rainfall events and during periods of heightened construction traffic.

Decommissioning /Reinstatement	Implement a Decommissioning and Reinstatement Method Statement for the temporary access road and associated temporary works, including removal of temporary structures where required, reinstatement of drainage and restoration of soils and land use, with post-decommissioning inspection and rectification where required.

18.4.7 NOISE AND VIBRATION

Phase	Measures / features
Construction	Appoint a Site Representative for noise and vibration; investigate complaints and maintain a written complaints log. Minimise and manage noise in accordance with the CEMP, including standard working hours and avoidance of heavy construction activities outside normal hours where practicable. Carry out noise monitoring with capability for real-time review where works are planned in close proximity to noise sensitive receptors; cease works if threshold values are met or exceeded and implement corrective measures immediately. Provide temporary acoustic screening/hoarding where possible along boundaries between construction activities/access routes and the nearest receptors, to break line of sight where feasible. Select low-noise plant and ensure equipment complies with EC Directive 2000/14/EC (as amended) and Directive 2005/88/EC; undertake precautionary vibration monitoring where works are in close proximity to receptors.
Operation (embedded design)	Enclose main OCGT noise sources within a turbine hall with an Rw value greater than 50dB. Provide blast walls (to 9.55m) partially enclosing LV transformers and an absorptive barrier to the south and west of the coolers. Provide berms (approximately 4.5m in height) along the western, southern and eastern boundaries; orient inverters inwards towards battery units. Service and maintain equipment to avoid inadvertent noise increases and comply with NG4 requirements for tonal and impulsive noise.

18.4.8 LANDSCAPE AND VISUAL

Phase	Measures / features
Design / Embedded features	Siting of the proposed development in a robust landscape context classified with low landscape sensitivity in the Galway County

	Development Plan; maintaining offset distances to receptors and utilising screening from rolling terrain and intervening vegetation. Several concepts were assessed to understand how the development would present within the receiving landscape context. A varied mix of tones and textures was incorporated into the Reserve Gas-Fired Generator building's design to further reduce its perceived scale[47]. It is proposed that the OCGT stacks will be finished an off-white/grey tone. This approach ensured that, when the uppermost portions of the stacks were viewed against the sky, they presented a low degree of contrast, thereby reducing the overall perceived visual mass of the development. Furthermore, when viewed from the south, the variation in tone and texture of the full stacks finished in an off-white/grey, contrasted against the darker grey tones of the reserve gas-fired generator building, helps to further break up the perceived visual mass of the development. Construction of earthen rolling berms rising to a maximum height of 5m along western, southern and eastern boundaries and provision of extensive native woodland planting to screen and soften the development.
Construction	Retain existing hedgerow boundaries within and around the site where feasible; reinstate temporary construction areas and cable trenches and revegetate disturbed areas following construction. For the temporary access road, limit vegetation removal to that required to facilitate the access and sightlines.
	Different options regarding the use of materials and finishes as a means of either breaking up the mass of the structure/buildings or selecting a singular colour palette so that no one element stood out. The studies were undertaken to help diminish the perceived scale of the reserve gas-fired generator building and extent when viewed from the surrounding landscape. Whilst the more organic form of the building aids in assimilating the development into the low, rolling surrounding landscape,

[47] Initially, the proposal included finishing the entire Reserve Gas-Fired Generator Building and its stacks in the same grey tone (Option 2 in the submitted comparative photomontage booklets). However, on review, it was considered that introducing further variations in tone and texture could help reduce its perceived visual mass, particularly as the development would most often be viewed against the skyline

	In this regard, several concepts were assessed to understand how the development would present within the receiving landscape context. This is provided as information to assist with understanding of our analysis and selection of mitigation. The Commission may consider that these alternatives result in a less visually obtrusive intrusion in this rural landscape and may wish to seek further information or a revision to the EIAR and design proposal to reflect this view. Overall, the combined mitigation measures employed help to assimilate the development into the receiving landscape context and reduce its visual presence at surrounding visual receptors.
Mitigation planting and maintenance	Bolster perimeter and internal hedgerows with under-planting and inter-planting (Hedgerow Type 1) and plant new Type 2 hedgerows within the site and along new access tracks. Plant sweeps of native woodland (approximately 19,918m^2) to screen and soften the development; allow planting to mature (native thicket approximately 8–10m high). For the temporary access road corridor, establish new native hedgerows, plant native trees at approximately 15m centres and establish/manage native meadows within residual corridor space. Prepare landscape tender drawings and specifications and supervise landscape works by a suitably qualified landscape architect; undertake planting in the next available planting season following completion of main civil/building works. Maintain landscape planting during the establishment phase (initial three years) and monitor on an ongoing basis, including replacement planting and pruning as required.

18.4.9 TRAFFIC AND TRANSPORT

Phase	Measures / features
Design / Embedded features	Provision of an alternative purpose-designed temporary construction access route from the N65 to provide a direct, controlled route for construction traffic, reducing interaction with local roads and residential frontages; unauthorised access controls to prevent public use of the temporary access route.
Construction	Implement the recommendations of the Road Safety Audit in full and complete subsequent Stage 2 and Stage 3 Road Safety Audits. Implement a Construction Traffic Management Plan (signage,

	visibility requirements, delivery scheduling and routing controls) to minimise interaction with local roads and to avoid peak-time clustering. Undertake visual inspections of the road network prior to, during and post construction and make good any localised degradation observed. Where utility works (including the gas pipeline connection) involve road crossings, undertake works in accordance with agreed road opening licences and Temporary Traffic Management designed and operated in accordance with prevailing national guidance.
Monitoring	Where necessary (depending on axle loading /abnormal loads), undertake further tests to determine structural strength of the L8763 and /or further visual inspections prior to and post construction in agreement with Galway County Council.

18.4.10 ARCHAEOLOGICAL & CULTURAL HERITAGE

Phase	Measures / features
Pre-construction / Construction	Carry out archaeological test trenching (minimum 10% of available lands) prior to any groundworks commencing, under licence and by a suitably experienced archaeologist; position trenches to target anomalies from geophysical survey and to test the footprint of the proposed development generally. For the temporary access road corridor, carry out archaeological test trenching (minimum of 12% of the corridor footprint) prior to groundworks, subject to National Monuments Service requirements. If archaeological features or deposits are exposed, sufficiently section to assess extent, nature and significance; following test trenching, further mitigation may include preservation in situ, excavation (preservation by record) and/or monitoring of topsoil stripping, as directed by the relevant authorities. Provide adequate time and resources for resolution of any archaeology identified, including post-excavation work and specialist analysis; compile and submit a report on completion of any archaeological works. Complete a visual assessment and photographic survey of the upstanding farmhouse and associated outbuildings scheduled for demolition prior to demolition. Undertake a townland boundary survey prior to groundworks where boundaries will be affected, comprising a comprehensive written and illustrated record; any machine-dug section through a

	townland boundary will be cleaned by hand and recorded as a measured survey.

18.4.11 CLIMATE

Phase	Measures / features
Construction (embedded / management)	Source raw materials locally where available (a 50km radius assumed for supply transport) to minimise environmental impact associated with vehicle emissions. Apply a balanced cut and fill design to minimise impact on the receiving environment, including no export from the site of spoil from excavation (with berming provided as part of landscape design). Fuel and plant efficiency measures including fuel-efficient driving practices, correct plant selection, regular servicing and switching off vehicles/plant when not in use. Minimise the use of generators and connect to mains electricity as soon as practicable; use energy-efficient devices (e.g., sensors linked to lighting) and staff awareness measures. Water efficiency measures including water-efficient devices and use of recycled/grey water for dust suppression where possible. Waste and materials measures supporting circular economy principles including minimising waste, procuring recycled materials where possible and implementing supplier take-back policies to reduce packaging and associated transport.
Operation (embedded)	Reserve Gas-Fired Generator shall operate in accordance with the needs of the system operator. Primary fuel is natural gas; secondary fuel (gas oil) is contained within bunded storage and limited operational hours are assumed for secondary fuel use.

18.4.12 MAJOR ACCIDENTS AND DISASTERS

Phase	Measures / features
Construction (management)	Implement spill prevention and response during construction (spill kits available, staff trained, incident reporting). Construction-phase drainage protection (temporary silt/spill controls; protect any interceptors/isolations from damage). Develop and brief fuel delivery/unloading procedures for any temporary generators/plant (supervision, connection standards, emergency shut-off where relevant).

Operation (embedded design /management)	Confirm diesel bund capacity, integrity and management (freeboard, penetrations, drain valve controls) at detailed design; documented inspection/maintenance regime. Permanent site drainage controls (oil/water interceptors, isolation arrangements, firewater/contaminated water retention); procedures for retention, sampling/testing, and authorised disposal of contaminated waters. Fuel delivery and unloading procedures (supervision, connection standards, emergency shutdown where appropriate, spill response equipment and training). Fire protection strategy for diesel storage /unloading areas (e.g., deluge/sprinkler/foam as appropriate) and protection of key emergency-water infrastructure. Locate occupied buildings and muster/assembly points outside relevant hazard zones informed by the consequence/TLUP outputs. Maximise separation, where practicable, between natural gas systems (pipelines /AGI) and the BESS /LDES compound to reduce escalation potential. BESS /LDES safety and emergency response strategy to prevent propagation and manage smoke and runoff, aligned with applicable standards/guidance. Further risk assessment at detailed design (including QRA where appropriate) and update of emergency arrangements accordingly.
Decommissioning	Decommissioning method statement to control spill/fire risks (isolation, make-safe, drain-down, controlled removal). Maintain drainage isolation/retention and pollution controls until all fuels/oils are removed and the site is clean. Waste classification, sampling/testing (where needed) and authorised disposal of any contaminated liquids/solids; maintain incident response capability until completion.

18.5 IMPLEMENTATION AND VERIFICATION

The applicant will comply with all applicable legislation, codes and regulatory policy relating to grid connections (gas and electricity). The GIS will be constructed in accordance with EirGrid functional specifications and standards for 400 kV GIS substations. The Applicant will obtain all necessary statutory approvals and authorisations, including (as applicable) CRU authorisations/licences, EPA Industrial Emissions (IE) licence and GHG permit (in

place prior to commencing operations), and HSA COMAH notifications and submissions (including a Major Accident Prevention Policy), together with all required fire safety / emergency response provisions agreed with the relevant fire authority.

APPENDICES

APPENDIX 17.3

FIRE RISK ASSESSMENT AND EMERGENCY RESPONSE PLAN

APPENDIX 1.5

LANDOWNDER CONSENT LETTERS

– ALTERNATIVE CONSTRUCTION ACCESS ROAD

Emmet Treacy
Newtown
Horseleap
Co Offaly

Coolpowra Flex Gen Limited

Parsons House
56 Axis Business Park
Tullamore
Co Offaly

Date: 29 September 2025

Re: Landowner consent letter

Applicant Name: Coolpowra Flex Gen Limited

Development: Coolpowra – Energy Infrastructure

I, Emmet Treacy, DO HEREBY CONSENT to Coolpowra Flex Gen Limited making an application for planning permission for an alternative access route for:

(1) a Reserve Gas -Fired Generator Case (An Coimisiún Pleanála Case Ref ABP-320095-24);

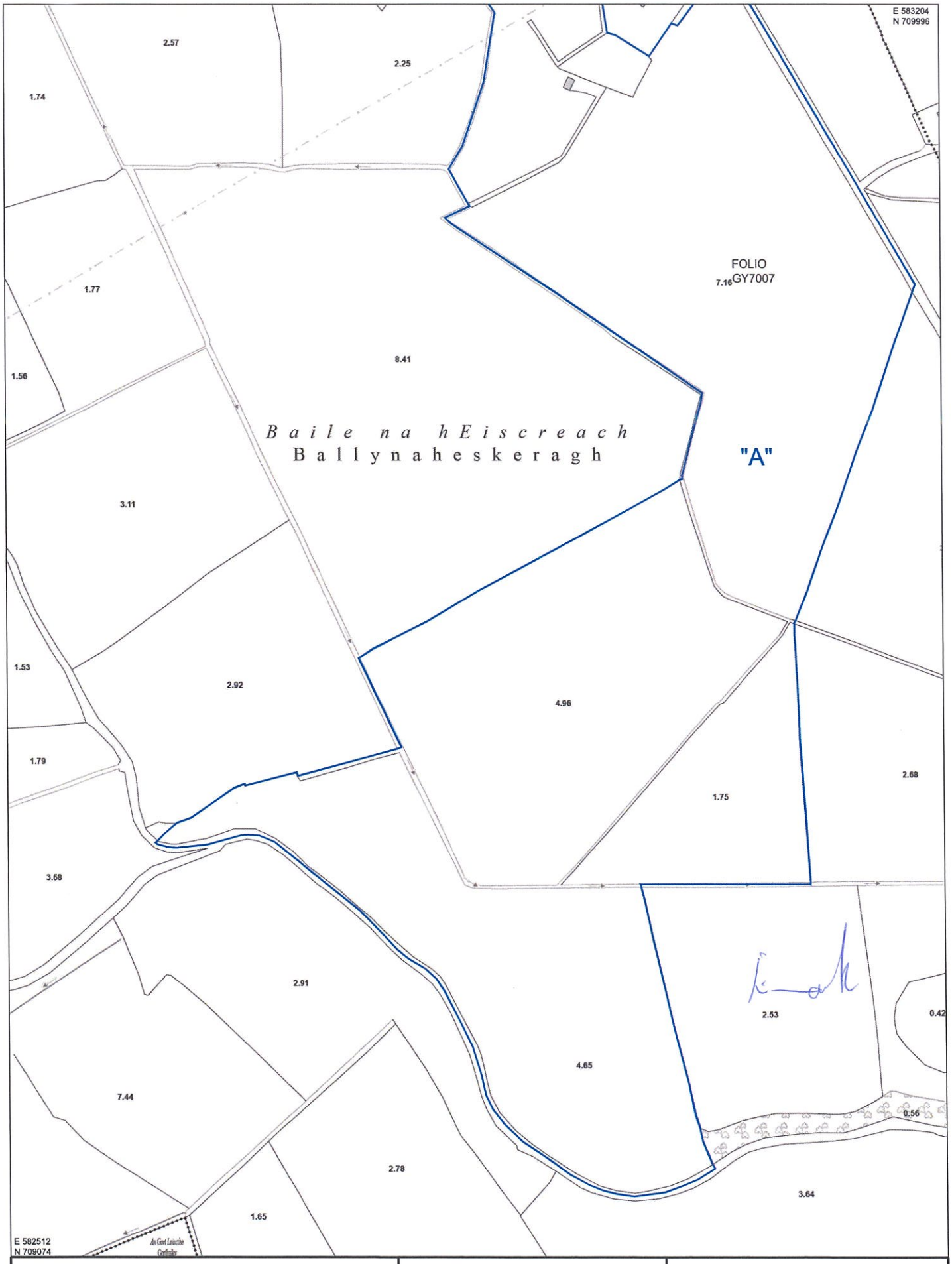
(2) a Gas Insulated Switchgear (GIS) substation (An Coimisiún Pleanála Case Ref ABP-320094-24); and

(3) Energy Storage System Facility (Galway County Council Case Ref 24/60845);

on lands owned by me being lands at Ballynaheskeragh, Killimor, Portumna, Co Galway being more particularly described as part of the lands contained in folios GY7007 and GY102156F and as lined in blue on the attached maps.

Signed: _____

Emmet Treacy



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F23 K162

Land Registry Map

Sheet 2 of 2
Scale: 1:2500 (A3)

CYAL50440526

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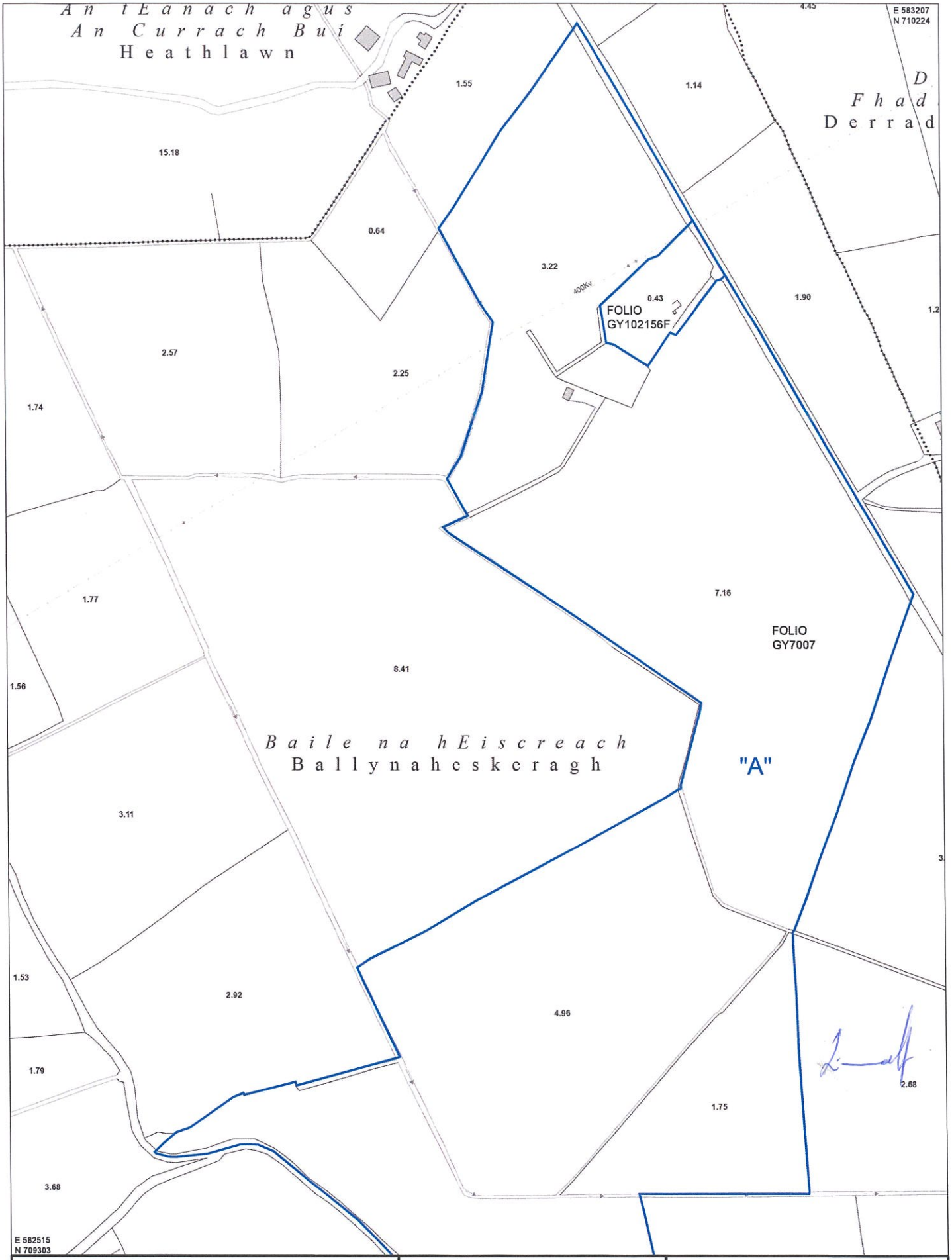
Plot "A" 22.56 ha in area or thereabout shown delineated in BLUE.

Date: 12 September 2025



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Land Registry Map

Sheet 1 of 2
Scale: 1:2500 (A3)

CYAL50440526

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Plot "A" 23.04 ha in area or thereabout shown delineated in BLUE.

Date: 22 September 2025

Coolpowra FlexGen Ltd
Parsons House, 56 Axis Business Park,
Tullamore, Co. Offaly, Ireland
Tel: +353 5793 61600
Email: info@lumcloonenergy.com
www.lumcloonenergy.com

An Coimisiún Pleanála

64 Marlborough Street

Dublin 1

Date: 29 September 2025

Applicant: Coolpowra Flex Gen Limited

Planning References: Reserve Gas -Fired Generator Case (An Coimisiún Pleanála Case Ref ABP-320095-24)

Gas Insulated Switchgear (GIS) substation (An Coimisiún Pleanála Case Ref ABP-320094-24)

Energy Storage System Facility (Galway County Council Case Ref 24/60845)

(the "**Planning Applications**")

Dear Sir/Madam

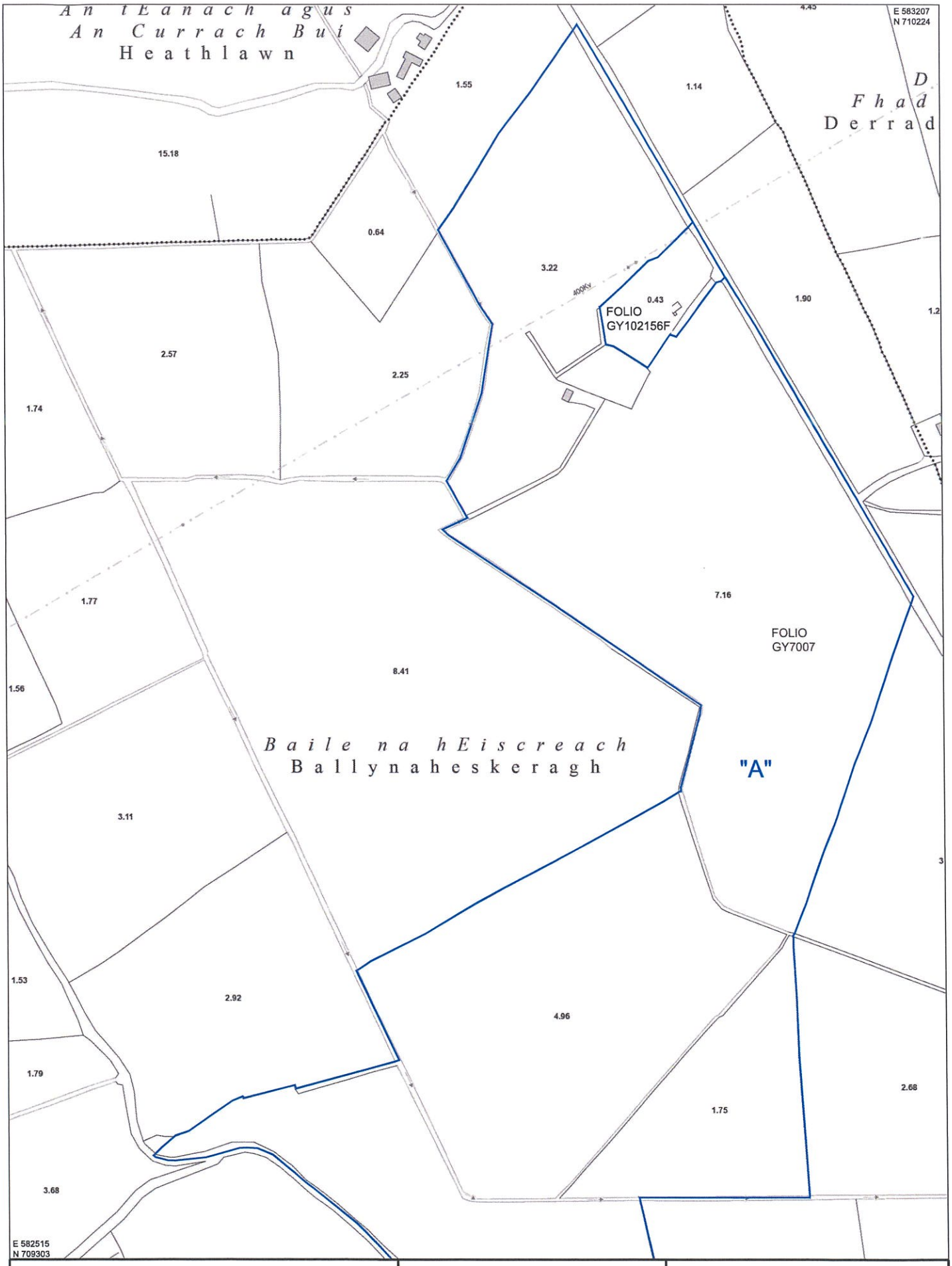
I, Marguerite Leech, legal counsel for the Applicant, hereby confirm that a member of the Applicant's group has entered into an option to purchase the lands required for the proposed alternative access route related to the Planning Applications being the land contained in Folio GY102156F and part of the land contained in Folio GY7007 and lined in blue on the maps attached hereto. Therefore, the Applicant's group will have all necessary legal property rights to build and maintain the proposed alternative access route.

Yours sincerely

Marguerite Leech

For and on behalf of

Coolpowra Flex Gen Limited



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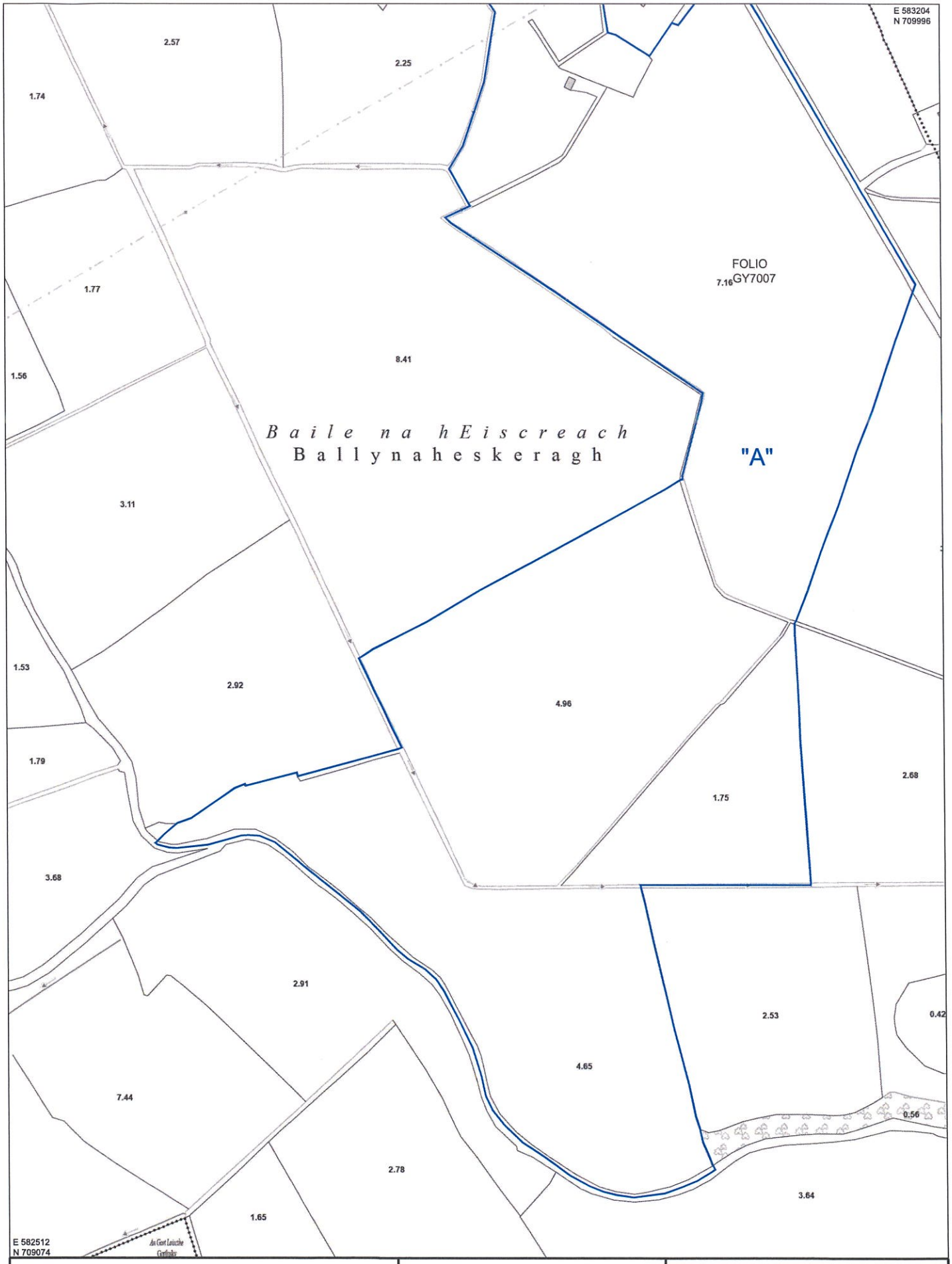

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Plot "A" 22.56 ha in area or thereabout shown delineated in BLUE.

Date: 12 September 2025

APPENDIX 2.3

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

– PROPOSED DEVELOPMENT (AS AMENDED)

CLIENT: Coolpowra Flexgen Limited

PROJECT: Coolpowra Preliminary Construction Environmental Management Plan (CEMP)

Prepared by: Halston Environmental & Planning Limited

Date: June 2024

Document Control

Client:	Coolpowra Flexgen Limited (CPFL)
Project Name	Coolpowra (CEMP)
Project Ref. No.	SEP-0398

Document Checking:

Author:	Colm Staunton	Signed:

Checked by:	Client	Signed:

Issue	Date	Status
v1	03/06/2024	Draft
v2	07/06/2024	Final
v3	05/06/2026	Revision – Proposed Development (as amended)

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Appendix A Construction and Demolition Resource Waste Management Plan

1 INTRODUCTION

This Construction Environmental Management Plan (CEMP) has been prepared by Halston Environmental & Planning Limited (Halston) on behalf of Coolpowra FlexGen Limited. ("the applicant") and is submitted to support applications for planning permission for the development of grid-connected energy support projects on lands with an area (redline boundary) of 42.3 hectares (ha) (105 acres) in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway.

The Proposed Development (as amended) comprises three energy projects. These are:

- Project 1: Reserve Gas-Fired Generator,
- Project 2: Energy Storage System (ESS), and
- Project 3: Gas Insulated Switchgear (GIS) Electricity Substation.

The three projects have been determined as being distinct in the context of applying for, and obtaining, valid planning consents under the Planning and Development Act 2000, as amended, (*"the Act").* This Preliminary Construction Environmental Management Plan (CEMP) incorporates the Construction Waste Management Plan and Incident Response Plan.

The CEMP is updated to align with the EIAR Addendum (January 2026) which introduces an alternative purpose-designed temporary construction access road from the N65. Accordingly, the term "proposed development (as amended)" refers to the development as assessed in the July 2024 EIAR, together with (i) the introduction of the Alternative Construction Access Road and associated temporary works, and (ii) the Revised Planning Application Boundary to incorporate these amendments. The EIAR Addendum should be read in conjunction with the July 2024 EIAR that accompanied, and was originally lodged with, the relevant planning applications. It is not intended that this EIAR Addendum replaces the July 2024 EIAR; rather, it identifies and assesses any material changes to baseline conditions, impact assessment and conclusions presented in the July 2024 EIAR.

1.1 PURPOSE AND OBJECTIVE

This CEMP outlines the approach to environmental and waste management throughout the construction works of the proposed development and associated activities with the primary aim of reducing any adverse impacts from construction on the environment and improving the overall environmental performance of the appointed construction contractor.

The purpose of this Plan is:

- To help ensure compliance with legal and contract requirements,
- To control and where possible minimise, the environmental impacts of the construction works,
- To minimise the risk of causing pollution or a nuisance and associated costs and delays, and
- Promote best construction and environmental on-site practices for the duration of the works.

The plan and methodology seek to demonstrate how works on the project can be delivered in a logical, sensible and safe sequence with the incorporation of specific measures to mitigate the impact on people, property and the environment. This document should be viewed as an outline plan with the site-specific CEMP to be developed by the Main Contractor /EPC Contractor for implementation throughout the project in consultation with Statutory Undertakers / Authorities and affected Stakeholders prior to works commencing on site.

Proposed environmental measures that will be installed on site during construction are included in this preliminary CEMP. This document will be updated to include any additional conditions proposed by the relevant local authority as a result of their review of the preliminary CEMP. The CEMP is an integral part of the site health, safety, environmental and quality management system and constitutes a component of the Construction Health and Safety Plan documentation. The CEMP is also subject to the requirements of the site quality management system with respect to documentation control, records control and other relevant measures.

1.2 REVISIONS OF THE CEMP

All the elements of this CEMP will be included in the Contractor's CEMP, which will be produced prior to construction by the Contractor. The CEMP will be updated prior to the commencement of the development, to include any additional mitigation measures, conditions and or alterations to the EIAR and application documents that may emerge during the course of the planning process. The final CEMP will be submitted to the Planning Authority for written approval in advance of commencement of any construction works on site. The.

This CEMP is a live document, and contents will be communicated to all site personnel and reviewed every month. In the event of an accident or emergency on site during the construction period, the CEMP will be reviewed, and procedures amended if necessary. All personnel and sub-contractors will be made aware of the CEMP during the toolbox talks.

The site manager or his environmental manager will be responsible for maintaining and updating the approved document.

This document should be read in conjunction with the mitigation measures expressed in the Halston Environmental Impact Assessment Report (EIAR) document (July 2024 EIAR) and EIAR Addendum (January 2026). The identification and control of environmental aspects are further examined as part of this document (Preliminary CEMP). As part of Contract CEMP works, the environmental aspects and control measures should be further reviewed and prioritised.

The Contractor is required to include further details and / or confirmation in the Contractor's CEMP which will include;

- Details of emergency plan including personnel and contact numbers.
- Details of fuel storage areas (including location and bunding).
- Site and traffic signage.
- Method statements.

2 LEGISLATION AND GUIDANCE

Relevant legislation and best practice guidance that have been considered includes but is not limited to the following.

2.1 NATIONAL AND INTERNATIONAL LEGISLATION

- Water Framework Directive (2000/60/EC);
- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009, as amended;
- Local Government (Water Pollution) Acts 1977, as amended;
- Habitats Directive (92/43/EEC);
- Air Pollution Act, 1987;
- Birds Directive (2009/147/EC); and
- Wildlife Act, 1976 (S.I. No. 39 of 1976)
- The Circular Economy and Miscellaneous Provisions Act 2022
-

2.2 ENVIRONMENT LIABILITY REGULATIONS

The Regulations supplement existing National and European Legislation to achieve the prevention and remediation of environmental damage. Environmental damage under the European Communities (Environmental Liability) Regulations 2008 means:

- Water damage that has significant adverse effects on water status under the Water Framework Directive (2000/60/EC);
- Land damage that creates a significant risk to human health as a result of the direct or indirect introduction, in, on or under land, of substances, preparations, organisms or micro-organisms; and
- Damage to protected species and natural habitats.

The Regulations represent an overarching piece of legislation that can be used in concert with all the Agency's existing powers but will only be used in the appropriate circumstances when environmental damage has occurred as a result of an incident.

2.3 BEST MANAGEMENT GUIDELINES

The following Guidelines should be used, as a minimum, by the contractor to prepare their Method Statements and Environmental Management Plan:

- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, January 2016;
- Fishery guidelines for Local Authority works. Department of Marine and Natural Resources 1998;
- CIRIA – Guideline Document C532 – Control of Water Pollution from Construction Sites;
- CIRIA – Guideline Document C624 – Development and Flood Risk – Guidance for the Construction Industry;
- CIRIA Guidance C515: 'Control of groundwater for temporary works' (Somerville et al., 1986);
- CIRIA Guidance C741: Environmental good practice on site guide (Charles & Edwards, 2015);
- CIRIA Guidance C750D: 'Groundwater control: design and practice' (Preene et al., 2016); and
- CIRIA - Control of water pollution from construction sites - guide to good practice (SP156);
- CIRIA - C648 Control of water pollution from linear construction projects & Site Guide C649;
- NetRegs Guidance for Pollution Prevention for works and maintenance in or near water (NetRegs, 2017);
- Environment Agency Pollution Prevention Guidelines for construction and demolition sites (EA, 2012).

- Inland Fisheries Ireland 2016 Guidance on Protection of Fisheries During Construction Works In and Adjacent to Waters.

Should this document further develop to contract stage, the following documents should be reviewed and associated requirements applicable to this contract be included within this Plan:

- Tender/contract documents
- Site Investigation
- Planning Application Documents (EIAR) and Planning Permission Conditions

2.4 WASTE MANAGEMENT CONTEXT

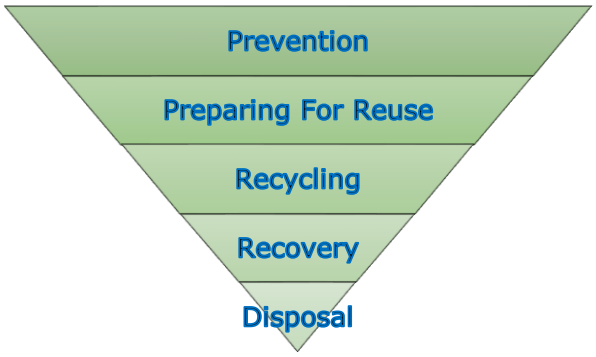
The Department of Environment, Climate and Communications (DECC) published the Waste Action Plan for a Circular Economy in September 2020 and is Ireland's new roadmap for waste planning and management. This Plan shifts focus away from waste disposal and instead seeks to preserve resources by creating a circular economy. The 2020 Plan replaced "A Resource Opportunity – Waste Management Policy in Ireland (DoECLG, 2012). The Plan outlines the contribution of the sector to the achievement of a number of other national plans and policies including the Climate Action Plan. It also matches the level of ambition being shown across the European Union through the European Green Deal, which encompasses a range of actions supporting circularity and sustainability. The Waste Action Plan for a Circular Economy sets out a range of aims and targets for the State and the measures by which these will be achieved, including increased regulation and measures across various waste areas such as Circular Economy, Municipal Waste, Consumer Protection and Citizen Engagement, Plastics and Packaging, Construction and Demolition, Textiles, Green Public Procurement and Waste Enforcement.

The Circular Economy and Miscellaneous Provisions Act 2022, which was signed by the President and has become law, underpins Ireland's shift from a *"take-make-waste"* linear model to a more sustainable pattern of production and consumption, that retains the value of resources in our economy for as long as possible and that will to significantly reduce our greenhouse gas emissions.

The Connacht-Ulster Waste Management Plan 2015-2021 (CUWMP) provides a framework for the prevention and management of waste in a sustainable manner in Galway and the other local authority areas. The Connacht-Ulster Waste Management Plan was adopted in May 2015. The county of Galway is located within the Connacht-Ulster region which encompasses Galway County, Galway City, Leitrim, Mayo, Sligo, Roscommon, Cavan, Donegal and Monaghan

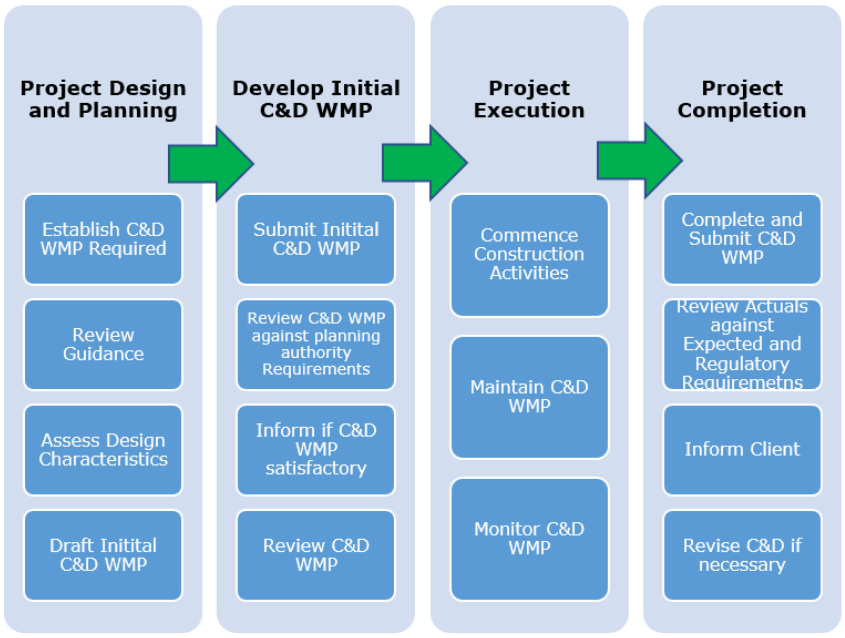
In terms of planning, the Plan sits alongside county and city development plans, guiding the development of regional and national waste treatment infrastructure. However, the scope of the regional plan is more than just the identification of infrastructure for the waste sector; it provides a roadmap for better coordination, prevention, resource efficiency and regulatory activities. This plan is currently being revised to accord with National Policy.

Figure 2.1 EU and National Waste Hierarchy



Waste management on construction sites is an iterative and step-by step process and accordingly the C&D WMP will be considered as a live document which requires inputs and updates over the entire construction phase.

Figure 2.2 EU and National Waste Hierarchy



In terms of the current Galway CDP and of relevance to the development proposal and waste management during the lifecycle (construction to decommissioning) of the project are the following waste management policies:

WM 1: Connacht and Ulster Waste Management Plan 2015-2021 *- Support the implementation of the Connacht and Ulster Waste Management Plan 2015- 2021 or any updated version of this document within the lifetime of the plan.*

WM 2: Requirements for Waste Management *- Support and promote the circular economy principles, prioritising prevention, reuse, recycling and recovery, and to sustainably manage residual waste. New developments will be expected to take account of the provisions of the Waste Management Plan for the Region and observe those elements of it that relate to waste prevention and minimisation, waste recycling facilities, and the capacity for source segregation.*

WM 4: Waste Legalisation *- To require that all waste disposal shall be undertaken in compliance with the requirements of the Environmental Protection Agency and relevant Waste Management Legislation.*

WM 5: Construction and Environmental Management Plans *- Construction Environment Management Plans shall be prepared in advance of the construction of relevant projects and implemented throughout. Such plans shall incorporate relevant mitigation measures which have been integrated into the Plan and any lower tier Environmental Impact Statement or Appropriate Assessment. CEMPs typically provide details of intended construction practice for the proposed development, including:*

(a) location of the sites and materials compound(s) including area(s) identified for the storage of construction refuse;
(b) location of areas for construction site offices and staff facilities;
(c) details of site security fencing and hoardings;
(d) details of on-site car parking facilities for site workers during the course of construction;
(e) details of the timing and routing of construction traffic to and from the construction site and associated directional signage;
(f) measures to obviate queuing of construction traffic on the adjoining road network;
(g) measures to prevent the spillage or deposit of clay, rubble or other debris;
(h) alternative arrangements to be put in place for pedestrians and vehicles in the case of the closure of any public right of way during the course of site development works;
(i) details of appropriate mitigation measures for noise, dust and vibration, and monitoring of such levels;

(j) containment of all construction-related fuel and oil within specially constructed bunds to ensure that fuel spillages are fully contained (such bunds shall be roofed to exclude rainwater);

(k) disposal of construction/demolition waste and details of how it is proposed to manage excavated soil, including compliance with 2006 Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects, Department of the Environment, Heritage and Local Government;

(l) a water and sediment management plan, providing for means to ensure that surface water runoff is controlled such that no silt or other pollutants enter local water courses or drains;

***WM 9: Separate Collection of Waste** - Encourage and support the provision of separate collection of waste in accordance with the requirements of the Waste Management (Food Waste) Regulations 2009, the Waste Framework Directive Regulations, 2011 and other relevant legislation.*

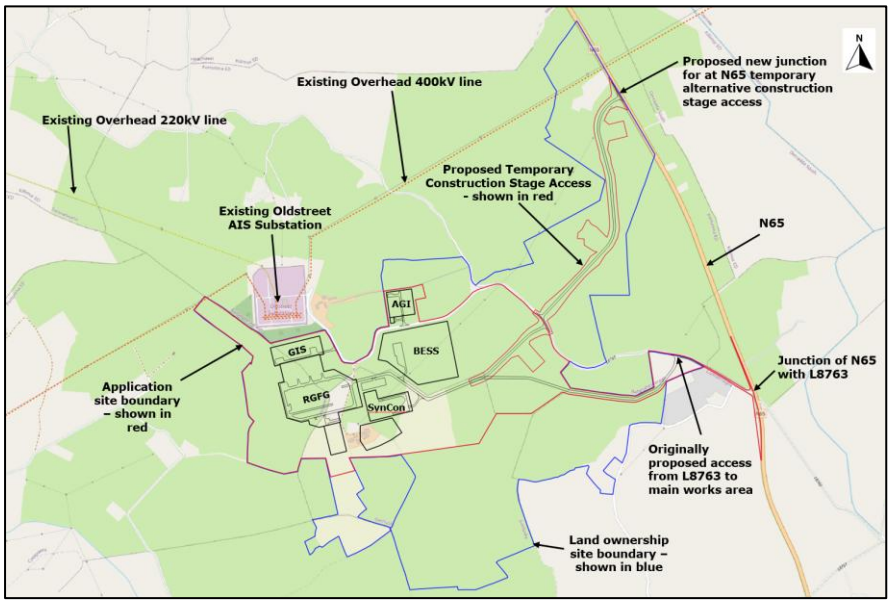
3 SITE DETAILS

The proposed development (as amended) is located on a 42.3 hectares (ha) (105 acres) site in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway (see **Error! Reference source not found.** and **Error! Reference source not found.**). The site is located approximately 5km north of the town of Portumna and 3.7km south of Killimor. Existing lands within the proposed development (as amended) site boundary are in agricultural use and include a farmhouse and outbuildings which will be demolished as part of development works. The proposed lands are situated at an elevation of c. 51-54m AOD and are accessed by public road via the N65 (National Road) and the L8763 (local road). The main works area and operational stage project compounds are positioned c.500 m west of the N65. The proposed development is located adjacent to, and south of, the existing operational 400kV AIS electricity substation (Oldstreet).

The area in which the proposed development site is located is typical productive rural landscape that is not rare or distinctive at a national or regional level. The are a number of residential properties within the surrounding rural area and these are described as one-off housing with a total of 40 recorded within 1km offset from the main development with the proposed development lands. The closest residential dwelling to the proposed development boundary is approximately 300m to the west of the development site.

The proposed development (as amended) will be accessed during the construction phase via a purpose-designed temporary construction access road extending from a new junction on the N65, traversing agricultural fields, crossing the L8763 via a staggered junction, and tying into the internal access arrangement serving the main works area south of the L8763. The access road is approximately 810m in length with a nominal 7.0m running width on the northeastern side of the original development lands (main works area). The amended red-line boundary also incorporates land required for: (i) associated construction compound (welfare, laydown, parking, materials handling), and (ii) two soil deposition / storage areas. These temporary areas will be managed to prevent track-out and to control runoff and sediment mobilisation. Following completion and commissioning of the main works area (energy project compounds), the temporary construction-stage access road will be decommissioned and reinstated unless otherwise authorised by condition of any grant of permission[1]. Decommissioning will typically include removal of surfacing and granular layers (as appropriate), removal of temporary drainage features not required for the operational phase, reinstatement of any affected field drainage, replacement of stored subsoil/topsoil and reinstatement of agricultural land through cultivation and reseeding. The proposed development (as amended) includes for construction of a new private entrance to the site from the L8763 (for operational stage traffic) with associated signage. Car parking serving Project 1 (RGFG) and Project 2 (ESS) is incorporated as part of infrastructure serving the overall development (see Figure 3.1).

Figure 3.1 Proposed Development Layout as amended



[1] Unless otherwise authorised by condition of any grant of permission, the temporary construction access road will be fully decommissioned and reinstated. Any authorised retention (in whole or in part) would be limited to that which is demonstrated to provide operational benefit and to be consistent with the permitted development and the environmental assessment herein.

The proposed development includes for the demolition and removal of a residential property (see Figure 3.2) within the site which contains a single storey house, associated outhouses and farm sheds.

Figure 3.2 Aerial view of Existing Residential Property

The construction and laydown area, as shown on the overall site layout plan and presented in Figure 3.4, will be provided for all projects described as part of the proposed development. The principal contractor will secure the area with temporary fencing, set up initial site accommodation and welfare facilities, and temporary services. It is envisaged that existing services serving the residential property on site will be altered to serve the main works area contractors construction compound.

Figure 3.3 Site Location Map

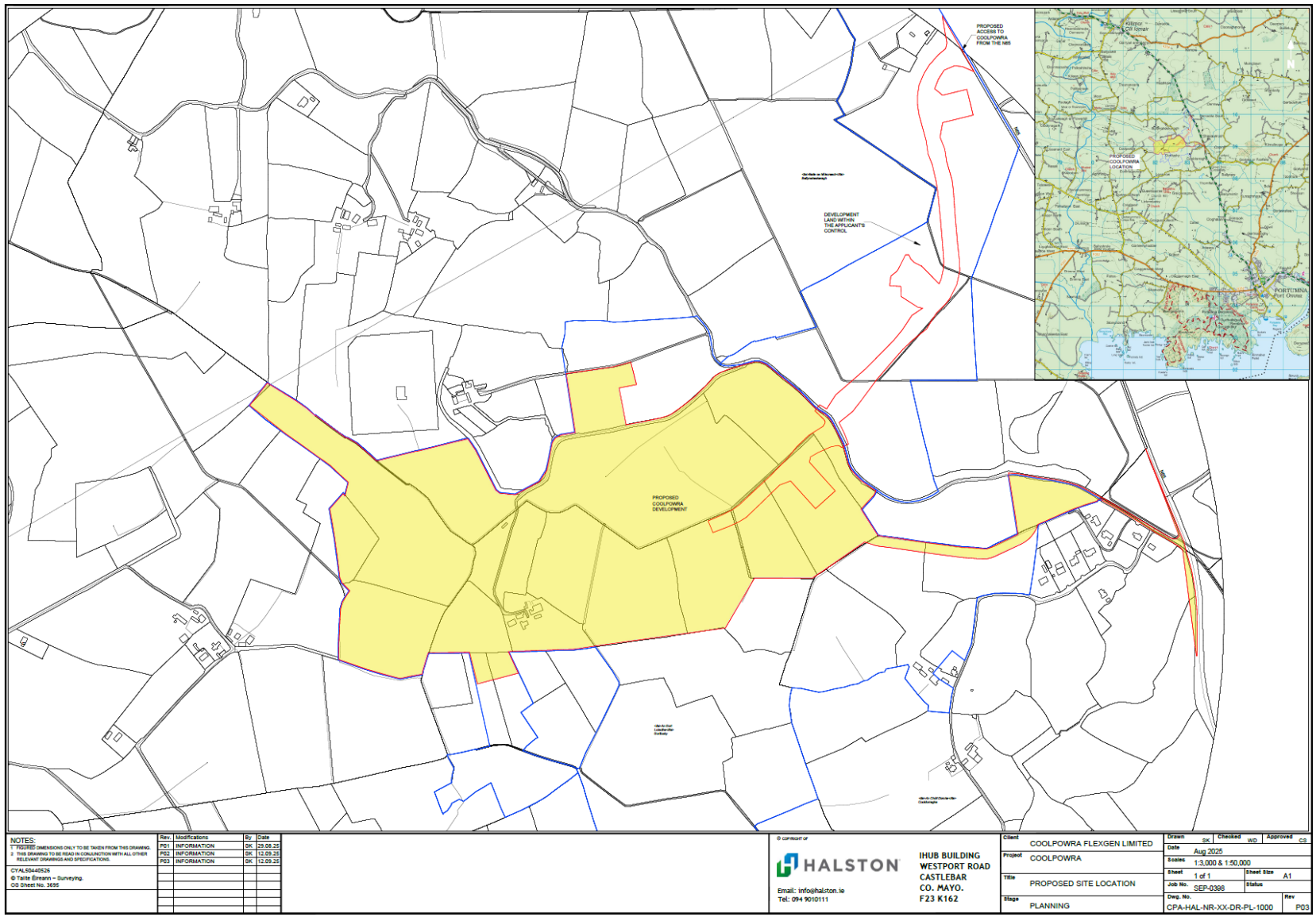
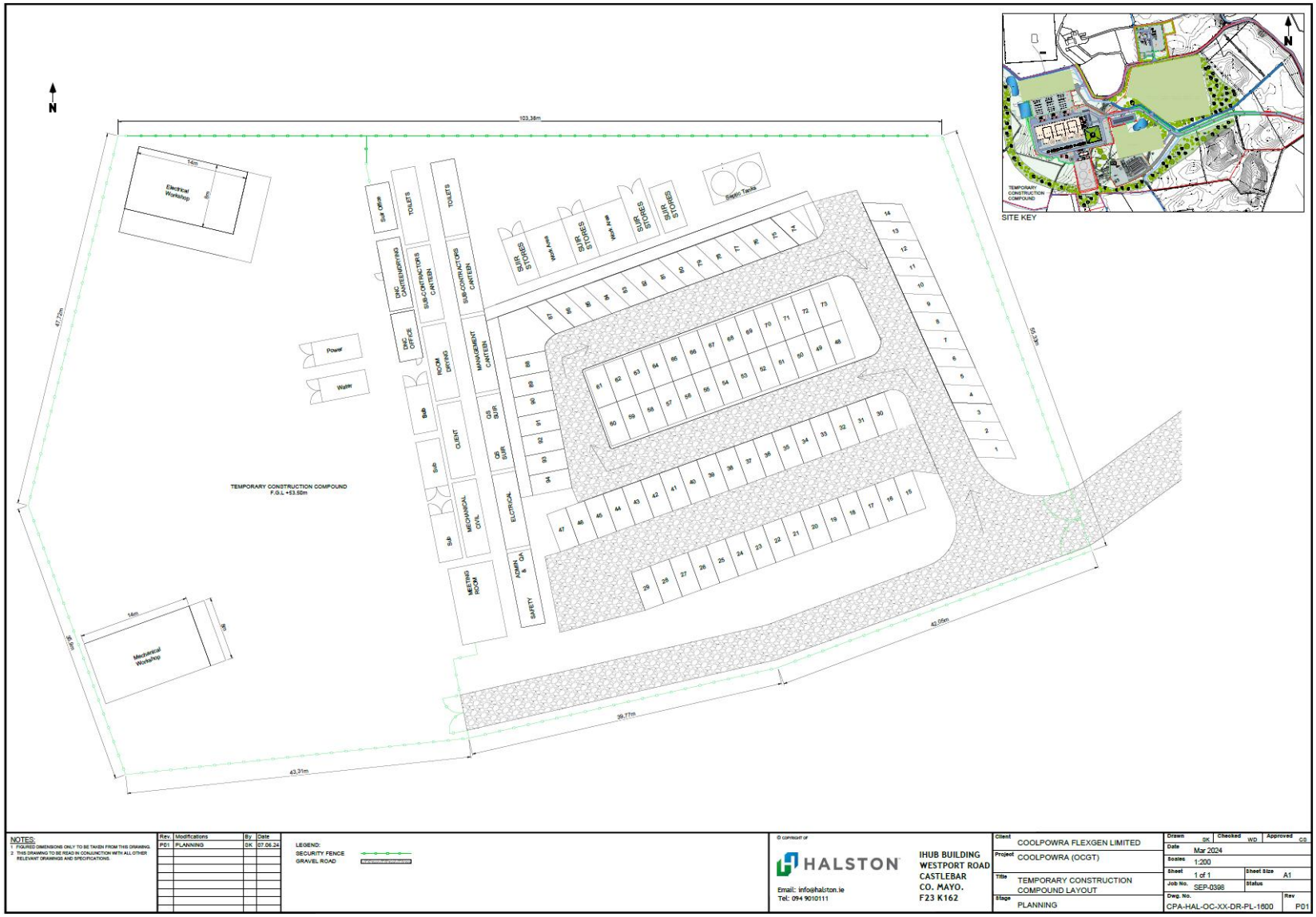


Figure 3.4 Construction Compound for the Proposed Development (As Amended) - main works area



4 PROJECT DESCRIPTION

As outlined above, this CEMP deals with construction works associated with three separate energy projects within the proposed development lands in County Galway. A description of the each project is provided below, and the Proposed Development Layout (Operational Stage) and Landscape & Biodiversity Mitigation Plan (Operational Stage) are provided in Figure 4.1 and Figure 4.2. Further details regarding the proposed development, including drawings, are submitted in support of the planning applications.

4.1 PROJECT 1: RESERVE GAS FIRED GENERATOR

OCGT units, by the nature of their design, capability and efficiency are designed to operate intermittently and provide generation capacity during periods of high demand or when renewable energy generators cannot meet system demand. OCGT units are advantageous due to their operational flexibility and can be turned on quickly to match system demand. The selected turbines are capable of being converted to allow for inclusion of green hydrogen in the fuel mix in the future, which will further assist with climate-neutral targets.

The proposed Reserve Gas Fired Generator will have the ability to operate 24 hours a day, seven days a week. However, while the plant has the potential to operate in this manner, it is expected that it will only operate during peak periods for a limited number of hours per year, i.e. it will be 100% available, but will only run, as and, when the system operator requires. This typically means when demand is high and or when renewable energy generators cannot meet system demand.

The Reserve Gas Fired Generator comprises three open cycle gas-fired generator (OCGT) units positioned within a building (turbine hall) along with auxiliary equipment (including hydraulic oil skid, instrument air skid, cable racks, air enclosures for combustion turbines, fire-fighting system, power control centre, ventilation systems, etc.). An OCGT unit consists of a turbine connected to an electric power generator and the three turbines are designed to operate independently of each other. The OCGT units will receive natural gas from the gas network via an underground pipeline to an Above Ground Installation (AGI) compound within the development lands. Gas Networks Ireland (GNI), as the designated competent authority, will separately manage the process of delivering the underground gas transmission pipeline to the proposed AGI.

The proposed OCGT units are dual fuel units as required by system requirements specified by the Commission for Regulation of Utilities (CRU). Natural gas will be the primary combustion fuel to each of the OCGT units when operating. Secondary fuel (gas oil) will be stored in a bunded structure outside the turbine hall along with ancillary items of

electrical plant and machinery such as coolers and transformers. To ensure compliance with the Grid Code, the Reserve Gas-Fired Generator must be capable of running continuously on secondary fuel equivalent to 72 hours of operating on the primary fuel. This preparedness is crucial for scenarios involving an outage or interruption to the natural gas supply.

4.2 PROJECT 2: ENERGY STORAGE SYSTEM (ESS)

The ESS technology is designed to complement and support the reserve gas-fired generator by providing zero carbon, instantaneous power and balancing power to the grid. The Energy Storage System (ESS) facility comprises (a) a Long Duration Energy Storage (LDES) static battery (400MW) positioned within a secure outdoor compound, and (b) a Synchronous Condenser (400MVA electrical rating) which will operate within a building in a separately secured compound. The LDES will provide peaking, active power and back start capability services to the electricity grid. The LDES battery will comprise a total of 224 modular single storey battery enclosures and medium voltage power stations (MVPS) and IPP building. The LDES will connect to the 400kV electricity network via the proposed GIS substation using electric plant and HV electrical lines. The horizontal synchronous generator will be positioned within a building and ancillary equipment including proprietary air-cooling units and electrical plant (including transformer) will be positioned adjacent to the synchronous generator hall. The synchronous condenser will connect to the 400kV electricity network via the proposed GIS substation using electric plant and HV electrical lines. The synchronous condenser will provide short-circuit power, inertia, and reactive power for dynamic loads and stabilise the network through voltage recovery during faults.

4.3 PROJECT 3: GAS INSULATED SWITCHGEAR (GIS) ELECTRICITY SUBSTATION

The Gas Insulated Switchgear (GIS) Electricity Substation comprises a two-storey building positioned and secured within a palisade fenced compound. The GIS building will contain a battery room, generator room, stairs, cable pits, switchgear rooms, workshop, messroom and stores. The proposed GIS will upgrade the existing air insulated switchgear (AIS) substation with a new gas GIS substation at Oldstreet. The GIS substation will serve the existing function of the AIS substation and facilitate connection of the proposed Reserve Gas-Fired Generator and ESS facility to the node on the 400kV transmission network. HV lines and associated electric plant which will connect Project 1 & 2 to the substation are included as part of the proposed development. Associated internal roads, fencing, lighting, civils and drainage works will be appropriately developed for the subject development.

Figure 4.1 Proposed Overall Site Layout (Operational Stage)

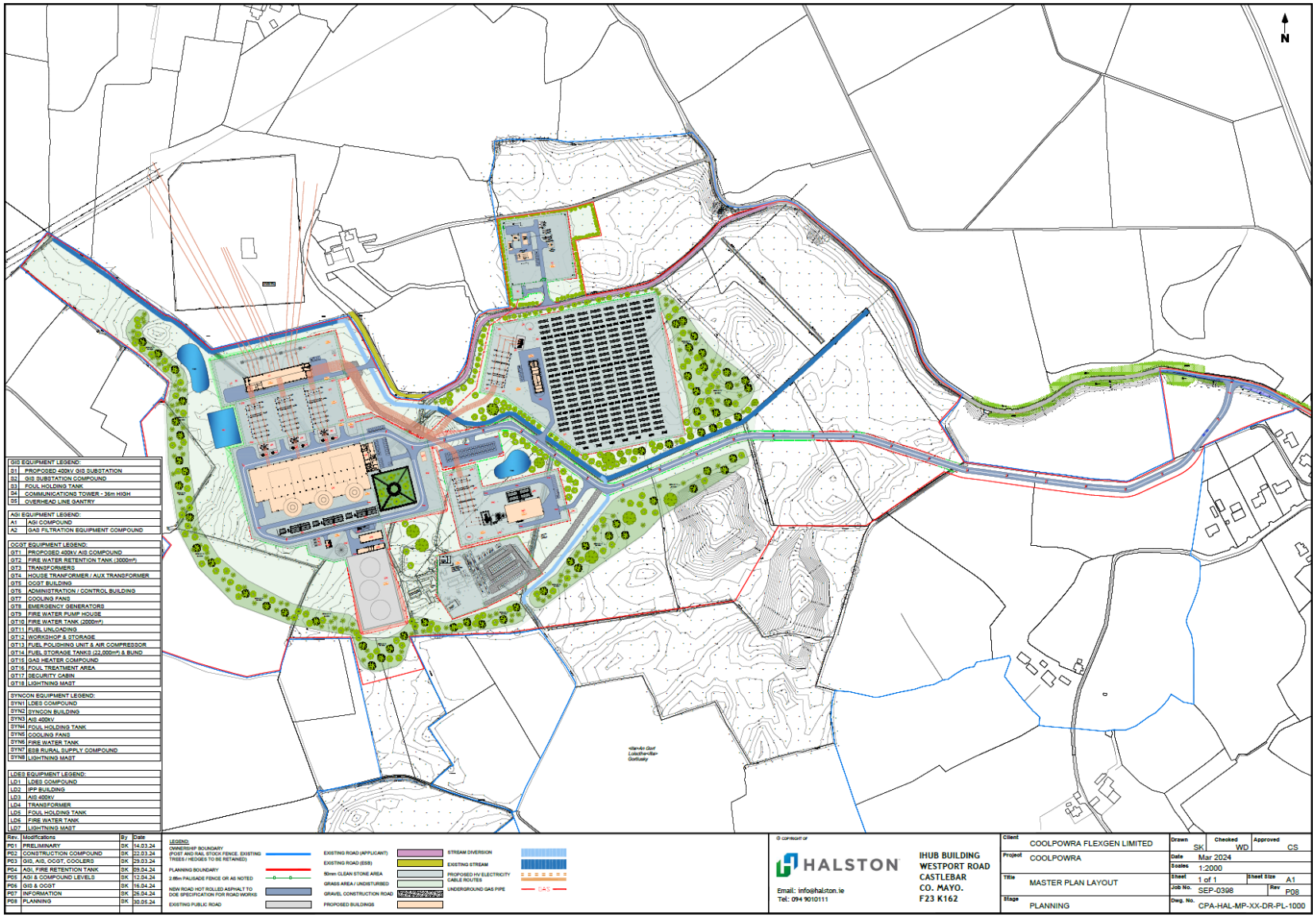
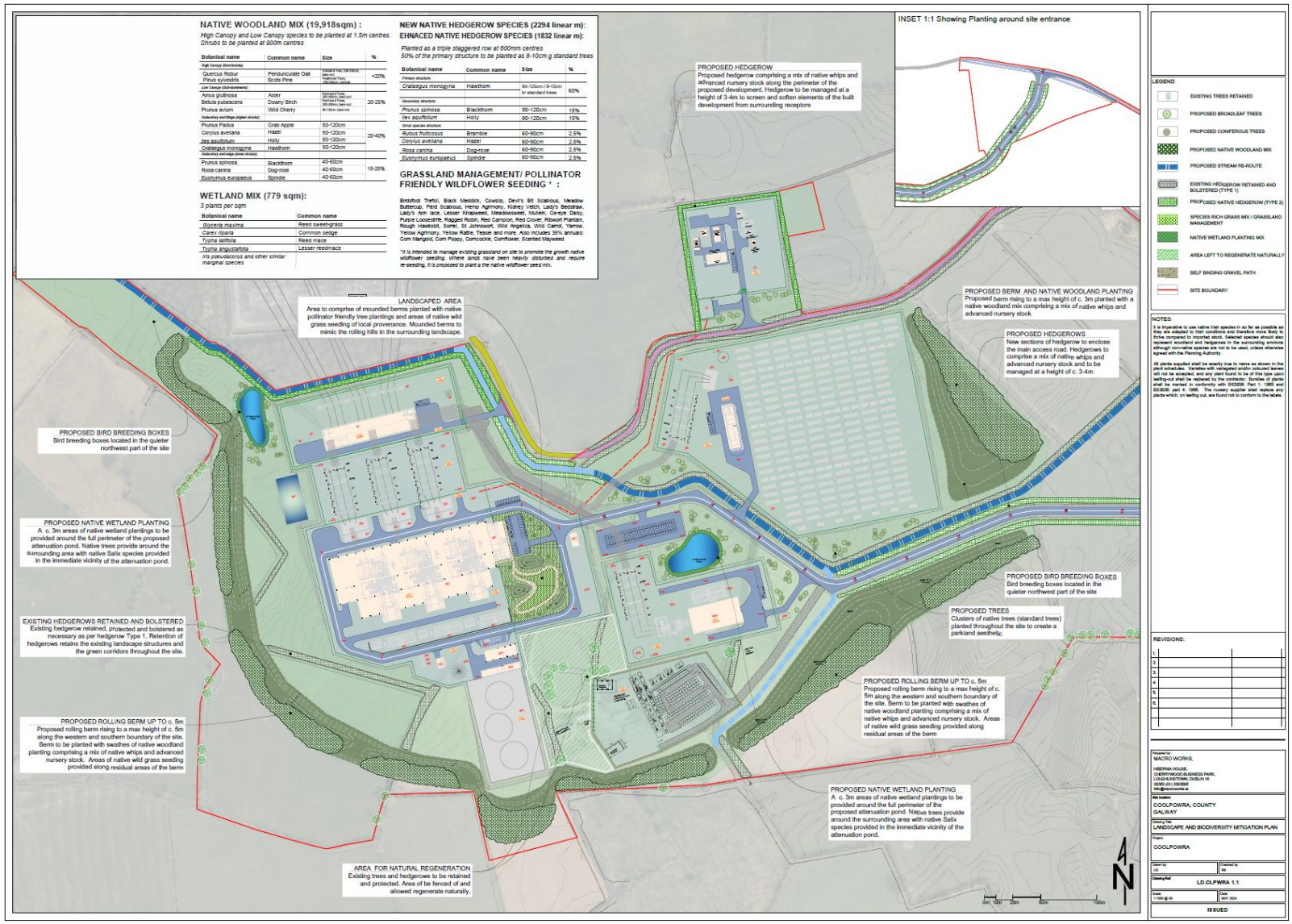


Figure 4.2 Landscape and Biodiversity Mitigation Plan (Operational Stage)



4.4 ENABLING WORKS

An alternative purpose-designed temporary construction access road is proposed to connect the N65 to the main works area in order to reduce construction-stage effects associated with use of local roads and sensitive receptors. The access road will operate as the primary construction-stage route for HGV deliveries, abnormal loads (where required), and site traffic, and will tie into the internal access arrangement serving the main works area south of the L8763. The temporary access alignment includes two watercourse / drainage feature crossings which will be clear-spanned (similar to those within the main works area) to avoid in-channel structures and to maintain channel function. The temporary access corridor also incorporates an associated construction compound and two soil deposition / storage areas.

5 CONSTRUCTION WORKS

5.1 OVERVIEW

It is envisaged that the proposed development (three projects) will be constructed over an estimated 20–28-month period. After the estimated 28 month-month construction period, it is expected that all projects will be fully constructed, commissioned and capable of operating as designed. The design and undertaking of construction work associated with the connection of the Reserve Gas-Fired Generator (Project 1) to the gas network will be managed by Gas Networks Ireland (GNI). Whilst the planning application and EIAR assess the potential effects of the associated underground gas pipeline project, the final route determined may be subject to change as part of the detailed design process which has to be carried out by GNI. As such, detailed design, construction methodologies and proposed mitigation for the construction, operation and decommissioning of the underground gas pipeline will be defined by GNI at a later date and included in a CEMP to accompany their future planning application(s).

The specific details of the construction programme are not currently known as such this programme will be developed under EPC contract as part of the detailed design phase. It is therefore difficult to assess the staffing and delivery levels for the development. However, it is considered that the design and proposed layout of projects has developed sufficiently to discuss the potential environmental impacts of proposed construction methods. An estimate of construction traffic volumes has been made for a site of this size and typical works associated with a development of this type are described.

The timing of the commencement of construction is subject to planning, design, tendering and ecological constraints. Any works associated with site clearance and removal of soils

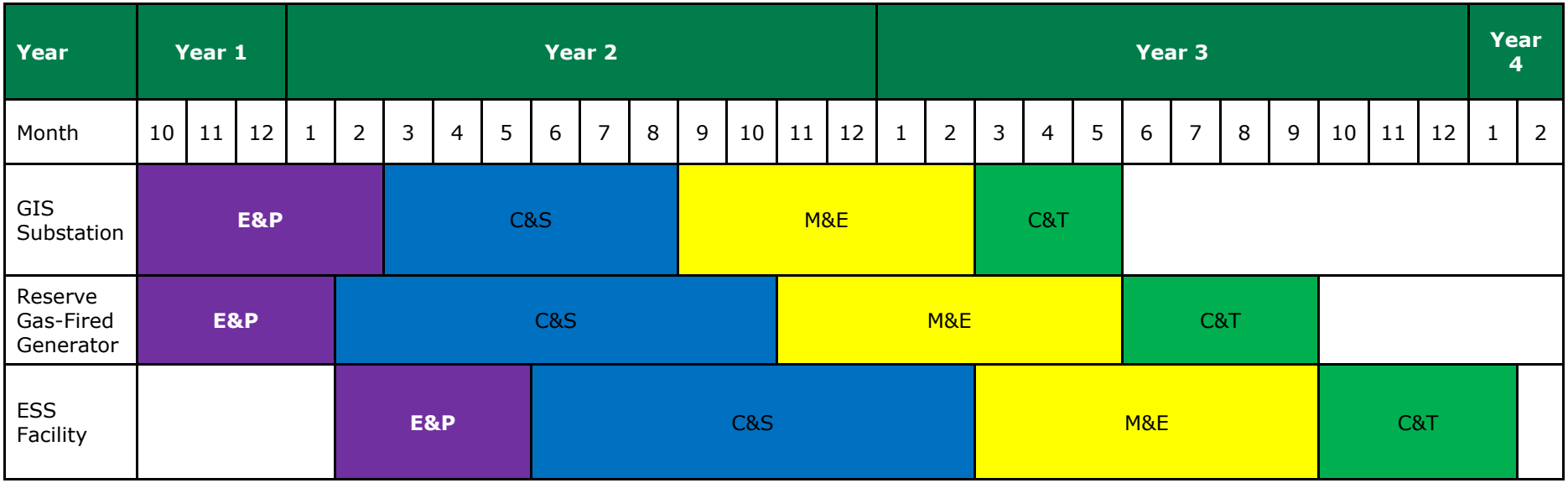
and internal hedging would be seasonally limited to mitigate against any adverse ecological effects. The impact of construction activities on Biodiversity and Roads and Traffic are assessed in the EIAR. This preliminary construction environmental management plan will be developed and implemented for the construction phase of the development. The document will provide a framework under which construction activities, which have potential for environmental impact (e.g., generation of dust, ecological impacts, surface water discharge, etc.), will be managed. Mitigation measures as outlined in the EIAR are included within this plan. An indicative construction schedule for each project relative to each other is outlined below in Figure 5.1 subject to the granting of statutory consent for each development separately. It should be noted that the timing and phasing of projects and activities are approximate and are indicative rather than a definitive programme of works.

5.2 ALTERNATIVE CONSTRUCTION ACCESS ROAD – SUMMARY METHODOLOGY:

Works will comprise: (i) setting out and fencing of the working corridor; (ii) establishment of environmental controls and temporary traffic management; (iii) topsoil stripping, segregation and storage; (iv) formation preparation including proof-rolling and local improvement/capping where required; (v) placement/compaction of sub-base and base layers; (vi) surfacing; and (vii) construction of road drainage, junction tie-ins and reinstatement works at field boundaries. Construction plant movements will be confined to the access corridor and defined working areas.

On an average construction day, approximately 32 HGV movements are anticipated to access the site, distributed across the working day to avoid peak-time clustering, with access managed at the N65 in accordance with agreed traffic management arrangements.

Figure 5.1 Indicative Construction Programme



Notes:

1. The construction timelines are for each project are indicative and will be finalised at detailed design stage of the projects.
2. In relation to GIS Project, timings of certain tasks /works will be subject to system outage planning by Eirgrid and EBS Networks.
3. Construction of the gas pipeline is non-contestable works and will be carried out by GNI.
4. E&P = Site Evaluation and Preparation (Works)
   C&S = Civil & Structural (Works)
   M&E = Mechanical & Electrical (Works)
   C&T = Commissioning and Testing (Works)

5.3 ORGANISATIONAL STRUCTURE AND RESPONSIBILITIES

The construction project will be managed by an EPC /Main contractor. The EPC /Main contractor will appoint a Construction Project Manager who will have responsibility for coordinating and managing good environmental and health and safety practices during construction.

The Construction Project Manager shall maintain monthly environmental programmes to ensure that construction activities on this contract are planned and managed in accordance with the environmental requirements stipulated by the Client /Owners Engineer. This management structure will be further defined by the appointed contractor and will include the names of the assigned personnel with the appropriate responsibility and reporting structure

5.4 CONTACTS

5.4.1 Primary Contacts

Table 5.1 Primary Contacts

Title	Name	Phone	Email
Project Manager			
Construction Manager			
SHEQ Advisor			
Site Engineer			
Quantity Surveyor			
Waste Representative			

The EPC Contractor /Main Contractor is responsible for ensuring that all employees and sub-contractors follow the requirements of the CEMP. The Contractor will be required to provide training and supervision to ensure that the requirements are adhered to. It is anticipated that the main environmental responsibilities for the key staff will be as set out below (TBC by the Contractor).

5.4.2 Third Party Contacts

Table 5.2 Third Party Contacts

Organisation	Position	Name	Phone	Email
Galway County Council				
Inland Fisheries Ireland				
Transport Infrastructure Ireland (TII)				
Office of Public Works (OPW)				
Environmental Protection Agency (EPA)				
National Parks and Wildlife Services (NPWS)				
Health and Safety Authority (HSA)				
Emergency Services				
Other				

The **Construction Project Manager** will:

- Provide information on contract requirements, including scope of works and forecast of waste quantities to SHEQ Advisor following contract award and prior to start of works on site and also when any changes occur.
- Nominate the following as required: Waste Rep, person to undertake weekly Site Compound checks, person to check drip trays and bunds and person to supervise refuelling of tanks and bowsers, person to complete watercourse monitoring Booklet (where applicable), person to complete air quality and noise booklet (where applicable).
- Ensure a forecast of waste types, quantities and disposal routes is produced before works start on site.
- Ensure required consents are obtained before associated works start.
- Ensure environmental waste minimisation and environmental mitigation measures are incorporated into design, construction method and/ or materials employed, where possible.
- Ensure environmental and waste requirements are included on Requisitions and in Subcontracts and Orders.
- Ensure a current version of the Contract Organisation Chart is displayed on site notice boards and individuals with environmental responsibilities are named on the Authorised Signatures List where appropriate.
- Ensure oil, including diesel, is stored in properly bunded tanks/ bunded mobile bowsers/ drip trays.
- Report Incidents in accordance with the reporting system.
- Report Non-conformances via the non-conformance tool.
- Report Incidents and Non-conformances to the SHEQ Advisor as soon as possible.
- Ensure the SHEQ Advisor is informed of environmental complaints.
- Liaise with Statutory Authorities and Client as required and ensure records of communication (including verbal) are kept. Ensure Statutory Authorities are always accompanied on site (preferably by the Project Manager and the SHEQ Advisor).
- Notify the Environmental Health Officer of any particularly noisy works or any works outside the contract hours before construction begins.
- Ensure all residents are notified of noisy works before they begin.
- Ensure environmental performance including review of Incidents and Non-conformances, Waste arisings and any Contract Objectives and Targets are included as part of Contract Review Meetings.

- Approve the Contract Environmental Management Plan and ensure employees and subcontractors implement the environmental controls.
- Ensure employees and subcontractors receive Induction Training (including environment) and Tool Box Talks as appropriate.
- Ensure staff needed for audits are available when required.
- Ensure actions resulting from Corrective Action Requests and Observations raised during audits are completed by the deadlines and signed off copies of Corrective Action Requests are forwarded to the relevant SHEQ Advisor.

The Ecological Clerk of Works (ECoW)

- Ensure that all mitigation measures used to protect the environment are in place and are maintained during the work;
- Undertake and report on the weekly monitoring and undertake the weekly site audits;
- Revise the mitigation measure if the monitoring evidence indicates that the measure is not effectively protecting the environment;
- Undertake an invasive species survey in advance of any soil being excavated for disposal off-site. If invasive species are identified the ECoW will prepare an Invasive Species Management Plan;
- Supervise any excavation; and
- Provide toolbox talks to all sub-contractors before they start on site.

The **SHEQ Advisor** will:

- Ensure the implementation of the Environmental Management System, and associated documentation on a daily basis.
- Address day to day environmental matters and communicate with construction management team
- Obtain environmental regulatory consents/permits as required (e.g. EPA, Galway County Council, OPW. National Waste Collection Permit Office (NWCPO), Inland Fisheries & NPWS).
- Report Environmental Incidents to the Statutory Authorities if necessary.
- Log and monitor Environmental Incidents and Non-conformances.
- Disseminate information including changes to legislation, to relevant employees.
- Identify employees that require environmental training, provide training and maintain training records.
- Provide advice and deal with queries and correspondence on environmental issues.

- Identify significant environmental impacts for contracts and help set-up contracts and site compounds to include necessary controls.
- Identify any environmental consents that are required and ensure they are obtained.
- Produce the Contract Environmental Management Plan and / or Site-Specific Information.
- Produce/ maintain or ensure production/ maintenance of all aspects of Site Waste Management Plan
- Monitor waste quantities and verify & validate the waste records obtained from site.
- Undertake contract environmental inspections to ensure controls are in place and working.
- Monitor progress in closing out Corrective Action Requests and Observations raised during audits.
- Agree process for regular reporting to senior management on the Contract.
- Ensure all environmental records are kept and readily available.
- Obtain prior agreement from site management in writing for any deviations from assigned Procedures (e.g. use of client procedures or forms).

Quantity Surveyor will:

- Check that Waste Carriers are registered and Waste Management Sites are licensed before subcontracts or orders are placed.
- Ensure environmental and waste requirements are included on Requisitions/ Subcontracts or Orders.
- Reconcile waste invoice against Waste Transfer Notes/ Consignment Notes and tip receipts before authorising payment.
- Monitor waste quantities and costs and provide information to assist in the production of Site Waste Management Plan Reports.

Waste Rep will:

- Arrange for collection of waste.
- Keep an up-to-date record of waste removed from Site
- Confirm with SHESQ Advisor that Waste Collection Permits/ Waste Facility Licenses are valid and either keep a record of confirmation or obtain copies for site files
- Complete and sign Waste Transfer Notes/ Hazardous Waste Consignment Notes. Give copies to Drivers, send top copy to invoicing and keep photocopy on file.
- If hazardous waste is being removed, complete and retain a copy of the Waste Transfer Form.

- Ensure waste storage/ segregation/ recycling activities are correctly implemented and appropriate waste records and statistics are maintained.

Subcontract Buyers will:

- If a subcontractor is to act as a Waste Carrier and dispose of waste provide details of their Waste Collection Permit and the intended disposal sites Waste Licence to SHEQ Advisor before placing subcontract.
- Include environmental and waste requirements in subcontracts.

Drivers will:

- Inform the Waste Rep. what waste they are removing and where it is being taken prior to removing any waste from site.
- Collect Waste Transfer Note/ Consignment Note from Waste Rep when collecting waste.
- Only take waste to a licensed Waste Management Site as instructed by the Waste Rep/ SHESQ Advisor.
- Get Waste Management Site to sign Waste Transfer Note/ Consignment Note and give to SHESQ Advisor along with all associated receipts.

All Construction Staff will:

- If there is an incident, stop work, contain it and report it to the Site Manager.
- Contact the Waste Rep when waste needs to be removed.
- Pass any queries or correspondence on environmental issues to SHESQ Advisor.
- Work in accordance with Group SHESQ Procedures, Contract Environmental Management Plan and Method Statements.

5.5 TRAINING

Environmental awareness training on this project will include:

- Induction Training
- Tool Box Talks
- Communication/ Briefing Sessions

Environmental awareness training included at induction shall cover the following basic elements:

- The SHEQ Policy

- Overview of applicable environmental legal and regulatory requirements
- The Construction Environmental Management Plan including works specific environmental aspects and impacts
- The Environmental Emergency response training including Spill Control & Spill Kits.
- The Construction Waste Management Plan
- Water Pollution Prevention
- Environmentally sensitive areas
- Wildlife/ Invasive Plants
- Dust management controls
- Noise and vibration Controls
- Material Storage and Refuelling
- Responding to communications/complaints received by the public.
- Reporting an Environmental Incident
- Other matters of environmental interest

The Environmental Advisor shall retain details and records of all training provided. Additional environmental training shall be provided as required by the Environmental Advisor or environmental experts.

Contract specific information will be displayed on notice boards and briefed to all staff. Site-specific Environmental Do's & Don'ts, which list the key controls specified in this Plan, will be issued to site operatives and subcontractors.

Training will be provided in accordance with the Core Skills Matrix. A Training Attendance Form will be completed for each training session and an Environmental Training Matrix will be maintained.

5.6 COMMUNICATION

5.6.1 Internal

Environmental issues will be reviewed at the monthly Contract Review meeting, in accordance with the appointed contractor's management system. The issues covered will include:

- Compliance contractor management system and any contract specific environmental requirements.
- Legal compliance e.g. consent requirements
- Environmental Incidents & Non-conformances
- Audit Corrective Action Requests to ensure actions are completed by deadlines.

5.6.2 External

The Project Manager (in conjunction with the SHEQ Advisor) will be responsible for receiving, documenting and responding to any environmental communication from third parties. All verbal communication from third parties will be logged in the contract Communication Log in accordance with the agreed Communication Plan.

The SHEQ Adviser will meet as required and as agreed with the client**,** with statutory agencies, e.g. Environmental Protection Agency, local authority (Galway County Council) Environmental Health Officers, Inland Fisheries Ireland, NPWS, other Stakeholders (Gardai, local business owners, landowners) and the local community to ensure works are carried out with minimal environmental disturbance.

Complaints from the public will be logged on a Complaint Record form and a recorded on the Complaint Register.

5.7 DOCUMENT CONTROL

All environmental documents will be controlled by the Appointed Contractor Procedures /Method Statements.

5.8 DESIGN

Environmental impacts of design will be managed in accordance with the Appointed Contractor Procedures /Method Statements. This involves including Environmental Design Aims in the Design Brief and monitoring these through the Design Review meetings.

5.9 CONTRACT CHECKS AND INSPECTIONS

The following inspections will be undertaken:

- Supervisor Weekly Checklist
- SHEQ Monthly Inspection
- Management Tours

5.10 RECORDS

Records will be maintained in accordance with the Appointed Contractor Procedures.

5.11 AUDITS

Internal audit of this contract will be undertaken in accordance with the Appointed Contractor Procedures.

5.12 MANAGEMENT REVIEW

A Contract Management Review will be undertaken every 3 months. Management reviews will be undertaken in accordance with the Appointed Contractor Procedures.

5.13 SCHEDULE AND WORKING HOURS

It is envisaged that construction of the development proposal is likely to occur over an estimated 28-month period; refer to Figure 5.1 for the overall indicative timeframe and timeframes for each of the three projects.

Subject to agreement with the planning authority, it is anticipated that the following times will constitute the standard working hours[2] on the construction site.

- Monday to Friday 07:00 to 19:00
- Saturdays 07:00 to 13:00
- Site closed on Sundays and Bank Holidays,

Working hours may vary slightly depending on weather conditions and daylight hours during winter months. Heavy construction activities will be avoided where possible outside the normal working hours outlined above. Lighting for night-time working will be downward facing and directed towards the centre of the site so as to minimise any nuisance outside of the site in relation to residential receptors or light disturbance to ecological receptors.

5.13.1 Accommodation /Facilities

The relevant statutory requirements will be provided for all workers on the construction site and will be provided in a secure compound including:

- Canteen facilities and drinking water supply
- Toilet, wash up and locker facilities and hot water
- Drying room
- Car parking for workers
- First Aid Office
- Site Engineers & Resident Engineers offices
- Site offices for Contractors

[2] Typical Construction hours will apply with the exception of commissioning and specific engineering works (e.g., concrete pours) which could take place outside these hours, as and when agreed with the planning authority. It is likely that some construction activities will be required to continue for 24 hours for limited durations. The facility may be operational at any point during a 24-hour period during commissioning (and operation).

6 CONTROLS AND MITIGATION MEASURES

Controls specified in this section are designed to:

- Meet legal and contract requirements
- Limit the identified significant impacts
- Deal with unexpected environmental issues

Environmental controls (e.g. consent conditions) that are more specific to certain activities will be discussed and agreed in advance with the Project Manager and the appropriate public bodies including local authorities and the Environment Agency. The controls will then be included in site specific Method Statements in accordance with the Group Procedure – Preparation and Issue of Method Statements Risk Assessments.

6.1 SUBCONTRACTORS

Subcontractors will be appointed in accordance with the Appointed Contractor (EPC Contractor) Procurement Policy Procedures:

Subcontractors are required to work in accordance with this Construction Environmental Management Plan and Method Statements.

Table 6.1 Subcontractors

Subcontractor (name)	Scope of Works	Main Activities	Environmental Controls
TBC	Earthworks, Drainage & Services	Bulk excavation, filling, installation of drainage & site services	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
TBC	Concrete and Structural Works	Construction of concrete foundations and Buildings	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
TBC	Mechanical Works	Installation of modular equipment and process pipework	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
TBC	Electrical Works	Installation of SCADA and process electrical works	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
TBC	Testing & Commissioning	Testing & Commissioning of the process	Subcontractor's Method Statement's environmental

Subcontractor (name)	Scope of Works	Main Activities	Environmental Controls
TBC	Earthworks, Drainage & Services	Bulk excavation, filling, installation of drainage & site services	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
			controls reviewed by Main Contractor
TBC	Site Fencing	Installation of Permanent boundary fence	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
TBC	Landscaping	Hard & Soft Landscaping of the site	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
TBC	Waste Disposal & Difficult waste disposal	Skip Supply Waste Removal/ Disposal	Duty of Care Waste Collection Permit
TBC	Dust Monitoring	Set up dust deposition jars Collection of the dust deposition jars and lab analysis (if required)	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
TBC	Noise Monitoring	Set up noise monitors at agreed locations (if required)	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor
TBC	Site Compound	Installation, maintenance & removal of temporary site compound & security	Subcontractor's Method Statement's environmental controls reviewed by Main Contractor

The above is a non-exclusive list of the main subcontracted works.

6.2 RESOURCE USE

Measures to reduce resource usage during the planning and operational phases of the works will include the actions given in the table below.

Table 6.2 Management of Resources

TASK	RESPONSIBILITY
Fuel Combustion (Transport/Plant)	
Collect data on quantities of diesel/ petrol used in vehicles and plant.	Project Manager/ SHEQ Advisor/ Manager
Collect data on quantities of gas oil used.	Project Manager/ SHEQ Advisor/ Manager
Collect data on modes of transport to and from work and business miles travelled.	Project Manager/ SHESQ Advisor/ Manager
Explore options to reduce the amount of car travel to and from work and minimise the adverse environmental effects of business-related travel.	Project Manager/ SHEQ Advisor/ Manager
Promote good practise by encouraging use of sustainable modes of transport and where feasible use minibuses/ vans to transport staff.	Project Manager/ SHEQ Advisor/ Manager
Promote fuel efficiency and good driving practices	Project Manager/ SHEQ Advisor/ Manager
Ensure the correct vehicle, plant & equipment is provided and used for the work being undertaken. I.e. do not select equipment that is over-powered for the task being carried out.	Project Manager/ SHEQ Advisor/ Manager
Ensure vehicles, mobile plant, generators and other equipment are serviced regularly to maintain their efficiency.	Foreman
Switch off vehicles and other mobile plant when not in use.	All staff
Electricity	
Minimise the use of generators to provide electricity. Wherever possible connect to mains electricity as soon as possible.	Project Manager
Collect data on quantities of directly purchased electricity.	Project Manager/ SHEQ Advisor/ Manager

TASK	RESPONSIBILITY
Install energy efficient devices/ renewable energy where reasonably practicable e.g. Infrared sensors linked to lighting, air conditioning and heating controls.	Project Manager
Promoting energy efficiency with all staff. Identifying where energy savings can be made and implement them. E.g. turning off computers/ photocopiers when not in use.	SHEQ Advisor/ Manager
Water	
Measure per capita water use in the site offices.	Project Manager/ SHEQ Advisor/ Manager
Install water efficient devices in washrooms e.g. push taps, flow regulator/ restrictors, low flush toilets, cistern devices e.g. hippo, save-a-flush to reduce flush volumes	Project Manager
Promoting water efficiency with all staff and encourage good behaviour. e.g. maintaining hoses, pipes and water using equipment in good condition and checking for leaks regularly	SHEQ Advisor/ Manager
Fit trigger nozzles on hosepipes and flow restrictors and automatic shut off devices to hoses and water supply pipes where appropriate	Foreman
Use recycled or grey water for damping down dust where possible	Foreman
Use scrappers to clean up mud rather than washing down with water	Foreman
Waste	
Minimise waste by ensuring materials are stored properly and used efficiently.	Project Manager/ Foreman
Consider waste when purchasing materials. Where possible/ practicable select materials that can be re-used or recycled.	Project Manager
Recycle and reuse materials where possible.	Project Manager/ SHEQ Advisor/ Manager
Collect data on quantities of waste produced and percentage recycled (diverted from landfill).	Project Manager/ SHEQ Advisor/ Manager
Materials	
Procure materials from certified sources.	Project Manager/ Buying Department

TASK	RESPONSIBILITY
Designing out unsustainable materials where possible and minimising waste.	Designers
Specifying materials/ products that have less impact on the environment.	Designers
Specifying the use of peat free product for landscaping.	Project Manager
Procure recycled materials where possible.	Project Manager/ Buying Department
Introduce a '*take-back policy*' on suppliers, so where possible, no delivery will leave the site without taking associated waste and packaging with them.	Project Manager/ Buying Department

Note: Reducing resource usage by minimising wastage and preventing pollution is also addressed under the other sub-headings in this section of the Plan.

6.3 WASTE MANAGEMENT

All waste arising on the Contract, including that generated by sub-contractors will be managed in accordance with the *Appointed Contractors Procedures /Method Statements*; The principle of "Duty of Care", as set out in the Waste Management Act 1996, as amended, will apply, whereby the waste producer is responsible for all waste from generation to recovery or disposal.

A separate Site Waste Management Plan (Attachment A) has been produced detailing how waste will be managed on this contract. The Construction and Demolition Waste Management Plan describes the controls and processes that will be used to manage materials effectively and reduce the amount of waste disposed of to landfill by identifying opportunities to reduce, re-use and recycle.

Waste quantities and management options will be identified prior to works commencing on site and recorded on a Waste Forecast.

Throughout the course of the Contract, whenever waste is removed from site, information on the identity of the person removing the waste, the type and quantity of the waste and the site the where waste is being taken to will be recorded using a Waste Transfer Note or Hazardous Waste Consignment Note and/ or summarised on the Record of Waste Movements.

Actual waste quantities and disposal routes will be reviewed periodically and summarised in a *Waste Report.* This review will monitor performance against the Contract Waste

Forecast and identify opportunities for improvement. The review will be discussed at the Progress Meetings**.**

Upon completion of the works the total waste produced on the Contract, the costs associated with its disposal, the disposal locations and the percentage recycled will be summarised on the *Contract Waste Report*. The Report includes a review of performance and any recommendations for waste management on future contracts.

A copy of the Construction Waste Management Plan comprising the Waste Forecast, the Quarterly Waste Returns Contract Waste Report will be retained at the site offices for three years after completion of the works.

6.3.1 Waste Controls

The following environmental controls and monitoring activities will be implemented on site:

Table 6.3 Waste Controls

TASK	RESPONSIBILITY
Ensure all waste disposal is arranged via the Waste Rep.	Project Manager/ SHEQ Advisor/ Manager
Where possible waste will be retained and reused on site to reduced traffic movements.	All staff
Plan to segregate waste as far as technically, environmentally and economically practicable into reusable and recyclable waste.	Project Manager/ SHEQ Advisor/ Manager
Introduce a '*take-back policy*' on suppliers, so where possible, no delivery will leave the site without taking associated waste and packaging with them.	Project Manager/ Buying Department
Documentation:	
Ensure that copies of the following are retained on site: • Evidence of all relevant Waste Collection Permits. • All relevant Waste Management Licences / Exemption Certificates. • Waste Transfer Notes and Consignment Notes. • Site Waste Management Plan/ Hazardous Waste Register.	SHEQ Advisor/ Manager/ Waste Rep.
Do not accept damaged skips/ waste containers on to site	Foreman/ Waste Rep.

TASK	RESPONSIBILITY
Locate skips/ waste containers away from drains, watercourses and heavily trafficked areas.	Foreman/ Waste Rep.
Ensure hazardous waste containers are covered and located on hardstanding.	Foreman/ Waste Rep.
Locate non-hazardous skips/ waste containers on hardstanding if possible.	Foreman/ Waste Rep.
Ensure that waste is segregated and placed in the right skip/bin	Foreman/ Waste Rep.
Ensure all waste is stored securely so that it cannot escape (wind/ vermin).	Foreman/ Waste Rep.
Remove waste, disused materials, packaging and other debris at frequent intervals to ensure the site is kept clean and tidy.	Foreman/ Waste Rep.
Ensure all hazardous waste containers are covered.	Foreman/ Waste Rep.
Ensure all skips and bins are labelled with their contents (incl. EWC Code).	Foreman/ Waste Rep.
Place the correct waste in the correct skip.	All staff
Report skips that are leaking or overfull to your supervisor.	All staff
Report fly-tipping to the Foreman/ SHEQ Advisor/ Manager	All staff
Eliminate unnecessary wastage by: • storing materials neatly on flat solid ground to avoid damage and loss; • keeping materials in their packaging for as long as possible to protect them from damage; • protecting materials from the weather to avoid loss from exposure to the elements; • ensuring existing material containers are empty before opening new ones; and • keeping significant off-cuts for use elsewhere.	Foreman/ All staff

Should any contaminated land be encountered it will be stockpiled separately; covered to prevent wind or water spreading contaminants to the wider environment; tested, at a UKAS accredited laboratory and sent for remediation/ disposed of in accordance with 'Duty of Care'.

Other aspects of waste management such as inspections and waste training requirements are addressed in the relevant sections elsewhere in this CEMP.

6.4 FUEL AND OIL STORAGE

Fuel and oils will be stored in a manner to minimise the risk of pollution or ecological damage during fuel handling. The implementation of good fuel management practices and increased environmental awareness can significantly reduce the risk of environmental pollution or impact of ecological damage. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner.

Secondary containment will be provided for all oil and diesel tanks:

- For a single tank, the secondary containment will be at least 110% of the maximum storage capacity
- For two or more tanks in one secondary containment system, the secondary containment will be at least 110% of the biggest tank's maximum storage capacity or 25% of the total maximum storage capacity of all the tanks, whichever is the greatest.

The types of fuel and oil that will be stored on this contract and how and where they will be stored are given in the table below:

Table 6.4 Fuel and Oil Storage

Type of Material	How and Where it will be stored
Diesel	• To be stored in bunded tanks or bowsers. • Fuel tanks and mobile bowsers must be kept locked when not in use and overnight. • Where a bulk tank is used, a 130-litre spill kit will be stored near the bunded area. • Metal jerry cans are to be used for hand carrying of fuel around the site. • Where practicable, only restricted hand carrying of fuel should be allowed on the site. • Metal jerry cans must be stored in a bund or drip tray when not in use. In vans /vehicles: • To be stored secure & upright in jerry cans (25 litres or less)

Type of Material	How and Where it will be stored
Oil	• To be stored in original container or in an appropriate container designed for the storage of oils. • Bowsers should be stored within site security compounds when not in operation. • Any tanks or drums should be stored in a secure container or compound, which should be kept locked when not in use. • Metal jerry cans are to be used for hand carrying of oil around the site. • Where practicable, only restricted hand carrying of fuel should be allowed on the site. • Metal jerry cans must be stored in a bund or drip tray when not in use. • The refuel of mobile plant will be undertaken well away from any drains or water bodies • A suitable spill kit or absorbent materials to be held in the vicinity

All refuelling and lubrication of equipment will take place on sealed and bunded surfaces within this area in order to avoid the potential for accidental spillage of hydrocarbons.

6.5 MATERIALS STORAGE

Materials and waste will be stored in a manner that minimises risk to the environment and reduces the potential for wastage due to exposure to the elements or damage. The types of potentially polluting materials associated with these works and how and where they will be stored is given in the table below:

Table 6.4 Material Storage

Type of Material	How and Where it will be stored
Topsoil	• To be stored beside the works to a height of no more than 3m. • Do not compact. • To be stored separately from subsoil. • Topsoil must be stored at least 3 metres away from any trees and hedgerows.

Type of Material	How and Where it will be stored
Subsoil	• To be stored beside the works to a height of no more than 5m. • Do not over compact. • To be stored separately from topsoil. • Subsoil must be stored at least 3 metres away from any trees and hedgerows.
Sand / Stone	• To be stockpiled in the allocated lay down area in the site compound in a way to minimise dust and wastage.
Cement	• To be stored in the original packaging on pallets inside the COSHH stores. • If cement is to be stored outside temporarily it should be stored off the ground on pallets, away from sensitive or heavily trafficked areas and covered with tarpaulin.
Other bagged materials	• To be stored inside a container where practicable otherwise off the ground on pallets and protected from the weather.
Chemicals, Bitumen, Paints, Solvents, Grease	• To be stored in the original packaging inside a drip tray. All chemicals should be stored appropriately in the COSHH stores. • Consult the SDS or COSHH sheets for details of particular storage requirements.
Batteries / fluorescent light tubes	• In a leak proof container within a designated covered storage area.
Contaminated Material	• To be stockpiled separately in a quarantined area, clearly marked and sealed off. To be covered to prevent wind or
Empty drums / containers	• To be stored in a designated area prior to disposal. • Away from sensitive boundaries and watercourses • Screening from external receptors, if possible
Inert waste	• To be kept separate from non-hazardous and hazardous waste in a clearly designated area, in a labelled skip located on hardstanding where possible.

Type of Material	How and Where it will be stored
Non-Hazardous waste	• To be kept separately from inert and hazardous waste. • To be segregated into its component streams where technically, environmentally and economically practicable. • To be kept in clearly labelled containers/ skips. • Containers/ skips to be in good condition, covered and located on hardstanding • Containers/ skips to be located away from sensitive
Hazardous waste	• To be kept separately from inert and non-hazardous waste. • To be segregated into its component streams and kept in clearly labelled containers/ skips. • Containers/ skip to be in good condition, covered and located on hardstanding • Containers/ skips to be located away from sensitive boundaries and watercourses • Containers/ skips to be screened from external receptors if possible.

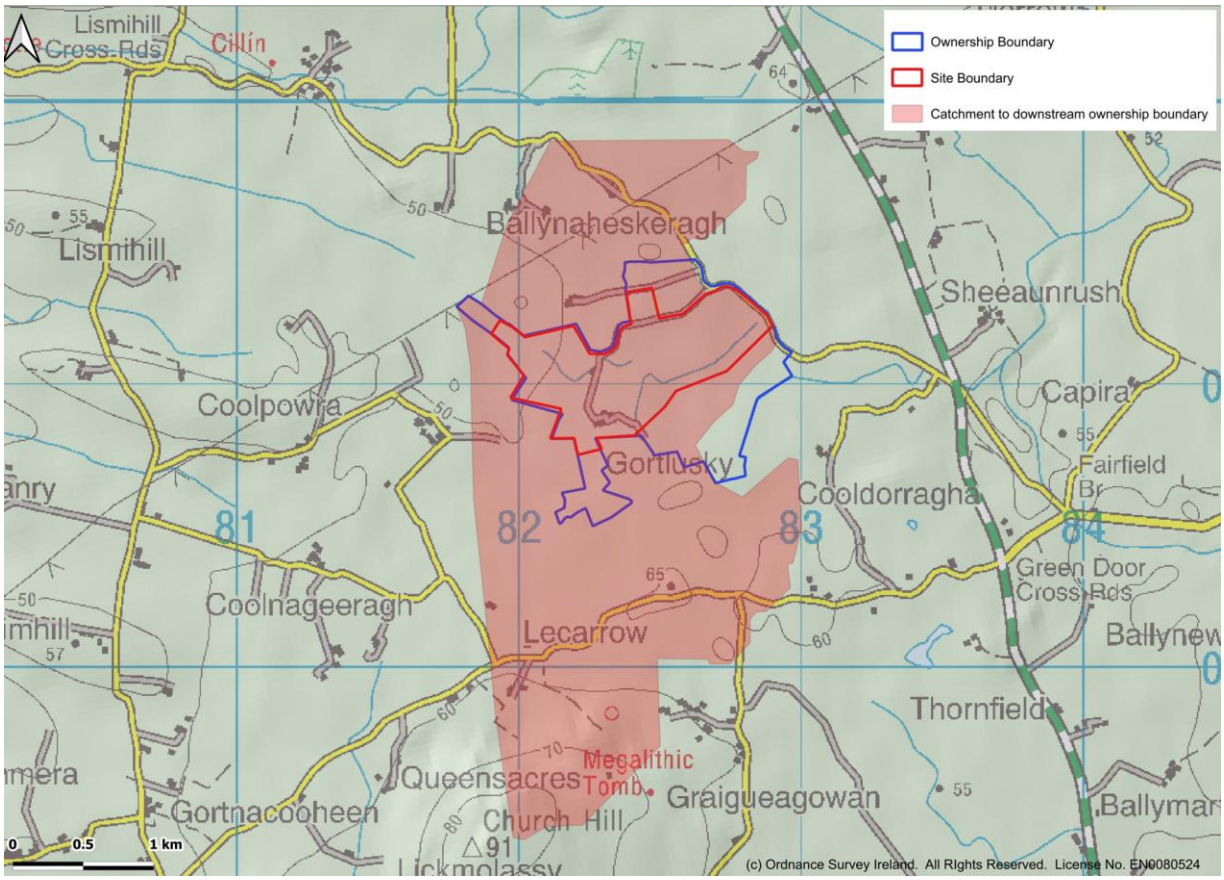
6.6 WATER

The two dominant sub-catchments in the area are the Gortaha (Catchment 025B), which drains to the east, and the Kilcrow (Catchment 025C), which drains to the west. These rivers are both part of the Lower Shannon Hydrometric Area. Following ground truthing it was established that the vast majority (main area of development works) of the proposal are contained in the Kilcrow_070 WFD subbasin (IE_SH_25K010700) of the Lower Shannon surface water catchment (Catchment ID 25C). There are several field boundary drains present within the site that contribute to the runoff at its downstream end. The largest of these drains extends 950m south, outfalling to the central stream just east of the on-site dwelling. This drainage channel has a sub-catchment of 0.675 km^2.

There are two culverts present on this tributary, with pipe diameters of 650 mm and 500 mm. The 500mm culvert lies immediately upstream of the confluence of the tributary and the main channel whilst the 650mm culvert acts as a field crossing further upstream. There is a 1m drop from the invert of the tributary channel to the invert of the main channel, resulting in a high velocity cascading flow regime at the confluence. The combined flows then continue westward. There are no other drainage channels that contribute significant flow to the central channel within the site.

The catchment (see Figure 6.1) falls within the Tynagh groundwater body (European Code IE_SH_G_236).

Figure 6.1 Catchment Map



6.6.1 Temporary Access Road Drainage

Surface water from the temporary access road will be managed using continuous roadside filter drains installed on both sides of the carriageway for the operational period of the temporary access. The filter drains will comprise a minimum 500 mm deep × 600 mm wide trench within a 2.0 m wide verge, incorporating a 150 mm perforated carrier pipe laid to a minimum longitudinal fall of 1:500, bedded in coarse aggregate and wrapped in geotextile to maintain permeability and prevent migration of fines. Runoff will be collected via road crossfall into the verges, attenuated and treated within the filter drain media prior to infiltration to ground, thereby avoiding uncontrolled discharge and reducing the potential for sediment-laden runoff leaving the access corridor.

The filter drain system will be installed early in enabling works such that it functions throughout the construction phase and will incorporate rodding points/inspection provisions and be subject to routine inspection and maintenance (including removal of silt at inlets/verges and repair/replacement of any geotextile/aggregate where fouling is identified).

The access alignment requires crossing of two water features (watercourses/drainage ditches). Crossings will be constructed as clear-span structures using a precast concrete

deck supported on gabion abutments set back from the banks so that no structural elements are placed within the wetted channel, materially reducing in-channel excavation compared with culverting and maintaining drainage channel profile and gradients. Following installation, approaches will be completed with engineered fill and pavement layers, and surface water from the crossings and approaches will be directed to appropriate roadside drainage and settlement/silt controls to prevent direct discharge to the watercourse.

6.6.2 Control of Construction Site Surface Water Runoff Quality[3]

The early establishment of temporary drainage facilities will manage the risk of impacts on watercourses on and adjacent to the site during construction. In addition, construction operations will adopt best working practices. An NIS has been prepared in support of the proposed development and includes mitigation measures which should be considered in addition to those presented below.

It is proposed to realign a portion of the Treananearla Stream within the site boundary. It is proposed that this is undertaken at the outset of development works in accordance with statutory obligations. It is proposed that the new channel is constructed initially and once complete the watercourse will be diverted.

Ground disturbance is unlikely to have indirect impacts the Lough Derg, North-east Shore SAC or the Lough Derg (Shannon) SPA. However, as a precaution, best practice construction methods are proposed to include standard site management to prevent local impacts. The standard best practices also outline methods for the prevention of chemical pollution.

The drainage proposals will be developed further prior to the commencement of construction however, any such improvements will be in line with the principles and mitigation presented in the EIAR and with conditions which be attached to planning. The protection of watercourses and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed development.

Prior to any works, all personnel involved will receive an on-site induction relating to operations adjacent to watercourses and the environmentally sensitive nature of the Treananearla Stream and re-emphasise the precautions that are required as well as the

[3] It should be noted that the controls measure are not prescribed to avoid or reduce adverse effects on European sites and are not considered in the determination of conclusions in the Screening Report for Appropriate Assessment.

construction management measures to be implemented, in particular in relation to the diversion of this stream.

The project proponent will ensure that the engineer setting out the works is fully aware of the ecological constraints and construction management requirements.

Run-off into excavations/earthworks cannot be prevented entirely and is largely a function of prevailing weather conditions. Care will be taken to ensure that exposed soil surfaces are stable to minimize erosion. All exposed soil surfaces will be within the main excavation site which limits the potential for any offsite impacts. All runoff will be prevented from directly entering any water courses as no construction will be undertaken directly adjacent to open water.

During the construction phase as part of standard practice, appropriate measures to prevent water pollution to any watercourses near the site will be implemented during all of the construction phases and will include referral to:

- Control of Water Pollution from construction Sites, Guidance for consultants and contractors (C532).
- Environmental Good Practice on Site (3rd edition) (C692).
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (2016).

As part of detailed design and in advance of any construction activities, a construction site drainage plan will be developed to assist with micro siting of proposed drainage controls. Artificial drains will be excavated and settlement ponds constructed to eliminate any suspended solids within surface water running off the site. Drainage infrastructure will include:

- Interceptor drains will be maintained up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained.
- Swales/road side drains will be maintained to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment and channel it to settlement ponds for sediment settling;
- Check dams will be maintained at regular intervals along interceptor drains and swales/roadside drains in order to reduce flow velocities and therefore minimise erosion within the system during storm rainfall events; and,
  Settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high

rainfall, thus reducing the hydraulic loading to watercourses. The settlement ponds will be sized according to the size of the area they will be receiving water from but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds will be ongoing through the construction period. Best practice and practical experience on other similar projects suggest that in addition to the drainage plans that are included in the EIAR, there are additional site based decisions and plans that can only be made in the field through interaction between the Site Construction Manager and Environmental Advisors. In relation to decisions that are made on site it is important to stress that these will be implemented in line with the associated drainage controls and mitigation measures of the EIAR and to ensure protection of all watercourses.

- Site boundary markings to safeguard features of interest/value, including drains and streams.
- Silt fencing will be installed strategically around and through the site. The location of the silt fencing will be determined in the construction stage CEMP and will be subject to a detailed assessment of the planned works methodology and works area. The purpose of the silt fencing is to prevent silt laden water leaving the site and entering adjoining lands and the existing watercourse with the potential to impact watercourses. A typical silt fence detail is shown below in the Figure below. It will consist of a double layer of geotextile membrane fixed to wooden stakes approximately 600mm high. The membrane will be anchored into the ground to form a continuous barrier to silt laden water from the works site. Silt fences will be monitored via a silt inspection log (to be maintained by the Environmental Manager/ ECoW) and periodically maintained during the construction period. Typical maintenance will consist of repairs to damaged sections of membrane and removal of a build-up of silt on the upslope side of the fence. Daily silt fence inspections are recommended as part of their operation ensuring that any necessary repairs can be expedited.

Figure 6.2 Typical Silt Fence to be Employed

- Drainage ditches will be installed to intercept surface water where there is a risk of significant water flow into excavations, adjoining lands or the existing watercourse. There will also be a requirement to periodically pump water from excavations. All collected and pumped water will have to be treated.
- Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the site compound. These agencies will be notified immediately in the event of a pollution incident.
- Site personnel will be trained in the importance of preventing pollution and the mitigation measures described here to ensure same.
- The Environmental Manager or ECoW will be responsible for the implementation of these measures. They will be inspected on at least a daily basis for the duration of the works, and a record of these inspections will be maintained.
- Any temporary storage of soil, hardcore, crushed concrete or similar material will be stored 50m from any surface water drains. All temporary storage areas should also have surface run- off controls in place to prevent migration of possible materials. There can be no direct pumping of silty water from the works directly to any watercourse. All water from excavations must be treated by infiltration over lands or via settlement areas, silt busters etc.

MANAGEMENT OF GROUNDWATER CONTAMINATION

The following measures will be required to avoid easy and rapid pathways to the ground water via high level bedrock:

- Stockpiles of soil shall be kept at areas of the site with low bedrock levels where there is at least 1m of soil above the bedrock.
- Silt fencing and settlement ponds shall be placed in areas with low bedrock levels where there is at least 1m of soil above the bedrock. Silt fences shall be inspected as part of the daily inspection regime. Trapped silt shall be removed from silt fencing at regular intervals and especially prior to any predicated flood event.
- Earthworks shall be left exposed for the minimum time possible. Earthworks formations shall be protected by a layer of imported granular fill.
- Landscaping and seeding of the site shall be carried out as early as possible.
- Site compounds, fuel storage areas, generators and the like shall be sited away from areas of high level bedrock.

Good housekeeping and facility management during the construction period will ensure that there will be no negative environmental impacts from the construction of the proposed facility. Sedimentation presentation controls include the following:

- Minimisation of exposed ground and soil stockpiles, through careful earthworks design.
- Minimising the time that ground is exposed and excavations are open through careful construction programming.
- Temporary stockpiles will be located away from drainage ditches, limited in height to 3m (topsoil) and the surface smoothed.
- Silt fences will be placed around the stockpiles where required to limit the potential for rainfall to wash fines into the drainage system. These comprise a technical filter fabric positioned as a fence around the exposed soil and sediment to catch fines within the runoff and reduce the input of fine sediment to the drainage system. Stockpiles which may be present for some time will be covered or seeded.
- Areas around infrastructure will be landscaped, and restored with topsoil and revegetated as soon as possible.
- Track drainage, designed to prevent the interception of large volumes of water, will be porous and act as soakaways thereby minimising any direct discharge to watercourses.
- Wheel washing activities will be conducted in designated areas, with runoff waters being conducted to soakaways constructed according to best practice.
- Use of buffer zones, silt traps and settlement ponds to avoid sediment reaching drains and watercourses

6.6.2.1 Fuel Oil, other Petroleum based substances and chemicals

- Construction compounds will be located at least 30m from local on site drains.

- Dedicated areas of hard standing for material deliveries separated a minimum of 10m drainage ditches
- Specific areas for oil storage and refuelling, separated a minimum of 10m from adjacent watercourses and comply with legislation, including providing bunds which contain 110% of on-site fuel storage capacity;
- Use spill kits, fill point drip trays, bunded pallets and secondary containment units;
- Enclosed and secured site and fuel storage areas will be secondarily secured;
- Develop a Construction Waste Management Plan;
- Develop a site-specific Incident Response Plan;
- Works involving the use of chemicals which are potentially harmful to the aquatic environment will be undertaken in a contained or lined area;
- Excavation and disposal off-site of contaminated soils (where required).
- Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the project site, and the proper use, storage and disposal of many substances used on construction sites, such as lubricants, fuels and oils and their containers can prevent soil contamination.

CONCRETE AND CEMENTOUS PRODUCTS

Wet concrete and cement are very alkaline and corrosive and can cause serious pollution to watercourses. Disposal of raw or uncured waste concrete will be controlled to ensure that watercourses will not be impacted.

- Best practice in bulk-liquid concrete management addressing pouring and handling, secure shuttering / form-work, adequate curing times will be implemented.
- Wash water from cleaning ready mix concrete lorries and mixers may be contaminated with cement and is therefore highly alkaline, therefore, washing will not be permitted on site.
- A suitable casing will be used where wet concrete is proposed to ensure protection of watercourses until concrete has set.
- No batching of wet-cement products will occur on site;
- Supply of ready-mixed wet concrete products where possible or emplacement of pre-cast elements,
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed.

- Use weather forecasting to plan dry days for pouring concrete;
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;

ACCIDENTAL SPILLS AND LEAKS

- Bulk fuel storage areas should be adequately protected with the provision of appropriate bunding to provide a minimum storage volume of 110% of total fuel storage capacity with the provision of a spill kit and the use of drip trays. Fuel storage must be sited away from any watercourse or on-site services as far as possible and have a designated area.
- Where sub-contractors are required to refuel vehicles on-site, this will be carried out at a central refuelling location only. The sub-contractor will be required to make the necessary arrangements with the Main Contractor to access and purchase fuel oil from a central supply. All refuelling areas will be on areas of hard standing only at designated agreed locations. Open valves will not be left unattended.
- All fuel, oil and chemical deliveries will be supervised by a responsible person who will be trained to deal with any spillage to prevent a pollution problem occurring.
- Storage tank levels will be checked before delivery to prevent overfilling and to ensure that the product is delivered to the correct tank.
- The storage of materials in the main compound and work sites will be controlled in such a manner to ensure that materials are not damaged prior to use either through vehicle or people movements or through exposure to the elements.
- All fuel, oil and chemicals will be stored on an impervious base within a bunded area and secured. The bund shall have a capacity of 110% of the volume of the products stored within it. All tanks and containers will be kept in a secure compound and be protected from vandalism and will be clearly marked with their contents. Stores shall be located at least 10 metres from any watercourse.
- All mobile plant will be refuelled in a designated area on an impermeable surface and away from drains. In case of any spillages, there will be a spill response kit available at each refuelling point and within each machines working area. Where it is impractical to refuel within a bunded area, a drip tray will be available to catch any spills caused by over fuelling.

Every effort will be made to prevent pollution incidents associated with spills during the construction of the proposed development. The risk of oil/ fuel spillages will exist on the site and any such incidents will require an emergency response procedure. Given the scale and extent of the proposed development all contractors will carry spill kit materials in their site cabins.

The following steps provide the procedure to be followed in the event of an oil/ fuel spill occurring on site:

- Identify and stop the source of the spill and alert people working in the vicinity.
- Notify the Environmental Manager immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident.
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses and/ or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- The Environmental Manager will notify the appropriate stakeholders, such as Galway County Council, National Parks and Wildlife Service, Department of Communications, Climate Action and Environment and Department of Housing, Planning and Local Government and/or the EPA.
- Environmental incidents are not limited to just fuel spillages, therefore, any environmental incident must be reported, recorded and investigated in accordance with the procedures described.

6.6.3 Water Monitoring

Proposed water quality monitoring is limited to the fact that there are no significant water features within the development lands. The water monitoring that will be undertaken on is outlined blow

- Check downstream watercourse to the south daily for:
    - Change in water colour.
    - Change in water transparency.
    - Oily sheen on water surface.
    - Scums & foams.
    - Dead / decaying plants, animals & fish.
- Turbidity, pH, Temperature, DO and Conductivity will be monitored at a chosen location along the downstream water course using a portable meter to ensure that the levels/concentrations are within expected and typical ranges.
- Keep a record of these checks in the Sampling Register.

- Ensure gullies/ drains are kept free from ingress of stone, spoil, tarmac and other material by checking daily

Prior to commencement of works on the temporary access route, a pre-works walkover will be completed along the access corridor and adjacent drainage features to confirm the location/condition of field drains, ditches and any nearby water features and to inform final protection measures. Surface water controls along the access route (including temporary drainage and silt/sediment controls) will be routinely inspected and maintained with increased frequency during /after heavy rainfall events.

Following decommissioning/reinstatement, verification inspections will confirm reinstated ground levels, surface condition and drainage performance (including field drain functionality) with rectification where required.

6.7 NOISE

6.7.1 Noise Controls

Noise will be minimised and managed in accordance with the controls specified in the EIAR (Chapter 11). Proposed contract working hours are Monday to Friday 07.00 to 19.00 and 07:00 to 13:00 on Saturdays. The site will be closed on Sundays and Bank Holidays. Controls that will be in place on this project are given in the table below.

- A Site Representative will be appointed for matters related to noise and vibration.
- Any complaints received will be thoroughly investigated.
- A written complaints log will be maintained by the Site Representative. This will, at a minimum, record complainant's details (where agreed) the date and time of the complaint, details of the complaint including where the effect was observed, corrective and preventative actions taken and any close-out communications. This will ensure that the concerns of local residents who may be affected by site activities are considered during the management of activities at the site.
- Specifically with regard to the access route construction potentially affecting NSRs to the southeast at the junction of the N65/L8763 the following measures apply:
  - Noise monitoring with capability for real-time review both on-site and remotely will be conducted at the boundary points when works are planned in close proximity.
  - In the event of meeting or exceedance of the threshold values at NSRs, works will be ceased and measures implemented immediately to ensure that the limits are complied with.
  - Temporary acoustic screening or hoarding will be placed along the boundaries where possible with the proposed access route and the nearest NSR; - NSR36.

As a general rule of thumb, it is recommended that temporary screening break the "line of sight" from the sources to the lower windows of the nearest NSRs where possible.

- The operation of certain pieces of equipment, where substitution, enclosure etc. cannot be carried out will be managed through monitoring and timing of use to ensure that noise levels remain below the threshold values/criteria specified.
- As a precautionary measure and as part of good practice, vibration monitoring will be carried out where works such as the use of rollers are in close proximity to NSR36 and other NSRs in the cluster located at the N65/L8763 junction.

- Measures such as the use of low noise plant and/or the use of enclosures will be chosen to minimise construction noise impact.
- During the construction phase all equipment will be required to comply with noise limits set out in EC Directive 2000/14/EC and the 2005/88/EC amendment on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors. The directive covers equipment such as compressors, welding generators, excavators, dozers, loaders and dump trucks.

6.7.2 Noise Monitoring

Noise monitoring will be undertaken to ensure compliance with required limits. Noise monitoring with capability for real-time review both on-site and remotely shall be conducted at nearby NSRs throughout site development and construction. Monitoring shall be conducted in accordance with any planning conditions which may be attached to a grant of permission. Additionally, a Type 1 portable noise meter will be available for use on site.

6.8 AIR

As part of the air quality control measure a Dust Management Plan (DMP) will be developed and implemented. The appointed contractor will carry out dust monitoring along the site perimeter to confirm that the dust levels do not exceed 350mg/m^2/day average over 30 days in accordance with TA LUFT VDI Method (Bergerhoff Gauge). Dust gauges will be put in place at a number of locations (6No.) and the samples analysed at an accredited laboratory.

Controls that will be in place on this contract are given in the table below.

Table 6.5 Air Quality Controls

Dust	A designated Site Agent will be assigned overall responsibility for Dust Management;
Dust	Implementation of the Construction and Environmental Management Plan.
Dust	The design of the site and Construction programme considers dust impact management and chooses design approaches to minimise dust emissions;
Dust and general air quality	An effective training programme for site personnel will be implemented for the duration of the Construction Programme;
Dust and general air quality	A strategy for ensuring effective communication with the local community will be developed and implemented;
Dust	A programme of dust minimisation and control measures will be implemented and regularly reviewed;
Dust	A monitoring programme will be implemented.
Dust	Activities with potential for significant emissions will wherever possible be located at a position as far as possible removed from the nearest residential and commercial receptors;
Dust	The areas on site which vehicles will be travelling on will generally be hard-surfaced or compressed ground thus significantly reducing the potential for dust emissions from the vehicles;
Dust	The construction compound areas will have hard standing areas to minimize dust generation from windblow.
Dust	In order to minimise the potential for wind-generated emissions from material storage bays, these bays will be oriented away from the dominant wind direction to minimise the effects of wind on release of dust and particulate.
Dust	Fixed and mobile water sprays will be used to control dust emissions from material stockpiles and road and yard surfaces as necessary in dry and/or windy weather.
Dust	A daily inspection programme will be formulated and implemented in order to ensure that dust control measures are inspected to verify effective operation and management.
Dust	A dust deposition monitoring programme will be implemented at the site boundaries for the duration of the construction phase in order to verify the continued compliance with relevant standards and limits.

Aspergillus Risks	The National Guidelines will be followed with regard to the effective management of Aspergillus risks.

In addition to the above, the Construction Site Manager shall enforce the following:

- Enforce appropriate an on-site speed limit on surfaced roads. Have sign posts indicating these speed limits.
- Turn off engines when not in use. If any plant or equipment is emitting black / heavy smoke, cease use and send for servicing
- No burning on site.
- Ensure vehicles do not queue at the site entrance.
- Provide wheel washing facilities at the entrance to the extension construction site lands to remove mud from haulage vehicles and to ensure mud is not transferred onto the surrounding road network (detergents will not be used and washes will incorporate appropriate containment systems).

6.9 WILDLIFE & ECOLOGY

There are no designated conservation areas within or close to the proposed development site. Control measures associated with the potential impact on water quality are dealt with under the Water Quality Section of the CEMP and are informed by the EIAR and NIS which were prepared in support of the planning applications for the proposed development.

6.9.1 Consents

No specific consents are required for the project works, but shall be reviewed as part of Contract CEMP preparation works.

6.9.2 Biodiversity Protection Measures

It is proposed to realign a portion of the Treananearla Stream within the site boundary. It is proposed that this is undertaken at the outset of development works in accordance with statutory obligations. It is proposed that the new channel is constructed initially and once complete the watercourse will be diverted.

Wildlife will be protected in accordance with the controls specified in the Environmental Handbook. Mitigation measures that will be in place on this contract are given in the table below.

Some tree felling and hedgerow removal is planned, as well as removal of species poor agricultural grassland and arable land. The realignment of the Treananearla Stream with

a new enhanced watercourse, together with the large area of new native woodland to be planted, as well as the new ponds and retained hedgerows will provide significant net gain of high quality habitat with improved connectivity for species in the wider landscape.

MITIGATION MEASURES FOR BATS

The current bat usage within the site is low as much of the site is open pasture and. The landscape plan will see a large quantity of woodland and tree planting providing more landscape features usable by bats. Treelines and woodlands to the north where an existing bat roost is located (outside the site) will be protected and enhanced, linking up other areas of the site. The addition of two ponds will allow for higher amounts of invertebrate prey for bats.

Tree felling

Trees will be felled in October to November or January to February. Any tree ranked category 1 or 2 will be examined 'at height' in order to ensure no bats are present.

Category 3 trees are defined as 'trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features which may have limited potential to support bats'. Also included within this category are trees with thick ivy however the ivy root is not thick enough to form mats, thus it is possible but unlikely a single bat may be roosting here. Following the precautionary approach all category 3 trees to be felled within the site the following procedure will be undertaken:

Tree-felling to be undertaken using heavy plant and chainsaw equipment. Normally trees are pushed over, with a need to excavate and sever roots in some cases. In order to ensure the optimum warning for any roosting bats that may still be present, the tree should be pushed lightly two to three times, with a pause of approximately 30 seconds between each nudge to allow bats to become active. The tree should then be pushed to the ground slowly. A period of at least 24 hours, and preferably 48 hours, should elapse prior to such operations to allow bats to escape. Felling works should be overseen by an ecological clerk of works.

All trees ranked category 4 can be felled and removed immediately.

Demolition of structures

A dwelling house and sheds located within the site were examined for bat roosts. None were found. As bats are a mobile species and can avail of roosting structure a pre-

demolition survey will be conducted on these structures. Should bats or their roosts be found a derogation license will be required before construction works begin.

Construction of new roost tower

A barn owl roosting tower is proposed within the site. This structure can also serve as a bat roost with a lower floor dedicated to roosting bats. Bat boxes will be installed within this lower section with a slot opening providing access into this room (15mm high by 40mm wide) positioned at a height of 2m.

MITIGATION MEASURES FOR BIRDS

Potential impacts on birds will be avoided by cutting of vegetation outside the bird nesting season March to August

In order to minimise the extent of light spill onto perimeter habitats, all lights that are pole mounted will be directional and/or cowled to ensure that light is directed downward and inwards. Lights will be programmed or otherwise to be off unless required.

An Ecological Clerk of Works will be involved in the construction and limit construction in areas based on when they are of value to birds, to avoid disturbance at vulnerable periods.

Planting of native tree species in linear features as well as woodland patches will provide ecological corridors, nest sites and will compensate for the loss of hedgerows as part of the development.

Sustainable Drainage Systems (SUDS) can also provide new still water habitats. As part of the design plan two attenuation pond on site will be designed to enhance biodiversity value with the provision of new wetland habitats. These new habitats will provide a breeding site for waterbirds such as Mallard, as well as a roost site for wintering waterbirds such as Teal, Widgeon or Lapwing.

The attenuation ponds will be created with gentle sloping side slopes that cover a large area, planted with a variety of suitable native wetland species.

A new roost tower for Barn owl and bats is to be constructed. This will provide enhanced roosting environment for species, including Barn swallow, House martin and Starling, which were observed to be using sheds on site, which are to be demolished as part of the development. Although no Barn Owls were seen on site, they are breeding within 1km of the site, and this purpose-built building will provide a suitable nest site for this species, as well as Kestrel and other roosting birds.

Table 6.6 Biodiversity

TASK	RESPONSIBILITY
General:	
Ensure all staff are aware of any conditions/ requirements attached to consents/ licences and of the controls detailed below.	Project Manager/ SHEQ Advisor
If any wildlife is found unexpectedly (e.g. reptiles, badgers or bats), contact your SHESQ Advisor.	All Staff
Implement controls as instructed by the SHEQ Advisor.	Project Manager/ Foreman
Nesting Birds:	
Check the site for nesting birds (including ground nesting birds). Make a record of this survey.	Project Manager/ Foreman
If any nesting birds are found, fence off the area and inform all staff of their location. Do NOT conduct works in this area.	Project Manager/ Foreman
Check trees for nesting birds before removing them or trimming any branches	All Staff
Do not disturb any nesting birds.	All Staff
When working near trees:	
Inform the SHEQ Advisor so that the council may be contacted to ensure there are no Tree Preservation Orders in the area.	Project Manager/ Foreman
Do not damage or interfere with any tree or hedge unless permission has been obtained from the Local Authority.	All Staff
Ensure where practicable young trees are relocated rather than removed	Project Manager/ Foreman
If trees that are suitable as bat roosts are to be removed arrange for inspection by a bat license holder.	Project Manager/ SHEQ Advisor/ Manager/
If bats are present obtain a derogation licence prior to felling and supervise the work.	Specialist/ SHEQ Advisor
Undertake any pruning, crown lifting or removal of trees at an appropriate time of year (i.e. outside the bird-breeding season, which is March to August). Employ specialist contractors to carry out all tree cutting/surgery.	Project Manager/ SHEQ Advisor/ All Staff
Only remove the minimum of branches to allow access.	All Staff
Where branches must be lopped, make a clean cut above a joint.	All Staff

TASK	RESPONSIBILITY
Ensure all site staff are briefed regarding the NJUG Guidelines on working in close proximity to trees and that the guidelines are implemented on site.	Project Manager/ SHEQ Advisor/ Manager/
Work as far away from the trees as possible. Where trees are in close proximity to the works set up protection zones around the trees to prevent damage to their branch and root system.	Project Manager/ Foreman
Ensure the tree protection zone is cordoned off and if possible is large enough to prevent access under the canopy of the tree.	Project Manager/ Foreman
Do not lean any materials up against tree trunks.	All Staff
If excavation under the canopy is required: • Hand-dig around tree roots • Retain as many roots as possible • If a root must be severed, make sure it is a clean cut • If roots are to be left exposed overnight cover with damp sacking	All Staff
Invasive Plants:	
No invasive species were identified as part of EIA survey works undertaken in support of the planning application. However, in accordance with best practice, invasive plant species is included as a task. *Invasive and Non-native Flora.* Japanese knotweed (*Fallopia japonica*) and Rhododendron (*Rhododendron ponticum*) have been recorded from within a 2km radius of the proposed development site, according to the NBDC data online. Should any of these plants be found in the general vicinity of the development site, please contact your SHEQ Advisor/ Manager for instructions on how to proceed.	Project Manager
If invasive plants are identified, contact specialist contractor to remove the plant off site in a safe manner in accordance with the relevant legal and other requirements.	SHEQ Advisor
Implement controls as instructed by the SHESQ Advisor/ Manager.	Project Manager/ Foreman

6.10 ARCHAEOLOGY AND HERITAGE

There are no previously recorded archaeological sites located within the proposed development lands and no adverse impacts are predicted upon the archaeological resource

as a result of the proposed development. No materials assets including features of architectural, archaeological or cultural heritage were identified in the planning applications (Refer to EIAR). There is no evidence that there are any material assets within the site. Archaeology and Heritage Protection Measures

6.10.1 Record of Protected Structures

Not Applicable

6.11 CONSTRUCTION SITE COMPOUND

The location of the Site Compound will be in the southern area of the site as shown in Figure 3.4. In addition to the main works compound, the amended development boundary incorporates an associated compound area along the temporary access corridor for welfare, laydown, parking and materials handling, together with two soil deposition / storage areas. These areas will be surfaced/managed to prevent tracking of mud onto public roads and to control runoff. Soil storage will be segregated by type (topsoil/subsoil), placed in stable stockpiles and protected to prevent erosion and sediment release. Stockpile locations will avoid encroachment on drainage lines and will maintain access for inspection and maintenance.

Table 6.7 Construction Site Compound Set Up

TASK	RESPONSIBILITY
Before site set up works begin photograph the condition of the site compound area (to help avoid erroneous claims after the works have been completed).	Project Manager/ Foreman
Provide perimeter fencing /hoarding at any location such that the environment in the area is not blighted by the construction site.	Project Manager
Provide signage with out of hours contact details.	Project Manager
Ensure that perimeter fencing /hoarding are regularly checked and kept free damage.	Foreman
Position site lighting to prevent intrusion /nuisance to neighbouring properties	Project Manager
Locate temporary site toilets/ waste skips away from site neighbours.	Project Manager
Ensure that the sites are kept clean, tidy and safe.	Project Manager
Store plant, equipment & materials at least 10m away from drains.	Project Manager/ Foreman

TASK	RESPONSIBILITY
Keep cabins/containers locked outside working hours	Foreman
Provide site drainage arrangements that comply with the requirements of any discharge consents	Project Manager/ Foreman
Prevent materials, waste, and dust from blowing around.	Foreman
Allocate a person to supervise all fuel deliveries.	Project Manager/ Foreman
Display a notice giving details of safe delivery and storage procedures.	SHEQ Advisor/ Manager
Supervise all deliveries at all times.	Nominated person
Check level in tank prior to delivery to prevent overfilling.	Nominated person
Check delivery before discharge to ensure the correct fuel is being delivered.	Nominated person
Ensure that valve on bunded tank is closed and kept locked when not in use	All staff
Only re-fuel in designated areas within the site compound, using drip trays.	All staff
Ensure that hose is kept within bund at all times	All staff
Never leave a vehicle/ plant unattended during re-fuelling.	All staff
Ensure any emergency vehicle maintenance is carried out using drip trays.	Fitters/ Foreman
Appoint a member of staff to be responsible for liaising with local groups	Project Manager
Consult with local resident groups about planned activities that may cause a nuisance, e.g. rock breaking, major deliveries etc.	Appointed person/Liaison Officer

6.12 UNAUTHORISED ACCESS CONTROL

Unauthorised access controls (temporary access route): To ensure the temporary access functions solely as a private construction access and does not attract public traffic through the new N65 junction or the staggered junction on the L8763, a layered package of controls will be implemented for the period the access is in place, including lockable gates/barriers at public-road interfaces, controlled entry procedures (including manned access control when gates are open), clear site rules and signage ("Construction Traffic Only / Site Access Only / No Public Access"), and integration with temporary traffic management in accordance with requirements for works affecting national and local roads.

6.13 EMERGENCY PREPAREDNESS/ENVIRONMENTAL INCIDENTS

An Emergency Response Plan (ERP) is presented in this section of the Preliminary CEMP. It provides details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

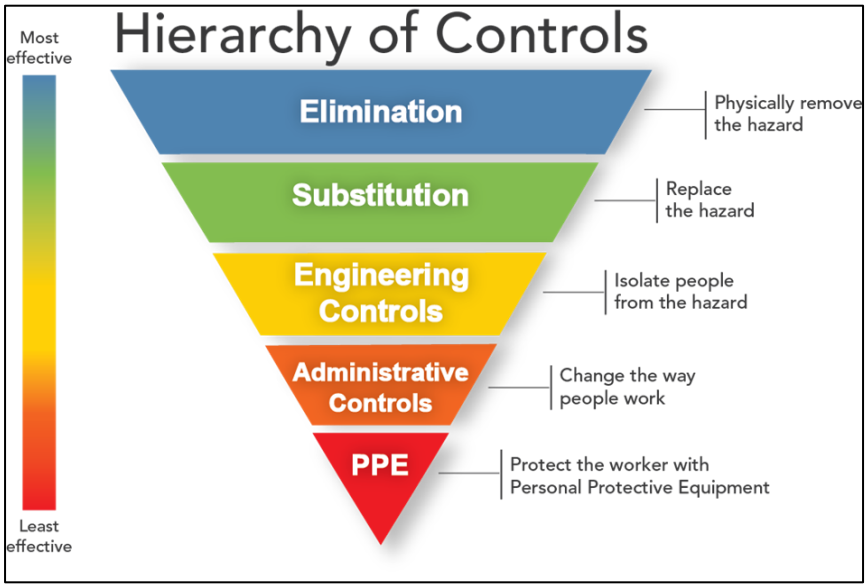
Environmental incidents have the potential to adversely affect the appointed contractor through potential prosecution, blight to a site, contractual issues, public relations issues, through to increased costs for clean-up / management fees and delays to the build programme. The reporting of environmental incidents is vital in order to ensure they are dealt with correctly, adverse effects negated or minimised and that valuable lessons are learnt. Where environmental incidents are reported, actions can be formally completed that ensure control measures are put in place to avoid any future recurrence on site and, where relevant, across the company as a whole.

Emergency response scenarios have been identified as part of the implementation of the IMS and the controls for prevention and management of these scenarios are documented in the "*Emergency Preparedness and Response Plan"*. The purpose of this plan is to identify the potential emergencies and the measures that are in place to prevent the emergency or procedure to follow should the emergency occur. Emergency scenarios include:

- Fire
- Gas Release
- Gas Explosion
- Major Spillage
- Minor Spillage
- Personnel Injury
- Adverse, Severe Weather Conditions
- Road Traffic Collision
- Mechanical Entrapment

For each scenario, actions and environmental controls are prescribed in accordance with the hierarchy of controls. The effectiveness of actions and controls are considered during internal audits, at monthly operations meetings, quarterly management meetings and at the Management Review.

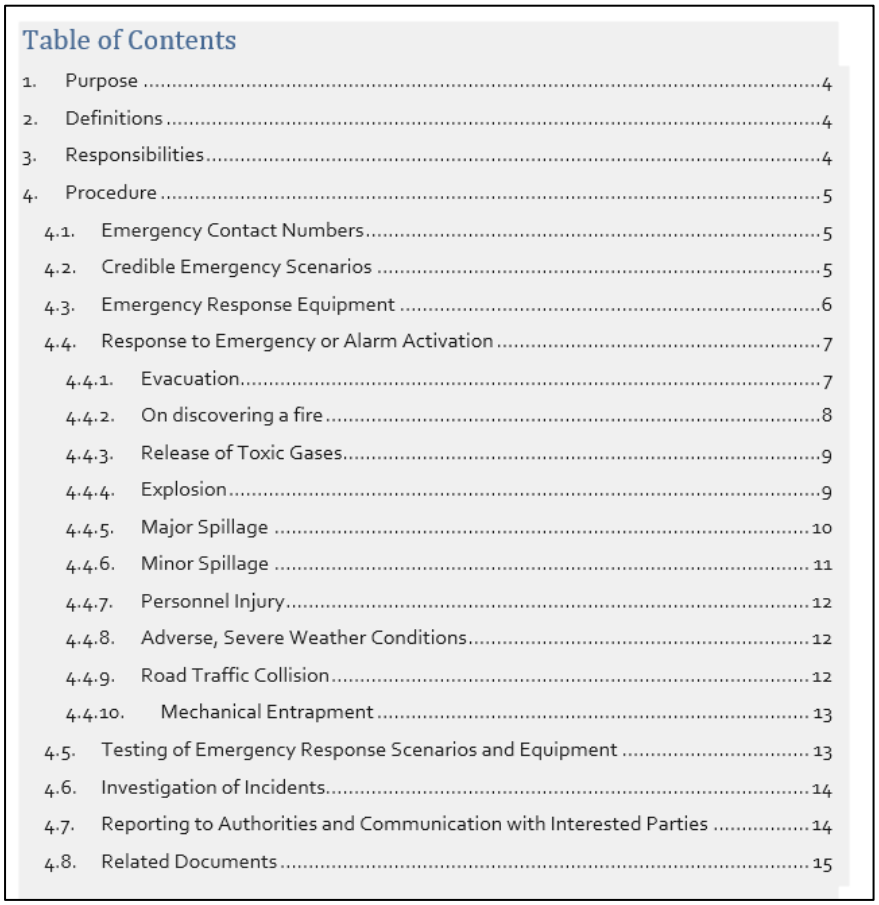
Figure 6.3 Hierarchy of Controls



It provides details of procedures to be adopted in the event of an emergency. The site ERP includes details on the response required and the responsibilities of all personnel in the event of an emergency. The ERP will require updating and submissions from the contractor/PSCS and suppliers as the project progresses. Where approved subcontractors on site are governed by their own emergency response procedure, a bridging arrangement will be adopted to allow for inclusion of the sub-contractor's ERP within this within this document. This is a working document that will requires updating and review throughout the various stages of the project.

The *Emergency Preparedness and Response Plan* contains the following detail which should be considered as part of finalisation of the development of the Outline CEMP to Contract CEMP:

Figure 6.4 Emergency Preparedness and Response Plan Contents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In relation to the proposed construction project, the Emergency and Preparedness Response Plan will include the following:

- Roles Responsibilities;
- Definitions;
- Pollution Prevention;
- Environmental Incident Action;
- Notification;
- Review and Reporting;
- Fire;
- Evacuation;
- Periodic Testing;
- Spill Kits.

6.13.1 Roles and Responsibilities

The chain of command during an emergency response sets out who is responsible for coordinating the response. The Construction Site Manager, will lead the emergency response which makes him/her responsible for activating and coordinating the emergency

response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response is the SHEQ manager. In a situation where the Site Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the SHEQ manager.

6.13.2 Initial Steps

In order to establish the type and scale of potential emergencies that may occur, the following hazards have been identified as being potential situations that may require an emergency response in the event of an occurrence.

Table 6.8 Hazards associated with emergency situations

Hazard	Emergency Situation
Construction Vehicles: Dump trucks, tractors, excavators, cranes etc	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/Portable Tools	Entanglement, amputation or electrical shock associated with portable tools
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services
Fire	Injury to operative through exposure to fire
Falls from heights including falls from scaffold towers, scissor lifts and ladders	Injury to operative after a fall from a height
Sickness	Illness unrelated to site activities of an operative e.g. heart attack, loss of consciousness, seizure

In the event of an emergency situation associated with, but not restricted to, the hazards outlined in the above table, the Site Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/fog horn that activates an emergency evacuation on the site.
- Make safe the area if possible and ensure that there is no identifiable risk exists with regard to dealing with the situation e.g. if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.

- Contact the required emergency services or delegate the task to someone if he is unable to do so. If delegating the task, ensure that they follow the procedures for contacting the emergency services.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g. cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g. ESB Networks, Galway County Council, Fire Brigade,
- Contact the next of kin of any injured personnel where appropriate.

6.13.3 Pollution Prevention;

The first priority is to prevent pollution occurring, in this regard, similar steps should be taken to managing the environment on site. In particular:

- Preplanning (e.g. Storage Bunding, Consent Licenses, Drainage Plan)
- Hazard identification and risk assessment
- Protective and preventative pollution measures incorporated in to the Environmental Management Plan (EMP), Method Statements and systems of work.
- Emergency planning e.g. procedures, spill kits etc.
- Information, instruction and training
- Inspection, supervision
- Performance auditing
- Review

6.13.4 Environmental Incidents /Non-Conformances

For the purposes of the CEMP, environmental incidents/ non-conformances are defined as follows:

- **Environmental Incident:** a failure to implement adequate environmental controls that has resulted in pollution of water, air or land, damage to wildlife and ecosystems (habitats) or nuisance to a local community.
- **Environmental Near Miss:** something that occurs that has the potential to cause an environmental incident but didn't.
- **Environmental Non-conformance:** a failure to implement environmental controls associated with planning conditions.
- **Complaint:** A significant grievance, dissatisfaction or accusation made by a client, member of the public or other third party relating to activities being completed by the appointed contractor

6.13.4.1 Types of Environmental Incident

To help with trend analysis incidents should be classified according to the type of incident. Incidents can usually be classified under one of the ten types listed below. However, this is not a definitive list and a different classification can be used if the incident does not fit within one of these.

- Air
- Archaeology & Heritage
- Contaminated Land
- Ecology
- Groundwater
- Noise & Vibration
- Oils & Chemicals
- Surface Water
- Traffic
- Waste

6.13.5 Notification

6.13.5.1 Response to an incident or imminent threat of an incident

All employees will be instructed to bring any environmental incidents they identify to the immediate attention of the Project /Site Manager, after first taking what steps they can to contain/ remediate the incident (without putting the health and safety of themselves or others at risk). If appropriate/ necessary the Project Manager/ SHEQ Manager will also inform the Client/ Statutory Authorities and liaise with their personnel in investigations, assessments and the implementation of appropriate corrective and preventive actions. Incident reports shall be completed within 1 day of occurrence. investigations shall be closed out within two weeks of occurrence. For more severe incidents, a full investigation report shall be carried out.

6.13.5.2 Emergency Communications Procedure

In the event of requiring the assistance of the emergency services the following steps should be taken:

- Stay calm. It's important to take a deep breath and not get excited. Any situation that requires 999/112 is, by definition, is an emergency. The dispatcher or call-taker knows that and will try to move things along quickly, but under control.
- Know the location of the emergency and the number you are calling from. This may be asked and answered a couple of times but don't get frustrated. Even though many emergency call centres have enhanced capabilities meaning they are able to

see your location on the computer screen they are still required to confirm the information. If for any reason you are disconnected, at least emergency crews will know where to go and how to call you back.

- Wait for the call-taker to ask questions, then answer clearly and calmly. If you are in danger of assault, the dispatcher or call-taker will still need you to answer quietly, mostly "yes" and "no" questions.
- If you reach a recording, listen to what it says. If the recording says your call cannot be completed, hang up and try again. If the recording says all call takers are busy, WAIT. When the next call-taker or dispatcher is available to take the call, it will transfer you.
- Let the call-taker guide the conversation. He or she is typing the information into a computer and may seem to be taking forever. There's a good chance, however, that emergency services are already being sent while you are still on the line.
- Follow all directions. In some cases, the call-taker will give you directions. Listen carefully, follow each step exactly and ask for clarification if you don't understand.
- Keep your eyes open. You may be asked to describe victims, suspects, vehicles, or other parts of the scene.
- Do not hang up the call until directed to do so by the call taker.

Table 6.9 Emergency Contacts List

Contact	Telephone No.
Emergency Services – Ambulance, Fire, Gardaí	To be completed
EPA Regional Inspectorate Castlebar	To be completed
Gardaí (Local)	To be completed
Gardai (Galway)	To be completed
Galway Fire Brigade	To be completed
Galway University Hospital	To be completed
Environmental Protection Agency	To be completed
Health & Safety Authority	To be completed
Eirgrid	To be completed
ESB Networks	To be completed
Galway County Council	To be completed
Inland Fisheries	To be completed
Other	

6.13.5.3 Reporting of Accidents and Dangerous Occurrences

Health and Safety Authority

Accidents and dangerous occurrences must be reported to the HSA in accordance with the Safety, Health and Welfare at Work (Reporting of Accidents and Dangerous Occurrences) Regulations 2016 (S.I. No. 370 of 2016).

The key points in relation to reporting of accidents and dangerous occurrences are:

- Only fatal and non-fatal injuries are reportable. Diseases, occupational illnesses or any impairments of mental condition are not reportable.
- Fatal accidents must be reported immediately to the Authority or Gardaí. Subsequently, the formal report should be submitted to the Authority within five working days of the death.
- Injuries to any employee as a result of an accident while at work where the injury results in the employee being unable to carry out their normal work duties for more than three consecutive days, excluding the day of the accident, must be reported to the Authority.
- Non-fatal accidents or dangerous occurrences should be reported to the Authority within ten working days of the event.
- Accidents to a person who is not your employee and is not at work but is injured by a work activity resulting in the person being taken to a hospital or medical facility must be reported.

A 'dangerous occurrence' means an occurrence arising from work activities in a place of work that causes or results in –

- The collapse, overturning, failure, explosion, bursting, electrical short circuit discharge or overload, or malfunction of any work equipment,
- The collapse or partial collapse of any building or structure under construction or in use as a place of work,
- The uncontrolled or accidental release, the escape or the ignition of any substance,
- A fire involving any substance, or
- Any unintentional ignition or explosion of explosives, as may be prescribed.

The prescribed dangerous occurrences which must be reported to the Authority are listed in Schedule 15 of Safety, Health and Welfare at Work (Reporting of Accidents and Dangerous Occurrences) Regulations 2016 (S.I. No. 370 of 2016)

6.13.6 Review and Reporting

The cause of any incident shall be determined by those involved when the incident or emergency occurred and those involved in the clean-up procedure. The appropriate corrective actions shall be implemented as soon as possible on detection of the incident. All incidents must be reported and documented on a site register. Where there has been direct damage to the environment it may be necessary to report this to the Regulator (e.g. Environmental Protection Agency /Local Authority). If direct damage has occurred the Construction Site Manager shall also be informed as soon as an incident has occurred.

6.13.7 Site Evacuation /Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or fog horn to notify all personnel of an emergency situation.
- An assembly point will be designated in construction compound areas and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Manager to account for all personnel on site.
- Once all personnel have been accounted for the Site Manager will decide the next course of action which be determined by the situation that exists at that time. The Site Manager will advise all personnel accordingly. All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills. Cognisance, integration and knowledge of emergency procedures associated with the existing biogas plant will be undertaken as part of Contract CEMP development works.

6.13.8 Periodic Testing

It is the responsibility of the Construction Site Manager or nominated SHEQ advisor to ensure that the emergency procedure is periodically tested to ensure it is effective. Frequency for testing should be determined by the level of risk for a particular project, however, it is recommended that this be carried out at least once every six months or once during the project lifetime where project duration is less than one year.

The test should be logged as good practice. The test should be reviewed to determine the effectiveness of the procedure and the need to amend the requirements if necessary.

6.13.9 Spill Kits

Sufficient types and quantities of spill response equipment should be available on site and should be kept where spills may occur. The quantity of spill response equipment should be sufficient to contain any likely spill that may occur on site. Types of spill equipment suitable for containing spills arising from different types of pollutants are provided below:

Table 6.10 Spill Kit Types

	Pollutants				
Spill on Ground	**Concrete Cement**	**Paints**	**Oils**	**Silt**	**Detergents**
Sand	✔	✔	✔	✗	✔
Straw Bales	✗	✗	✔	✔	✗

APPENDICES

APPENDIX A

Construction and Demolition Resource Waste Management Plan

Construction and Demolition Resource Waste Management Plan

Introduction

The purpose of this C&D RWMP is to ensure that waste arisings during the construction and demolition phase will be managed and disposed of in a way that ensures the provisions of the Waste Management Act 1996 as amended, and associated regulations, and the Connacht and Ulster Waste Management Plan 2015-2021 2021 are complied with. It will also ensure that optimum levels of waste reduction, re-use and recycling are achieved.

The following matrix[4] (Table 1) was developed by Halston and is used to provide indicative construction and demolition (C&D) waste management complexity scoring. The matrix uses six key metrics to assess how likely the project is to require a high level of regulatory attention and the level of detail which should be contained in the C&D WMP. The overall score for the project is calculated by adding the individual score for each of the metrics. The level of detail which should be contained in the C&D WMP is appropriate to the rating of the site:

- No requirement for C&D WMP's are those with score of up to 6
- Standard C&D WMP's are those with score of 7 -15
- Detailed C&D WMP's are those with a score of >15

Table 1 Matrix to Estimate Site C&D WMP Complexity

Metric		Score 1	Score 2	Score 3	Score 4
1	Do works involve infrastructural demolition works and /or is there potential ground contamination	Greenfield – undeveloped site	Existing buildings on site –non-industrial /commercial use or agricultural	Former light Industrial brownfield Use – potential for ground contamination	Former heavy industrial brownfield site with known ground contamination
2	Site Setting and Environmental Sensitivity including invasive species	Low	Medium	High	Very High

[4] Matrix adapted from WG (Welsh Government), 2013. Waste (Wales) Measure 2010: Site Waste Management Plans Consultation Document and consideration of Irish Waste Regulations and Best Practice Guidance

Metric		Score 1	Score 2	Score 3	Score 4
3	Duration of Construction Phase	<3 months	3-12 months	12 months – 2 years	>2 years
4	Expected Volume of Waste (export)	<100m^3	100-500m^3	500 – 1,000m^3	>1,000m^3
5	Floor Area	<125m^2	125-1,250m^2	>1,250m^2	
6	Estimated Cost of Project	<€300,000	€300,000 – €1,000,000	€1,000,000 – €10,000,000	>€10,000,000

Table 2 Matrix Score Assigned to Project

Metric	Answer	Score	Overall Score
Do works involve infrastructural demolition works and /or is there potential ground contamination	Yes, ground contamination unlikely.	2	16 (Detailed C&D WMP)
Site Setting and Environmental Sensitivity	Low	1	
Duration of Construction Phase	28 months	4	
Expected Volume of Waste (export off-site)	<100m^3	1	
Floor Area	>1,250m^2	4	
Estimated Cost of Project	>10M -	4	

As can be seen in Table 2, the proposed development characteristics resulted in a score of 16; a detailed C&D WMP requirement. Outline details in respect of this is provided below.

Waste Classification

The EPA and the Connacht and Ulster Waste Management Plan 2015-2021 2021 defines Construction and Demolition (C&D) waste as *"...all waste that arises from construction and demolition activities including excavated soil from contaminated sites....listed in Chapter 17 of the European Waste Catalogue (EWC)[5][6].*

If demolition waste is generated as part of the proposed development works it will involve careful decommission and removal of all plant and structures at the site (to provide for extension to the feedstock reception building and office building).

[5] Ref EPA Waste Classification – List of Waste & Determining if Waste is Hazardous or Non-Hazardous. EWC codes referred to as LoW codes
[6] It is worth noting, however, that the C&D W stream can overlap into other EWC chapters (Chapters 8, 15 and 20)

Other anticipated wastes which will be generated on site include soils, blocks; concrete and reinforced concrete; timber; metal sheeting, steel, bituminous materials such as bitumen macadam and asphalt; paving slabs; kerbs; used shuttering; scrap metal, scrap pipes and other plastics; canteen and office waste; lubricating oil, hydraulic oil, scrap parts and other fluids generated from equipment maintenance; sewage from construction phase site toilets. The expected primary non-hazardous and hazardous waste streams that will be generated during construction activities are classified in accordance with the European Waste Catalogue in Table 3 below.

Table 3 EWC Classification of Wastes

Waste Description	EWC Code
Waste plastics	02 01 04
Soil and Stone	17 05 04
Concrete	17 05 07
Wood	17 02 01
Bituminous mixtures	17 03 02
Gypsum	17 08 02
Iron and steel	17 04 05
Insulation materials	17 06 04
Mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03	17 09 04
Canteen waste	20 03 01

Construction Site Waste Management

Roles and Responsibilities

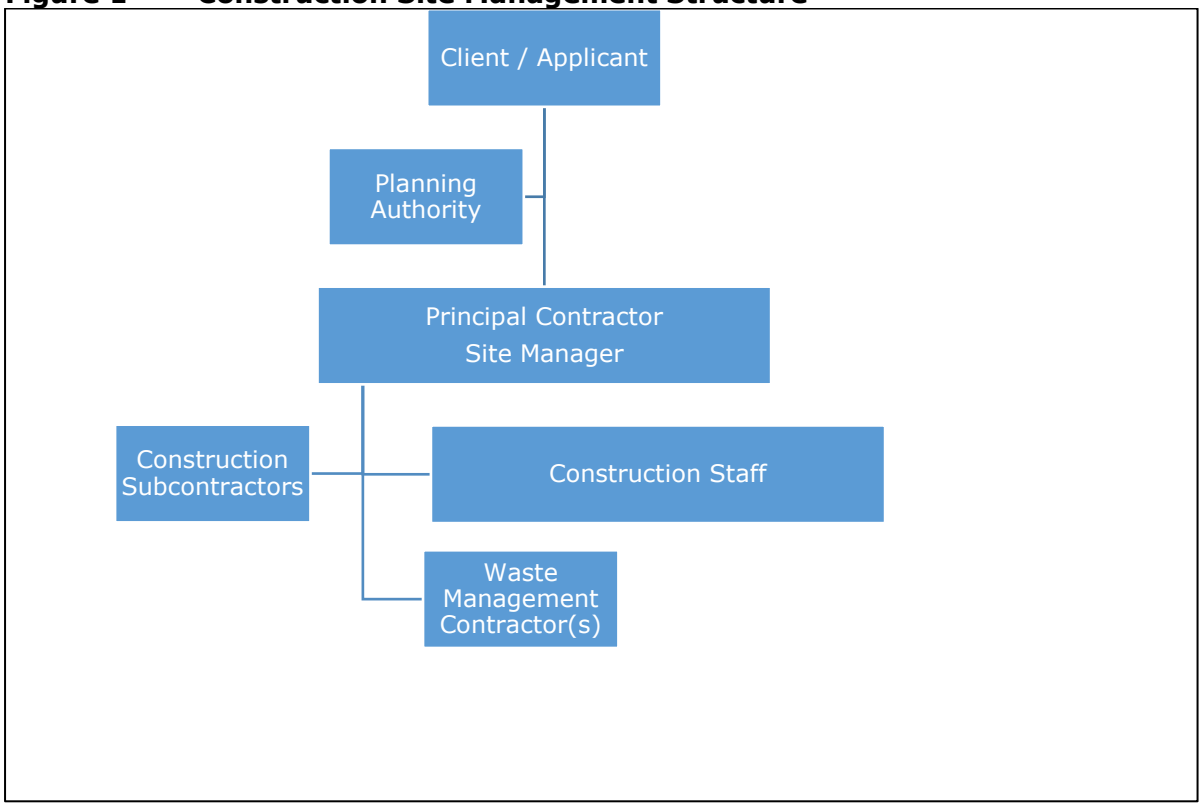
Both the applicant and principal contractor have roles and responsibilities in relation to the C&D WMP. The Appointed Contractor will be responsible for most aspects of the Construction Waste from the date of the contract.

The Site Construction Manager will be designated as the Responsible Person and have overall responsibility for the implementation of the on-site C&D WMP. The site manager will be assigned the authority to instruct all site personnel to comply with the specific provisions of the C&D WMP. At the operational level, a nominated Environmental Representative from each sub-contractor company on the site will be assigned the direct responsibility to ensure that the discrete operations stated in the overall construction plan are performed on an on-going basis. Figure 1 below provides a management structure for the construction site.

Table 4 Roles and Responsibilities

Description of Duty	Client	Principal Contractor
Ensure that from the start of the Project, an approach to waste management is taken that complies with all relevant waste regulations Produce and submit a C&D WMP that meets Galway Co. Co. requirements and industry guidance	✓	
Give reasonable directions to any contractor so far as is necessary to enable the Principal Contractor to comply with his duties under these Regulations.	✓	✓
Make and maintain arrangements to record waste arisings within the Project.		✓
Communicate the C&D WMP to all those affected by it, including workers on site and any subcontractors, and undertake monitoring checks to ensure that it is implemented.		✓
Receive and record waste carrier registration details and waste transfer notes in the C&D WMP to ensure that waste removed from the site is transferred to the prescribed destination and is managed in accordance with applicable waste management legislation		✓
Ensure so far as is reasonably practicable that every worker carrying out the construction work is provided with (i) suitable site induction; and (ii) any further information and training which the worker needs for the particular work to be carried out within the terms of the C&D WMP		✓
View, revise and update the C&D WMP as and when necessary, ensuring that any changes in roles and responsibilities are clearly communicated to those affected	✓	✓
Take reasonable steps to ensure that sufficient site security measures are put in place at the site to prevent any illegal disposal of waste	✓	✓
Inform the Client on the requirements of a construction waste management plan to ensure that Client is aware of obligations to meet under regulations (applies to Principal Contractors where appointed)		✓

Figure 1 Construction Site Management Structure



Designated skips and receptacles will be provided on site for all recyclable wastes. The appointed waste contractor will collect and transfer the recyclable wastes as skips are filled. The non-recyclable waste will be transferred by an authorised waste collector to licensed facilities (e.g. canteen waste, general waste). Numerous licensed waste contractors are available in the area and will be obtained from the waste management authority listing.

A successful C&D WMP is largely dependent on how readily it can be integrated in to normal site operations by site manager. The C&D WMP will be implemented to compliment site construction activities and will be promoted by raising awareness and its importance via site inductions, site training, toolbox talks, etc.

Demolition Waste Generation

The majority of the C&D waste will be clean, inert material and it is proposed to reuse it for construction purposes where possible. The existing house farm outbuilding, farm will be demolished and removed from site in accordance with best practice. Works will involve careful decommission and removal of all farm structures at the site. Anticipated wastes which will be generated include soils, bricks and blocks; concrete and reinforced concrete; timber; metal sheeting and steel. Materials arising from this process will be recycled /disposed of at authorised waste management facilities.

Construction Waste Generation

During construction activities, it is expected that construction waste will be produced from surplus materials such as broken or off-cuts of timber, plasterboard, concrete, glass, packaging waste, steel etc.

Soils, Subsoils and Bedrock

A key aspect in the design stage of the project was to aim to eliminate the off-site disposal of excavated materials wherever possible and to reduce the potential for landscape and visual effects.

Construction activities during the construction phase have the potential to release contaminants to the surface waters via drainage channels, specifically silt /sediment, concrete /grouting materials, foul effluent and oils. However, these impacts can be controlled and mitigated and considered as imperceptible negative temporary impacts on the basis that construction mitigation measures are carried out as outlined below.

- Prior to commencement of construction, the outline CEMP will be further development and submitted to the planning authority for agreement.
- Planned construction works will be carried out with the least feasible disturbance of soils. It is proposed that no excavated soil materials (spoil) will be exported off site and will be near boundaries (particularly to the north). Soil stripping and site levelling works will be confined to the site itself. Low lying areas of the site will be filled and levelled with the spoil material. Timetabling of vegetation removal, topsoil stripping and the development of earthworks on-site will fully consider seasonal, ecological and hydrological constraints.
- An accident management plan will be developed to provide spill response procedures, emergency contact details in addition to equipment inventories and their location. All staff will be made aware of this document, and its content, during site induction and it will be available in the site office. Staff will be trained in the implementation of the Plan and the use of any spill control equipment as necessary.
- A drainage plan will be prepared for the construction programme and showing proposed sediment traps and monitoring /discharge control points. The plan will include use of settlement features and traps.
- Concrete will be mixed off–site and imported to the site. The pouring of concrete will take place within a designated area to prevent concrete runoff into the soil / groundwater media.
- Wash down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

- Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the project site, and the proper use, storage and disposal of many substances used on construction sites, such as lubricants, fuels and oils and their containers can prevent soil contamination.
- Pollution of aquatic systems during the construction phase will be reduced by the implementation of the following best practice mitigation measures. Due cognisance is paid to the following guidance documents for construction work on or near water;
    - IFI (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters - Guidance for consultants and contractors;
    - CIRIA (2004) – Guideline Document C697 The SUDS Manual;
    - CIRIA (2004)– Guideline Document C624 Development and flood risk - guidance for the construction industry;
    - CIRIA (2006) Control of water pollution from linear construction projects. Site guide;
    - SEPA (2010) Engineering in the water environment good practice guide sediment management;
    - SEPA (2009) Engineering in the Water Environment Good Practice Guide: Temporary Construction Methods; and,
    - SEPA (2017) Works and maintenance in or near water. GPP 5.
- All chemical and fuel fill points and hoses will be contained within bunded areas. Adequate protection measures will be put in place to ensure that all hydrocarbons used during the construction phase are appropriately handled, stored and disposed of in accordance with recognised standards as prescribed out by the EPA.
- Foul drainage from all site offices and construction facilities will be contained and disposed of in an appropriate manner to prevent pollution of local watercourses in accordance with the relevant statutory regulations.
- Routine monitoring of water quality will be carried out at appropriate locations during construction. Parameters to be monitored should include pH, total suspended solids, BOD and COD.

It is not expected that any contaminated material will be encountered during the construction works due to the history of the site (greenfield). However, in this unlikely instance, the material will be segregated, classified and suitably disposed of under waste permit to a waste licensed facility following notification to the Council. This highly unlikely event would increase the off-site disposal rates.

Plastic

As plastic is now considered a highly recyclable material, much of the plastic generated during construction will be diverted from landfill and recycled. The plastic will be segregated at source and kept as clean as possible and stored in a dedicated skip.

Timber /Wood

There will be timber waste generated from the construction work as off-cuts or damaged pieces of timber from building construction. Timber that is uncontaminated (free from paints, preservatives, glues etc.) will be recycled. Again, designated signed areas will be used for segregation and collection on site. A permitted contractor will be used to transfer the material to a waste licensed facility for recovery /recycling (e.g. energy use, wood chips, etc.).

Scrap Metal

Steel is a highly recyclable material and there are numerous companies that will accept waste steel and other scrap metals. A segregated skip will be available for steel/metal storage on-site pending recycling.

Cardboard Packaging

Cardboard packaging will be flattered and placed in a covered skip to prevent it getting wet prior to its recovery off site.

Plasterboard

Waste gypsum can be recycled into new plasterboard. A skip will be provided for the separate collection of waste plasterboard and collected as necessary.

Hazardous Wastes

On-site storage of any hazardous wastes produced will be minimised with off-site removal organised on a regular basis. Appropriate storage of all hazardous wastes on-site will be undertaken including bunding of fuels, lubricants etc. to minimise exposure and risk to human beings and environmental receptors. Segregated hazardous wastes (such as waste oils) will be recovered wherever possible and failing this, disposed of appropriately.

Canteen and General Waste

Regular housekeeping of the temporary canteen/W/C areas will be carried out. Removal of domestic waste from the construction compounds will be carried out by a permitted

waste contractor. Any temporary W/C utilities used on site during the construction phase will be maintained by an approved and permitted contractor.

There will be a general skip or receptacle for C&D waste not suitable for reuse or recovery. This skip will include general wet waste (mixed food waste and food packaging), contaminated cardboard, contaminated plastic etc. Workers on the site will be encouraged to recycle as much municipal waste as possible and segregated bins will be provided. Prior to removal, the municipal waste receptacle will be examined to confirm not cross contamination has occurred.

Tracking and Documentation

The site manager will maintain a copy of all waste collection permits in the construction site office. A record of all imported material (such as clean fill material such as broken rock, clause 804 gravel, etc.) will also be kept on file. If waste is being transported to another site, a copy of the waste permit or EPA waste licence will be kept on file at the site construction office. It is not expected that any waste will be produced on site that will require transfrontier shipping documentation (TFS). If this instance arises, this will be arranged via the national competent authority; Dublin City Council is designated as the National Competent Authority for the export, import and transit of waste shipments under S.I. No. 419 of 2007 Waste Management (Shipments of Waste) Regulations, 2007.

Estimated Cost of Waste Management

The cost associated with waste management for the site will be further developed and incorporated into the CEMP (containing Construction Waste Management Plan) by the construction site manager once construction contracts have been put in place and appointments made. Estimated waste totals will initially be calculated during costing of the project and these will be comparted against actual waste total as construction on the project progresses. The CEMP will be updated with this information when available will be inputted to the CEMP and a summary overview will be available.

Training of construction staff in relation to the CEMP will be the responsibility of the site manager. A copy of the CEMP will be made available to all personnel on site. All site personnel and sub-contractors will be instructed about the objectives of the CEMP and informed of the responsibilities which fall upon them as a consequence of its provisions. Where source segregation, selective demolition and material reuse techniques apply, each member of staff will be given instructions on how to comply with the CEMP. Signage will be designed to reinforce the key messages within the CEMP and will be displayed prominently for the benefit of site staff.

Record Keeping and Waste Audits

Records will be kept for each waste material which leaves the site, wither for reuse on another site, recovery, recycling or disposal. A system will be put in place to record the construction waste arising on-site.

The waste manager or delegate will record the following:

- Waste taken off-site for reuse.
- Waste taken off-site for recovery.
- Waste taken off-site for recycling.
- Waste taken off-site for disposal.
- Waste (soil & stone) accepted on-site for recovery.

For each movement of waste off-site, a signed waste collection docket will be obtained by the waste manager (or delegate) from the contractor. This will be carried out for each material type. This system will also be linked with the delivery records. A signed waste acceptance docket will be issued for each movement of waste on-site.

Waste Audits

The site manager will be responsible for conducting waste audits at the site during the construction of the development. The site manager will arrange for full details of all arisings, movements and treatment of construction and demolition waste discards to be recorded during the construction stage of the project. Each consignment of C&D waste taken from the site will be subject to documentation to ensure full traceability of the material to its final destination.

Review of Records and Identification of Corrective Actions

A review of all the records for the waste generated and transported off-site, as well as waste accepted, will be undertaken mid-way through the C&D phase. If waste movements are not accounted for, the reasons for this will be established in order to see if and why the record keeping system has not been maintained. Each material type will be examined in order to see where the largest percentage waste generation is occurring. The waste management methods for each material type will be reviewed in order to highlight how the waste reduction targets can be achieved. Waste management costs will also be reviewed.

Consultation with Relevant Authorities

The site manager will consult and respond to any planning requirements of Galway County Council during the construction phase of the project. The Council will also be consulted to discuss all available all available waste reduction, re-use and recycling opportunities are identified and utilised.

Post-Construction

Within three months of all construction works being completed, a final version of the CEMP (including construction waste management plan) will be completed and made available to the planning authority for inspection. The report will summarise the outcomes of waste management processes adopted and the total recycling/reuse/recovery figures for the development.

APPENDIX 2.4

INFILTRATION CALCULATIONS

– ALTERNATIVE CONSTRUCTION ACCESS ROAD

Alternative Construction Access Roads - Infiltration Trench							
Duration (D)	Rainfall (R)	Impermeable Area (A)	Soil Infiltration Rate (f)	Soakaway Surface Area (a_{s50})	Inflow (I)	Outflow (O)	S Required +20%
Mins	mm	m²	m/sec	m²	m³	m³	m³
5.00	11.70	350.00	2.00E-05	28.79	4.10	0.17	4.71
10.00	16.20	350.00	2.00E-05	28.79	5.67	0.35	6.39
15.00	19.10	350.00	2.00E-05	28.79	6.69	0.52	7.40
30.00	23.00	350.00	2.00E-05	28.79	8.05	1.04	8.42
60.00	27.70	350.00	2.00E-05	28.79	9.70	2.07	9.15
120.00	33.40	350.00	2.00E-05	28.79	11.69	4.15	9.05
180.00	37.30	350.00	2.00E-05	28.79	13.06	6.22	8.20
240.00	40.30	350.00	2.00E-05	28.79	14.11	8.29	6.98
360.00	45.00	350.00	2.00E-05	28.79	15.75	12.44	3.98
540.00	50.10	350.00	2.00E-05	28.79	17.54	18.65	-1.34
720.00	54.20	350.00	2.00E-05	28.79	18.97	24.87	-7.08
1080.00	60.40	350.00	2.00E-05	28.79	21.14	37.31	-19.40
1440.00	65.30	350.00	2.00E-05	28.79	22.86	49.75	-32.27
2880.00	78.40	350.00	2.00E-05	28.79	27.44	99.49	-86.46
4320.00	89.60	350.00	2.00E-05	28.79	31.36	149.24	-141.45
5760.00	99.60	350.00	2.00E-05	28.79	34.86	198.98	-196.95

Infiltration Trench Details	
Width (m)	0.60
Depth (m)	0.48
Length (m)	100.00
Voids (%)	33.00
a_{s50} (m^2)	28.79
$S_{Required}$ (m^3)	9.15
$S_{Provided}$ (m^3)	9.50
t_{s50} (hours)	2.29

APPENDIX 7.1

GROUND INVESTIGATION REPORT

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
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D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

Ground Investigations Ireland

Coolpowra Galway

Lumcloon Energy

Ground Investigation Report

December 2024

Directors:
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DOCUMENT CONTROL SHEET

Project Title	Coolpowra Galway
Engineer	Kilgallen and Partners Consulting Engineers
Client	Lumcloon Energy
Project No	13999-07-24
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	J Cashen	C Finnerty	F McNamara	Dublin	15 October 2024
B	Final	J Cashen	C Finnerty	F McNamara	Dublin	09 December 2024

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1.0 Preamble

On the instructions of Lumcloon Energy, a site investigation was carried out by Ground Investigations Ireland Ltd. (GII) between September and October 2024 at the site of the proposed power station in townlands of Coolpowra, Gortlusky and Ballyboggan, County Galway.

2.0 Overview

2.1. Background

A new Open Cycle Gas Turbine Power Plant and associated structures are proposed next to the existing Oldstreet Substation in townlands of Coolpowra, Gortlusky and Ballyboggan, County Galway. At the time of the site investigation the site consisted of grassed and arable farmland. The site is situated 5.5km north of Portumna, County Galway.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 48 No. Trial Pits to a maximum depth of 3.00m BGL
- Carry out 10 No. Soakaways to determine a soil infiltration value to BRE Digest 365
- Carry out 42 No. Dynamic Probes to determine soil strength/density characteristics
- Carry out 7 No. Rotary Core Boreholes to a maximum depth of 10.70m BGL
- Carry out 12 No. Plate bearing tests to determine the modulus of subgrade reaction and equivalent CBR values
- Geophysical Survey
- Installation of 6 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing were undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015+A1:2020.

3.2. Trial Pits

The trial pits were excavated using a 13 tonne tracked excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered, and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 3 of this Report.

3.4. Dynamic Probing (DPH)

The dynamic probe tests (DPH) were carried out at the locations shown in the location plan in Appendix 1 in accordance with B.S. 1377: Part 9 1990. The test consists of mechanically driving a 43.7mm diameter cone with an apex angle of 90° using a 50kg weight in 100mm intervals and monitoring the number of blows required. An equivalent Standard Penetration Test (SPT) 'N' value may be calculated by dividing the total number of blows over a 300mm drive length by 1.5. The dynamic probe logs are provided in Appendix 4 of this Report.

3.5. Rotary Boreholes

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface.
The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the "overshoot" recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or

water flush is passed from the surface through hollow drill rods to the drill bit and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids. It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 5 of this Report.

3.6. In-situ Plate Bearing Test

The plate bearing tests were carried out using a 457mm diameter plate at the locations shown on the site plan in Appendix 1. The plate was loaded in increments using a hydraulic jack and an excavator to provide a reaction and the displacement was monitored in accordance with BS1377 Part 9 using independently mounted digital strain gauges. The constrained modulus and equivalent CBR are calculated in accordance with HD29/75 and are provided on the test reports in Appendix 6 of this Report.

3.7. Surveying

The exploratory hole locations have been recorded using a KQGeo M8 GNSS System which records the coordinates and elevation of the locations to Irish Transverse Mercator (ITM) as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.8. Groundwater Monitoring Installations

Groundwater Monitoring Installations were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.
The results of the groundwater monitoring are included in Appendix 7 of this Report.

3.9. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Environmental & Chemical testing as required by the specification, including the Rilta Suite, pH and sulphate testing was carried out by Element Materials Technology Laboratory in the United Kingdom (UK). The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria.

Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), hydrometer, California Bearing Ratio (CBR), Moisture Condition Value (MCV), 2.5kg Compaction and 3-point thermal resistivity tests were carried out by Professional Soils Laboratory (PSL) in the UK.
Rock strength testing including Point Load (Is_{50}) and Unconfined Compressive Strength (UCS) testing was carried out by Geotechnical and Soil Testing Services Ltd in Moynalty, County Meath.
The results of the laboratory testing are included in Appendix 8 of this Report.

3.10. Geophysical Survey

A geophysical survey was carried out by Apex Geophysics at the proposed site. The survey consisted of a collection of Seismic Refraction profiles, 2D resistivity profiles and Electromagnetic Conductivity readings. The survey findings were calibrated using the intrusive site investigation data collected as part of the overarching ground investigation. The Geophysical Survey Report is included in Appendix 9 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to in-situ and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were variable across the site but generally comprised;

- Topsoil
- Made Ground (TP-07, TP-08, and TP-14)
- Peat (TP-18 only)
- Cohesive Deposits
- Granular Deposits
- Weathered Bedrock
- Bedrock

TOPSOIL: Topsoil was encountered most exploratory holes and was present to a maximum depth of 0.30m BGL.

MADE GROUND: Made Ground deposits were encountered from ground level in TP-07 and TP-14, and beneath the Topsoil in TP-08 and were present to a depth of 1.20m to 2.80m BGL. The full extent of the made ground deposit may not have been determined at TP-14, as the trial pit was terminated on presumed boulders at a depth of TP-14. These deposits were described generally as *brown / greyish brown / grey slightly sandy gravelly Clay with low cobble and boulder content* and contained *rare fragments of ceramic, timber, bale netting and plastic.* A strong organic odour was noted in made ground deposits at TP-08 from

0.50m to 1.60m BGL, and at TP-14 from 1.20m to 2.80m BGL. At several locations, rare anthropogenic fragments were noted in the topsoil layer where the layer had likely been turned for agricultural purposes.

PEAT: A peat deposit was encountered in TP-18 only and was present to a depth of 0.80m BGL. The peat was described as a *very soft dark brown slightly gravelly clayey pseudo-fibrous PEAT*.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil or Made Ground at most locations and were described typically as *grey / light grey / brown slightly sandy gravelly CLAY with medium cobble and boulder content*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content, where noted on the exploratory hole logs.

GRANULAR DEPOSITS: Granular deposits were encountered beneath the topsoil at several locations, and beneath the cohesive deposits at most locations and were typically described as g*rey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content.* The secondary sand/gravel and fines constituents varied across the site and with depth, while low (<5%), medium (5%-20%) or high (20%-50%) cobble and boulder content was also present, where noted on the exploratory hole logs.

WEATHERED BEDROCK: At SK-03 and TP-17, weathered bedrock was encountered at 0.60m and 1.00m, respectively. This layer was diggable with the large excavator to a depth of up to 1.20m below the top of the stratum. The trial pits were terminated upon encountering the more competent bedrock, in which further excavation became more difficult. This material was recovered typically as angular gravel and cobbles of Limestone, however there was some variability in the fracture spacing and the ease at which the excavator could progress. Some clay and sand were also present with the rock mass either from weathering or as infilling to fractures which were opened upon excavation. Most other trial pit locations were terminated before their scheduled depth on possible bedrock or large boulders.

BEDROCK: The rotary core boreholes recovered *medium strong to strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE.* This is typical of the Lucan Formation, which is noted on the Geological Survey Ireland's (GSI) geological mapping of the site. The degree of weathering ranged from fresh to slightly weathered with occasional calcite veins noted within the rock.

The depth to rock varies from 2.00m BGL in BH-01, BH-03, BH-04, and BH-05, to a maximum of 5.30m BGL in BH-02. The total core recovery is good, typically 100% with some of the uppermost runs dropping to 89% or 93%. The SCR and RQD both are relatively poor in the upper weathered zone, often recovered as non-intact, however both indices show an increase with depth in each of the boreholes.

4.2. In-situ Strength Testing

The correlated DPH blow counts indicate that the overburden deposits are soft or loose to a depth of 0.30m to 2.30m BGL and become firm to stiff or medium dense with depth.

4.3. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred. It should be noted that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in BH-01, BH-02, BH-03, BH-04, BH-05, and BH-06 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 7 of this Report.

4.4. Laboratory Testing

4.4.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 4% and 49% generally with fines contents of 25% to 70%. The Particle Size Distribution tests confirm that the granular deposits are generally well-graded with Gravel being the predominant primary constituent. The deposits had percentages of sands and silt/clay typically between 20% and 50% with a gravel content of typically 50% to 70%.
The CBR testing on remoulded samples gave results ranging between 0.3% and 38.4% for the tested samples. Twenty-Two (22 No.) Moisture Condition Value (MCV) relationship tests at natural moisture were undertaken giving a range of <1 to 12.6, at moisture contents between 13.2% to 25%.

4.4.2. Chemical Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water-soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

4.4.3. Environmental Laboratory Testing

A number of samples were analysed for a suite of parameters which allows for the assessment of the sampled material in terms of total pollutant content for classification of materials as *hazardous* or *non-hazardous*. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous etc.). The parameter list for the suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead,

nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen.
The suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC), which for the solid samples are total organic carbon (TOC), speciated aliphatic and aromatic petroleum hydrocarbons, BTEX, phenol, polychlorinated biphenyls (PCB) and PAH.
As part of the suite a leachate is generated from the solid sample, which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).
While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled nor does it comment on any potentially hazardous properties of the materials tested. The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present, or the previous site use or location indicate a risk of environmental variation. A waste classification report is recommended to be carried out to provide an interpretation of the laboratory data should any material be required to be disposed of off-site.

4.4.4. Rock Laboratory Testing

The rock testing carried out on samples recovered from the boreholes reported Unconfined Compressive Strength (UCS) values ranging between 17.2 MPa and 41.7 MPa while the point load testing gave Is50 values ranging between 1.34 MPa to 4.74 MPa. The Is_{50} results correlate to the UCS values using a factor of approximately 20, giving values of 26.8 MPa and 94.8 MPa. These results correlate to the strength descriptions ranging between of *moderately weak to strong* and confirming the variability of this stratum and the descriptions on the logs.

The results from the completed laboratory testing are included in Appendix 8 of this report.

5.0 Recommendations & Conclusions

5.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

5.2. Foundations

At the location of the proposed structures, an allowable bearing capacity of 250 kN/m^2 is recommended for conventional strip or pad foundations on the very stiff cohesive deposits or dense granular deposits at the depths outlined in Table 1 and Table 2 below. Where the ground conditions and dynamic probe results permit a lower bearing capacity at a shallower depth, an allowable bearing capacity of 100kN/m^2 and/or 150 kN/m^2 is given in Table 2. Where bedrock is present at foundation depth, an allowable bearing capacity of 750 kN/m^2 is recommended for conventional strip or pad foundations on the competent bedrock stratum.

Table 1 - Allowable Bearing Capacities (Borehole Locations)

Depth to 250 kN/m^2							
Borehole	ABC	Depth		Borehole	ABC	Depth	
No.	kN/m^2	m BGL	Comment	No.	kN/m^2	m BGL	Comment
BH-01	250	1.00		BH-05	250	1.00	
BH-02	250	1.00		BH-06	250	1.00	
BH-03	250	1.30		BH-07	250	1.00	
BH-04	250	1.00					

Table 2 - Allowable Bearing Capacities (Dynamic Probe Locations)

Depth to 150 kN/m^2				Depth to 250 kN/m^2			
Probe	ABC	Depth		Probe	ABC	Depth	
No.	kN/m^2	m BGL	Comment	No.	kN/m^2	m BGL	Comment
DP-01	150	0.70		DP-01	250	1.00	Refusal at 1.00m BGL
DP-02	150	0.70		DP-02	250	1.00	Refusal at 1.00m BGL
DP-03	-	-		DP-03	250	0.70	Refusal at 1.30m BGL
DP-04	150	0.80		DP-04	250	1.50	Refusal at 1.80m BGL
DP-05	-	-		DP-05	250	0.70	Refusal at 1.20m BGL
DP-06	150	0.70		DP-06	250	1.00	Refusal at 1.30m BGL

Depth to 150 kN/m²				Depth to 250 kN/m²			
Probe No.	ABC kN/m²	Depth m BGL	Comment	Probe No.	ABC kN/m²	Depth m BGL	Comment
DP-07	150	2.40	Lean Mix Trench Fill	DP-07	250	2.90	Lean Mix Trench Fill
DP-08	150	1.20	MADE GROUND encountered in TP-08 to 1.20m BGL. Refusal of DPH at 1.30m BGL	DP-08	-	-	Further investigation needed
DP-09	-	-		DP-09	250	0.70	Refusal at 1.10m BGL
DP-10	-	-		DP-10	250	0.70	Refusal at 1.30m BGL
DP-11	-	-		DP-11	250	0.70	
DP-12	-	-		DP-12	250	0.70	Refusal at 0.80m BGL
DP-13	-	-		DP-13	250	0.70	Refusal at 0.50m BGL
DP-14	150	2.80	MADE GROUND encountered in TP-14 to 2.80m BGL. Refusal of DPH at 0.70m BGL	DP-14	-	-	Further investigation needed
DP-15	150	1.90	100 kN/m² at 1.10m BGL	DP-15	250	2.00	Refusal at 2.20m BGL
DP-16	150	1.50	100 kN/m² at 0.70m BGL	DP-16	250	1.60	Refusal at 2.00m BGL
DP-17	-	-		DP-17	250	0.70	Refusal at 0.80m BGL
DP-18	-	-		DP-18	250	1.20	Refusal at 1.40m BGL
DP-19	-	-		DP-19	250	0.70	Refusal at 1.10m BGL
DP-20	-	-		DP-20	250	0.70	Refusal at 0.90m BGL
DP-21	-	-		DP-21	250	0.70	Refusal at 0.80m BGL
DP-22	-	-		DP-22	250	0.70	Refusal at 1.10m BGL
DP-23	150	0.80		DP-23	250	1.40	Refusal at 1.60m BGL
DP-24	150	0.90		DP-24	250	1.30	Refusal at 1.40m BGL
DP-25	-	-		DP-25	250	0.70	Refusal at 0.70m BGL
DP-26	150	1.10		DP-26	250	1.40	
DP-27	150	0.70		DP-27	250	1.80	
DP-28	-	-		DP-28	250	0.70	Refusal at 0.80m BGL

Depth to 150 kN/m^2				Depth to 250 kN/m^2			
Probe No.	ABC kN/m^2	Depth m BGL	Comment	Probe No.	ABC kN/m^2	Depth m BGL	Comment
DP-29	-	-		DP-29	250	0.70	Refusal at 0.70m BGL
DP-30	-	-		DP-30	250	1.40	Refusal at 1.50m BGL
DP-31	150	0.70		DP-31	250	1.40	Refusal at 1.90m BGL
DP-32	150	0.70		DP-32	250	2.80	Lean Mix Trench Fill
DP-33	-	-		DP-33	250	0.70	Refusal at 1.20m BGL
DP-34	-	-		DP-34	250	0.70	Refusal at 0.80m BGL
DP-35	-	-		DP-35	250	0.70	Refusal at 0.80m BGL
DP-36	-	-		DP-36	250	0.70	Refusal at 0.80m BGL
DP-37	-	-		DP-37	250	0.70	Refusal at 1.20m BGL
DP-38	-	-		DP-38	250	0.80	Refusal at 1.30m BGL
PBT-06	150	1.60		PBT-06	250	2.40	Refusal at 2.60m BGL / Lean Mix Trench Fill
PBT-07	-	-		PBT-07	250	0.70	Refusal at 0.90m BGL
PBT-08	-	-		PBT-08	250	0.70	Refusal at 0.80m BGL
PBT-13	150	0.70		PBT-13	250	1.00	Refusal at 1.20m BGL

The possibility for variation in the depth of the made ground in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete.

Where the recommended depths exceed conventional foundation depths, lean mix trench fill may be utilised to build up the foundation level.

In any part of the site, should part of a foundation be on rock it is recommended that all the foundations of the unit in question be lowered to the competent rock stratum to avoid differential settlement.

In any part of the site, should part of the foundation be on both granular and cohesive deposits it is recommended that all the foundations of the unit in question be lowered to the competent deeper stratum or suitably reinforced to avoid problems with differential settlement.

5.3. External Pavements

The proposed pavements are recommended to be designed in accordance with the CBR test results included in the Appendices of this Report. The CBR test results indicate that a capping layer or a sufficient

depth of crushed stone fill may be required. Plate bearing tests are recommended at the time of construction to verify the design assumptions for the proposed pavement make up and to verify adequate compaction has been achieved.

5.4. Material Reuse

The results of the material reuse testing are shown in Table 3 below. Typically, an MCV of between 7 and 8 is considered marginal, with 8 or greater considered suitable for reuse. Generally, the material is variable, with eleven of the twenty-two samples tested indicating they may be suitable for reuse as a Class 1B or 2 Fill in their current state. For the samples that recorded an MCV of below 7, these results indicate these soils will require treatment during the earthworks to reduce the moisture content to an acceptable level for use as Class 2 Fill. The moisture content should be carefully monitored and controlled to achieve an MCV of greater than 7 or 8. Furthermore, we would recommend the works take place during the summer months as air drying may be the most economical method of drying the unacceptable material to render it useable as Class 2 Fill. The addition of lime can assist in reducing the moisture content and render it suitable for reuse, providing strict controls are put in place to monitor the works and to ensure compliance with the project earthworks specification.

Table 3 - Material Reuse

Exp Hole No.	Sample Depth (m BGL)	Sample Depths (m OD)	MC (%)	MCV	Stratum	Silt/Clay Content (%)	Material Reuse
TP01	0.50	48.06	13.2	12.6	slightly gravelly sandy CLAY	49	Class 2A Fill
TP01	1.50	47.06	10.2	5.1	clayey sandy GRAVEL	12	Requires Treatment
TP02	1.50	46.56	5.4	>20	slightly sandy GRAVEL	NT	Class 1B Fill
TP03	0.50	48.14	12.7	13.4	slightly sandy slightly gravelly CLAY	NT	Class 2A Fill
TP04	0.50	48.63	18.8	5.5	slightly sandy gravelly CLAY	29	Requires Treatment
TP05	1.50	50.83	8.9	8.4	clayey very sandy GRAVEL	15	Class 2C2 Fill
TP06	0.50	49.25	17.4	1.5	slightly sandy gravelly CLAY	38	Requires Treatment
TP07	2.00	47.82	20.9	3.8	slightly sandy gravelly CLAY	32	Requires Treatment
TP08	1.50	48.27	17.9	4.6	slightly sandy gravelly CLAY	41	Requires Treatment
TP10	0.50	49.03	13.5	6.2	clayey very sandy GRAVEL	19	Requires Treatment
TP12	1.00	49.76	20.4	9.6	slightly sandy slightly gravelly CLAY	68	Class 2A Fill
TP13	0.50	50.55	12.7	7.6	slightly sandy slightly gravelly CLAY	47	Class 2C1 Fill
TP16	0.50	50.70	13.5	4.2	very clayey very sandy GRAVEL	25	Requires Treatment
TP19	1.50	50.14	18.9	6.7	slightly sandy slightly gravelly CLAY	59	Requires Treatment

Exp Hole No.	Sample Depth (m BGL)	Sample Depths (m OD)	MC (%)	MCV	Stratum	Silt/Clay Content (%)	Material Reuse
TP22	0.50	51.42	22.1	9.5	slightly sandy slightly gravelly CLAY	65	Class 2A Fill
TP24	0.50	52.93	27.7	9.9	slightly sandy slightly gravelly CLAY	65	Class 2A Fill
TP26	1.00	50.77	19.3	2.7	slightly gravelly very silty SAND	27	Requires Treatment
TP29	1.50	53.10	11.3	8.2	slightly sandy gravelly CLAY	26	Class 2C2 Fill
TP33	0.50	53.24	21	13.5	slightly sandy slightly gravelly CLAY	70	Class 2A Fill
TP34	1.00	54.29	9.7	7.8	clayey very sandy GRAVEL	16	Class 2C2 Fill
TP35	1.50	53.81	8.8	9.2	clayey sandy GRAVEL	13	Class 1B Fill
TP38	0.50	52.69	13.8	2.7	slightly gravelly sandy CLAY	60	Requires Treatment

*NT = not tested

5.5. Excavations

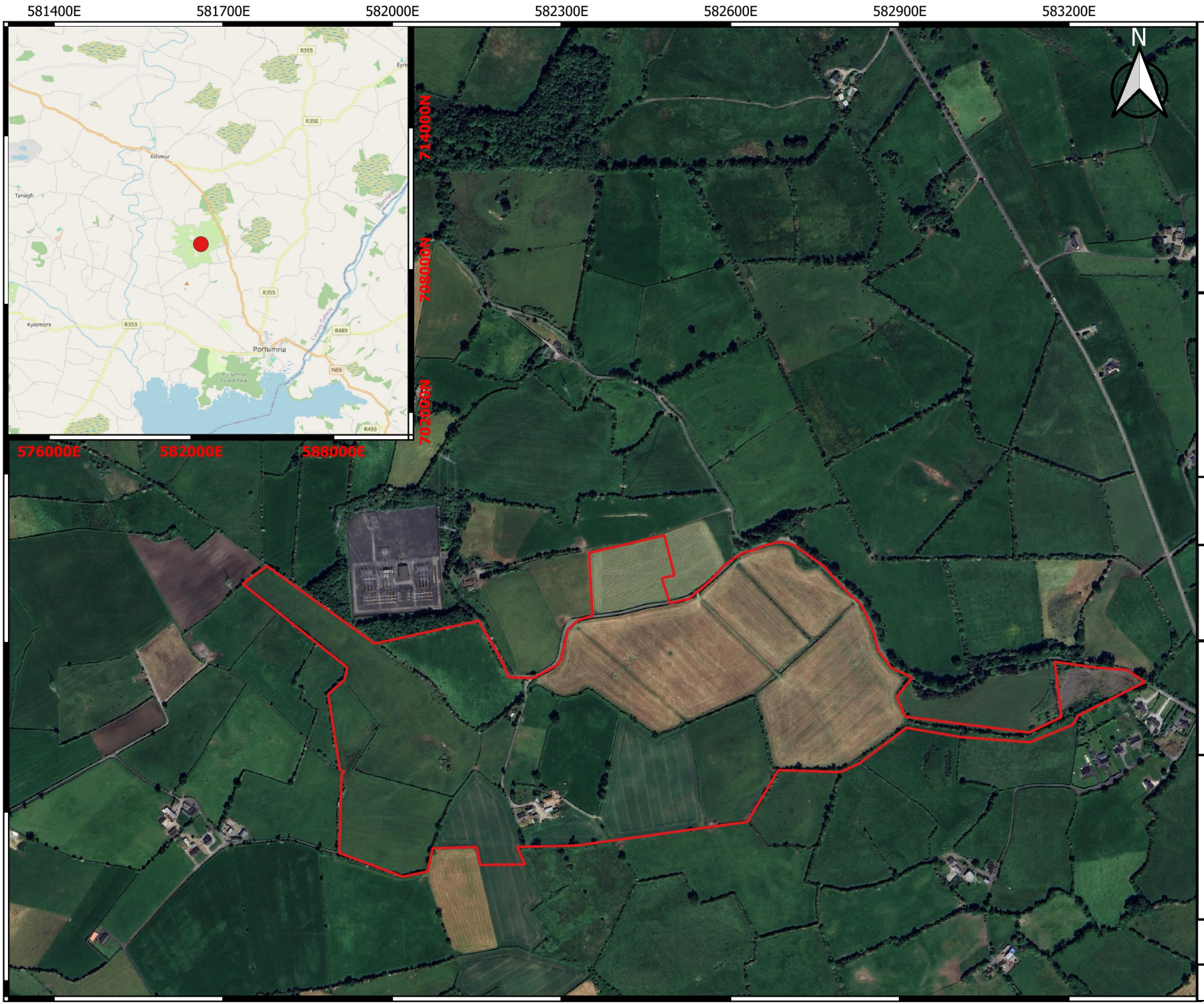
Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry. Excavations in the Made Ground or soft Cohesive Deposits will require to be appropriately battered, or the sides supported due to the low strength of these deposits. Any excavations which penetrate the granular deposits will require to be appropriately battered or the sides supported and may require dewatering. The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations. Excavations in the upper cohesive and weathered rock deposits are expected to be excavatable with conventional excavation equipment, with zones of more intact bedrock below this depth requiring rock breaking techniques. Based on the fracture spacing, the rock strength testing and Pettifer & Fookes (1994) Revised Excavatability Graph, the Lucan Formation ranges from easy ripping to hard ripping, however the zones recovered as non-intact should be easy to hard digging. The 13-tonne excavator was generally able to excavate to depths of 0.20m to 1.20m below the top of the weathered rock and became difficult to excavate within the confines of the trial pit on encountering the more competent rock.

5.6. Soakaway Design

Infiltration rates of f = 6.708 x 10^{-6} m/s, f = 7.118 x 10^{-5} m/s, f = 1.38 x 10^{-5} m/s, f = 5.961 x 10^{-6} m/s, f = 2.053 x 10^{-5} m/s and f = 4.024 x 10^{-5} m/s were calculated for the soakaway locations SK-01, SK-04, SK-05, SK-06, SK-07, and SK-09, respectively. At the locations of SK-02, SK-03, SK-08 and SK-10, the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration rate. These locations are therefore not recommended as suitable for soakaway design and construction.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Figures



Client:

LUMCLOON ENERGY

Project Code:

13999-07-24

Project Title:

Coolpowra Galway

Drawing Title:

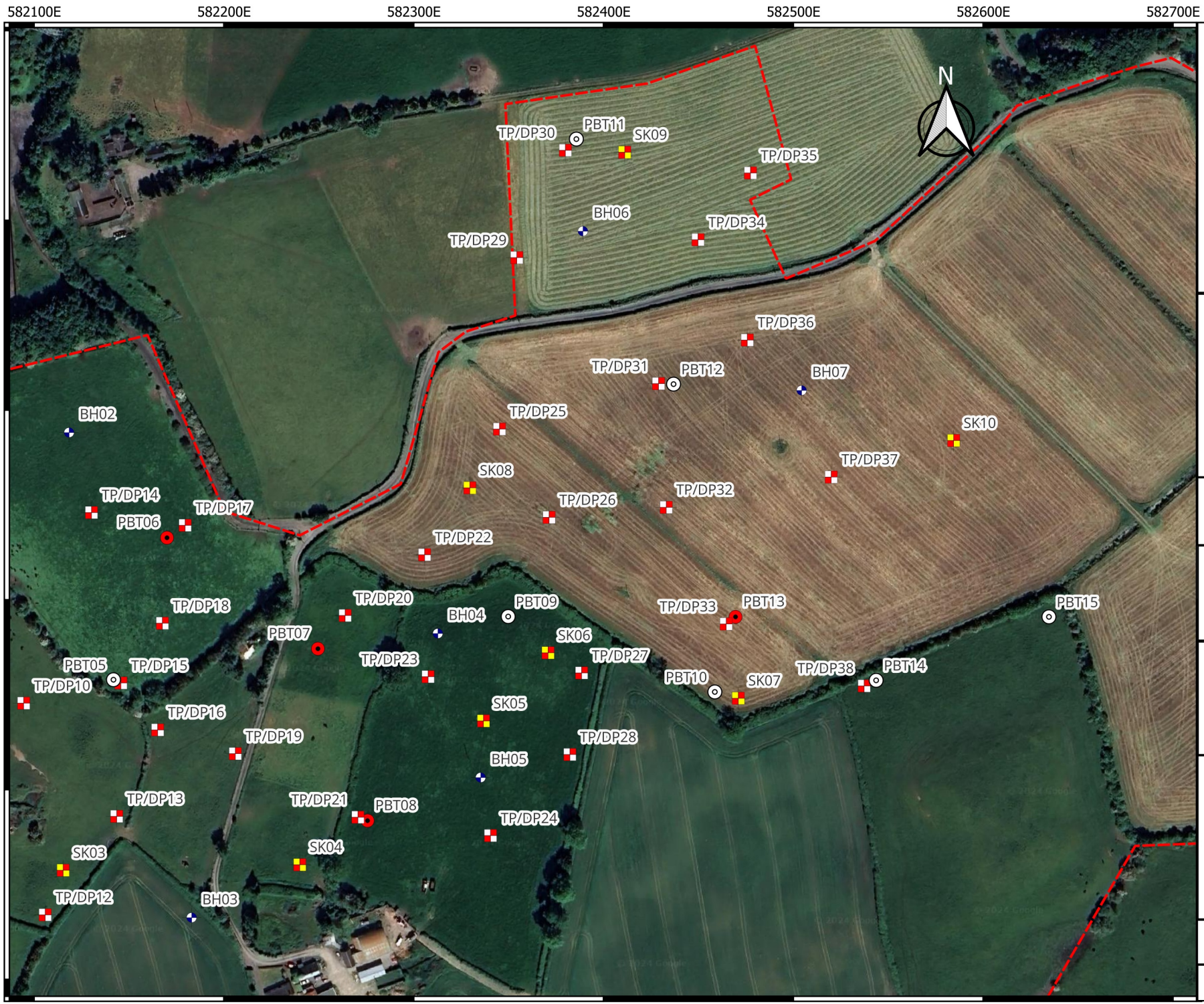
Figure 1 Site Location

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

0 60 120 180 240 300 m

Drawn By:	Date:
SF	04-10-2024

581900E
582000E
582100E
582200E
582300E
709200N
709100N
709000N
708900N
N
BH02
TP/DP25
PBT19
TP/DP07
SK08
TP/DP14
TP/DP26
TP/DP17
TP/DP08
PBT06
TP/DP01
PBT01
TP/DP22
SK01
TP/DP02
PBT02
TP/DP20
PBT09
TP/DP18
TP/DP09
BH04
PBT07
SK06
TP/DP23
PBT05
TP/DP15
TP/DP03
PBT03
TP/DP10
SK05
TP/DP06
TP/DP16
TP/DP19
BH01
BH05
SK02
TP/DP13
TP/DP21
PBT08
TP/DP24
TP/DP04
TP/DP05
PBT04
TP/DP11
SK04
SK03
TP/DP12
BH03
Indicative Site Boundary
Trial Pit + Dynamic Probe
Soakaway Test
Dynamic Probe Only
Borehole
Plate Test
Client:
LUMCLOON ENERGY
Project Code:
13999-07-24
Project Title:
Coolpowra Galway
Drawing Title:
Figure 2 - Site Investigation Points - West
GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176
0 20 40 60 80 m
Drawn By:
JC
Date:
14/10/2024



Indicative Site Boundary
Trial Pit + Dynamic Probe
Soakaway Test
Dynamic Probe Only
Borehole
Plate Test

Client:

LUMCLOON ENERGY

Project Code:
13999-07-24

Project Title:
Coolpowra Galway

Drawing Title:
Figure 3 - Site Investigation Points - East

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental
Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

0 20 40 60 80 m

Drawn By:	Date:
JC	14/10/2024

APPENDIX 2 – Trial Pit Records

www.gii.ie

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www.gii.ie

Site Coolpowra Galway			**Trial Pit Number** SK-01
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.70m x 1.30m x 2.00m (L x W x D)	**Ground Level (mOD)** 48.44	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 581973.8 E 709106.8 N	**Dates** 16/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				48.24	0.20	Brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(1.80)			
				46.44	2.00	Obstruction at 2.00m BGL due to possible Bedrock or Boulders		
						Complete at 2.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-02
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.70m x 1.30m x 2.20m (L x W x D)	**Ground Level (mOD)** 49.71	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582007.9 E 708993.6 N	**Dates** 16/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				49.51	0.20	Brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
					(0.70)			
				48.81	0.90	Firm brown sandy gravelly CLAY with high cobble and boulder content		
					(0.90)			
				47.91	1.80	Grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(0.40)			
				47.51	2.20	Obstruction at 2.20m BGL due to possible Bedrock or Boulders		
						Complete at 2.20m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-03
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.30m x 1.30m x 1.90m (L x W x D)	**Ground Level (mOD)** 50.57	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582115.1 E 708956.9 N	**Dates** 16/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				50.37	0.20	Soft to firm grey sandy gravelly silty CLAY with low cobble content		
					(0.50)			
				49.87	0.70	Grey clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
					(1.20)			
				48.67	1.90	Obstruction at 1.90m BGL due to possible Bedrock or Boulders		
						Complete at 2.20m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-04
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.50m x 1.30m x 1.50m (L x W x D)	**Ground Level (mOD)** 52.62	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582239.7 E 708959.8 N	**Dates** 17/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				52.42	0.20	Firm brown slightly sandy gravelly CLAY with low cobble content		
					(0.40)			
				52.02	0.60	WEATHERED BEDROCK recovered as: Grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
					(0.90)			
						Obstruction at 1.50m BGL due to Bedrock		
				51.12	1.50	Complete at 1.50m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-05
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.20m x 1.30m x 1.50m (L x W x D)	**Ground Level (mOD)** 53.27	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582336.5 E 709035.6 N	**Dates** 16/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
				52.97	0.30	Brown clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
					(0.80)			
				52.17	1.10	Firm to stiff brown slightly sandy gravelly CLAY with medium cobble and boulder content		
					(0.40)			
				51.77	1.50	Obstruction at 1.50m BGL due to possible Bedrock or Boulders Complete at 1.50m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-06
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.20m x 1.30m x 1.80m (L x W x D)	**Ground Level (mOD)** 53.74	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582370.5 E 709071.6 N	**Dates** 16/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				53.44	(0.30) 0.30	TOPSOIL		
					(0.60)	Firm brown slightly sandy slightly gravelly CLAY		
				52.84	0.90	Brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
					(0.90)			
				51.94	1.80	Obstruction at 1.80m BGL due to possible Bedrock or Boulders		
						Complete at 1.80m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-07
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.40m x 1.30m x 1.60m (L x W x D)	**Ground Level (mOD)** 53.39	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582470.8 E 709047.6 N	**Dates** 17/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				53.19	0.20	Firm brown slightly sandy gravelly CLAY with low cobble content		
					(0.30)			
				52.89	0.50	Brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
					(1.10)			
				51.79	1.60	Obstruction at 1.60m BGL due to possible Bedrock or Boulders		
						Complete at 1.60m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-08
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.20m x 1.30m x 2.00m (L x W x D)	**Ground Level (mOD)** 51.87	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582329.3 E 709158.5 N	**Dates** 17/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				51.67	0.20	Soft to firm light grey sandy gravelly silty CLAY		
					(0.80)			
				50.87	1.00	Grey slightly clayey gravelly fine to coarse SAND with high boulder content		
					(1.00)			
						Obstruction at 2.00m BGL due to Boulders		
				49.87	2.00	Complete at 2.00m		

Plan

Remarks

Groundwater encountered at 2.00m BGL; Seepage
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-09
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.50m x 1.30m x 1.40m (L x W x D)	**Ground Level (mOD)** 54.88	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582410.9 E 709335.3 N	**Dates** 17/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				54.68	0.20	Firm brown slightly sandy gravelly CLAY with low cobble content		
					(0.20)			
				54.48	0.40	Grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
					(1.00)			
						Obstruction at 1.40m BGL due to Boulders		
				53.48	1.40	Complete at 1.40m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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Site Coolpowra Galway			**Trial Pit Number** SK-10
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 3.30m x 1.30m x 1.80m (L x W x D)	**Ground Level (mOD)** 54.31	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582584.2 E 709183.4 N	**Dates** 17/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				54.11	0.20	Firm brown slightly sandy gravelly CLAY with low cobble content		
					(0.60)			
				53.51	0.80	Greyish brown clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
					(1.00)			
						Obstruction at 1.80m BGL due to Boulders		
				52.51	1.80	Complete at 1.80m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Soakaway carried out in trial pit
Trial pit backfilled upon completion of soakaway test

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.SK-01

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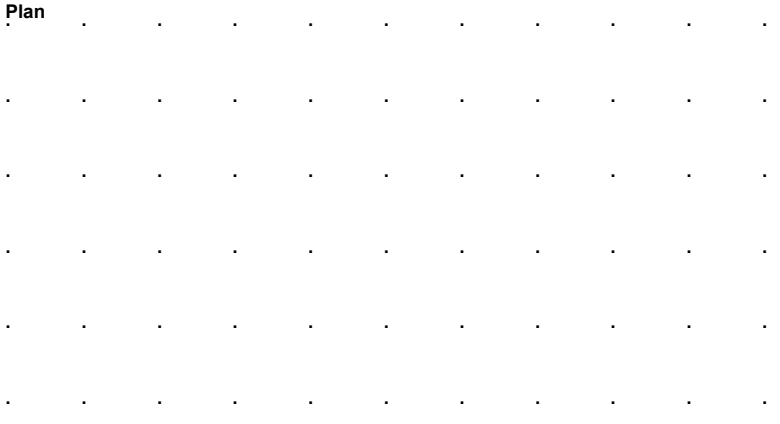
Site Coolpowra Galway			**Trial Pit Number** TP-01
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.20m x 1.30m x 2.60m (L x W x D)	**Ground Level (mOD)** 48.56	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 581942.1 E 709124.6 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				48.36	0.20	Firm to stiff light grey sandy gravelly CLAY with medium cobble and boulder content		
0.50	B				(0.60)			
				47.76	0.80	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
1.50	B				(1.80)			
2.50	B			45.96	2.60	Obstruction at 2.60m BGL due to possible Bedrock or Boulders		
						Complete at 2.60m		

Plan



Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.TP-01

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Site Coolpowra Galway			**Trial Pit Number** TP-02
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.00m x 1.30m x 2.70m (L x W x D)	**Ground Level (mOD)** 48.06	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582000.4 E 709111.5 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				47.86	0.20	Firm light grey slightly sandy gravelly CLAY with medium cobble content		
0.50	B				(0.50)			
				47.36	0.70	Firm to stiff light grey slightly sandy gravelly CLAY with medium cobble content		
					(0.50)			
				46.86	1.20	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
1.50	B				(1.20)			
				45.66	2.40	Very stiff grey slightly sandy gravelly CLAY with high cobble and boulder content		▽1
2.50	B		Seepage(1) at 2.50m.		(0.30)			
				45.36	2.70	Obstruction at 2.70m BGL due to possible Bedrock or Boulders		
						Complete at 2.70m		

Plan

Remarks

Groundwater encountered at 2.50m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.TP-01

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Site Coolpowra Galway			**Trial Pit Number** TP-03
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.40m x 1.30m x 2.60m (L x W x D)	**Ground Level (mOD)** 48.64	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582014.8 E 709053.1 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				48.44	0.20	Firm grey slightly sandy gravelly CLAY with high cobble and boulder content		
					(0.40)			
0.50	B			48.04	0.60	Medium dense grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble content		
					(0.50)			
				47.54	1.10	Dense grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble content		
1.50	B				(1.10)			
				46.44	2.20	Dense grey clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
					(0.40)			
2.50	B			46.04	2.60	Obstruction at 2.60m BGL due to possible Bedrock or Boulders		
						Complete at 2.60m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.TP-01

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Site Coolpowra Galway			**Trial Pit Number** TP-04
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.80m x 1.30m x 2.70m (L x W x D)	**Ground Level (mOD)** 49.13	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 581992.4 E 708973.1 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				48.93	0.20			
					(0.20)	Firm light brown slightly sandy gravelly CLAY		
				48.73	0.40			
0.50	B				(0.40)	Loose to medium dense grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
				48.33	0.80			
					(0.70)	Medium dense grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
1.50	B			47.63	1.50			
					(0.80)	Medium dense grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
				46.83	2.30			
					(0.40)	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
2.50	B					Obstruction at 2.70m BGL due to possible Bedrock or Boulders		
				46.43	2.70	Complete at 2.70m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-05
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 52.33	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582036.1 E 708972.1 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Gravelly TOPSOIL		
				52.03	0.30			
					(0.30)	Medium dense light grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
0.50	B			51.73	0.60			
					(0.80)	Dense light grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
				50.93	1.40			
1.50	B					Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(1.60)			
2.50	B							
				49.33	3.00	Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-06
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.40m x 1.30m x 2.70m (L x W x D)	**Ground Level (mOD)** 49.75	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582048.2 E 709036.1 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				49.55	0.20	Stiff light grey slightly sandy gravelly CLAY with medium cobble and low boulder content		
0.50	B				(1.10)			
				48.45	1.30	Very stiff grey slightly sandy gravelly CLAY with medium cobble and boulder content		
1.50	B				(1.40)			
			Seepage(1) at 2.30m.					▽1
				47.05	2.70	Obstruction at 2.70m BGL due to possible Bedrock or Boulders		
						Complete at 2.70m		

Plan

Remarks

Groundwater encountered at 2.30m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-07
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.40m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 49.82	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582059.1 E 709168.4 N	**Dates** 13/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.50)	MADE GROUND: Brown slightly sandy gravelly Clay with rare fragments of ceramic		
				49.32	0.50	MADE GROUND: Greyish brown slightly sandy gravelly Clay with low cobble and boulder content and with rare fragments of timber		
1.00	B				(1.10)	Strong organic odour encountered between 0.50m and 1.60m BGL		
				48.22	1.60	Soft to firm grey slightly sandy gravelly CLAY with medium cobble and boulder content		
2.00	B				(0.80)	Organic odour encountered between 1.60m and 3.00m BGL		
				47.42	2.40	Stiff grey slightly sandy gravelly CLAY with medium cobble and boulder content		
					(0.60)			
3.00	B			46.82	3.00	Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-08
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 49.77	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582079 E 709129.6 N	**Dates** 13/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				49.57	0.20	MADE GROUND: Greyish brown slightly sandy gravelly Clay with low cobble and boulder content and with rare fragments of ceramic		
0.50	B				(1.00)			
				48.57	1.20	Very stiff grey slightly sandy gravelly CLAY with medium cobble and boulder content		
1.50	B				(1.80)			
2.50	B							
				46.77	3.00	Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-09
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 49.48	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582073.9 E 709083.4 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				49.28	0.20	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble content		
					(1.10)			
1.00	B							
				48.18	1.30	Dense grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
					(0.90)			
2.00	B							
				47.28	2.20	Obstruction at 2.20m BGL due to possible Bedrock or Boulders		
						Complete at 2.20m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-10
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.10m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 49.53	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582094.4 E 709045 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
				49.23	0.30	Stiff grey sandy gravelly silty CLAY		
0.50	B				(0.80)			
				48.43	1.10	Dense grey silty clayey very gravelly fine to coarse SAND with low cobble and boulder content		
1.50	B				(1.30)			
				47.13	2.40	Very stiff grey sandy slightly gravelly silty CLAY with medium cobble and boulder content		
2.50	B				(0.60)			
			Seepage(1) at 3.00m.	46.53	3.00	Complete at 3.00m		▽1

Plan

Remarks

Groundwater encountered at 3.00m BGL; Seepage
Trial pit unstable; side walls spalling
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-11
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.40m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 52.66	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582079.5 E 708974.3 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				52.46	0.20	Medium dense brown slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
0.50	B				(0.40)			
				52.06	0.60	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
1.50	B				(2.40)			
2.50	B							
				49.66	3.00	Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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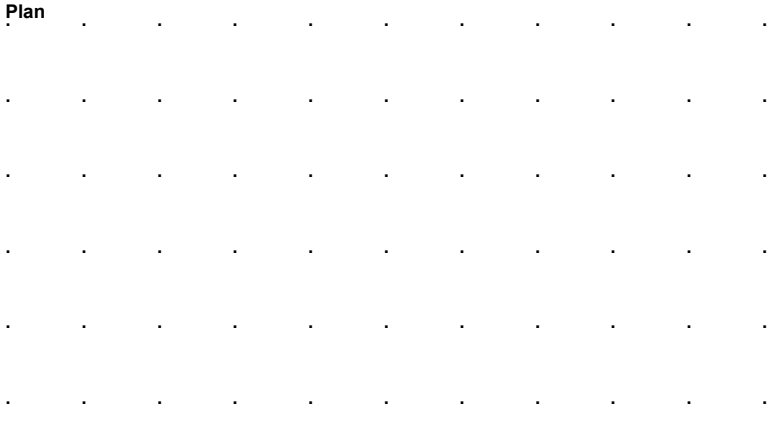
Site Coolpowra Galway			**Trial Pit Number** TP-12
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.30m x 2.00m (L x W x D)	**Ground Level (mOD)** 50.76	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582105.8 E 708933.4 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				50.56	0.20			
					(0.30)	Stiff grey slightly sandy gravelly CLAY with low cobble content		
				50.26	0.50			
					(0.60)	Very stiff grey slightly sandy gravelly CLAY with low cobble content		
1.00	B			49.66	1.10			
					(0.90)	Grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content		
2.00	B			48.76	2.00	Obstruction at 2.00m BGL due to possible Bedrock or Boulders		
						Complete at 2.00m		

Plan



Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-13
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.30m x 1.30m x 2.70m (L x W x D)	**Ground Level (mOD)** 51.05	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582143.4 E 708985.3 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				50.85	0.20	Firm to stiff grey slightly sandy gravelly CLAY with low cobble content		
0.50	B				(1.10)			
				49.75	1.30	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
1.50	B				(1.40)			
2.50	B							
				48.35	2.70	Obstruction at 2.70m BGL due to possible Bedrock or Boulders		
						Complete at 2.70m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-14
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.30m x 2.80m (L x W x D)	**Ground Level (mOD)** 51.39	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582130.1 E 709145.4 N	**Dates** 13/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Brown slightly sandy gravelly Clay with rare fragments of bale netting		
				51.09	0.30			
0.50	B				(0.90)	MADE GROUND: Greyish brown slightly clayey sandy subangular to subrounded fine to coarse Gravel with high cobble and boulder content and with rare fragments of bale netting		
				50.19	1.20			
1.50	B				(1.60)	MADE GROUND: Grey slightly sandy gravelly Clay with high cobble and boulder content and with rare fragments of timber and plastic Strong organic odour encountered between 1.20m and 2.80m BGL		
2.50	B					Obstruction at 2.80m BGL due to Boulders		
				48.59	2.80	Complete at 2.80m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-15
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.10m x 1.30m x 2.60m (L x W x D)	**Ground Level (mOD)** 50.71	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582145.6 E 709055.6 N	**Dates** 13/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	TOPSOIL		
				50.31	0.40	Soft brown sandy gravelly CLAY with low cobble content		
					(0.40)			
				49.91	0.80	Soft grey slightly sandy gravelly CLAY with low cobble content		
					(0.20)			
1.00	B			49.71	1.00	Firm grey slightly sandy gravelly CLAY with low cobble content		
					(0.50)			
				49.21	1.50	Firm grey and brown sandy gravelly silty CLAY with medium cobble and boulder content		
					(0.50)			
2.00	B			48.71	2.00	Very stiff grey and brown sandy gravelly silty CLAY with medium cobble and boulder content		
					(0.60)			
2.60	B			48.11	2.60	Obstruction at 2.60m BGL due to possible Bedrock or Boulders		
						Complete at 2.60m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-16
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.20m x 1.30m x 2.50m (L x W x D)	**Ground Level (mOD)** 51.20	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582165 E 709030.9 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
				50.90	0.30			
0.50	B					Medium dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
					(1.10)			
				49.80	1.40			
1.50	B				(0.30)	Medum dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
				49.50	1.70			
					(0.80)	Dense clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
						Obstruction at 2.50m BGL due to possible Bedrock		
2.50	B		Seepage(1) at 2.50m.	48.70	2.50	Complete at 2.50m		▽1

Plan

Remarks

Groundwater encountered at 2.50m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-17
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.30m x 2.20m (L x W x D)	**Ground Level (mOD)** 51.41	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582179.5 E 709138.7 N	**Dates** 13/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Brown slightly sandy gravelly Clay with rare fragments of bale netting		
				51.11	0.30			
0.50	B				(0.70)	Dense greyish brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
				50.41	1.00			
1.50	B				(1.20)	WEATHERED BEDROCK recovered as: Grey slightly clayey sandy angular fine to coarse GRAVEL with high cobble and boulder content Obstruction at 2.20m BGL due to possible Bedrock		
				49.21	2.20	Complete at 2.20m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-18
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.20m x 1.30m x 2.50m (L x W x D)	**Ground Level (mOD)** 51.52	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582167.5 E 709087.1 N	**Dates** 13/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Peaty TOPSOIL		
				51.12	0.40			
0.50	B				(0.40)	Very soft dark brown slightly gravelly clayey pseudofibrous PEAT		
				50.72	0.80			
1.00	B				(0.50)	Firm grey and greyish brown slightly sandy gravelly silty CLAY		
				50.22	1.30			
					(1.20)	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
						Obstruction at 2.50m BGL due to possible Bedrock		
2.50	B			49.02	2.50	Complete at 2.50m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

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Site Coolpowra Galway			**Trial Pit Number** TP-19
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.30m x 1.30m x 2.50m (L x W x D)	**Ground Level (mOD)** 51.64	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582205.9 E 709018.4 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				51.44	0.20	Stiff brown slightly sandy slightly gravelly CLAY		
					(0.40)			
0.50	B			51.04	0.60	Very stiff dark grey slightly sandy gravelly CLAY with low cobble content		
					(1.50)			
1.50	B							
				49.54	2.10	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
					(0.40)			
2.50	B			49.14	2.50	Obstruction at 2.50m BGL due to possible Bedrock or Boulders		
						Complete at 2.50m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

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Site Coolpowra Galway			**Trial Pit Number** TP-20
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.20m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 54.42	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582263.8 E 709091.2 N	**Dates** 10/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
				54.12	0.30			
0.50	B				(0.50)	Medium dense brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and medium boulder content		
				53.62	0.80			
1.50	B				(1.30)	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
				52.32	2.10			
2.50	B				(0.90)	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
				51.42	3.00			
						Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

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Site Coolpowra Galway			**Trial Pit Number** TP-21
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.40m x 1.30m x 1.50m (L x W x D)	**Ground Level (mOD)** 53.67	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582270.5 E 708984.9 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	MADE GROUND: Brown slightly sandy slightly gravelly Clay with rare fragments of rope		
				53.37	0.30	Firm brown slightly sandy slightly gravelly CLAY with rootlets		
0.50	B				(0.50)			
				52.87	0.80	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(0.70)			
						Obstruction at 1.50m BGL due to possible Bedrock		
1.50	B			52.17	1.50	Complete at 1.50m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-22
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 1.30m x 2.70m (L x W x D)	**Ground Level (mOD)** 51.92	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582305.7 E 709123.2 N	**Dates** 12/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Gravelly TOPSOIL		
				51.62	0.30	Very stiff grey slightly sandy gravelly CLAY with low cobble content		
0.50	B				(0.80)			
				50.82	1.10	Very stiff grey sandy gravelly CLAY with low cobble content		
1.50	B				(0.70)			
				50.12	1.80	Dense grey clayey very gravelly fine to coarse SAND with low cobble content		
			Medium Ingress(1) at 2.30m.		(0.90)			▽1
2.50	B					Obstruction at 2.70m BGL due to possible Bedrock or Boulders		
				49.22	2.70	Complete at 2.70m		

Plan

Remarks

Groundwater encountered at 2.30m BGL; Medium Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-23
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.50m x 1.30m x 1.70m (L x W x D)	**Ground Level (mOD)** 52.52	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582307.5 E 709058.9 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				52.32	0.20	Firm brown slightly sandy slightly gravelly CLAY with rootlets		
0.50	B				(0.50)			
				51.82	0.70	Medium dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(0.70)			
				51.12	1.40	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
1.50	B				(0.30)	Obstruction at 1.70m BGL due to possible Bedrock		
				50.82	1.70	Complete at 1.70m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-24
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.70m x 1.30m x 2.00m (L x W x D)	**Ground Level (mOD)** 53.43	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582340.4 E 708975.2 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				53.23	0.20	Firm brown slightly sandy slightly gravelly CLAY with rootlets		
0.50	B				(0.60)			
				52.63	0.80	Stiff grey slightly sandy gravelly CLAY with high cobble and boulder content		
					(0.50)			
				52.13	1.30	Very stiff grey slightly sandy gravelly CLAY with high cobble and boulder content		
1.50	B				(0.70)			
				51.43	2.00	Obstruction at 2.00m BGL due to possible Bedrock or Boulders		
						Complete at 2.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-25
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.40m x 1.30m x 2.60m (L x W x D)	**Ground Level (mOD)** 52.15	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582345.1 E 709189.4 N	**Dates** 12/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				51.95	0.20	Firm to stiff greyish brown slightly sandy gravelly CLAY with rootlets and with low cobble content		
0.50	B				(0.80)			
				51.15	1.00	Dense grey slightly clayey very sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and low boulder content		
1.50	B				(1.10)			
			Medium Ingress(1) at 2.10m.	50.05	2.10	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		▽1
					(0.50)			
2.50	B			49.55	2.60	Obstruction at 2.60m BGL due to possible Bedrock or Boulders		
						Complete at 2.60m		

Plan

Remarks

Groundwater encountered at 2.10m BGL; Medium Ingress
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** **TP-26**
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.10m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 51.77	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582371.3 E 709142.9 N	**Dates** 12/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
				51.47	0.30			
					(0.40)	Soft grey sandy gravelly silty CLAY with low cobble and boulder content		
				51.07	0.70			
					(0.40)	Firm grey sandy gravelly silty CLAY with low cobble and boulder content		
1.00	B			50.67	1.10			
					(0.50)	Medium dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and low boulder content		
				50.17	1.60			
2.00	B		Seepage(1) at 2.00m.		(1.00)	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and low boulder content		▽1
				49.17	2.60			
					(0.40)	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
3.00	B			48.77	3.00			
						Complete at 3.00m		

Plan

Remarks

Groundwater encountered at 2.00m BGL; Seepage
Trial pit unstable; side walls spalling
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-27
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.10m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 53.10	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582388.4 E 709060.9 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				52.90	0.20	Soft to firm brown slightly sandy slightly gravelly CLAY with rootlets		
0.50	B				(0.60)			
				52.30	0.80	Medium dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and low boulder content		
1.50	B				(1.00)			
				51.30	1.80	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and low boulder content		
					(0.30)			
				51.00	2.10	Obstruction at 2.10m BGL due to possible Bedrock or Boulders		
						Complete at 2.10m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-28
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.30m x 1.30m x 1.60m (L x W x D)	**Ground Level (mOD)** 53.20	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582382.2 E 709017.9 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				53.00	(0.20) 0.20	TOPSOIL		
						Firm to stiff brown slightly sandy slightly gravelly CLAAY with rootlets		
				52.50	(0.50) 0.70	Very stiff grey slightly sandy gravelly CLAY with meium cobble and boulder content		
1.00	B				(0.90)			
				51.60	1.60	Obstruction at 1.60m BGL due to possible Bedrock or Boulders		
						Complete at 1.60m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

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Site Coolpowra Galway			**Trial Pit Number** TP-29
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.30m x 1.30m x 2.00m (L x W x D)	**Ground Level (mOD)** 54.60	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582354.3 E 709279.8 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL with rare fragments of red brick		
				54.30	0.30			
					(0.30)	Firm to stiff brown slightly sandy gravelly CLAY with medium cobble and boulder content		
0.50	B			54.00	0.60			
						Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(1.40)			
1.50	B							
				52.60	2.00	Obstruction at 2.00m BGL due to possible Bedrock or Boulders		
						Complete at 2.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-30
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.20m x 1.30m x 2.00m (L x W x D)	**Ground Level (mOD)** 54.84	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582379.8 E 709336.4 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				54.64	0.20	Firm brown slightly sandy slightly gravelly CLAY with rootlets		
0.50	B				(0.60)			
				54.04	0.80	Very loose grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(0.20)			
				53.84	1.00	Loose to medium dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(0.40)			
				53.44	1.40	Dense slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(0.60)			
2.00	B			52.84	2.00	Obstruction at 2.00m BGL due to possible Bedrock or Boulders Complete at 2.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-31
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 6.10m x 1.30m x 2.50m (L x W x D)	**Ground Level (mOD)** 52.04	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582428.9 E 709213.4 N	**Dates** 12/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Gravelly TOPSOIL		
				51.74	0.30	Stiff brown sandy gravelly CLAY with low cobble content		
					(0.30)			
				51.44	0.60	Stiff grey sandy gravelly silty CLAY with low cobble and boulder content		
1.00	B				(0.80)			
				50.64	1.40	Dense dark grey slightly clayey very sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
2.00	B				(1.10)			
			Seepage(1) at 2.30m.					▽1
				49.54	2.50	Obstruction at 2.40m BGL due to possible Bedrock or Boulders		
						Complete at 2.50m		

Plan

Remarks

Groundwater encountered at 2.30m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-32
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 52.19	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582432.9 E 709148.2 N	**Dates** 12/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				51.99	0.20	Firm to stiff grey mottled brown slightly sandy gravelly CLAY with medium cobble content		
0.50	B				(1.00)			
				50.99	1.20	Medium dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and medium boulder content		
					(0.30)			
1.50	B			50.69	1.50	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and medium boulder content		
			Seepage(1) at 2.00m.		(0.90)			▽1
				49.79	2.40	Dense grey clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
2.50	B				(0.60)			
			Seepage(2) at 3.00m.	49.19	3.00	Complete at 3.00m		▽2

Plan

Remarks

Groundwater encountered at 2.30m and 3.00m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-33
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.20m x 1.30m x 3.00m (L x W x D)	**Ground Level (mOD)** 53.74	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582464.6 E 709086.7 N	**Dates** 12/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				53.54	0.20	Firm brown slightly sandy slightly gravelly CLAY with low cobble content		
0.50	B				(0.90)			
				52.64	1.10	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
1.50	B				(1.90)			
2.50	B							
				50.74	3.00	Complete at 3.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-34
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 1.30m x 2.60m (L x W x D)	**Ground Level (mOD)** 55.29	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582449.8 E 709289.3 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Gravelly TOPSOIL		
				54.99	0.30	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and medium boulder content		
1.00	B				(1.40)			
				53.59	1.70	Dense dark grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
2.00	B				(0.90)			
				52.69	2.60	Obstruction at 2.60m BGL due to possible Bedrock or Boulders		
						Complete at 2.60m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-35
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.60m x 1.30m x 2.60m (L x W x D)	**Ground Level (mOD)** 55.31	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582477.4 E 709324.4 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				55.11	0.20	Firm brown slightly sandy gravelly CLAY with high cobble content		
					(0.40)			
0.50	B			54.71	0.60	Dense grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
1.50	B				(2.00)			
2.50	B			52.71	2.60	Obstruction at 2.60m BGL due to possible Bedrock or Boulders		
						Complete at 2.60m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-36
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.40m x 1.30m x 2.00m (L x W x D)	**Ground Level (mOD)** 52.23	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582475.7 E 709236.4 N	**Dates** 12/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				52.03	0.20	Stiff grey mottled brown slightly sandy gravelly CLAY with low cobble content		
0.50	B				(0.70)			
				51.33	0.90	Dense dark grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with medium cobble and boulder content		
1.50	B				(1.10)			
				50.23	2.00	Obstruction at 2.00m BGL due to possible Bedrock or Boulders		
						Complete at 2.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-37
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 5.80m x 1.30m x 2.00m (L x W x D)	**Ground Level (mOD)** 54.66	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582519.9 E 709164.1 N	**Dates** 12/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL		
				54.46	0.20	Firm brown slightly sandy slightly gravelly CLAY with rootlets		
					(0.30)			
				54.16	0.50	Very stiff greyish brown slightly sandy gravelly CLAY with high cobble and low boulder content		
1.00	B				(1.30)			
				52.86	1.80	Dense greyish brown slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
					(0.20)			
2.00	B			52.66	2.00	Obstruction at 2.00m BGL due to possible Bedrock or Boulders		
						Complete at 2.00m		

Plan

Remarks

No groundwater encountered
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
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Site Coolpowra Galway			**Trial Pit Number** TP-38
Machine : 13T tracked excavator **Method :** Trial Pit	**Dimensions** 4.20m x 1.30m x 2.60m (L x W x D)	**Ground Level (mOD)** 53.19	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582537.3 E 709054.1 N	**Dates** 11/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	TOPSOIL		
				52.89	0.30	Soft to firm grey slightly sandy gravelly CLAY with low cobble content		
0.50	B				(0.50)			
				52.39	0.80	Very stiff grey slightly sandy gravelly CLAY with low cobble content		
					(0.40)			
				51.99	1.20	Dense dark grey slightly clayey sandy subangular to subrounded fine to coarse GRAVEL with high cobble and boulder content		
1.50	B				(1.40)			
2.50	B		Seepage(1) at 2.50m.	50.59	2.60	Obstruction at 2.60m BGL due to possible Bedrock or Boulders		▽1
						Complete at 2.60m		

Plan

Remarks

Groundwater encountered at 2.50m BGL; Seepage
Trial pit stable
Trial pit backfilled upon completion

Scale (approx)	Logged By	Figure No.
1:25	CMP	13999-07-24.TP-01

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Coolpowra Galway – Trial Pit Photographs

SK-01

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Coolpowra Galway – Trial Pit Photographs

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Coolpowra Galway – Trial Pit Photographs

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Coolpowra Galway – Trial Pit Photographs

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Coolpowra Galway – Trial Pit Photographs

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Coolpowra Galway – Trial Pit Photographs

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APPENDIX 3 – Soakaway Testing Results

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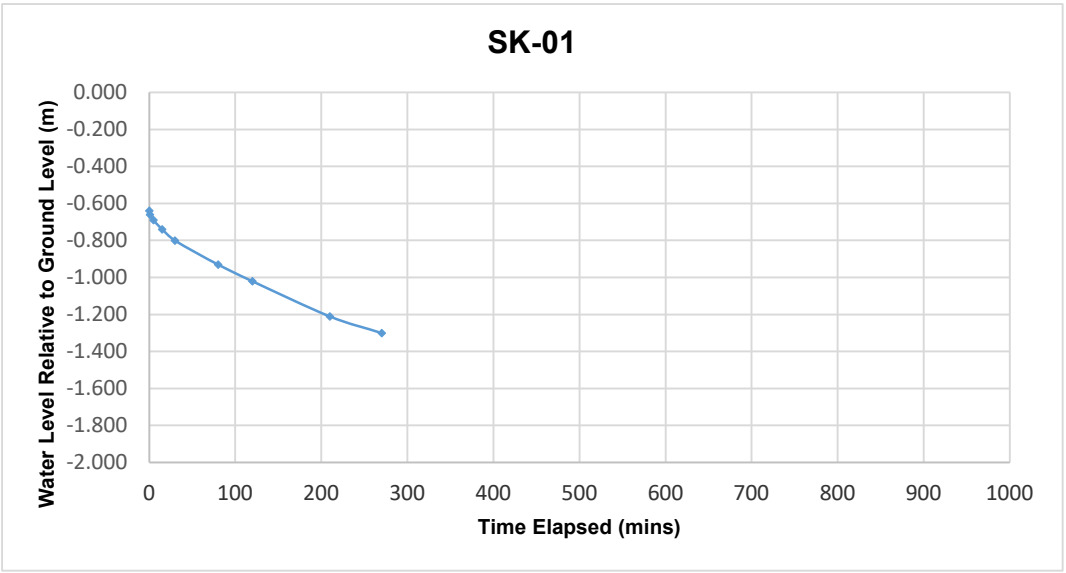
SK-01

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.70m x 1.30m x 2.00m (L x W x D)

Date	Time	Water level (m bgl)
16/09/2024	0	-0.640
16/09/2024	1	-0.660
16/09/2024	5	-0.690
16/09/2024	15	-0.740
16/09/2024	30	-0.800
16/09/2024	80	-0.930
16/09/2024	120	-1.020
16/09/2024	210	-1.210
16/09/2024	270	-1.300

Start depth	Depth of Pit		Diff	75% full	25%full
0.64	**2.000**		**1.360**	**0.98**	**1.66**

Length of pit (m)	Width of pit (m)			75-25Ht (m)	Vp75-25 (m3)
3.700	1.300			0.680	3.27
Tp75-25 (from graph) (s)		**42000**		50% Eff Depth	ap50 (m2)
				0.680	11.61
f =	**6.708E-06**	**m/s**			



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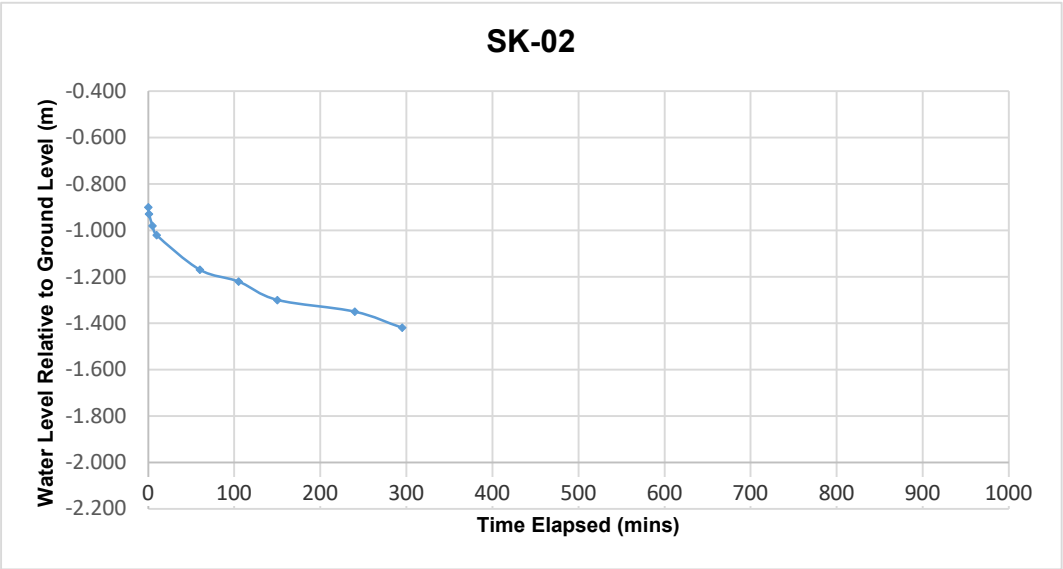
SK-02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.70m x 1.30m x 2.20m (L x W x D)

Date	Time	Water level (m bgl)
16/09/2024	0	-0.900
16/09/2024	1	-0.930
16/09/2024	5	-0.980
16/09/2024	10	-1.020
16/09/2024	60	-1.170
16/09/2024	105	-1.220
16/09/2024	150	-1.300
16/09/2024	240	-1.350
16/09/2024	295	-1.420

Start depth	Depth of Pit	Diff	75% full	25%full
0.90	2.200	1.300	1.225	1.875



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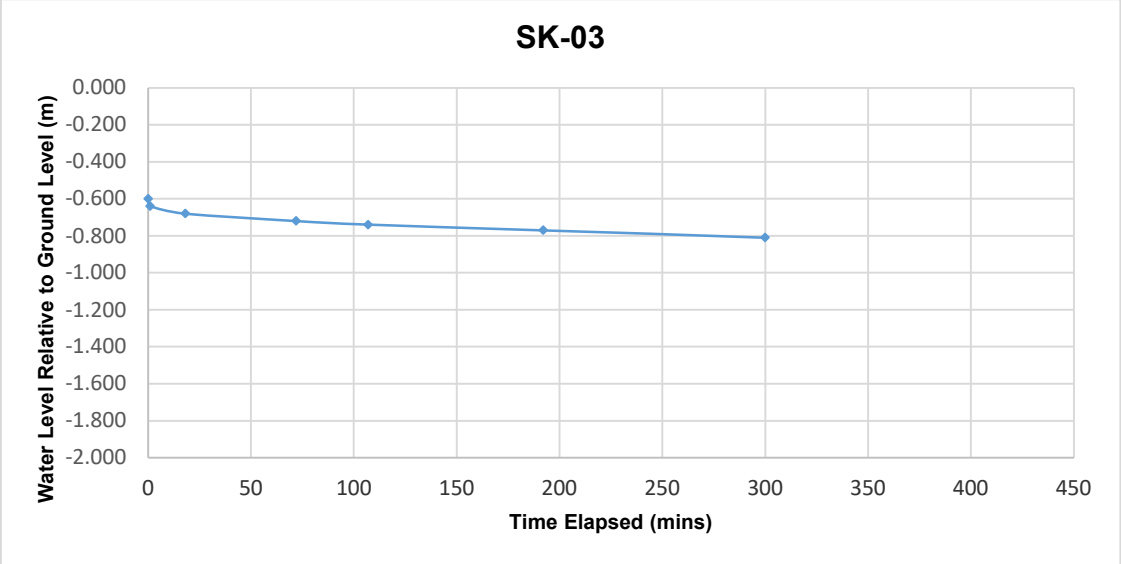
SK-03

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.30m x 1.30m x 1.90m (L x W x D)

Date	Time	Water level (m bgl)
16/09/2024	0	-0.600
16/09/2024	1	-0.640
16/09/2024	18	-0.680
16/09/2024	72	-0.720
16/09/2024	107	-0.740
16/09/2024	192	-0.770
16/09/2024	300	-0.810

***Soakaway failed - pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.60	1.900	1.300	0.925	1.575



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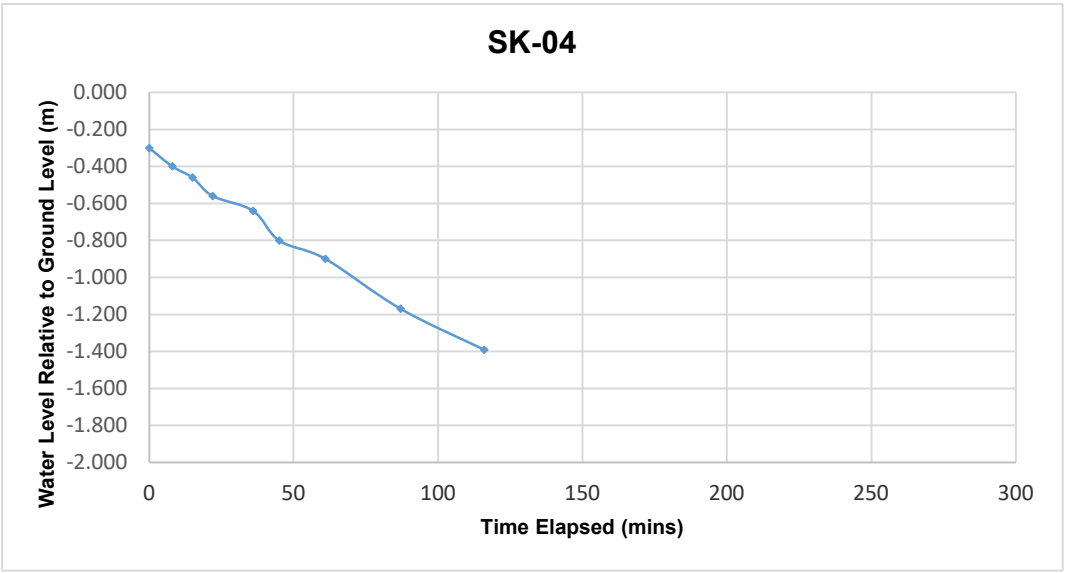
SK-04

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.50m x 1.30m x 1.50m (L x W x D)

Date	Time	Water level (m bgl)
17/09/2024	0	-0.300
17/09/2024	8	-0.400
17/09/2024	15	-0.460
17/09/2024	22	-0.560
17/09/2024	36	-0.640
17/09/2024	45	-0.800
17/09/2024	61	-0.900
17/09/2024	87	-1.170
17/09/2024	116	-1.390

Start depth	Depth of Pit		Diff	75% full	25%full
0.30	**1.500**		**1.200**	**0.6**	**1.2**

Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
3.500	1.300		0.600	2.73
Tp75-25 (from graph) (s)		**3720**	50% Eff Depth	ap50 (m2)
			0.600	10.31
f =	**7.118E-05**	**m/s**		



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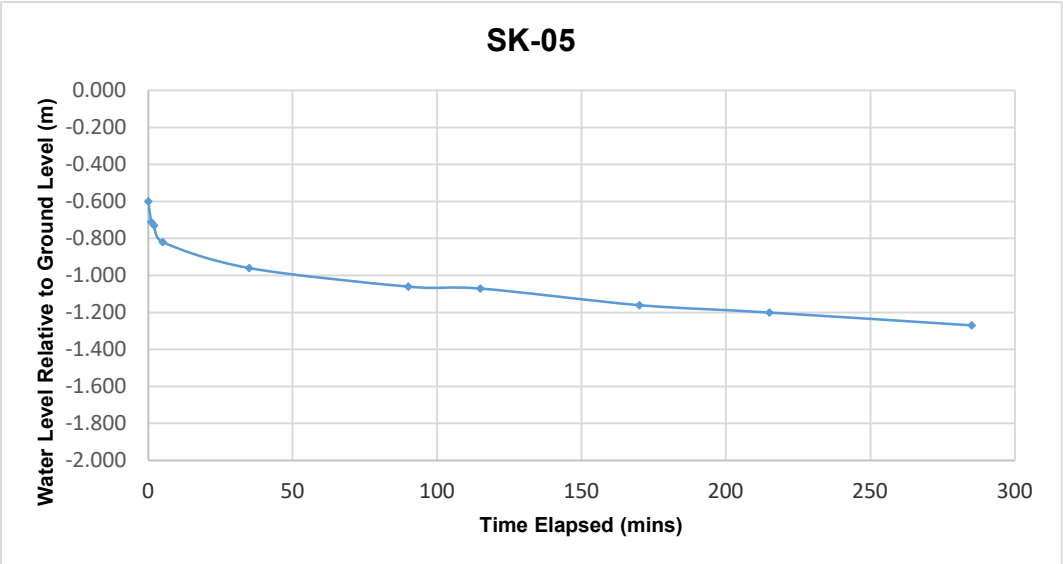
SK-05

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 4.20m x 1.30m x 1.50m (L x W x D)

Date	Time	Water level (m bgl)
16/09/2024	0	-0.600
16/09/2024	1	-0.710
16/09/2024	2	-0.730
16/09/2024	5	-0.820
16/09/2024	35	-0.960
16/09/2024	90	-1.060
16/09/2024	115	-1.070
16/09/2024	170	-1.160
16/09/2024	215	-1.200
16/09/2024	285	-1.270

Start depth	Depth of Pit		Diff	75% full	25%full
0.60	**1.500**		**0.900**	**0.825**	**1.275**

Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
4.200	1.300		0.450	2.46
Tp75-25 (from graph) (s)		**17100**	50% Eff Depth	ap50 (m2)
			0.450	10.41
f =	**1.380E-05**	**m/s**		



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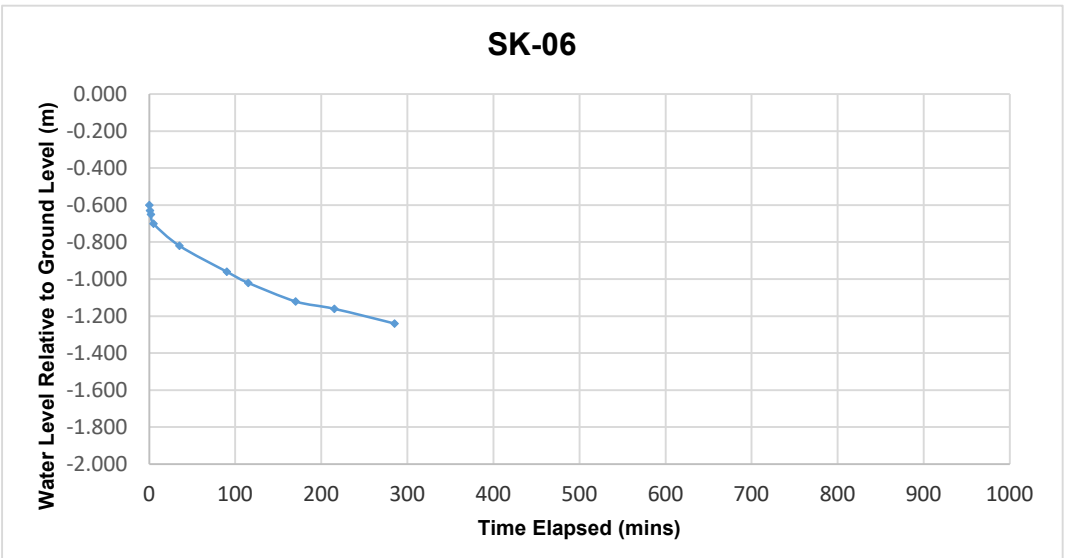
SK-06

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.20m x 1.30m x 1.80m (L x W x D)

Date	Time	Water level (m bgl)
16/09/2024	0	-0.600
16/09/2024	1	-0.630
16/09/2024	2	-0.650
16/09/2024	5	-0.700
16/09/2024	35	-0.820
16/09/2024	90	-0.960
16/09/2024	115	-1.020
16/09/2024	170	-1.120
16/09/2024	215	-1.160
16/09/2024	285	-1.240

Start depth	Depth of Pit		Diff	75% full	25%full
0.60	**1.800**		**1.200**	**0.9**	**1.5**

Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
3.200	1.300		0.600	2.50
Tp75-25 (from graph) (s)		**43800**	50% Eff Depth	ap50 (m2)
			0.600	9.56
f =	**5.961E-06**	**m/s**		



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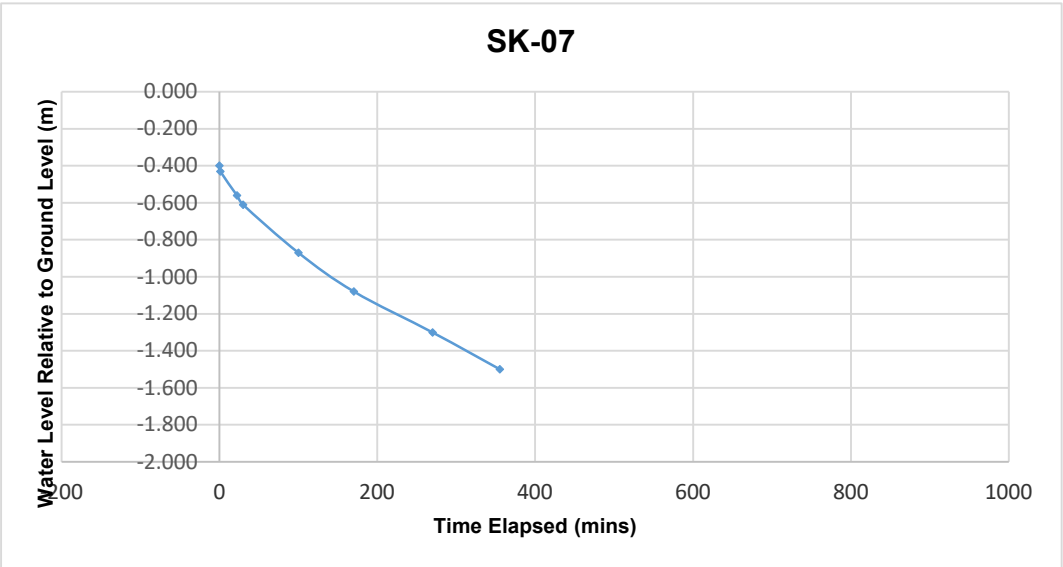
SK-07

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.40m x 1.30m x 1.60m (L x W x D)

Date	Time	Water level (m bgl)
17/09/2024	0	-0.400
17/09/2024	1	-0.430
17/09/2024	22	-0.560
17/09/2024	30	-0.610
17/09/2024	100	-0.870
17/09/2024	170	-1.080
17/09/2024	270	-1.300
17/09/2024	355	-1.500

Start depth	Depth of Pit		Diff	75% full	25%full
0.40	1.600		1.200	0.7	1.3

Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
3.400	1.300		0.600	2.65
Tp75-25 (from graph) (s)		**12840**	50% Eff Depth	ap50 (m2)
			0.600	10.06
f =	**2.053E-05**	**m/s**		



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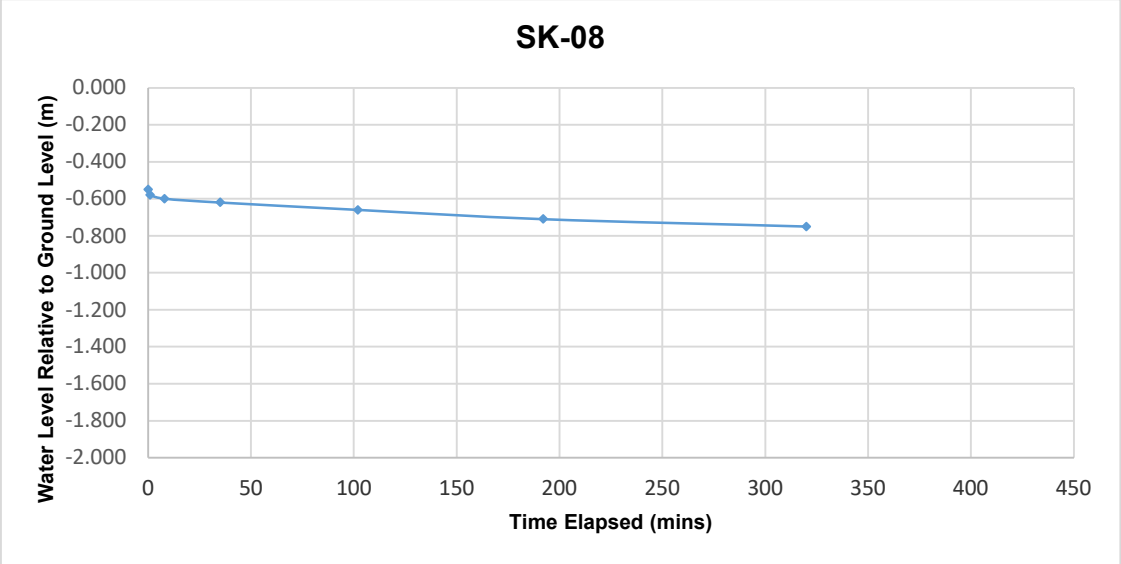
Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.30m x 1.30m x 1.90m (L x W x D)

Date	Time	Water level (m bgl)
17/09/2024	0	-0.550
17/09/2024	1	-0.580
17/09/2024	8	-0.600
17/09/2024	35	-0.620
17/09/2024	102	-0.660
17/09/2024	192	-0.710
17/09/2024	320	-0.750

***Soakaway failed - pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.55	1.900	1.350	0.8875	1.5625



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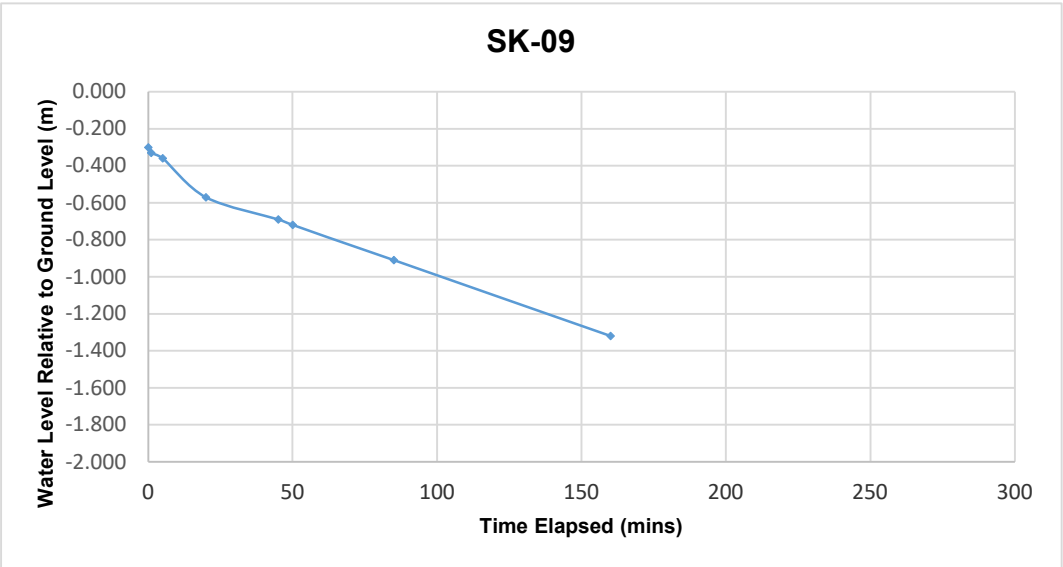
SK-09

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.50m x 1.30m x 1.40m (L x W x D)

Date	Time	Water level (m bgl)
17/09/2024	0	-0.300
17/09/2024	1	-0.330
17/09/2024	5	-0.360
17/09/2024	20	-0.570
17/09/2024	45	-0.690
17/09/2024	50	-0.720
17/09/2024	85	-0.910
17/09/2024	160	-1.320

Start depth	Depth of Pit		Diff	75% full	25%full
0.30	**1.400**		**1.100**	**0.575**	**1.125**

Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
3.400	1.300		0.550	2.43
Tp75-25 (from graph) (s)		**6300**	50% Eff Depth	ap50 (m2)
			0.550	9.59
f =	**4.024E-05**	**m/s**		



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

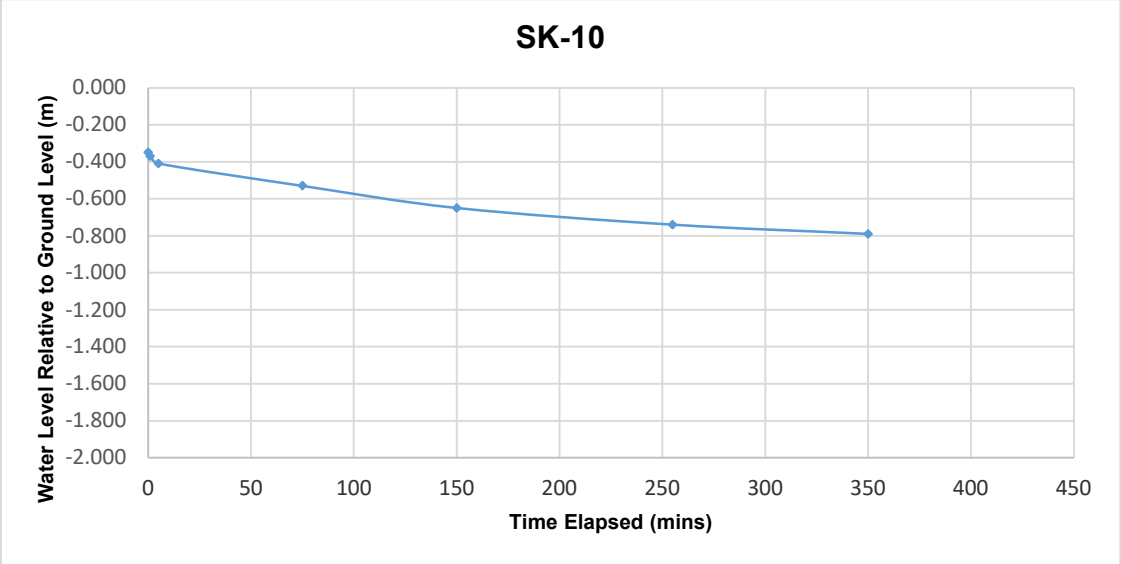
SK-10

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 3.30m x 1.30m x 1.80m (L x W x D)

Date	Time	Water level (m bgl)
17/09/2024	0	-0.350
17/09/2024	1	-0.370
17/09/2024	5	-0.410
17/09/2024	75	-0.530
17/09/2024	150	-0.650
17/09/2024	255	-0.740
17/09/2024	350	-0.790

***Soakaway failed - pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.35	1.800	1.450	0.7125	1.4375



APPENDIX 4 – Dynamic Probe Records

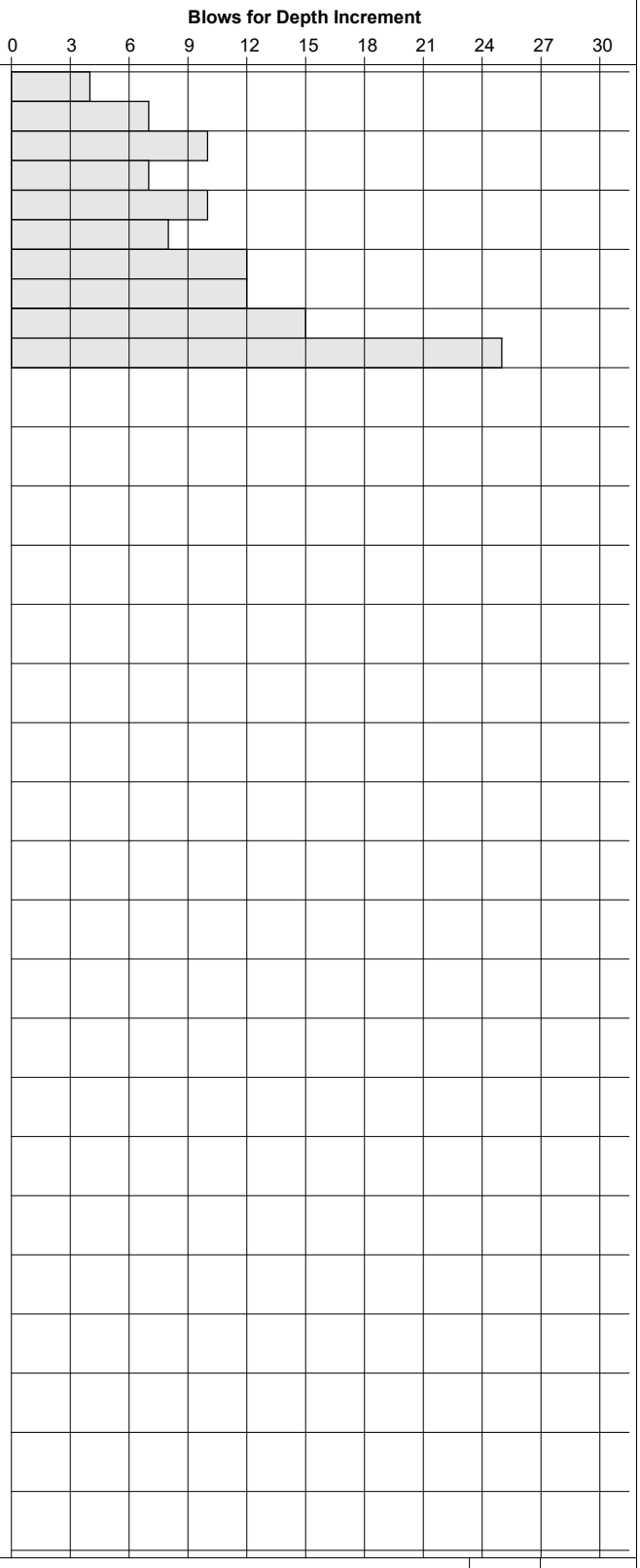
Ground Investigations Ireland Ltd
www.gii.ie

Site	Probe Number
Coolpowra Galway	DP-01

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	48.56	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
581942.1 E 709124.6 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		48.56	0.00
0.10-0.20	7			
0.20-0.30	10			
0.30-0.40	7			
0.40-0.50	10			
0.50-0.60	8		48.06	0.50
0.60-0.70	12			
0.70-0.80	12			
0.80-0.90	15			
0.90-1.00	25		47.56	1.00
			47.06	1.50
			46.56	2.00
			46.06	2.50
			45.56	3.00
			45.06	3.50
			44.56	4.00
			44.06	4.50
			43.56	5.00



Remarks
Refusal at 1.00m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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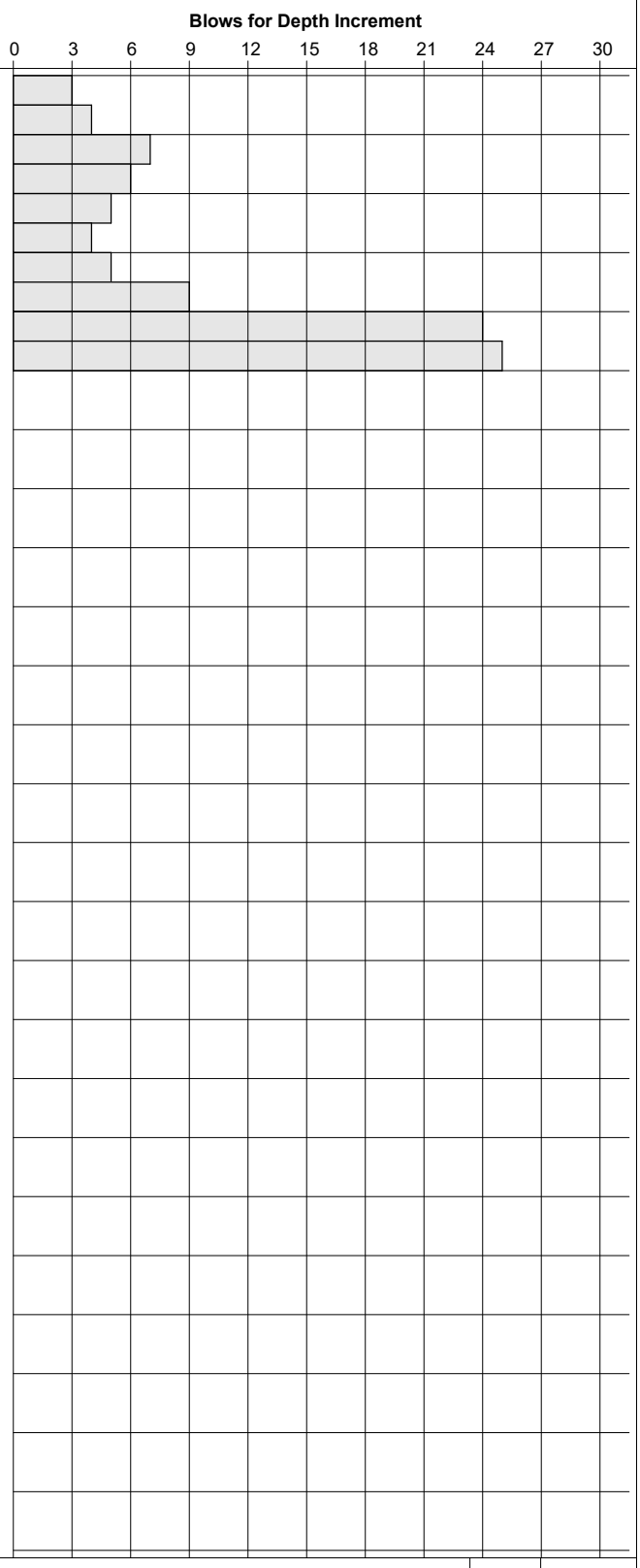
Ground Investigations Ireland Ltd
www.gii.ie

Site	Probe Number
Coolpowra Galway	DP-02

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	48.06	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582000.4 E 709111.5 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		48.06	0.00
0.10-0.20	4			
0.20-0.30	7			
0.30-0.40	6			
0.40-0.50	5			
0.50-0.60	4		47.56	0.50
0.60-0.70	5			
0.70-0.80	9			
0.80-0.90	24			
0.90-1.00	25		47.06	1.00
			46.56	1.50
			46.06	2.00
			45.56	2.50
			45.06	3.00
			44.56	3.50
			44.06	4.00
			43.56	4.50
			43.06	5.00



Remarks
Refusal at 1.00m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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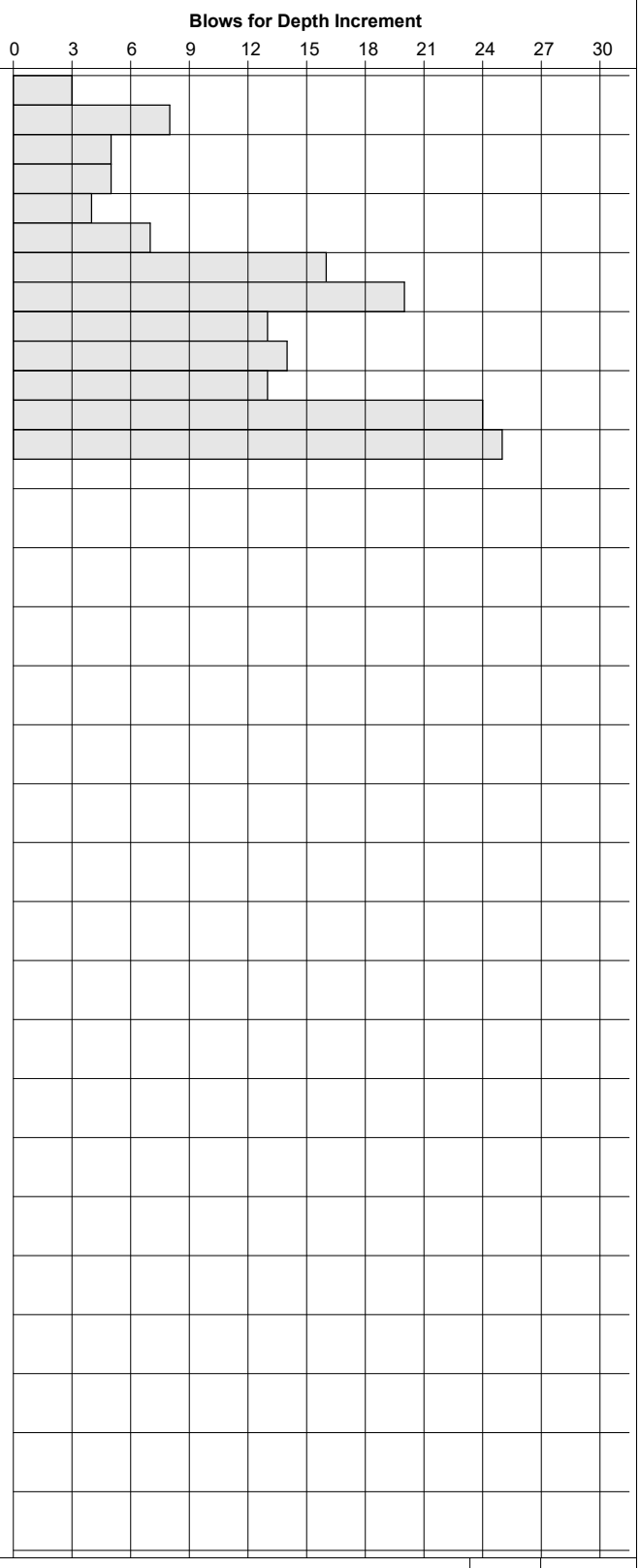
Site	Probe Number
Coolpowra Galway	DP-03

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	48.64	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582014.8 E 709053.1 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		48.64	0.00
0.10-0.20	8			
0.20-0.30	5			
0.30-0.40	5			
0.40-0.50	4			
0.50-0.60	7		48.14	0.50
0.60-0.70	16			
0.70-0.80	20			
0.80-0.90	13			
0.90-1.00	14			
1.00-1.10	13		47.64	1.00
1.10-1.20	24			
1.20-1.30	25			
			47.14	1.50
			46.64	2.00
			46.14	2.50
			45.64	3.00
			45.14	3.50
			44.64	4.00
			44.14	4.50
			43.64	5.00



Remarks
Refusal at 1.30m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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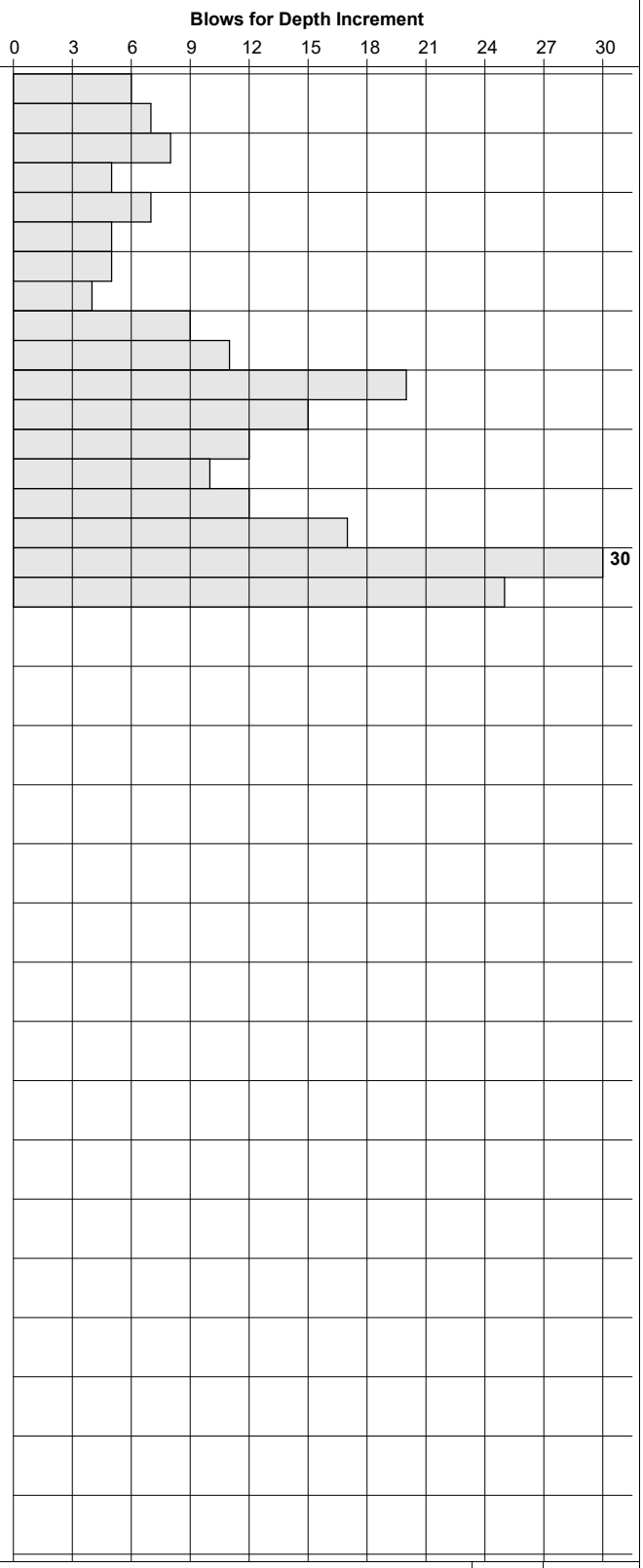
Site	Probe Number
Coolpowra Galway	DP-04

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	49.13	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	581992.4 E 708973.1 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	6		49.13	0.00
0.10-0.20	7			
0.20-0.30	8			
0.30-0.40	5			
0.40-0.50	7			
0.50-0.60	5		48.63	0.50
0.60-0.70	5			
0.70-0.80	4			
0.80-0.90	9			
0.90-1.00	11			
1.00-1.10	20		48.13	1.00
1.10-1.20	15			
1.20-1.30	12			
1.30-1.40	10			
1.40-1.50	12			
1.50-1.60	17		47.63	1.50
1.60-1.70	30			
1.70-1.80	25			
			47.13	2.00
			46.63	2.50
			46.13	3.00
			45.63	3.50
			45.13	4.00
			44.63	4.50
			44.13	5.00



Remarks
Refusal at 1.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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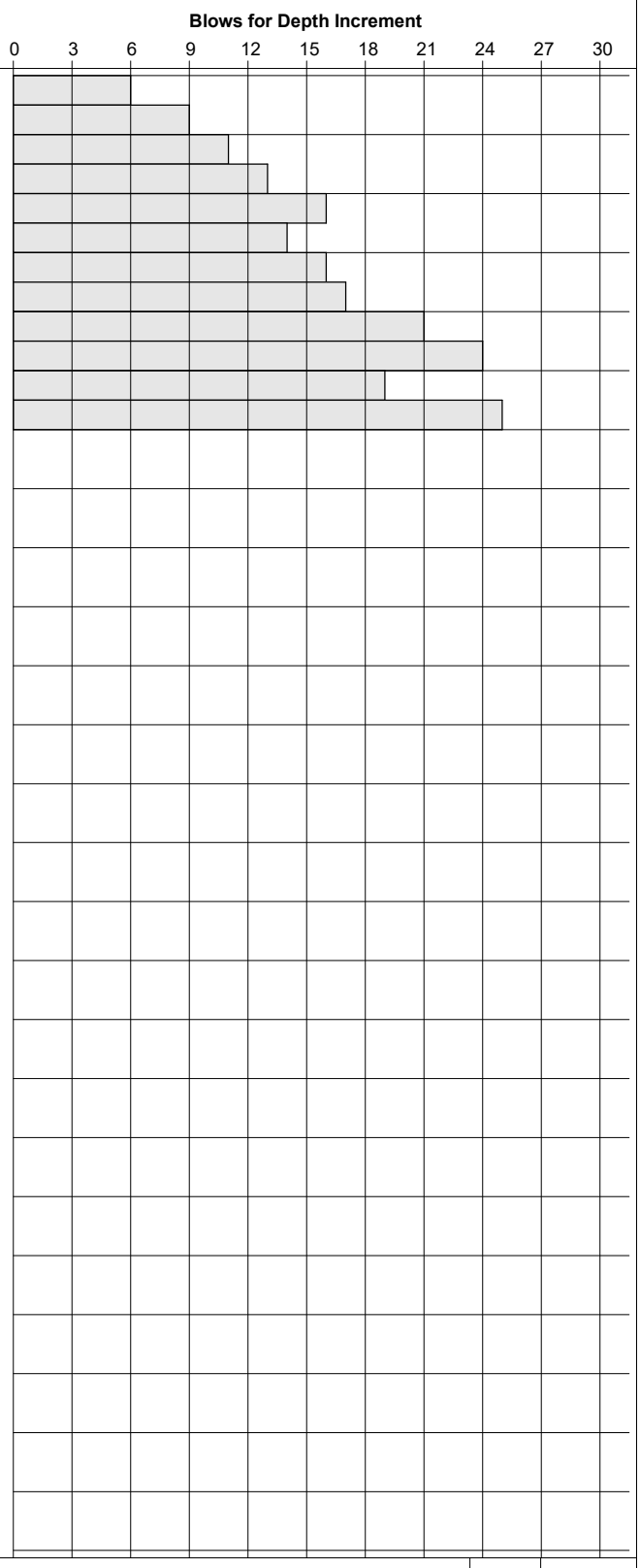
Site	Probe Number
Coolpowra Galway	DP-05

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	52.33	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582036.1 E 708972.1 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	6		52.33	0.00
0.10-0.20	9			
0.20-0.30	11			
0.30-0.40	13			
0.40-0.50	16			
0.50-0.60	14		51.83	0.50
0.60-0.70	16			
0.70-0.80	17			
0.80-0.90	21			
0.90-1.00	24			
1.00-1.10	19		51.33	1.00
1.10-1.20	25			
			50.83	1.50
			50.33	2.00
			49.83	2.50
			49.33	3.00
			48.83	3.50
			48.33	4.00
			47.83	4.50
			47.33	5.00



Remarks
Refusal at 1.20m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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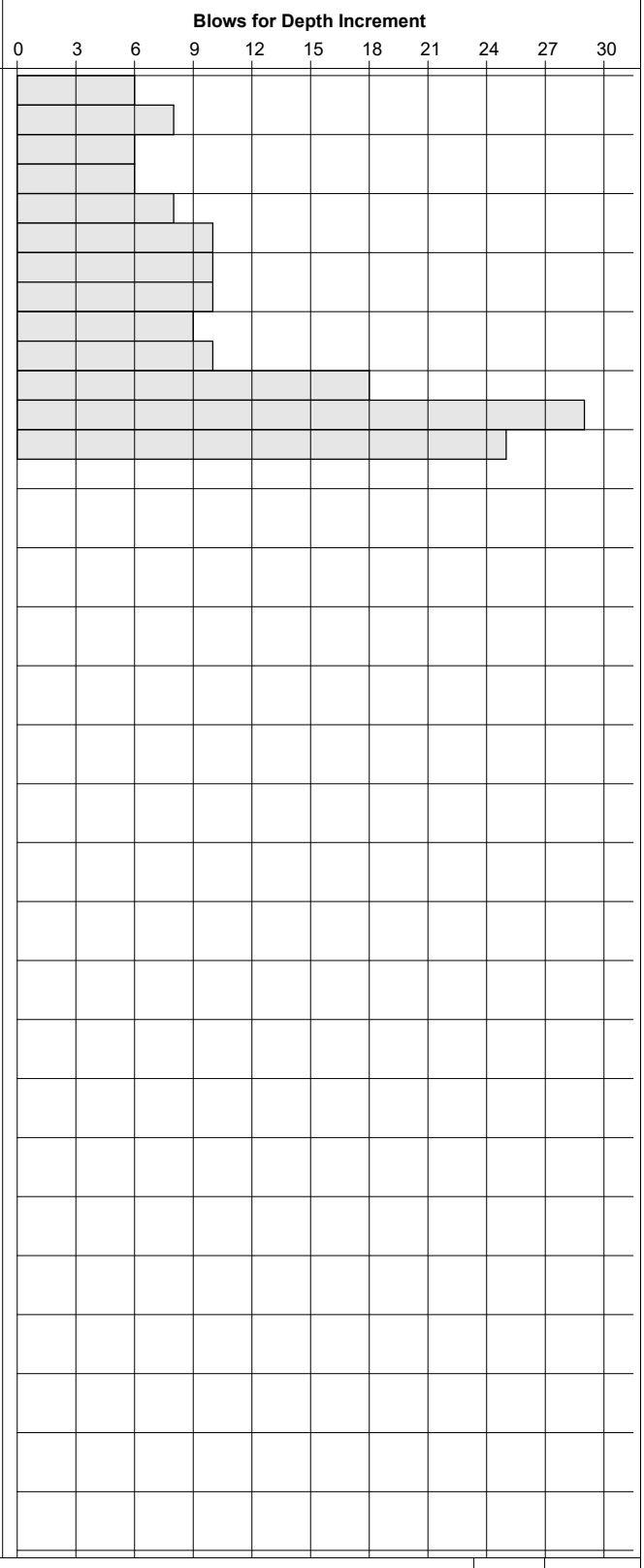
Site	Probe Number
Coolpowra Galway	DP-06

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	49.75	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582048.2 E 709036.1 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	6	
0.10-0.20	8	
0.20-0.30	6	
0.30-0.40	6	
0.40-0.50	8	
0.50-0.60	10	
0.60-0.70	10	
0.70-0.80	10	
0.80-0.90	9	
0.90-1.00	10	
1.00-1.10	18	
1.10-1.20	29	
1.20-1.30	25	



Remarks
Refusal at 1.30m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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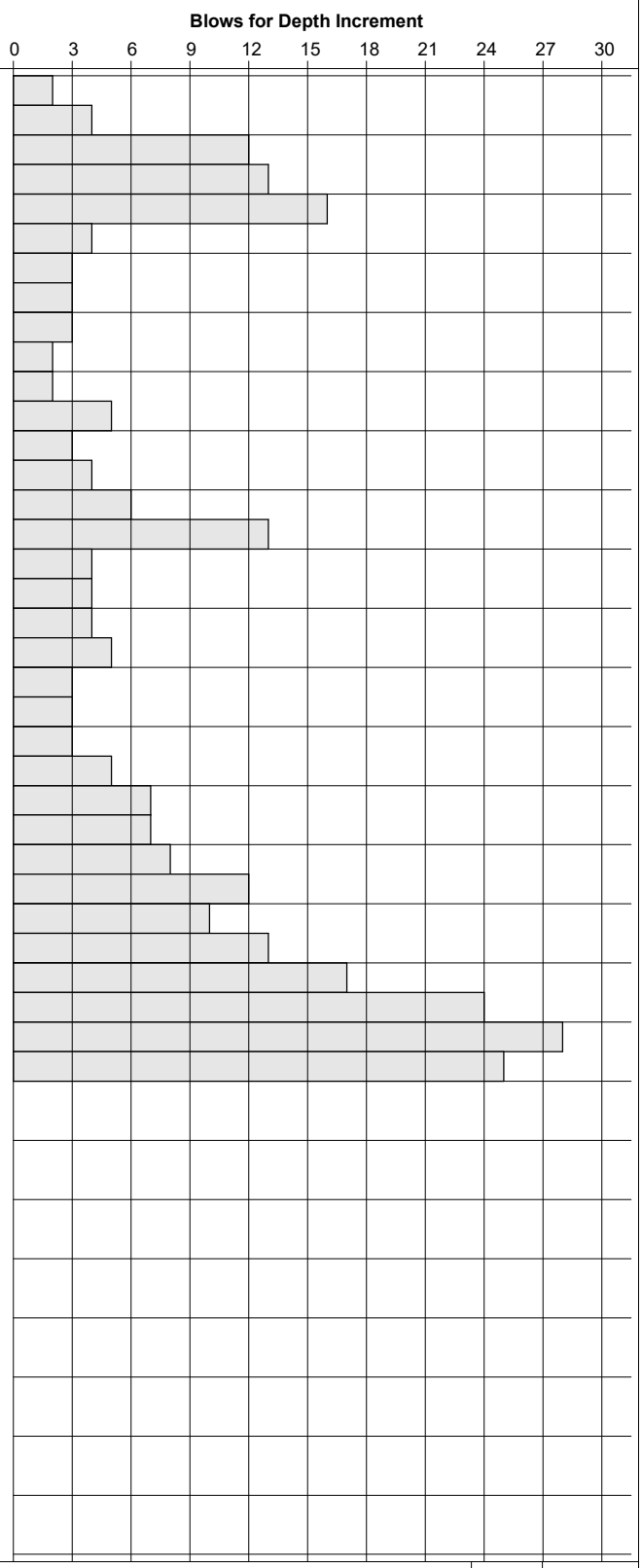
Site	Probe Number
Coolpowra Galway	DP-07

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	49.82	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582059.1 E 709168.4 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	2		49.82	0.00
0.10-0.20	4			
0.20-0.30	12			
0.30-0.40	13			
0.40-0.50	16			
0.50-0.60	4		49.32	0.50
0.60-0.70	3			
0.70-0.80	3			
0.80-0.90	3			
0.90-1.00	2			
1.00-1.10	2		48.82	1.00
1.10-1.20	5			
1.20-1.30	3			
1.30-1.40	4			
1.40-1.50	6			
1.50-1.60	13		48.32	1.50
1.60-1.70	4			
1.70-1.80	4			
1.80-1.90	4			
1.90-2.00	5			
2.00-2.10	3		47.82	2.00
2.10-2.20	3			
2.20-2.30	3			
2.30-2.40	5			
2.40-2.50	7			
2.50-2.60	7		47.32	2.50
2.60-2.70	8			
2.70-2.80	12			
2.80-2.90	10			
2.90-3.00	13			
3.00-3.10	17		46.82	3.00
3.10-3.20	24			
3.20-3.30	28			
3.30-3.40	25			
			46.32	3.50
			45.82	4.00
			45.32	4.50
			44.82	5.00



Remarks
Refusal at 3.40m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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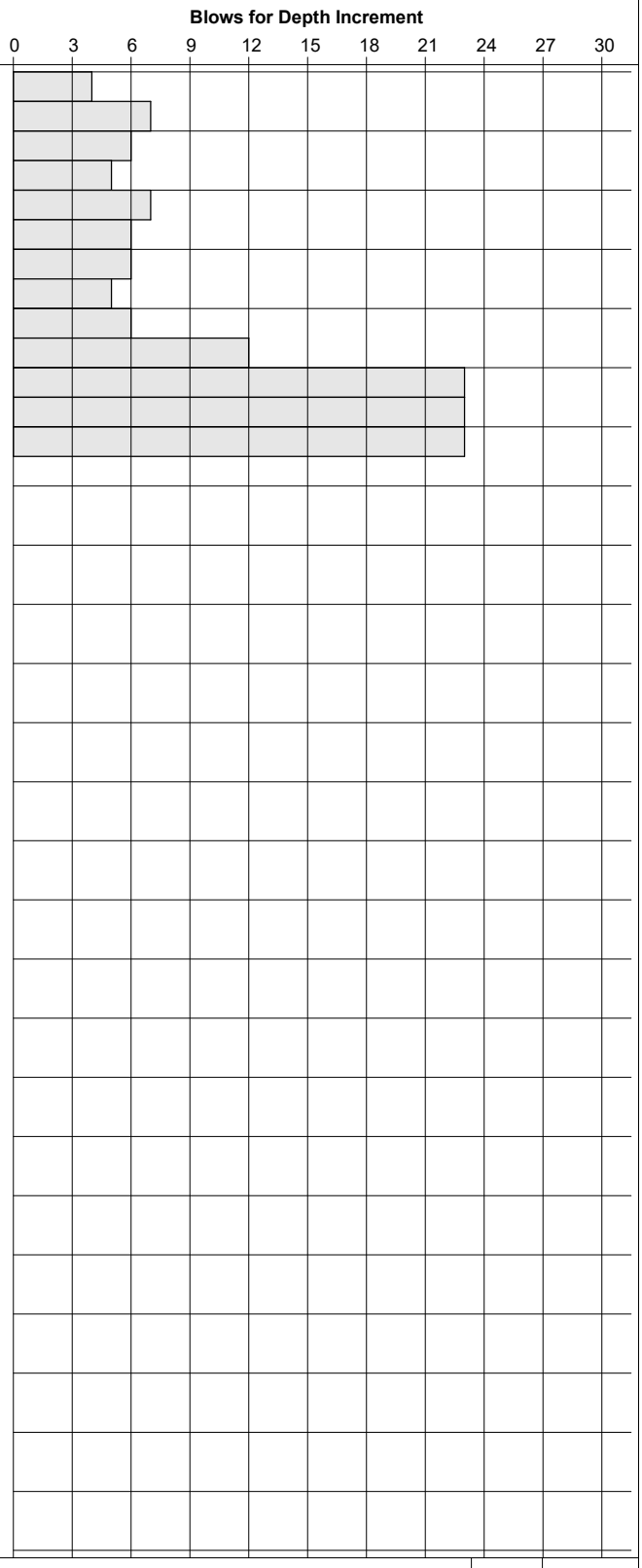
Site	Probe Number
Coolpowra Galway	DP-08

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	49.77	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582079 E 709129.6 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		49.77	0.00
0.10-0.20	7			
0.20-0.30	6			
0.30-0.40	5			
0.40-0.50	7			
0.50-0.60	6		49.27	0.50
0.60-0.70	6			
0.70-0.80	5			
0.80-0.90	6			
0.90-1.00	12			
1.00-1.10	23		48.77	1.00
1.10-1.20	23			
1.20-1.30	23			
			48.27	1.50
			47.77	2.00
			47.27	2.50
			46.77	3.00
			46.27	3.50
			45.77	4.00
			45.27	4.50
			44.77	5.00



Remarks
Refusal at 1.30m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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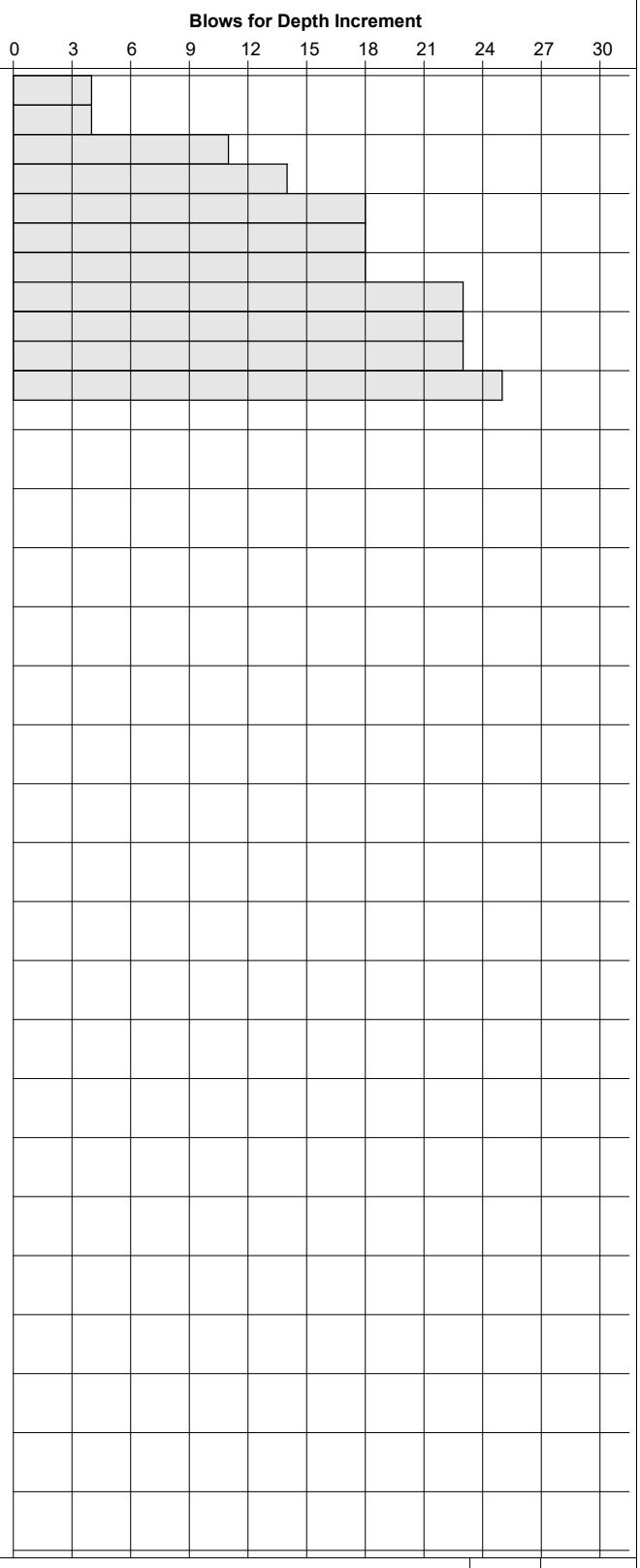
Site	Probe Number
Coolpowra Galway	DP-09

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	49.48	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582073.9 E 709083.4 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		49.48	0.00
0.10-0.20	4			
0.20-0.30	11			
0.30-0.40	14			
0.40-0.50	18			
0.50-0.60	18		48.98	0.50
0.60-0.70	18			
0.70-0.80	23			
0.80-0.90	23			
0.90-1.00	23			
1.00-1.10	25		48.48	1.00
			47.98	1.50
			47.48	2.00
			46.98	2.50
			46.48	3.00
			45.98	3.50
			45.48	4.00
			44.98	4.50
			44.48	5.00



Remarks
Refusal at 1.10m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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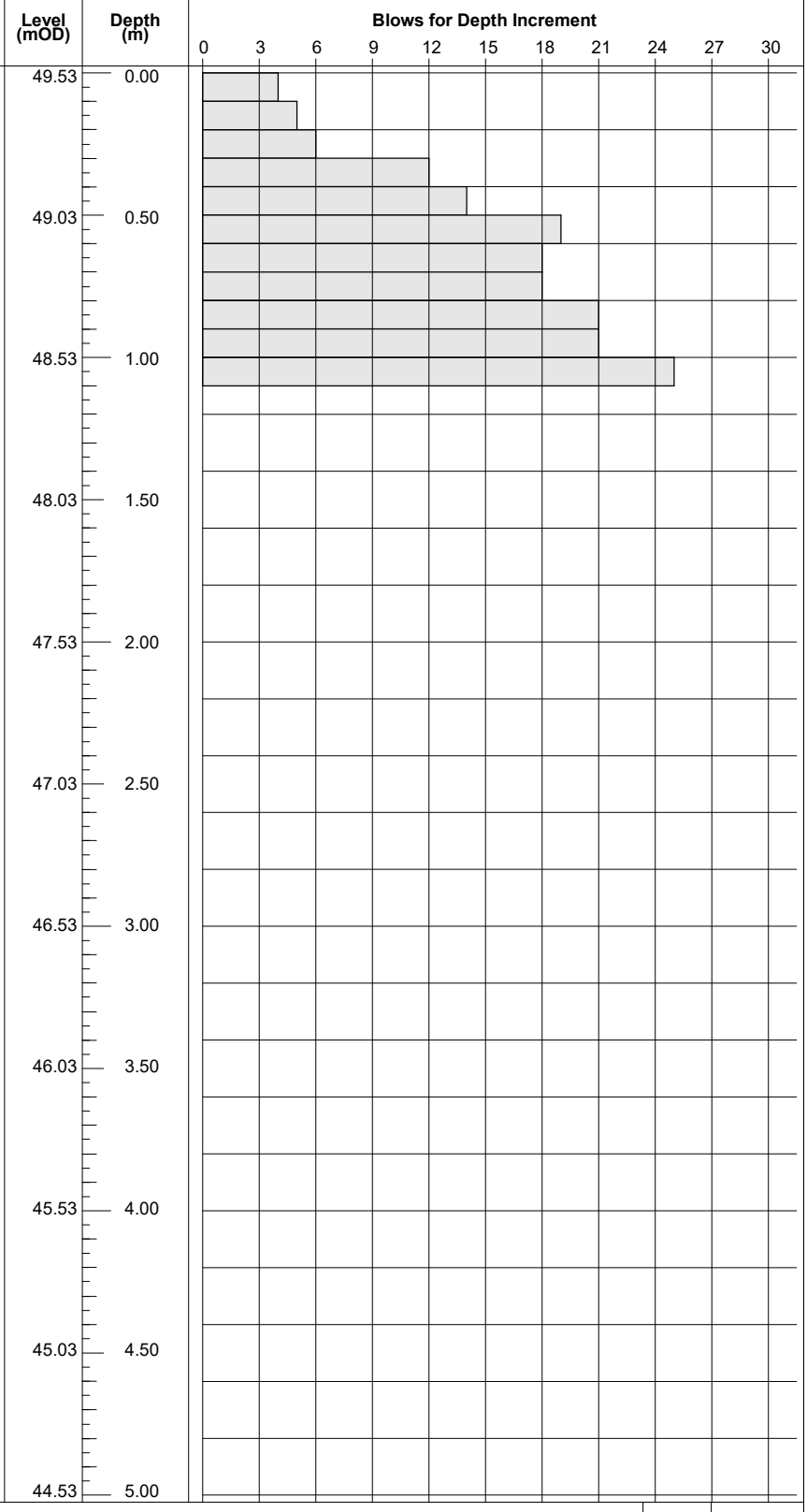
Site	Probe Number
Coolpowra Galway	DP-10

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	49.53	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582094.4 E 709045 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	4	
0.10-0.20	5	
0.20-0.30	6	
0.30-0.40	12	
0.40-0.50	14	
0.50-0.60	19	
0.60-0.70	18	
0.70-0.80	18	
0.80-0.90	21	
0.90-1.00	21	
1.00-1.10	25	



Remarks
Refusal at 1.10m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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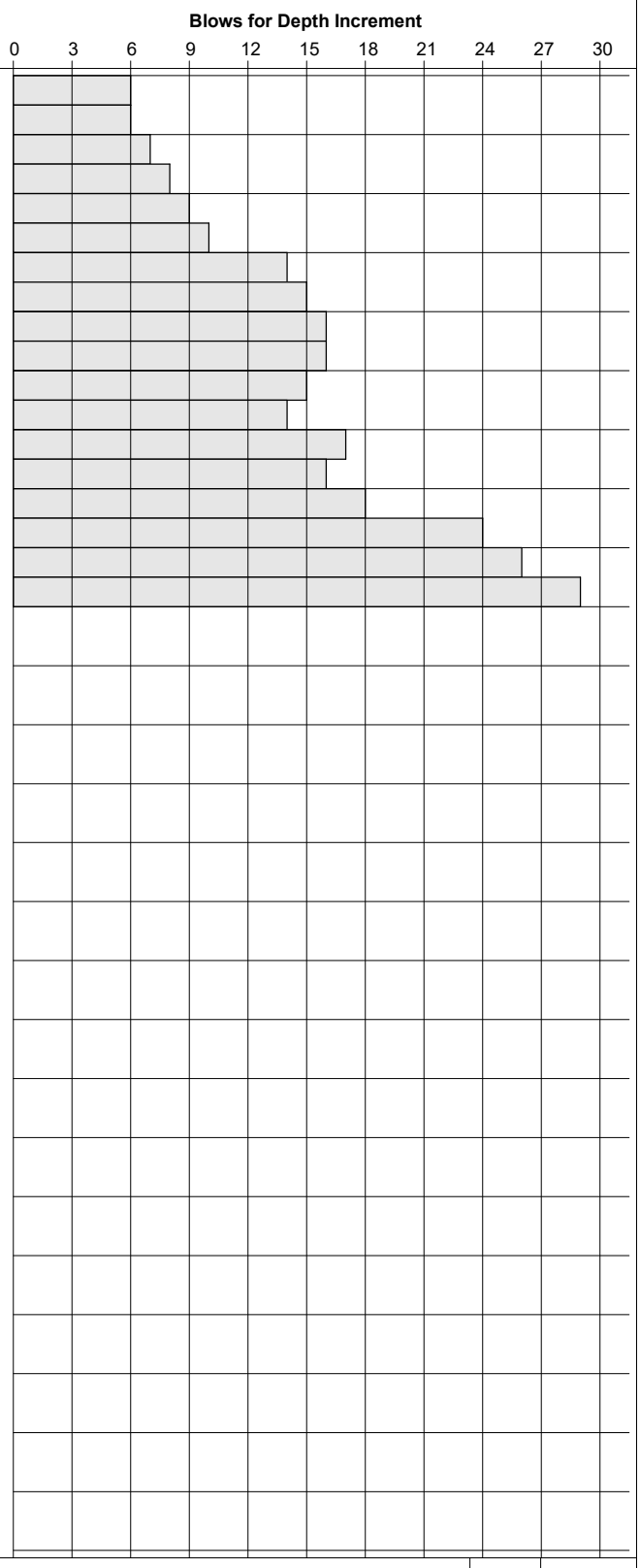
Site	Probe Number
Coolpowra Galway	DP-11

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	52.66	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582079.5 E 708974.3 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	6		52.66	0.00
0.10-0.20	6			
0.20-0.30	7			
0.30-0.40	8			
0.40-0.50	9			
0.50-0.60	10		52.16	0.50
0.60-0.70	14			
0.70-0.80	15			
0.80-0.90	16			
0.90-1.00	16			
1.00-1.10	15		51.66	1.00
1.10-1.20	14			
1.20-1.30	17			
1.30-1.40	16			
1.40-1.50	18			
1.50-1.60	24		51.16	1.50
1.60-1.70	26			
1.70-1.80	29			
			50.66	2.00
			50.16	2.50
			49.66	3.00
			49.16	3.50
			48.66	4.00
			48.16	4.50
			47.66	5.00



Remarks
Refusal at 1.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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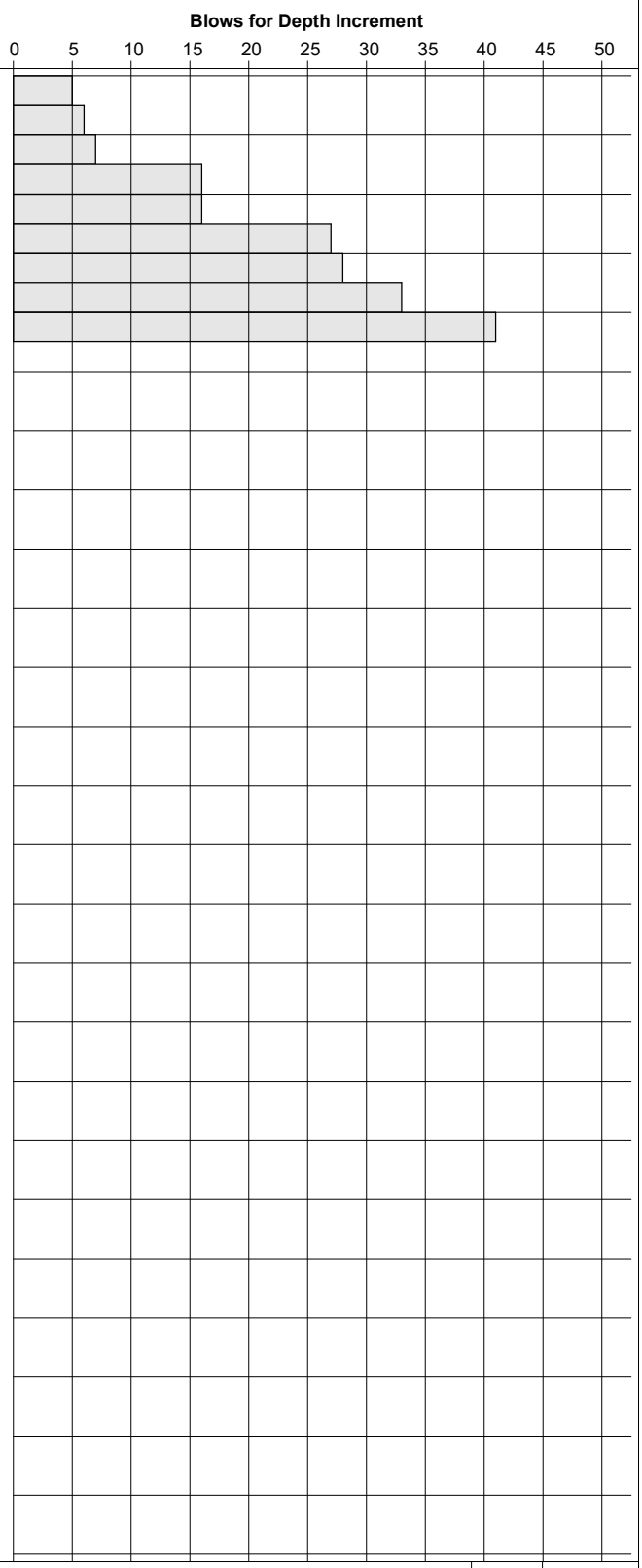
Site	Probe Number
Coolpowra Galway	DP-12

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	50.76	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582105.8 E 708933.4 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	5		50.76	0.00
0.10-0.20	6			
0.20-0.30	7			
0.30-0.40	16			
0.40-0.50	16			
0.50-0.60	27		50.26	0.50
0.60-0.70	28			
0.70-0.80	33			
0.80-0.90	41			
			49.76	1.00
			49.26	1.50
			48.76	2.00
			48.26	2.50
			47.76	3.00
			47.26	3.50
			46.76	4.00
			46.26	4.50
			45.76	5.00



Remarks
Refusal at 0.90m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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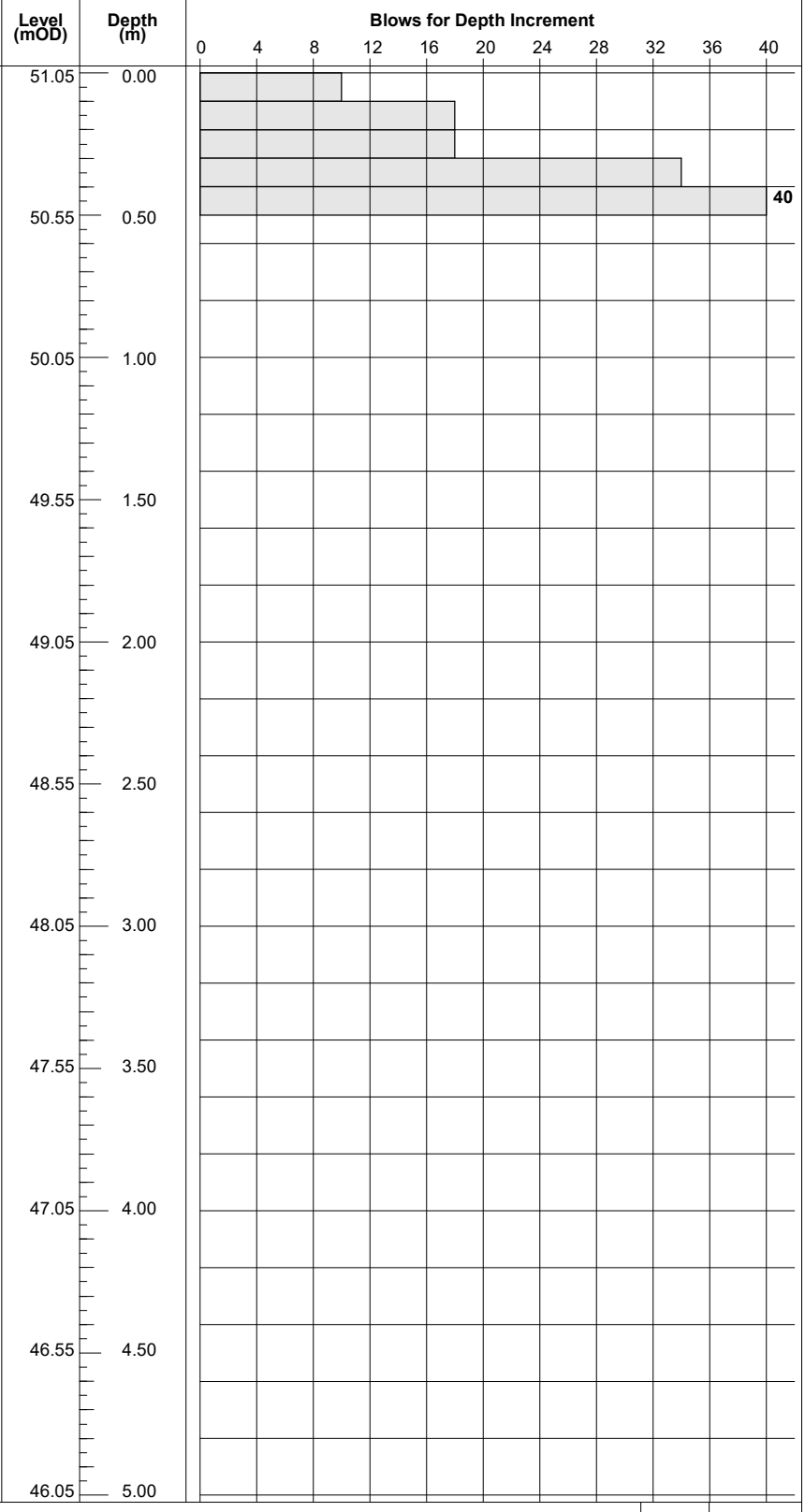
Site	Probe Number
Coolpowra Galway	DP-13

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.05	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582143.4 E 708985.3 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	10	
0.10-0.20	18	
0.20-0.30	18	
0.30-0.40	34	
0.40-0.50	40	



Remarks
Refusal at 0.50m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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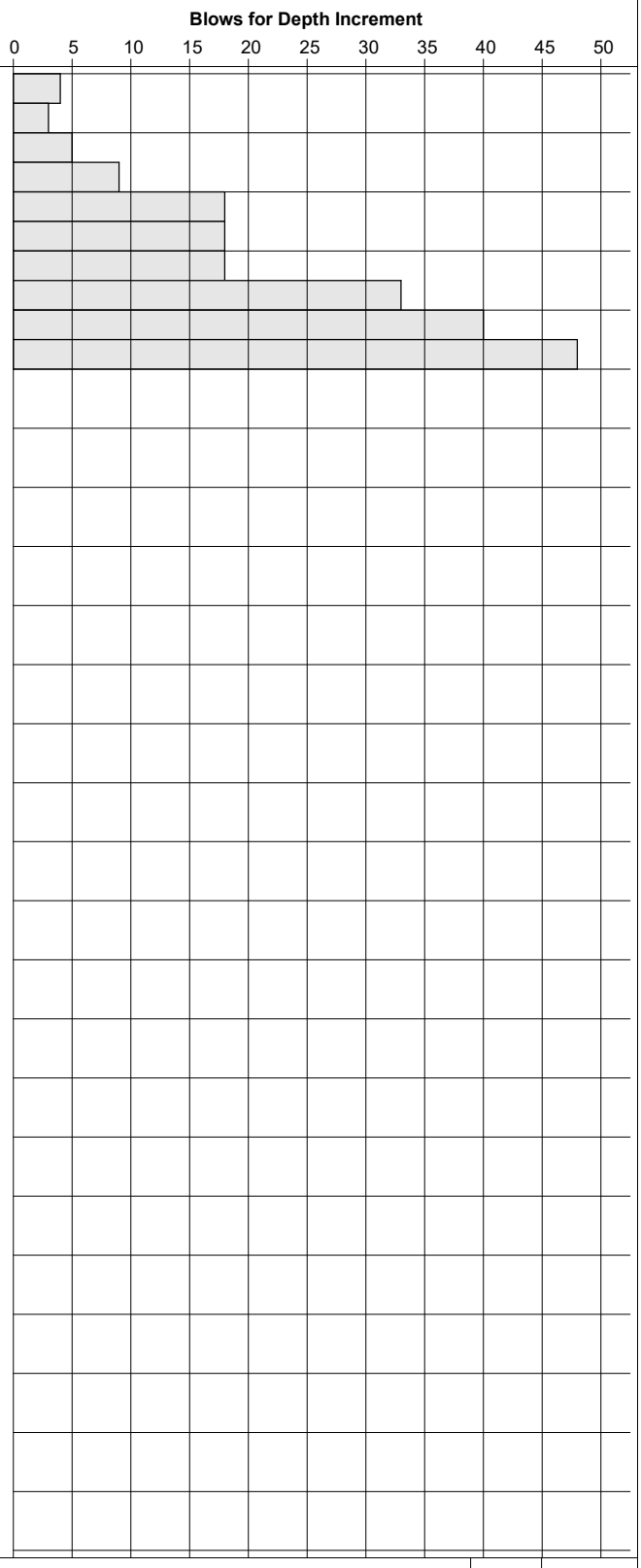
Site	Probe Number
Coolpowra Galway	DP-14

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.39	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582130.1 E 709145.4 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		51.39	0.00
0.10-0.20	3			
0.20-0.30	5			
0.30-0.40	9			
0.40-0.50	18			
0.50-0.60	18		50.89	0.50
0.60-0.70	18			
0.70-0.80	33			
0.80-0.90	40			
0.90-1.00	48		50.39	1.00
			49.89	1.50
			49.39	2.00
			48.89	2.50
			48.39	3.00
			47.89	3.50
			47.39	4.00
			46.89	4.50
			46.39	5.00



Remarks
Refusal at 1.00m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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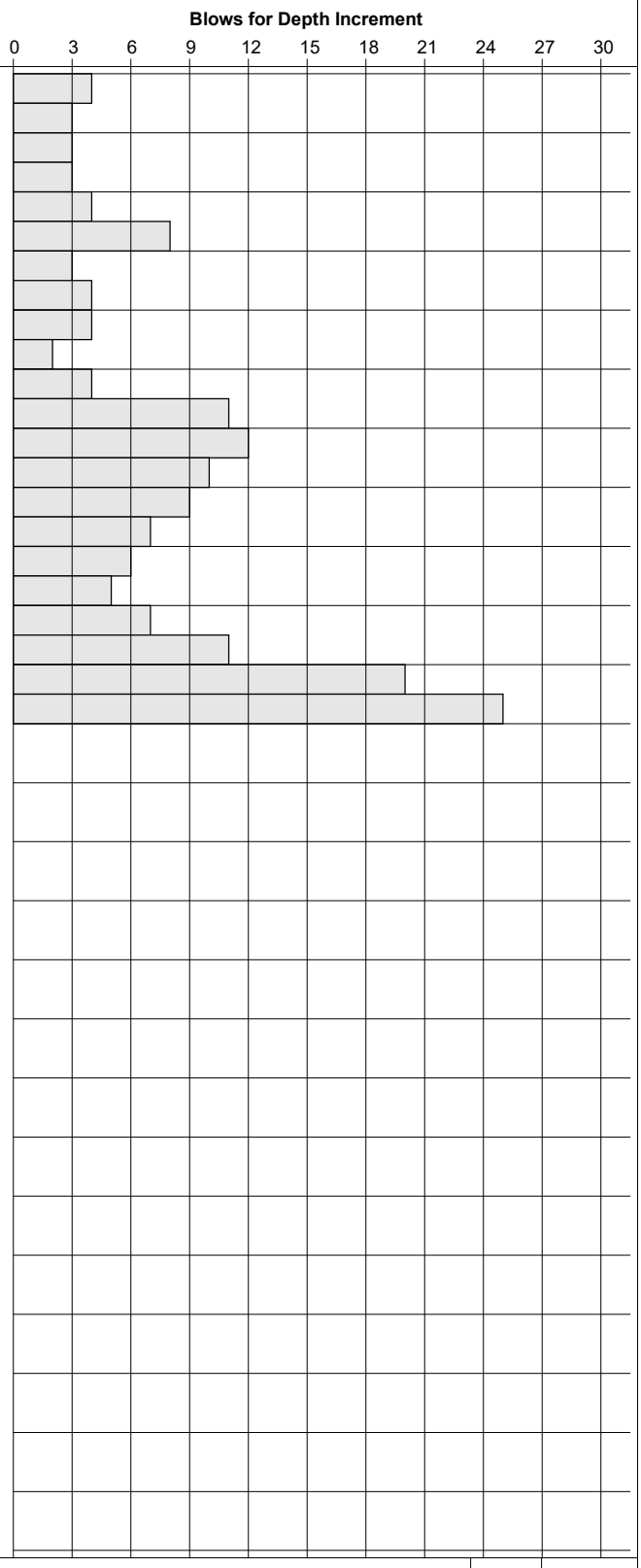
Site	Probe Number
Coolpowra Galway	DP-15

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	50.71	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582145.6 E 709055.6 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		50.71	0.00
0.10-0.20	3			
0.20-0.30	3			
0.30-0.40	3			
0.40-0.50	4			
0.50-0.60	8		50.21	0.50
0.60-0.70	3			
0.70-0.80	4			
0.80-0.90	4			
0.90-1.00	2			
1.00-1.10	4		49.71	1.00
1.10-1.20	11			
1.20-1.30	12			
1.30-1.40	10			
1.40-1.50	9			
1.50-1.60	7		49.21	1.50
1.60-1.70	6			
1.70-1.80	5			
1.80-1.90	7			
1.90-2.00	11			
2.00-2.10	20		48.71	2.00
2.10-2.20	25			
			48.21	2.50
			47.71	3.00
			47.21	3.50
			46.71	4.00
			46.21	4.50
			45.71	5.00



Remarks
Refusal at 2.20m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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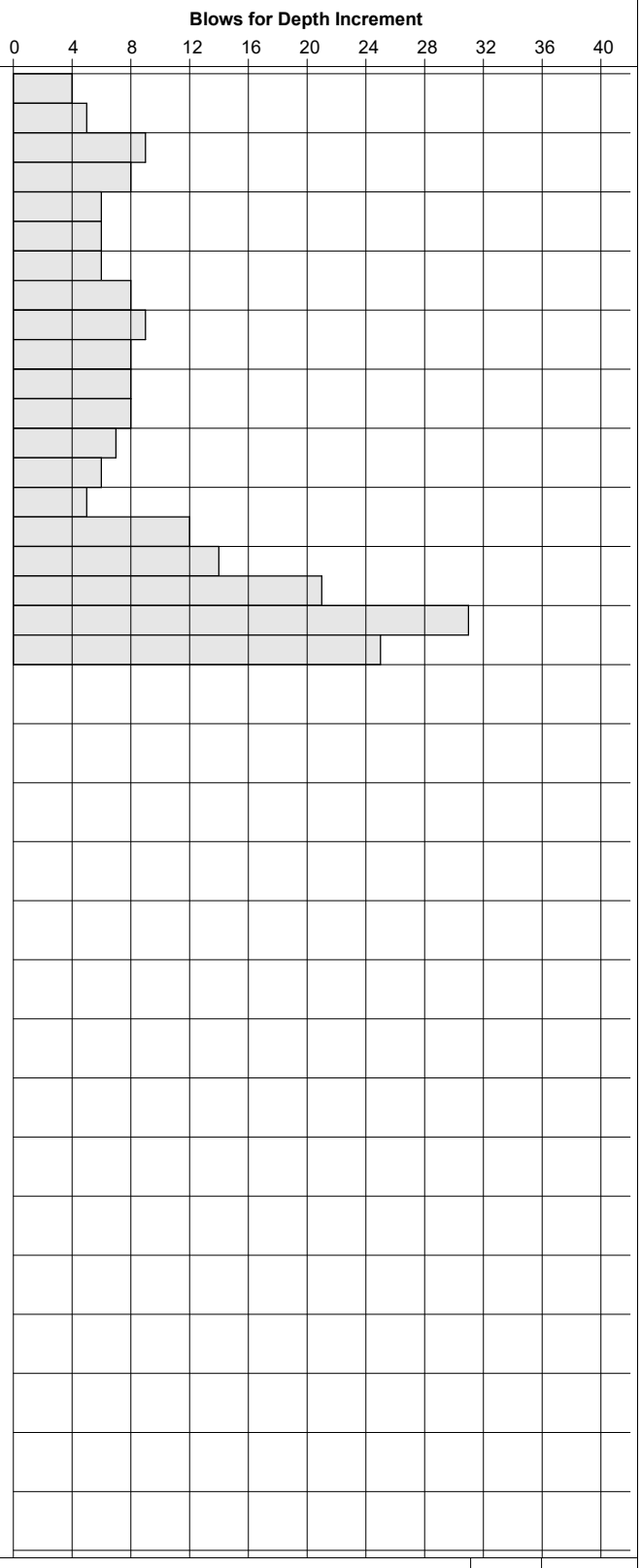
Site	Probe Number
Coolpowra Galway	DP-16

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.20	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582165 E 709030.9 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		51.20	0.00
0.10-0.20	5			
0.20-0.30	9			
0.30-0.40	8			
0.40-0.50	6			
0.50-0.60	6		50.70	0.50
0.60-0.70	6			
0.70-0.80	8			
0.80-0.90	9			
0.90-1.00	8			
1.00-1.10	8		50.20	1.00
1.10-1.20	8			
1.20-1.30	7			
1.30-1.40	6			
1.40-1.50	5			
1.50-1.60	12		49.70	1.50
1.60-1.70	14			
1.70-1.80	21			
1.80-1.90	31			
1.90-2.00	25		49.20	2.00
			48.70	2.50
			48.20	3.00
			47.70	3.50
			47.20	4.00
			46.70	4.50
			46.20	5.00



Remarks
Refusal at 2.00m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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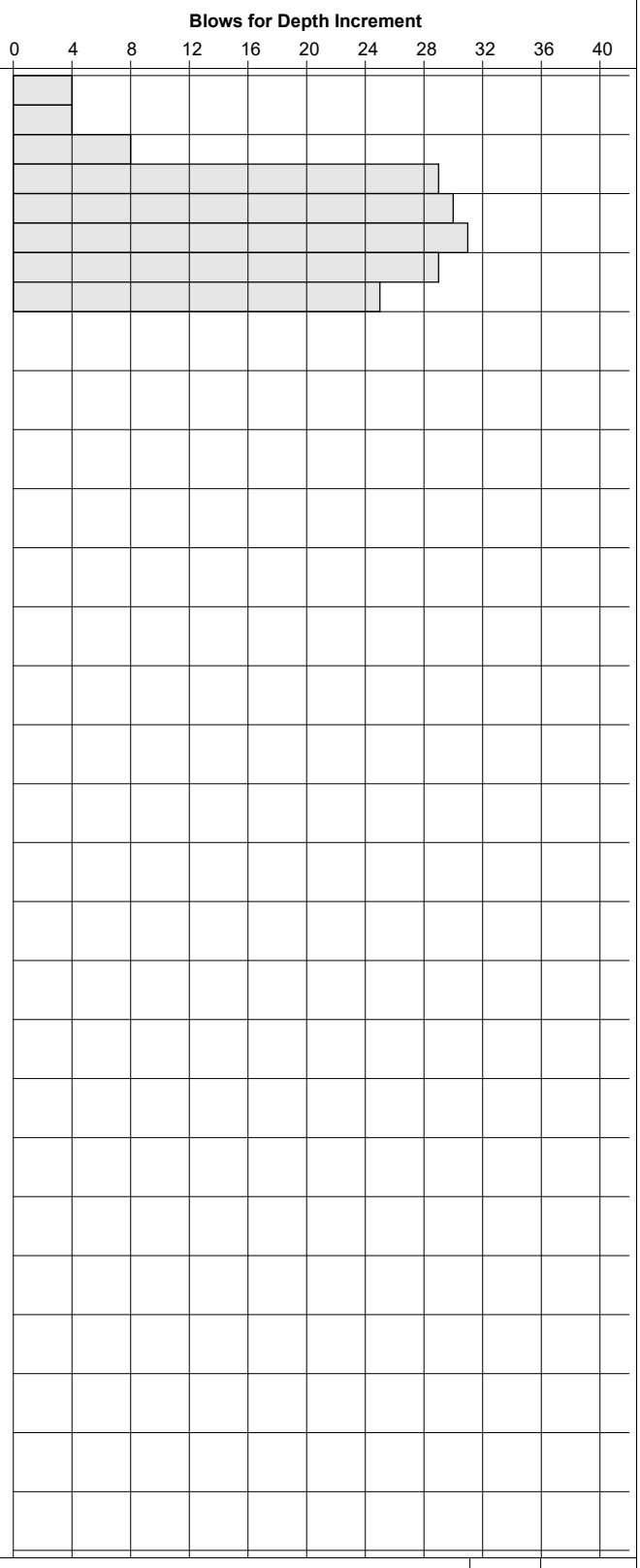
Site	Probe Number
Coolpowra Galway	DP-17

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.41	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582179.5 E 709138.7 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		51.41	0.00
0.10-0.20	4			
0.20-0.30	8			
0.30-0.40	29			
0.40-0.50	30			
0.50-0.60	31		50.91	0.50
0.60-0.70	29			
0.70-0.80	25			
			50.41	1.00
			49.91	1.50
			49.41	2.00
			48.91	2.50
			48.41	3.00
			47.91	3.50
			47.41	4.00
			46.91	4.50
			46.41	5.00



Remarks
Refusal at 0.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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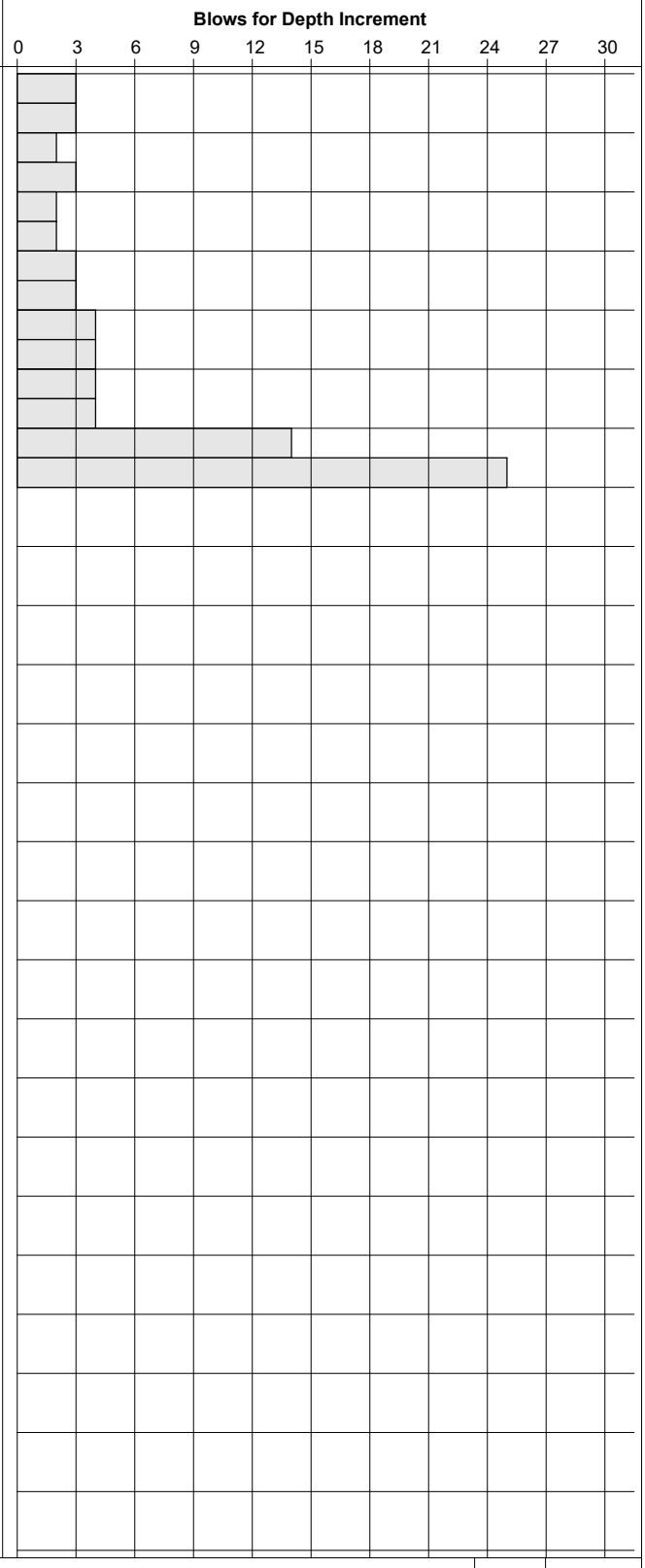
Site	Probe Number
Coolpowra Galway	DP-18

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.52	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582167.5 E 709087.1 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	3	
0.10-0.20	3	
0.20-0.30	2	
0.30-0.40	3	
0.40-0.50	2	
0.50-0.60	2	
0.60-0.70	3	
0.70-0.80	3	
0.80-0.90	4	
0.90-1.00	4	
1.00-1.10	4	
1.10-1.20	4	
1.20-1.30	14	
1.30-1.40	25	



Remarks
Refusal at 1.40m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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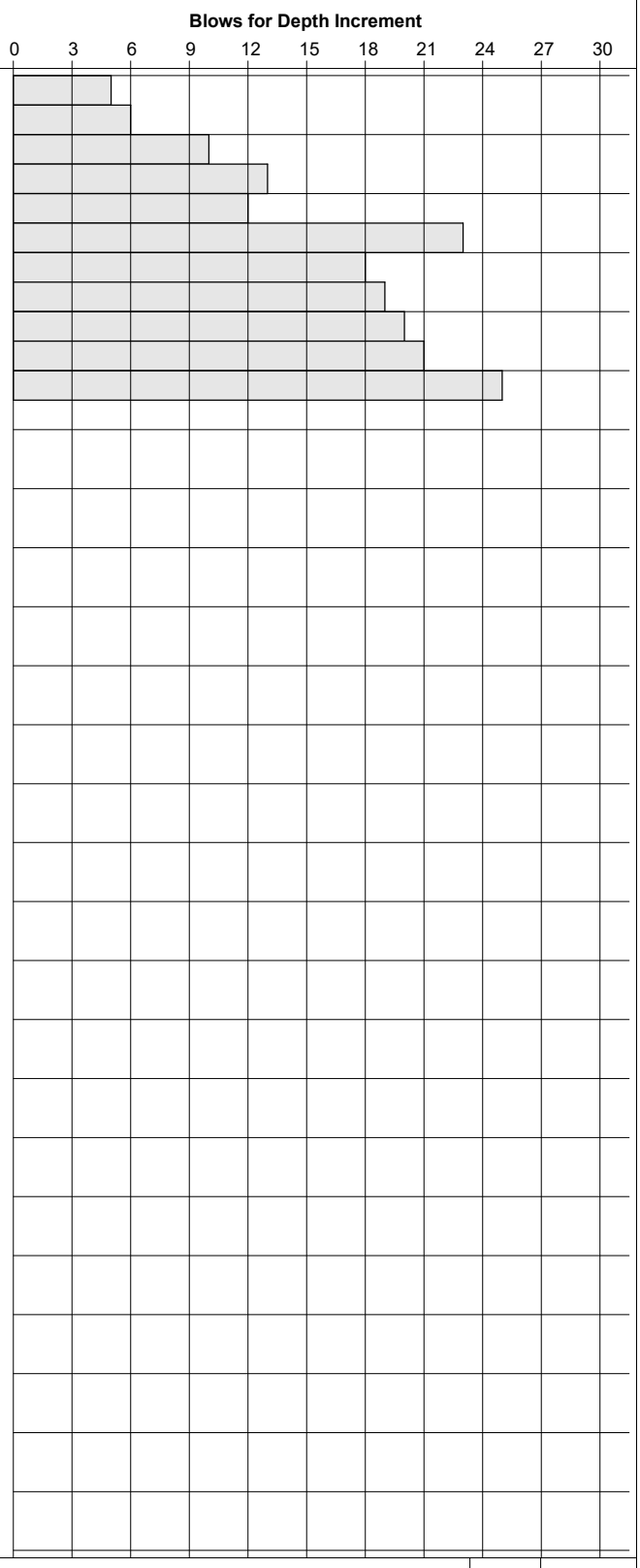
Site	Probe Number
Coolpowra Galway	DP-19

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.64	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582205.9 E 709018.4 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	5		51.64	0.00
0.10-0.20	6			
0.20-0.30	10			
0.30-0.40	13			
0.40-0.50	12			
0.50-0.60	23		51.14	0.50
0.60-0.70	18			
0.70-0.80	19			
0.80-0.90	20			
0.90-1.00	21			
1.00-1.10	25		50.64	1.00
			50.14	1.50
			49.64	2.00
			49.14	2.50
			48.64	3.00
			48.14	3.50
			47.64	4.00
			47.14	4.50
			46.64	5.00



Remarks
Refusal at 1.10m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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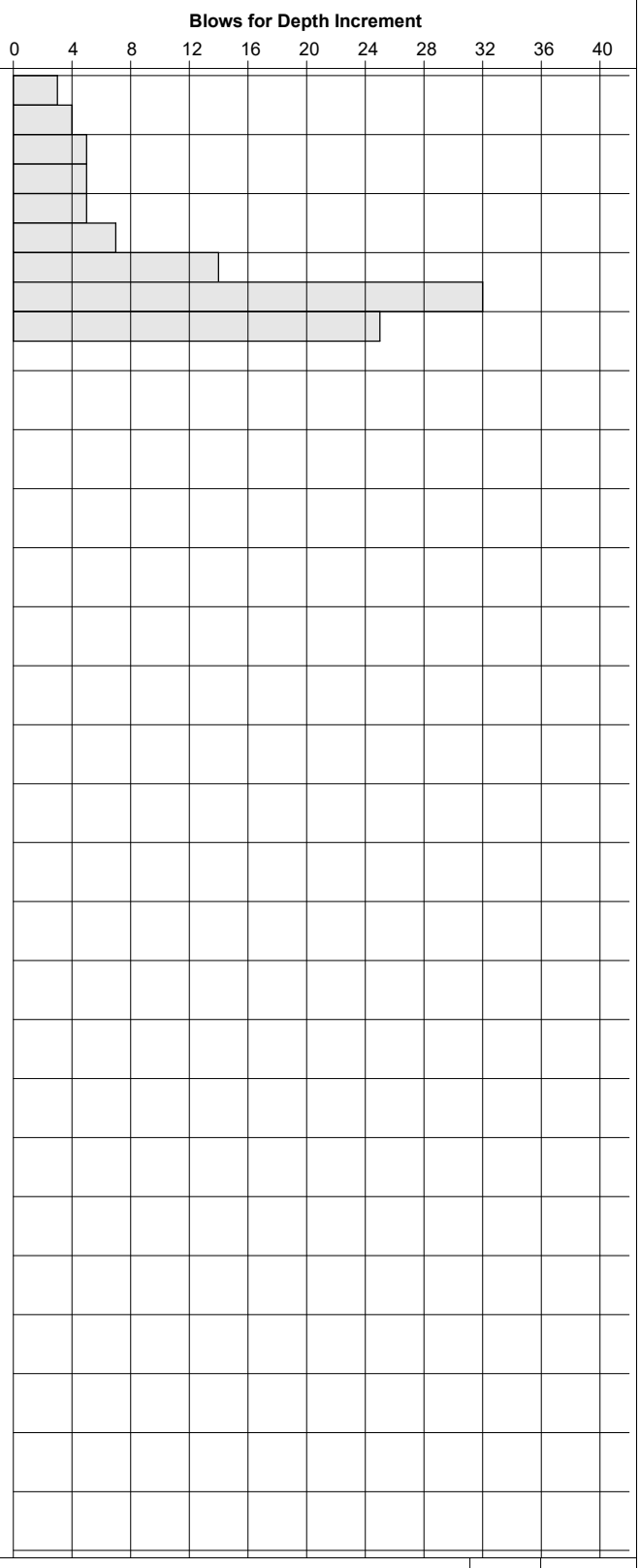
Site	Probe Number
Coolpowra Galway	DP-20

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	54.42	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582263.8 E 709091.2 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		54.42	0.00
0.10-0.20	4			
0.20-0.30	5			
0.30-0.40	5			
0.40-0.50	5			
0.50-0.60	7		53.92	0.50
0.60-0.70	14			
0.70-0.80	32			
0.80-0.90	25		53.42	1.00
			52.92	1.50
			52.42	2.00
			51.92	2.50
			51.42	3.00
			50.92	3.50
			50.42	4.00
			49.92	4.50
			49.42	5.00



Remarks
Refusal at 0.90m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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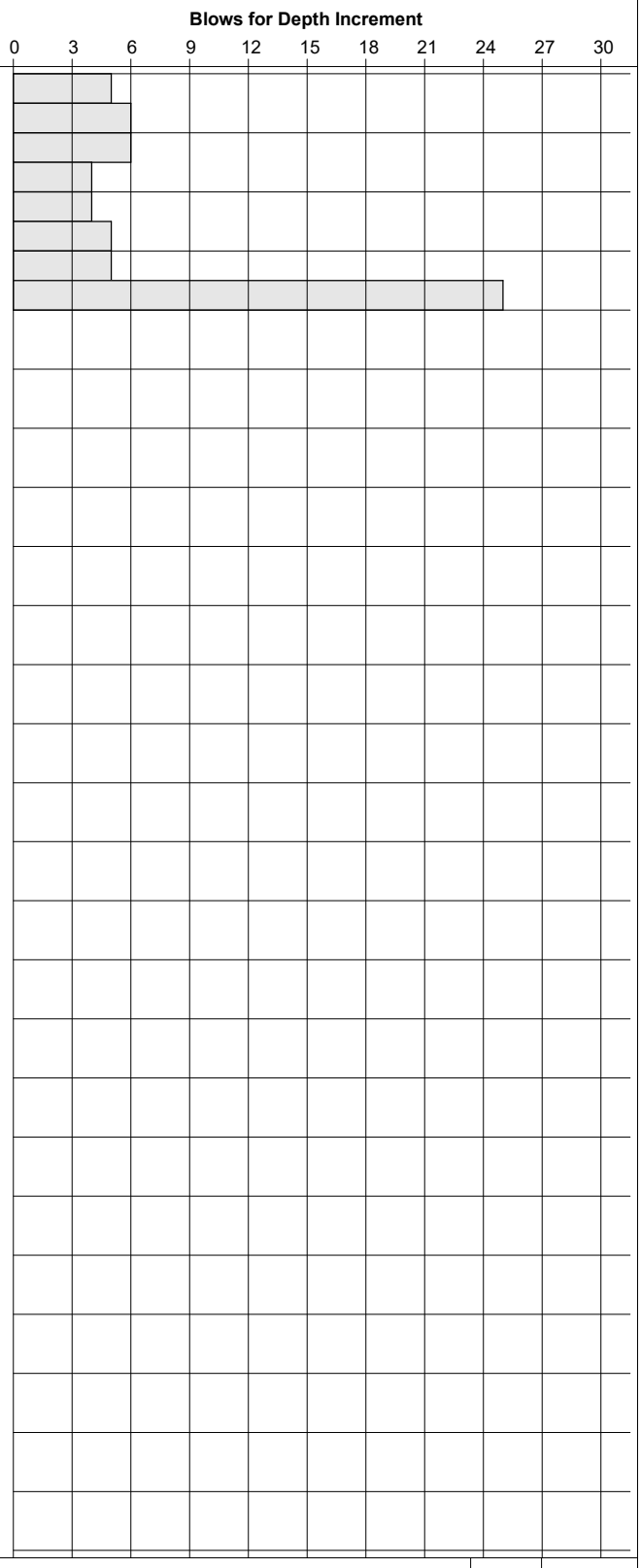
Site	Probe Number
Coolpowra Galway	DP-21

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	53.67	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582270.5 E 708984.9 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	5	
0.10-0.20	6	
0.20-0.30	6	
0.30-0.40	4	
0.40-0.50	4	
0.50-0.60	5	
0.60-0.70	5	
0.70-0.80	25	



Remarks
Refusal at 0.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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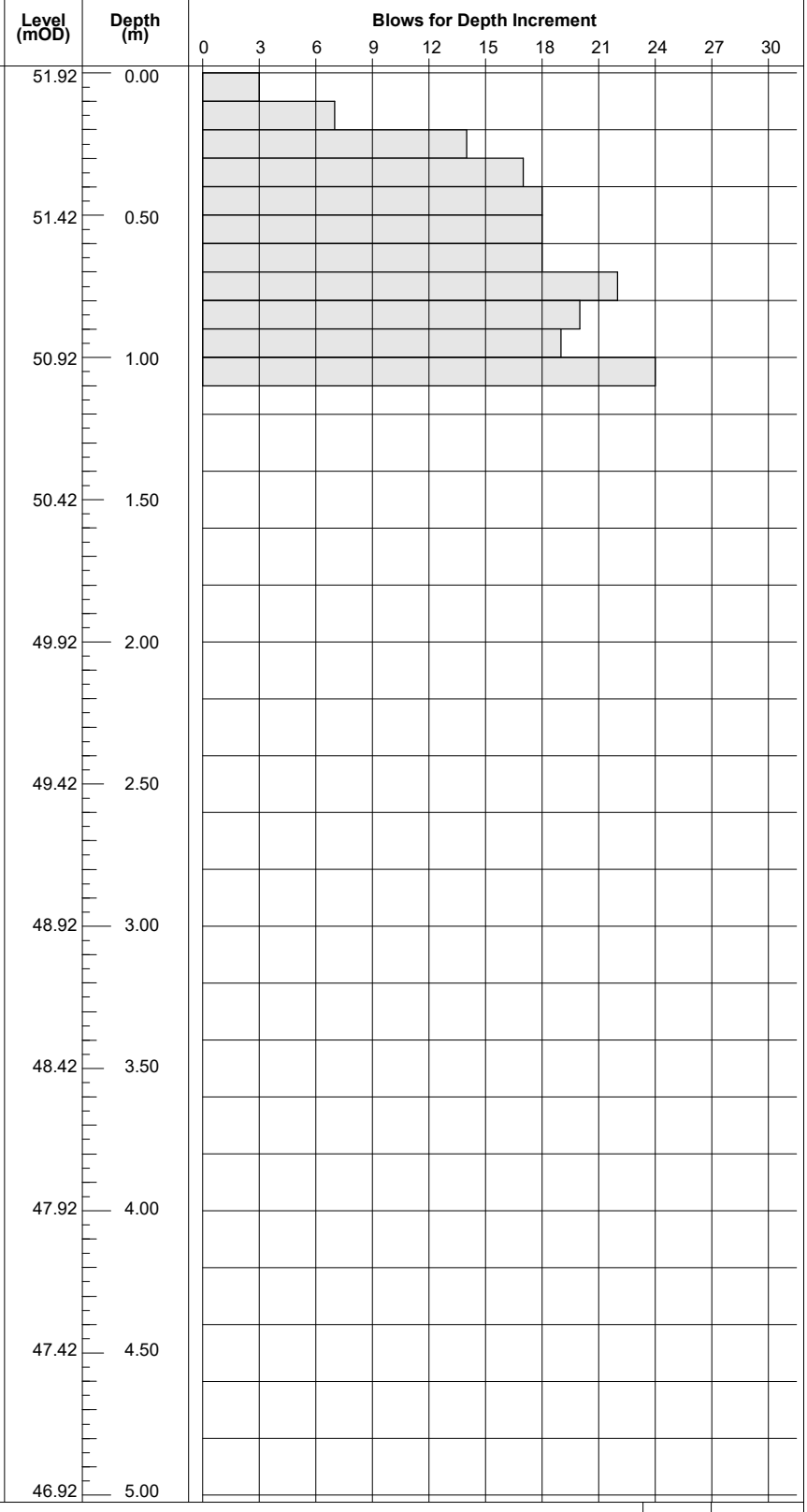
Site	Probe Number
Coolpowra Galway	DP-22

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.92	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582305.7 E 709123.2 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	3	
0.10-0.20	7	
0.20-0.30	14	
0.30-0.40	17	
0.40-0.50	18	
0.50-0.60	18	
0.60-0.70	18	
0.70-0.80	22	
0.80-0.90	20	
0.90-1.00	19	
1.00-1.10	24	



Remarks
Refusal at 1.10m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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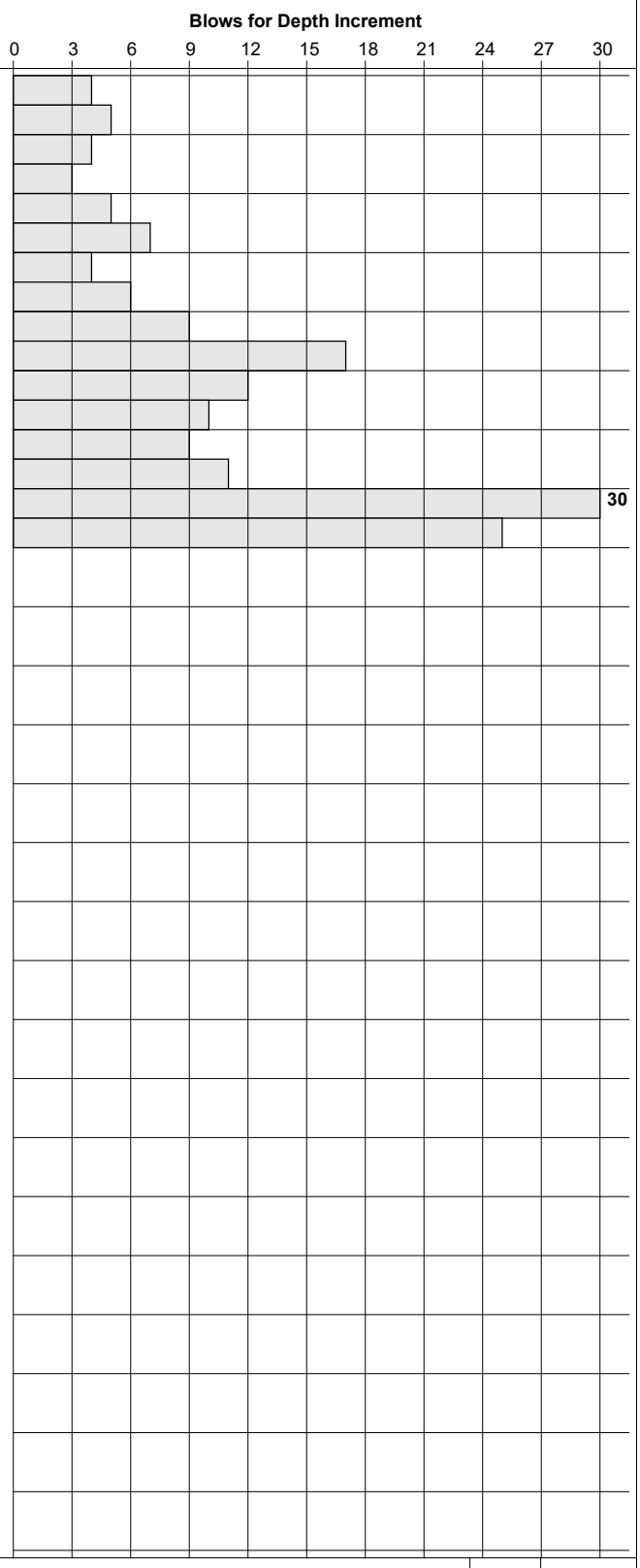
Site	Probe Number
Coolpowra Galway	DP-23

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	52.52	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582307.5 E 709058.9 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		52.52	0.00
0.10-0.20	5			
0.20-0.30	4			
0.30-0.40	3			
0.40-0.50	5			
0.50-0.60	7		52.02	0.50
0.60-0.70	4			
0.70-0.80	6			
0.80-0.90	9			
0.90-1.00	17			
1.00-1.10	12		51.52	1.00
1.10-1.20	10			
1.20-1.30	9			
1.30-1.40	11			
1.40-1.50	30			
1.50-1.60	25		51.02	1.50
			50.52	2.00
			50.02	2.50
			49.52	3.00
			49.02	3.50
			48.52	4.00
			48.02	4.50
			47.52	5.00



Remarks
Refusal at 1.60m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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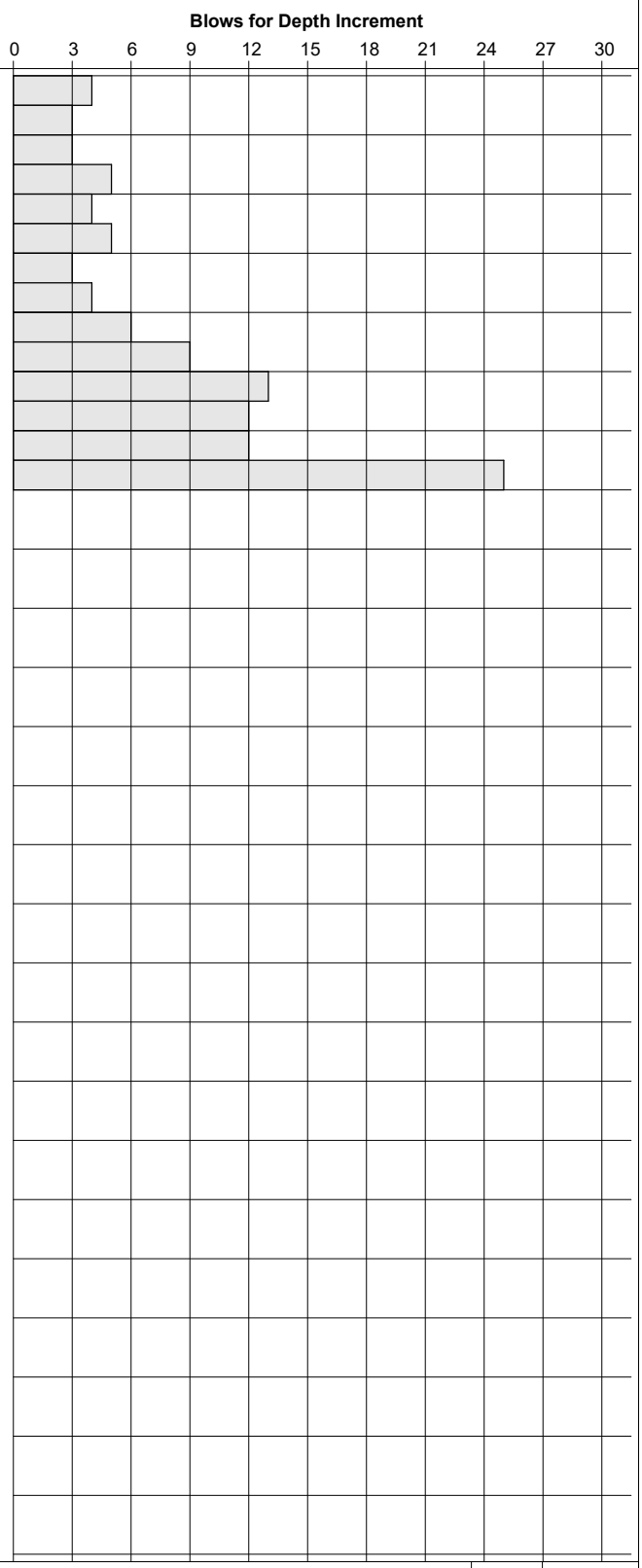
Site	Probe Number
Coolpowra Galway	DP-24

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	53.43	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582340.4 E 708975.2 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		53.43	0.00
0.10-0.20	3			
0.20-0.30	3			
0.30-0.40	5			
0.40-0.50	4			
0.50-0.60	5		52.93	0.50
0.60-0.70	3			
0.70-0.80	4			
0.80-0.90	6			
0.90-1.00	9			
1.00-1.10	13		52.43	1.00
1.10-1.20	12			
1.20-1.30	12			
1.30-1.40	25			
			51.93	1.50
			51.43	2.00
			50.93	2.50
			50.43	3.00
			49.93	3.50
			49.43	4.00
			48.93	4.50
			48.43	5.00



Remarks
Refusal at 1.40m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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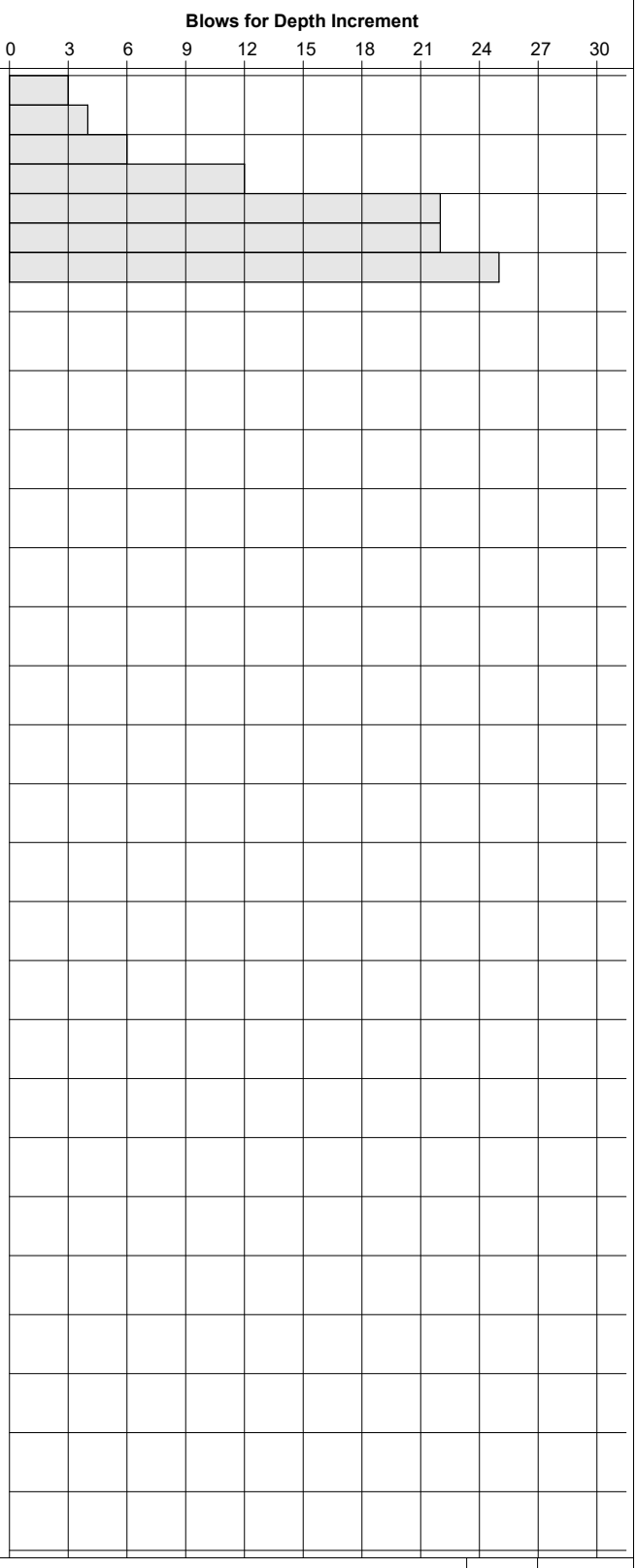
Site	Probe Number
Coolpowra Galway	DP-25

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	52.15	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582345.1 E 709189.4 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	3	
0.10-0.20	4	
0.20-0.30	6	
0.30-0.40	12	
0.40-0.50	22	
0.50-0.60	22	
0.60-0.70	25	

Level (mOD)	Depth (m)
52.15	0.00
51.65	0.50
51.15	1.00
50.65	1.50
50.15	2.00
49.65	2.50
49.15	3.00
48.65	3.50
48.15	4.00
47.65	4.50
47.15	5.00



Remarks
Refusal at 0.70m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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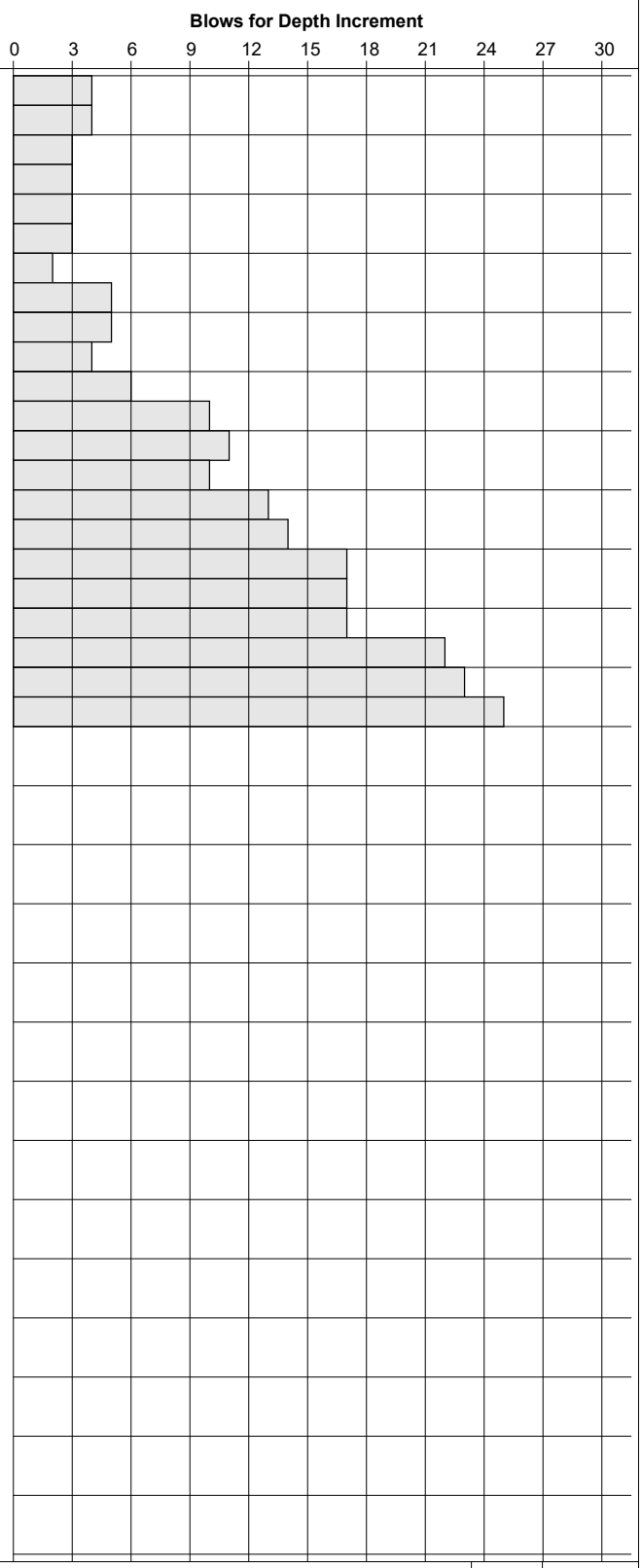
Site	Probe Number
Coolpowra Galway	DP-26

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.77	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582371.3 E 709142.9 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		51.77	0.00
0.10-0.20	4			
0.20-0.30	3			
0.30-0.40	3			
0.40-0.50	3			
0.50-0.60	3		51.27	0.50
0.60-0.70	2			
0.70-0.80	5			
0.80-0.90	5			
0.90-1.00	4			
1.00-1.10	6		50.77	1.00
1.10-1.20	10			
1.20-1.30	11			
1.30-1.40	10			
1.40-1.50	13			
1.50-1.60	14		50.27	1.50
1.60-1.70	17			
1.70-1.80	17			
1.80-1.90	17			
1.90-2.00	22			
2.00-2.10	23		49.77	2.00
2.10-2.20	25			
			49.27	2.50
			48.77	3.00
			48.27	3.50
			47.77	4.00
			47.27	4.50
			46.77	5.00



Remarks
Refusal at 2.20m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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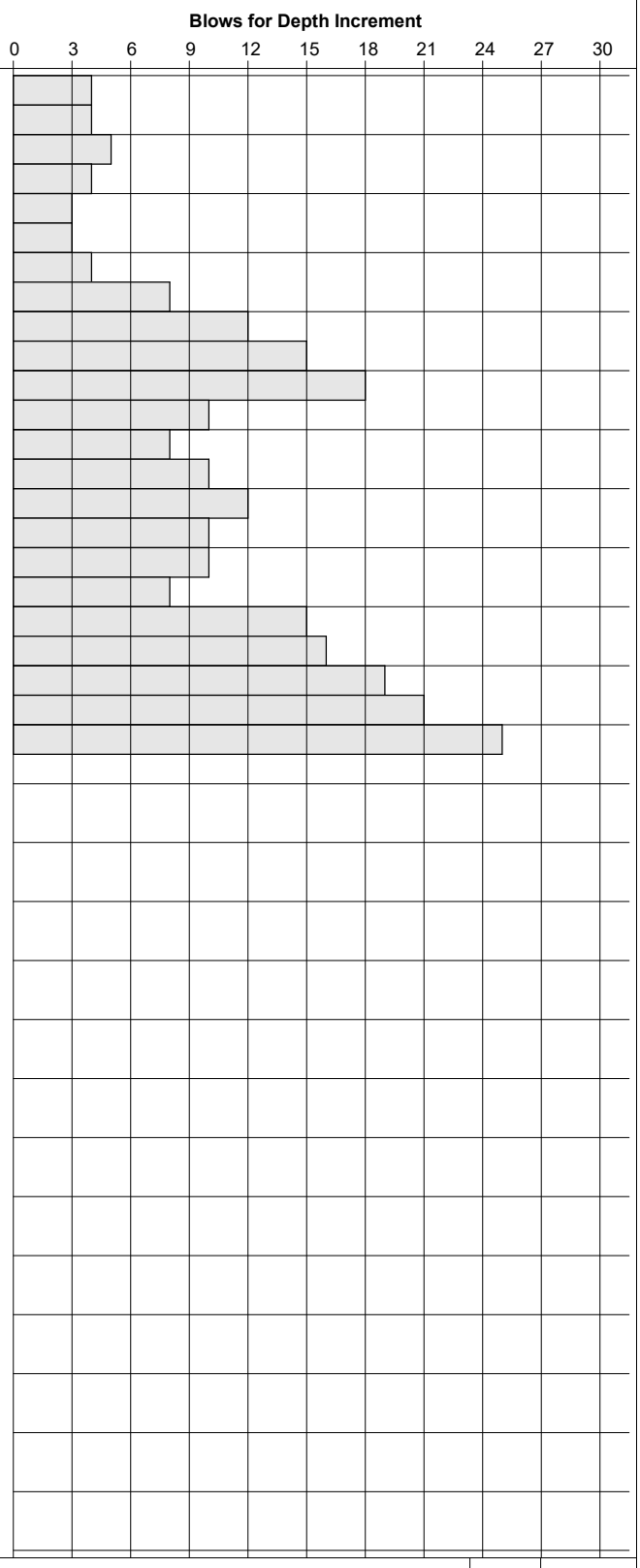
Site	Probe Number
Coolpowra Galway	DP-27

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	53.10	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582388.4 E 709060.9 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		53.10	0.00
0.10-0.20	4			
0.20-0.30	5			
0.30-0.40	4			
0.40-0.50	3			
0.50-0.60	3		52.60	0.50
0.60-0.70	4			
0.70-0.80	8			
0.80-0.90	12			
0.90-1.00	15			
1.00-1.10	18		52.10	1.00
1.10-1.20	10			
1.20-1.30	8			
1.30-1.40	10			
1.40-1.50	12			
1.50-1.60	10		51.60	1.50
1.60-1.70	10			
1.70-1.80	8			
1.80-1.90	15			
1.90-2.00	16			
2.00-2.10	19		51.10	2.00
2.10-2.20	21			
2.20-2.30	25			
			50.60	2.50
			50.10	3.00
			49.60	3.50
			49.10	4.00
			48.60	4.50
			48.10	5.00



Remarks
Refusal at 2.30m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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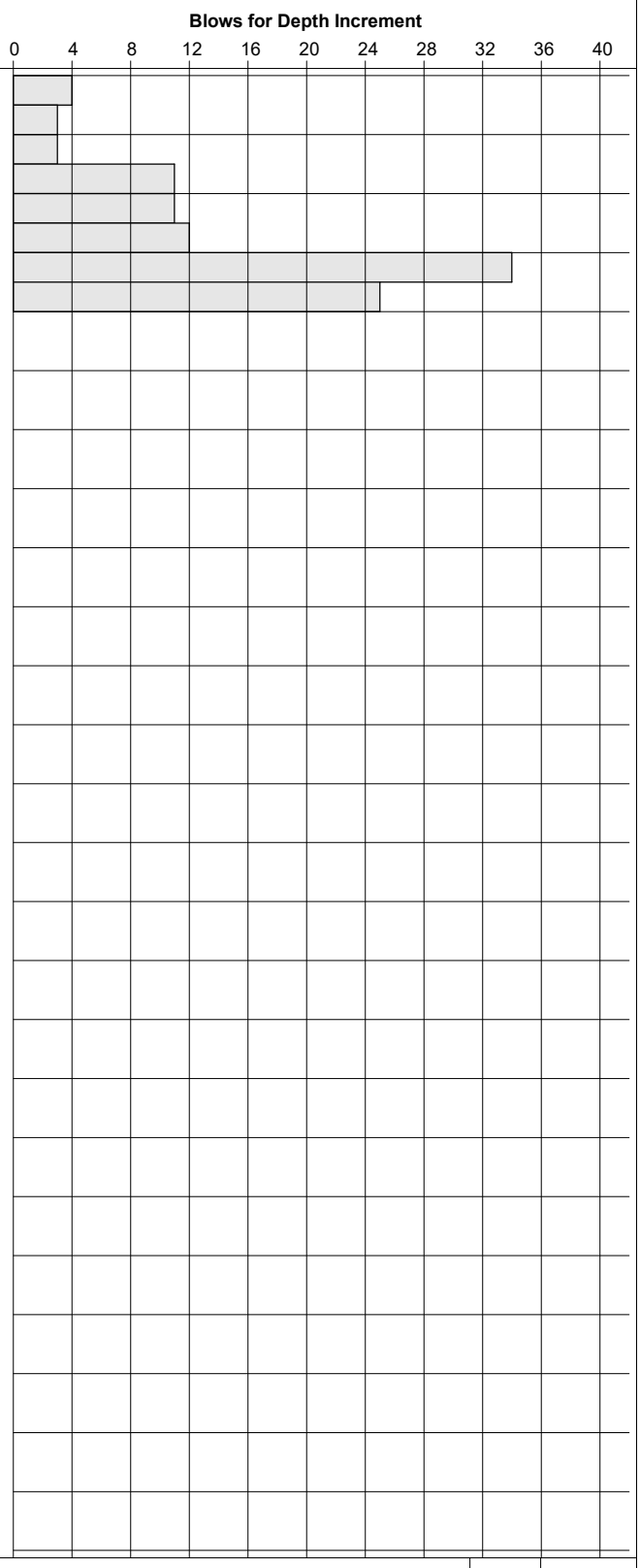
Site	Probe Number
Coolpowra Galway	DP-28

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	53.20	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582382.2 E 709017.9 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		53.20	0.00
0.10-0.20	3			
0.20-0.30	3			
0.30-0.40	11			
0.40-0.50	11			
0.50-0.60	12		52.70	0.50
0.60-0.70	34			
0.70-0.80	25			
			52.20	1.00
			51.70	1.50
			51.20	2.00
			50.70	2.50
			50.20	3.00
			49.70	3.50
			49.20	4.00
			48.70	4.50
			48.20	5.00



Remarks
Refusal at 0.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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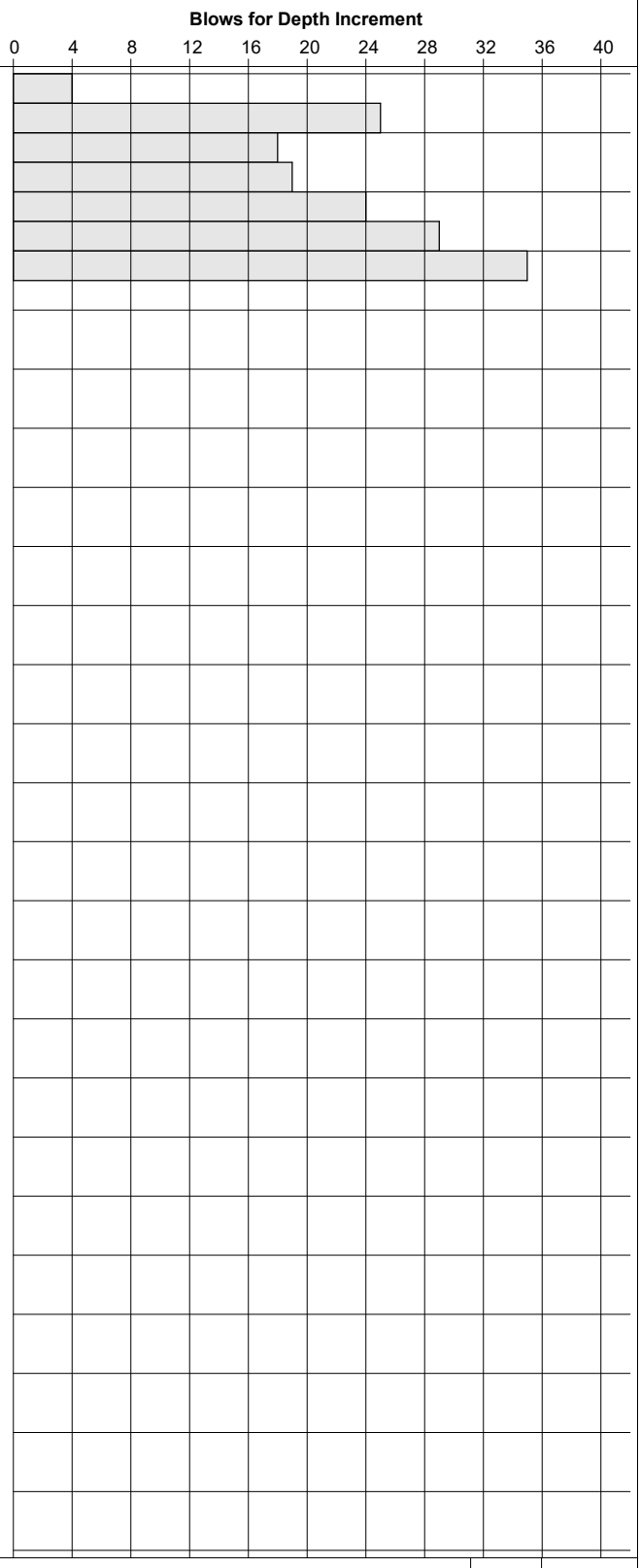
Site	Probe Number
Coolpowra Galway	DP-29

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	54.60	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582354.3 E 709279.8 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	4		54.60	0.00
0.10-0.20	25			
0.20-0.30	18			
0.30-0.40	19			
0.40-0.50	24			
0.50-0.60	29		54.10	0.50
0.60-0.70	35			
			53.60	1.00
			53.10	1.50
			52.60	2.00
			52.10	2.50
			51.60	3.00
			51.10	3.50
			50.60	4.00
			50.10	4.50
			49.60	5.00



Remarks
Refusal at 0.70m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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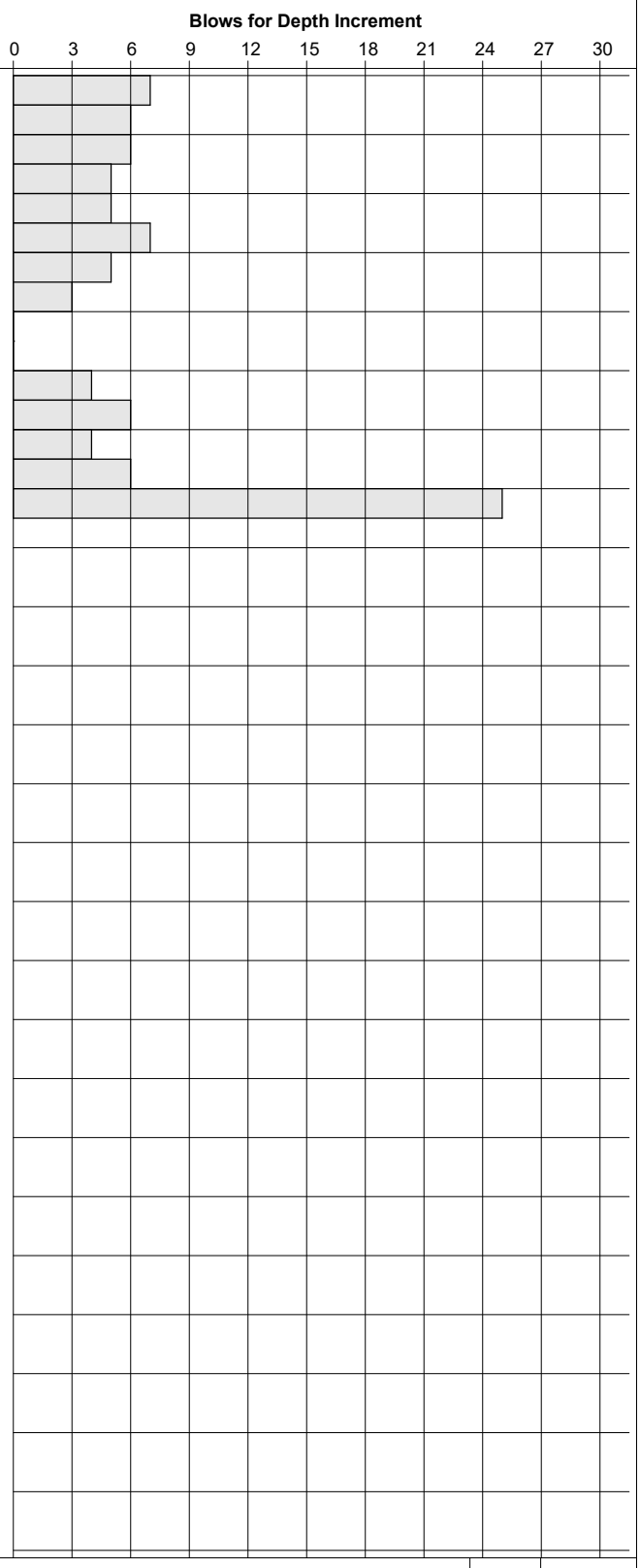
Site	Probe Number
Coolpowra Galway	DP-30

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	54.84	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582379.8 E 709336.4 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	7		54.84	0.00
0.10-0.20	6			
0.20-0.30	6			
0.30-0.40	5			
0.40-0.50	5			
0.50-0.60	7		54.34	0.50
0.60-0.70	5			
0.70-0.80	3			
0.80-0.90	0			
0.90-1.00	0			
1.00-1.10	4		53.84	1.00
1.10-1.20	6			
1.20-1.30	4			
1.30-1.40	6			
1.40-1.50	25		53.34	1.50
			52.84	2.00
			52.34	2.50
			51.84	3.00
			51.34	3.50
			50.84	4.00
			50.34	4.50
			49.84	5.00



Remarks
Refusal at 1.50m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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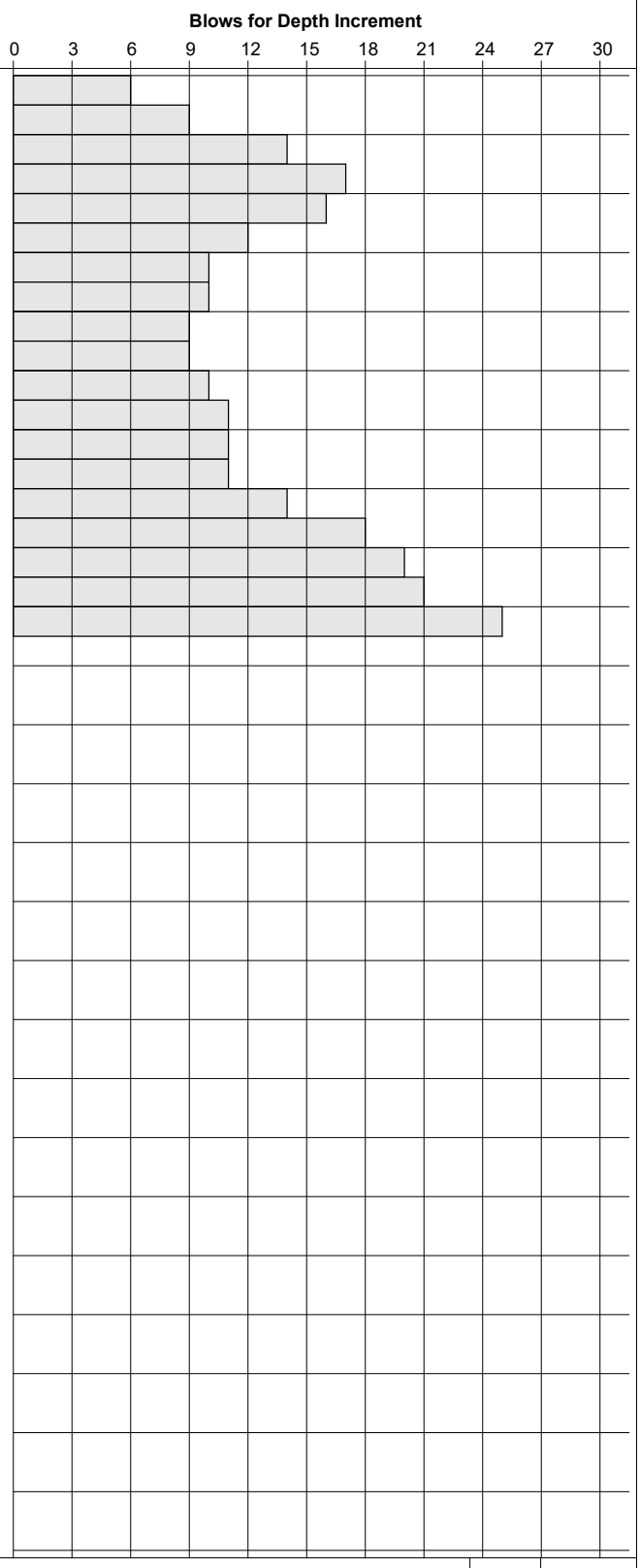
Site	Probe Number
Coolpowra Galway	DP-31

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	52.04	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582428.9 E 709213.4 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	6		52.04	0.00
0.10-0.20	9			
0.20-0.30	14			
0.30-0.40	17			
0.40-0.50	16			
0.50-0.60	12		51.54	0.50
0.60-0.70	10			
0.70-0.80	10			
0.80-0.90	9			
0.90-1.00	9			
1.00-1.10	10		51.04	1.00
1.10-1.20	11			
1.20-1.30	11			
1.30-1.40	11			
1.40-1.50	14			
1.50-1.60	18		50.54	1.50
1.60-1.70	20			
1.70-1.80	21			
1.80-1.90	25			
			50.04	2.00
			49.54	2.50
			49.04	3.00
			48.54	3.50
			48.04	4.00
			47.54	4.50
			47.04	5.00



Remarks
Refusal at 1.90m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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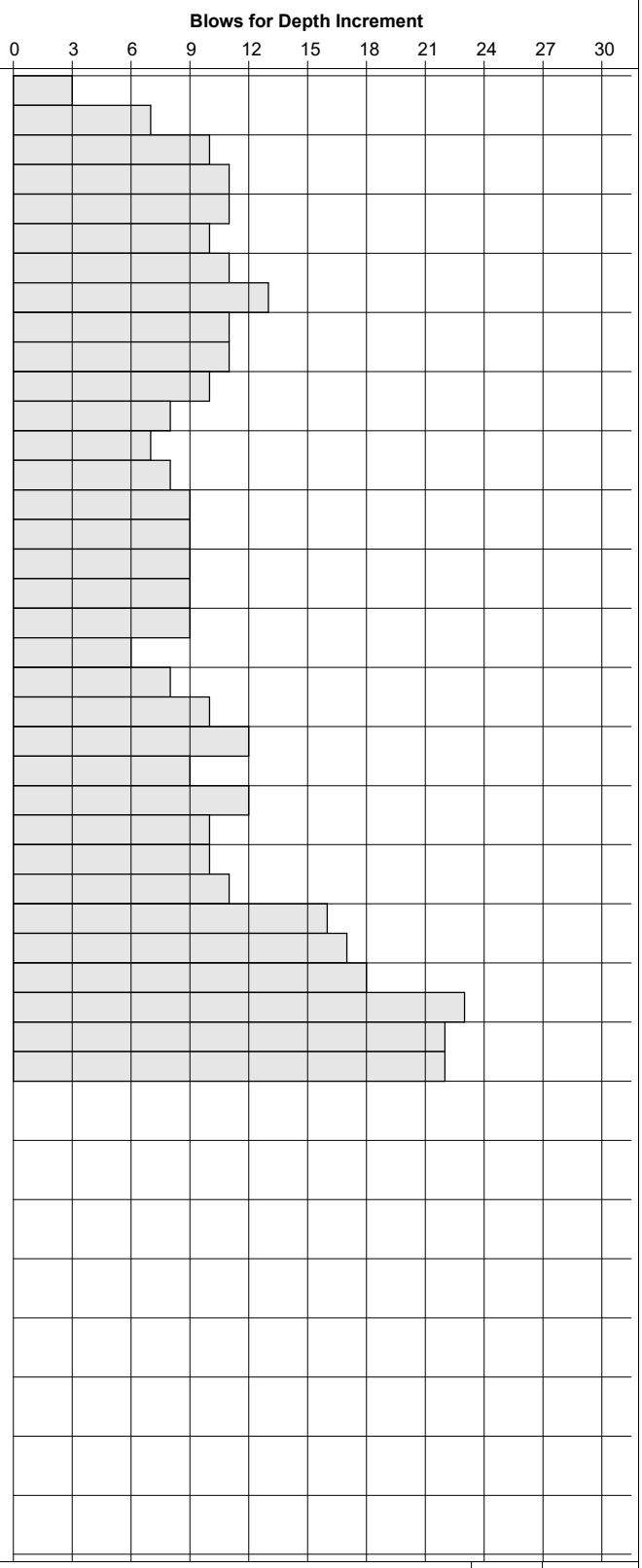
Site	Probe Number
Coolpowra Galway	DP-32

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	52.19	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582432.9 E 709148.2 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		52.19	0.00
0.10-0.20	7			
0.20-0.30	10			
0.30-0.40	11			
0.40-0.50	11			
0.50-0.60	10		51.69	0.50
0.60-0.70	11			
0.70-0.80	13			
0.80-0.90	11			
0.90-1.00	11			
1.00-1.10	10		51.19	1.00
1.10-1.20	8			
1.20-1.30	7			
1.30-1.40	8			
1.40-1.50	9			
1.50-1.60	9		50.69	1.50
1.60-1.70	9			
1.70-1.80	9			
1.80-1.90	9			
1.90-2.00	6			
2.00-2.10	8		50.19	2.00
2.10-2.20	10			
2.20-2.30	12			
2.30-2.40	9			
2.40-2.50	12			
2.50-2.60	10		49.69	2.50
2.60-2.70	10			
2.70-2.80	11			
2.80-2.90	16			
2.90-3.00	17			
3.00-3.10	18		49.19	3.00
3.10-3.20	23			
3.20-3.30	22			
3.30-3.40	22			
			48.69	3.50
			48.19	4.00
			47.69	4.50
			47.19	5.00



Remarks
Refusal at 3.40m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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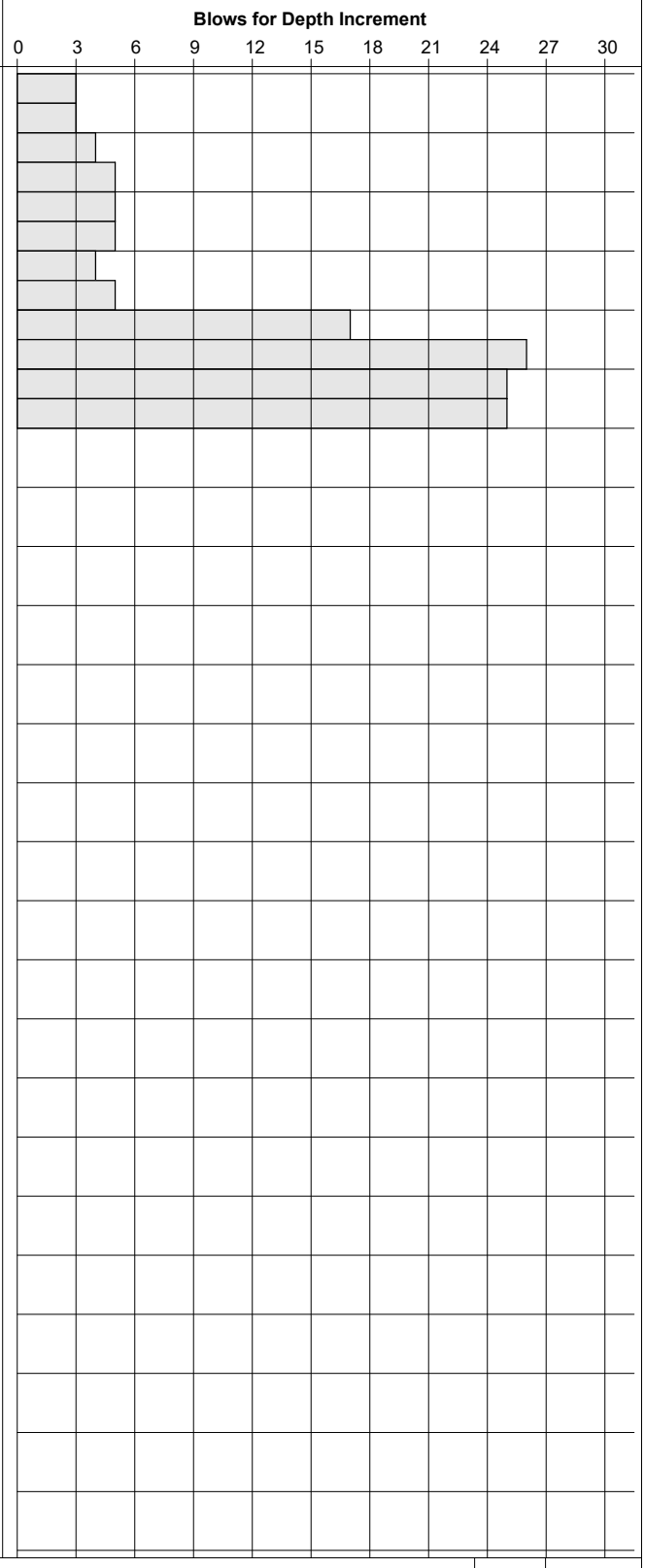
Site	Probe Number
Coolpowra Galway	DP-33

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	53.74	Lumcloon Energy	13999-07-24

Location	Dates	Engineer	Sheet
582464.6 E 709086.7 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	3	
0.10-0.20	3	
0.20-0.30	4	
0.30-0.40	5	
0.40-0.50	5	
0.50-0.60	5	
0.60-0.70	4	
0.70-0.80	5	
0.80-0.90	17	
0.90-1.00	26	
1.00-1.10	25	
1.10-1.20	25	



Remarks
Refusal at 1.20m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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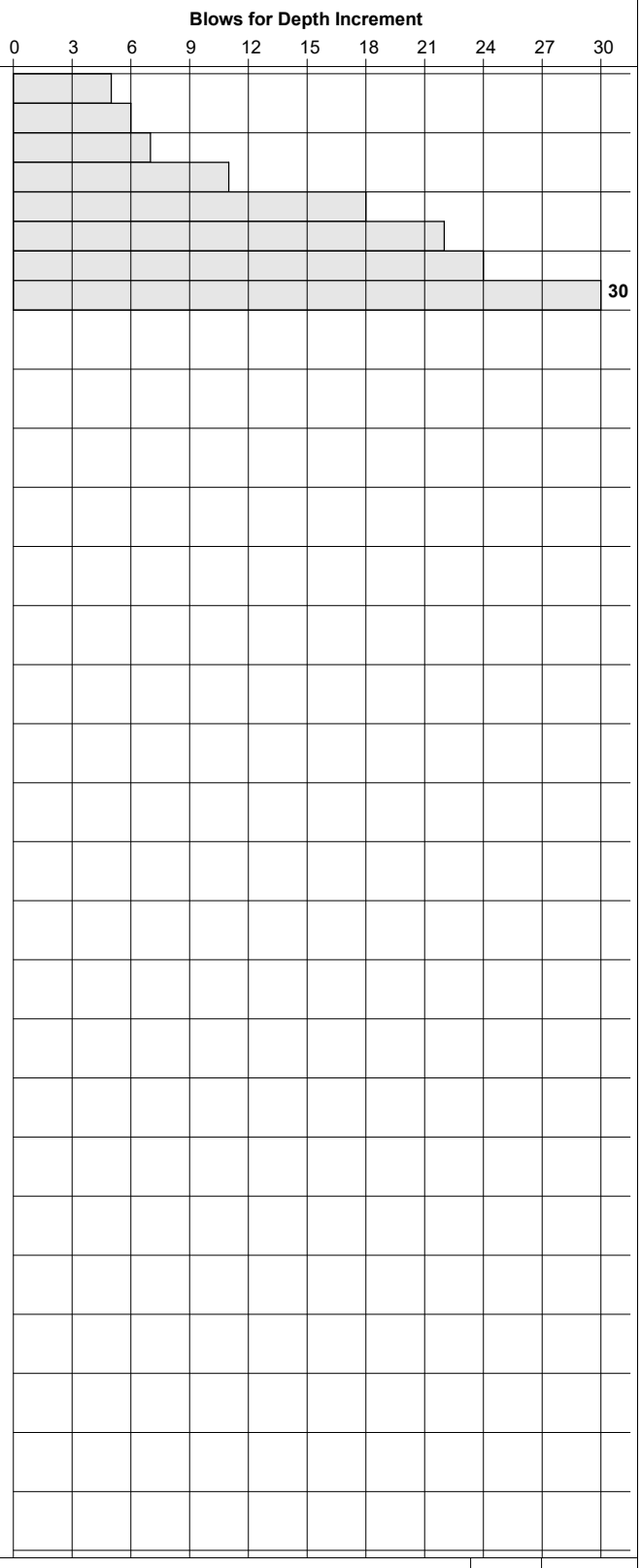
Site	Probe Number
Coolpowra Galway	DP-34

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	55.29	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582449.8 E 709289.3 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	5		55.29	0.00
0.10-0.20	6			
0.20-0.30	7			
0.30-0.40	11			
0.40-0.50	18			
0.50-0.60	22		54.79	0.50
0.60-0.70	24			
0.70-0.80	30			
			54.29	1.00
			53.79	1.50
			53.29	2.00
			52.79	2.50
			52.29	3.00
			51.79	3.50
			51.29	4.00
			50.79	4.50
			50.29	5.00



Remarks
Refusal at 0.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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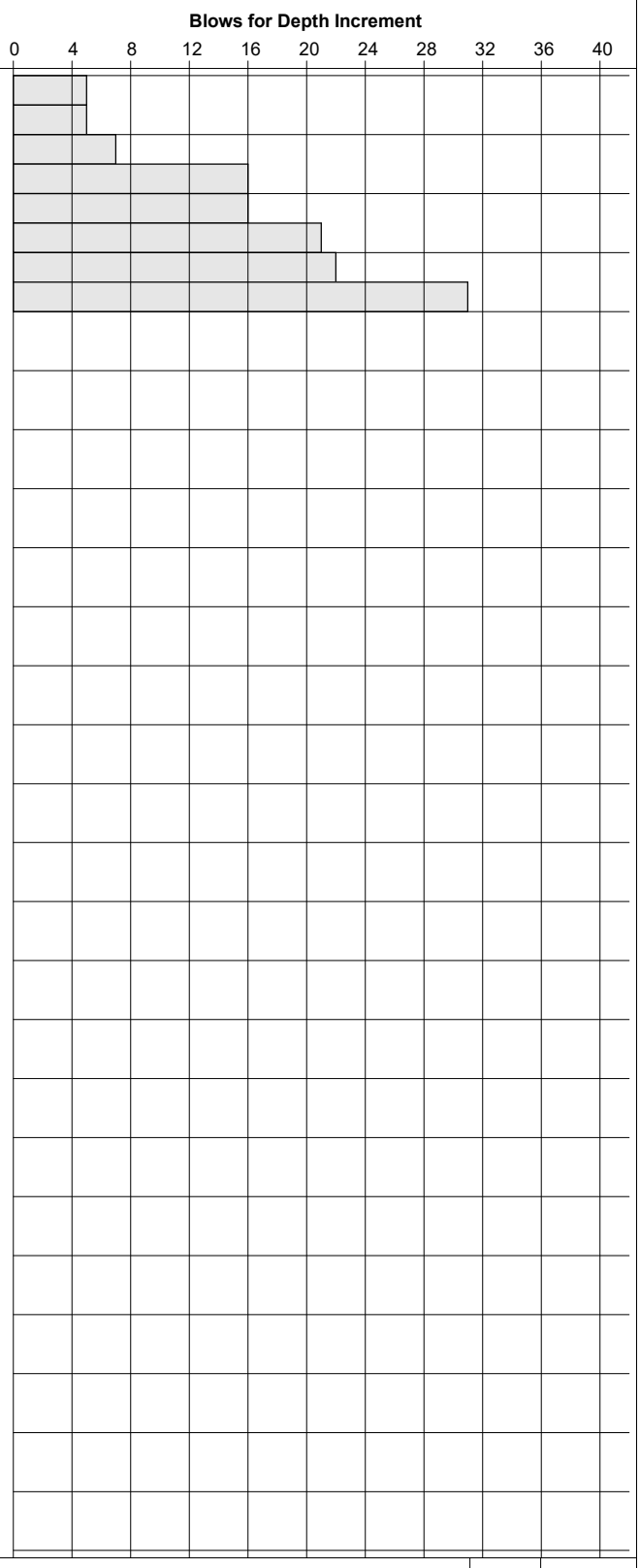
Site	Probe Number
Coolpowra Galway	DP-35

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	55.31	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582477.4 E 709324.4 N	17/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	5		55.31	0.00
0.10-0.20	5			
0.20-0.30	7			
0.30-0.40	16			
0.40-0.50	16			
0.50-0.60	21		54.81	0.50
0.60-0.70	22			
0.70-0.80	31			
			54.31	1.00
			53.81	1.50
			53.31	2.00
			52.81	2.50
			52.31	3.00
			51.81	3.50
			51.31	4.00
			50.81	4.50
			50.31	5.00



Remarks
Refusal at 0.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
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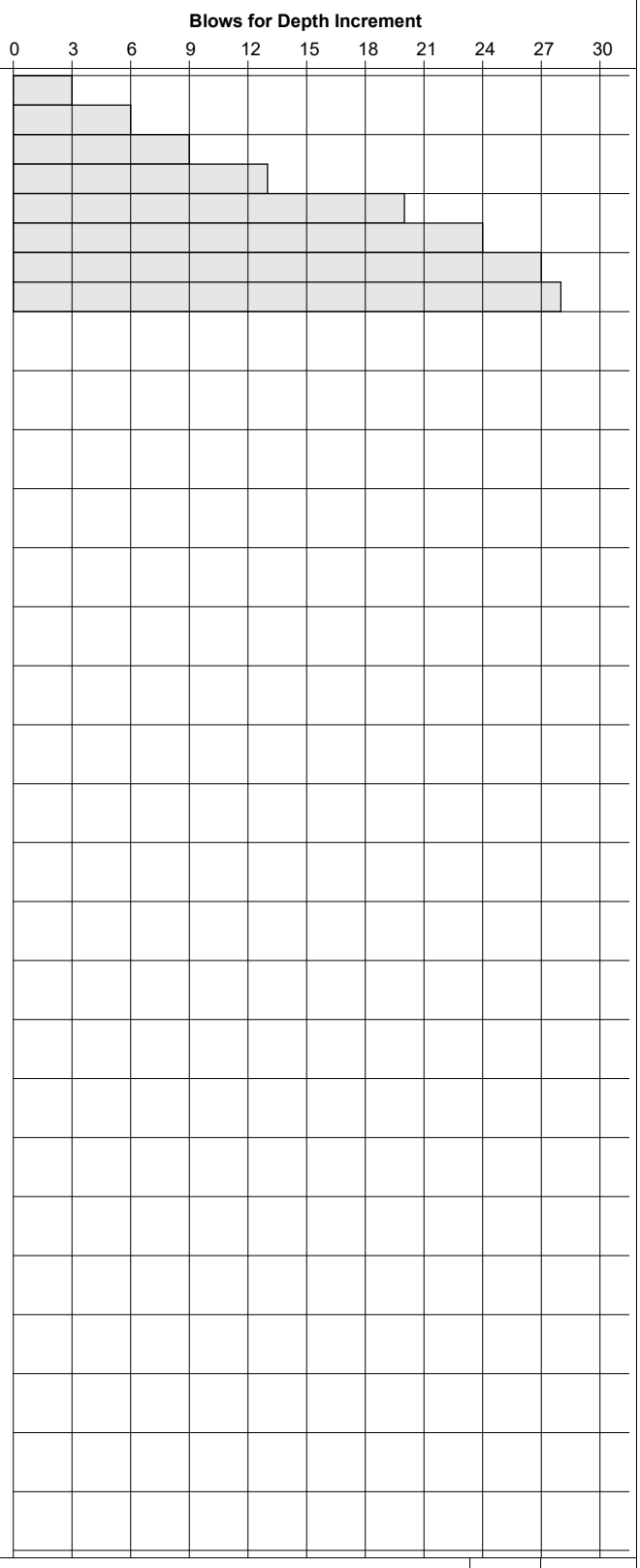
Site	Probe Number
Coolpowra Galway	DP-36

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	52.23	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582475.7 E 709236.4 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		52.23	0.00
0.10-0.20	6			
0.20-0.30	9			
0.30-0.40	13			
0.40-0.50	20			
0.50-0.60	24		51.73	0.50
0.60-0.70	27			
0.70-0.80	28			
			51.23	1.00
			50.73	1.50
			50.23	2.00
			49.73	2.50
			49.23	3.00
			48.73	3.50
			48.23	4.00
			47.73	4.50
			47.23	5.00



Remarks
Refusal at 0.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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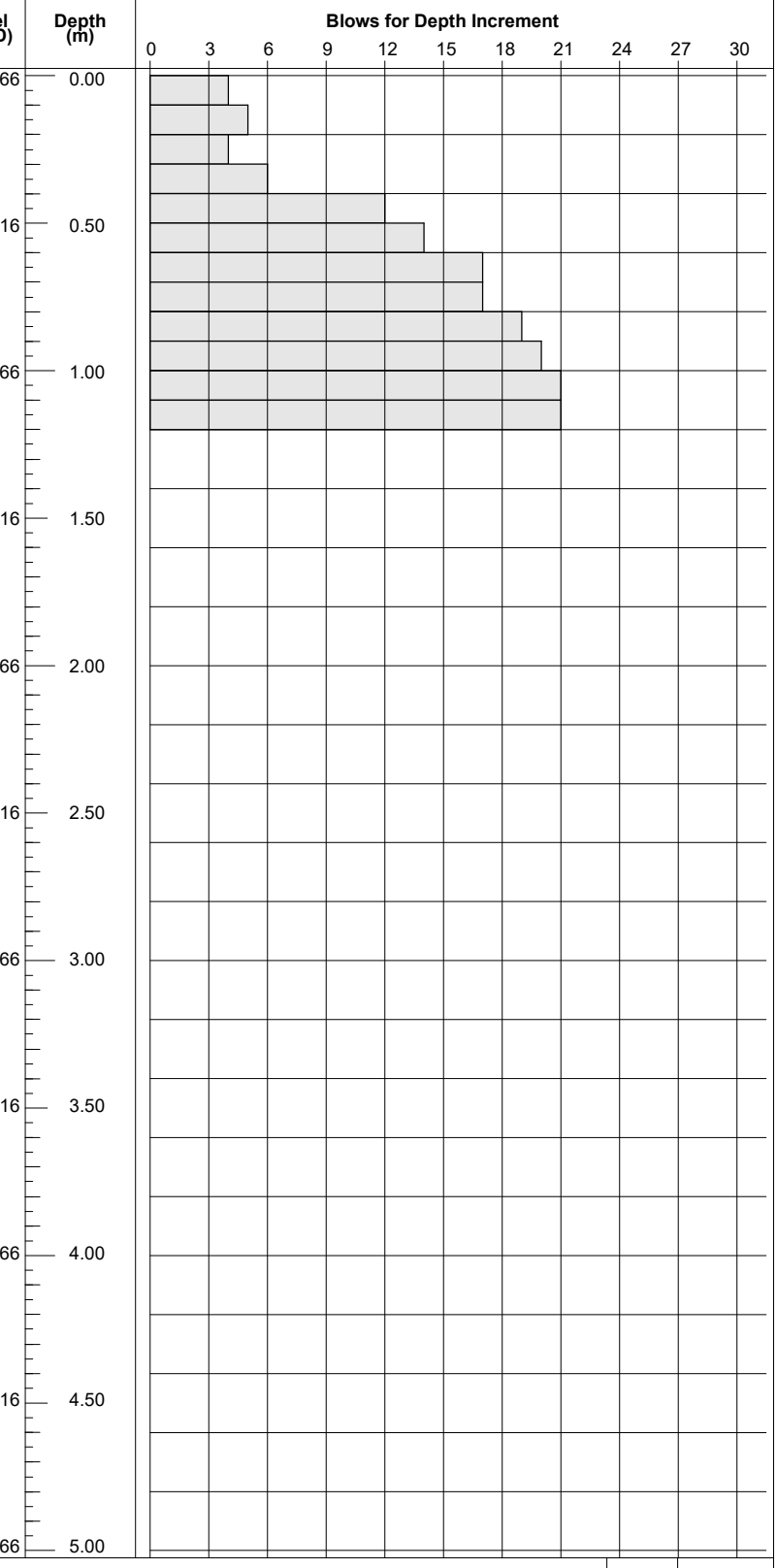
Site	Probe Number
Coolpowra Galway	DP-37

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	54.66	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582519.9 E 709164.1 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	4	
0.10-0.20	5	
0.20-0.30	4	
0.30-0.40	6	
0.40-0.50	12	
0.50-0.60	14	
0.60-0.70	17	
0.70-0.80	17	
0.80-0.90	19	
0.90-1.00	20	
1.00-1.10	21	
1.10-1.20	21	



Remarks
Refusal at 1.20m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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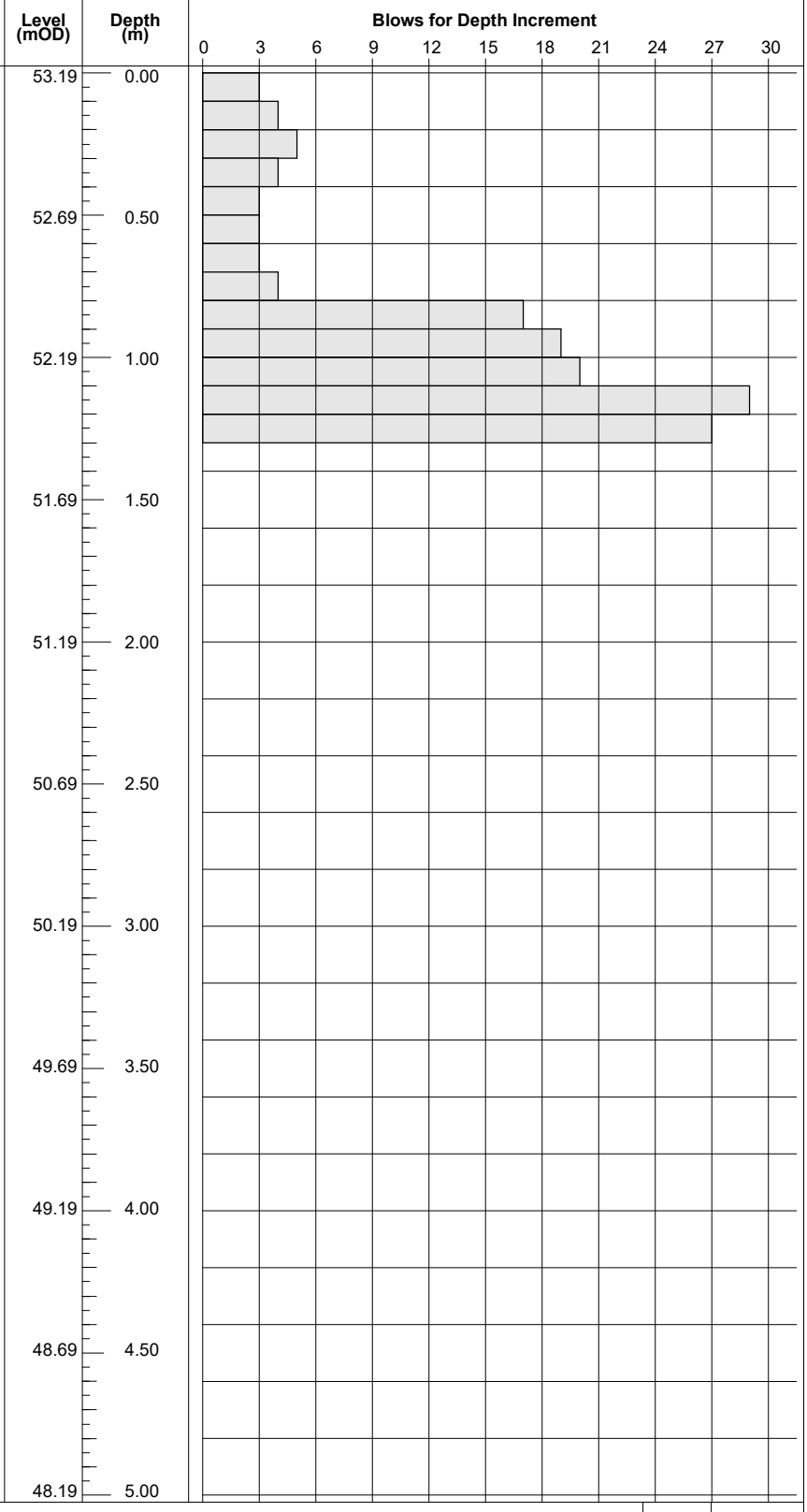
Site	Probe Number
Coolpowra Galway	DP-38

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	53.19	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582537.3 E 709054.1 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	3	
0.10-0.20	4	
0.20-0.30	5	
0.30-0.40	4	
0.40-0.50	3	
0.50-0.60	3	
0.60-0.70	3	
0.70-0.80	4	
0.80-0.90	17	
0.90-1.00	19	
1.00-1.10	20	
1.10-1.20	29	
1.20-1.30	27	



Remarks
Refusal at 1.30m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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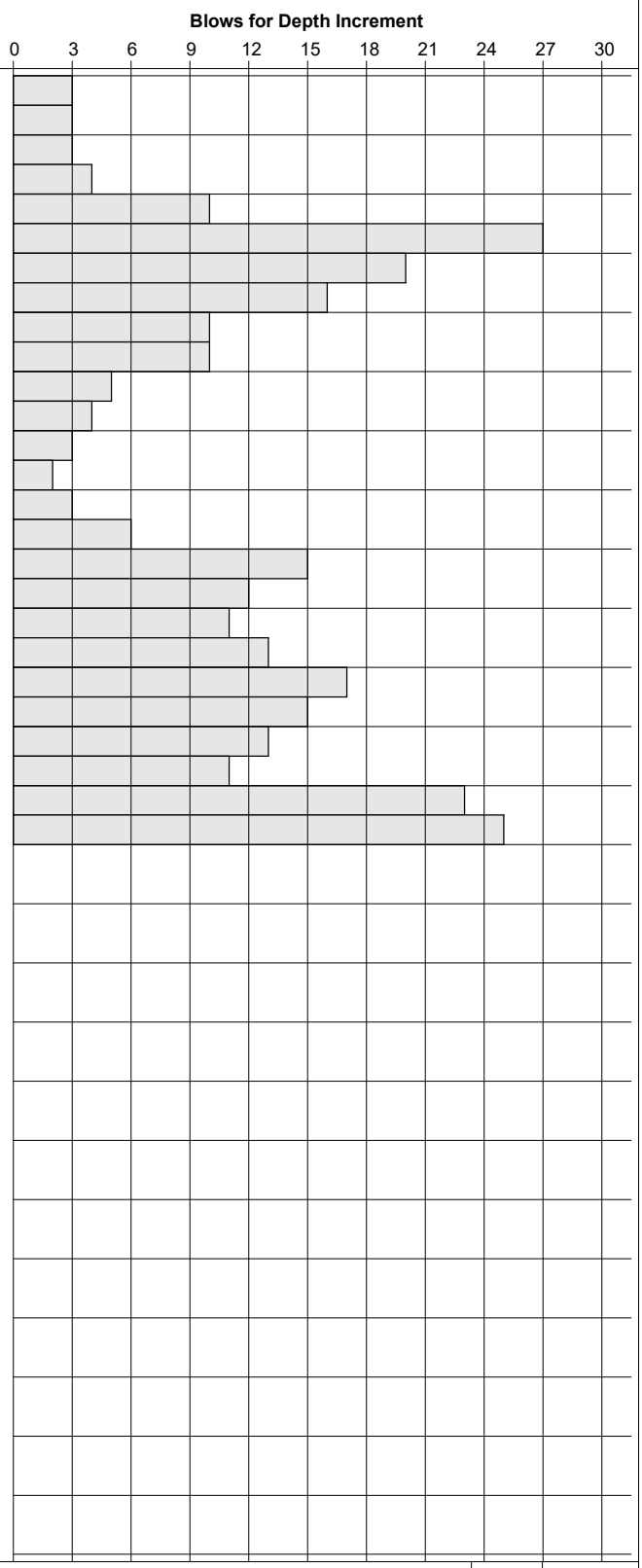
Site	Probe Number
Coolpowra Galway	PBT-06

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	51.47	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582169.9 E 709133 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		51.47	0.00
0.10-0.20	3			
0.20-0.30	3			
0.30-0.40	4			
0.40-0.50	10			
0.50-0.60	27		50.97	0.50
0.60-0.70	20			
0.70-0.80	16			
0.80-0.90	10			
0.90-1.00	10			
1.00-1.10	5		50.47	1.00
1.10-1.20	4			
1.20-1.30	3			
1.30-1.40	2			
1.40-1.50	3			
1.50-1.60	6		49.97	1.50
1.60-1.70	15			
1.70-1.80	12			
1.80-1.90	11			
1.90-2.00	13			
2.00-2.10	17		49.47	2.00
2.10-2.20	15			
2.20-2.30	13			
2.30-2.40	11			
2.40-2.50	23			
2.50-2.60	25		48.97	2.50
			48.47	3.00
			47.97	3.50
			47.47	4.00
			46.97	4.50
			46.47	5.00



Remarks
Refusal at 2.60m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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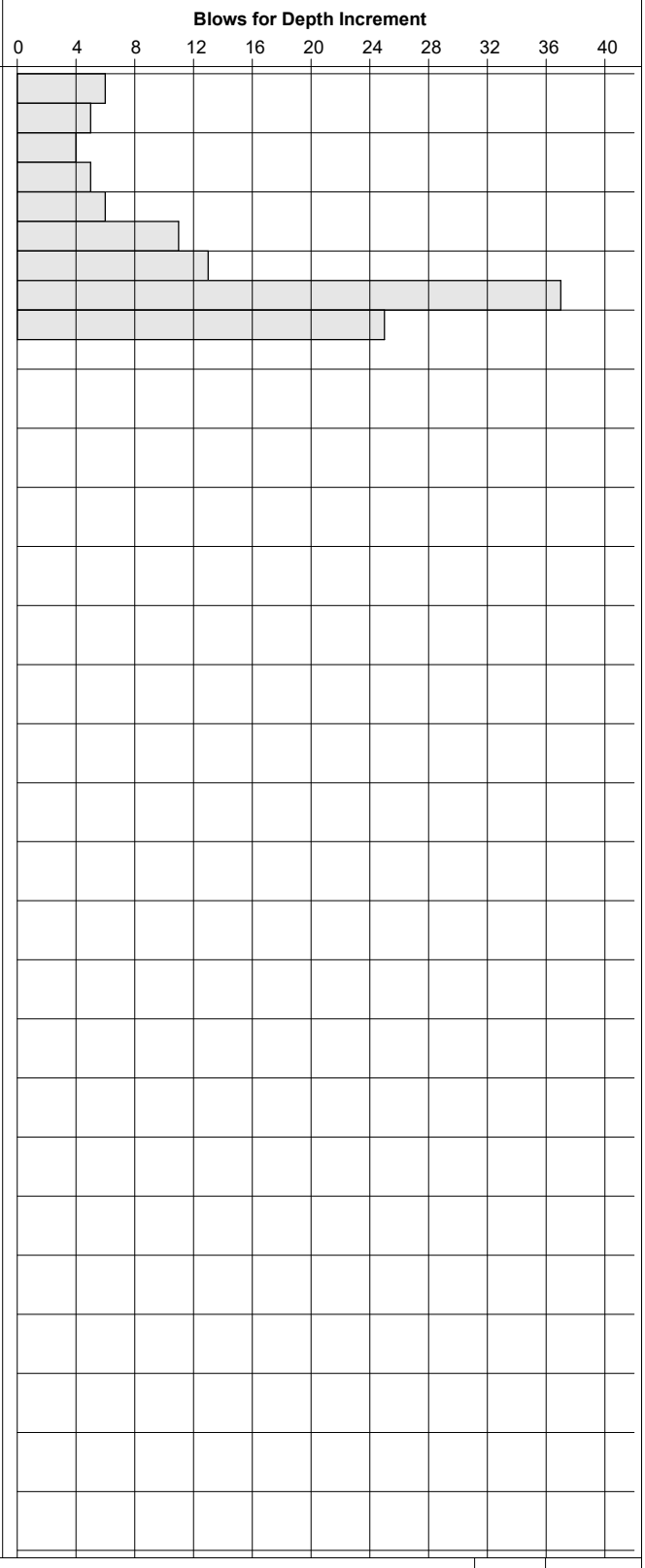
Site	Probe Number
Coolpowra Galway	PBT-07

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	52.49	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582249.5 E 709074.5 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	6	
0.10-0.20	5	
0.20-0.30	4	
0.30-0.40	5	
0.40-0.50	6	
0.50-0.60	11	
0.60-0.70	13	
0.70-0.80	37	
0.80-0.90	25	



Remarks
Refusal at 0.90m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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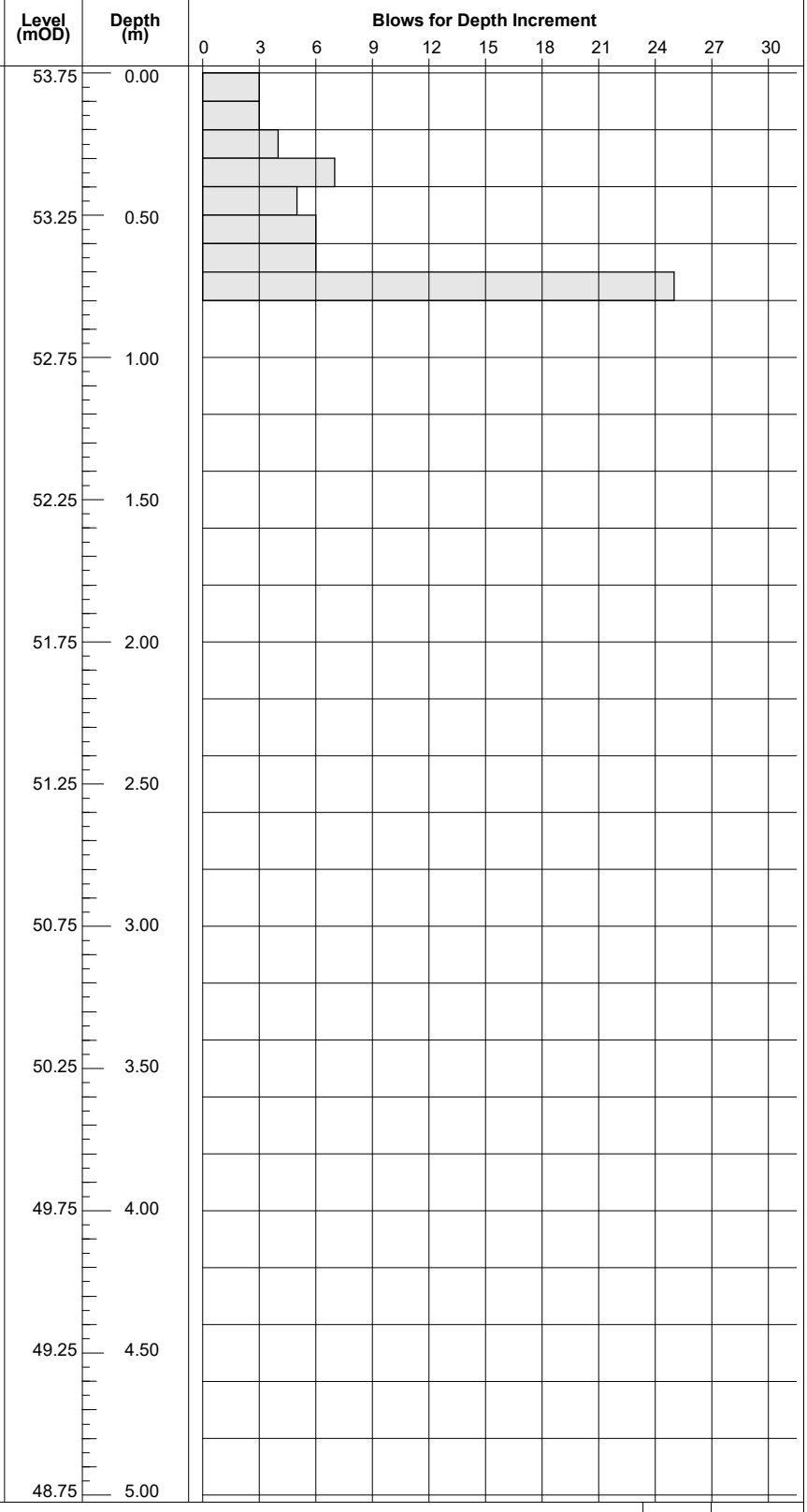
Site	Probe Number
Coolpowra Galway	PBT-08

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	53.75	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582275.6 E 708983.9 N	18/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	3	
0.10-0.20	3	
0.20-0.30	4	
0.30-0.40	7	
0.40-0.50	5	
0.50-0.60	6	
0.60-0.70	6	
0.70-0.80	25	



Remarks
Refusal at 0.80m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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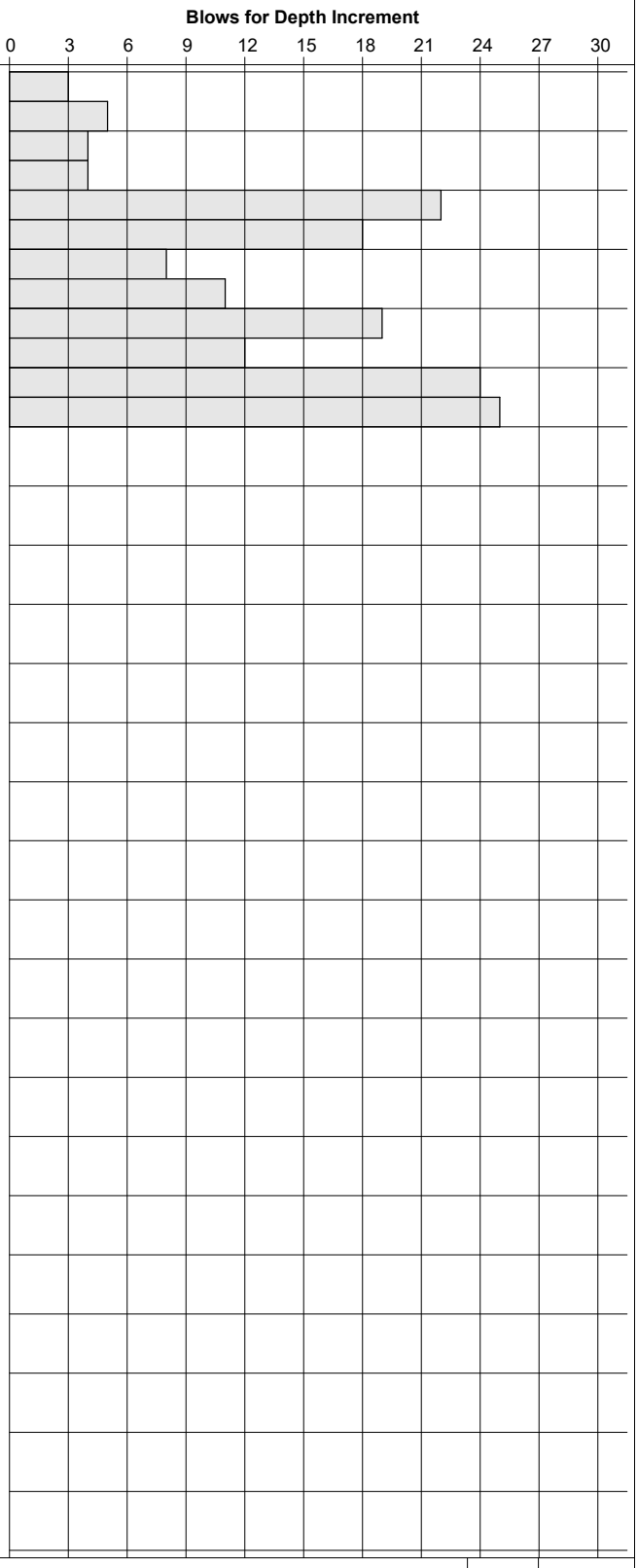
Site	Probe Number
Coolpowra Galway	PBT-13

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH), Hammer Drop Height 500mm, Hammer Weight 50Kg	Diameter 43.70mm, Angle 90°	53.93	Lumcloon Energy	13999-07-24
	Location	**Dates**	**Engineer**	**Sheet**
	582469.5 E 709091.3 N	16/09/2024	Kilgallen & Partners Consulting Engineers	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	3		53.93	0.00
0.10-0.20	5			
0.20-0.30	4			
0.30-0.40	4			
0.40-0.50	22			
0.50-0.60	18		53.43	0.50
0.60-0.70	8			
0.70-0.80	11			
0.80-0.90	19			
0.90-1.00	12			
1.00-1.10	24		52.93	1.00
1.10-1.20	25			
			52.43	1.50
			51.93	2.00
			51.43	2.50
			50.93	3.00
			50.43	3.50
			49.93	4.00
			49.43	4.50
			48.93	5.00



Remarks
Refusal at 1.20m BGL

Scale (approx)	Logged By
1:25	CMP

Figure No.
13999-07-24.PBT-06

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APPENDIX 5 – Rotary Core Records

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Site Coolpowra Galway			**Borehole Number** BH01
Machine : Beretta T-44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.70m	**Ground Level (mOD)** 48.60	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 581992.8 E 709010.4 N	**Dates** 25/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(1.00)	Recovery consists of dark grey slightly sandy gravelly CLAY with low cobble content. Driller notes brown CLAY onto black CLAY			
1.00-1.45	50	9	9		8,10/11,12,7,10 SPT(C) N=40	47.60	1.00	Recovery consists of dark grey slightly sandy gravelly CLAY with low cobble content. Driller notes brown CLAY onto black CLAY (Very Stiff)			
							(1.00)				
2.00						46.60	2.00				
2.20				12				Medium strong to strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE with calcite veins and fossil beds. Fresh to slightly weathered			
2.90	96	34	34					2.00m to 2.90m BGL - Two Fracture Sets - F1: 0 to 20 degree fractures, close to very closely spaced, undulating, rough. F2: 70 to 90 degree fractures, closely spaced, undulating, rough.			
3.56-3.70					C			2.90m to 6.70m BGL - One Fracture Set - F1: 0 to 20 degree fractures, close to medium spaced, undulating to planar, rough.			
3.70 3.90-4.12					C						
4.20-4.39	100	100	90	5	C		(4.70)	4.40m to 4.45m BGL - Fault gouge recovered as dark grey slightly gravelly sandy Clay			
								4.75m to 4.80m BGL - Fault gouge recovered as dark grey slightly gravelly sandy Clay			
5.20	100	100	80					5.45m to 5.50m BGL - Fault gouge recovered as dark grey slightly gravelly sandy Clay			
6.70						41.90	6.70	Complete at 6.70m			

Remarks
Borehole complete at 6.70m BGL
50mm slotted standpipe with pea gravel surround installed from 6.70m to 2.00m BGL. 50mm plain standpipe with a bentonite seal installed from 2.00m to GL with a raised cover.

Scale (approx)	Logged By
1:50	JK

Figure No. 13999-07-24.BH01

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Site Coolpowra Galway			**Borehole Number** BH02
Machine : Beretta T-44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 10.70m	**Ground Level (mOD)** 50.68	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582118.3 E 709187.8 N	**Dates** 01/10/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	30						(1.00)	Recovery consists of dark brown slightly gravelly sandy Clay. Driller notes Clay onto Gravel			
1.00 1.00-1.45	35				8,7/9,13,13,15 SPT(C) N=50	49.68	1.00	Recovery consists of Cobbles of Limestone with some dark grey gravelly Clay. Driller notes Cobbles with grey silt washback (Very stiff/ Dense)			
2.00 2.00-2.28	20				10,10/16,25 SPT(C) 41/130		(4.30)				
3.50 3.50-3.95	13				4,6/9,14,27 SPT(C) N=50						
5.00 5.00-5.20					18,25/50 SPT(C) 50/50						
5.30						45.38	5.30	Strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE. Fresh to slightly weathered 5.30m to 6.50m BGL - One Fracture Set - F1: 0 to 20 degree fractures, medium to closely spaced, undulating, rough.			
5.72-5.90	93	76	60		C		(1.20)				
6.30-6.50					C						
6.50				8		44.18	6.50	Medium strong to strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE with calcite veins and fossil beds. Fresh to slightly weathered 6.50m to 7.80m BGL - One Fracture Set - F1: 0 to 20 degree fractures, close to very closely spaced, undulating to planar, rough.			
7.45-7.55	100	100	60		C						
7.80											
8.00	100	100	87	3			(4.20)	7.80m to 10.70m BGL - One Fracture Set - F1: 0 to 20 degree fractures, wide to medium spaced, undulating, rough.			
9.50											

Remarks
Borehole complete at 10.70m BGL
50mm slotted standpipe with pea gravel surround installed from 10.70m to 2.00m BGL. 50mm plain standpipe with a bentonite seal installed from 2.00m to GL with a raised cover.

Scale (approx)	Logged By
1:50	JK

Figure No. 13999-07-24.BH01

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Site Coolpowra Galway			**Borehole Number** BH02
Machine : Beretta T-44 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 10.70m	**Ground Level (mOD)** 50.68	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582118.3 E 709187.8 N	**Dates** 01/10/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 2/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	100	100	79								
10.70						39.98	10.70	Complete at 10.70m			

Remarks

Scale (approx)	Logged By
1:50	JK

Figure No. 13999-07-24.BH01

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Site Coolpowra Galway			**Borehole Number** BH03
Machine : Beretta T-44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.70m	**Ground Level (mOD)** 51.88	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582182.9 E 708932.1 N	**Dates** 25/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(1.00)	Recovery consists of greyish brown slightly sandy gravelly Clay. Driller notes brown CLAY.			
1.00-1.45	50				5,6/5,4,7,5 SPT(C) N=21	50.88	1.00				
							(1.00)	Recovery consists of dark grey subangular to subrounded Gravel with low cobble content and low boulder content. Driller notes brown CLAY (Stiff)			
2.00						49.88	2.00				
2.20				NI				Medium strong to strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE with calcite veins and occasional fossils. Fresh to slightly weathered			
2.52-2.66					C						
2.60	100	80	43					2.00m to 2.30m BGL - Not Intact			
2.97-3.05					C			2.30m to 2.60m BGL - Two Fracture Sets - F1: 0 to 20 degree fractures, very closely spaced, undulating to planar, rough. F2: 50 to 70 degree fractures, very closely spaced, undulating, rough.			
3.40-3.55					C						
3.70	90	90	70	6			(4.70)	2.60m to 6.70m BGL - Three Fracture Sets - F1: 0 to 20 degree fractures, close to medium spaced, undulating, rough. F2: 40 to 60 degree fractures, close to medum spaced, undulating, rough. F3: 70 to 90 degree fractures, widely spaced, undulating, rough.			
5.20	100	100	70								
6.70						45.18	6.70	Complete at 6.70m			

Remarks
Borehole complete at 6.70m BGL
50mm slotted standpipe with pea gravel surround installed from 6.70m to 2.00m BGL. 50mm plain standpipe with a bentonite seal installed from 2.00m to GL with a raised cover.

Scale (approx)	Logged By
1:50	JK

Figure No. 13999-07-24.BH01

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Site Coolpowra Galway			**Borehole Number** BH04
Machine : Beretta T-44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.70m	**Ground Level (mOD)** 52.23	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582312.6 E 709081.9 N	**Dates** 25/09/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
							(1.00)	Recovery consists of brown slightly sandy slightly gravelly Clay. Driller notes brown CLAY			
1.00-1.45	60	9	5		6,67/5,8,8,7 SPT(C) N=28	51.23	1.00				
							(1.00)	Recovery consists of dark grey slightly sandy slightly gravelly Clay with low cobble content. Driller notes Brown CLAY (Stiff to Very Stiff)			
2.00						50.23	2.00				
2.20 2.35-2.48					C			Medium strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE with calcite veins and occasional fossils. Fresh to slightly weathered 2.00m to 3.70m BGL - Two Fracture Sets - F1: 0 to 20 degree fractures, close to very closely spaced, undulating to planar, rough. F2: 50 to 70 degree fractures, medium spaced, undulating, rough.			
2.75-2.86	100	100	19	15	C						
3.70											
4.25-4.45	89	89	56		C		(4.70)	3.70m to 6.70m BGL - Two Fracture Sets - F1: 0 to 20 degree fractures, medium spaced, undulating, rough. F2: 40 to 60 degree fractures, medum to widely spaced, undulating, rough.			
5.20	100	100	73	3							
6.70						45.53	6.70	Complete at 6.70m			

Remarks
Borehole complete at 6.70m BGL
50mm slotted standpipe with pea gravel surround installed from 6.70m to 2.00m BGL. 50mm plain standpipe with a bentonite seal installed from 2.00m to GL with a raised cover.

Scale (approx)	Logged By
1:50	JK

Figure No. 13999-07-24.BH01

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Site Coolpowra Galway			**Borehole Number** BH05
Machine : Beretta T-44 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.50m	**Ground Level (mOD)** 53.27	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582335.2 E 709006 N	**Dates** 01/10/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
	55					53.17	0.10	TOPSOIL Recovery consists of brown slightly sandy slightly gravelly Clay. Driller notes CLAY.			
1.00 1.00-1.42	50				5,7/9,11,12,18 SPT(C) 50/270	52.07	(1.10) 1.20	Recovery consists of dark grey slightly clayey slightly sandy subanguar to subrounded Gravel with low cobble content. Driller notes grey Gravel and Cobbles (Dense)			
2.00 2.00-2.45 2.20-2.47	100	80	67		25/50 SPT(C) N=50 C	51.27	(0.80) 2.00	Medium strong to strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE with calcite veins and occasional fossils. Fresh to slightly weathered 2.00m to 2.80m BGL - Two Fracture Sets - F1: 0 to 20 degree fractures, close to medium spaced, undulating, rough. F2: 70 to 90 degree fractures, widely spaced undulating rough			
3.45-3.57 3.50					C						
4.10-4.30	96	93	83	5	C		(4.50)				
5.00	100	100	76					2.80m to 6.50m BGL - Three Fracture Sets - F1: 0 to 20 degree fractures, medium spaced, undulating to planar, rough. F2: 40 to 60 degree fractures, widely spaced undulating rough. F3: 70 to 90 degree fractures, widely spaced, undulating to stepped, rough.			
6.50						46.77	6.50	Complete at 6.50m			

Remarks
Borehole complete at 6.50m BGL
50mm slotted standpipe with pea gravel surround installed from 6.50m to 2.50m BGL. 50mm plain standpipe with a bentonite seal installed from 2.50m to GL with a raised cover.

Scale (approx)	Logged By
1:50	JK

Figure No. 13999-07-24.BH01

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Site Coolpowra Galway			**Borehole Number** BH06
Machine : Beretta T-44 **Flush :** Water **Core Dia:** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.50m	**Ground Level (mOD)** 54.37	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582389.1 E 709293.9 N	**Dates** 02/10/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						54.27	0.10	TOPSOIL			
	80						(0.90)	Recovery consists of brown slightly sandy slightly gravelly Clay. Driller notes brown CLAY			
1.00 1.00-1.10	75				25/50 SPT(C) 25*/100 50/0	53.37	1.00	Recovery consists of dark grey clayey sandy subanguar to subrounded Gravel with low cobble content and low boulder content. Driller notes Possible Weathered Bedrock			
							(1.00)				
2.00						52.37	2.00	Medium strong massive dark grey fine grained argillaceous LIMESTONE with calcite veins and fossil beds. Fresh to slightly weathered 2.00m to 3.85m BGL - Two Fracture Sets - F1: 0 to 20 degree fractures, close to medium spaced, undulating, rough. F2: 40 to 60 degree fractures, medium spaced undulating rough			
2.60-2.85	93	93	67		C						
2.90-2.98				6	C						
3.11-3.20					C						
3.50											
3.85	100	100	50					3.85m to 6.50m BGL - Two Fracture Sets - F1: 0 to 20 degree fractures, medium spaced, undulating to planar, rough. F2: 40 to 60 degree fractures, widely spaced, undulating rough.			
							(4.50)				
5.00	100	100	80	4							
6.50						47.87	6.50	Complete at 6.50m			

Remarks
Borehole complete at 6.50m BGL
50mm slotted standpipe with pea gravel surround installed from 6.50m to 2.00m BGL. 50mm plain standpipe with a bentonite seal installed from 2.00m to GL with a raised cover.

Scale (approx)	Logged By
1:50	JK

Figure No. 13999-07-24.BH01

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Site Coolpowra Galway			**Borehole Number** BH07
Machine : Beretta T-44 **Flush :** Water **Core Dia :** 63.5 mm **Method :** Rotary Cored	**Casing Diameter** 96mm cased to 6.50m	**Ground Level (mOD)** 52.55	**Client** Lumcloon Energy	**Job Number** 13999-07-24
	Location 582504.3 E 709210 N	**Dates** 01/10/2024	**Engineer** Kilgallen & Partners Consulting Engineers	**Sheet** 1/1

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
	60					52.45	0.10	TOPSOIL		
							(0.90)	Recovery consists of brown slightly sandy slightly gravelly Clay onto light brown slightly gravelly clayey Sand. Driller notes CLAY onto SAND.		
1.00 1.00-1.25	55				4,5/5,45 SPT(C) 50/100	51.55	1.00	Recovery consists of dark grey slightly clayey slightly sandy subanguar to subrounded Gravel. Driller notes GRAVEL with Cobbles. (Dense)		
							(1.50)			
2.00 2.00-2.35					6,6/12,10,28 SPT(C) 50/200					
2.45-2.70	93	80	30		C	50.05	2.50	Medium strong thinly to medium bedded dark grey fine grained argillaceous LIMESTONE with calcite veins and occassional fossils. Fresh to slightly weathered		
2.95-3.02					C					
3.50										
4.15-4.35	100	100	76	7	C			2.50m to 6.50m BGL - Three Fracture Sets - F1: 0 to 20 degree fractures, widely spaced, undulating, rough. F2: 30 to 50 degree fractures, medium to widely spaced undulating rough. F3: 70 to 90 degree fractures, widely spaced, undulating, rough.		
							(4.00)			
5.00										
	100	100	76							
6.50						46.05	6.50	Complete at 6.50m		

Remarks
Borehole complete at 6.50m BGL

Scale (approx)	Logged By
1:50	JK

Figure No.
13999-07-24.BH01

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Coolpowra Galway - Rotary Core Photographs

BH01

BH01

Coolpowra Galway - Rotary Core Photographs

BH02

BH02

Coolpowra Galway - Rotary Core Photographs

BH02

Coolpowra Galway - Rotary Core Photographs

BH03

BH03

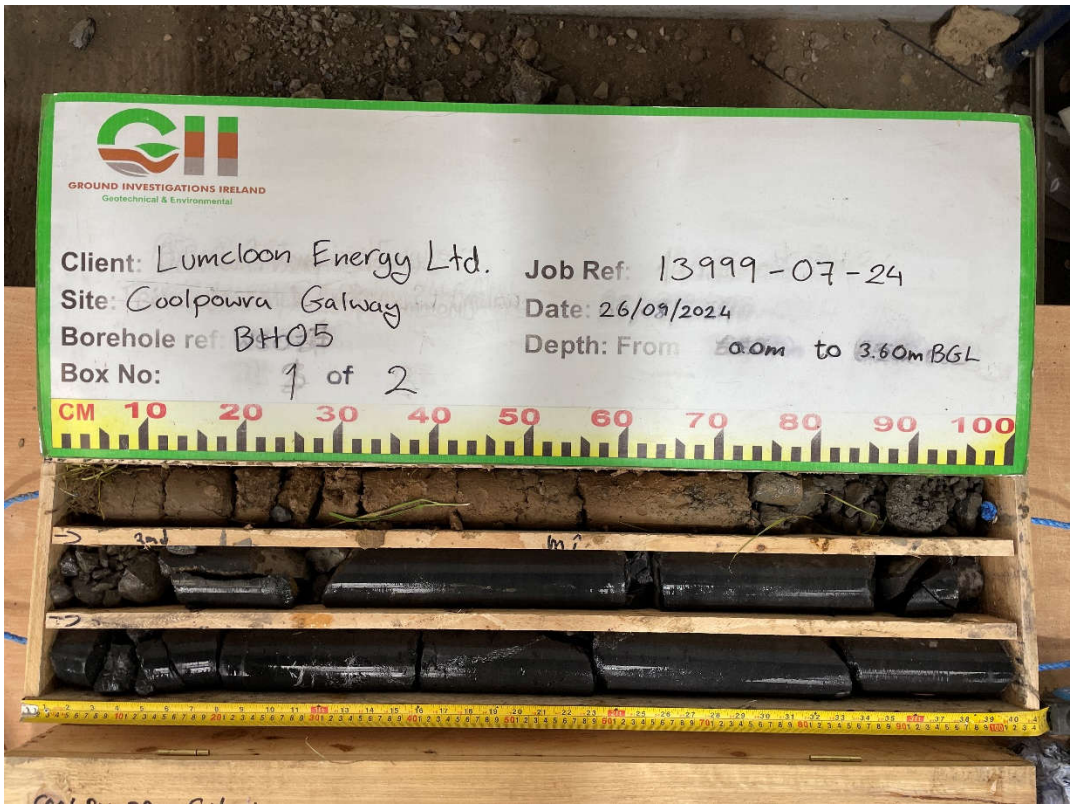
Coolpowra Galway - Rotary Core Photographs

BH04

BH04

Coolpowra Galway - Rotary Core Photographs

BH05



BH05

Coolpowra Galway - Rotary Core Photographs

BH06

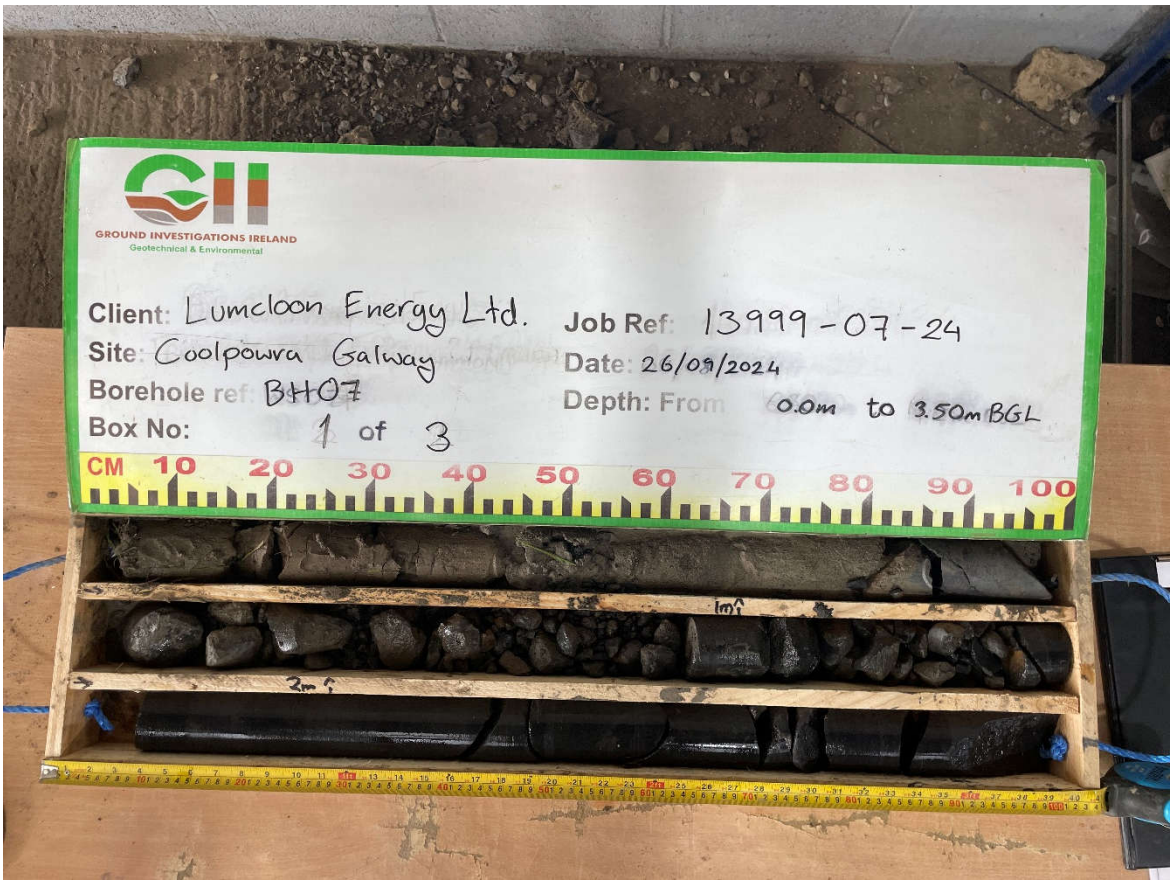
BH06

Coolpowra Galway - Rotary Core Photographs

BH06

Coolpowra Galway - Rotary Core Photographs

BH07



BH07

Coolpowra Galway - Rotary Core Photographs

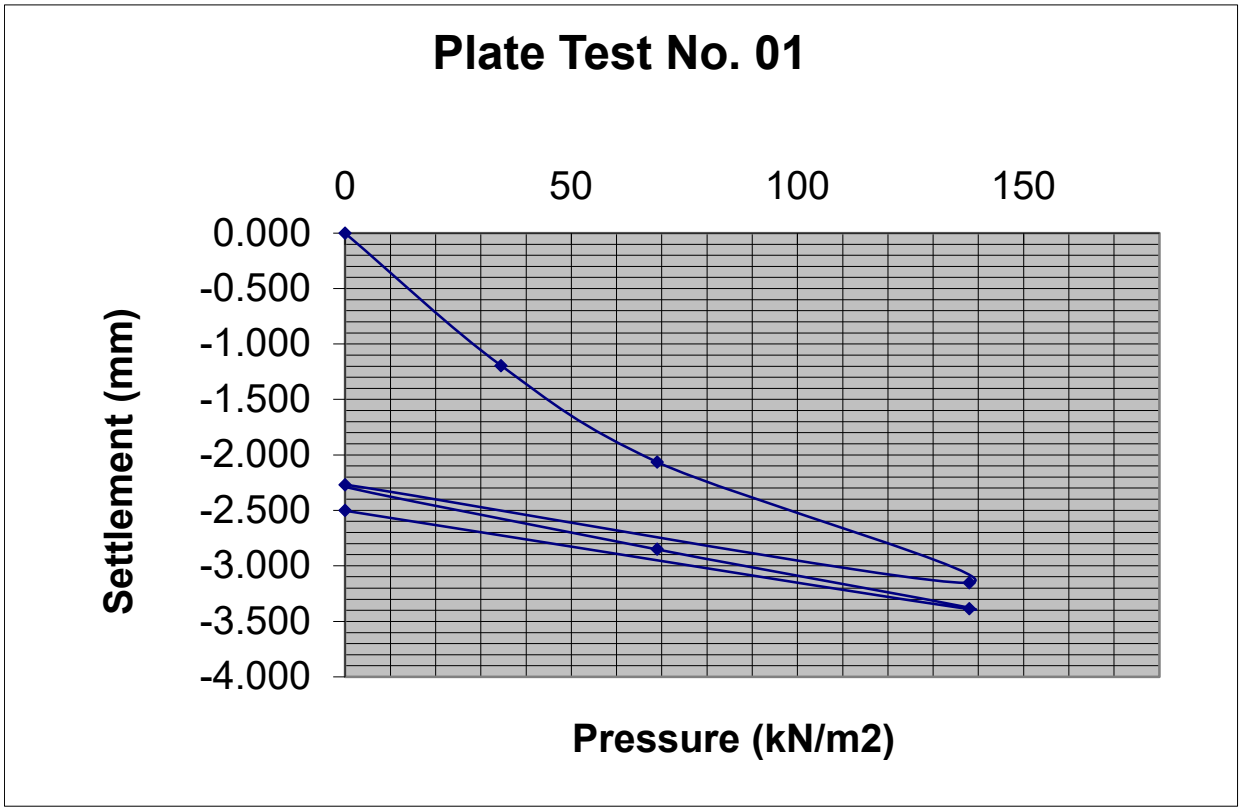
BH07

APPENDIX 6 – Plate Test Records

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-1.1955
69	-2.065
138	-3.153
0	-2.27
69	-2.851
138	-3.3885
0	-2.5015

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm brown slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	12/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-01	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **22.58 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **80.25 MN/m2/m**

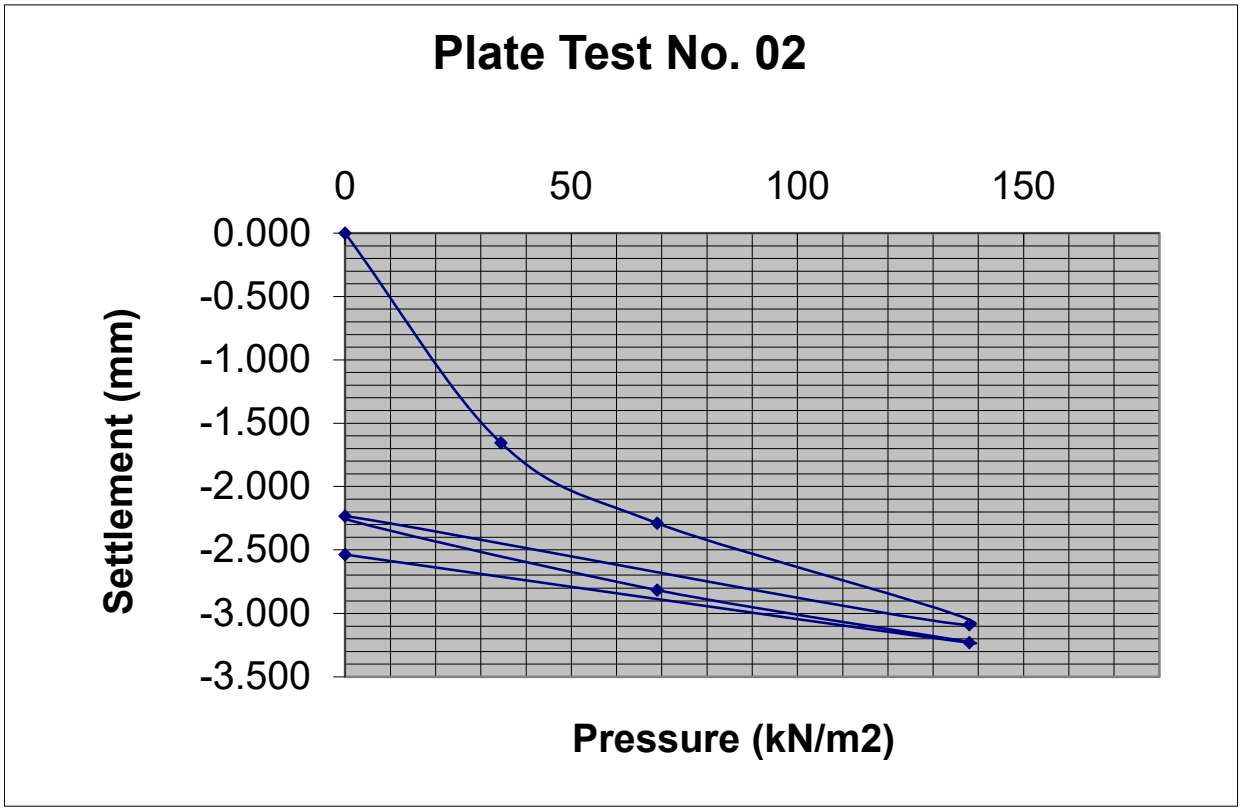
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **2.14 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **19.26 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-1.6555
69	-2.2895
138	-3.0905
0	-2.2335
69	-2.8175
138	-3.231
0	-2.536

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm brown slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	12/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-02	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **20.36 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **79.83 MN/m2/m**

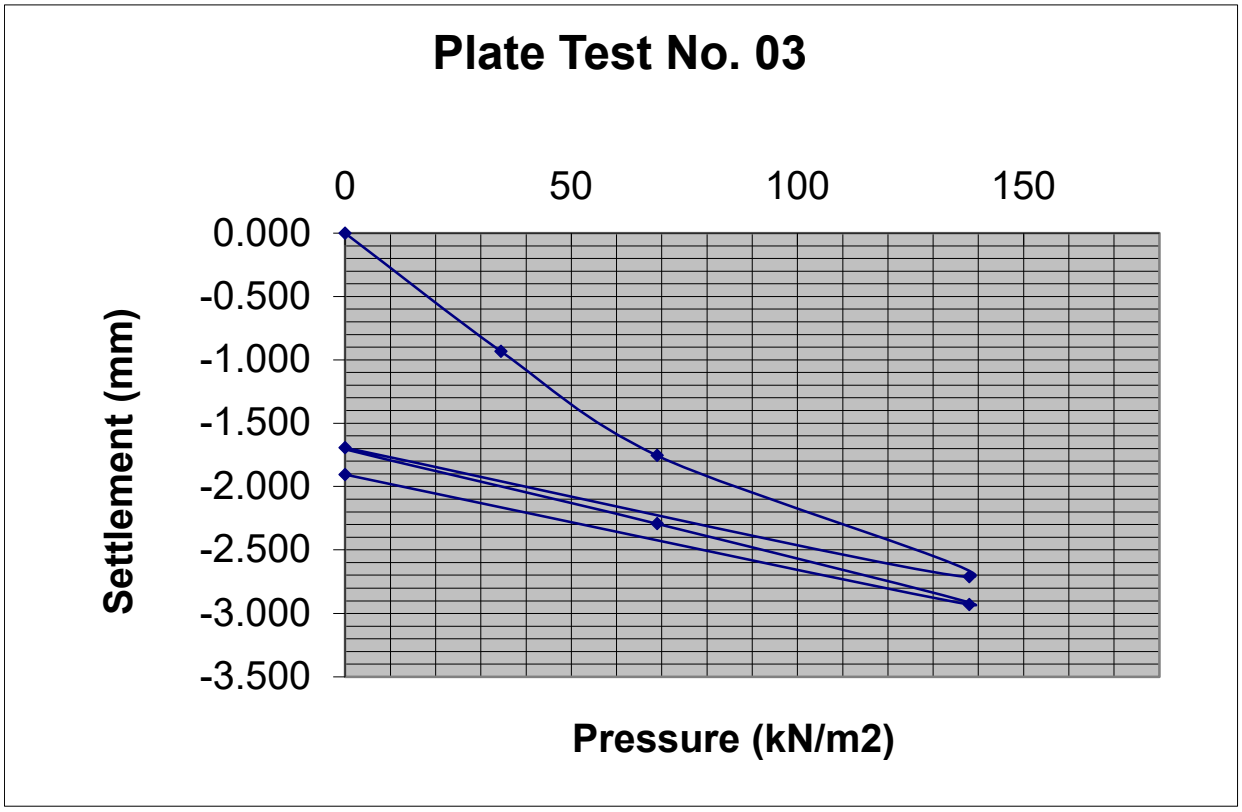
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **1.79 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **19.09 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-0.933
69	-1.7545
138	-2.712
0	-1.6945
69	-2.2925
138	-2.93
0	-1.905

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm brown slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	12/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-03	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **26.57 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **77.97 MN/m2/m**

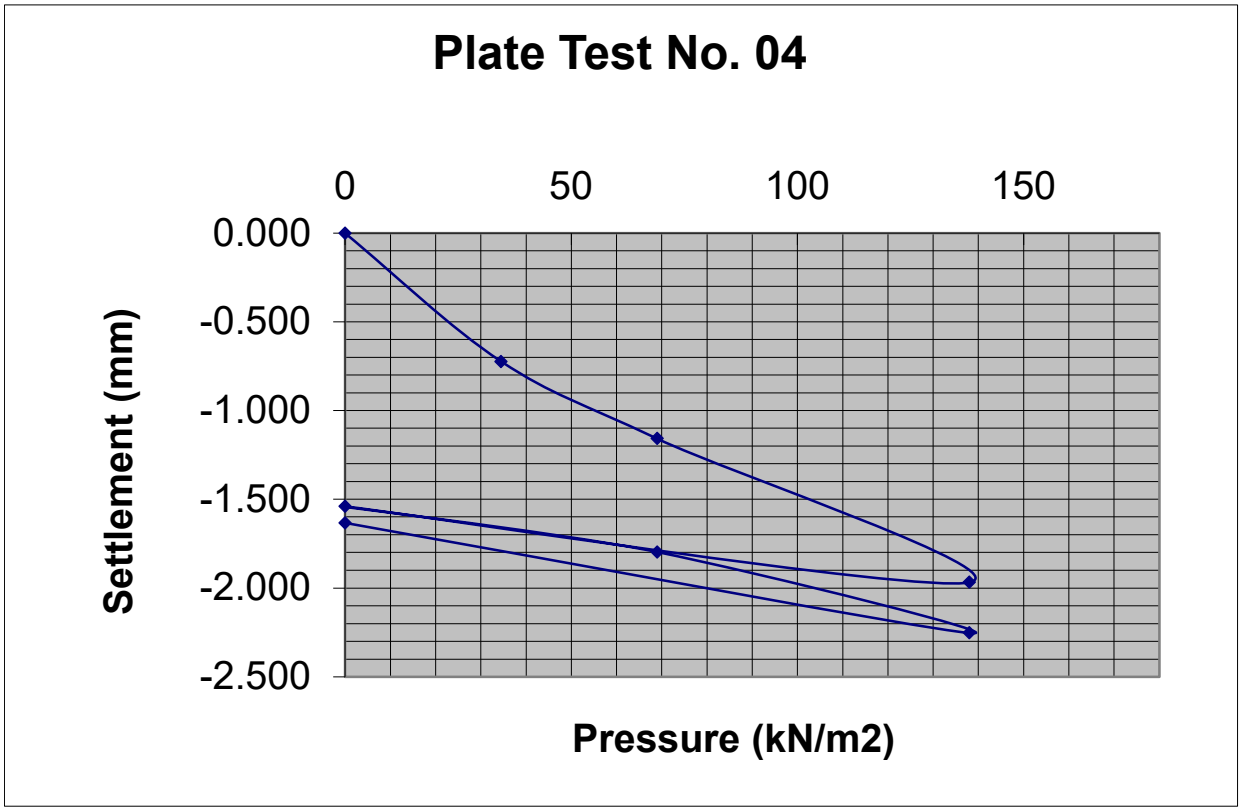
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **2.84 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **18.32 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-0.724
69	-1.158
138	-1.9675
0	-1.54
69	-1.797
138	-2.253
0	-1.6335

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm brown slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	12/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-04	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **40.26 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **181.41 MN/m2/m**

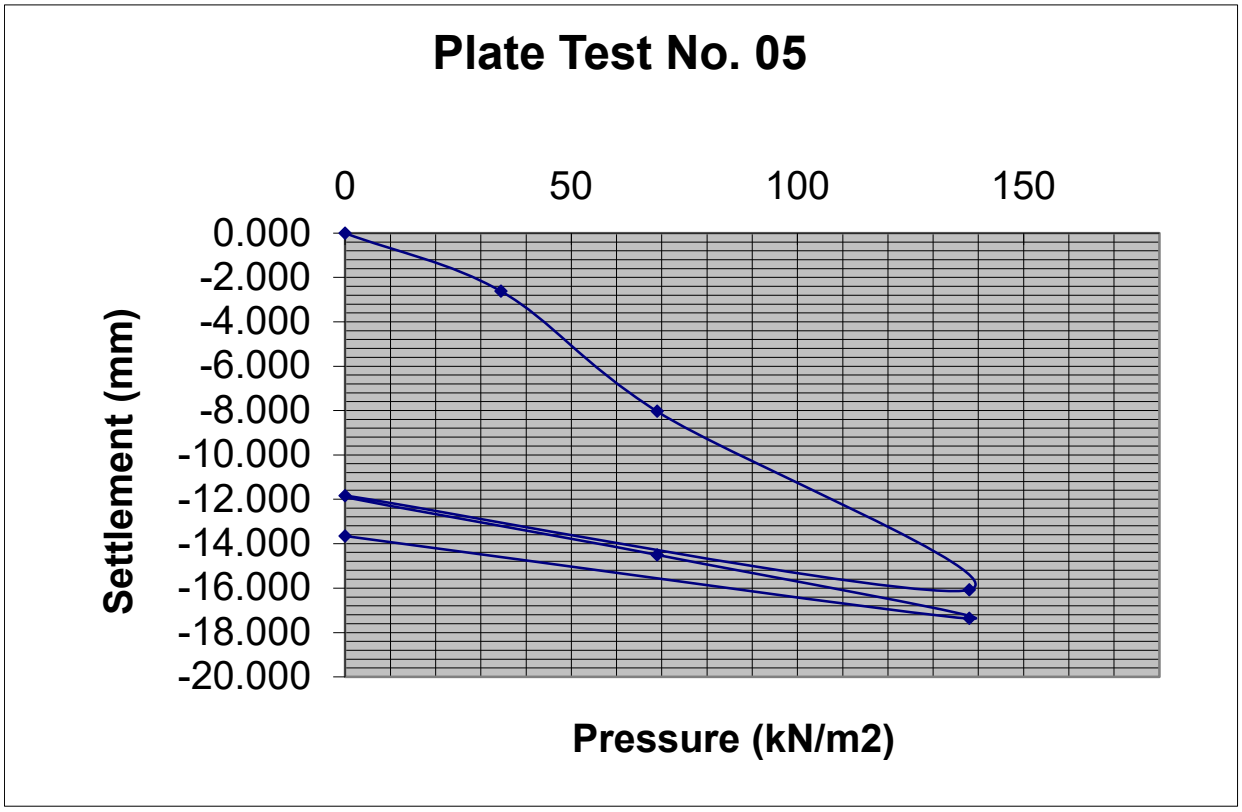
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **5.83 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **79.18 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-2.624
69	-8.0375
138	-16.0805
0	-11.8345
69	-14.506
138	-17.377
0	-13.656

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Soft brown slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	12/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-05	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **5.80 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **17.45 MN/m2/m**

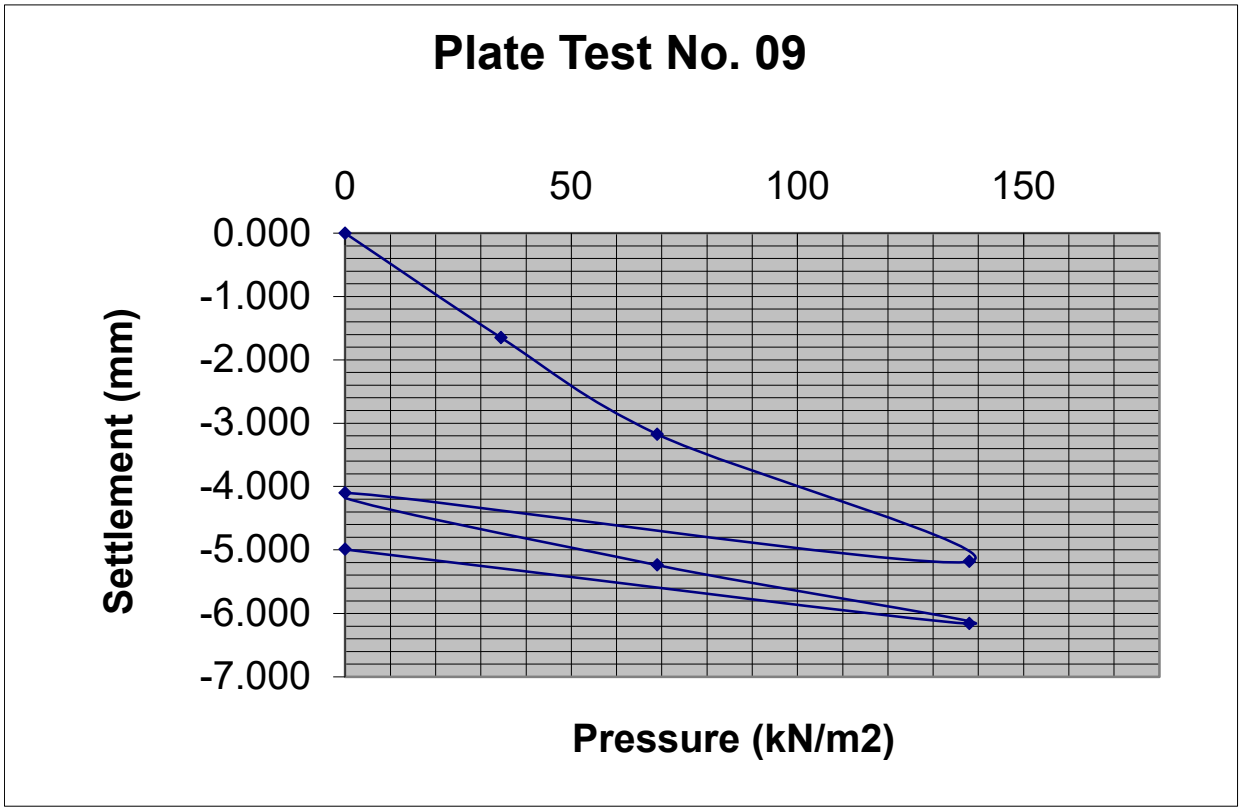
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.20 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **1.37 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-1.651
69	-3.174
138	-5.1805
0	-4.1
69	-5.237
138	-6.1625
0	-4.9895

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm brown slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	11/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-09	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **14.69 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **41.01 MN/m2/m**

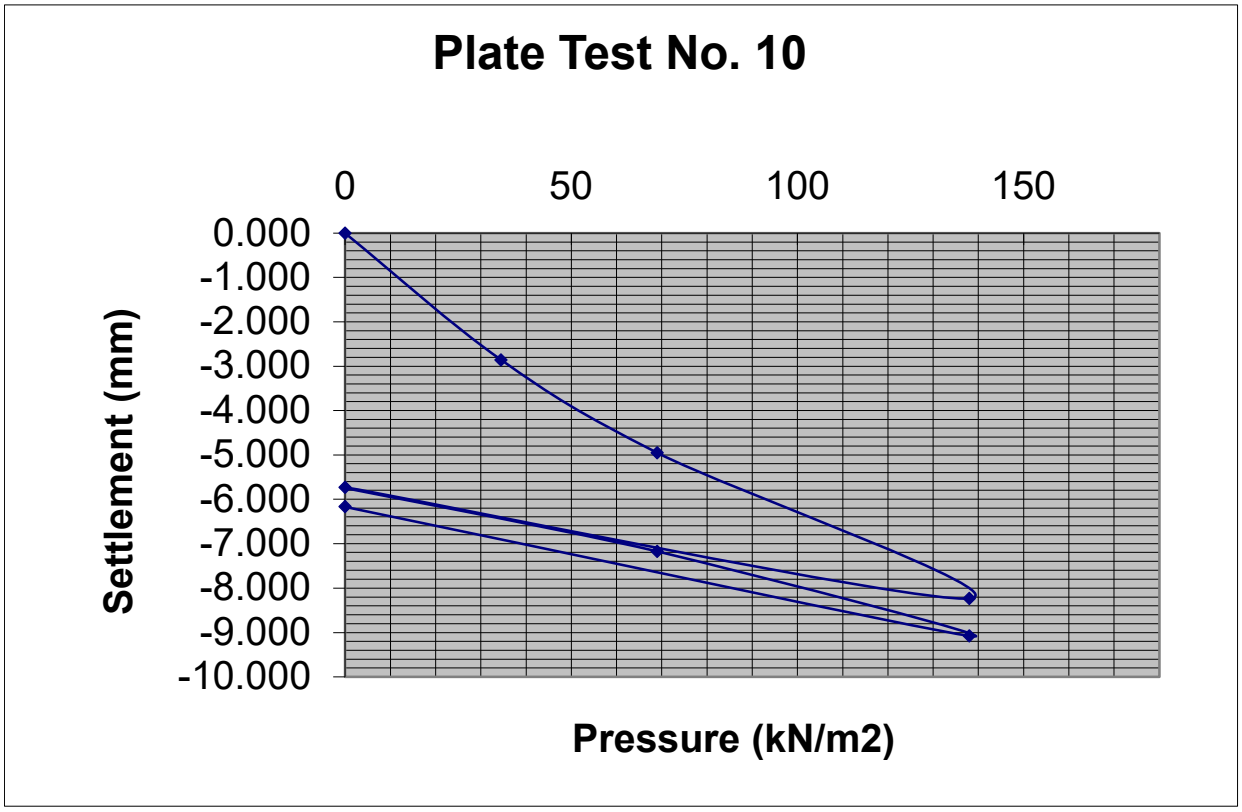
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **1.02 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **6.02 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-2.859
69	-4.9505
138	-8.235
0	-5.7295
69	-7.1745
138	-9.0785
0	-6.1695

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm brown slightly sandy gravelly CLAY with low cobble and boulder content
CONTRACT NO.	13999-07-24		
DATE	11/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-10	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **9.42 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **32.27 MN/m2/m**

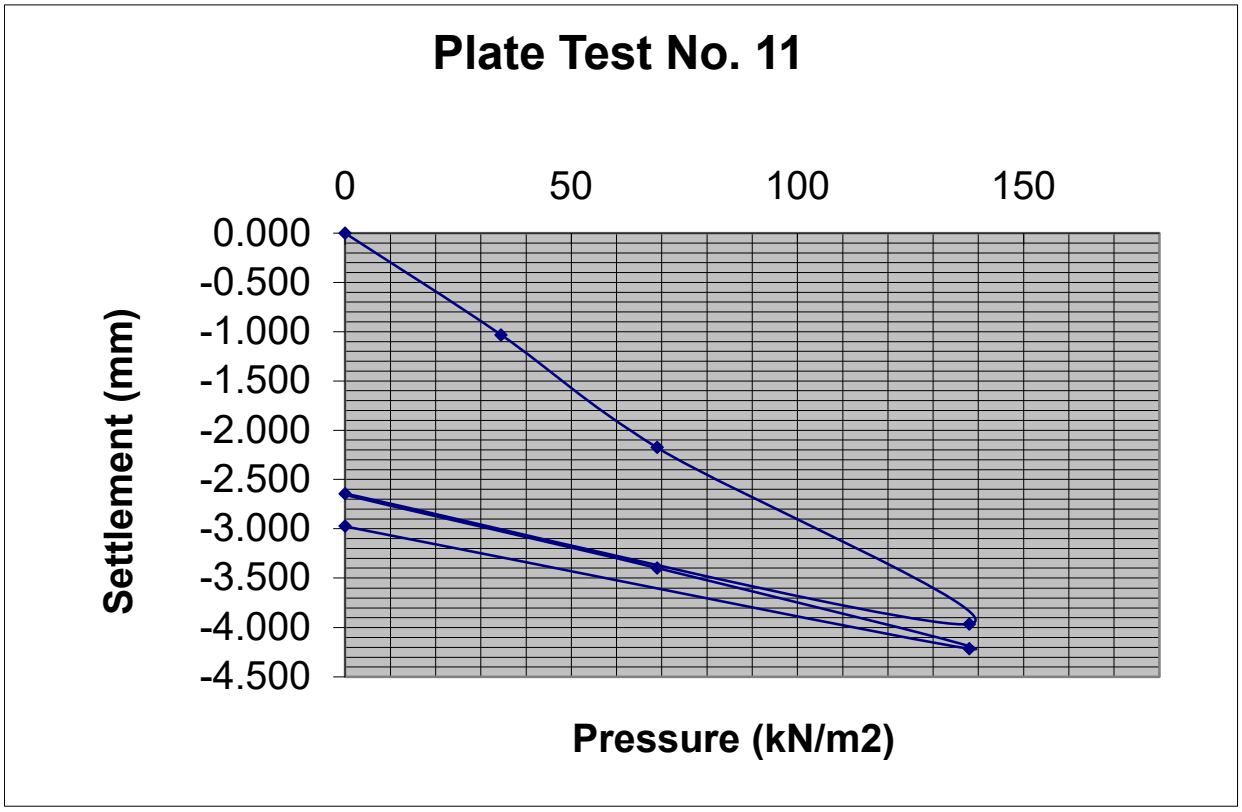
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.47 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **3.97 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-1.0325
69	-2.175
138	-3.9655
0	-2.644
69	-3.3975
138	-4.216
0	-2.9735

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm brown slightly sandy slightly gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	11/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-11	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **21.44 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **61.88 MN/m2/m**

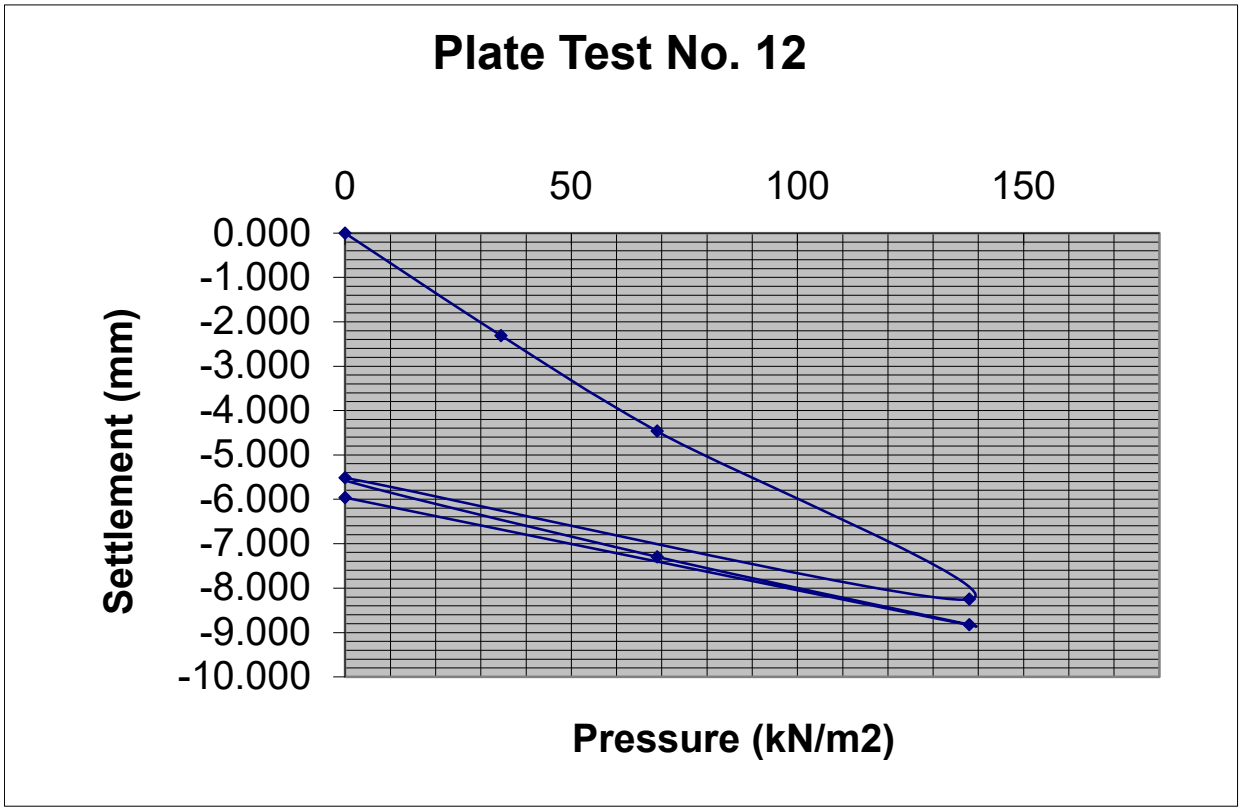
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **1.96 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **12.28 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-2.3105
69	-4.4655
138	-8.2545
0	-5.5195
69	-7.2965
138	-8.8325
0	-5.9605

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm greyish brown slightly sandy slightly gravelly CLAY with low cobble content
CONTRACT NO.	13999-07-24		
DATE	11/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-12	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **10.44 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **26.24 MN/m2/m**

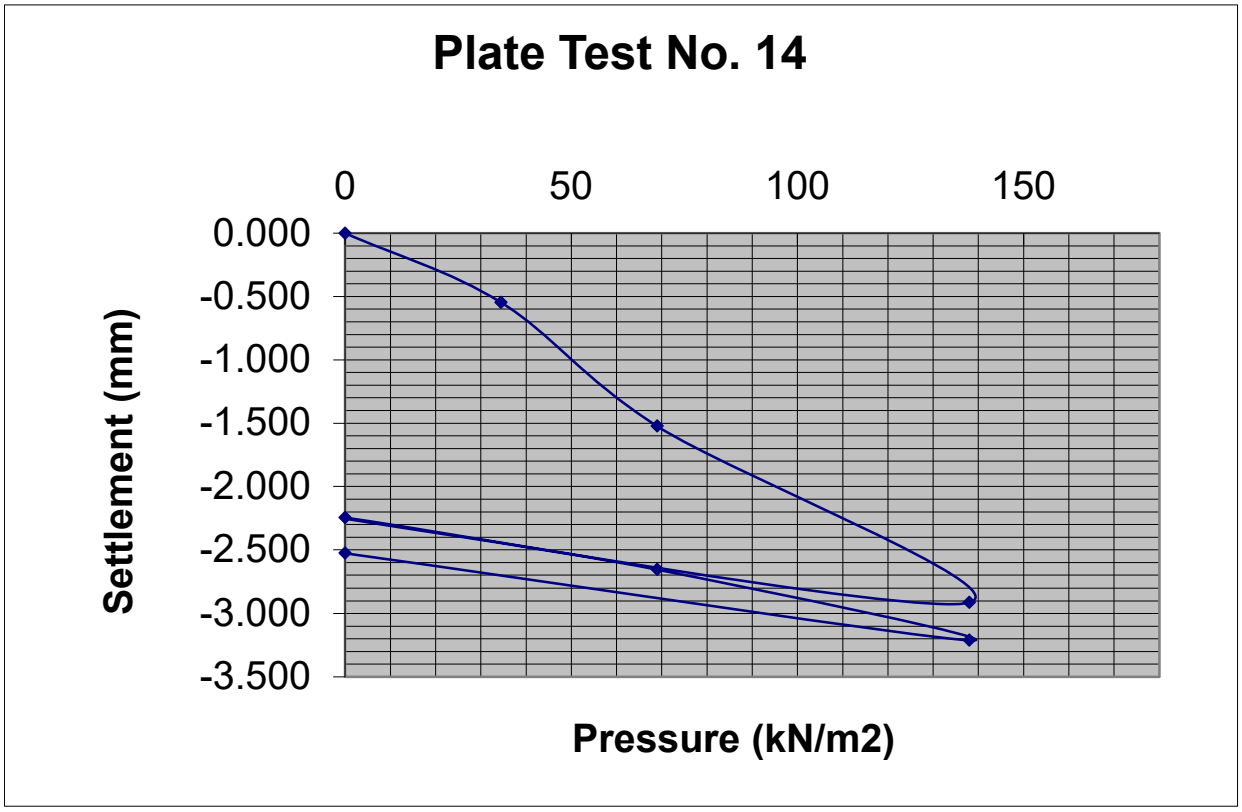
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.56 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **2.78 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-0.5465
69	-1.5225
138	-2.914
0	-2.2445
69	-2.6545
138	-3.2125
0	-2.525

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Stiff grey slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	11/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-14	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **30.62 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **113.72 MN/m2/m**

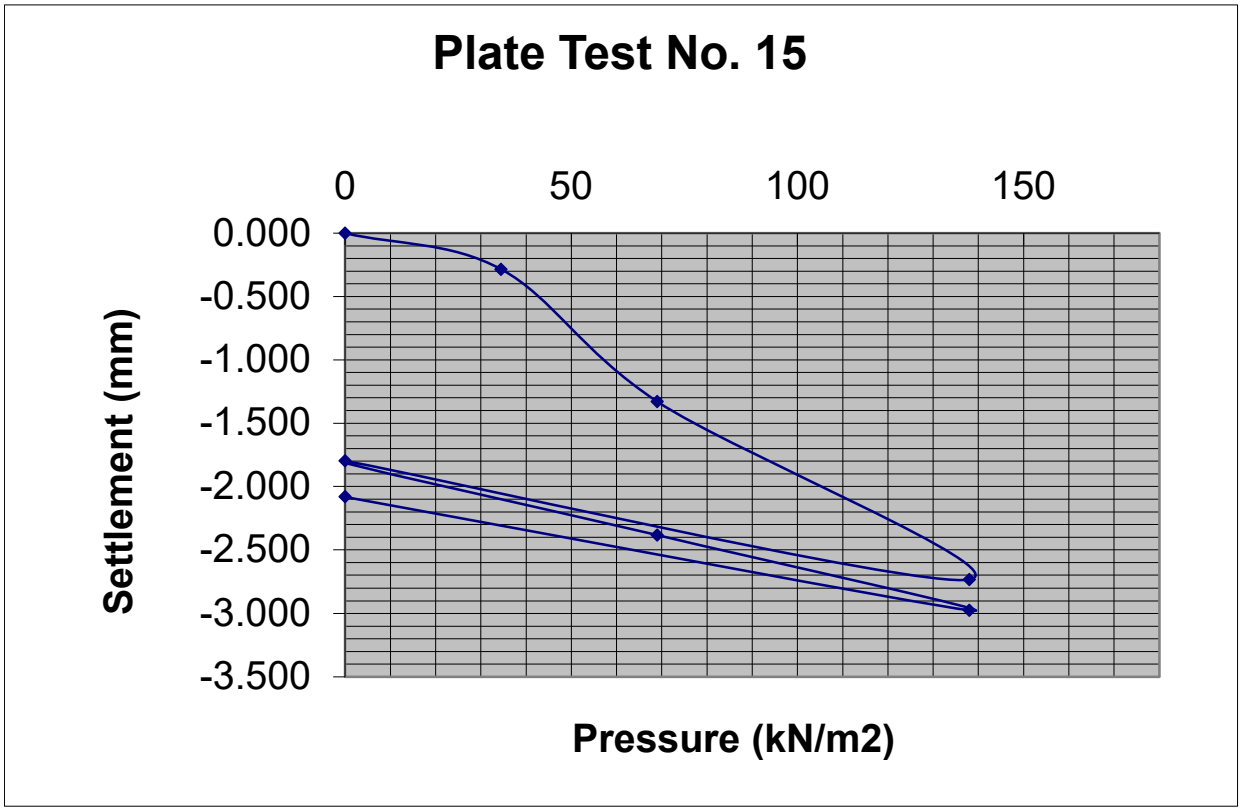
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **3.63 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **35.24 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-0.2855
69	-1.3295
138	-2.733
0	-1.7975
69	-2.3825
138	-2.976
0	-2.0805

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Stiff grey slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	11/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-15	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **35.07 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **79.70 MN/m2/m**

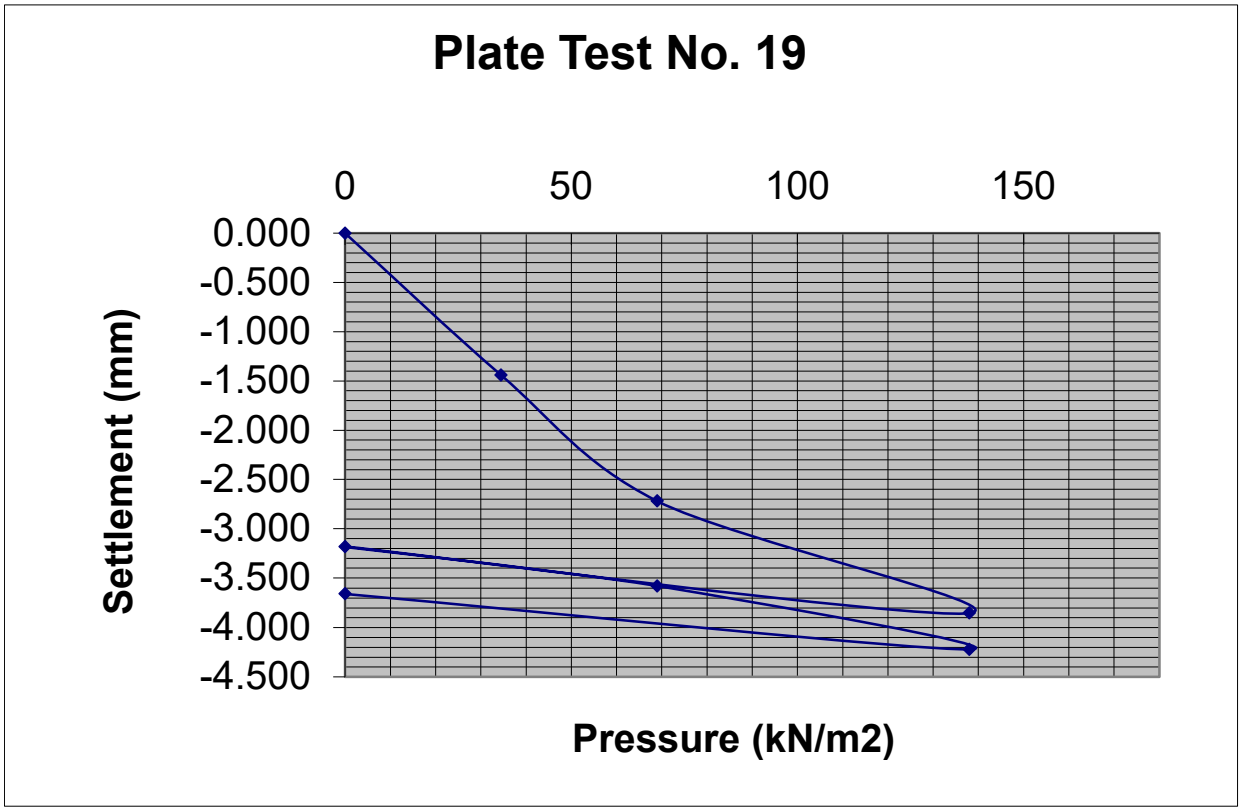
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **4.59 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **19.03 %**

Applied Load (kN/m^2)	Gauge settlement (mm)
0	**0.000**
34.5	-1.4405
69	-2.7175
138	-3.854
0	-3.1795
69	-3.5795
138	-4.223
0	-3.6585

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Coolpowra Galway	**MATERIAL**	Firm brown slightly sandy gravelly CLAY
CONTRACT NO.	13999-07-24		
DATE	12/09/2024		
CLIENT	Lumcloon Energy	**DEPTH**	0.40m
PLATE DIAMETER	457mm	**NOTES**	
TEST NO.	PBT-19	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **17.16 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **116.56 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **1.33 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **36.78 %**

APPENDIX 7 – Groundwater Monitoring

www.gii.ie

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
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D22 YD52

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Email: info@gii.ie
Web: www.gii.ie

GROUNDWATER MONITORING

Coolpowra Galway

BOREHOLE	DATE	TIME	GROUNDWATER LEVEL		COMMENT
			m BGL	m OD	
BH01	11/10/2024	16:20:00	2.57	46.03	
BH02	11/10/2024	16:30:00	-	-	Standpipe destroyed - unable to dip
BH03	11/10/2024	16:14:00	2.34	49.54	
BH04	11/10/2024	15:52:00	1.80	50.43	
BH05	11/10/2024	15:48:00	2.55	50.72	
BH06	11/10/2024	16:48:00	4.83	49.54	
BH01	25/10/2024	17:00:00	2.04	46.56	
BH03	25/10/2024	16:55:00	2.19	49.69	
BH04	25/10/2024	17:25:00	1.30	50.93	
BH05	25/10/2024	17:23:00	2.19	51.08	
BH06	25/10/2024	16:37:00	2.04	52.33	

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

GROUNDWATER MONITORING

Coolpowra Galway

BOREHOLE	DATE	TIME	GROUNDWATER LEVEL		COMMENT
			m BGL	m OD	
BH01	02/11/2024	10:54:00	2.26	46.34	
BH03	02/11/2024	11:00:00	1.80	50.08	
BH04	02/11/2024	11:04:00	1.42	50.81	
BH05	02/11/2024	11:10:00	1.52	51.75	
BH06	02/11/2024	11:13:00	2.19	52.18	
BH01	08/11/2024	16:07:00	2.27	46.33	
BH03	08/11/2024	16:11:00	1.69	50.19	
BH04	08/11/2024	16:19:00	1.52	50.71	
BH05	08/11/2024	16:17:00	1.70	51.57	Cap removed, full of hair and mud.
BH06	08/11/2024	15:56:00	2.14	52.23	

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
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D22 YD52

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Email: info@gii.ie
Web: www.gii.ie

GROUNDWATER MONITORING

Coolpowra Galway

BOREHOLE	DATE	TIME	GROUNDWATER LEVEL		COMMENT
			m BGL	m OD	
BH01	16/11/2024	08:58:00	2.27	46.33	
BH03	16/11/2024	09:02:00	1.67	50.21	
BH04	16/11/2024	09:12:00	1.57	50.66	
BH05	16/11/2024	09:10:00	1.50	51.77	
BH06	16/11/2024	08:57:00	2.14	52.23	

APPENDIX 8 – Laboratory Testing

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

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W: www.element.com

Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland
D22 K5P8

Attention :	James Cashen
Date :	16th October, 2024
Your reference :	13999-07-24
Our reference :	Test Report 24/17004 Batch 1
Location :	Coolpowra Galway
Date samples received :	4th October, 2024
Status :	Final Report
Issue :	202410161415

Twenty five samples were received for analysis on 4th October, 2024 of which twenty five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 72.11 kg of CO2

Scope 1&2&3 emissions - 170.416 kg of CO2

Authorised By:

Sean Anglish
Project Coordinator

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1	2-5	6-7	8	9-12	13-16	17-18	19-22	23-26	27	LOD/LOR	Units	Method No.
Sample ID	TP01	TP02	TP04	TP06	TP07	TP07	TP07	TP08	TP08	TP10			
Depth	0.50	0.50	0.50	1.50	1.00	2.00	3.00	0.50	1.50	1.50			
COC No / misc													
Containers	T	V J T	T	T	V J T	V J T	T	V J T	V J T	T			
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024			
Antimony	-	3	-	-	<1	<1	-	<1	<1	-	<1	mg/kg	TM30/PM15
Arsenic #	-	4.1	-	-	3.1	3.9	-	4.3	4.6	-	<0.5	mg/kg	TM30/PM15
Barium #	-	54	-	-	31	24	-	36	11	-	<1	mg/kg	TM30/PM15
Cadmium #	-	<0.1	-	-	0.2	0.2	-	0.2	0.3	-	<0.1	mg/kg	TM30/PM15
Chromium #	-	262.3 AA	-	-	49.9	35.9	-	45.2	8.7	-	<0.5	mg/kg	TM30/PM15
Copper #	-	13	-	-	7	8	-	7	8	-	<1	mg/kg	TM30/PM15
Lead #	-	20	-	-	13	13	-	15	11	-	<5	mg/kg	TM30/PM15
Mercury #	-	0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM30/PM15
Molybdenum #	-	1.1	-	-	3.0	2.2	-	2.7	0.4	-	<0.1	mg/kg	TM30/PM15
Nickel #	-	29.7	-	-	16.2	16.7	-	16.1	9.3	-	<0.7	mg/kg	TM30/PM15
Selenium #	-	<1	-	-	<1	<1	-	<1	<1	-	<1	mg/kg	TM30/PM15
Zinc #	-	37	-	-	30	29	-	30	24	-	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	-	<0.04	-	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Acenaphthylene	-	<0.03	-	-	<0.03	<0.03	-	<0.03	<0.03	-	<0.03	mg/kg	TM4/PM8
Acenaphthene #	-	<0.05	-	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	mg/kg	TM4/PM8
Fluorene #	-	<0.04	-	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Phenanthrene #	-	<0.03	-	-	<0.03	<0.03	-	<0.03	<0.03	-	<0.03	mg/kg	TM4/PM8
Anthracene #	-	<0.04	-	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Fluoranthene #	-	<0.03	-	-	<0.03	<0.03	-	<0.03	<0.03	-	<0.03	mg/kg	TM4/PM8
Pyrene #	-	<0.03	-	-	<0.03	<0.03	-	<0.03	<0.03	-	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	-	<0.06	-	-	<0.06	<0.06	-	<0.06	<0.06	-	<0.06	mg/kg	TM4/PM8
Chrysene #	-	<0.02	-	-	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	-	<0.07	-	-	<0.07	<0.07	-	<0.07	<0.07	-	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	-	<0.04	-	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	-	<0.04	-	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	-	<0.04	-	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	-	<0.04	-	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Coronene	-	<0.04	-	-	<0.04	<0.04	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	-	<0.22	-	-	<0.22	<0.22	-	<0.22	<0.22	-	<0.22	mg/kg	TM4/PM8
PAH 17 Total	-	<0.64	-	-	<0.64	<0.64	-	<0.64	<0.64	-	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	-	<0.05	-	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	-	<0.02	-	-	<0.02	<0.02	-	<0.02	<0.02	-	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	-	<1	-	-	<1	<1	-	<1	<1	-	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	-	93	-	-	90	91	-	94	95	-	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	-	<30	-	-	<30	<30	-	<30	<30	-	<30	mg/kg	TM5/PM8/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1	2-5	6-7	8	9-12	13-16	17-18	19-22	23-26	27	LOD/LOR	Units	Method No.
Sample ID	TP01	TP02	TP04	TP06	TP07	TP07	TP07	TP08	TP08	TP10			
Depth	0.50	0.50	0.50	1.50	1.00	2.00	3.00	0.50	1.50	1.50			
COC No / misc													
Containers	T	V J T	T	T	V J T	V J T	T	V J T	V J T	T			
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024			
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	-	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	-	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	-	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	-	<0.2	-	-	<0.2	<0.2	-	<0.2	<0.2	-	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	-	<4	-	-	<4	<4	-	<4	<4	-	<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	-	<7	-	-	<7	<7	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	-	<7	-	-	<7	<7	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	-	<7	-	-	<7	<7	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH_CU+HS_1D_AL)	-	<26	-	-	<26	<26	-	<26	<26	-	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	-	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_CU_1D_AL)	-	<10	-	-	<10	<10	-	<10	<10	-	<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_CU_1D_AL)	-	<10	-	-	<10	<10	-	<10	<10	-	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	-	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	-	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	-	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	-	<0.2	-	-	<0.2	<0.2	-	<0.2	<0.2	-	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	-	<4	-	-	<4	<4	-	<4	<4	-	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	-	<7	-	-	<7	<7	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	-	<7	-	-	<7	<7	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	-	<7	-	-	<7	<7	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH_CU+HS_1D_AR)	-	<26	-	-	<26	<26	-	<26	<26	-	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH_CU+HS_1D_Total)	-	<52	-	-	<52	<52	-	<52	<52	-	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	-	<0.1	-	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_CU_1D_AR)	-	<10	-	-	<10	<10	-	<10	<10	-	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_CU_1D_AR)	-	<10	-	-	<10	<10	-	<10	<10	-	<10	mg/kg	TM5/PM8/PM16
MTBE#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM36/PM12
Benzene#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM36/PM12
Toluene#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM36/PM12
Ethylbenzene#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM36/PM12
m/p-Xylene#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM36/PM12
o-Xylene#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM36/PM12
PCB 28#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 52#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 101#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 118#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 138#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 153#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 180#	-	<5	-	-	<5	<5	-	<5	<5	-	<5	ug/kg	TM17/PM8
Total 7 PCBs#	-	<35	-	-	<35	<35	-	<35	<35	-	<35	ug/kg	TM17/PM8

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1	2-5	6-7	8	9-12	13-16	17-18	19-22	23-26	27	LOD/LOR	Units	Method No.
Sample ID	TP01	TP02	TP04	TP06	TP07	TP07	TP07	TP08	TP08	TP10			
Depth	0.50	0.50	0.50	1.50	1.00	2.00	3.00	0.50	1.50	1.50			
COC No / misc													
Containers	T	V J T	T	T	V J T	V J T	T	V J T	V J T	T			
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024			
Natural Moisture Content	-	16.8	-	-	20.2	20.6	-	22.2	17.1	-	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	-	14.4	-	-	16.8	17.1	-	18.2	14.6	-	<0.1	%	PM4/PM0
Hexavalent Chromium #	-	<0.3	-	-	<0.3	<0.3	-	<0.3	<0.3	-	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0306	-	0.0023	0.0057	-	-	0.0125	-	-	0.0116	<0.0015	g/l	TM38/PM20
Chromium III	-	262.3	-	-	49.9	35.9	-	45.2	8.7	-	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	-	0.41	-	-	1.02	0.69	-	1.27	0.18	-	<0.02	%	TM21/PM24
Loss on Ignition #	-	-	-	-	-	-	-	-	-	-	<1.0	%	TM22/PM0
pH #	8.49	8.58	8.41	8.72	8.41	8.13	8.26	8.23	8.77	8.73	<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	28-31	32-33	34-37	38-41	42-45	46	47	48-51	52-55	56-57	LOD/LOR	Units	Method No.
Sample ID	TP12	TP13	TP14	TP14	TP15	TP18	TP22	TP24	TP25	TP26			
Depth	1.00	2.50	0.50	1.50	1.00	0.50	2.50	0.50	0.50	1.00			
COC No / misc													
Containers	V J T	T	V J T	V J T	V J T	T	T	V J T	V J T	T			
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024			
Antimony	<1	-	<1	<1	<1	-	-	1	<1	-	<1	mg/kg	TM30/PM15
Arsenic #	3.0	-	3.9	3.5	2.8	-	-	12.9	4.9	-	<0.5	mg/kg	TM30/PM15
Barium #	50	-	32	25	23	-	-	112	22	-	<1	mg/kg	TM30/PM15
Cadmium #	0.4	-	0.3	0.3	<0.1	-	-	0.3	0.2	-	<0.1	mg/kg	TM30/PM15
Chromium #	39.1	-	33.7	73.4	62.7	-	-	27.8	25.0	-	<0.5	mg/kg	TM30/PM15
Copper #	9	-	9	8	8	-	-	29	7	-	<1	mg/kg	TM30/PM15
Lead #	21	-	12	11	10	-	-	22	12	-	<5	mg/kg	TM30/PM15
Mercury #	0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM30/PM15
Molybdenum #	0.4	-	2.1	0.7	3.8	-	-	1.1	1.6	-	<0.1	mg/kg	TM30/PM15
Nickel #	8.4	-	15.7	15.1	13.0	-	-	36.4	14.9	-	<0.7	mg/kg	TM30/PM15
Selenium #	<1	-	1	<1	<1	-	-	2	<1	-	<1	mg/kg	TM30/PM15
Zinc #	25	-	28	25	19	-	-	102	23	-	<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	-	<0.04	<0.04	<0.04	-	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	-	<0.03	<0.03	<0.03	-	-	<0.03	<0.03	-	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	-	<0.05	<0.05	<0.05	-	-	<0.05	<0.05	-	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	-	<0.04	<0.04	<0.04	-	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	-	<0.03	<0.03	<0.03	-	-	<0.03	<0.03	-	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	-	<0.04	<0.04	<0.04	-	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	-	<0.03	<0.03	<0.03	-	-	<0.03	<0.03	-	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	-	<0.03	<0.03	<0.03	-	-	<0.03	<0.03	-	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	-	<0.06	<0.06	<0.06	-	-	<0.06	<0.06	-	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	-	<0.02	<0.02	<0.02	-	-	<0.02	<0.02	-	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	-	<0.07	<0.07	<0.07	-	-	<0.07	<0.07	-	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	-	<0.04	<0.04	<0.04	-	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	-	<0.04	<0.04	<0.04	-	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	-	<0.04	<0.04	<0.04	-	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	-	<0.04	<0.04	<0.04	-	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	-	<0.04	<0.04	<0.04	-	-	<0.04	<0.04	-	<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	-	<0.22	<0.22	<0.22	-	-	<0.22	<0.22	-	<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	-	<0.64	<0.64	<0.64	-	-	<0.64	<0.64	-	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	-	<0.05	<0.05	<0.05	-	-	<0.05	<0.05	-	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	-	<0.02	<0.02	<0.02	-	-	<0.02	<0.02	-	<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	-	<1	<1	<1	-	-	<1	<1	-	<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	95	-	97	98	95	-	-	91	96	-	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	-	<30	<30	<30	-	-	<30	<30	-	<30	mg/kg	TM5/PM8/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	28-31	32-33	34-37	38-41	42-45	46	47	48-51	52-55	56-57	LOD/LOR	Units	Method No.
Sample ID	TP12	TP13	TP14	TP14	TP15	TP18	TP22	TP24	TP25	TP26			
Depth	1.00	2.50	0.50	1.50	1.00	0.50	2.50	0.50	0.50	1.00			
COC No / misc													
Containers	V J T	T	V J T	V J T	V J T	T	T	V J T	V J T	T			
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024			
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	-	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	-	<4	<4	<4	-	-	<4	<4	-	<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	-	<7	<7	<7	-	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	15	-	16	22	<7	-	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	<7	-	<7	<7	<7	-	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH_CU+HS_1D_AL)	<26	-	<26	<26	<26	-	-	<26	<26	-	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_CU_1D_AL)	<10	-	<10	<10	<10	-	-	<10	<10	-	<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_CU_1D_AL)	15	-	16	22	<10	-	-	<10	<10	-	<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	-	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	-	<4	<4	<4	-	-	<4	<4	-	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	-	<7	<7	<7	-	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	19	-	46	59	<7	-	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	<7	-	<7	<7	<7	-	-	<7	<7	-	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH_CU+HS_1D_AR)	<26	-	46	59	<26	-	-	<26	<26	-	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH_CU+HS_1D_Total)	<52	-	<52	59	<52	-	-	<52	<52	-	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_CU_1D_AR)	<10	-	<10	<10	<10	-	-	<10	<10	-	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_CU_1D_AR)	19	-	46	59	<10	-	-	<10	<10	-	<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM36/PM12
Benzene#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM36/PM12
Toluene#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM36/PM12
o-Xylene#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM36/PM12
PCB 28#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 52#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 101#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 118#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 138#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 153#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM17/PM8
PCB 180#	<5	-	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	-	<35	<35	<35	-	-	<35	<35	-	<35	ug/kg	TM17/PM8

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	28-31	32-33	34-37	38-41	42-45	46	47	48-51	52-55	56-57	LOD/LOR	Units	Method No.
Sample ID	TP12	TP13	TP14	TP14	TP15	TP18	TP22	TP24	TP25	TP26			
Depth	1.00	2.50	0.50	1.50	1.00	0.50	2.50	0.50	0.50	1.00			
COC No / misc													
Containers	V J T	T	V J T	V J T	V J T	T	T	V J T	V J T	T			
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024			
Natural Moisture Content	25.7	-	15.3	28.1	14.0	-	-	11.3	11.1	-	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	20.4	-	13.3	21.9	12.3	-	-	10.1	10.0	-	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	-	<0.3	<0.3	<0.3	-	-	<0.3	<0.3	-	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-	0.0094	-	-	-	-	0.1657	-	-	0.0922	<0.0015	g/l	TM38/PM20
Chromium III	39.1	-	33.7	73.4	62.7	-	-	27.8	25.0	-	<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.95	-	1.98	2.31	0.17	-	-	0.51	0.29	-	<0.02	%	TM21/PM24
Loss on Ignition #	-	-	-	-	-	74.4	-	-	-	-	<1.0	%	TM22/PM0
pH #	8.50	8.88	8.04	7.91	8.77	-	7.81	7.98	8.55	8.38	<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	58-61	62	63-64	65-68	69						LOD/LOR	Units	Method No.
Sample ID	TP30	TP30	TP35	TP37	TP38								
Depth	0.50	2.00	1.50	1.00	0.50								
COC No / misc													
Containers	V J T	T	T	V J T	T								
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024								
Antimony	2	-	-	<1	-						<1	mg/kg	TM30/PM15
Arsenic #	12.7	-	-	5.7	-						<0.5	mg/kg	TM30/PM15
Barium #	54	-	-	23	-						<1	mg/kg	TM30/PM15
Cadmium #	0.3	-	-	0.2	-						<0.1	mg/kg	TM30/PM15
Chromium #	30.5	-	-	17.7	-						<0.5	mg/kg	TM30/PM15
Copper #	16	-	-	11	-						<1	mg/kg	TM30/PM15
Lead #	25	-	-	10	-						<5	mg/kg	TM30/PM15
Mercury #	0.1	-	-	<0.1	-						<0.1	mg/kg	TM30/PM15
Molybdenum #	1.9	-	-	1.2	-						<0.1	mg/kg	TM30/PM15
Nickel #	32.8	-	-	20.0	-						<0.7	mg/kg	TM30/PM15
Selenium #	1	-	-	<1	-						<1	mg/kg	TM30/PM15
Zinc #	70	-	-	34	-						<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	-	-	<0.04	-						<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	-	-	<0.03	-						<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	-	-	<0.05	-						<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	-	-	<0.04	-						<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	-	-	<0.03	-						<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	-	-	<0.04	-						<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	-	-	<0.03	-						<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	-	-	<0.03	-						<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	-	-	<0.06	-						<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	-	-	<0.02	-						<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	-	-	<0.07	-						<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	-	-	<0.04	-						<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	-	-	<0.04	-						<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	-	-	<0.04	-						<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	-	-	<0.04	-						<0.04	mg/kg	TM4/PM8
Coronene	<0.04	-	-	<0.04	-						<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	-	-	<0.22	-						<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	-	-	<0.64	-						<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	-	-	<0.05	-						<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	-	-	<0.02	-						<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	-	-	<1	-						<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	98	-	-	93	-						<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	-	-	<30	-						<30	mg/kg	TM5/PM8/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	58-61	62	63-64	65-68	69							
Sample ID	TP30	TP30	TP35	TP37	TP38							
Depth	0.50	2.00	1.50	1.00	0.50							
COC No / misc												
Containers	V J T	T	T	V J T	T							
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024							
Sample Type	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1							
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024							

Please see attached notes for all abbreviations and acronyms

											LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	-	-	<0.1	-						<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	-	-	<0.1	-						<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	-	-	<0.1	-						<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	-	-	<0.2	-						<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	-	-	<4	-						<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	-	-	<7	-						<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	-	-	<7	-						<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	<7	-	-	<7	-						<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH_CU+HS_1D_AL)	<26	-	-	<26	-						<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	-	-	<0.1	-						<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_CU_1D_AL)	<10	-	-	<10	-						<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_CU_1D_AL)	<10	-	-	<10	-						<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	-	-	<0.1	-						<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	-	-	<0.1	-						<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	-	-	<0.1	-						<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	-	-	<0.2	-						<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	-	-	<4	-						<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	-	-	<7	-						<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	-	-	<7	-						<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	<7	-	-	<7	-						<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH_CU+HS_1D_AR)	<26	-	-	<26	-						<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH_CU+HS_1D_Total)	<52	-	-	<52	-						<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1	-	-	<0.1	-						<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_CU_1D_AR)	<10	-	-	<10	-						<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_CU_1D_AR)	<10	-	-	<10	-						<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	-	-	<5	-						<5	ug/kg	TM36/PM12
Benzene#	<5	-	-	<5	-						<5	ug/kg	TM36/PM12
Toluene#	<5	-	-	<5	-						<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	-	-	<5	-						<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	-	-	<5	-						<5	ug/kg	TM36/PM12
o-Xylene#	<5	-	-	<5	-						<5	ug/kg	TM36/PM12
PCB 28#	<5	-	-	<5	-						<5	ug/kg	TM17/PM8
PCB 52#	<5	-	-	<5	-						<5	ug/kg	TM17/PM8
PCB 101#	<5	-	-	<5	-						<5	ug/kg	TM17/PM8
PCB 118#	<5	-	-	<5	-						<5	ug/kg	TM17/PM8
PCB 138#	<5	-	-	<5	-						<5	ug/kg	TM17/PM8
PCB 153#	<5	-	-	<5	-						<5	ug/kg	TM17/PM8
PCB 180#	<5	-	-	<5	-						<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	-	-	<35	-						<35	ug/kg	TM17/PM8

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	58-61	62	63-64	65-68	69						LOD/LOR	Units	Method No.
Sample ID	TP30	TP30	TP35	TP37	TP38								
Depth	0.50	2.00	1.50	1.00	0.50								
COC No / misc													
Containers	V J T	T	T	V J T	T								
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024								
Natural Moisture Content	26.0	-	-	17.5	-						<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	20.7	-	-	14.9	-						<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	-	-	<0.3	-						<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	-	0.0044	0.0093	-	0.0165						<0.0015	g/l	TM38/PM20
Chromium III	30.5	-	-	17.7	-						<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.71	-	-	0.19	-						<0.02	%	TM21/PM24
Loss on Ignition #	-	-	-	-	-						<1.0	%	TM22/PM0
pH #	8.35	8.80	8.96	8.61	8.86						<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	2-5	9-12	13-16	19-22	23-26	28-31	34-37	38-41	42-45	48-51	LOD/LOR	Units	Method No.
Sample ID	TP02	TP07	TP07	TP08	TP08	TP12	TP14	TP14	TP15	TP24			
Depth	0.50	1.00	2.00	0.50	1.50	1.00	0.50	1.50	1.00	0.50			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024			
Dissolved Antimony #	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.003	0.004	0.004	<0.003	<0.003	<0.003	0.004	0.007	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	0.03	0.04	0.04	<0.03	<0.03	<0.03	0.04	0.07	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	<0.002	0.002	0.006	<0.002	<0.002	<0.002	<0.002	0.006	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	<0.02	<0.02	0.06	<0.02	<0.02	<0.02	<0.02	0.06	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM26/PM0
Fluoride	0.6	0.4	0.4	0.5	<0.3	0.5	0.4	0.3	0.3	0.8	<0.3	mg/l	TM173/PM0
Fluoride	6	4	4	5	<3	5	4	<3	3	8	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	20.2	<0.5	<0.5	<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	<5	<5	<5	<5	<5	<5	<5	202	<5	<5	<5	mg/kg	TM38/PM0
Mass of raw test portion	0.1081	0.1089	0.1075	0.1098	0.1056	0.1074	0.1049	0.1226	0.1025	0.1087		kg	NONE/PM17
Chloride #	<0.3	<0.3	0.5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/l	TM38/PM0
Chloride #	<3	<3	5	<3	<3	<3	<3	<3	<3	<3	<3	mg/kg	TM38/PM0
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17
Dissolved Organic Carbon	4	6	6	6	2	4	8	6	2	<2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	60	60	60	20	40	80	60	20	<20	<20	mg/kg	TM60/PM0
pH	7.99	8.00	8.29	8.06	7.93	7.97	8.03	8.12	7.97	8.19	<0.01	pH units	TM73/PM0

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	2-5	9-12	13-16	19-22	23-26	28-31	34-37	38-41	42-45	48-51	LOD/LOR	Units	Method No.
Sample ID	TP02	TP07	TP07	TP08	TP08	TP12	TP14	TP14	TP15	TP24			
Depth	0.50	1.00	2.00	0.50	1.50	1.00	0.50	1.50	1.00	0.50			
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024			
Total Dissolved Solids #	65	74	98	65	<35	41	78	114	<35	<35	<35	mg/l	TM20/PM0
Total Dissolved Solids #	650	740	980	650	<350	410	780	1140	<350	<350	<350	mg/kg	TM20/PM0

Please see attached notes for all abbreviations and acronyms

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	52-55	58-61	65-68									
Sample ID	TP25	TP30	TP37									
Depth	0.50	0.50	1.00									
COC No / misc												
Containers	V J T	V J T	V J T									
Sample Date	02/10/2024	02/10/2024	02/10/2024									
Sample Type	Soil	Soil	Soil									
Batch Number	1	1	1									
Date of Receipt	04/10/2024	04/10/2024	04/10/2024									

Please see attached notes for all abbreviations and acronyms

											LOD/LOR	Units	Method No.
Dissolved Antimony #	<0.002	<0.002	<0.002								<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02								<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025								<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025								<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	<0.003	<0.003								<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	<0.03	<0.03								<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005								<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005								<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015								<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015								<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007								<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07								<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005								<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05								<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	<0.002	<0.002	<0.002								<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	<0.02	<0.02	<0.02								<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002								<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02								<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003								<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03								<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	<0.003	<0.003								<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03								<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001								<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001								<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01								<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1								<0.1	mg/kg	TM26/PM0
Fluoride	0.4	0.7	0.3								<0.3	mg/l	TM173/PM0
Fluoride	4	7	3								<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<0.5	<0.5	<0.5								<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	<5	<5	<5								<5	mg/kg	TM38/PM0
Mass of raw test portion	0.1	0.1084	0.1042									kg	NONE/PM17
Chloride #	<0.3	<0.3	<0.3								<0.3	mg/l	TM38/PM0
Chloride #	<3	<3	<3								<3	mg/kg	TM38/PM0
Mass of dried test portion	0.09	0.09	0.09									kg	NONE/PM17
Dissolved Organic Carbon	<2	<2	<2								<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	<20	<20								<20	mg/kg	TM60/PM0
pH	7.96	8.09	7.99								<0.01	pH units	TM73/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	52-55	58-61	65-68									
Sample ID	TP25	TP30	TP37									
Depth	0.50	0.50	1.00									
COC No / misc												
Containers	V J T	V J T	V J T									
Sample Date	02/10/2024	02/10/2024	02/10/2024									
Sample Type	Soil	Soil	Soil									
Batch Number	1	1	1									
Date of Receipt	04/10/2024	04/10/2024	04/10/2024									

Please see attached notes for all abbreviations and acronyms

											LOD/LOR	Units	Method No.
Total Dissolved Solids #	<35	60	<35								<35	mg/l	TM20/PM0
Total Dissolved Solids #	<350	600	<350								<350	mg/kg	TM20/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	2-5	9-12	13-16	19-22	23-26	28-31	34-37	38-41	42-45	48-51						
Sample ID	TP02	TP07	TP07	TP08	TP08	TP12	TP14	TP14	TP15	TP24						
Depth	0.50	1.00	2.00	0.50	1.50	1.00	0.50	1.50	1.00	0.50						
COC No / misc																
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024	02/10/2024						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1	1	1	1						
Date of Receipt	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	04/10/2024	Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Solid Waste Analysis																
Total Organic Carbon #	0.41	1.02	0.69	1.27	0.18	0.95	1.98	2.31	0.17	0.51	3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.03	0.04	0.04	<0.03	<0.03	<0.03	0.04	0.07	<0.03	<0.03	20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	<0.02	<0.02	0.06	<0.02	<0.02	<0.02	<0.02	0.06	<0.02	<0.02	0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	650	740	980	650	<350	410	780	1140	<350	<350	4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	40	60	60	60	20	40	80	60	20	<20	500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1081	0.1089	0.1075	0.1098	0.1056	0.1074	0.1049	0.1226	0.1025	0.1087	-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	83.0	82.6	83.9	81.7	85.4	84.1	85.8	73.3	87.9	82.6	-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.882	0.881	0.883	0.88	0.885	0.883	0.885	0.867	0.888	0.881	-	-	-		l	NONE/PM17
Moisture Content 105C (% Dry Weight)	20.5	21.1	19.2	22.4	17.1	18.9	16.6	36.4	13.7	21.1	-	-	-	<0.1	%	PM4/PM0
pH #	8.58	8.41	8.13	8.23	8.77	8.50	8.04	7.91	8.77	7.98	-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	6	4	4	5	<3	5	4	<3	3	8	10	150	500	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<5	<5	<5	<5	<5	<5	<5	202	<5	<5	1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	<3	5	<3	<3	<3	<3	<3	<3	<3	800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen
EMT Job No: 24/17004

Report : **EN12457_2**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	52-55	58-61	65-68													
Sample ID	TP25	TP30	TP37													
Depth	0.50	0.50	1.00													
COC No / misc																
Containers	V J T	V J T	V J T													
Sample Date	02/10/2024	02/10/2024	02/10/2024													
Sample Type	Soil	Soil	Soil													
Batch Number	1	1	1													
Date of Receipt	04/10/2024	04/10/2024	04/10/2024													
Solid Waste Analysis																
Total Organic Carbon #	0.29	0.71	0.19								3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025								6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035								1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30								500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22								-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64								100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	<0.025	<0.025								0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	<0.03	<0.03								20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005								0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015								0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07								2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001								0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	<0.02	<0.02	<0.02								0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02								0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05								0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02								0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03								0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03								4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	<350	600	<350								4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	<20	<20								500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1	0.1084	0.1042								-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	90.0	82.7	86.5								-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.89	0.881	0.886								-	-	-		l	NONE/PM17
Moisture Content 105C (% Dry Weight)	11.1	20.9	15.6								-	-	-	<0.1	%	PM4/PM0
pH #	8.55	8.35	8.61								-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1								1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	4	7	3								10	150	500	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<5	<5	<5								1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	<3	<3								800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 13999-07-24

Location: Coolpowra Galway

Contact: James Cashen

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
24/17004	1	TP02	0.50	2-5	No interpretation possible
24/17004	1	TP07	1.00	9-12	No interpretation possible
24/17004	1	TP07	2.00	13-16	No interpretation possible
24/17004	1	TP08	0.50	19-22	No interpretation possible
24/17004	1	TP08	1.50	23-26	No interpretation possible
24/17004	1	TP12	1.00	28-31	No interpretation possible
24/17004	1	TP14	0.50	34-37	No interpretation possible
24/17004	1	TP14	1.50	38-41	Traces of unknown Hydrocarbons and traces of possible naturally occurring compounds
24/17004	1	TP15	1.00	42-45	No interpretation possible
24/17004	1	TP24	0.50	48-51	No interpretation possible
24/17004	1	TP25	0.50	52-55	No interpretation possible
24/17004	1	TP30	0.50	58-61	No interpretation possible
24/17004	1	TP37	1.00	65-68	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Asbestos sub-samples are retained for not less than 6 months from the date of analysis unless specifically requested.

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

Where trace asbestos is reported the amount of asbestos will be <0.1%.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
24/17004	1	TP02	0.50	5	Catherine Coles	07/10/2024	**General Description (Bulk Analysis)**	brown soil,stone
					Catherine Coles	07/10/2024	**Asbestos Fibres**	NAD
					Catherine Coles	07/10/2024	**Asbestos ACM**	NAD
					Catherine Coles	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP07	1.00	12	Kieran Hunt	08/10/2024	**General Description (Bulk Analysis)**	Brown soil / stones
					Kieran Hunt	08/10/2024	**Asbestos Fibres**	NAD
					Kieran Hunt	08/10/2024	**Asbestos ACM**	NAD
					Kieran Hunt	08/10/2024	**Asbestos Type**	NAD
24/17004	1	TP07	2.00	16	Simon Postlewhite	07/10/2024	**General Description (Bulk Analysis)**	Brown soil/stones
					Simon Postlewhite	07/10/2024	**Asbestos Fibres**	NAD
					Simon Postlewhite	07/10/2024	**Asbestos ACM**	NAD
					Simon Postlewhite	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP08	0.50	22	Catherine Coles	07/10/2024	**General Description (Bulk Analysis)**	brown soil,stone
					Catherine Coles	07/10/2024	**Asbestos Fibres**	NAD
					Catherine Coles	07/10/2024	**Asbestos ACM**	NAD
					Catherine Coles	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP08	1.50	26	Kieran Hunt	07/10/2024	**General Description (Bulk Analysis)**	Brown soil / stones
					Kieran Hunt	07/10/2024	**Asbestos Fibres**	NAD
					Kieran Hunt	07/10/2024	**Asbestos ACM**	NAD
					Kieran Hunt	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP12	1.00	31	Catherine Coles	07/10/2024	**General Description (Bulk Analysis)**	brown soil,stone
					Catherine Coles	07/10/2024	**Asbestos Fibres**	NAD
					Catherine Coles	07/10/2024	**Asbestos ACM**	NAD
					Catherine Coles	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP14	0.50	37	Catherine Coles	07/10/2024	**General Description (Bulk Analysis)**	brown soil,stone
					Catherine Coles	07/10/2024	**Asbestos Fibres**	NAD
					Catherine Coles	07/10/2024	**Asbestos ACM**	NAD
					Catherine Coles	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP14	1.50	41	Kieran Hunt	08/10/2024	**General Description (Bulk Analysis)**	Brown soil / stones
					Kieran Hunt	08/10/2024	**Asbestos Fibres**	NAD
					Kieran Hunt	08/10/2024	**Asbestos ACM**	NAD
					Kieran Hunt	08/10/2024	**Asbestos Type**	NAD

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
24/17004	1	TP15	1.00	45	Emily Smith	07/10/2024	**General Description (Bulk Analysis)**	Brown soil with stones
					Emily Smith	07/10/2024	**Asbestos Fibres**	NAD
					Emily Smith	07/10/2024	**Asbestos ACM**	NAD
					Emily Smith	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP24	0.50	51	Simon Postlewhite	07/10/2024	**General Description (Bulk Analysis)**	Brown soil/stones
					Simon Postlewhite	07/10/2024	**Asbestos Fibres**	NAD
					Simon Postlewhite	07/10/2024	**Asbestos ACM**	NAD
					Simon Postlewhite	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP25	0.50	55	Emily Smith	07/10/2024	**General Description (Bulk Analysis)**	Brown soil with stones
					Emily Smith	07/10/2024	**Asbestos Fibres**	NAD
					Emily Smith	07/10/2024	**Asbestos ACM**	NAD
					Emily Smith	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP30	0.50	61	Kieran Hunt	07/10/2024	**General Description (Bulk Analysis)**	Brown soil / stones
					Kieran Hunt	07/10/2024	**Asbestos Fibres**	NAD
					Kieran Hunt	07/10/2024	**Asbestos ACM**	NAD
					Kieran Hunt	07/10/2024	**Asbestos Type**	NAD
24/17004	1	TP37	1.00	68	Emily Smith	08/10/2024	**General Description (Bulk Analysis)**	Brown soil with stones
					Emily Smith	08/10/2024	**Asbestos Fibres**	NAD
					Emily Smith	08/10/2024	**Asbestos ACM**	NAD
					Emily Smith	08/10/2024	**Asbestos Type**	NAD

Client Name: Ground Investigations Ireland
Reference: 13999-07-24
Location: Coolpowra Galway
Contact: James Cashen

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 24/17004						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.
It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

Please include all sections of this report if it is reproduced

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 24/17004

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 35°C ±5°C.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 24/17004

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35 degrees Celsius or 105 degrees Celsius. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.	Yes		AD	Yes

EMT Job No: 24/17004

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	PM0	No preparation is required.	Yes		AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 degrees Celsius. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) - All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes

EMT Job No: 24/17004

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35 degrees Celsius or 105 degrees Celsius. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

LABORATORY REPORT

Contract Number: PSL24/7255

Report Date:	29 October 2024
Client's Reference:	13999-07-24
Client Name:	Ground Investigations Ireland Ltd Catherinestown House Hazelhatch Road Newcastle Co Dublin D22 YD52
For the attention of:	**James Cashen**
Contract Title:	Coolpowra Galway
Date Received:	3/10/2024
Date Commenced:	3/10/2024
Date Completed:	29/10/2024
Notes:	**Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Managing Director)	R Berriman (Associate Director)	S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)	S Eyre (Senior Technician)	T Watkins (Senior Technician)

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awatkins@prosoils.co.uk

SUMMARY OF SOIL CLASSIFICATION TESTS

BS 1377 - Part 2 : 2022 in accordance with BS EN ISO 17892 (as below)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Water Content %	Linear Shrinkage	Particle Density Mg/m^3	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 0.425mm %	Remarks
TP01		B&D	0.50		13.2			29	14	15	77	Low Plasticity CIL
TP01		B&D	1.50		10.2				NP			
TP04		B&D	0.50		18.8			35	19	16	44	Medium Plasticity CIM
TP05		B&D	1.50		8.9				NP			
TP06		B&D	0.50		17.4			27	14	13	52	Low Plasticity CIL
TP07		B&D	2.00		20.9			37	19	18	47	Medium Plasticity CIM
TP08		B&D	1.50		17.9			31	17	14	50	Low Plasticity CIL
TP10		B&D	0.50		13.5				NP			
TP12		B&D	1.00		20.4			45	21	24	80	Medium Plasticity CIM
TP13		B&D	0.50		12.7			25	12	13	59	Low Plasticity CIL
TP16		B&D	0.50		13.5			27	12	15	35	Low Plasticity CIL
TP19		B&D	1.50		18.9			32	17	15	65	Low Plasticity CIL
TP22		B&D	0.50		22.1			39	22	17	85	Medium Plasticity CIM
TP22		B&D	2.50		10.4				NP			
TP24		B&D	0.50		27.7			54	26	28	82	High Plasticity CIH

Water Content - BS 1377 - Part 2 : 2022 : Clause 4 in accordance with BS EN ISO 17892 - 1 : 2014 + A1 : 2022
Linear Shrinkage - BS 1377 - Part 2 : 2022 : Clause 7
Particle Density (Gas Jar method) - BS 1377 - Part 2 : 2022 : Clause 9
Liquid, Plastic Limit & Plasticity Index - BS 1377 - Part 2 : 2022 : Clause 5 & 6 in accordance with BS EN ISO 17892 - 12 : 2018 + A2 : 2022

SYMBOLS : NP = Non Plastic

UKAS TESTING 4043

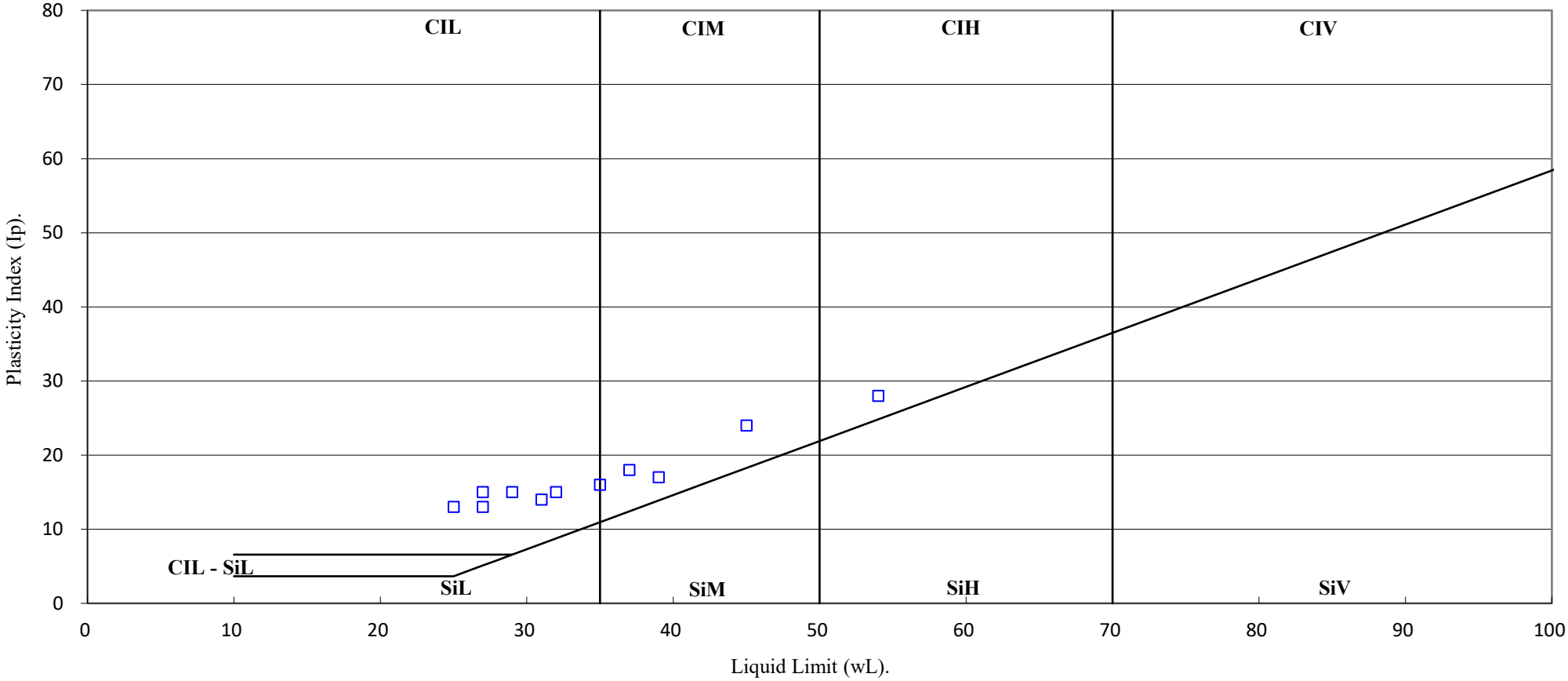
PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No:
PSL24/7255
Client Ref:
13999-07-24

PLASTICITY CHART

BS EN ISO 14688-2:2017 Clause 4.4



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Coolpowra Galway**	**Contract No:** PSL24/7255 **Client Ref:**

SUMMARY OF SOIL CLASSIFICATION TESTS

BS 1377 - Part 2 : 2022 in accordance with BS EN ISO 17892 (as below)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Water Content %	Linear Shrinkage	Particle Density Mg/m^3	Liquid Limit %	Plastic Limit %	Plasticity Index %	Passing 0.425mm %	Remarks
TP26		B&D	1.00		19.3				NP			
TP29		B&D	1.50		11.3			30	14	16	36	Low Plasticity CIL
TP31		B&D	1.00		18.9				NP			
TP33		B&D	0.50		21.0			47	24	23	89	Medium Plasticity CIM
TP34		B&D	1.00		9.7				NP			
TP35		B&D	1.50		8.8				NP			
TP38		B&D	0.50		13.8			27	13	14	81	Low Plasticity CIL
TP09		B&D	1.00		13.1			26	14	12	27	Low Plasticity CIL
TP10		B&D	1.50		15.4				NP			
TP11		B&D	2.50		11.0				NP			
TP13		B&D	2.50		10.6				NP			
TP20		B&D	1.50		9.3				NP			
TP26		B&D	2.00		10.3				NP			
TP36		B&D	0.50		14.1			26	16	10	49	

Water Content - BS 1377 - Part 2 : 2022 : Clause 4 in accordance with BS EN ISO 17892 - 1 : 2014 + A1 : 2022
Linear Shrinkage - BS 1377 - Part 2 : 2022 : Clause 7
Particle Density (Gas Jar method) - BS 1377 - Part 2 : 2022 : Clause 9
Liquid, Plastic Limit & Plasticity Index - BS 1377 - Part 2 : 2022 : Clause 5 & 6 in accordance with BS EN ISO 17892 - 12 : 2018 + A2 : 2022

SYMBOLS : NP = Non Plastic

UKAS TESTING 4043

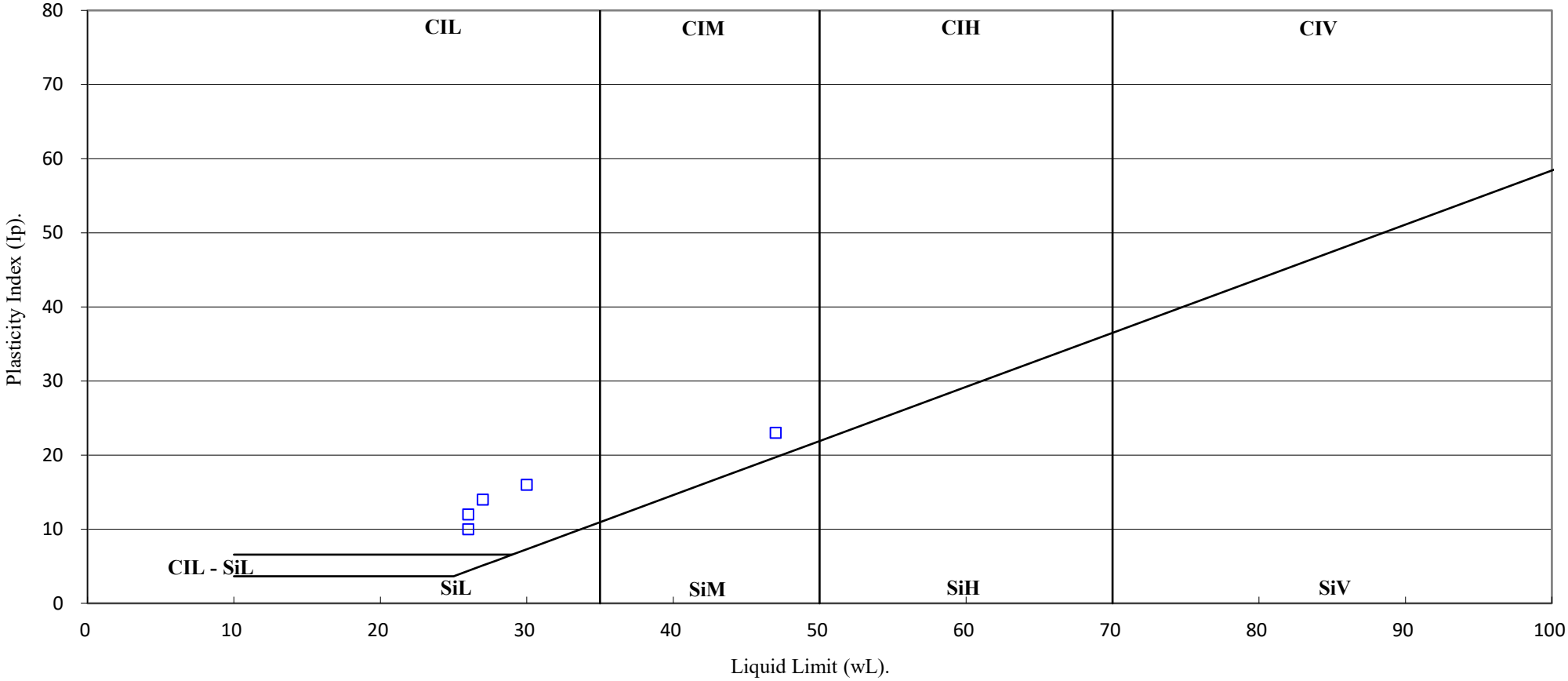
PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No:
PSL24/7255
Client Ref:
13999-07-24

PLASTICITY CHART

BS EN ISO 14688-2:2017 Clause 4.4



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Coolpowra Galway**	**Contract No:** PSL24/7255 **Client Ref:**

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP01		B&D	0.50		Brown sandy slightly gravelly CLAY.
TP01		B&D	1.50		Grey clayey sandy GRAVEL with cobbles.
TP02		B&D	1.50		Grey slightly sandy GRAVEL.
TP03		B&D	0.50		Brown very clayey sandy GRAVEL.
TP04		B&D	0.50		Grey very clayey very sandy GRAVEL.
TP05		B&D	1.50		Brown clayey very sandy GRAVEL.
TP06		B&D	0.50		Brown slightly sandy gravelly CLAY.
TP07		B&D	2.00		Grey very clayey very sandy GRAVEL.
TP08		B&D	1.50		Grey slightly sandy gravelly CLAY.
TP10		B&D	0.50		Brown silty very sandy GRAVEL.
TP12		B&D	1.00		Grey slightly sandy slightly gravelly CLAY.
TP13		B&D	0.50		Grey slightly sandy slightly gravelly CLAY.
TP16		B&D	0.50		Brown very clayey very sandy GRAVEL.
TP19		B&D	1.50		Brown slightly sandy slightly gravelly CLAY.
TP22		B&D	0.50		Grey slightly sandy slightly gravelly CLAY.
TP22		B&D	2.50		Grey silty very gravelly SAND.
TP24		B&D	0.50		Brown slightly sandy slightly gravelly CLAY.
TP26		B&D	1.00		Grey very silty slightly gravelly SAND.
TP29		B&D	1.50		Grey slightly sandy gravelly CLAY.

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP31		B&D	1.00		Grey silty slightly gravelly SAND.
TP33		B&D	0.50		Brown slightly sandy slightly gravelly CLAY.
TP34		B&D	1.00		Brown clayey very sandy GRAVEL.
TP35		B&D	1.50		Brown silty sandy GRAVEL.
TP38		B&D	0.50		Grey sandy slightly gravelly CLAY.
TP09		B&D	1.00		Brown mottled grey very clayey sandy GRAVEL with many cobbles.
TP10		B&D	1.50		Brown silty slightly gravelly SAND.
TP11		B&D	2.50		Brown mottled grey clayey very sandy GRAVEL with some cobbles.
TP13		B&D	2.50		Brown mottled grey clayey sandy GRAVEL with many cobbles.
TP20		B&D	1.50		Brown mottled grey clayey very sandy GRAVEL with some cobbles.
TP26		B&D	2.00		Dark grey silty very sandy GRAVEL with cobbles.
TP36		B&D	0.50		Brown very clayey gravelly SAND.

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No:
PSL24/7255
Client Ref:
13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

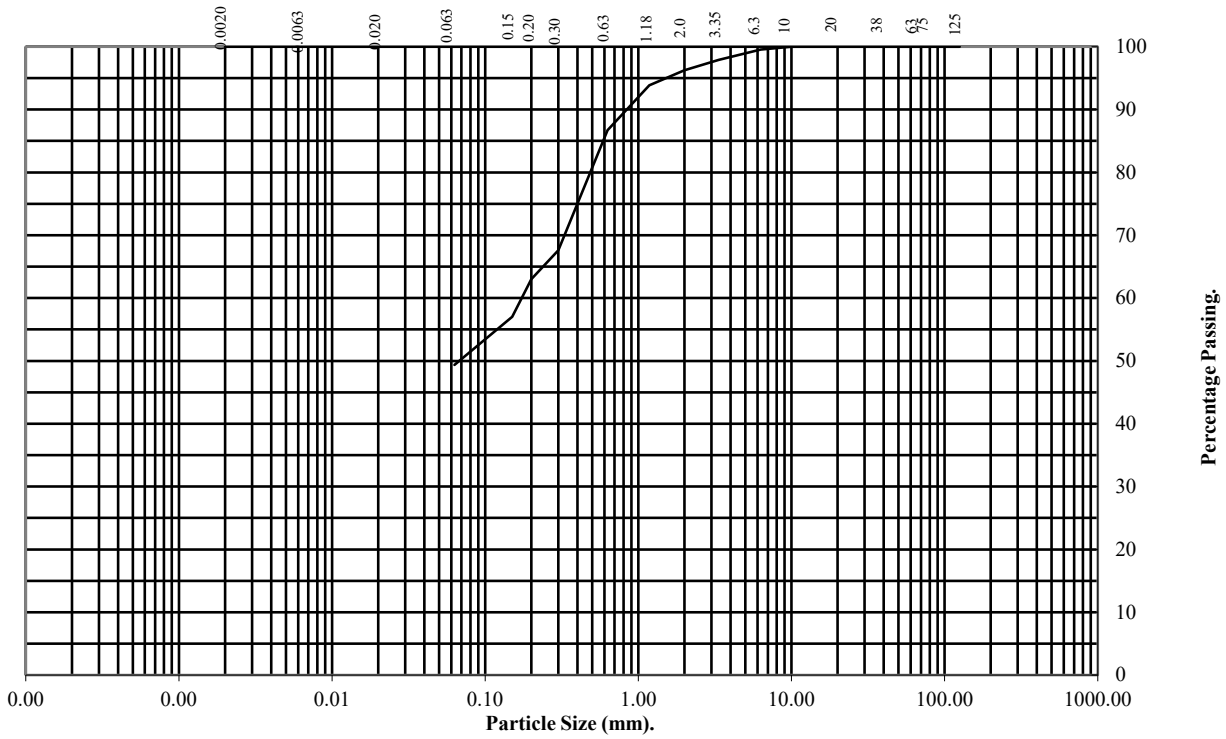
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP01 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	98
2	96
1.18	94
0.63	87
0.3	68
0.2	63
0.15	57
0.063	49

Soil Fraction	Total Percentage
Cobbles	0
Gravel	4
Sand	47
Silt/Clay	49

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

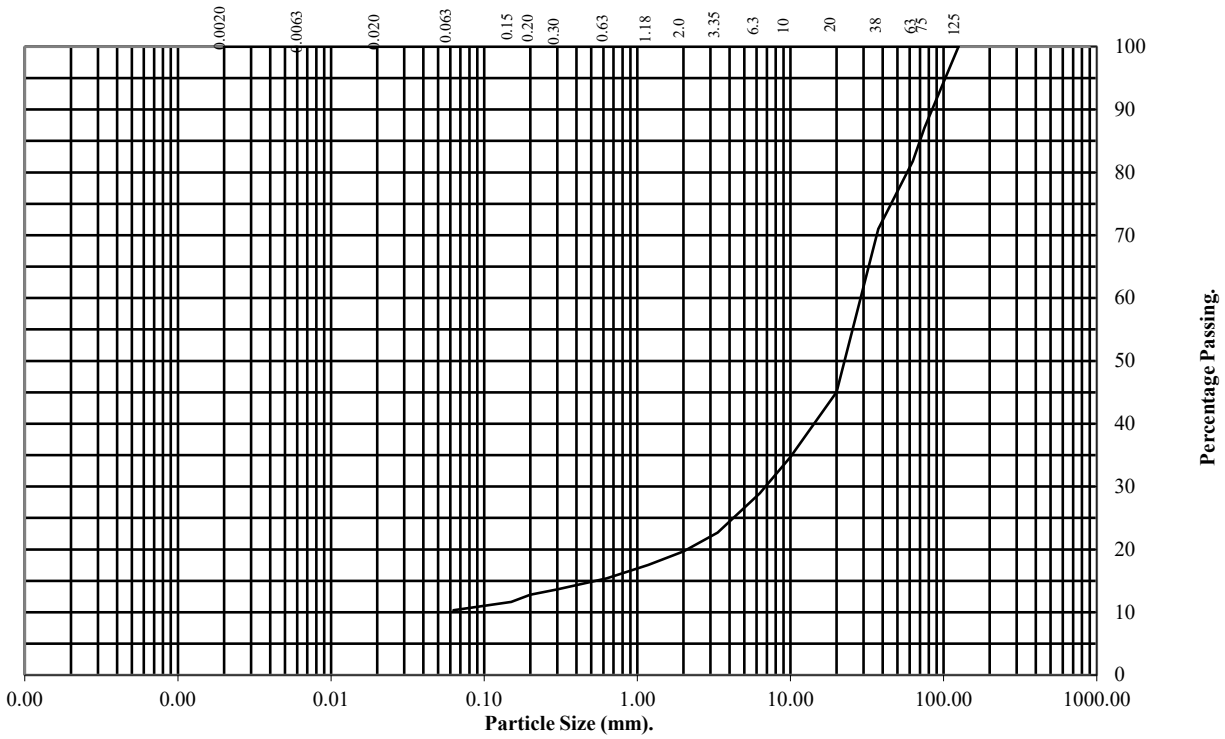
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP01 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	87
63	82
37.5	71
20	45
10	35
6.3	29
3.35	23
2	20
1.18	18
0.63	15
0.3	14
0.2	13
0.15	12
0.063	10

Soil Fraction	Total Percentage
Cobbles	18
Gravel	62
Sand	10
Silt/Clay	10

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

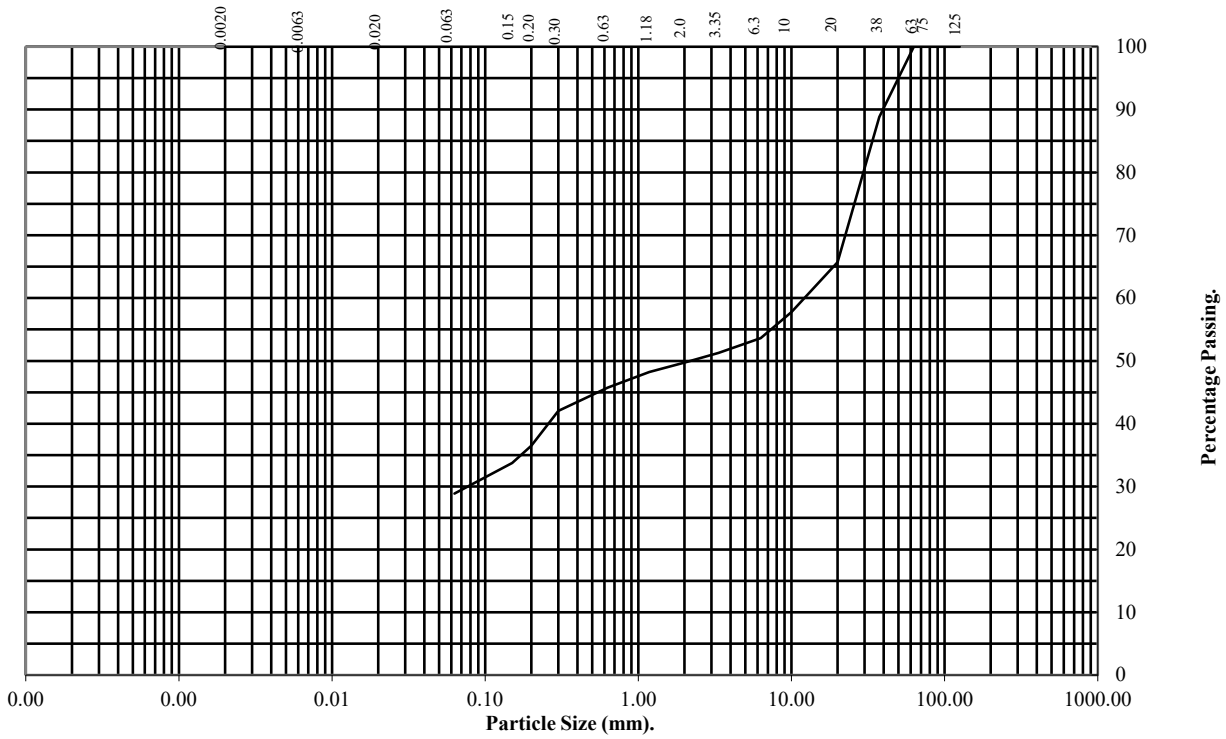
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP04 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	89
20	66
10	58
6.3	54
3.35	51
2	50
1.18	48
0.63	46
0.3	42
0.2	36
0.15	34
0.063	29

Soil Fraction	Total Percentage
Cobbles	0
Gravel	50
Sand	21
Silt/Clay	29

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

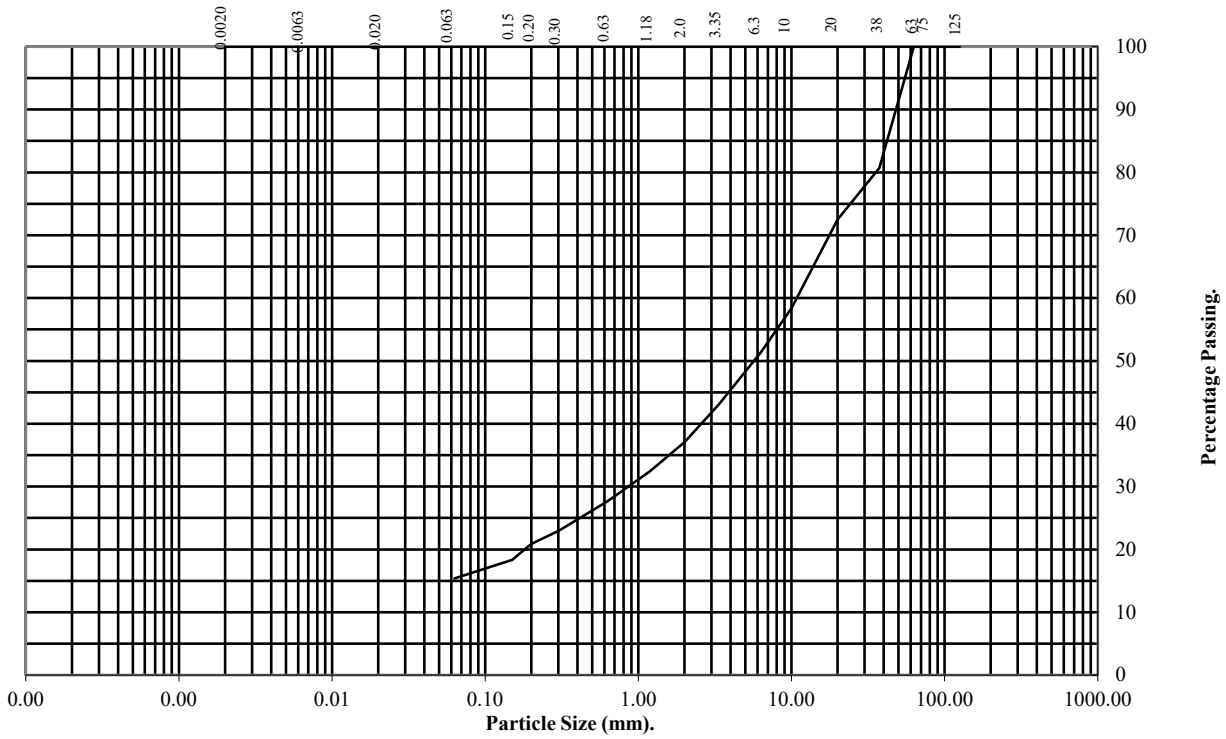
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP05 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	81
20	73
10	58
6.3	51
3.35	43
2	37
1.18	32
0.63	28
0.3	23
0.2	21
0.15	18
0.063	15

Soil Fraction	Total Percentage
Cobbles	0
Gravel	63
Sand	22
Silt/Clay	15

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

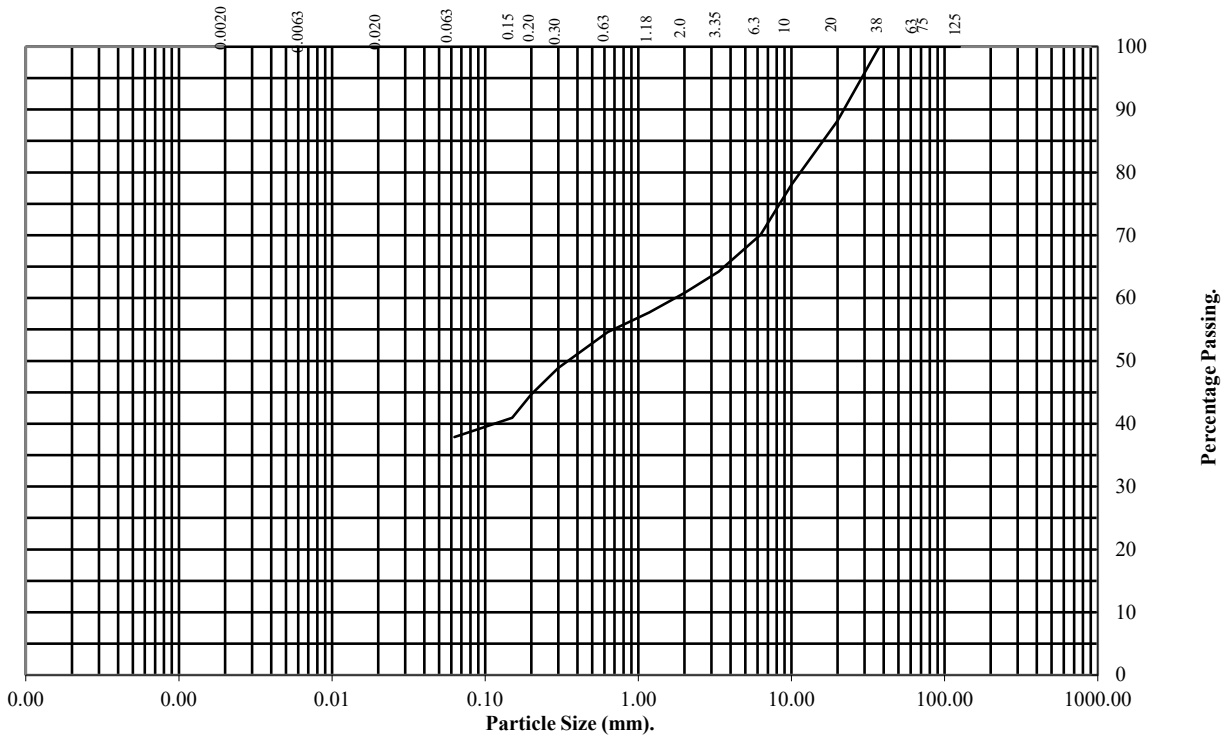
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP06 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	88
10	78
6.3	70
3.35	64
2	61
1.18	58
0.63	55
0.3	49
0.2	45
0.15	41
0.063	38

Soil Fraction	Total Percentage
Cobbles	0
Gravel	39
Sand	23
Silt/Clay	38

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

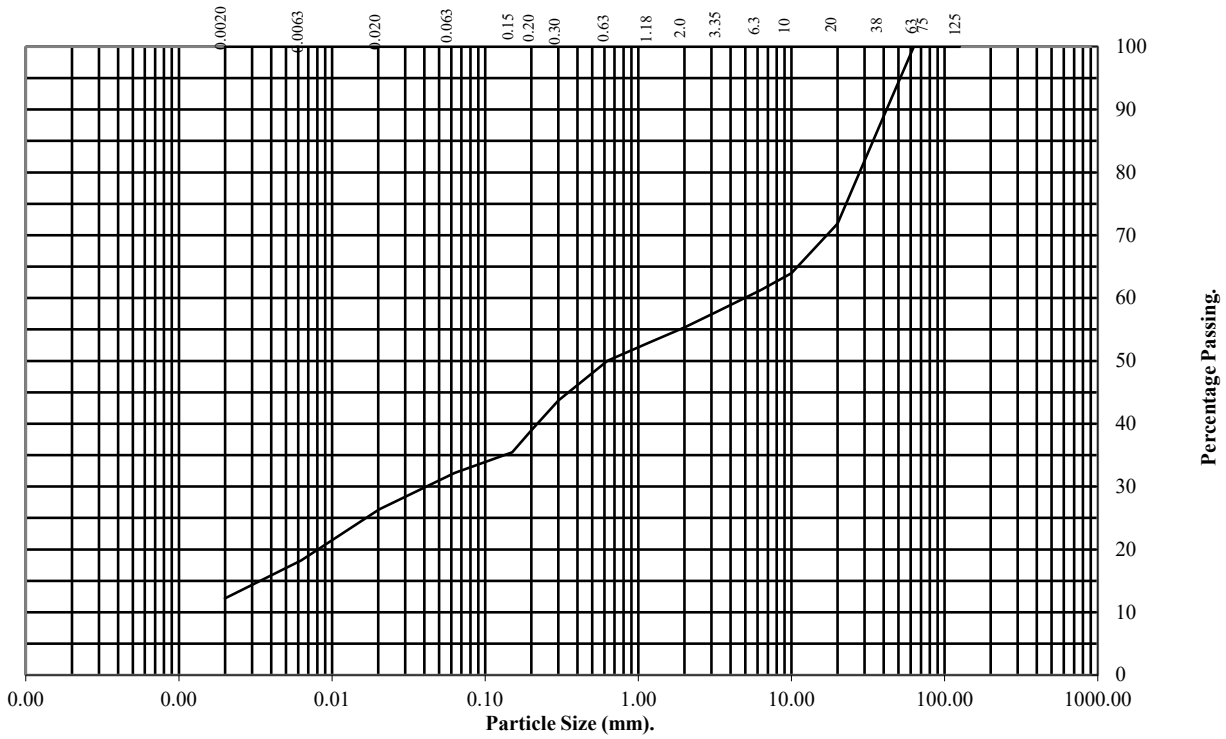
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2 & Pipette Method, Clause 5.4

Hole Number: TP07 **Top Depth (m):** 2.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	87
20	72
10	64
6.3	61
3.35	58
2	55
1.18	53
0.63	50
0.3	44
0.2	39
0.15	35
0.063	32

Particle Diameter	Percentage Passing
0.020	26
0.0063	18
0.0020	12
Particle Density - 2.65 Mg/m3 assumed	

Soil Fraction	Total Percentage
Cobbles	0
Gravel	45
Sand	23
Silt	20
Clay	12

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

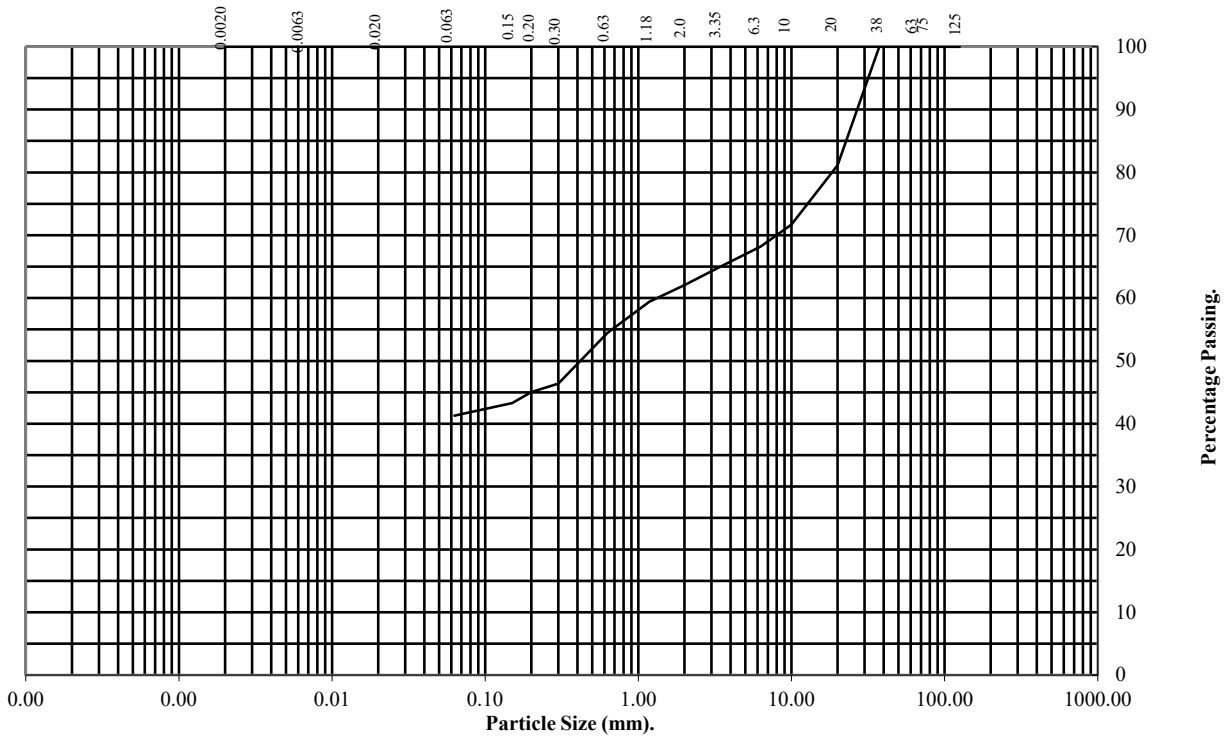
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP08 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	81
10	72
6.3	68
3.35	65
2	62
1.18	59
0.63	54
0.3	46
0.2	45
0.15	43
0.063	41

Soil Fraction	Total Percentage
Cobbles	0
Gravel	38
Sand	21
Silt/Clay	41

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

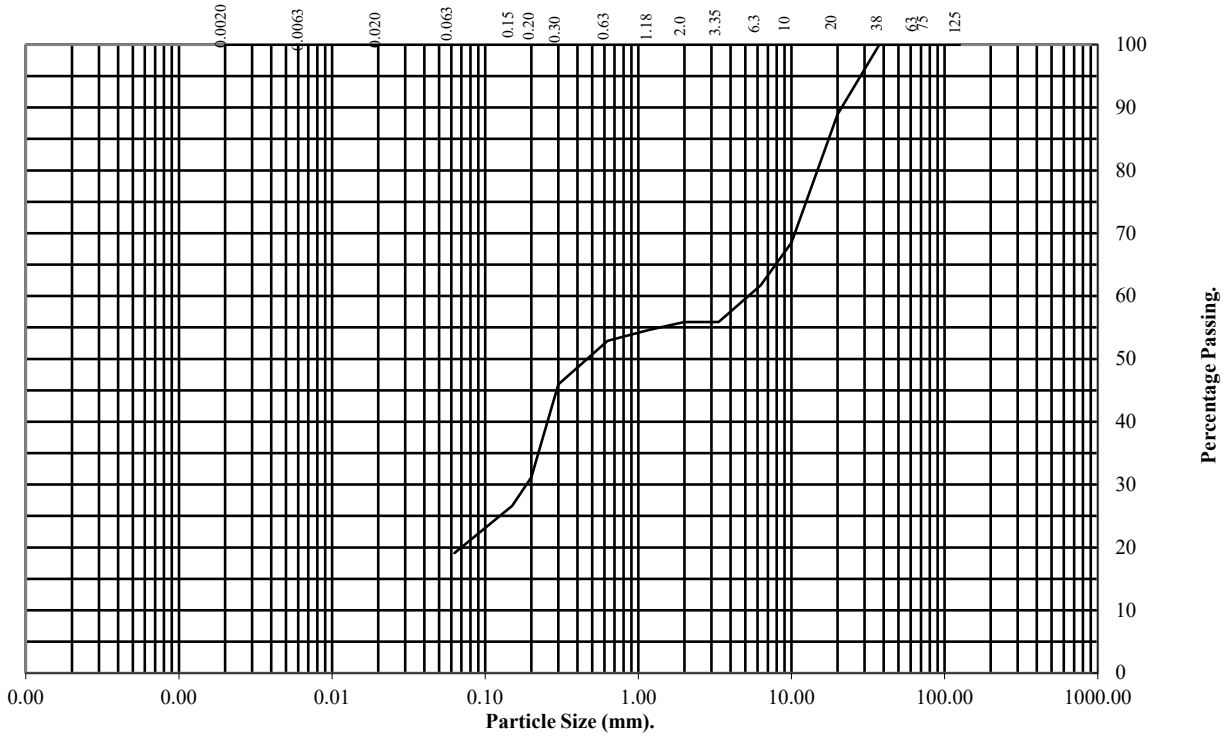
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP10 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	89
10	68
6.3	62
3.35	56
2	56
1.18	55
0.63	53
0.3	46
0.2	31
0.15	27
0.063	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	44
Sand	37
Silt/Clay	19

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

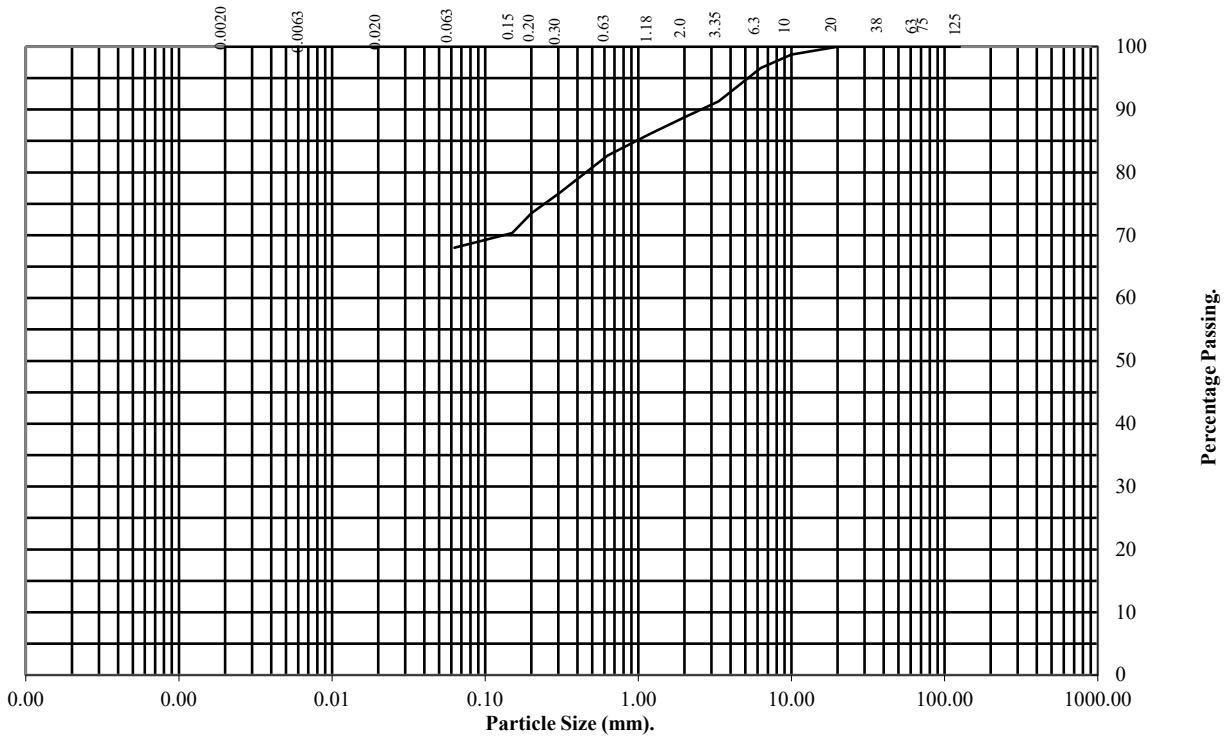
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP12 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	97
3.35	91
2	89
1.18	86
0.63	83
0.3	77
0.2	73
0.15	70
0.063	68

Soil Fraction	Total Percentage
Cobbles	0
Gravel	11
Sand	21
Silt/Clay	68

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

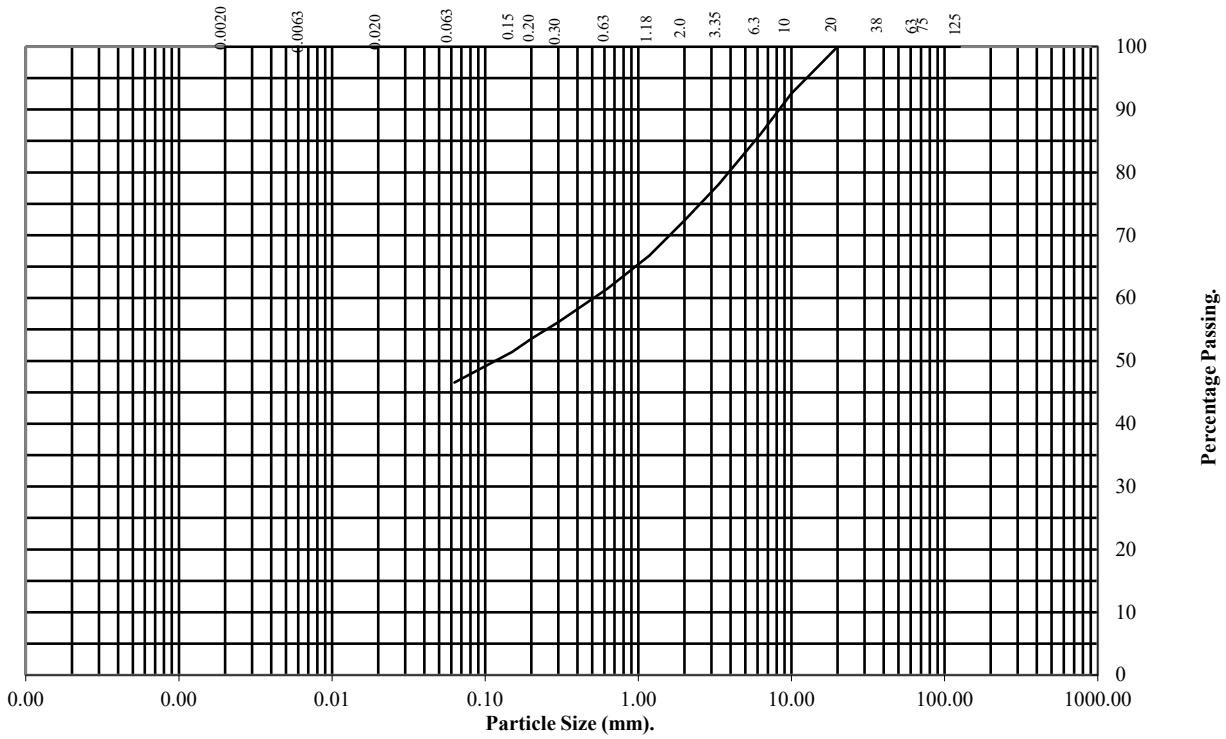
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP13 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	93
6.3	86
3.35	78
2	72
1.18	67
0.63	62
0.3	56
0.2	54
0.15	51
0.063	47

Soil Fraction	Total Percentage
Cobbles	0
Gravel	28
Sand	25
Silt/Clay	47

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

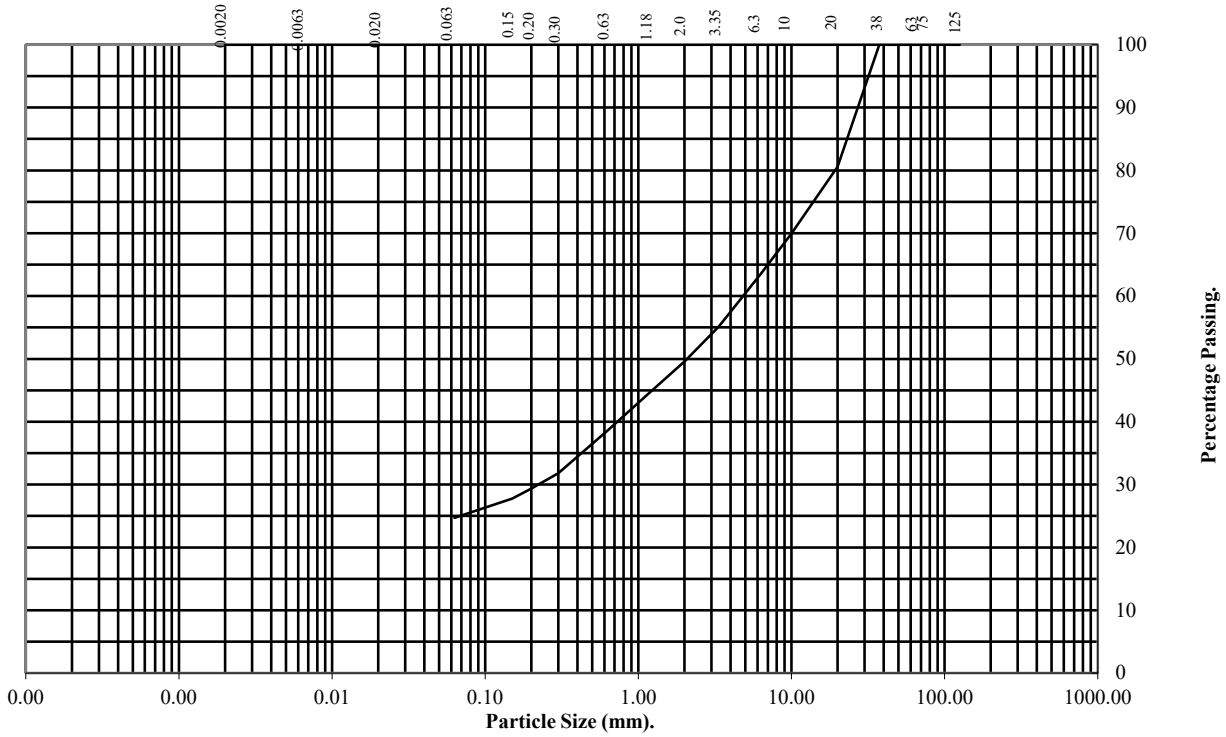
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP16 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	81
10	70
6.3	64
3.35	55
2	50
1.18	45
0.63	39
0.3	32
0.2	29
0.15	28
0.063	25

Soil Fraction	Total Percentage
Cobbles	0
Gravel	50
Sand	25
Silt/Clay	25

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

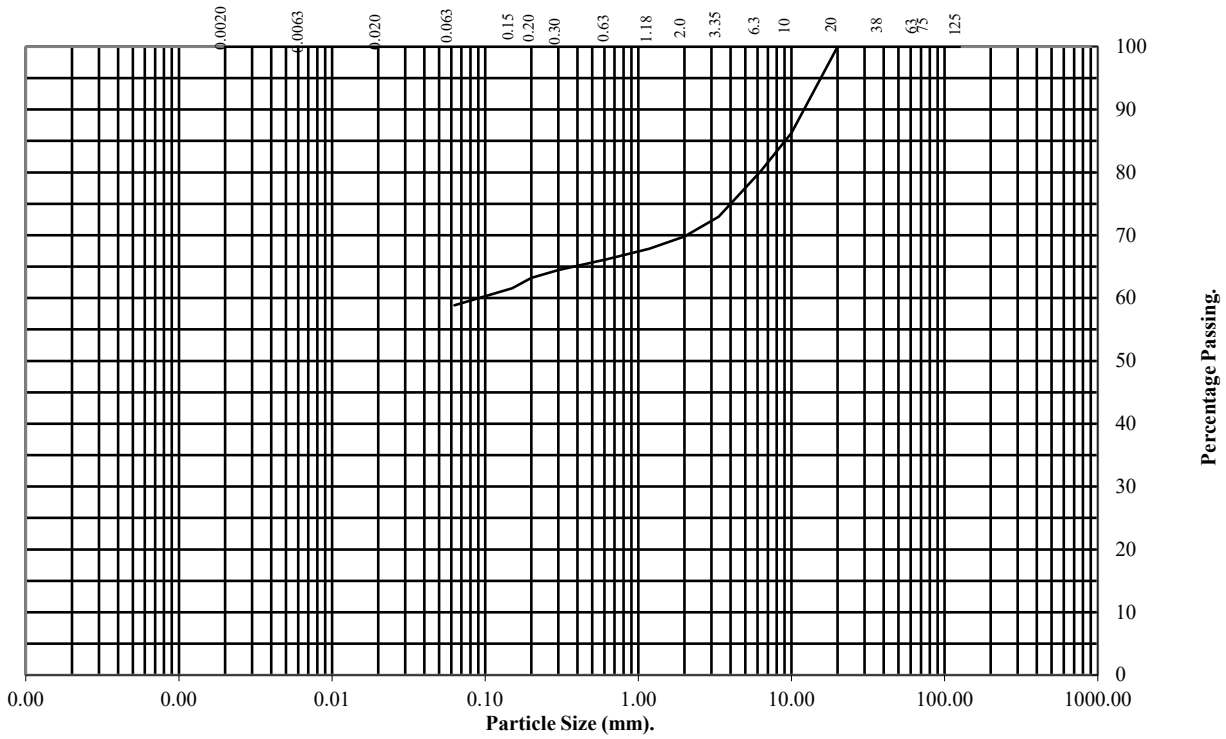
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP19 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	86
6.3	80
3.35	73
2	70
1.18	68
0.63	66
0.3	64
0.2	63
0.15	62
0.063	59

Soil Fraction	Total Percentage
Cobbles	0
Gravel	30
Sand	11
Silt/Clay	59

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

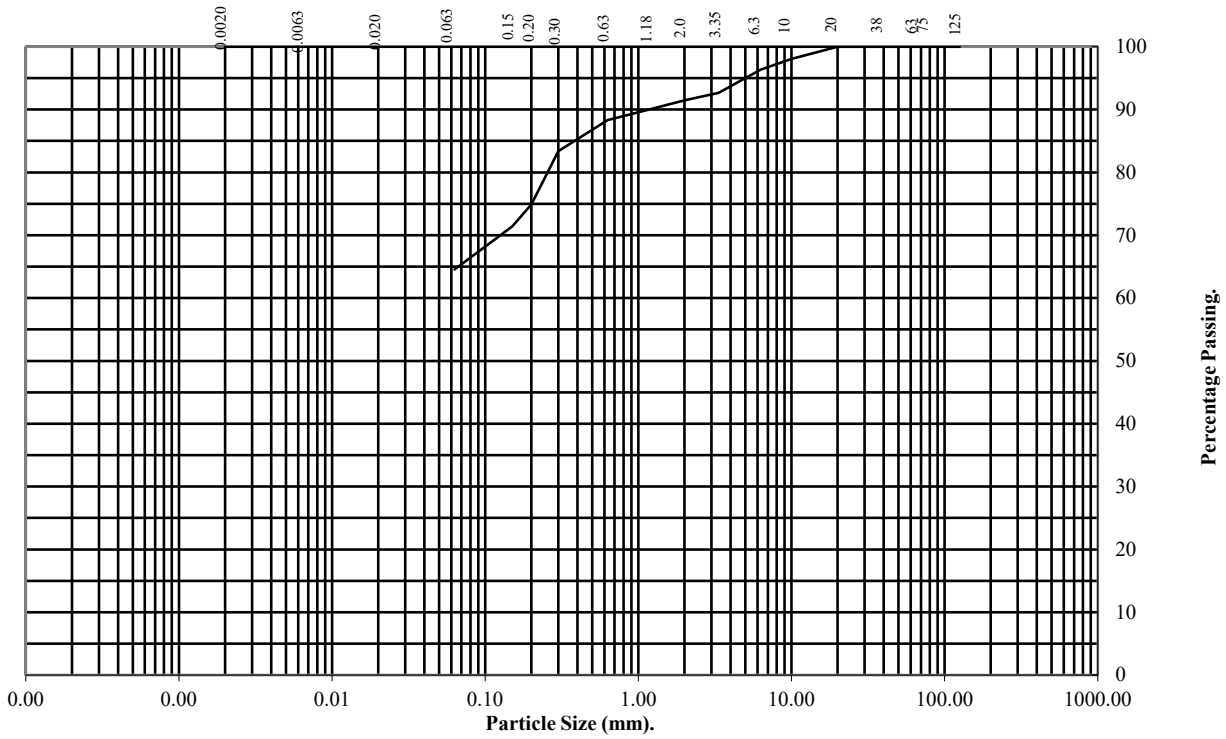
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP22 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	98
6.3	96
3.35	93
2	91
1.18	90
0.63	88
0.3	83
0.2	75
0.15	71
0.063	65

Soil Fraction	Total Percentage
Cobbles	0
Gravel	9
Sand	26
Silt/Clay	65

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

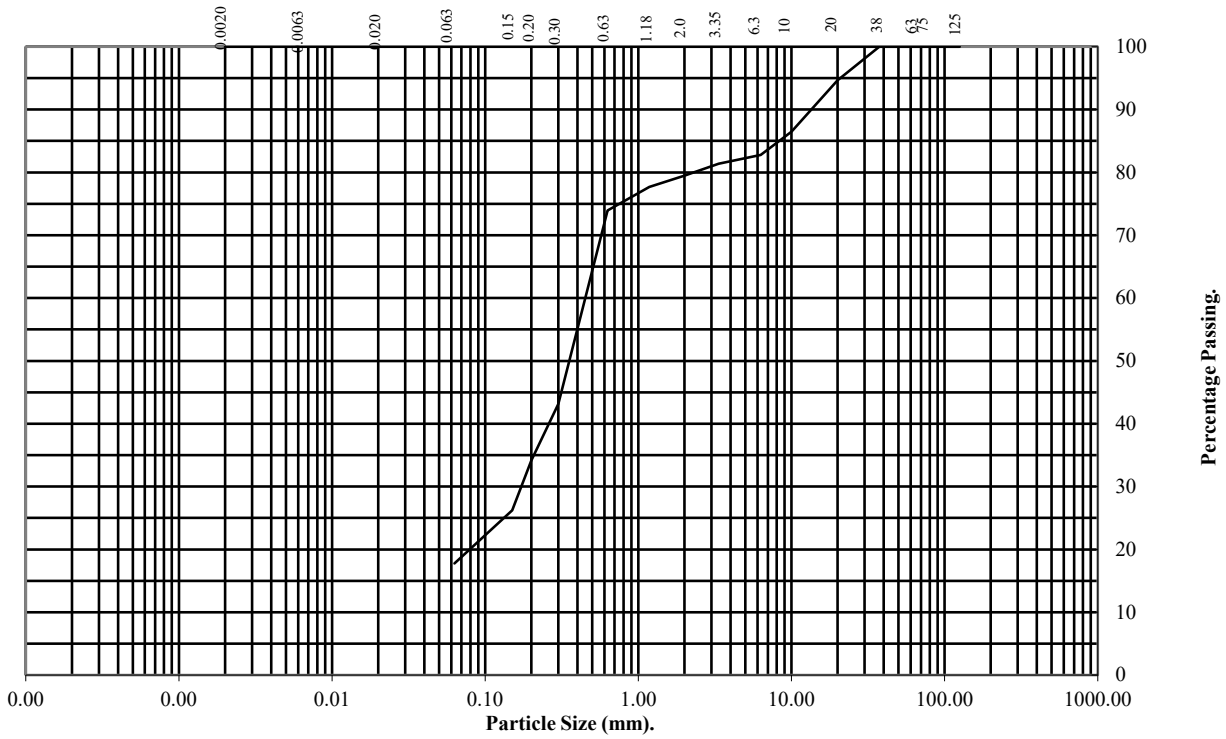
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP22 **Top Depth (m):** 2.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	95
10	86
6.3	83
3.35	81
2	79
1.18	78
0.63	74
0.3	43
0.2	34
0.15	26
0.063	18

Soil Fraction	Total Percentage
Cobbles	0
Gravel	21
Sand	61
Silt/Clay	18

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

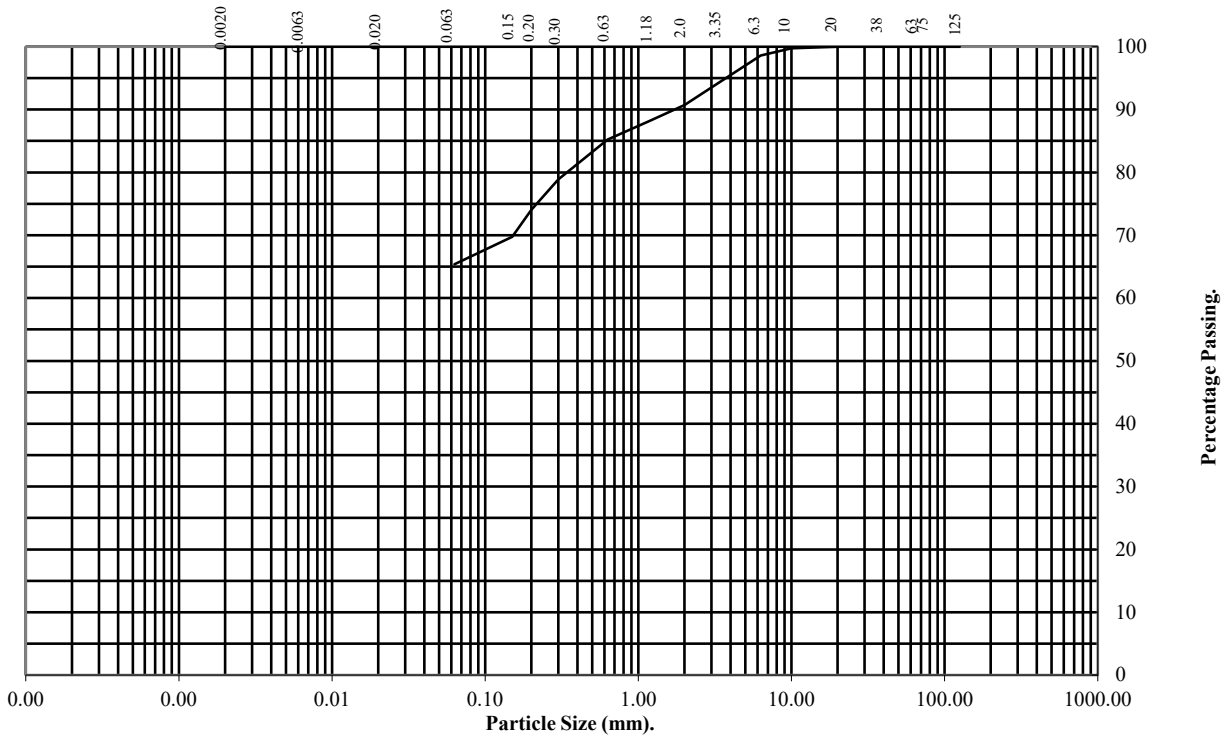
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP24 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	94
2	91
1.18	88
0.63	85
0.3	79
0.2	74
0.15	70
0.063	65

Soil Fraction	Total Percentage
Cobbles	0
Gravel	9
Sand	26
Silt/Clay	65

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

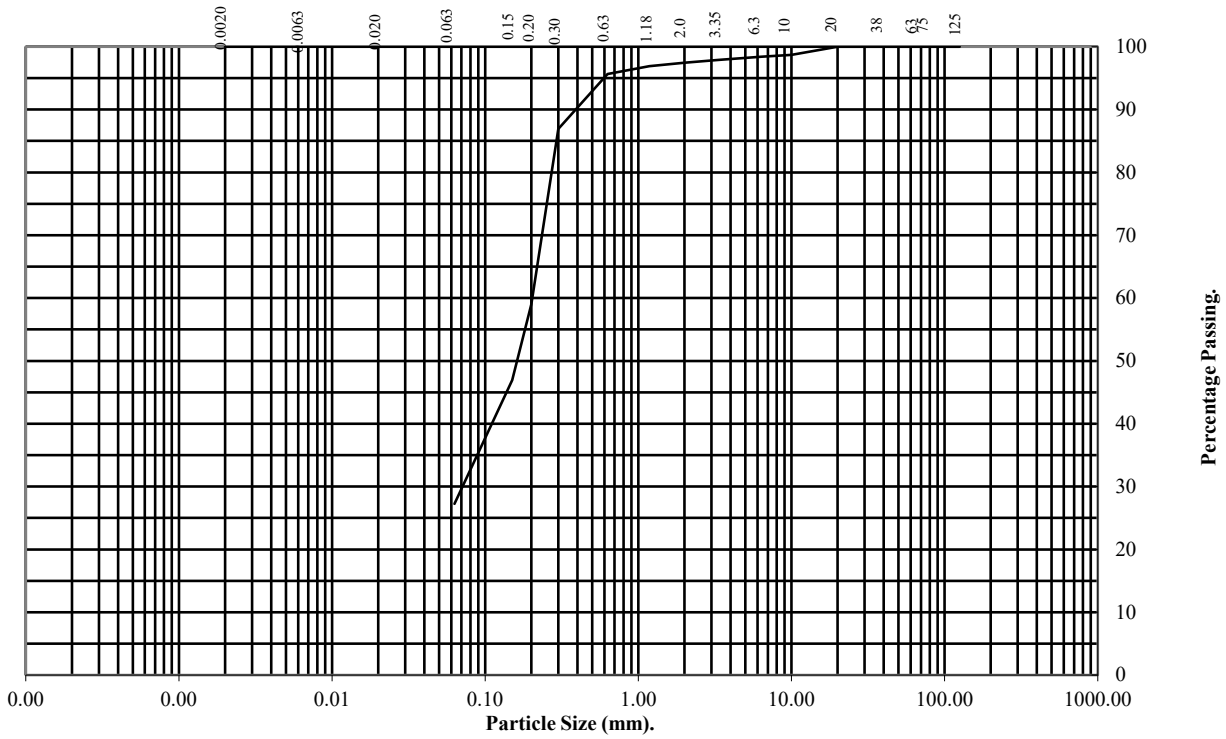
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP26 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	98
3.35	98
2	97
1.18	97
0.63	96
0.3	87
0.2	59
0.15	47
0.063	27

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	70
Silt/Clay	27

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

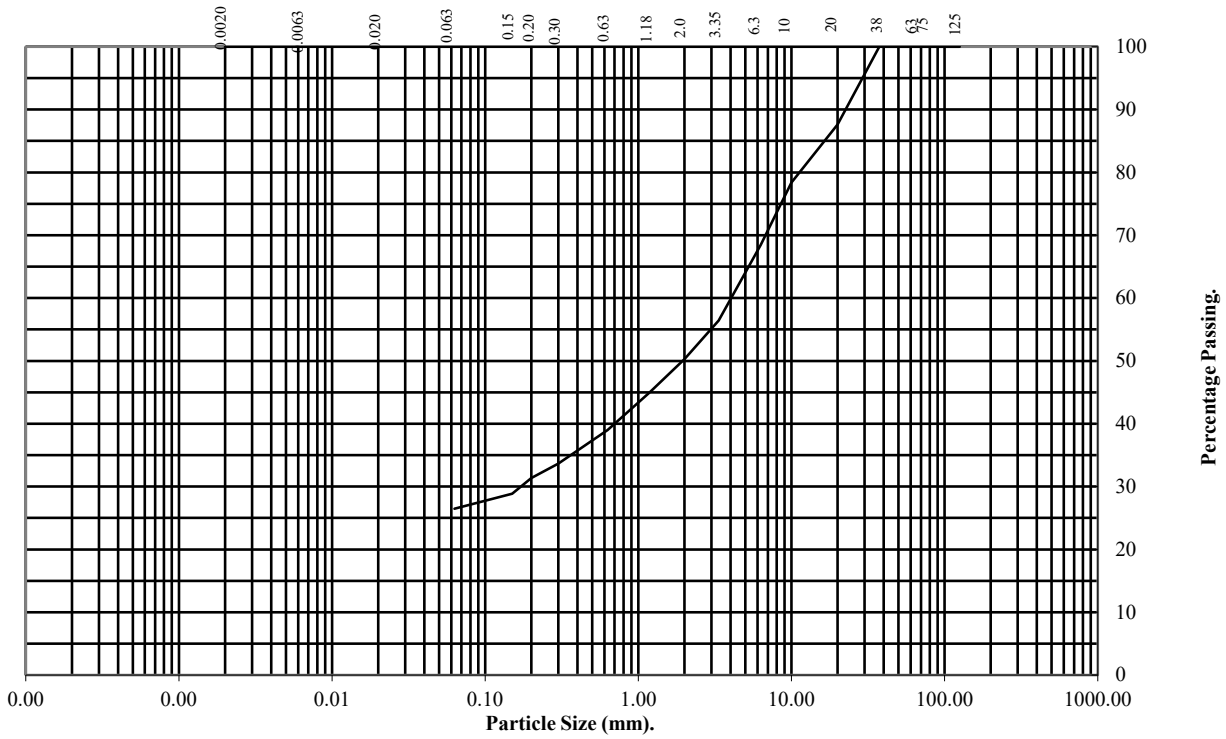
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP29 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	88
10	78
6.3	68
3.35	56
2	50
1.18	45
0.63	39
0.3	34
0.2	31
0.15	29
0.063	26

Soil Fraction	Total Percentage
Cobbles	0
Gravel	50
Sand	24
Silt/Clay	26

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

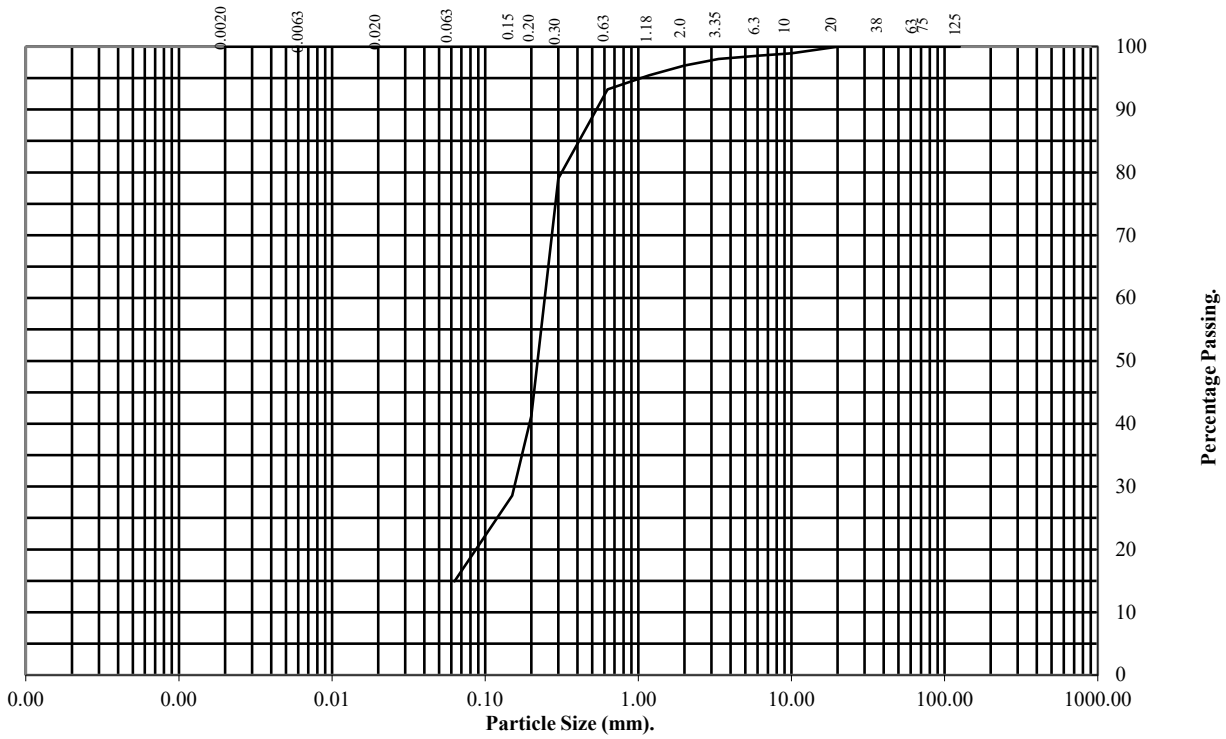
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP31 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	99
3.35	98
2	97
1.18	95
0.63	93
0.3	79
0.2	41
0.15	29
0.063	15

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	82
Silt/Clay	15

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

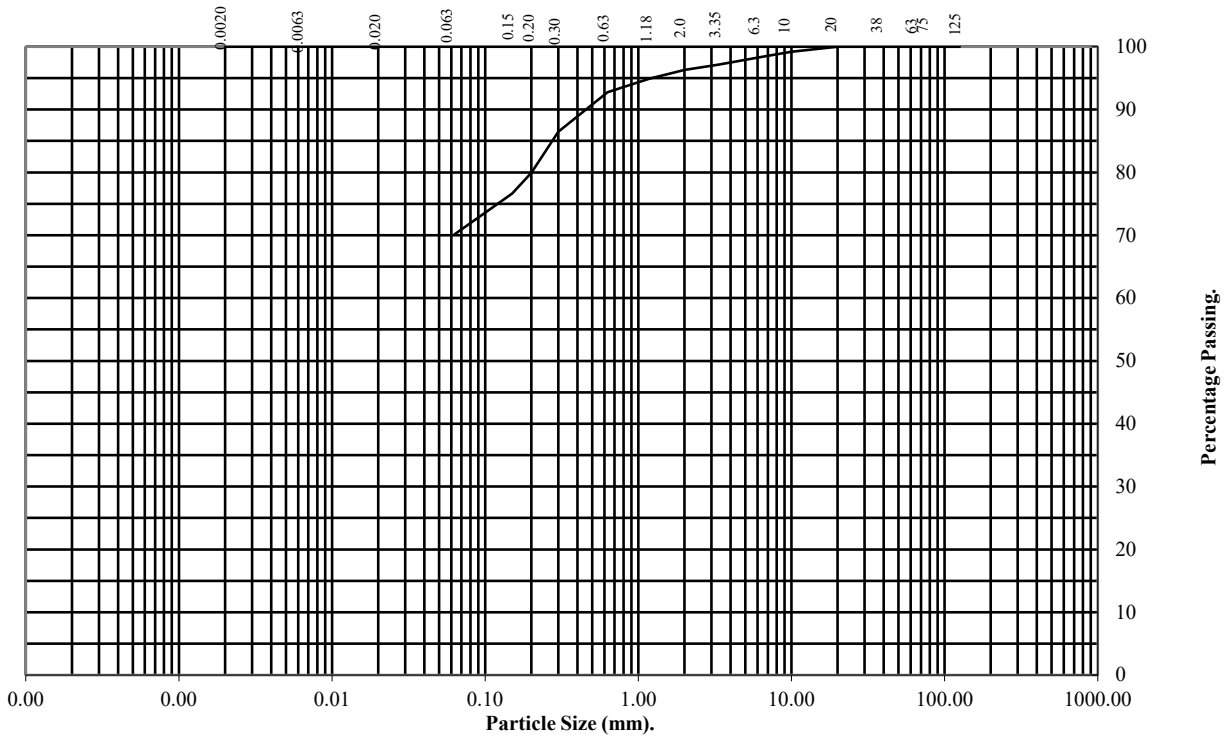
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP33 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	99
6.3	98
3.35	97
2	96
1.18	95
0.63	93
0.3	86
0.2	80
0.15	77
0.063	70

Soil Fraction	Total Percentage
Cobbles	0
Gravel	4
Sand	26
Silt/Clay	70

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

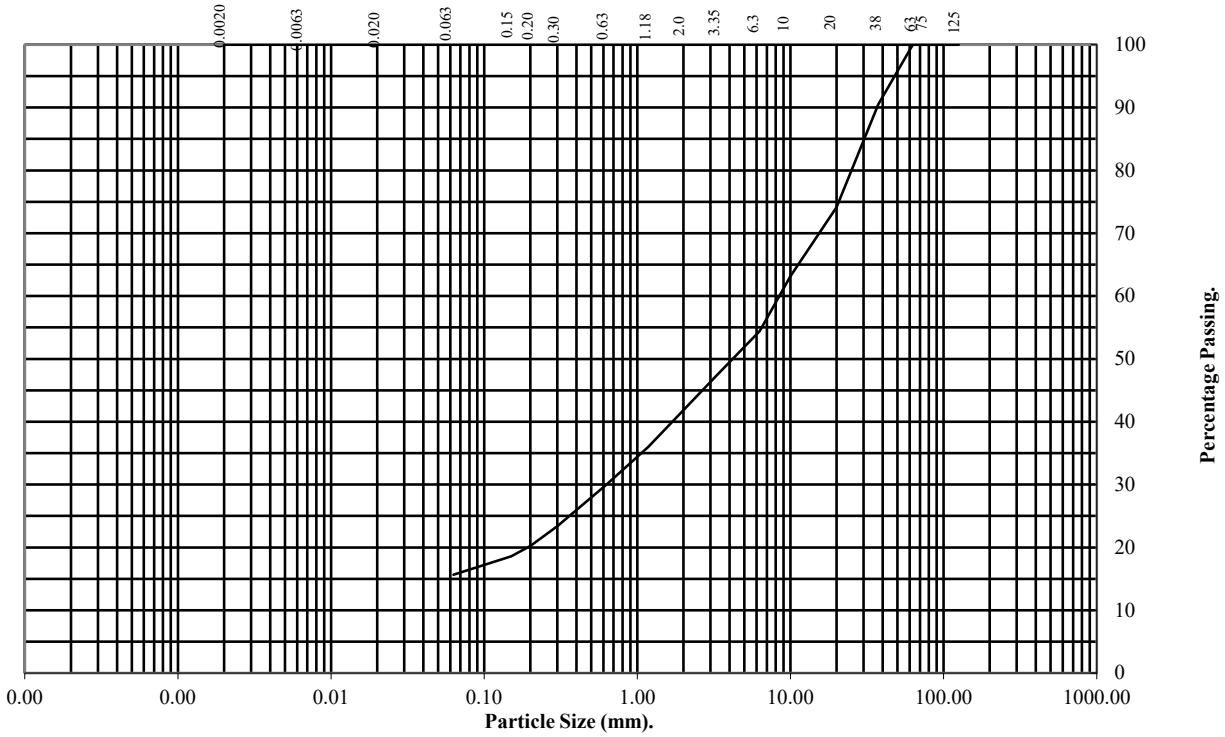
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP34 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	91
20	74
10	63
6.3	54
3.35	48
2	42
1.18	36
0.63	30
0.3	23
0.2	20
0.15	19
0.063	16

Soil Fraction	Total Percentage
Cobbles	0
Gravel	58
Sand	26
Silt/Clay	16

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

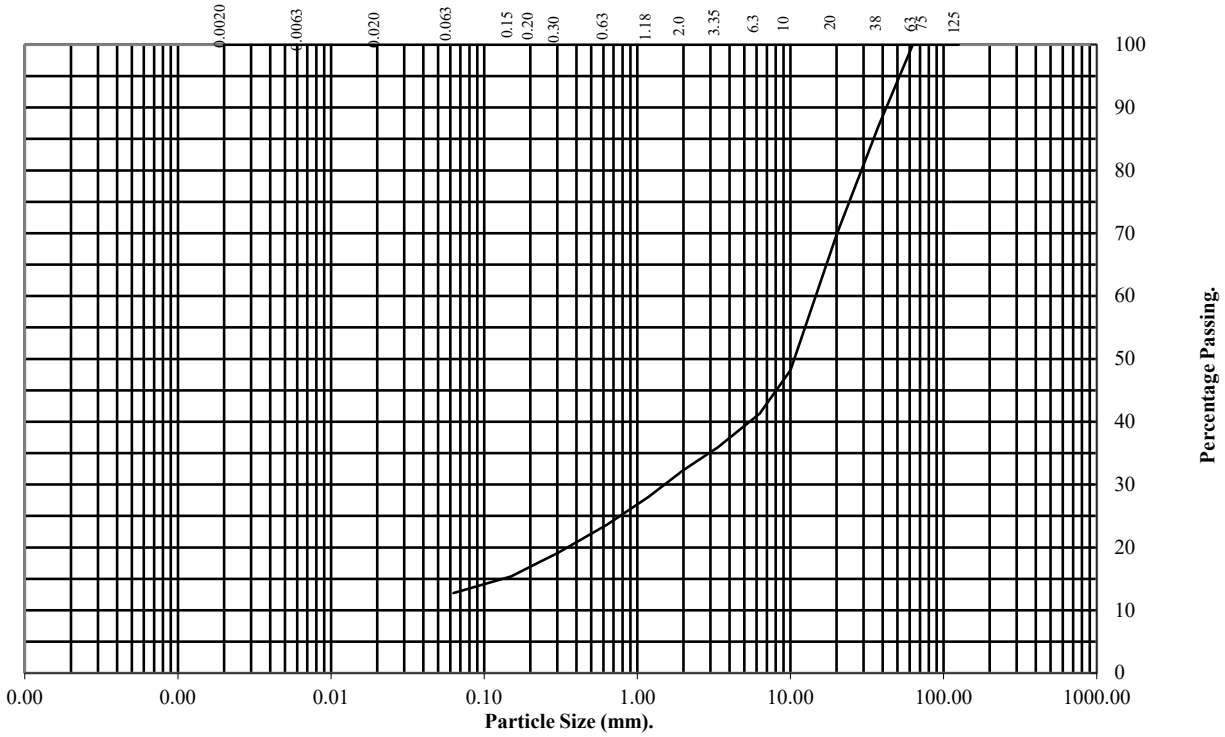
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP35 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	87
20	70
10	48
6.3	41
3.35	36
2	32
1.18	28
0.63	24
0.3	19
0.2	17
0.15	15
0.063	13

Soil Fraction	Total Percentage
Cobbles	0
Gravel	68
Sand	19
Silt/Clay	13

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

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PARTICLE SIZE DISTRIBUTION TEST

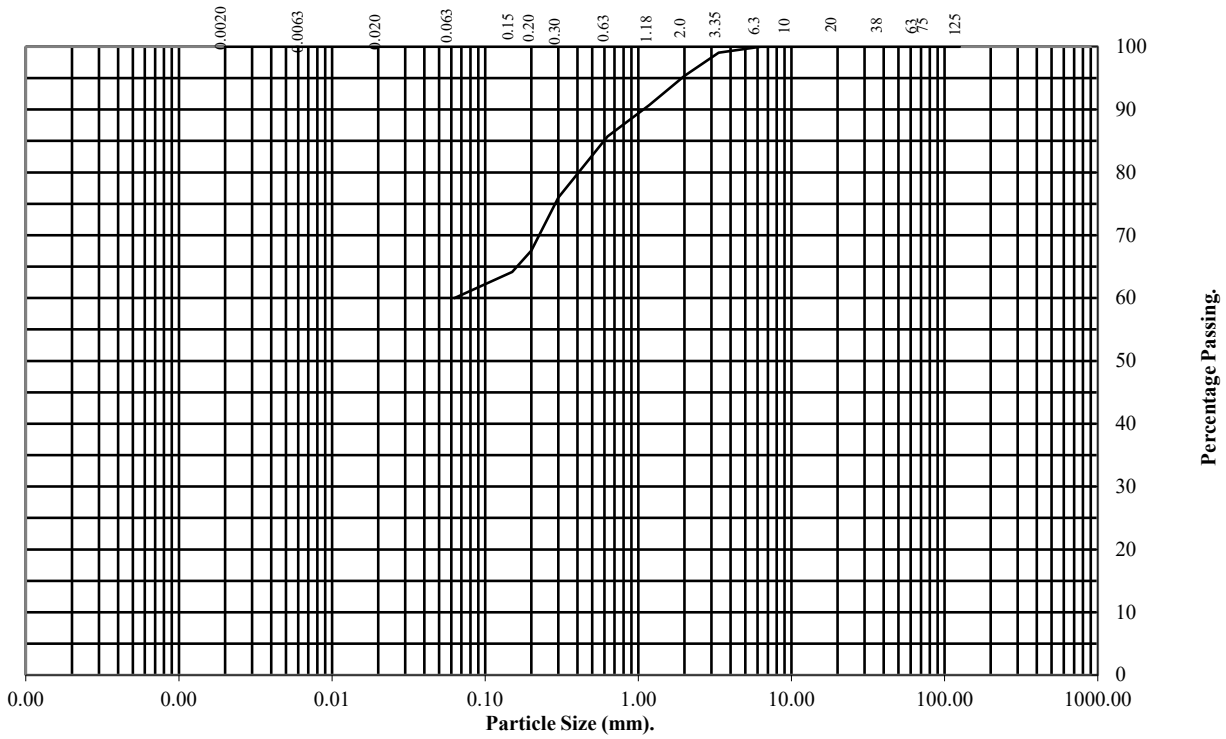
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP38 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	95
1.18	91
0.63	86
0.3	76
0.2	68
0.15	64
0.063	60

Soil Fraction	Total Percentage
Cobbles	0
Gravel	5
Sand	35
Silt/Clay	60

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

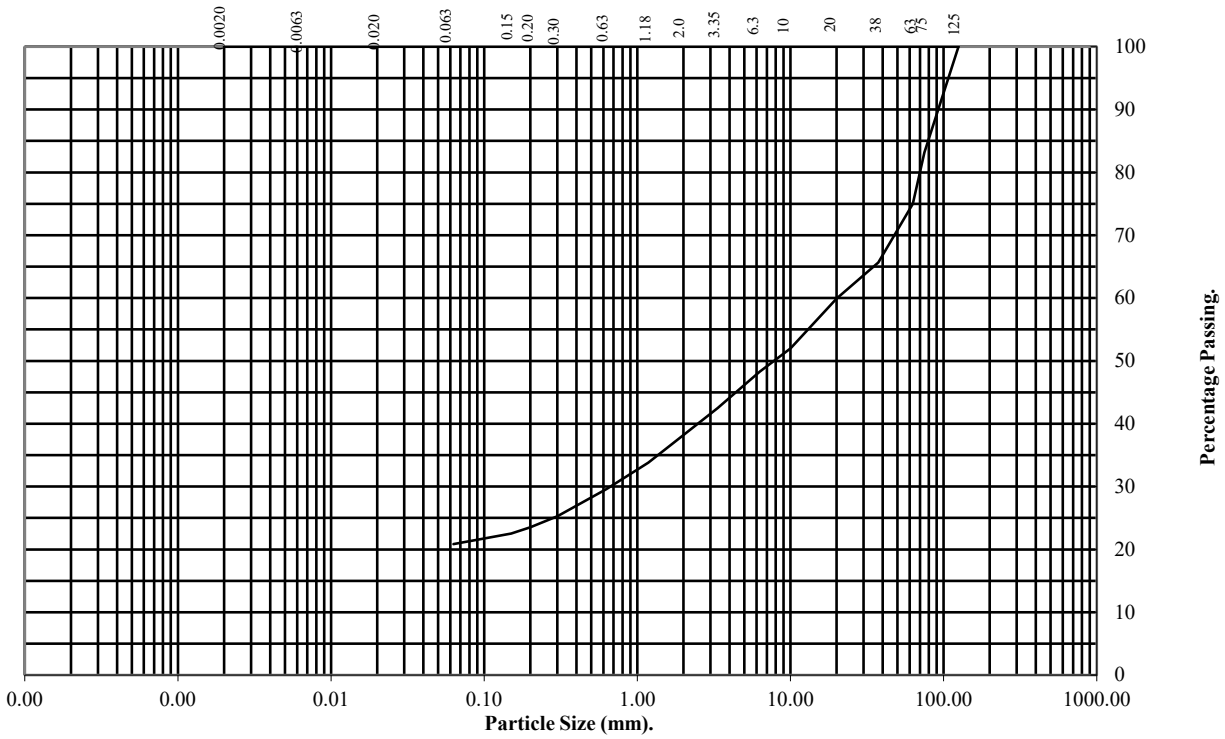
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP09 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	83
63	75
37.5	66
20	60
10	52
6.3	48
3.35	42
2	38
1.18	34
0.63	30
0.3	25
0.2	24
0.15	23
0.063	21

Soil Fraction	Total Percentage
Cobbles	25
Gravel	37
Sand	17
Silt/Clay	21

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

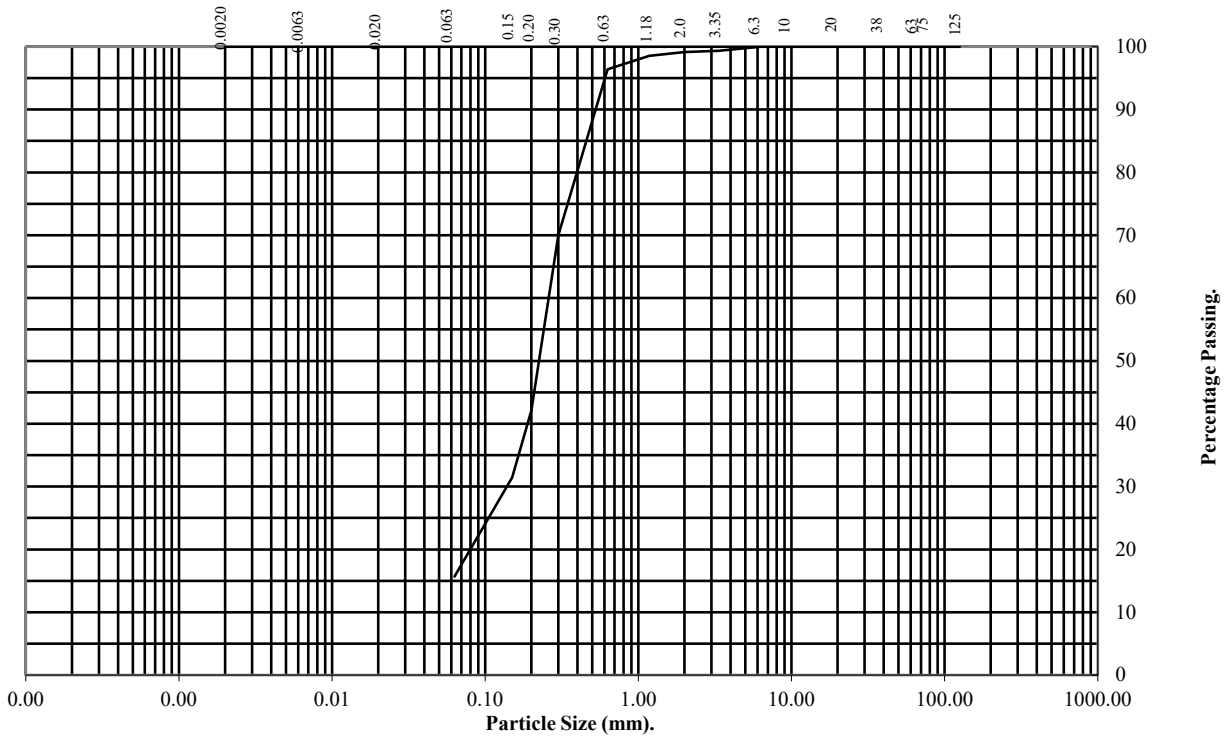
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP10 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	99
2	99
1.18	99
0.63	96
0.3	70
0.2	42
0.15	31
0.063	16

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	83
Silt/Clay	16

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

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PARTICLE SIZE DISTRIBUTION TEST

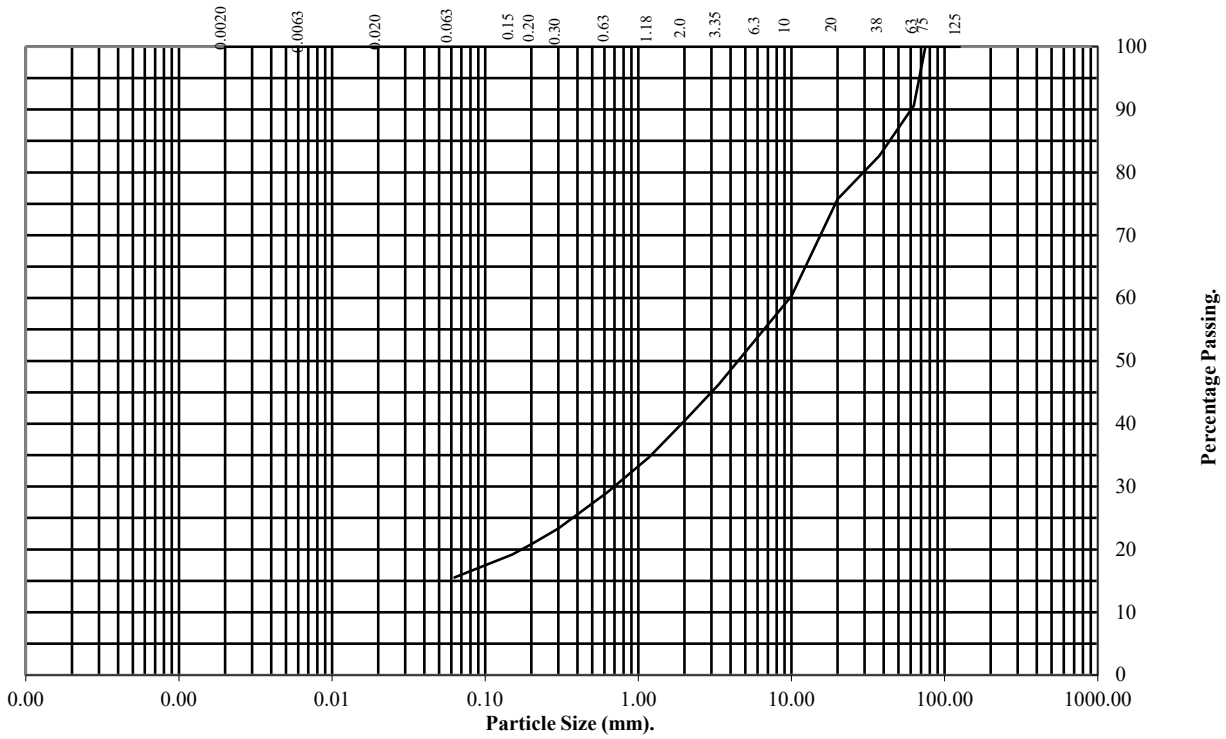
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP11 **Top Depth (m):** 2.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	91
37.5	83
20	76
10	60
6.3	54
3.35	46
2	40
1.18	35
0.63	29
0.3	23
0.2	21
0.15	19
0.063	16

Soil Fraction	Total Percentage
Cobbles	9
Gravel	51
Sand	24
Silt/Clay	16

Remarks:

See Summary of Soil Descriptions

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Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

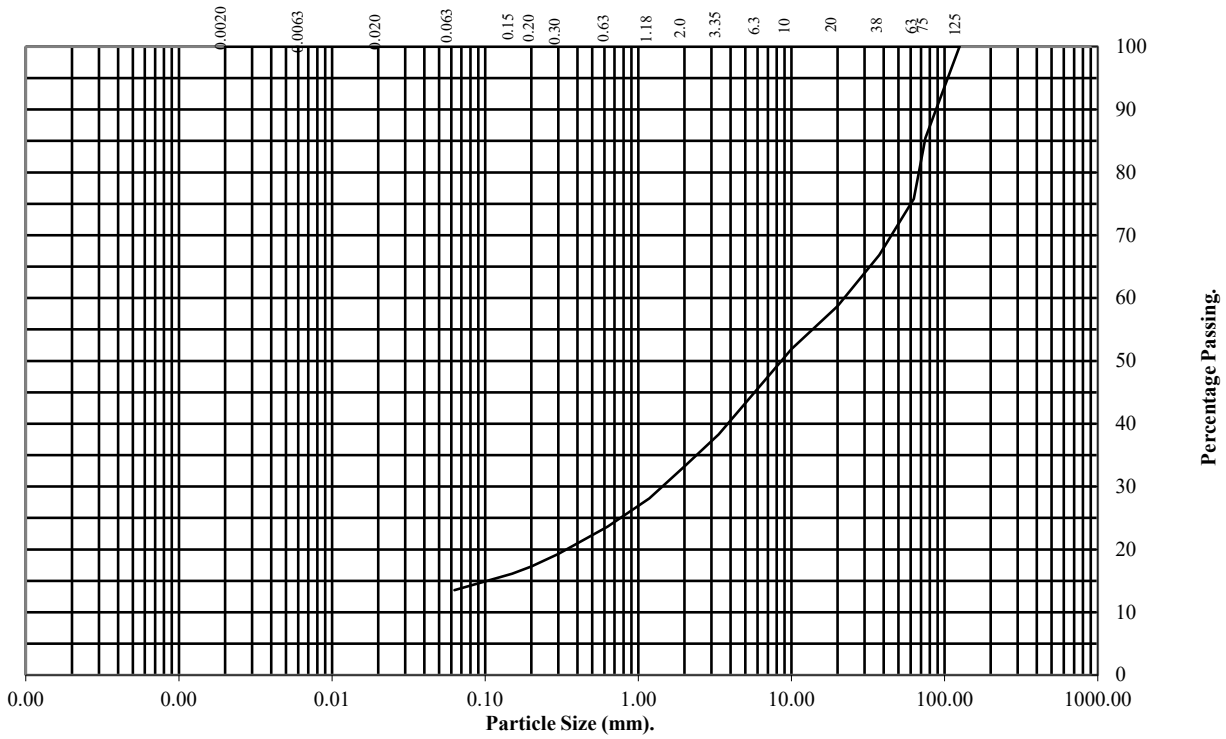
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP13 **Top Depth (m):** 2.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	85
63	76
37.5	67
20	59
10	52
6.3	46
3.35	38
2	33
1.18	28
0.63	24
0.3	19
0.2	17
0.15	16
0.063	14

Soil Fraction	Total Percentage
Cobbles	24
Gravel	43
Sand	19
Silt/Clay	14

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

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Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

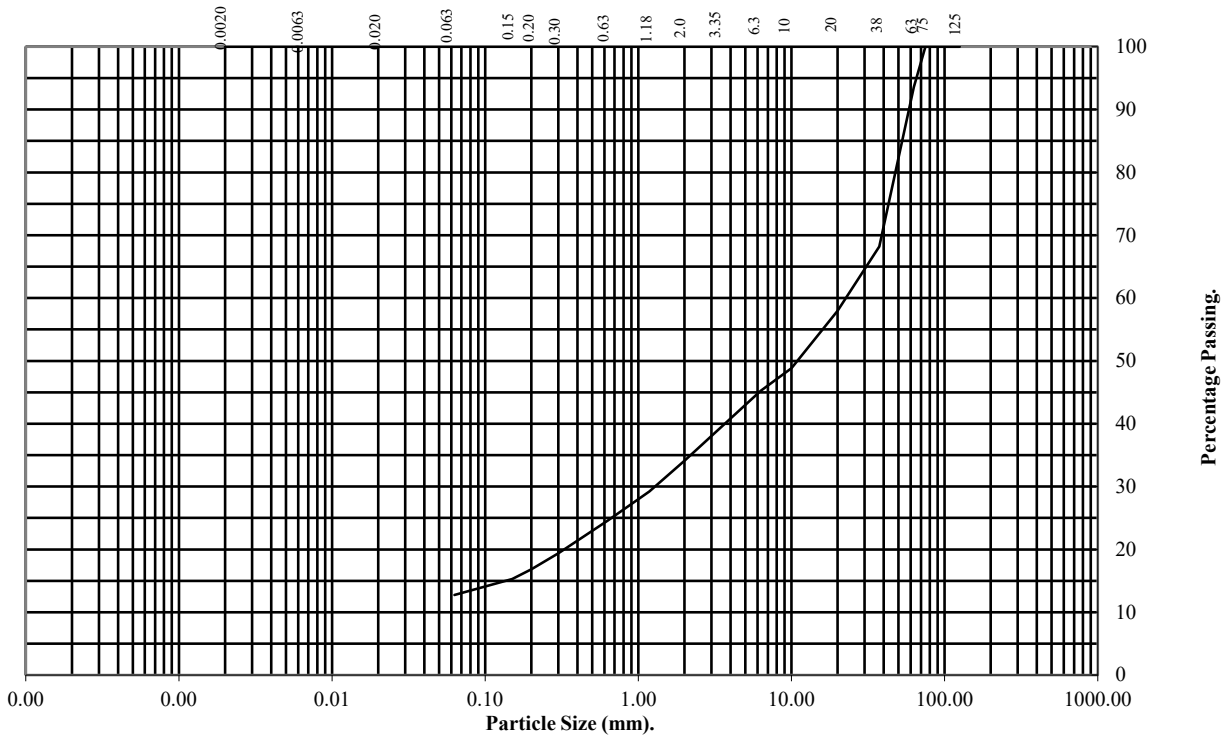
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP20 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	94
37.5	68
20	58
10	49
6.3	45
3.35	39
2	34
1.18	29
0.63	25
0.3	19
0.2	17
0.15	15
0.063	13

Soil Fraction	Total Percentage
Cobbles	6
Gravel	60
Sand	21
Silt/Clay	13

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

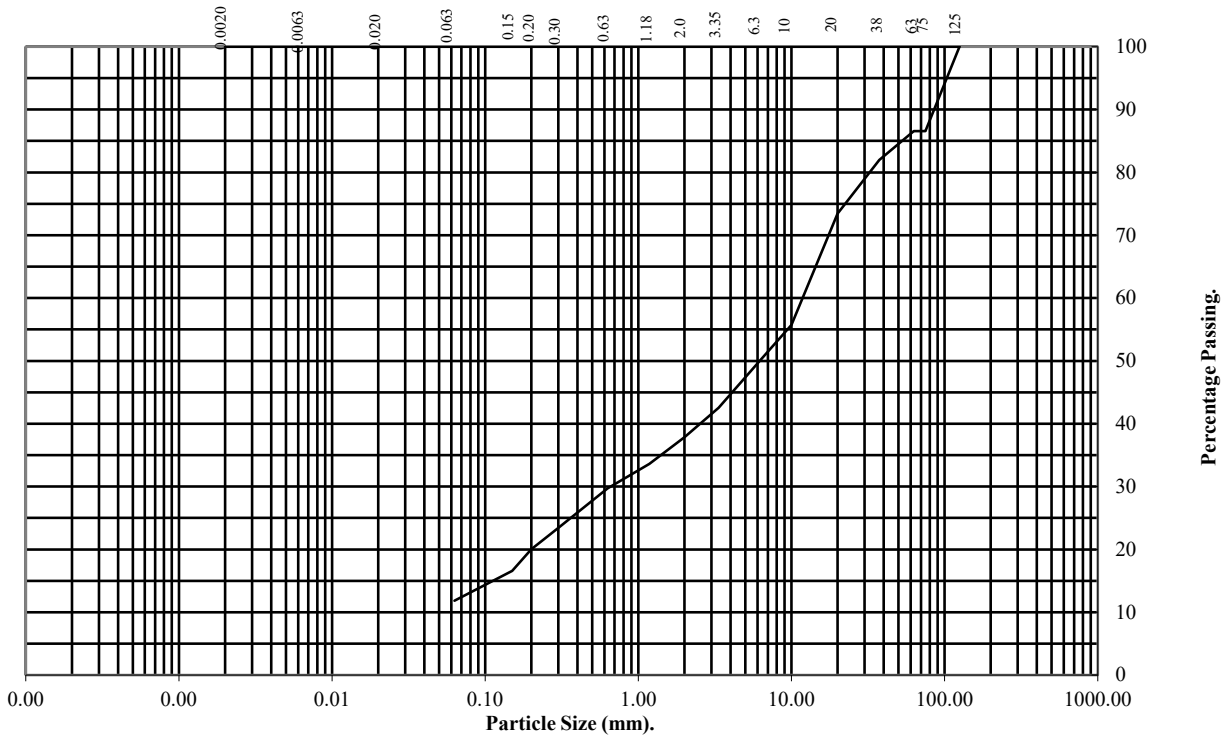
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP26 **Top Depth (m):** 2.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	87
63	87
37.5	82
20	73
10	56
6.3	50
3.35	43
2	38
1.18	34
0.63	30
0.3	23
0.2	20
0.15	17
0.063	12

Soil Fraction	Total Percentage
Cobbles	13
Gravel	49
Sand	26
Silt/Clay	12

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

PARTICLE SIZE DISTRIBUTION TEST

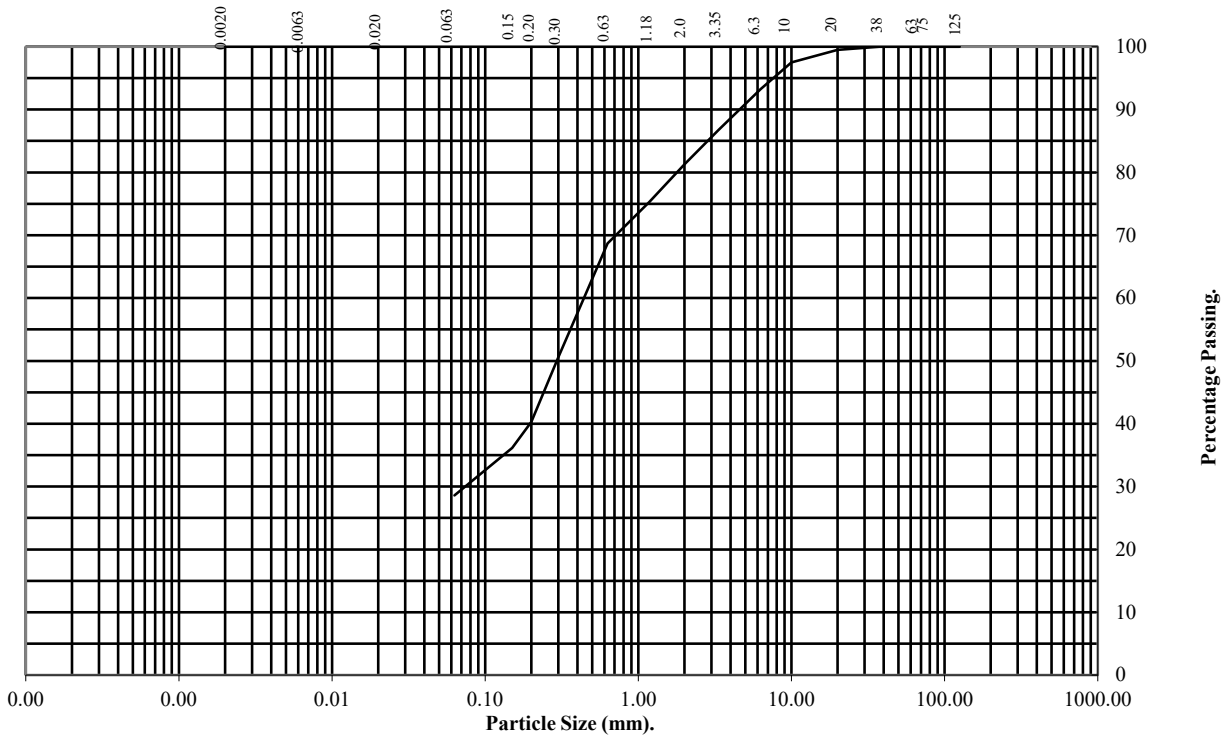
BS 1377 - Part 2 : 2022 : Clause 10 in accordance with BS EN ISO 17892 - 4 : 2016

Sieve Method, Clause 5.2

Hole Number: TP36 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	97
6.3	93
3.35	87
2	81
1.18	75
0.63	69
0.3	51
0.2	40
0.15	36
0.063	29

Soil Fraction	Total Percentage
Cobbles	0
Gravel	19
Sand	52
Silt/Clay	29

Remarks:

See Summary of Soil Descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

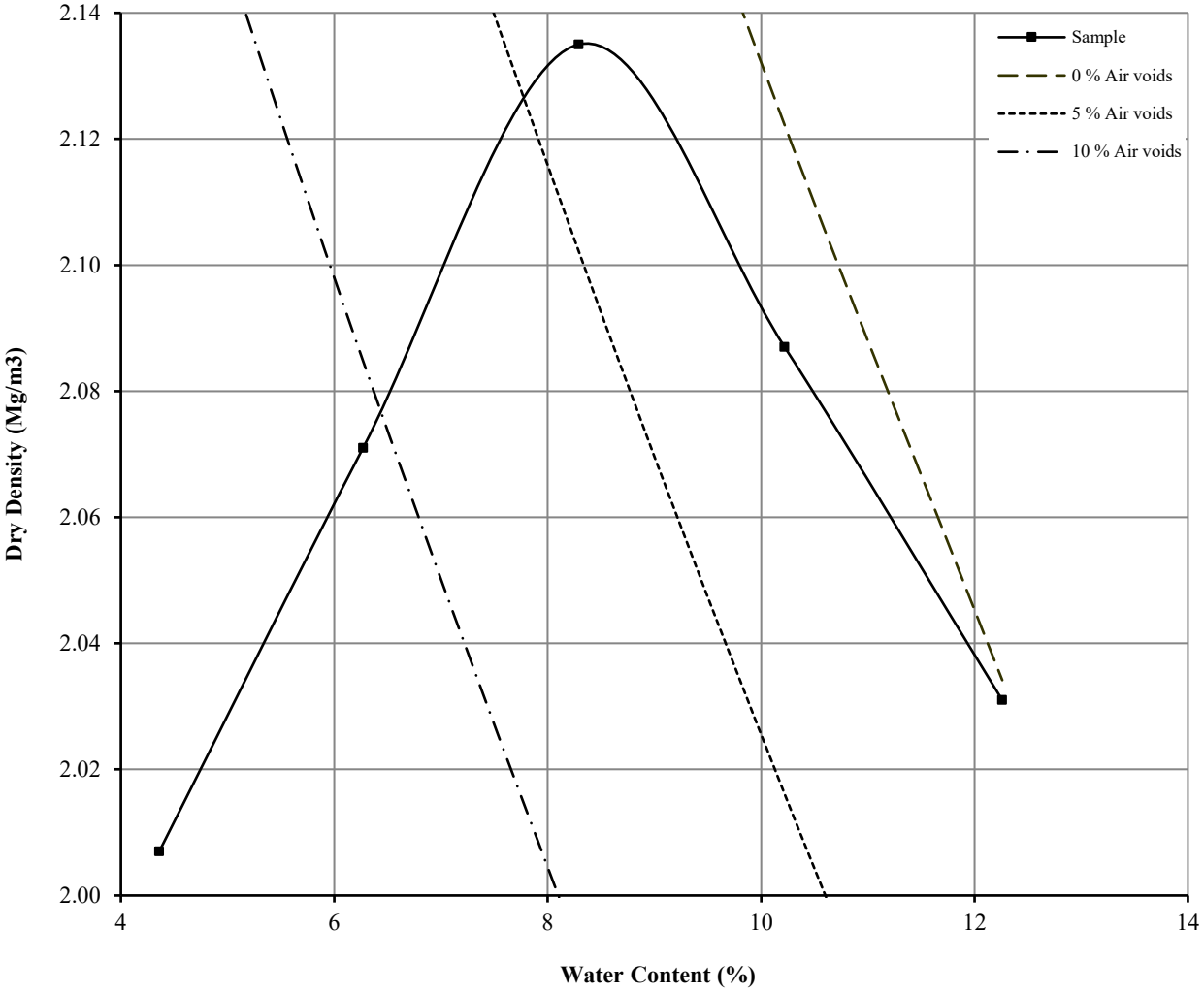
DRY DENSITY/WATER CONTENT RELATIONSHIP

Non compliance with BS 1377 - Part 2 : Clause 11 : 2022

Hole Number: TP01 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Water Content:		10.2	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.71	Assumed	Material Retained on 37.5 mm Test Sieve (%):		29
Maximum Dry Density (Mg/m3):		2.14	Material Retained on 20.0 mm Test Sieve (%):		26
Optimum Water Content (%):		8	Grading Zone:		X
Remarks See summary of soil descriptions					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No.
PSL24/7255
Client Ref
13999-07-24

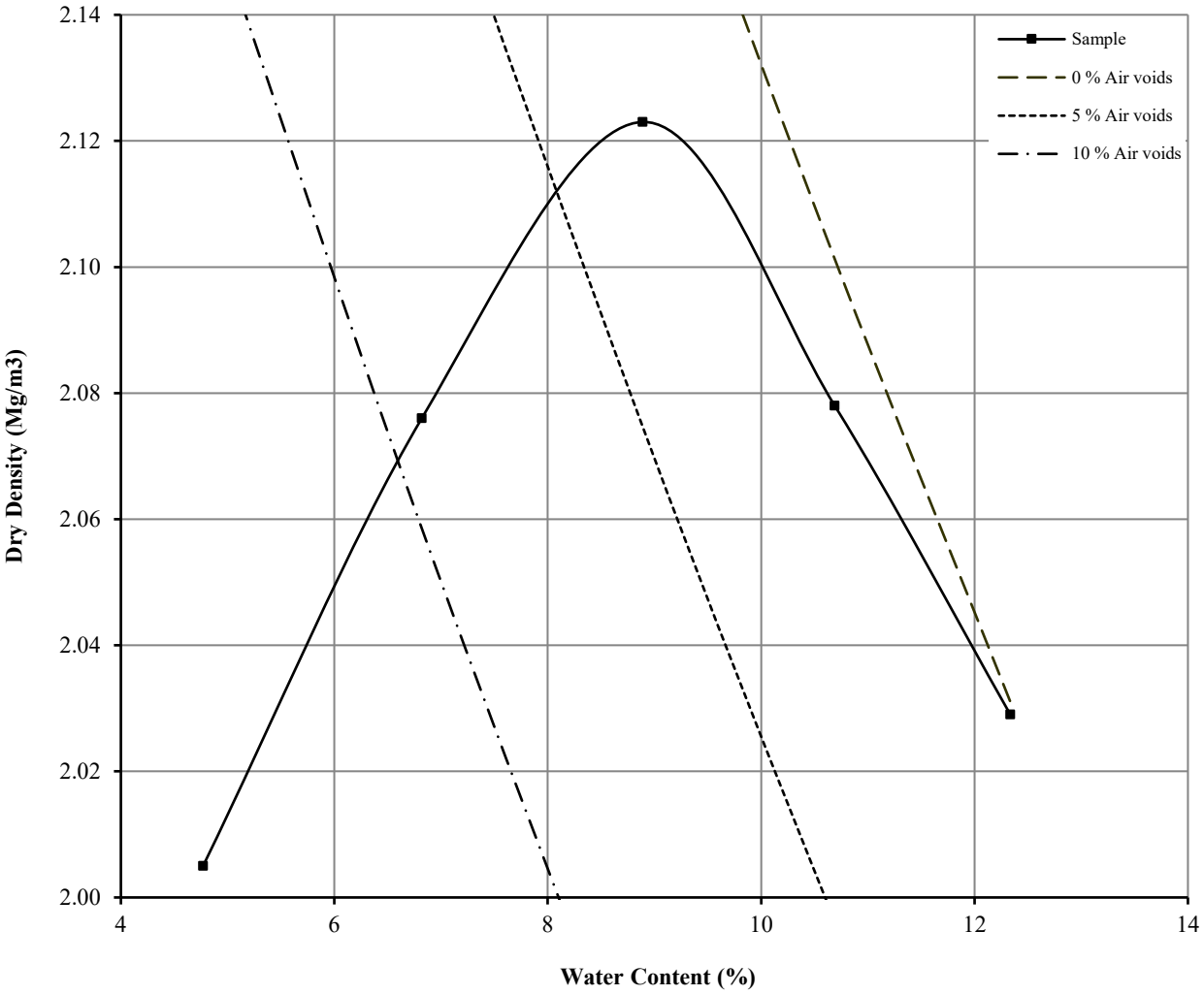
DRY DENSITY/WATER CONTENT RELATIONSHIP

Non compliance with BS 1377 - Part 2 : Clause 11 : 2022

Hole Number: TP05 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Water Content:		8.9	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.71	Assumed	Material Retained on 37.5 mm Test Sieve (%):		19
Maximum Dry Density (Mg/m3):		2.12	Material Retained on 20.0 mm Test Sieve (%):		8
Optimum Water Content (%):		9	Grading Zone:		X
Remarks See summary of soil descriptions					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No. PSL24/7255

Client Ref 13999-07-24

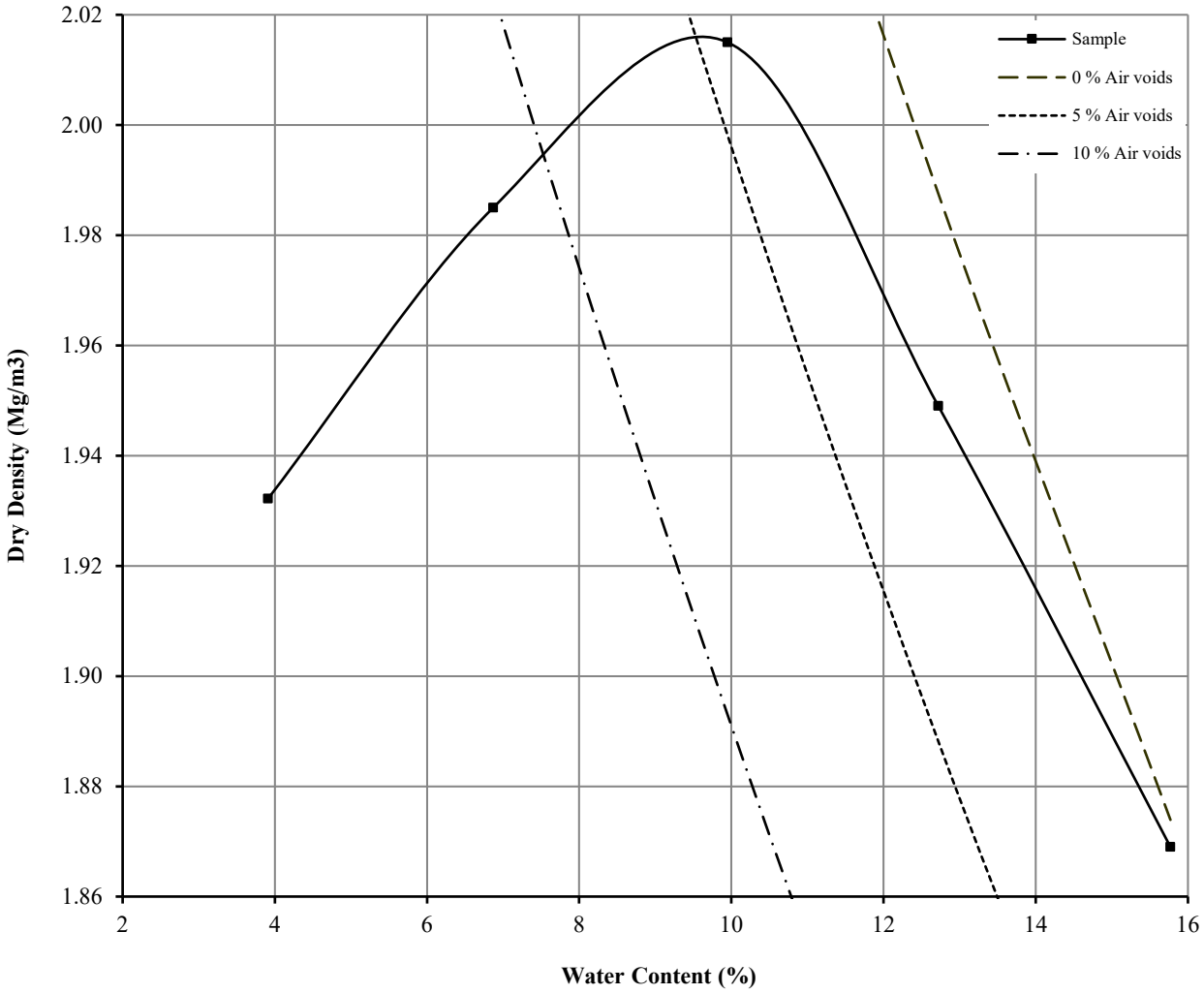
DRY DENSITY/WATER CONTENT RELATIONSHIP

BS 1377 - Part 2 : Clause 11 : 2022

Hole Number: TP13 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Water Content:		12.7	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.66	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		2.02	Material Retained on 20.0 mm Test Sieve (%):		0
Optimum Water Content (%):		10	Grading Zone:		1
Remarks See summary of soil descriptions					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No.
PSL24/7255
Client Ref
13999-07-24

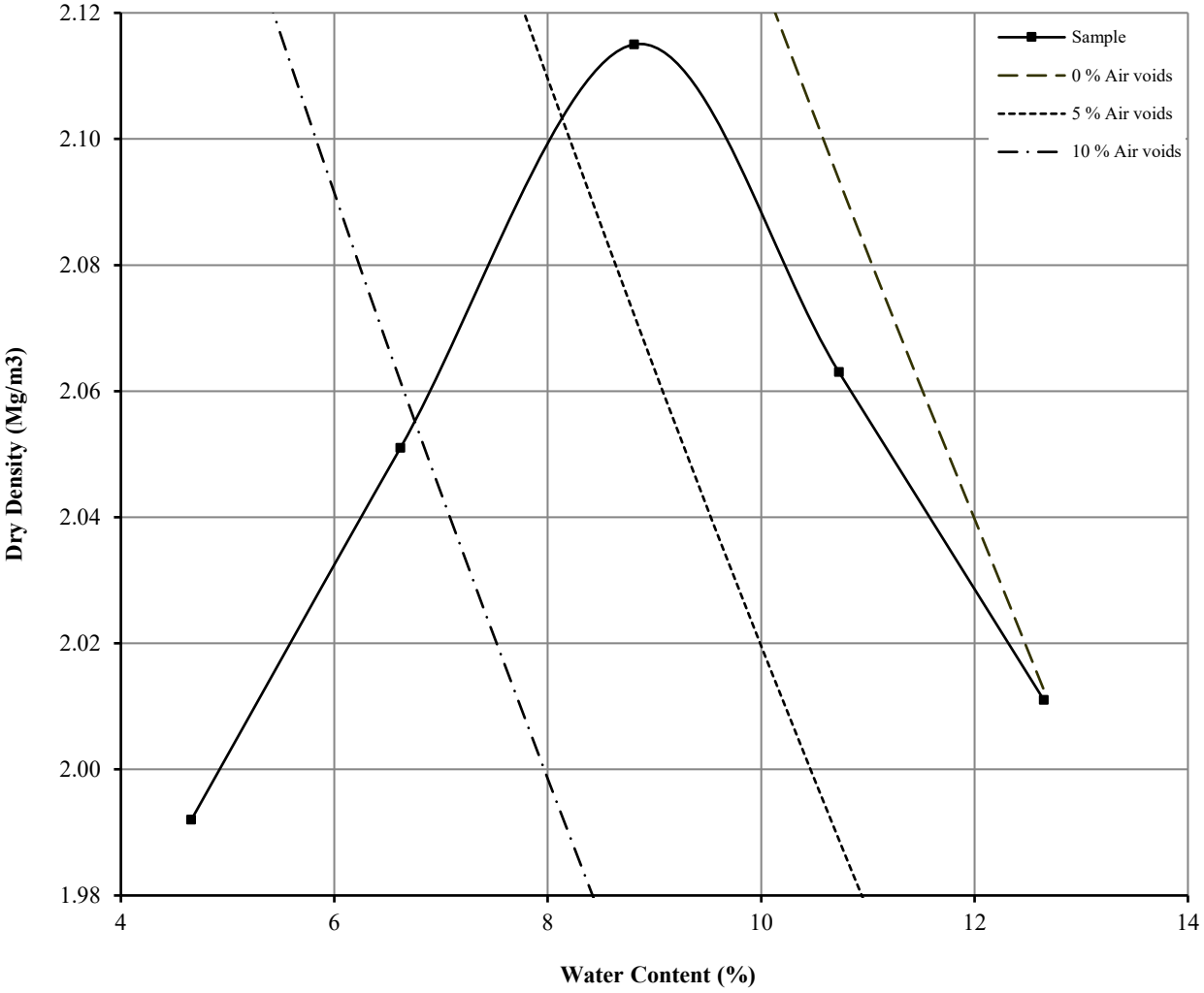
DRY DENSITY/WATER CONTENT RELATIONSHIP

Non compliance with BS 1377 - Part 2 : Clause 11 : 2022

Hole Number: TP35 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Water Content:		8.8	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.70	Assumed	Material Retained on 37.5 mm Test Sieve (%):		13
Maximum Dry Density (Mg/m3):		2.12	Material Retained on 20.0 mm Test Sieve (%):		17
Optimum Water Content (%):		9	Grading Zone:		X
Remarks See summary of soil descriptions					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No.
PSL24/7255
Client Ref
13999-07-24

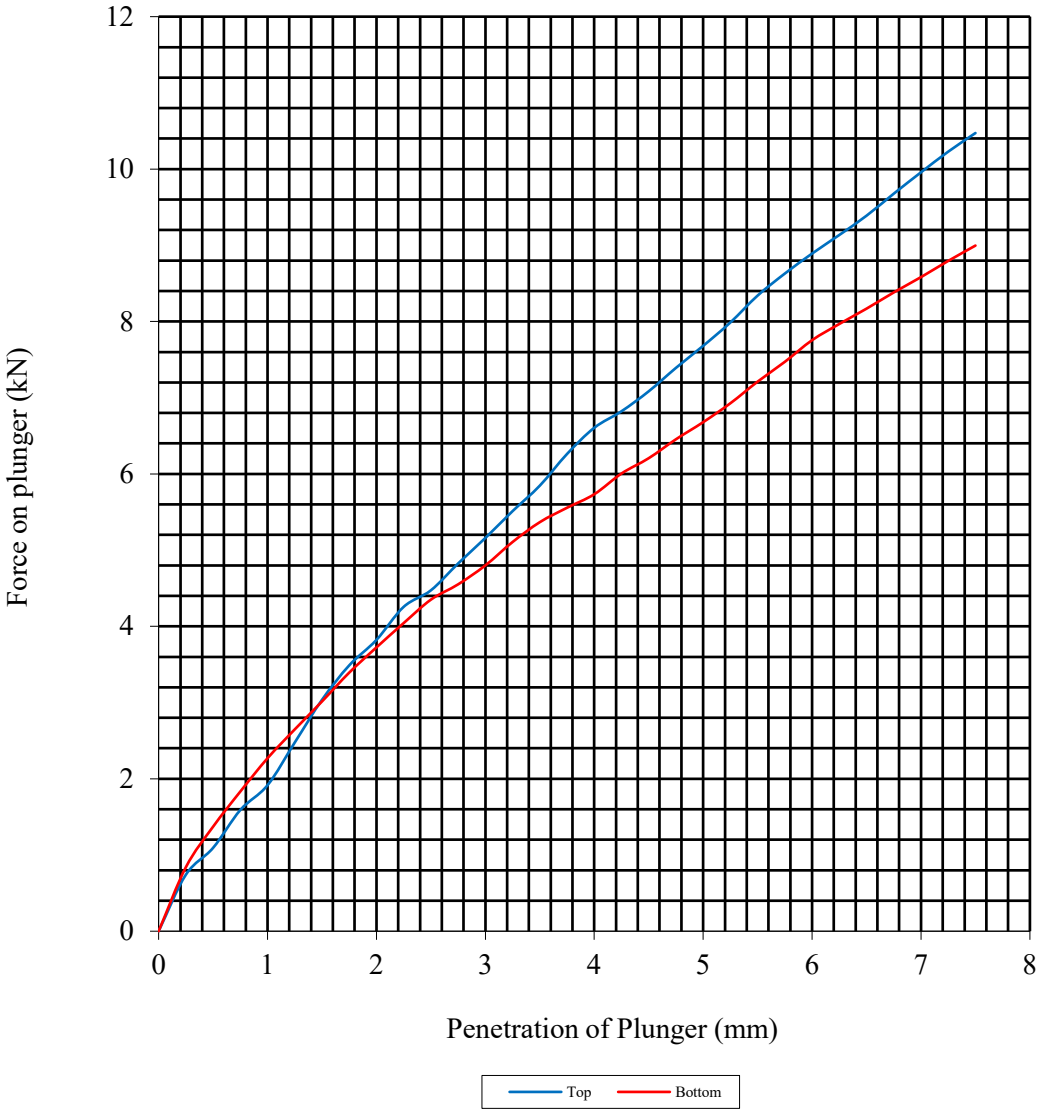
CALIFORNIA BEARING RATIO (CBR)

BS 1377 - Part 2 : Clause 15 : 2022

Hole Number: TP01 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Sample Conditions		Sample Preparation		Final Water Content %		C.B.R. Value %	
Water Content:	13.2	Surcharge Kg:	4.00	Sample Top	13.2	Sample Top	38.4
Bulk Density Mg/m3:	2.10	Soaking Time hrs	0	Sample Bottom	13.4	Sample Bottom	33.4
Dry Density Mg/m3:	1.86	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			0				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

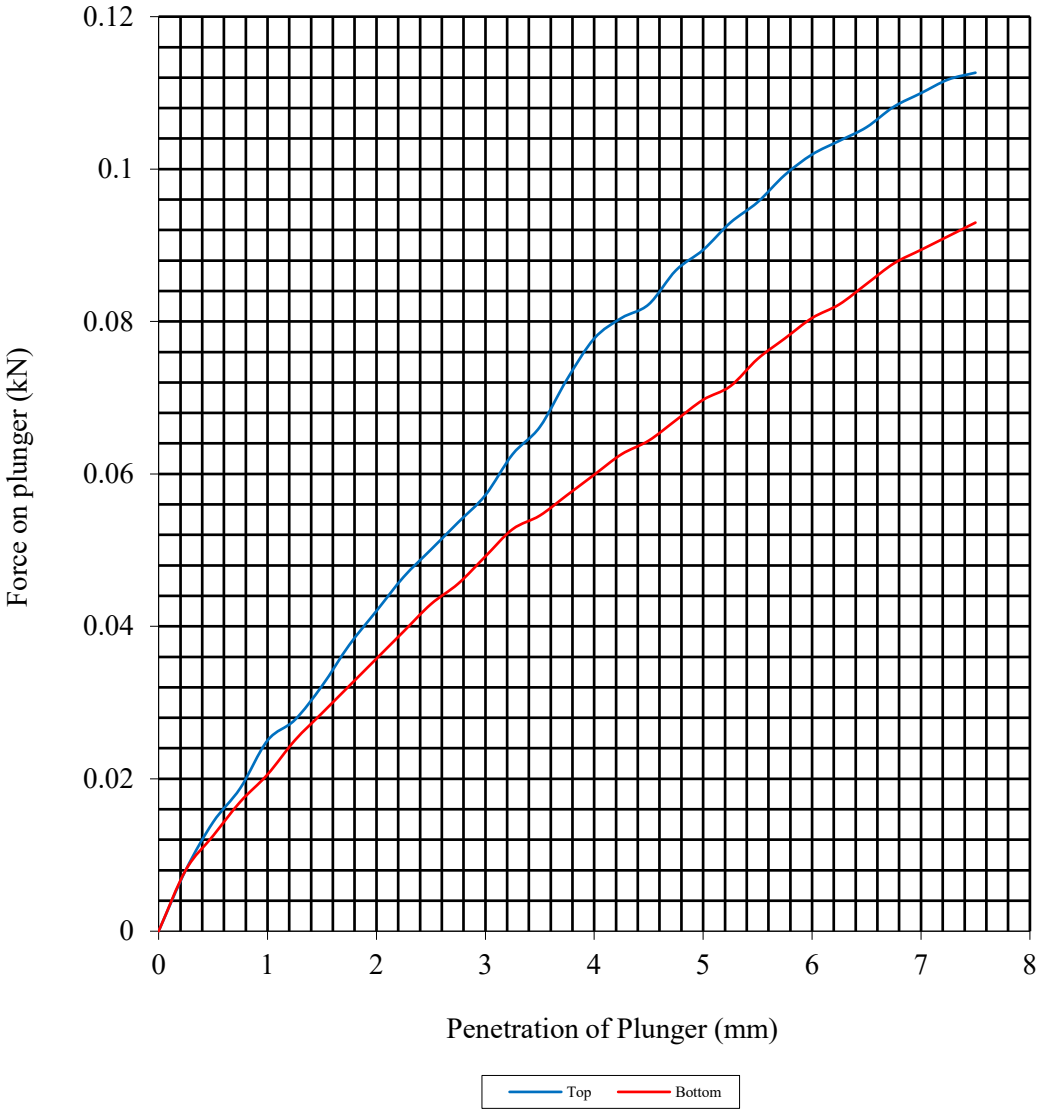
CALIFORNIA BEARING RATIO (CBR)

BS 1377 - Part 2 : Clause 15 : 2022

Hole Number: TP06 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Sample Conditions		Sample Preparation		Final Water Content %		C.B.R. Value %	
Water Content:	17.4	Surcharge Kg:	4.00	Sample Top	17.5	Sample Top	0.4
Bulk Density Mg/m3:	2.15	Soaking Time hrs	0	Sample Bottom	17.7	Sample Bottom	0.3
Dry Density Mg/m3:	1.83	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			12				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

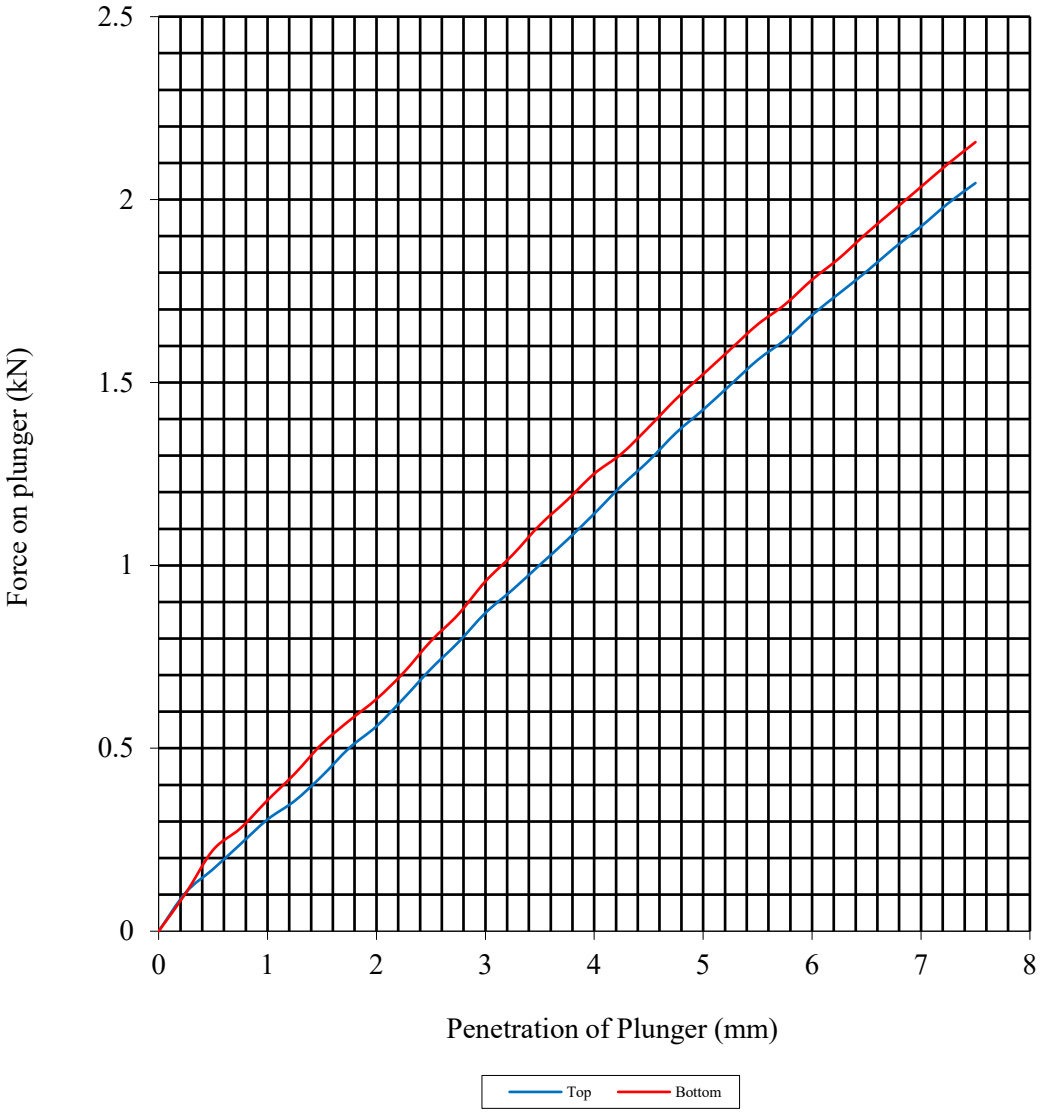
CALIFORNIA BEARING RATIO (CBR)

BS 1377 - Part 2 : Clause 15 : 2022

Hole Number: TP12 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Sample Conditions		Sample Preparation		Final Water Content %		C.B.R. Value %	
Water Content:	20.4	Surcharge Kg:	4.00	Sample Top	20.3	Sample Top	7.1
Bulk Density Mg/m3:	2.03	Soaking Time hrs	0	Sample Bottom	20.8	Sample Bottom	7.6
Dry Density Mg/m3:	1.69	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			0				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

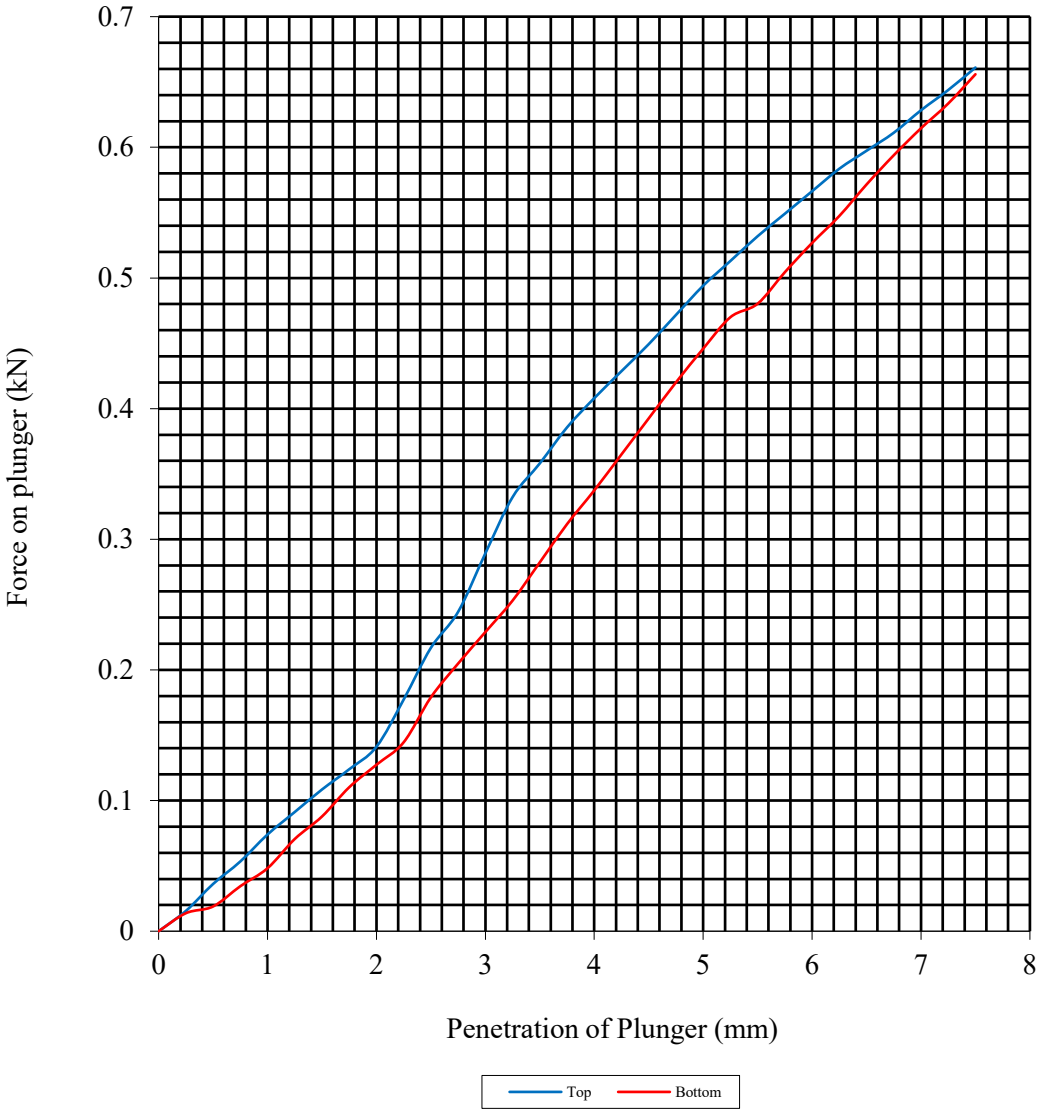
CALIFORNIA BEARING RATIO (CBR)

BS 1377 - Part 2 : Clause 15 : 2022

Hole Number: TP19 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Sample Conditions		Sample Preparation		Final Water Content %		C.B.R. Value %	
Water Content:	18.9	Surcharge Kg:	4.00	Sample Top	18.7	Sample Top	2.5
Bulk Density Mg/m3:	2.13	Soaking Time hrs	0	Sample Bottom	19.2	Sample Bottom	2.2
Dry Density Mg/m3:	1.79	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			0				
Compaction Conditions		2.5kg					

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PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

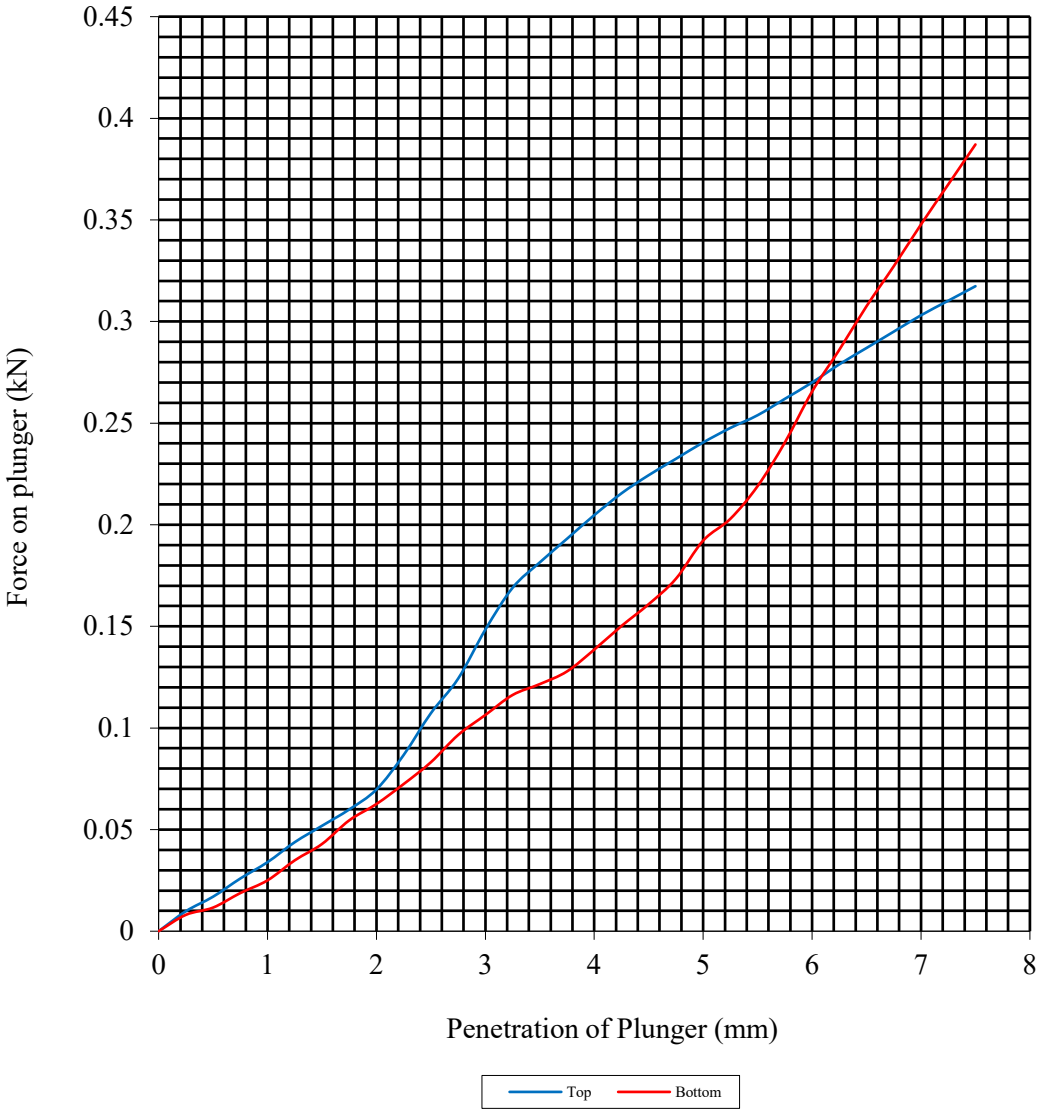
CALIFORNIA BEARING RATIO (CBR)

BS 1377 - Part 2 : Clause 15 : 2022

Hole Number: TP31 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D



Initial Sample Conditions		Sample Preparation		Final Water Content %		C.B.R. Value %	
Water Content:	18.9	Surcharge Kg:	4.00	Sample Top	18.8	Sample Top	1.2
Bulk Density Mg/m3:	2.04	Soaking Time hrs	0	Sample Bottom	19.1	Sample Bottom	1.0
Dry Density Mg/m3:	1.72	Swelling mm:	0	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:			0				
Compaction Conditions		2.5kg					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

Hole Number: TP01 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination

Blows (N)	Penetration (mm)	n to 4n (mm)
1	67.3	14.6
2	59.7	12.7
3	55.4	11.2
4	52.7	10.2
6	49.2	8.8
8	47.0	7.8
12	44.2	6.5
16	42.5	5.8
24	40.4	4.9
32	39.2	
48	37.7	
64	36.7	
96	35.5	
128		
192		
256		

Test Results.

Water Content (%)	13.2
MCV	12.6

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

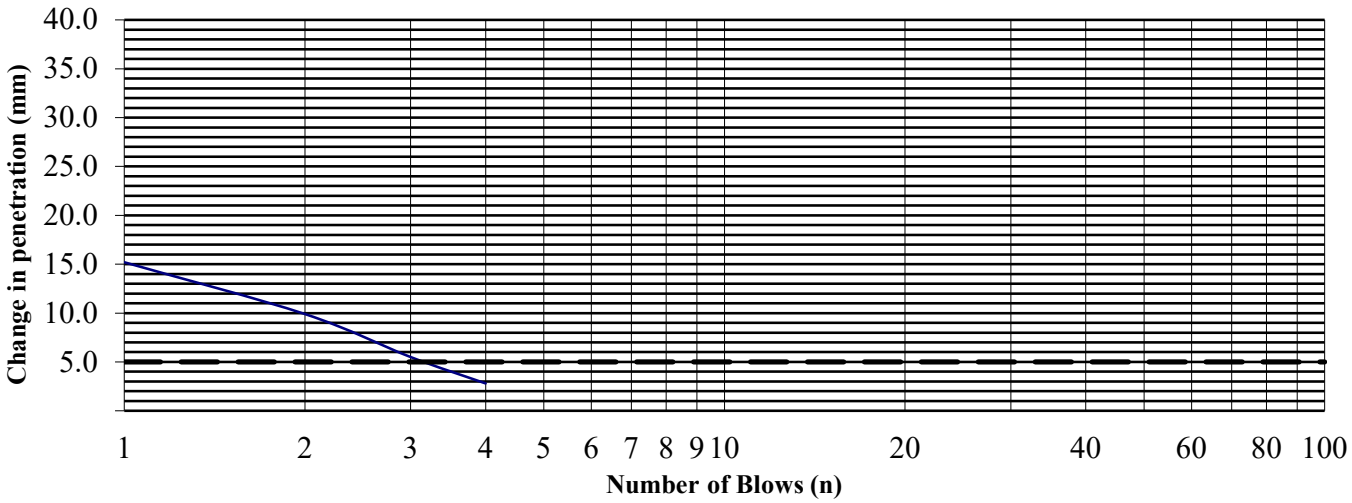
Hole Number: TP01 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	55
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	48.9	15.2
2	40.9	9.9
3	36.5	5.5
4	33.7	2.8
6	31.2	
8	31.0	
12	31.0	
16	30.9	
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	10.2
MCV	5.1

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

Hole Number: TP02 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	77
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination

Blows (N)	Penetration (mm)	n to 4n (mm)
1	70.5	12.2
2	62.1	10.8
3	59.5	11.2
4	58.3	10.4
6	54.7	10.7
8	51.3	9.7
12	48.3	8.4
16	47.9	8.8
24	44.0	6.8
32	41.6	6.7
48	39.9	6.0
64	39.1	5.4
96	37.2	
128	34.9	
192	33.9	
256	33.7	

Test Results.

Water Content (%)	5.4
MCV	>20

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

Hole Number: TP03 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	31
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination

Blows (N)	Penetration (mm)	n to 4n (mm)
1	68.6	13.6
2	62.0	11.7
3	58.2	10.9
4	55.0	9.2
6	52.3	8.7
8	50.3	8.2
12	47.3	6.7
16	45.8	5.5
24	43.6	3.7
32	42.1	
48	40.6	
64	40.3	
96	39.9	
128		
192		
256		

Test Results.

Water Content (%)	13.4
MCV	12.7

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

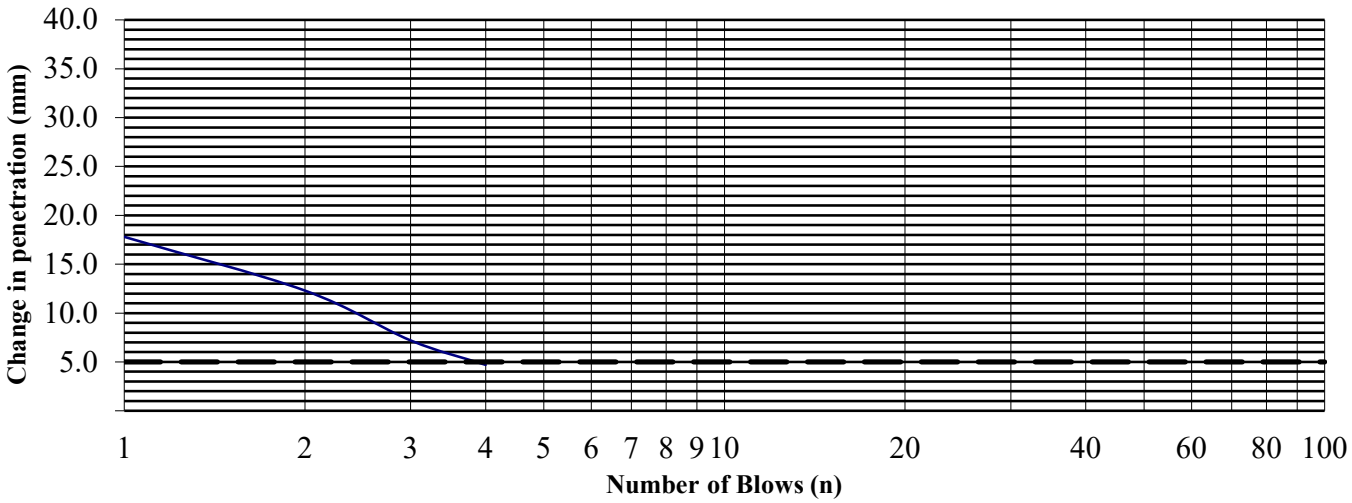
Hole Number: **TP04** **Top Depth (m):** **0.50**

Sample Number: **Base Depth (m):**

Sample Type: **B&D**

Material Retained on the 20mm BS Test Sieve (%):	34
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	62.8	17.8
2	53.4	12.3
3	47.9	7.2
4	45.0	4.7
6	42.2	
8	41.1	
12	40.7	
16	40.3	
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	18.8
MCV	5.5

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: **PSL24/7255**

Client Ref: **13999-07-24**

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

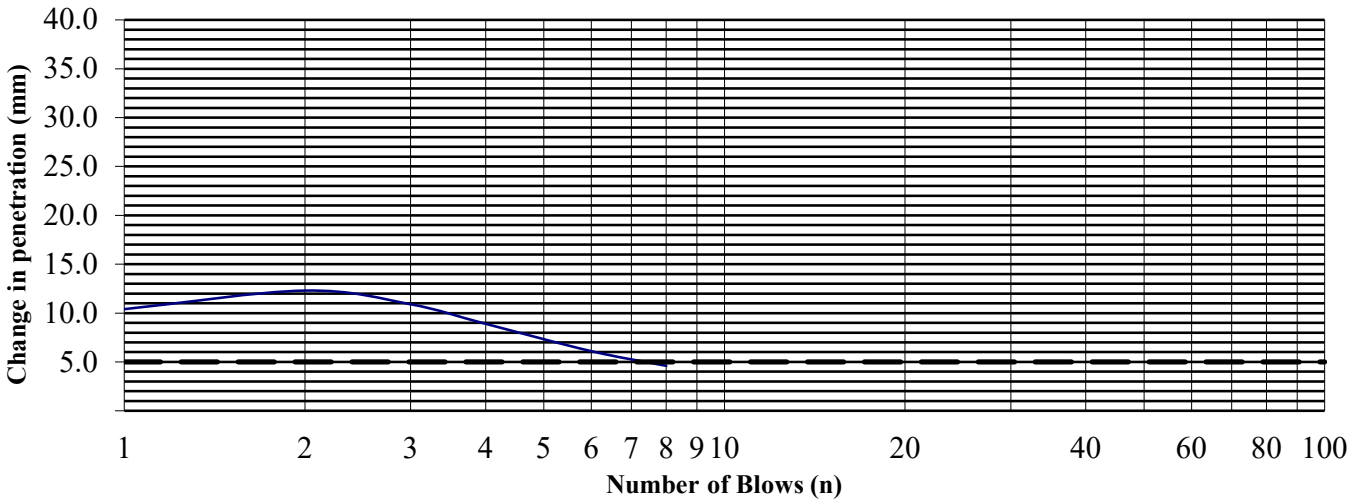
Hole Number: **TP05** **Top Depth (m):** **1.50**

Sample Number: **Base Depth (m):**

Sample Type: **B&D**

Material Retained on the 20mm BS Test Sieve (%):	27
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	49.5	10.4
2	45.5	12.3
3	41.9	10.9
4	39.1	8.9
6	35.3	6.1
8	33.2	4.6
12	31.0	
16	30.2	
24	29.2	
32	28.6	
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	8.9
MCV	8.4

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

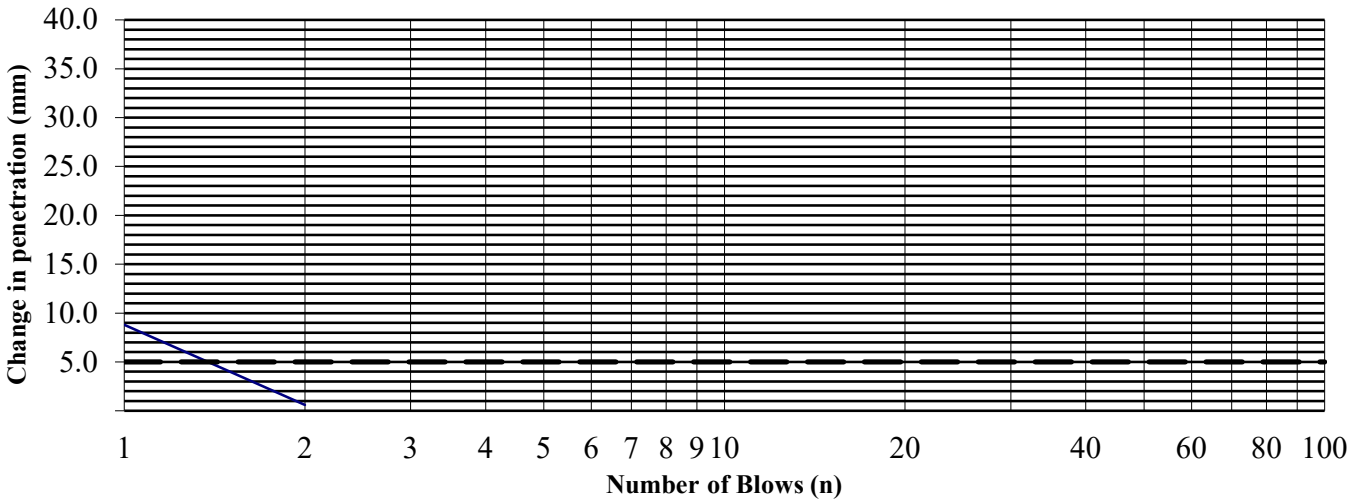
Hole Number: **TP06** **Top Depth (m):** **0.50**

Sample Number: **Base Depth (m):**

Sample Type: **B&D**

Material Retained on the 20mm BS Test Sieve (%):	12
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	47.5	8.8
2	39.2	0.6
3	38.9	
4	38.7	
6	38.7	
8	38.6	
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	17.4
MCV	1.5

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

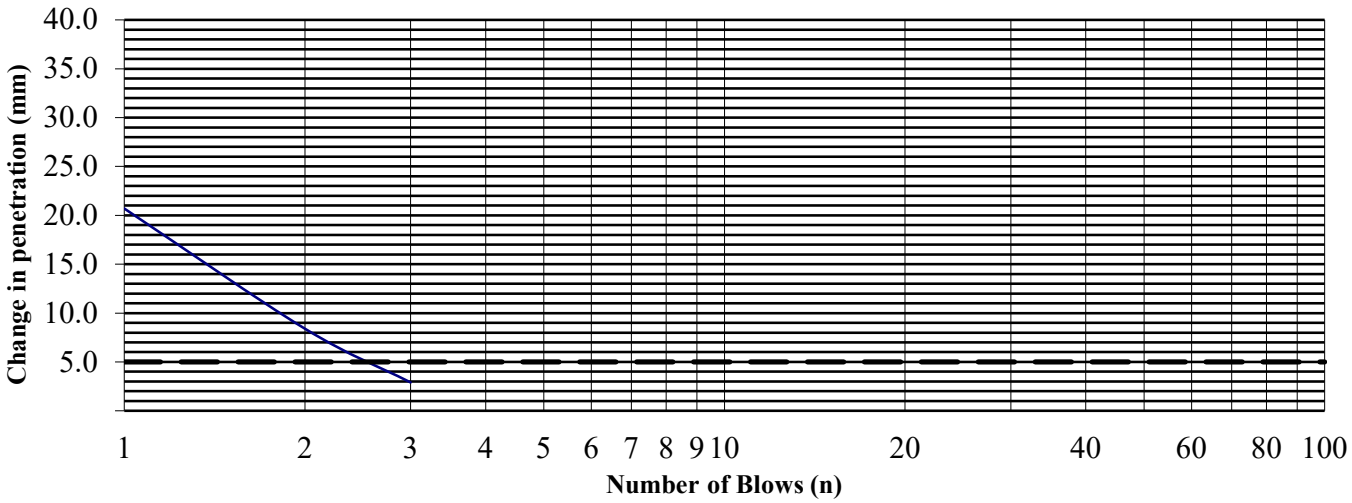
Hole Number: TP07 **Top Depth (m):** 2.00

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	28
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	63.0	20.7
2	49.9	8.4
3	44.3	2.9
4	42.3	
6	41.6	
8	41.5	
12	41.4	
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	20.9
MCV	3.8

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

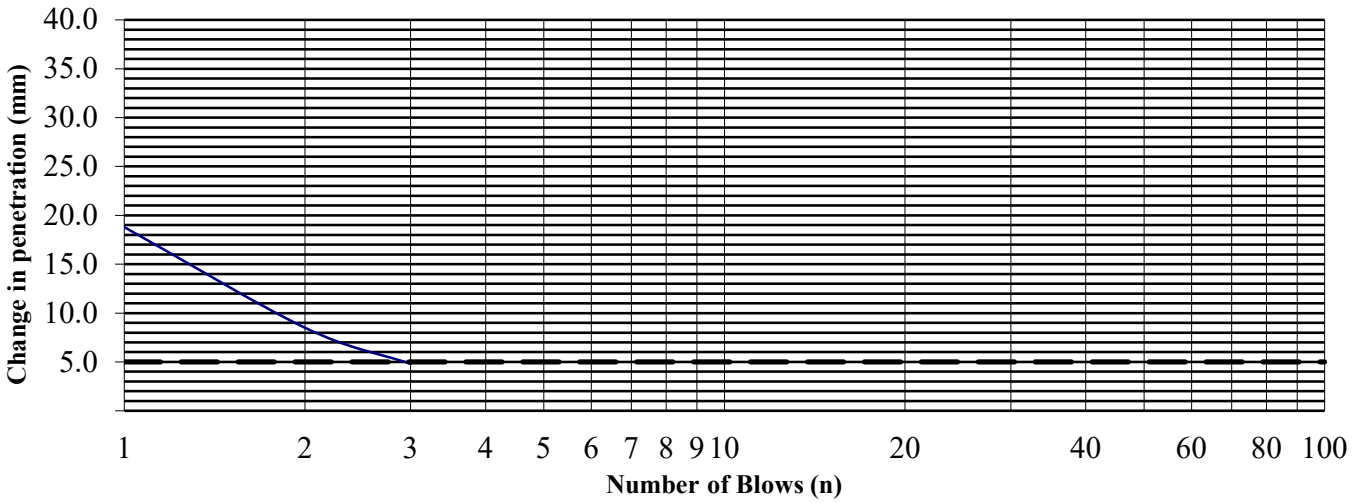
Hole Number: **TP08** **Top Depth (m):** **1.50**

Sample Number: **Base Depth (m):**

Sample Type: **B&D**

Material Retained on the 20mm BS Test Sieve (%):	19
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	58.0	18.8
2	44.6	8.5
3	40.7	4.8
4	39.2	
6	37.1	
8	36.1	
12	35.9	
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	17.9
MCV	4.6

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: **PSL24/7255**

Client Ref: **13999-07-24**

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

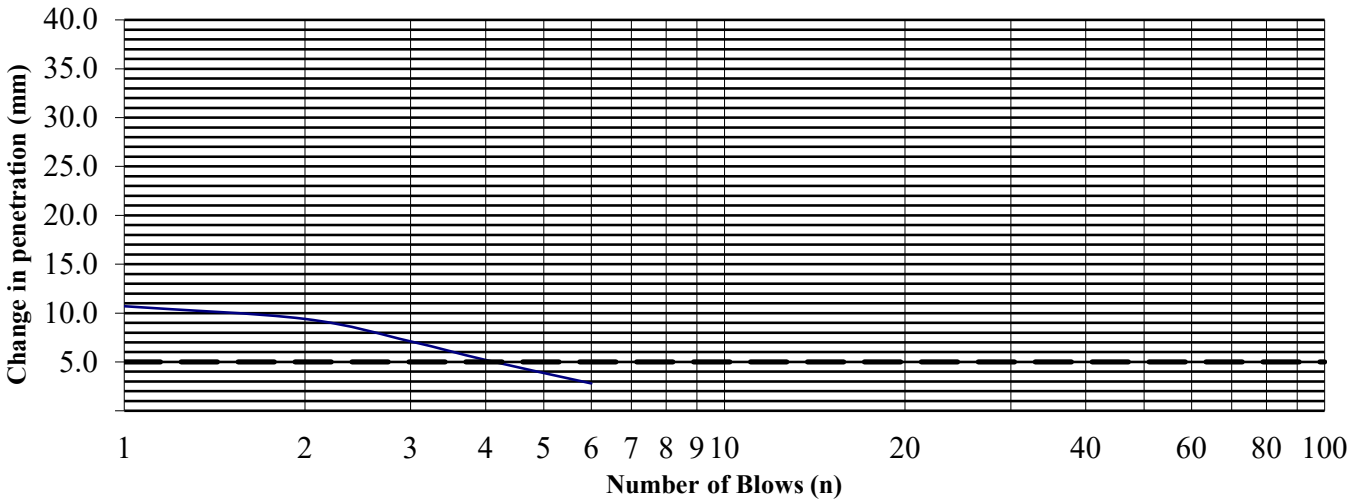
Hole Number: TP10 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	11
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	52.4	10.7
2	47.0	9.4
3	43.8	7.1
4	41.7	5.2
6	39.1	2.8
8	37.6	
12	36.7	
16	36.5	
24	36.3	
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	13.5
MCV	6.2

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

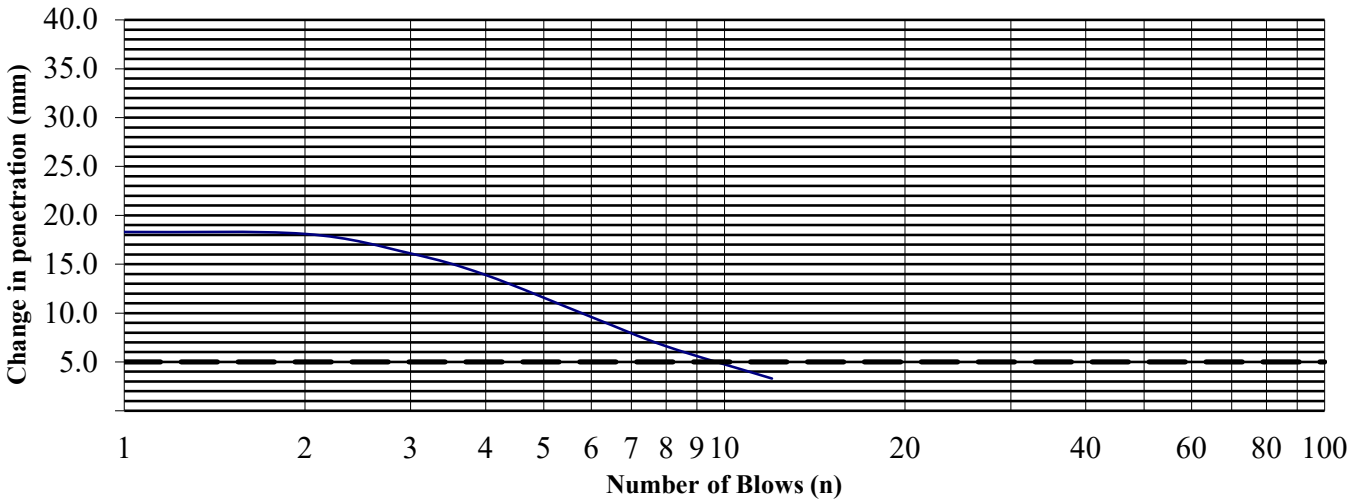
Hole Number: TP12 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	75.9	18.3
2	67.0	18.1
3	61.4	16.1
4	57.6	13.9
6	52.1	9.6
8	48.9	6.6
12	45.3	3.3
16	43.7	
24	42.5	
32	42.3	
48	42.0	
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	20.4
MCV	9.6

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

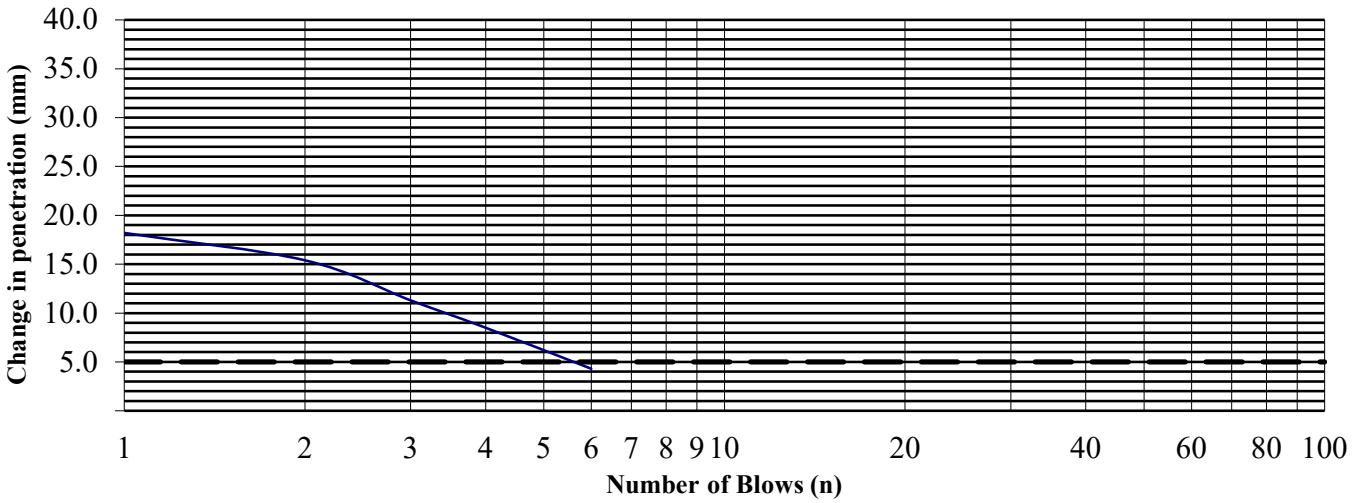
Hole Number: TP13 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	60.7	18.2
2	51.5	15.4
3	46.0	11.3
4	42.5	8.5
6	38.2	4.3
8	36.1	
12	34.7	
16	34.0	
24	33.9	
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	12.7
MCV	7.6

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

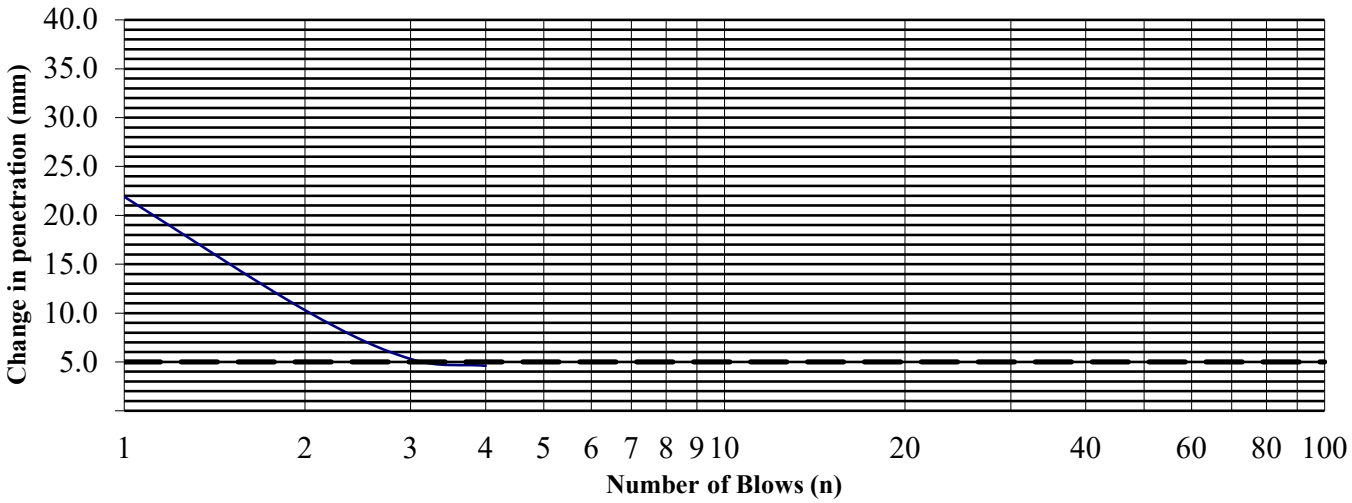
Hole Number: TP16 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	19
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	61.2	21.9
2	46.1	10.3
3	40.3	5.3
4	39.3	4.6
6	37.4	
8	35.8	
12	35.0	
16	34.7	
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	13.5
MCV	4.2

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

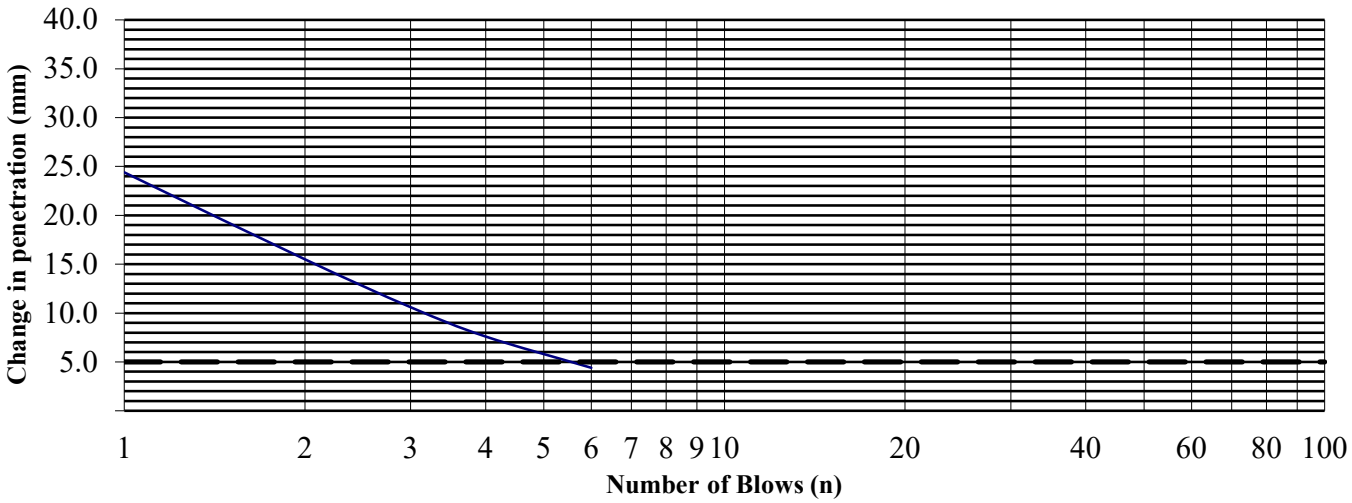
Hole Number: TP19 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	76.7	24.4
2	62.9	15.5
3	55.9	10.6
4	52.3	7.6
6	48.3	4.4
8	47.4	
12	45.3	
16	44.7	
24	43.9	
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	18.9
MCV	6.7

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

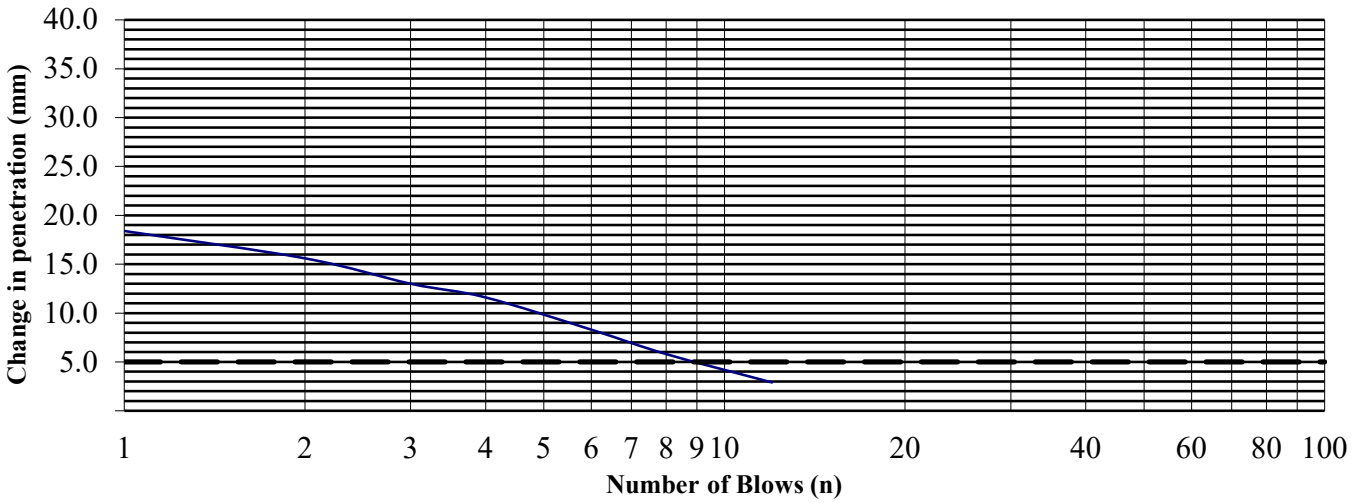
Hole Number: TP22 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	74.9	18.4
2	65.0	15.6
3	59.4	13.0
4	56.5	11.6
6	52.1	8.3
8	49.4	5.8
12	46.4	2.9
16	44.9	
24	43.8	
32	43.6	
48	43.5	
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	22.1
MCV	9.5

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

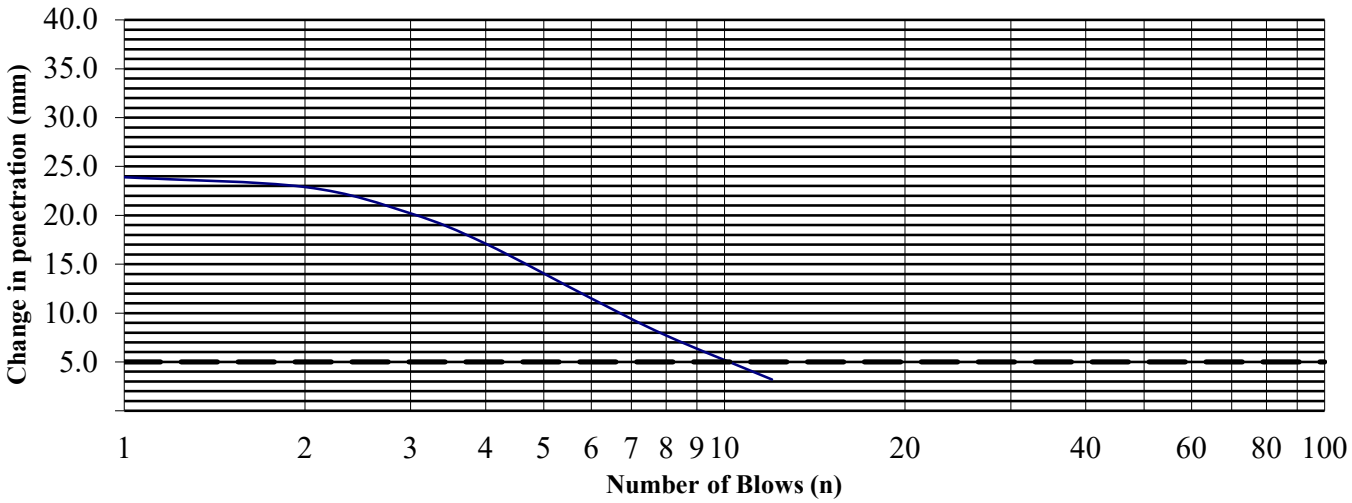
Hole Number: TP24 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	89.2	23.9
2	77.6	22.9
3	70.3	20.2
4	65.3	17.1
6	58.7	11.5
8	54.7	7.7
12	50.1	3.2
16	48.2	
24	47.2	
32	47.0	
48	46.9	
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	27.7
MCV	9.9

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

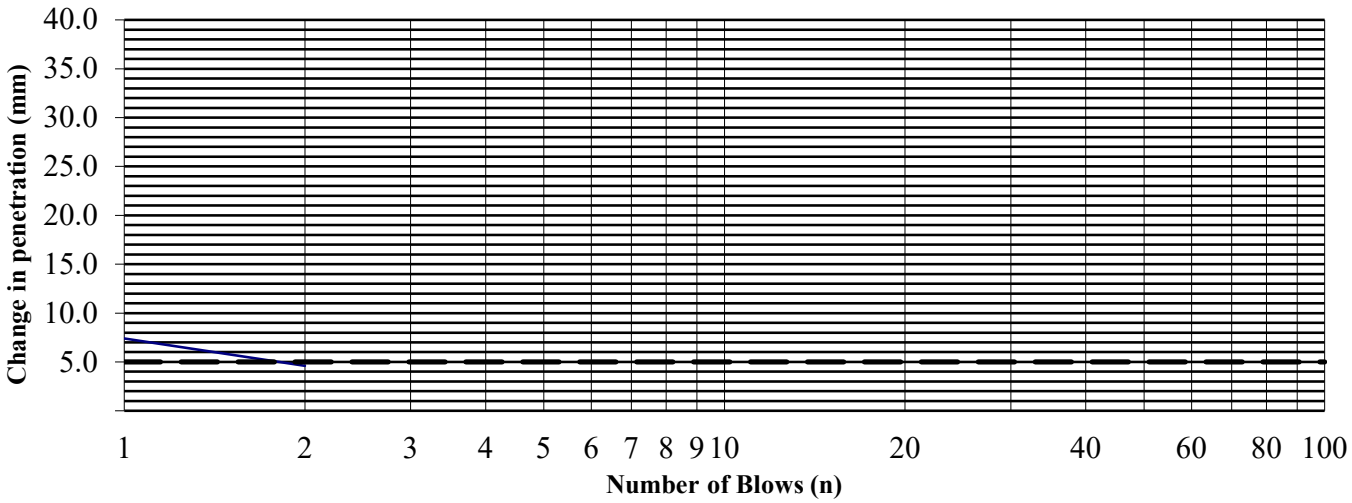
Hole Number: TP26 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	51.7	7.4
2	47.6	4.6
3	45.2	
4	44.3	
6	43.4	
8	43.0	
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	19.3
MCV	2.7

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

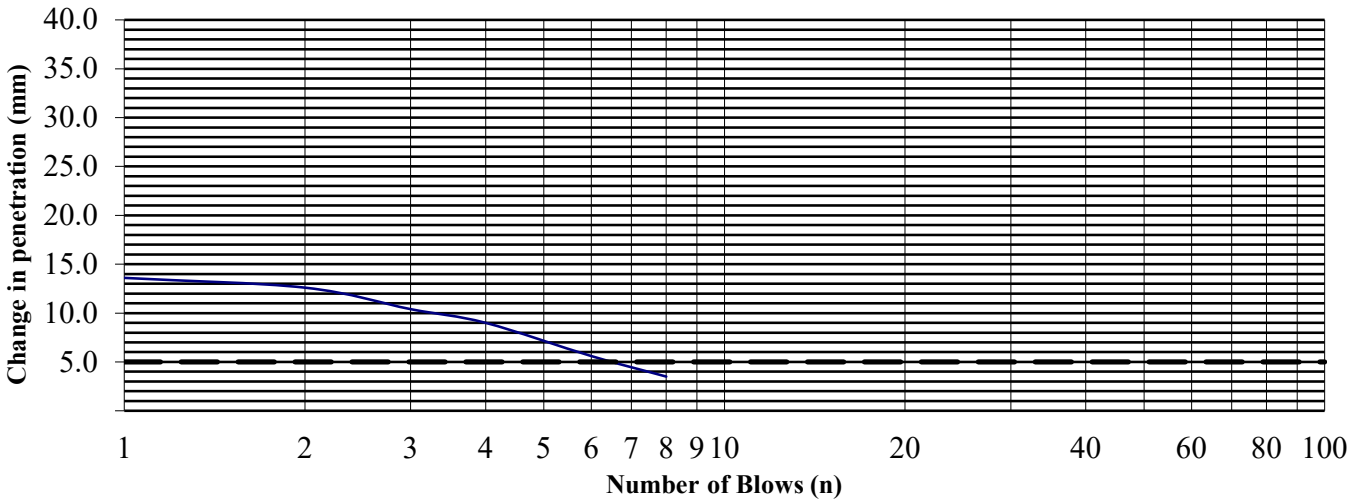
Hole Number: TP29 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	12
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	55.7	13.6
2	48.7	12.6
3	44.4	10.4
4	42.1	9.0
6	38.5	5.6
8	36.1	3.5
12	34.0	
16	33.1	
24	32.9	
32	32.6	
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	11.3
MCV	8.2

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

Contract No: PSL24/7255

Client Ref: 13999-07-24

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

Hole Number: TP33 **Top Depth (m):** 0.50

Sample Number: **Base Depth (m):**

Sample Type: B&D

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination

Blows (N)	Penetration (mm)	n to 4n (mm)
1	87.8	20.4
2	78.2	20.5
3	71.9	19.4
4	67.4	18.0
6	61.8	16.0
8	57.7	13.9
12	52.5	10.4
16	49.4	7.8
24	45.8	5.3
32	43.8	3.9
48	42.1	
64	41.6	
96	40.5	
128	39.9	
192		
256		

Test Results.

Water Content (%)	21.0
MCV	13.5

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

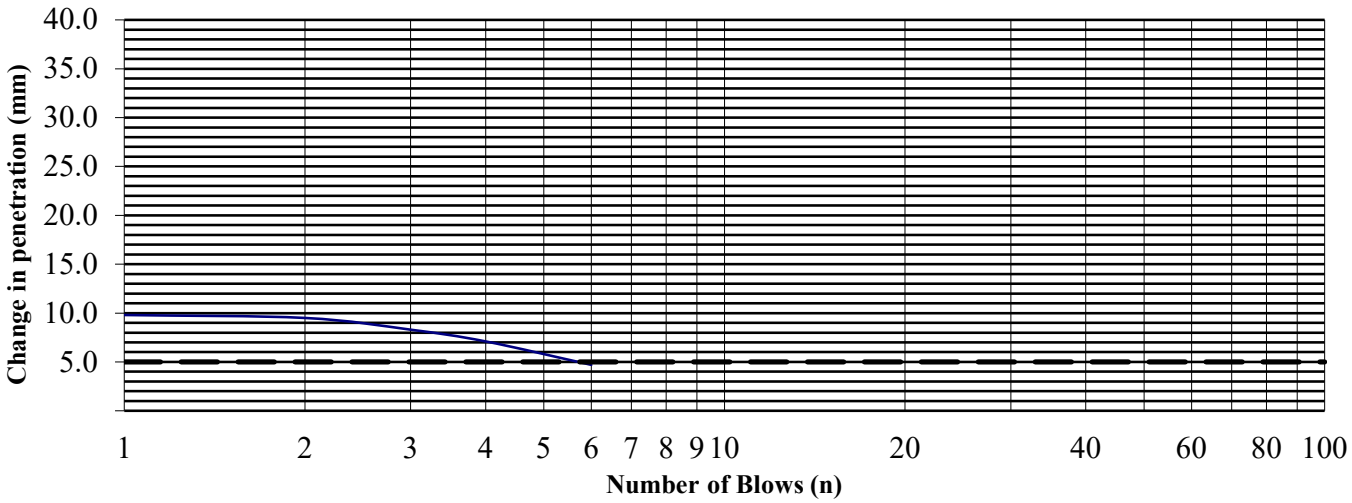
Hole Number: **TP34** **Top Depth (m):** **1.00**

Sample Number: **Base Depth (m):**

Sample Type: **B&D**

Material Retained on the 20mm BS Test Sieve (%):	26
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	47.8	9.8
2	42.8	9.5
3	40.1	8.3
4	38.0	7.1
6	35.3	4.7
8	33.3	
12	31.8	
16	30.9	
24	30.6	
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	9.7
MCV	7.8

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

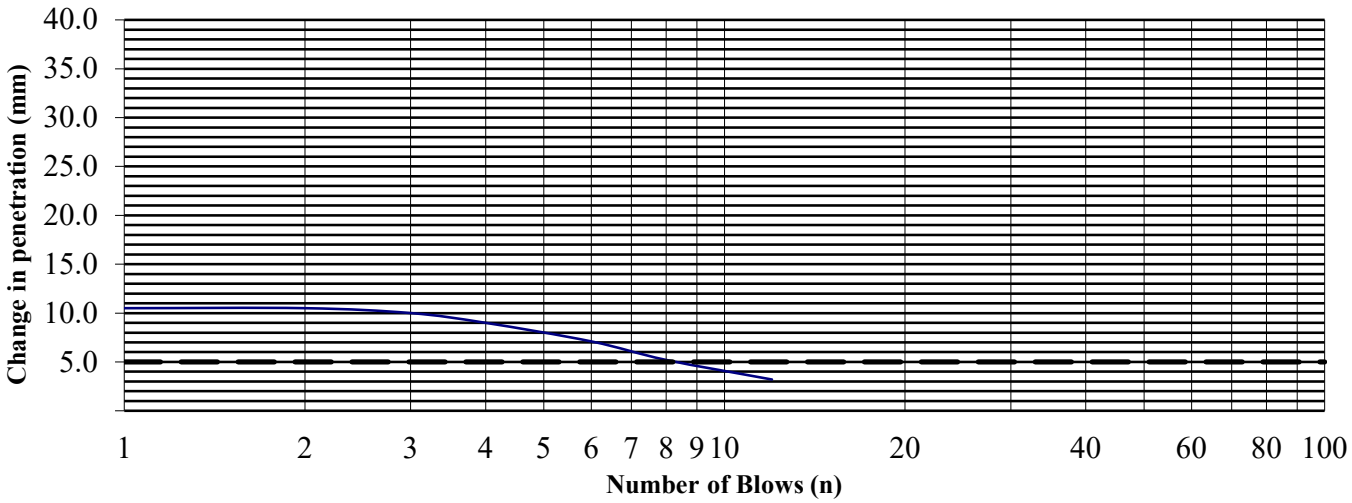
Hole Number: **TP35** **Top Depth (m):** **1.50**

Sample Number: **Base Depth (m):**

Sample Type: **B&D**

Material Retained on the 20mm BS Test Sieve (%):	30
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	50.6	10.5
2	45.4	10.5
3	42.4	10.0
4	40.1	9.0
6	37.1	7.1
8	34.9	5.2
12	32.4	3.2
16	31.1	
24	30.0	
32	29.7	
48	29.2	
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	8.8
MCV	9.2

MOISTURE CONDITION VALUE (MCV)

BS1377 - Part 2 : 2022 : Clause 13

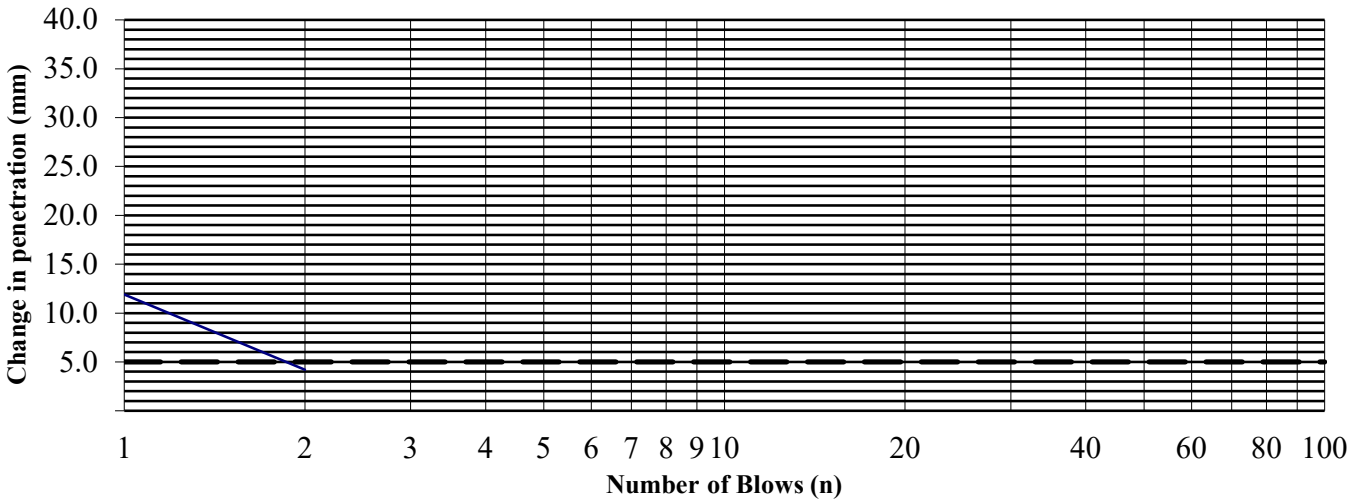
Hole Number: **TP38** **Top Depth (m):** **0.50**

Sample Number: **Base Depth (m):**

Sample Type: **B&D**

Material Retained on the 20mm BS Test Sieve (%):	0
Interpretation based on steepest straight line intercept with 5mm change in penetration.	

MCV Determination



Blows (N)	Penetration (mm)	n to 4n (mm)
1	56.1	11.9
2	46.9	4.2
3	45.6	
4	44.2	
6	43.0	
8	42.7	
12		
16		
24		
32		
48		
64		
96		
128		
192		
256		

Test Results.

Water Content (%)	13.8
MCV	2.7

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Coolpowra Galway

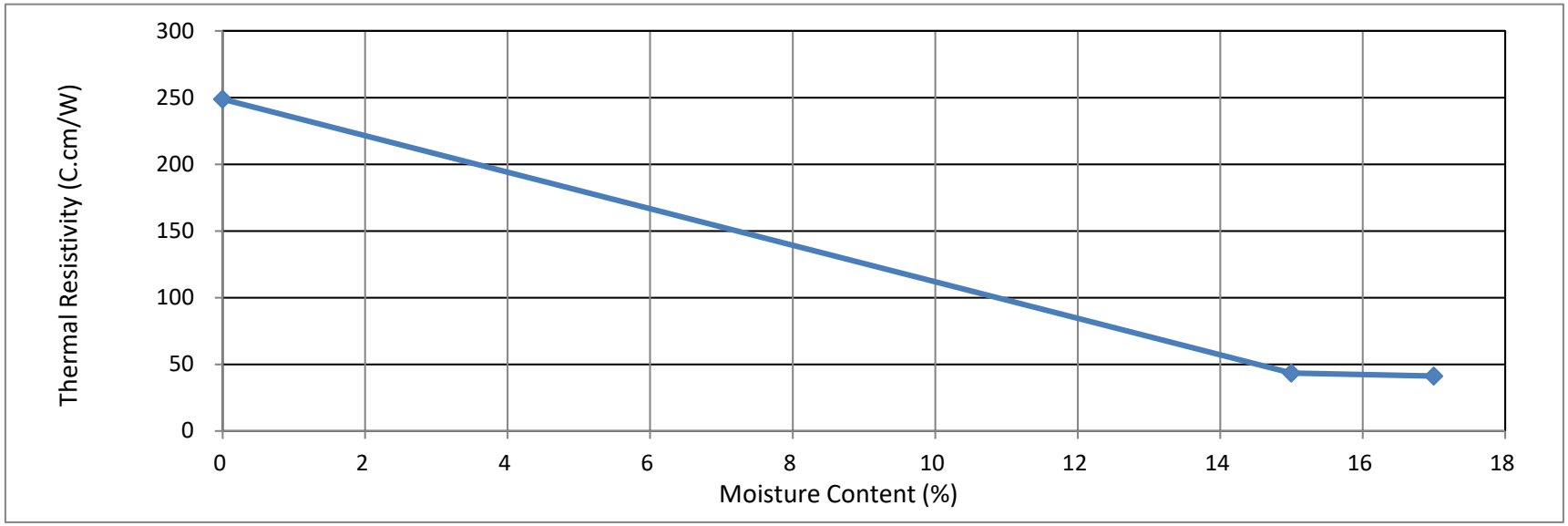
Contract No: **PSL24/7255**

Client Ref: **13999-07-24**

SUMMARY OF THERMAL PROPERTY TESTS

In accordance with ASTM-D5334

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Thermal Conductivity W/m K	Thermal Resistivity C.cm/W	Test Temp C^o	Remarks
TP06		B&D	0.50		0	1.64	1.64	0.402	248.8	29.1	
TP06		B&D	0.50		15	2.07	1.80	2.306	43.4	20.3	
TP06		B&D	0.50		17	2.03	1.74	2.428	41.2	21.0	Natural

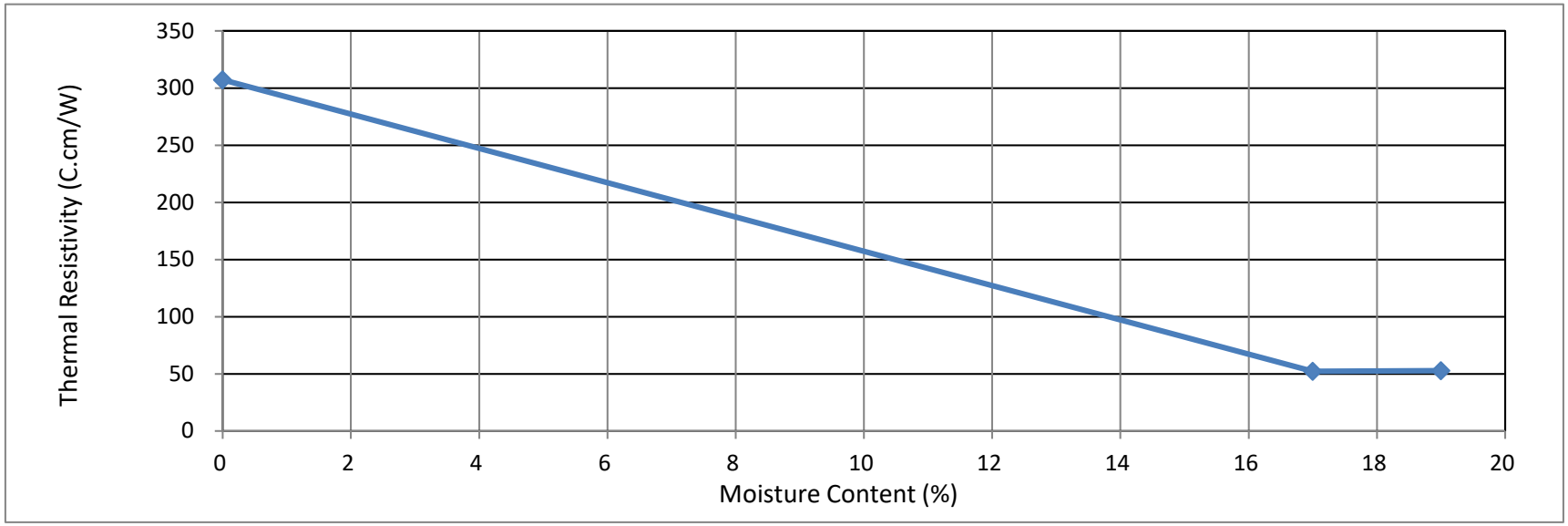


PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Coolpowra Galway**	**Contract No:**
		PSL24/7255
		Client Ref:
		13999-07-24

SUMMARY OF THERMAL PROPERTY TESTS

In accordance with ASTM-D5334

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Thermal Conductivity W/m K	Thermal Resistivity C.cm/W	Test Temp C^o	Remarks
TP19		B&D	1.50		0	1.54	1.54	0.326	307.2	34.3	
TP19		B&D	1.50		17	1.95	1.67	1.915	52.2	19.7	
TP19		B&D	1.50		19	2.03	1.71	1.897	52.7	20.6	Natural



PROFESSIONAL SOILS LABORATORY
A PHENNA GROUP COMPANY

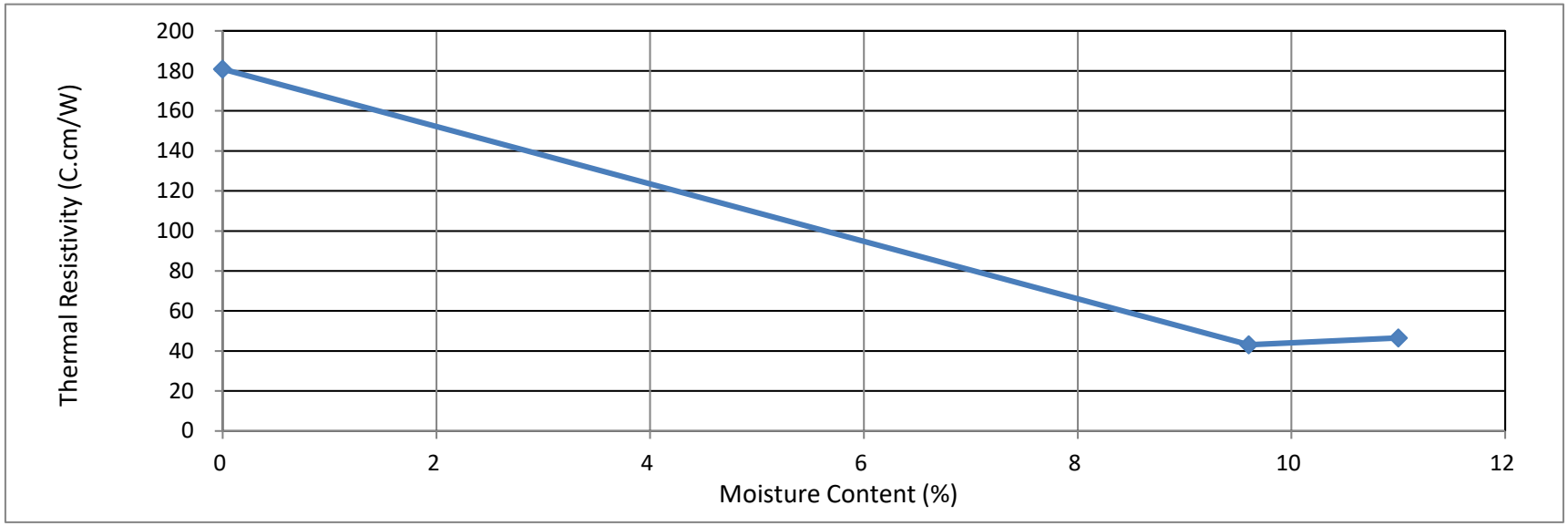
Coolpowra Galway

Contract No:
PSL24/7255
Client Ref:
13999-07-24

SUMMARY OF THERMAL PROPERTY TESTS

In accordance with ASTM-D5334

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Thermal Conductivity W/m K	Thermal Resistivity C.cm/W	Test Temp C^o	Remarks
TP29		B&D	1.50		0	1.82	1.82	0.553	180.9	31.3	
TP29		B&D	1.50		9.6	2.23	2.03	2.321	43.1	19.1	
TP29		B&D	1.50		11	2.21	1.99	2.151	46.5	20.7	Natural

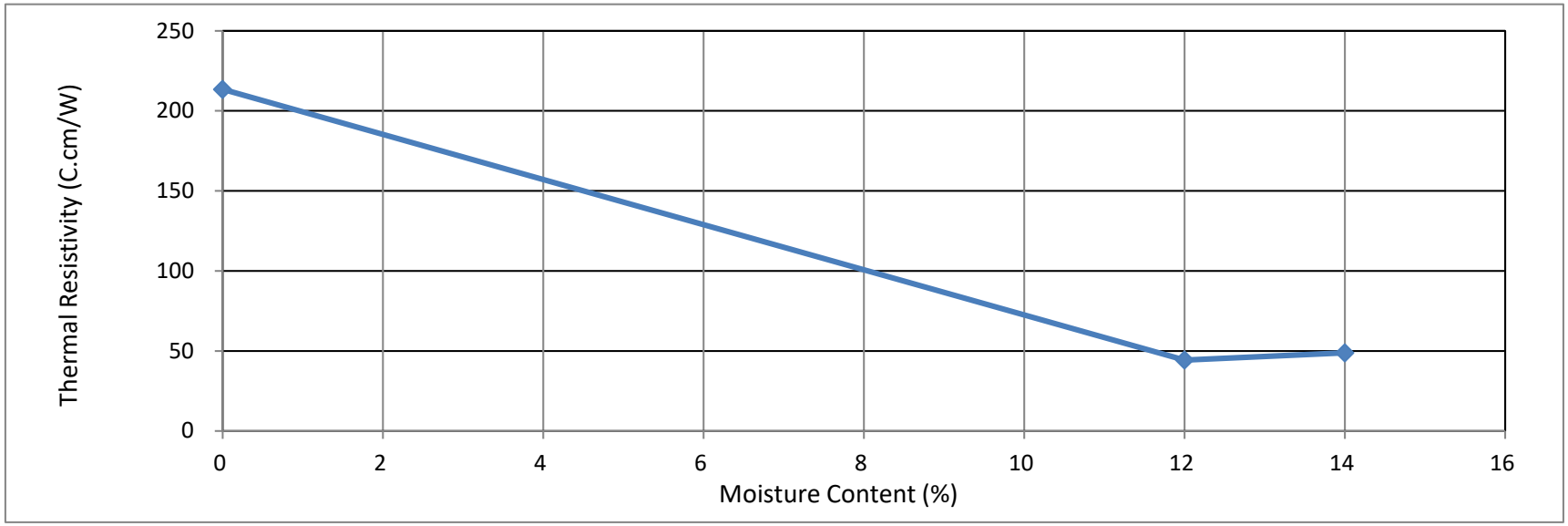


PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Coolpowra Galway**	**Contract No:** **PSL24/7255** **Client Ref:** **13999-07-24**

SUMMARY OF THERMAL PROPERTY TESTS

In accordance with ASTM-D5334

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Bulk Density Mg/m^3	Dry Density Mg/m^3	Thermal Conductivity W/m K	Thermal Resistivity C.cm/W	Test Temp C^o	Remarks
TP38		B&D	0.50		0	1.76	1.76	0.468	213.5	26.4	
TP38		B&D	0.50		12	2.19	1.96	2.259	44.3	18.7	
TP38		B&D	0.50		14	2.15	1.89	2.050	48.8	20.4	Natural



PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Coolpowra Galway**	**Contract No:** **PSL24/7255** **Client Ref:** **13999-07-24**

Old School Building
Ughtyneill
Moynalty
Co.Meath

Geotechnical and Soil Testing Services Ltd

CONTRACT	Coolpowra Galway	**REPORT NO:**	**SA 2407 PLI**
CLIENT NO.	C028	**JOB NO:**	**GII 337**
CLIENT	Ground Investigations Ireland		
ADDRESS	Catherinestown House	**DATE:**	**18/10/2024**
	Hazelhatch Road		
	Newcastle D22 YD52		

TEST REPORT FOR DETERMINATION OF POINT LOAD INDEX

Single Diametrical Determination in accordance with ISRM 1985

Sample Number		SA2407 to SA 2427
Sampled By		Client
Sampled Date		08/10/2024
Received Date		08/10/2024
Sample Source/Location	*	Coolpowra Galway
Depth /Location	*	Coolpowra Galway
Sample Description		Rock core
Rock Type tested		Core
Sample Ref / Identification		See table of Results
Date Start Test		26/09/24
Date Tested		26/09/24
Deviations from Standard		None

Test Results

Sample No.	BH No.	Average Diameter	Height/ Length	Distance between contact point and free end	Load at Failure (kN)	IS(50) Mpa	Density (Mg/M3)
2407	BH01 @3.56-3.70m	63.50	160.00	>0.5	20.71	**4.74**	2.53
2409	BH01 @4.20-4.39m	63.50	210.00	>0.5	18.71	**4.28**	2.63
2410	BH02 @5.72-5.90m	63.50	200.00	>0.5	14.73	**3.37**	2.63
2412	BH02 @7.45-7.55m	63.50	110.00	>0.5	9.17	**2.10**	2.61
2414	BH03 @2.97-3.05m	63.50	215.00	>0.5	14.31	**3.28**	2.65
2415	BH03 @3.40-3.55m	63.50	195.00	>0.5	9.47	**2.17**	2.62
2416	BH04 @2.35-2.48m	63.50	165.00	>0.5	11.51	**2.64**	2.62
2417	BH04 @2.75-2.86m	63.50	190.00	>0.5	7.93	**1.82**	2.61
2420	BH05 @3.45-3.57m	63.50	180.00	>0.5	11.40	**2.61**	2.63
2421	BH05 @4.10-4.30m	63.50	225.00	>0.5	14.02	**3.21**	2.63
2423	BH06 @2.90-2.98m	63.50	125.00	>0.5	9.00	**2.06**	2.63
2424	BH06 @3.11-3.20m	63.50	130.00	>0.5	7.89	**1.81**	2.63
2426	BH07 @2.95-3.02m	63.50	145.00	>0.5	5.86	**1.34**	2.65
2427	BH07 @4.15-4.35	63.50	230.00	>0.5	8.04	**1.84**	2.64

Notes: *Specimens prepared and tested in accordance with suggested method from

International Society for Rock Mechanics (ISRM), 1985

This test report shall not be reproduced except in full,without the prior written approval of the laboratory.

Results relate only to the sample tested and apply to sample as receieved.

(*)Denotes sample information above has been provided by the client.

Signed: _ **Date:** ___ 18/10/2024

for Geotechnical and Soil Testing Services Ltd

Authorised signatories : G. Reilly

End of Report

Old School Building
Ughtyneill
Moynalty
Co.Meath

Geotechnical and Soil Testing Services Ltd

CONTRACT Coolpowra Galway
CLIENT NO. C028
CLIENT Ground Investigations Ireland
ADDRESS Catherinestown House
Hazelhatch Road
Newcastle D22 YD52

REPORT NO: **SA 2408 UCS**
JOB NO: **GII 337**

DATE: 18/10/2024

TEST REPORT FOR DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH
of Rock cores in accordance with ISRM 1985

Sample Number	SA2408	SA 2425
Sampled By	Client	
Sampled Date	08/10/2024	
Received Date	08/10/2024	
Sample Source/Location	* Coolpowra Galway	
Depth /Location	See table of Results	
Sample Description	Rock core	
Rock Type tested	Core	
Sample Ref / Identification	See table of Results	
Date Start Test	26/09/24	
Date Tested	26/09/24	
Deviations from Standard	None	

Test Results

Sample No.	BH No. / Depth	Average Diameter	Height/ Length	Length / Dia Ratio	Load at Failure (kN)	Unconfined Compressive Strength **(Mpa)**	Density (Mg/M3)
2408	BH01 @3.90-4.12m	63.50	152.20	2.40	68.00	**21.50**	2.63
2411	BH02 @6.30-6.50m	63.50	161.00	2.54	132.20	**41.70**	2.57
2413	BH03 @2.52-2.66m	63.50	154.30	2.43	123.80	**39.00**	2.66
2418	BH04 @4.25-4.45m	63.50	167.20	2.63	54.70	**17.20**	2.63
2419	BH05 @2.20-2.47m	63.50	157.00	2.47	104.80	**33.00**	2.66
2422	BH06 @2.60-2.85m	63.50	158.80	2.50	102.30	**32.20**	2.64
2425	BH07 @2.45-2.70m	63.50	157.30	2.48	109.50	**34.60**	2.65

Notes: *Specimens prepared and tested in accordance with suggested method from
International Society for Rock Mechanics (ISRM), 1985

This test report shall not be reproduced except in full,without the prior written approval of the laboratory.

Results relate only to the sample tested and apply to sample as receieved.

(*)Denotes sample information above has been provided by the client.

Signed: _____ **Date:** ___ 18/10/2024

for Geotechnical and Soil Testing Services Ltd

Authorised signatories : G. Reilly

End of Report

APPENDIX 9 – Geophysical Survey

AGP24105_01

Report on the Geophysical Investigation For the Coolpowra Power plant Co. Galway For Ground Investigations Ireland Limited

6TH December 2024

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W: www.apexgeophysics.com

PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOPHYSICS LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGP24105		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
TONY LOMBARD M.SC. (GEOPHYSICS) & SEBASTIAN CORRALES B.SC. (GEOPHYSICS)	DR. YVONNE O'CONNELL P.GEO, EURGEOL , PH.D., M.SC. (GEOPHYSICS)	01	6TH DECEMBER 2024

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1. EXECUTIVE SUMMARY

APEX Geophysics Limited was commissioned by Ground Investigations Ireland Limited to carry out a geophysical investigation for the proposed Coolpowra Power Plant, County Galway. The purpose of the geophysical investigation was to provide information on the sub-soil conditions across the site including type, thickness and stiffness of the soils, depth to bedrock, type, quality and excavatability of bedrock, the presence of faults, fissures and possible karst features within the bedrock.

The site is located south of Oldstreet Substation, situated approximately 5.1 km north of the town of Portumna in County Galway. The area surveyed is c. 20.4 ha in extents and comprises of open agricultural land. The topography rises from 47.1 mOD in the northwest to 54.8 mOD in the north.

The Geological Survey of Ireland (GSI) Quaternary sediments map for the area indicates the site is in an area of till derived from limestones. The GSI bedrock map indicates the site is underlain by dark grey to black bedded limestone and shale of the Lucan Formation. Though karst features are atypical in the Lucan Formation, the GSI Karst Database indicates the nearest karst feature is a spring >13 km north of the site.

Trial pits and soakaway pits generally encountered topsoil and made ground over soft to very stiff sandy gravelly clay, silty clay, clayey gravelly sand and clayey sandy gravel. The coreholes generally encountered thin topsoil, stiff-very stiff sandy gravelly clay and dense clayey sandy gravel and possible weathered rock over slightly weathered to fresh argillaceous LIMESTONE at depths of 2.0 to 5.3 m bgl.

The survey was carried out over a number of sessions between the 12th of August and the 23rd of October 2024 and involved the collection of EM ground conductivity data, seven Electrical Resistivity Tomography (ERT) profiles at locations specified by the client and 12 seismic refraction profiles.

The combined geophysical and direct investigation data have been interpreted as indicating the following subsurface layers:

- **Layer 1** - a thin upper layer of predominantly soft sandy gravelly clay with loose clayey sand/gravel soils 0.3 to 1.8 m thick (average 1.0 m).
- **Layer 2** - a layer of predominantly firm to stiff sandy gravelly clay and medium dense to dense clayey sand/gravel to depths ranging from 0.8 to 9.0 m bgl (average 3.5 m). No distinct weathered rock layer could be interpreted from the geophysical data however two trial pits encountered weathered rock and one corehole encountered 1.0 m of possible weathered bedrock. As such, the base of Layer 2 may comprise of highly to moderately weathered rock which would be diggable to marginally rippable.
- **Layer 3** - slightly weathered to fresh rock at elevations ranging from 41.8 to 52.8 mOD. The seismic velocities indicate that the rock is of good quality and any excavation will require heavy breaking/blasting if within proposed construction depth.

Two bedrock types have been interpreted; predominantly high resistivity (300-1,000 Ohm-m) dark limestone with thin interbedded shales with some areas of low resistivity (100-300 Ohm-m) mudstone/shale. A number of possible NE-SW faults are also interpreted across the site.

If bedrock excavation is proposed, a detailed assessment of excavatability should be carried out combining the results of the geophysical survey, rotary core drilling, strength testing and trial excavation pits using a high-powered excavator such as a CAT 336E or more powerful model. Trial excavations should be attempted down to formation level using a high-powered excavator of similar rating to that to be used during construction.

The findings of the geophysical investigation should be reviewed following any further direct investigation.

2. INTRODUCTION

APEX Geophysics Limited was commissioned by Ground Investigations Ireland Limited to carry out a geophysical investigation for the proposed Coolpowra Power Plant, County Galway. The purpose of the geophysical investigation was to provide information on the sub-soil conditions across the site.

2.1 Survey Objectives

The objectives of the investigation were to provide information on:

- Type, thickness and stiffness of the soils.
- Depth to bedrock.
- Type, quality and excavatability of bedrock.
- The presence of faults, fissures and possible karst features within the bedrock.

2.2 Site Background

The site is located south of Oldstreet Substation, situated approximately 5.1 km north of the town of Portumna in County Galway (Fig. 2.1). The area surveyed is c. 20.4 ha in extent and comprises of open agricultural land. The topography rises from 47.1 mOD in the northwest to 54.8 mOD in the north.

Fig 2.1: Location map.

2.2.1 Soils

The Geological Survey of Ireland (GSI) Quaternary sediments map for the area (GSIa, 2019) indicates the site is in an area of till derived from limestones (Fig. 2.2). An area of eskers comprised of gravels is shown to the east of the site and an area of bedrock outcrop or subcrop is shown to the southwest.

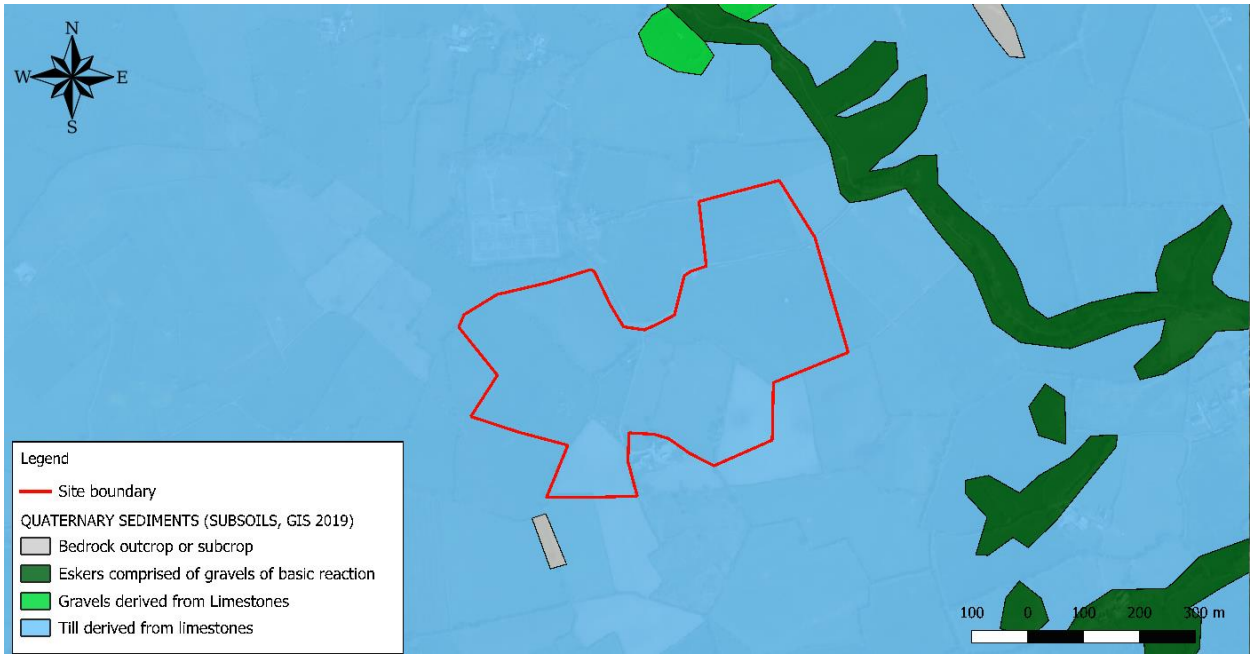

Fig 2.2: The GSI Quaternary sediments map.

2.2.2 Geology

The GSI 1:100k Bedrock Geology map (GSI, 2018) indicates that the site is underlain by dark grey to black bedded limestone and shale of the Lucan Formation ('Calp') (Fig. 2.3). Though karst features are atypical in the Lucan Formation, the GSI Karst Database indicates the nearest karst feature within this formation is a spring >13 km north of the site.

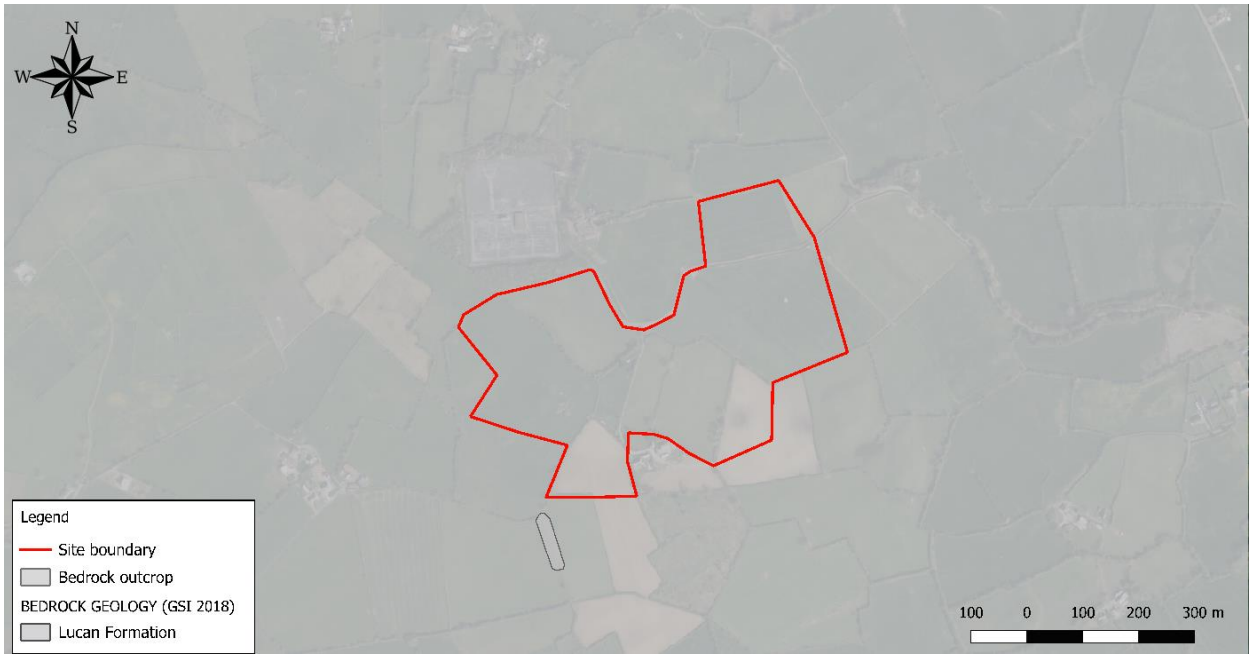

Fig 2.3: The GSI bedrock map.

2.2.3 Groundwater

The groundwater vulnerability rating (GSIb, 2019) for the site is classified 'Moderate' to 'High' in the west of the site (Fig. 2.4). The Lucan Formation is classified (GSIc, 2019) as a 'locally important aquifer – bedrock which is moderately productive only in local zones.'

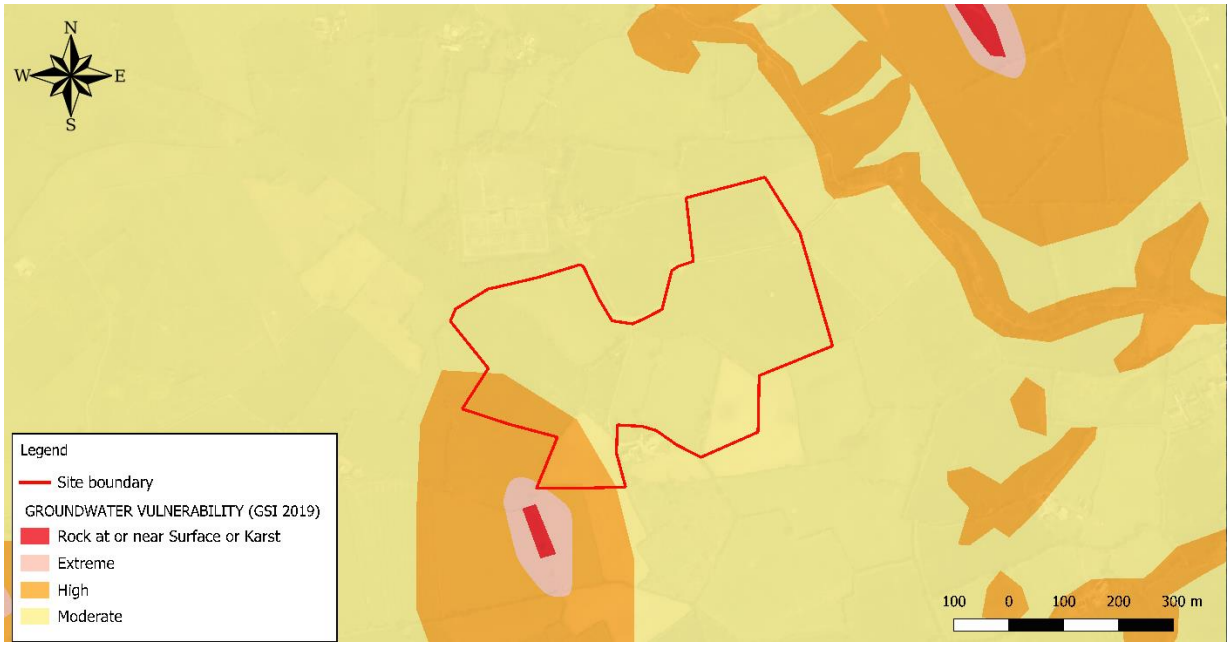

Fig 2.4: The GSI groundwater vulnerability classification map.

2.2.4 Historical Mapping Data

The historical 6'' inch sheet (Fig. 2.5) notes 'Undulating drift' to the north of the site, 'Rocky clayey gravel in small mounds' to the southeast and 'black limestone' c. 100 m to the south of the site.

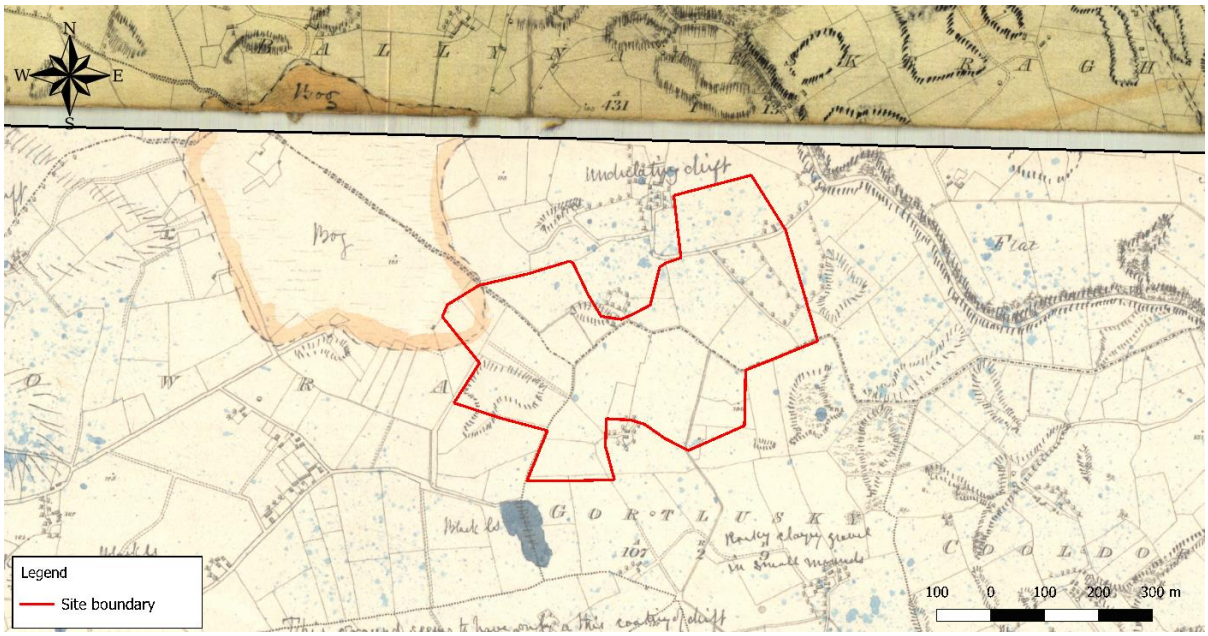

Fig 2.5: The GSI 6-inch geological mapping.

2.2.5 Direct Investigation

Thirty eight trial pits, ten soakaway pits and seven rotary coreholes were completed between 10th September and 2nd October 2024.

The trial pits and soakaway pits generally encountered 0.2 to 0.4 m of topsoil with 0.3 to 2.8 m of made ground of sandy gravelly clay and sandy gravel encountered in six trial pits (TP 07, TP08, TP14, TP17, TP 21 and TP29) over soft to very stiff sandy gravelly clay, silty clay, clayey gravelly sand and clayey sandy gravel. Very soft peat was encountered in one trial pit (TP18) to 0.8 m bgl and weathered rock was encountered in two pits (SK04 and TP17) at depths of 0.6 to 2.2 m bgl. With the exception of nine trial pits (TP05, TP07, TP08, TP10, TP11, TP20, TP26, TP32 and TP33) all trial pits and soakaway pits terminated on obstructions due to possible bedrock or boulders at depths of 1.5 to 3.0 m bgl.

The coreholes generally encountered thin topsoil (in BH05 to BH07), stiff-very stiff sandy gravelly clay and dense clayey sandy gravel and possible weathered rock (Driller's note) over rock. Slightly weathered to fresh argillaceous LIMESTONE was encountered at depths of 2.0 to 5.3 m bgl to termination depths of 6.5 m 10.7 m bgl.

2.3 Survey Rationale

The investigation consisted of EM ground conductivity, 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction profiling:

EM ground conductivity mapping operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated to give apparent ground conductivity in milliSiemens/metre (mS/m). This technique provides information on the shallow (0-6m below ground level) variation of the superficial deposits.

ERT images the resistivity of the materials in the subsurface along a profile to produce a 2-dimensional cross-section showing the variation in resistivity with depth, depending on the length of the profile. Each cross-section is interpreted to determine the material type along the profile at increasing depth, based on the typical resistivities returned for Irish ground materials.

P-wave Seismic Refraction profiling measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. By combining a number of techniques, it is possible to provide a higher quality interpretation and reduce any ambiguities which may otherwise exist. Further information on the detailed methodology of each geophysical method employed in this investigation is given in **APPENDIX A: DETAILED METHODOLOGY**.

3. RESULTS

The survey was carried out over a number of sessions between the 12th of August and the 23rd of October 2024 and involved the collection of EM ground conductivity data, seven ERT profiles (R1-R7) at locations specified by the client and 12 seismic refraction profiles (S1 – S12). The survey locations are shown on Drawing AGP24105_01 (Appendix D).

3.1 EM Ground Conductivity Mapping

The contoured EM ground conductivity results (Drawing AGP24105_02) are indicative of the bulk conductivity of the ground materials from 0 - 6.0 m bgl. Recorded values are in the range of 4.0 to 16.0 mS/m and these have been generally interpreted in conjunction with the ERT and seismic refraction data as follows:

Conductivity (mS/m)	Interpretation
4.0-8.0	Clayey SAND/GRAVEL and Sandy gravelly CLAY over rock
8.0-16.0	Predominantly Sandy gravelly CLAY over rock

3.2 ERT

The ERT results are presented on Drawings AGP24105_R1 to AGP24105_R7. The modelled resistivity values have been interpreted in conjunction with the trial pit and corehole information as follows:

Resistivity (Ohm-m)	Interpretation
64-250	Sandy gravelly CLAY
250-500	Clayey SAND/GRAVEL or weathered rock
100-300	MUDSTONE/SHALE
300-1,500	Dark LIMESTONE with thin interbedded SHALES

3.3 Seismic Refraction Profiling

The seismic data were analysed as tomographic inversions and layered models. The resultant data are plotted on Drawings AGP24105_R1 to AGP24105_R7 and indicate 3 velocity layers which have been interpreted in conjunction with the trial pit and corehole information as follows:

Layer	Seismic Velocity (m/s)	Average Seismic Vel. (m/s)	Interpretation*	Estimated Stiffness/ Rock Quality	Estimated Excavatability
1	240-428	328	Soil	Soft/Loose	Diggable
2	609-1569	1047	Soil	Firm-Stiff / Medium Dense-Dense	
			Highly to Moderately Weathered Rock	Poor-Fair	Diggable – Marginally Ripp.
3	3876-5116	4490	Sightly Weathered to Fresh Rock	Good	Heavy Break/Blast

3.4 Integrated Interpretation

The combined geophysical and direct investigation data are plotted on Drawings AGP24105_R1 to AGP24105_R7 and have been interpreted as indicating the following subsurface layers:

- **Layer 1** - a thin upper layer of predominantly soft sandy gravelly clay or loose clayey sand/gravel soils ranging from 0.3 to 1.8 m thick (average 1.0 m).

- **Layer 2** - a layer of predominantly firm to stiff sandy gravelly clay and/or medium dense to dense clayey sand/gravel to depths ranging from 0.8 to 9.0 m bgl (average 3.5 m). No distinct weathered rock layer could be interpreted from the geophysical data however two trial pits (TP17 and SK04) encountered 0.9 to 1.2 m of weathered rock returned as clayey sandy gravel and one corehole (BH06) encountered 1.0 m of possible weathered bedrock. As such, the base of Layer 2 may comprise of highly to moderately weathered rock which the seismic velocities indicate would be diggable to marginally rippable.
- **Layer 3** - slightly weathered to fresh rock at elevations ranging from 41.8 to 52.8 mOD. The seismic velocities indicate that the rock is of good quality and any excavation will require heavy breaking/blasting if within the proposed construction depth.

The interpreted soil thickness (Layers 1 and 2 combined) is contoured on Drawing AGP23147_03 and ranges from 0.8 m in the south of the site to 9.0 m in the northwest, where there is a localised thickening of sandy gravelly clay soil (Drawing AGP24105_R7). The top of the slightly weathered to fresh rock has been interpreted at elevations ranging from 41.8 mOD in the northwest to 52.8 mOD in the northeast and is contoured on Drawing AGP24105_04.

While there is generally a good correlation between the geophysical data and depth to bedrock encountered in the coreholes, the geophysical data indicates the diggable weathered rock encountered in the trial pits (TP17 and SK04) generally lies within Layer 2 material.

Two bedrock types have been interpreted; predominantly high resistivity (300-1,000 Ohm-m) dark limestone with thin interbedded shales with some areas of low resistivity (100-300 Ohm-m) rock interpreted as mudstone/shale on profiles R2, R3, R4, R6 and R7.

A number of zones of lower bedrock resistivities are present on NW-SE trending ERT profiles (see Drawings AGP24105_R2, R3, R4, R6 and R7). These zones could be indicative of a change in rock lithology (i.e. an increase in shale content) or increased weathering/fracturing/ faulting.

These zones have been interpreted as indicating possible NE-SW faulting as the seismic data across these zones does not indicate the presence of lower velocity zones indicative of weathered/fractured rock. The interpreted fault locations, the lateral extent of which is unclear, are indicated on Drawings AGP24105_03 and AGP24150_04.

NOTE: The maps shown on Drawings AGP24105_02 to AGP24105_04 include a degree of interpolation and extrapolation between the measured geophysical data points and direct investigation data, and reference to the type, number and location of these points should be made when assessing the significance of these data.

4. RECOMMENDATIONS

If bedrock excavation is proposed, a detailed assessment of excavatability should be carried out combining the results of the geophysical survey, rotary core drilling, strength testing and trial excavation pits using a high-powered excavator such as a CAT 336E or more powerful model. Trial excavations should be attempted down to formation level using a high-powered excavator of similar rating to that to be used during construction. A more detailed discussion of velocity and excavatability is contained in Appendix B.

The findings of the geophysical investigation should be reviewed following any further direct investigation.

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Groundwater Vulnerability Shapefile. http://www.gsi.ie/Mapping.htm

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Quaternary Subsoils Shapefile. http://www.gsi.ie/Mapping.htm

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APPENDIX A: DETAILED METHODOLOGY

A combination of geophysical techniques was used to provide a high-quality interpretation and reduce any ambiguities, which may otherwise exist.

EM Ground Conductivity Mapping

Principles

This is an electromagnetic technique used to investigate lateral variations in overburden material and to assist with the indication of the depth to bedrock. This method operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated to give apparent ground conductivity in milliSiemens/metre (mS/m). Readings over material such as organic waste and peat give high conductivity values while readings over dry materials with low clay mineral content such as gravels, limestone or quartzite give low readings. The EM31 survey technique determines the apparent conductivity of the different overburden layers from 0-6m bgl depending on the dipole mode used.

Data collection

The EM31 equipment used was a GF CMD-4 conductivity meter equipped with data logger. This instrument features a real time graphic display of the previous 20 measurement points to monitor data quality and results. Conductivity and in-phase values were recorded across the site. Local conditions and variations were recorded.

Data processing

The conductivity and in-phase field readings were downloaded, contoured and plotted using the SURFER 12 program (Golden Software, 2015). Data which was affected by metallic objects was removed. Assignation of material types and possible anomaly sources was carried out, with cross-reference to other data.

Electrical Resistivity Tomography

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the overburden material as well as on the underlying overburden and bedrock.

Principles

This surveying technique makes use of the Gradient resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. This method involves the use of electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

Data Collection

Profiles were recorded using an ABEM LS4 resistivity meter, imaging software, four 21 takeout multicore cables and up to 64 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after surveying.

Data Processing
The field readings were stored in computer files and inverted using the RES2DINV package (Geotomo Software, 2006) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-depth model of the resistivities.

The inverted 2D resistivity models and corresponding interpreted geology are displayed on the accompanying drawings alongside the processed seismic sections. Profiles have been contoured using the same contour intervals and colour codes. Distance is indicated along the horizontal axis of the profiles.

Seismic refraction profiling

Principles
This method measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

Seismic profiling measures the p-wave velocity (Vp) of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher Vp velocities while soft, loose or fractured materials have lower Vp velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

Data Collection
A Geode high resolution 24 channel digital seismograph, 24 x 10HZ vertical geophones and a 10 kg hammer were used to provide first break information, with a 24 take-out cable (2m spacing). Equipment was carried was operated by a two-person crew.

Readings are taken using geophones connected via multi-core cable to a seismograph. The depth of resolution of soil/bedrock boundaries is determined by the length of the seismic spread, typically the depth of resolution is about one third the length of the profile (eg. 46m profile ~15m depth). Shots from seven different positions were taken (2 x off-end, 2 x end, 3 x middle) to ensure optimum coverage of all refractors.

Data Processing
The recorded data was processed and interpreted using the ray-tracing and tomographic inversion methods, to acquire depths to boundaries and the P-wave velocities of these layers, using the SeisImager/2D programme from Geometrics.
SeisImager/2D interprets seismic refraction data as a laterally varying layered earth structure. The programme includes three methods for data analysis, time-term inversion, the reciprocal method and tomography.

The tomography method creates an initial velocity model, then traces rays through the model, comparing the calculated and measured traveltimes. The model is then modified and the process repeated to minimise the difference between the calculated and measured times. The data was processed using this method and was then converted to a layer model for display and interpretation.

Approximate errors for Vp velocities are estimated to be +/- 10%. Errors for the calculated layer thicknesses are of the order of +/-20%. Possible errors due to the "hidden layer" and "velocity inversion" effects may also occur (Soske, 1959).

Spatial Relocation & Survey Locations

All ERT and Seismic Refraction locations were acquired using a Trimble R10 high-accuracy GNSS handheld system using the settings listed below. This system allows collection of GPS data with c.20mm accuracy.

Projection:	Irish Transverse Mercator (ITM)
Datum:	IRENET95
Coordinate units:	Metres
Altitude units:	Metres
Survey altitude reference:	MSL
Geoid model:	OSGM15_Malin

APPENDIX B: EXCAVATABILITY

The seismic velocity of a rock formation is related to characteristics of the rock mass which include rock hardness and strength, degree of weathering and discontinuities. Usually the velocity is just one of several parameters used in the assessment of excavatability. The excavatability of a rock formation is favoured by the following factors:

- Open fractures, faults and other planes of weakness of any kind
- Weathering
- Brittleness and crystalline nature
- High degree of stratification or lamination
- Large grain size
- Low compressive strength

Weaver (1975) presented a comprehensive rippability rating chart (Fig.1) in which the p-wave velocity value and the relevant geological factors could be entered and assigned appropriate weightings. The total weighted index was found to correlate very well with actual rippability.

Fig.1 Rippability Rating Chart

Rock class	I	II	III	IV	V
Description	Very good rock	Good rock	Fair rock	Poor rock	Very poor rock
Seismic velocity (m/s)	>2150	2150-1850	1850-1500	1500-1200	1200-450
Rating	26	24	20	12	5
Rock hardness	Extremely hard rock	Very hard rock	Hard rock	Soft rock	Very soft rock
Rating	10	5	2	1	0
Rock weathering	Unweathered	Slightly weathered	Weathered	Highly weathered	Completely weathered
Rating	9	7	5	3	1
Joint spacing (mm)	>3000	3000-1000	1000-300	300-50	<50
Rating	30	25	20	10	5
Joint continuity	Non continuous	Slightly continuous	Continuous-no gouge	Continuous-some gouge	Continuous-with gouge
Rating	5	5	3	0	0
Joint gouge	No separation	Slight separation	Separation <1mm	Gouge <5mm	Gouge >5mm
Rating	5	5	4	3	1
Strike and dip orientation	Very unfavourable	Unfavourable	Slightly unfavourable	Favourable	Very favourable
Rating	15	13	10	5	3
Total rating	100-90	90-70*	70-50	50-25	<25
Rippability assessment	Blasting	Extremely hard ripping and blasting	Very hard ripping	Hard ripping	Easy ripping
Tractor horsepower		770/385	385/270	270/180	180
Tractor kilowatts		575/290	290/200	200/135	135

APPENDIX C: SEISMIC REFRACTION PLATES

The tomographic inversion plates for the seismic refraction spreads are shown below:

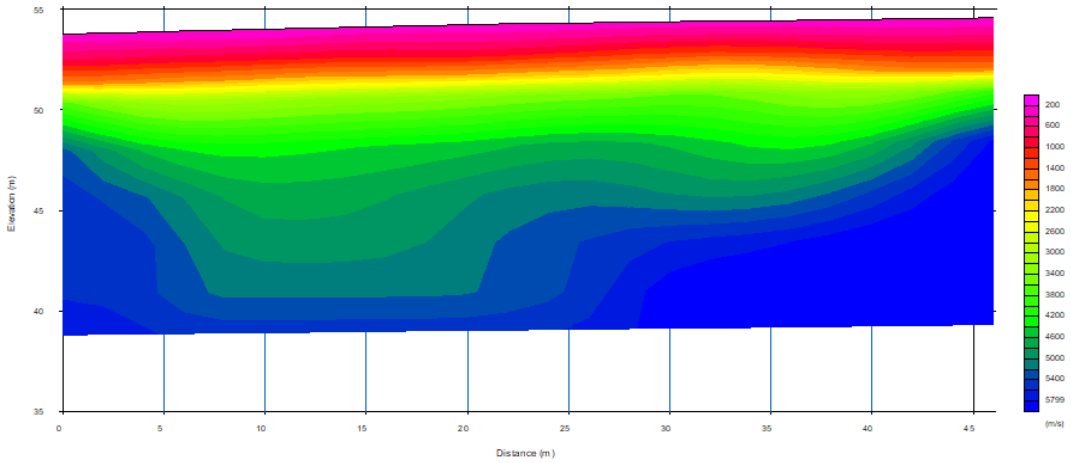


Fig.C.1. Tomographic inversion for seismic refraction spread S1 (SE-NW).

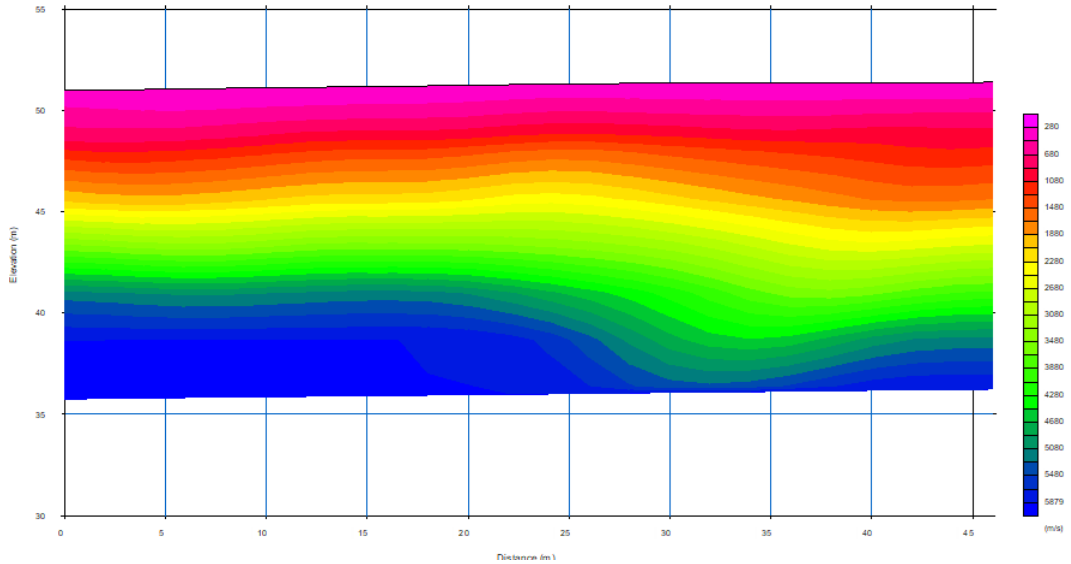


Fig.C.2. Tomographic inversion for seismic refraction spread S2 (SE-NW).

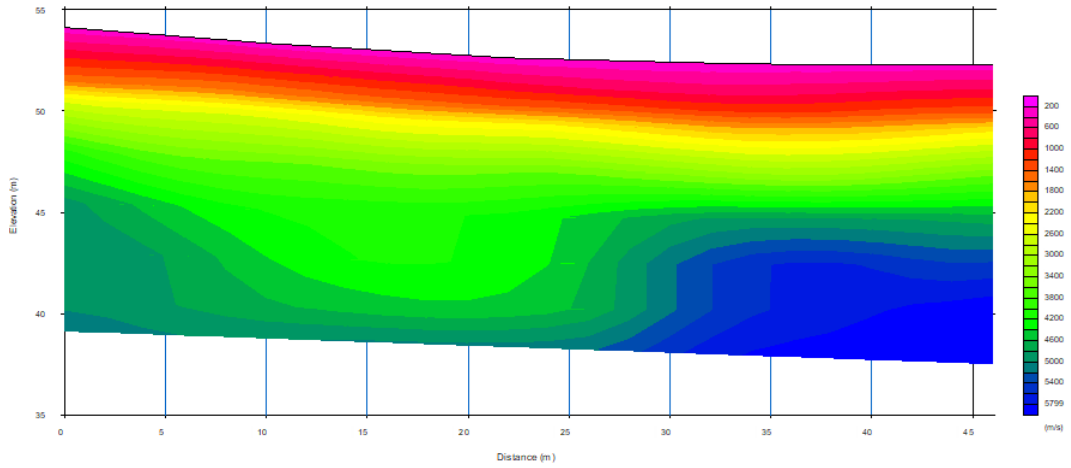


Fig.C.3. Tomographic inversion for seismic refraction spread S3 (SE-NW).

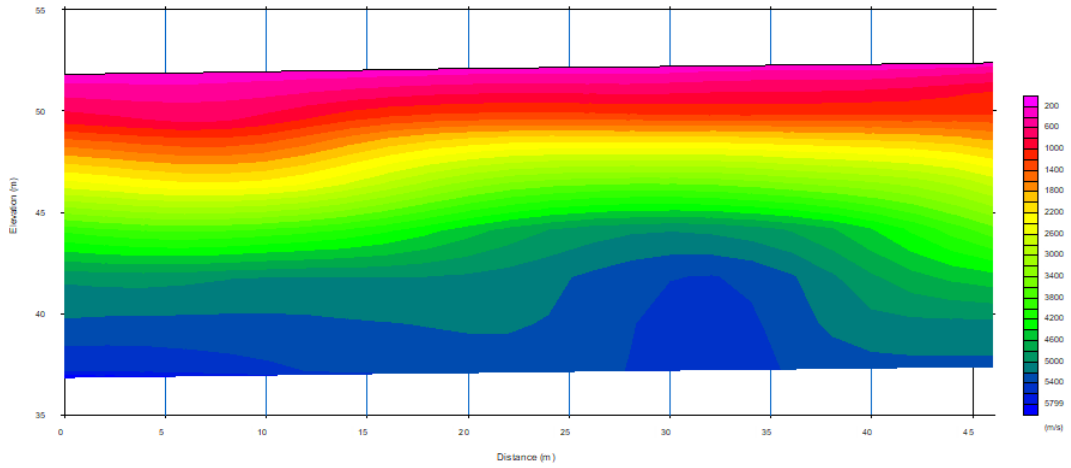


Fig.C.4. Tomographic inversion for seismic refraction spread S4 (SE-NW).

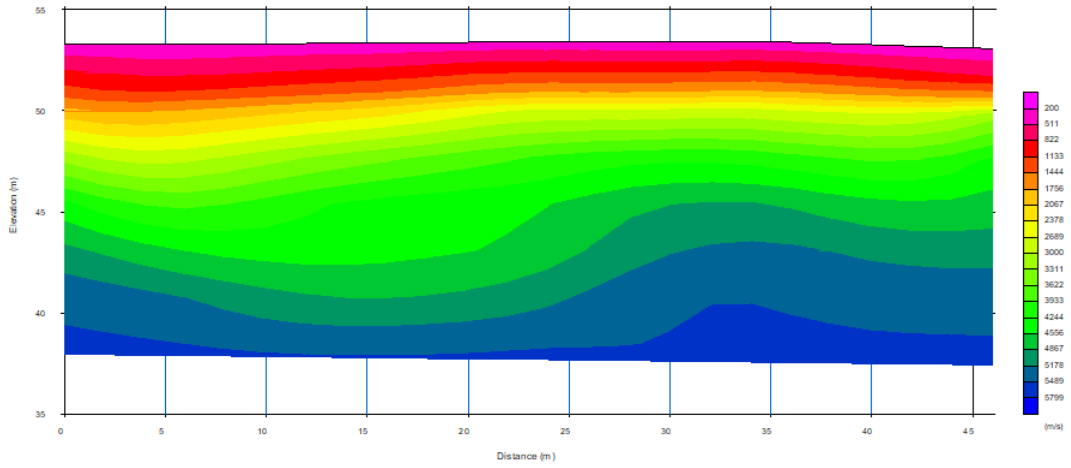


Fig.C.5. Tomographic inversion for seismic refraction spread S5 (SE-NW).

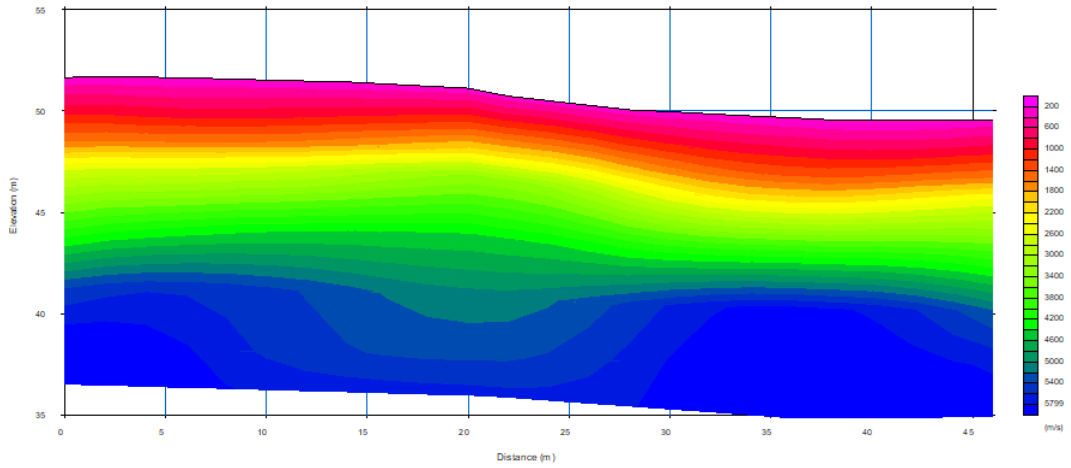


Fig.C.6. Tomographic inversion for seismic refraction spread S6 (SW-NE).

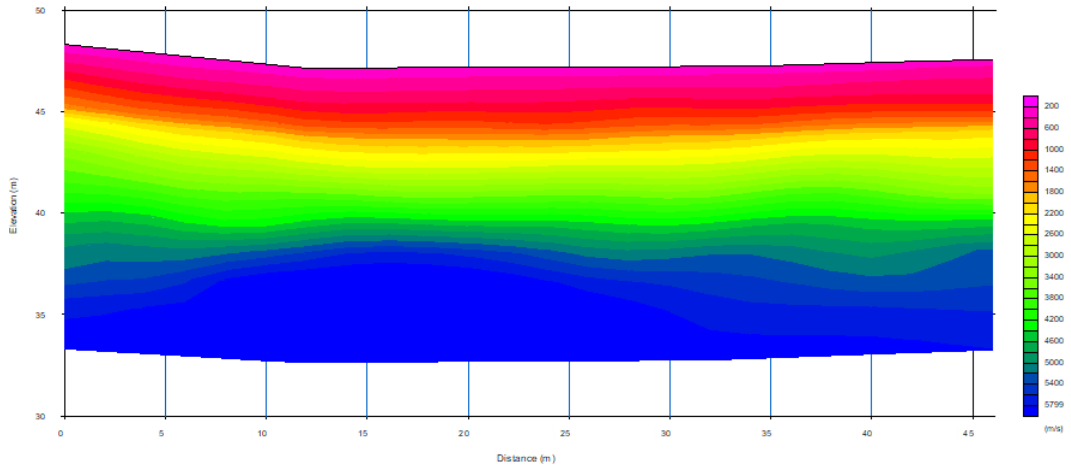


Fig.C.7. Tomographic inversion for seismic refraction spread S7 (SE-NW).

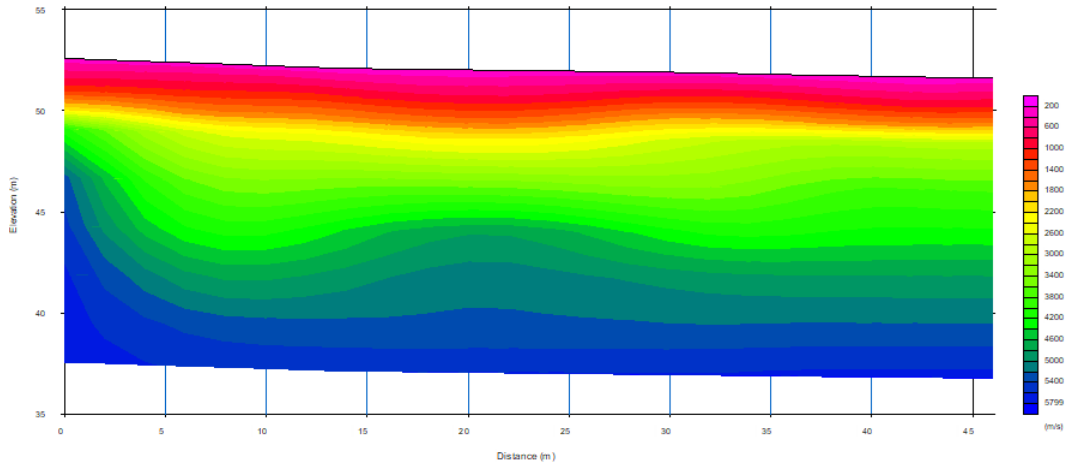


Fig.C.8. Tomographic inversion for seismic refraction spread S8 (SE-NW).

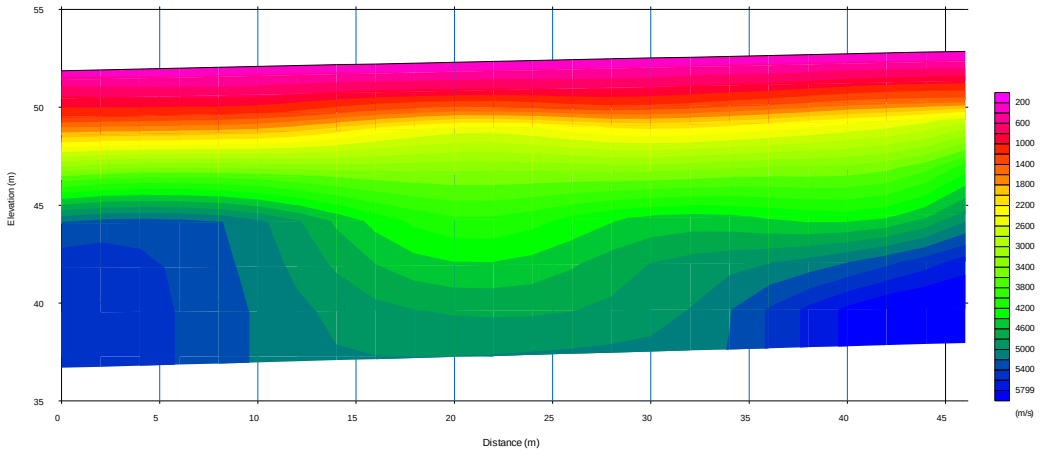


Fig.C.9. Tomographic inversion for seismic refraction spread S9 (NW-SE).

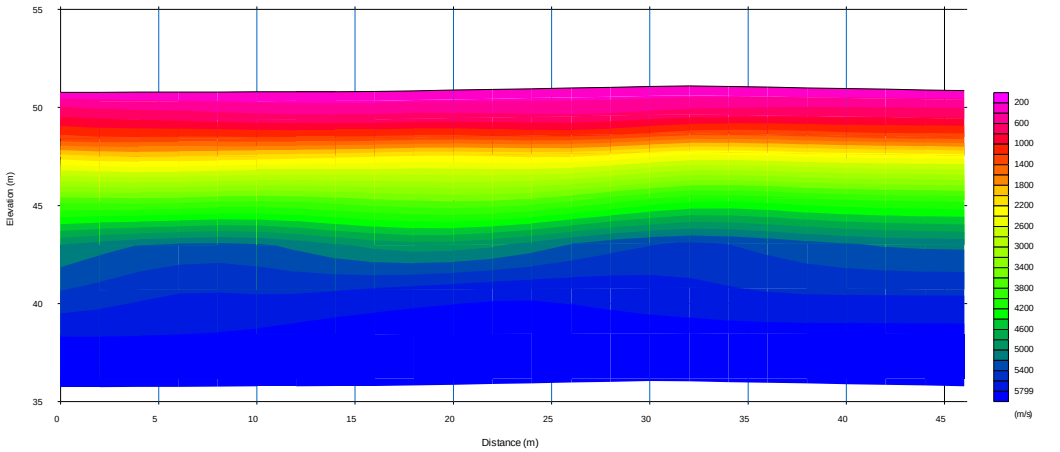


Fig.C.10. Tomographic inversion for seismic refraction spread S10 (SE-NW).

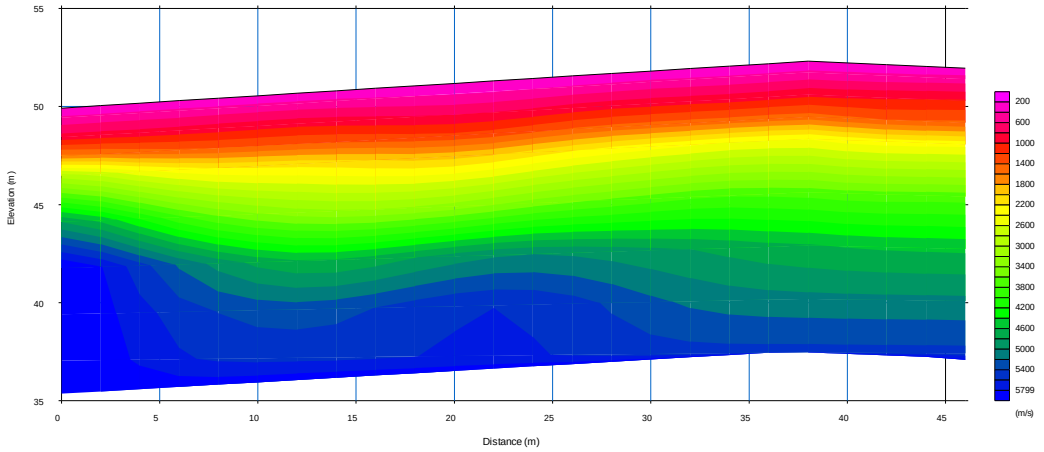


Fig.C.11. Tomographic inversion for seismic refraction spread S11 (NW-SE).

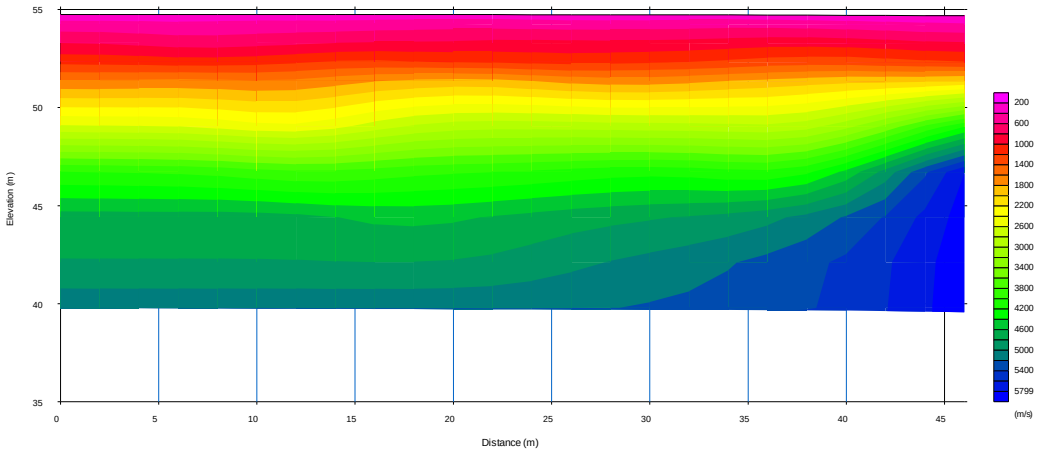


Fig.C.12. Tomographic inversion for seismic refraction spread S12 (NW-SE).

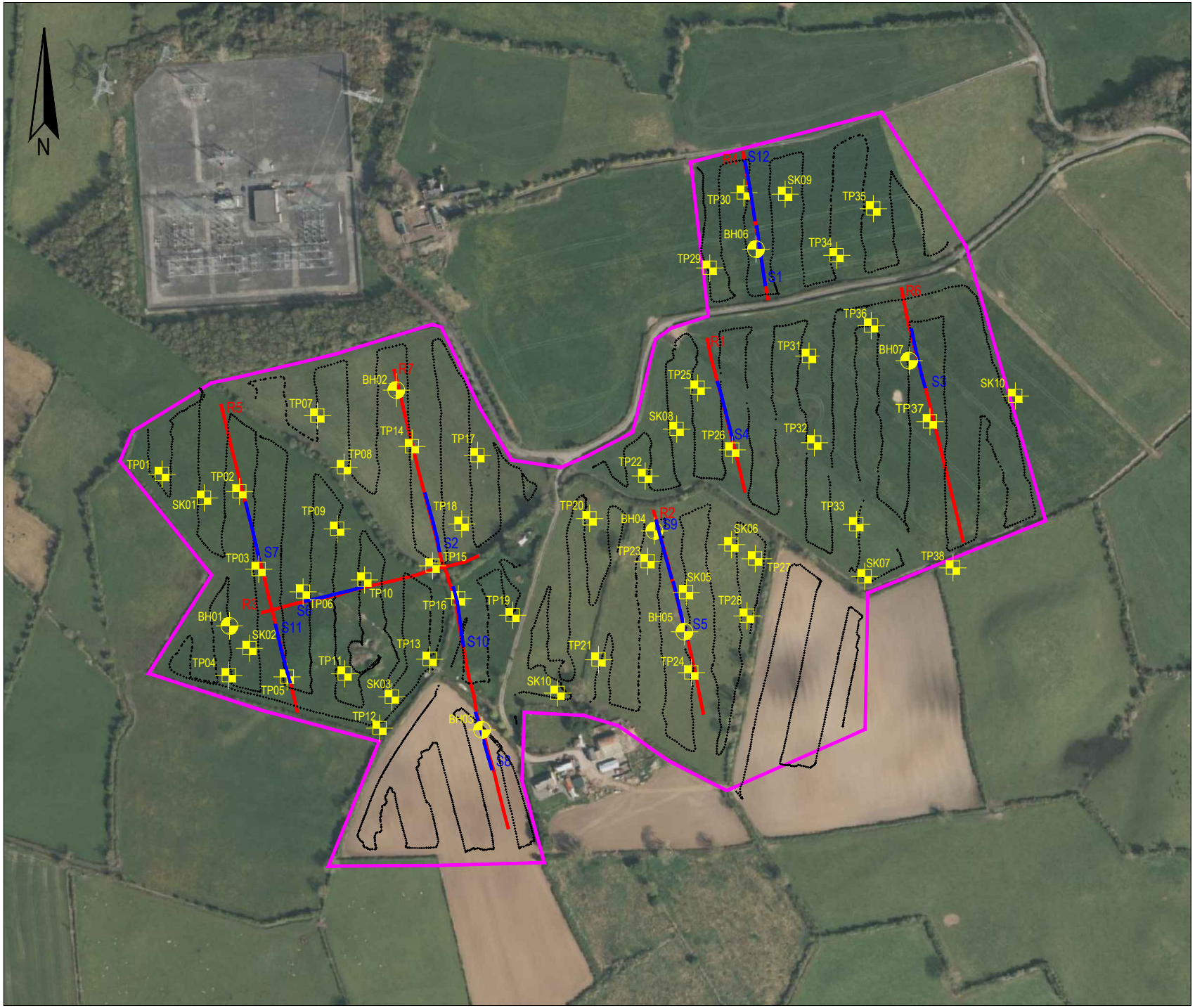
APPENDIX D: DRAWINGS

The information derived from the geophysical investigation in conjunction with the available direct investigation is presented in the following drawings:

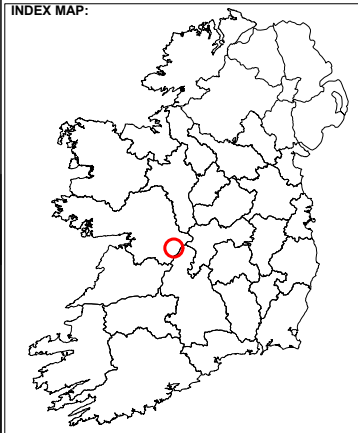
AGP24105_01	Geophysical Survey Locations	1:4000@A4
AGP24105_02	EM Ground Conductivity Results (mS/m)	1:4000@A4
AGP24105_03	Interpreted Soil Thickness Layers 1 & 2 (m)	1:4000@A4
AGP24105_04	Interpreted Top of Slightly Weathered to Fresh Rock (mOD)	1:4000@A4
AGP24105_R1	Results & interpretation – R1 & S4	1:750@A4
AGP24105_R2	Results & interpretation – R2, S5 & S9	1:750@A4
AGP24105_R3	Results & interpretation – R3 & S6	1:750@A4
AGP24105_R4	Results & interpretation – R4, S1 & S12	1:750@A4
AGP24105_R5	Results & interpretation – R5, S7 & S11	1:750@A4
AGP24105_R6	Results & interpretation – R6 & S3	1:750@A4
AGP24105_R7	Results & interpretation – R7, S2, S8 &S10	1:2000@A4

GEOPHYSICAL SURVEY LOCATIONS

SCALE 1:4000



INDEX MAP:



LEGEND:

- Site
- EM conductivity reading
- ERT profile
- Seismic refraction profile
- Borehole
- Trial pit, soakaway pit

The information displayed here is to be used in conjunction with AGP24105_01 Report on the Geophysical Investigation at Coolpowra Power Plan, Co. Galway, for GII Ltd., APEX Geophysics Ltd., 06/12/2024.

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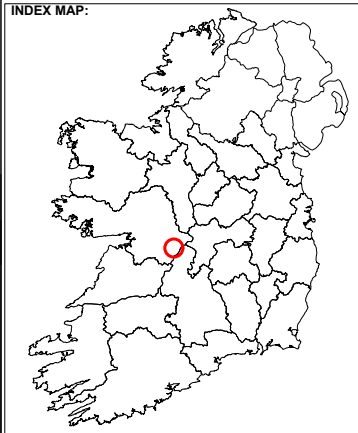
PROJECT:	COOLPOWRA POWER PLANT GEOPHYSICAL SURVEY
CLIENT.:	GROUND INVESTIGATIONS IRELAND LTD
DRAWING NO:	AGP24105_01
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

Version:	Date:	Drawn By:	Checked:
01	06-12-2024	SC	TL

EM GROUND CONDUCTIVITY RESULTS (mS/m)

SCALE 1:4000

INDEX MAP:



LEGEND:

Site

3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

(mS/m)

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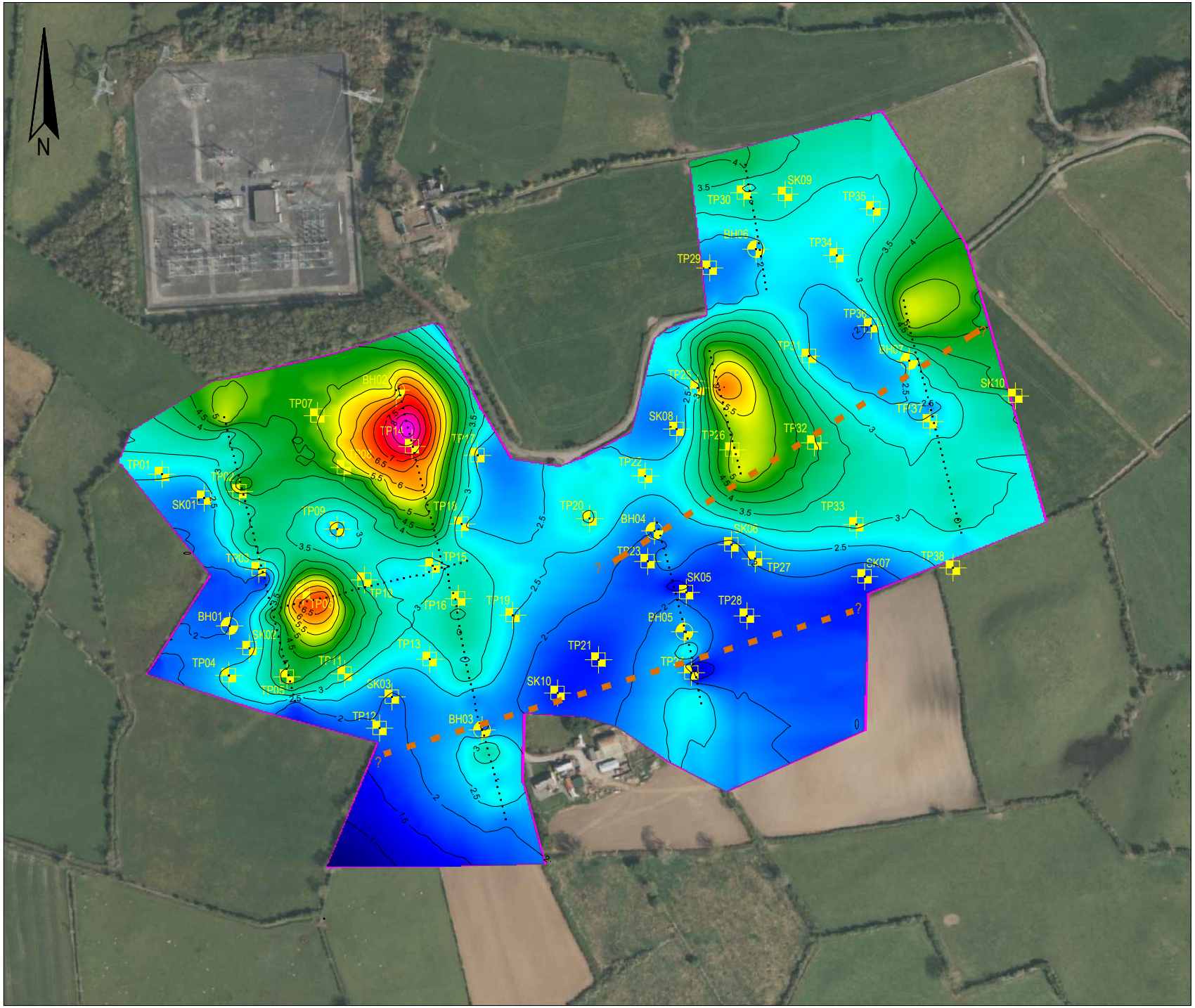
DATE:	06-12-2024

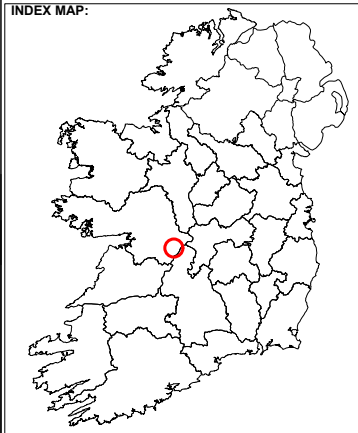
Version:	Date:	Drawn By:	Checked:
01	06-12-2024	SC	TL

INTERPRETED SOIL THICKNESS LAYERS 1 & 2 (m)

SCALE 1:4000



INDEX MAP:



LEGEND:

- Site
- Data point
- 1 2 3 4 5 6 7 8 9 (m)
- borehole
- trial pit, soakaway pit
- Possible fault

Maps displayed here are produced based on interpolation and extrapolation between discrete data points and should be used accordingly.

The information displayed here is to be used in conjunction with AGP24105_01 Report on the Geophysical Investigation at Coolpowra Power Plan, Co. Galway, for GII Ltd., APEX Geophysics Ltd., 06/12/2024.

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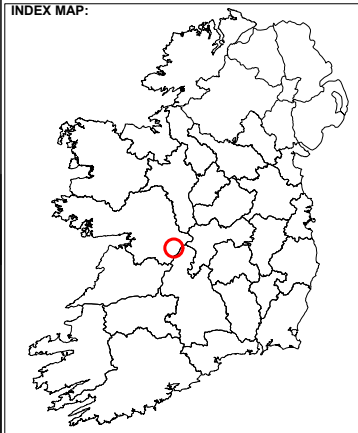
DRAWING NO:	AGP24105_03
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

Version:	Date:	Drawn By:	Checked:
01	06-12-2024	SC	TL

INTERPRETED TOP OF SLIGHTLY WEATHERED TO FRESH ROCK (mOD)

SCALE 1:4000

INDEX MAP:



LEGEND:

- Site
- Data point
- (mOD): 41 42 43 44 45 46 47 48 49 50 51 52 53
- borehole
- trial pit, soakaway pit
- Possible fault

Maps displayed here are produced based on interpolation and extrapolation between discrete data points and should be used accordingly.

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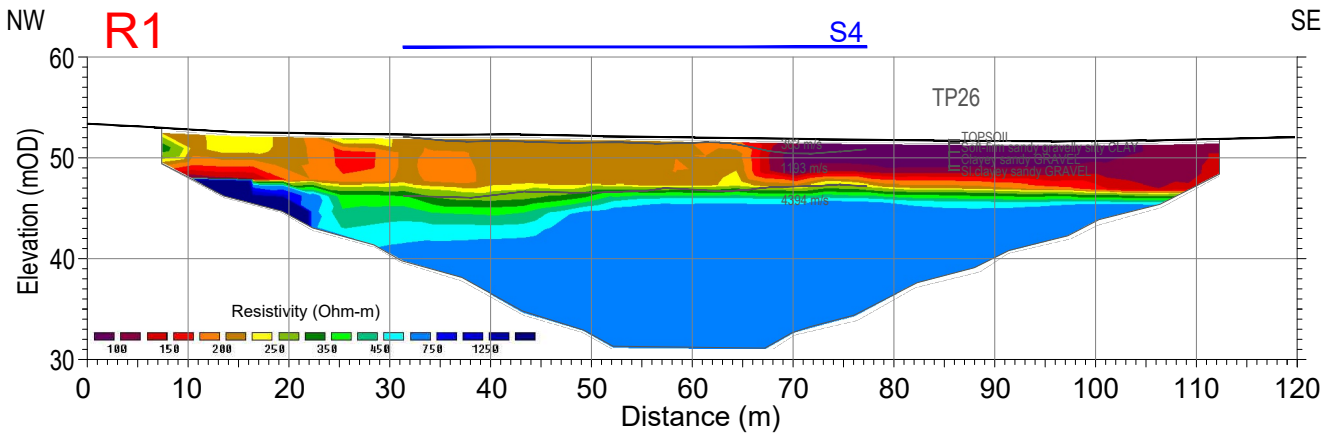
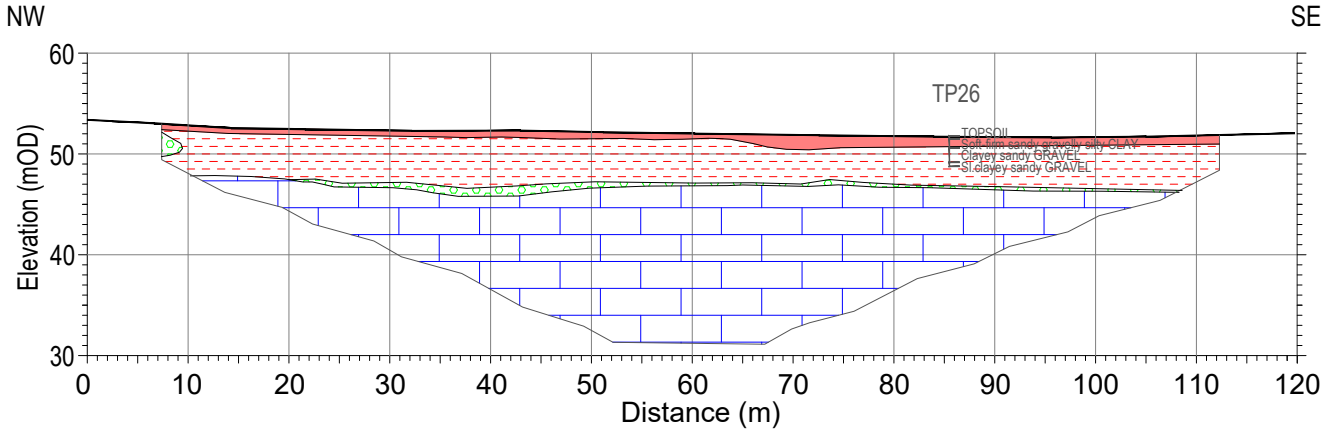
PROJECT:	COOLPOWRA POWER PLANT GEOPHYSICAL SURVEY
CLIENT.:	GROUND INVESTIGATIONS IRELAND LTD
DRAWING NO:	AGP24105_04
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

Version:	Date:	Drawn By:	Checked:
01	06-12-2024	SC	TL

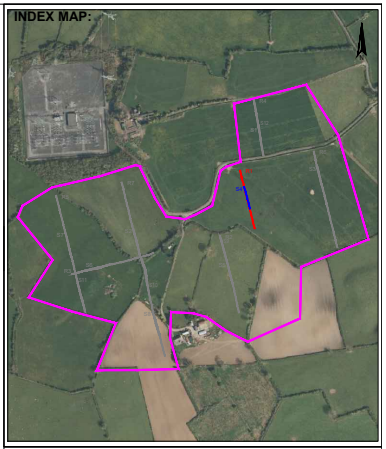
RESULTS & INTERPRETATION - R1 & S4

SCALE 1:750





INDEX MAP:



LEGEND:

- Soft sandy gravelly CLAY
- Firm-Stiff Sandy gravelly CLAY
- Loose clayey SAND/GRAVEL
- Medium dense-Dense clayey SAND/GRAVEL or Highly to Moderately weathered ROCK
- Slightly weathered-Fresh MUDSTONE/SHALE
- Slightly weathered-Fresh dark LIMESTONE with thin interbedded Shales
- Possible Fault
- BH1 — Direct investigation location

The information displayed here is to be used in conjunction with AGP24105_01 Report on the Geophysical Investigation at Coolpowra Power Plan, Co. Galway, for GII Ltd., APEX Geophysics Ltd., 06/12/2024.

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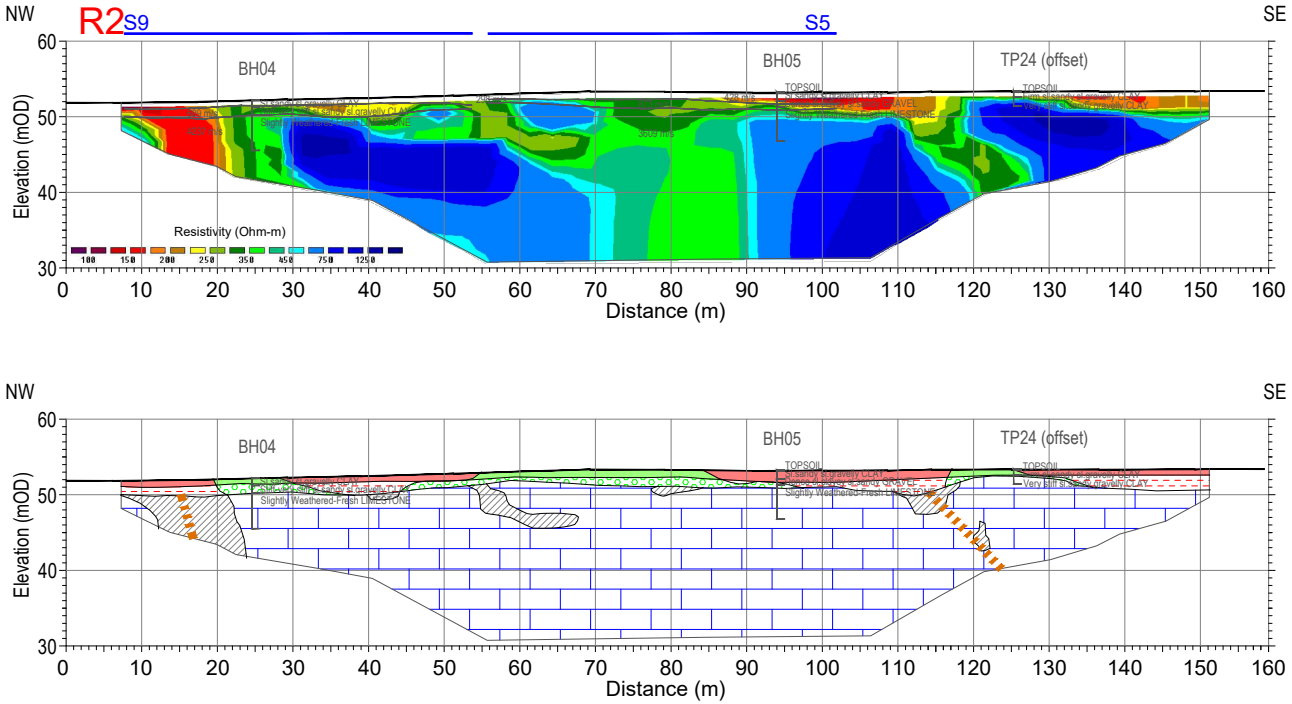
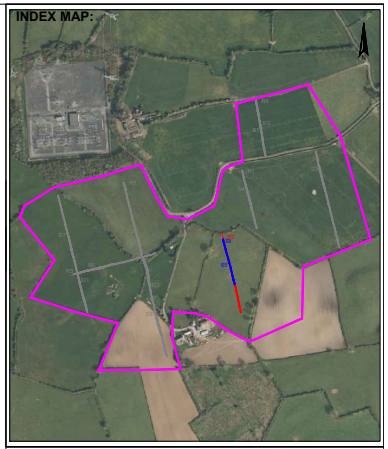
PROJECT:	COOLPOWRA POWER PLANT GEOPHYSICAL SURVEY
CLIENT.:	GROUND INVESTIGATIONS IRELAND LTD
DRAWING NO:	AGP24105_R1
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

Version:	Date:	Drawn By:	Checked:
01	06-12-2024	SC	TL

RESULTS & INTERPRETATION - R2, S9 & S5

SCALE 1:1000





LEGEND:

- Soft sandy gravelly CLAY
- Firm-Stiff Sandy gravelly CLAY
- Loose clayey SAND/GRAVEL
- Medium dense-Dense clayey SAND/GRAVEL or Highly to Moderately weathered ROCK
- Slightly weathered-Fresh MUDSTONE/SHALE
- Slightly weathered-Fresh dark LIMESTONE with thin interbedded Shales
- Possible Fault
- BH1 — Direct investigation location

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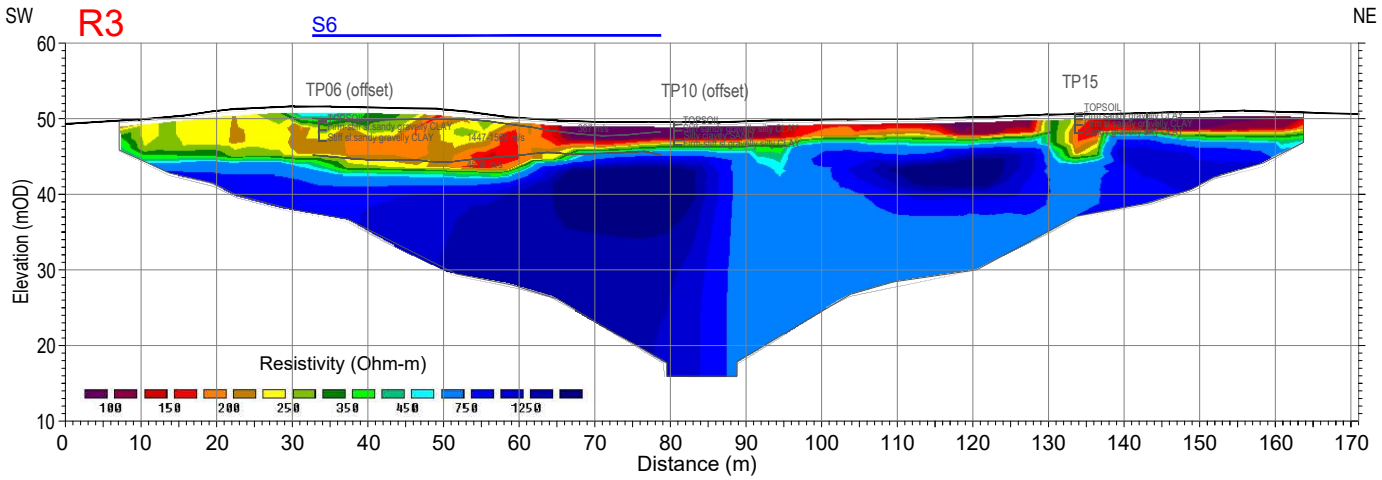
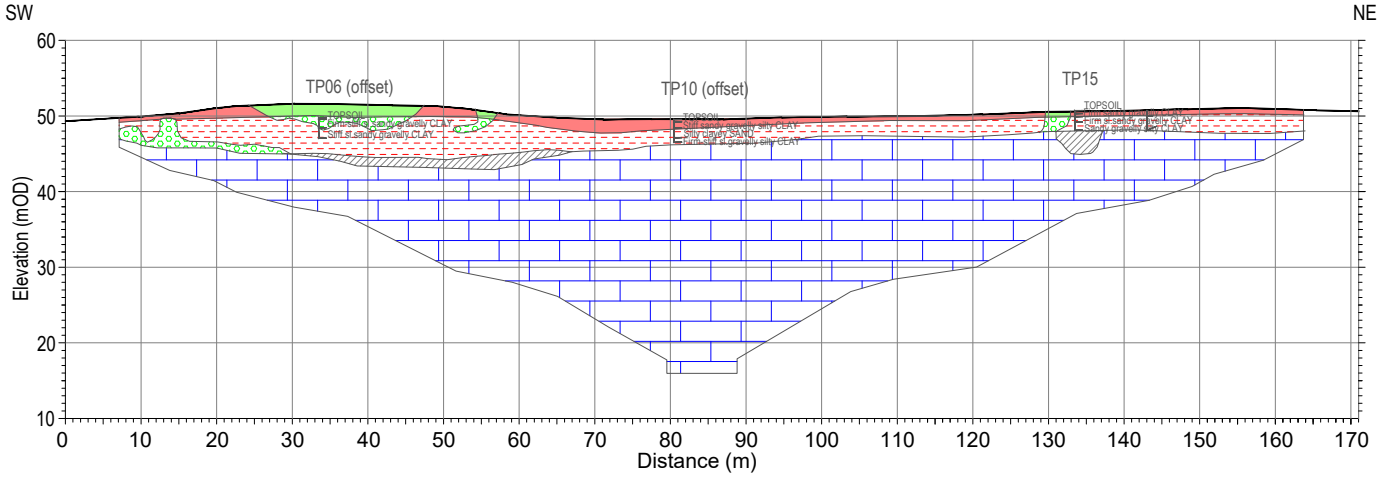
PROJECT:	COOLPOWRA POWER PLANT GEOPHYSICAL SURVEY
CLIENT.:	GROUND INVESTIGATIONS IRELAND LTD
DRAWING NO:	AGP24105_R2
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

Version:	Date:	Drawn By:	Checked:
01	06-12-2024	SC	TL

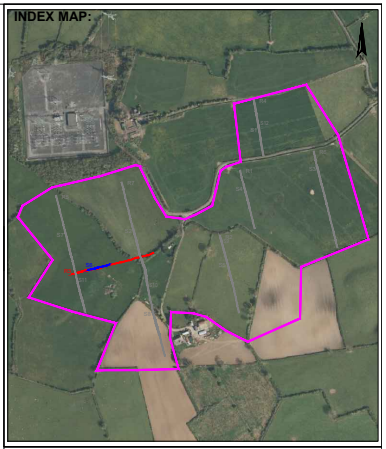
RESULTS & INTERPRETATION - R3 & S6

SCALE 1:1000





INDEX MAP:



LEGEND:

- Soft sandy gravelly CLAY
- Firm-Stiff Sandy gravelly CLAY
- Loose clayey SAND/GRAVEL
- Medium dense-Dense clayey SAND/GRAVEL or Highly to Moderately weathered ROCK
- Slightly weathered-Fresh MUDSTONE/SHALE
- Slightly weathered-Fresh dark LIMESTONE with thin interbedded Shales
- Possible Fault
- BH1 — Direct investigation location

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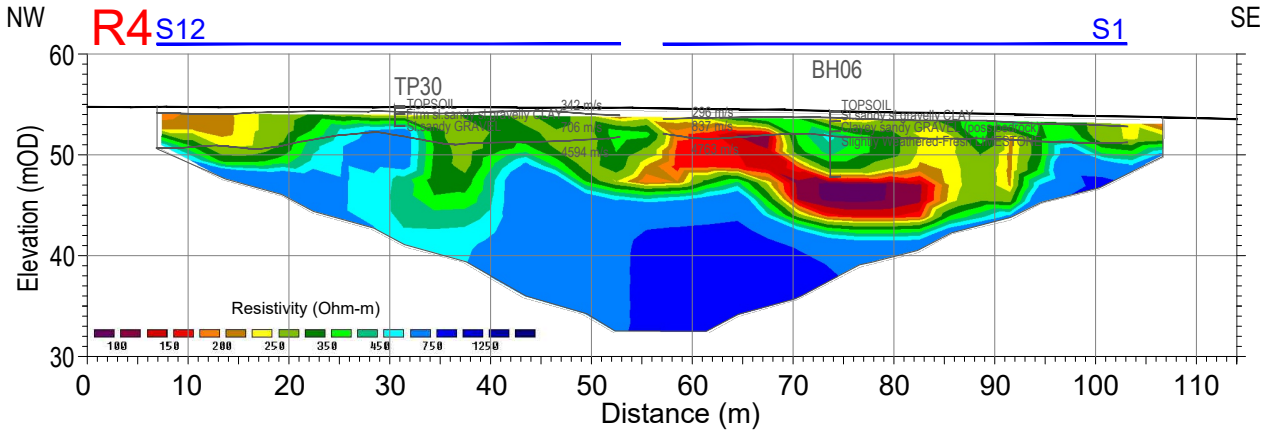
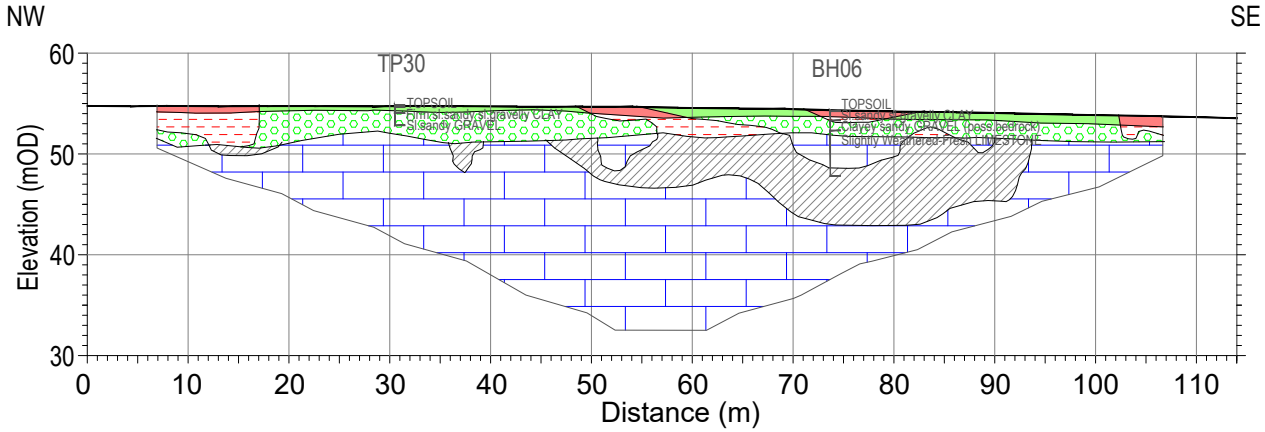
CLIENT.:	GROUND INVESTIGATIONS IRELAND LTD
DRAWING NO:	AGP24105_R3
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

Version:	Date:	Drawn By:	Checked:
01	06-12-2024	SC	TL

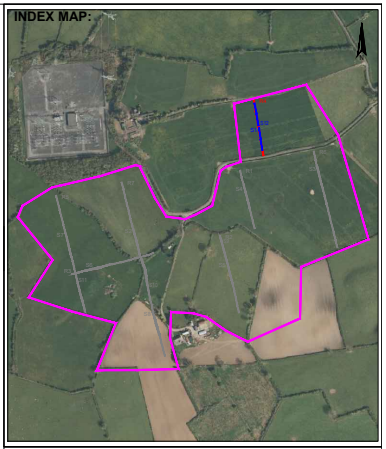
RESULTS & INTERPRETATION - R4, S12 & S1

SCALE 1:750





INDEX MAP:



LEGEND:

- Soft sandy gravelly CLAY
- Firm-Stiff Sandy gravelly CLAY
- Loose clayey SAND/GRAVEL
- Medium dense-Dense clayey SAND/GRAVEL or Highly to Moderately weathered ROCK
- Slightly weathered-Fresh MUDSTONE/SHALE
- Slightly weathered-Fresh dark LIMESTONE with thin interbedded Shales
- Possible Fault
- BH1 Direct investigation location

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PROJECT:	COOLPOWRA POWER PLANT GEOPHYSICAL SURVEY
CLIENT.:	GROUND INVESTIGATIONS IRELAND LTD
DRAWING NO:	AGP24105_R4
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

Version:	Date:	Drawn By:	Checked:
01	06-12-2024	SC	TL

RESULTS & INTERPRETATION - R5, S7 & S11

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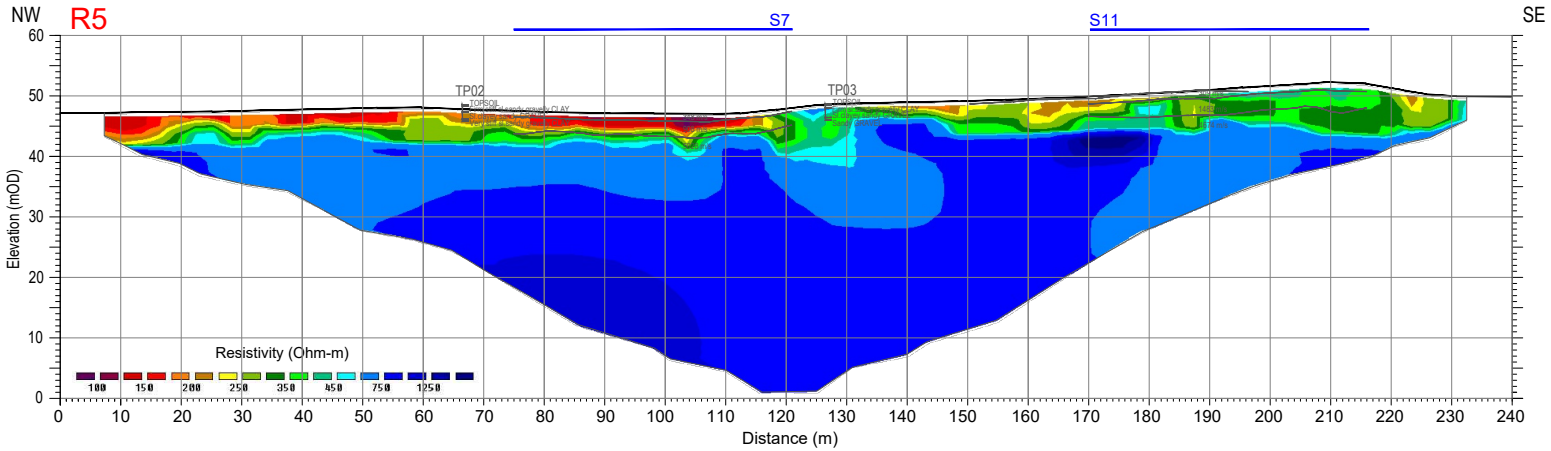

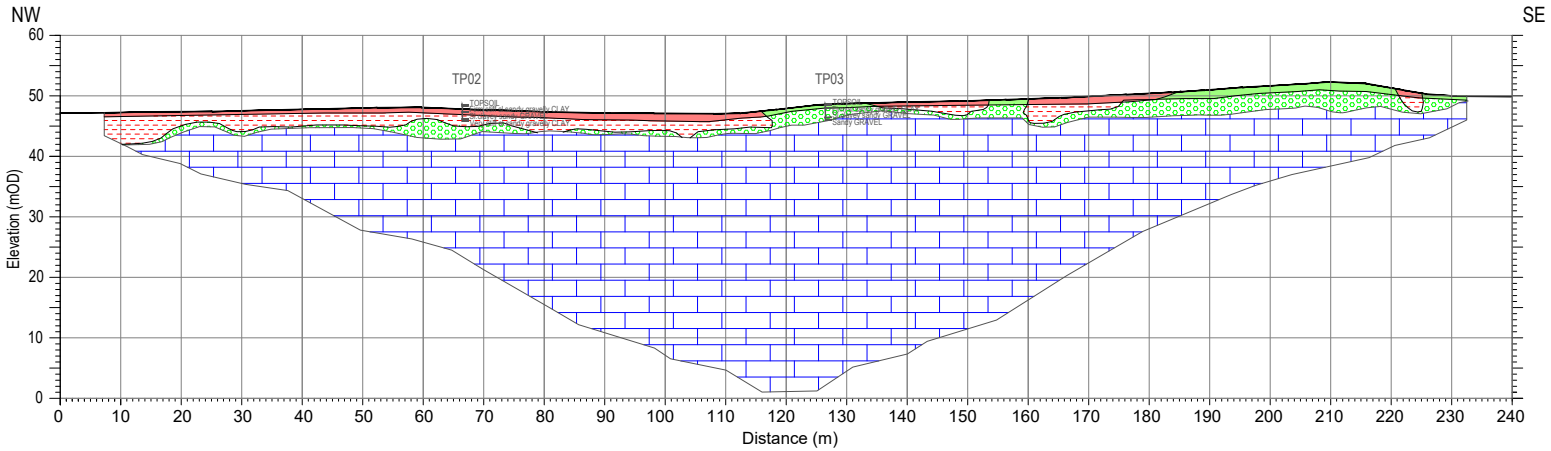

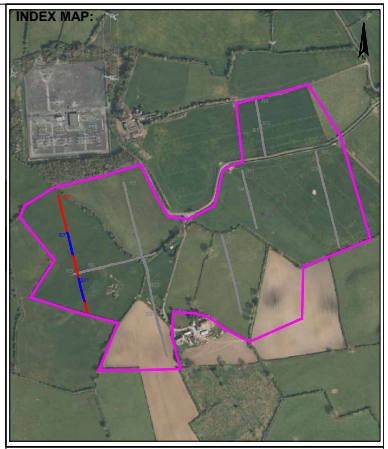

LEGEND:

- Soft sandy gravelly CLAY
- Firm-Stiff Sandy gravelly CLAY
- Loose clayey SAND/GRAVEL
- Medium dense-Dense clayey SAND/GRAVEL or Highly to Moderately weathered ROCK
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- Slightly weathered-Fresh dark LIMESTONE with thin interbedded Shales
- Possible Fault
- BH1 — Direct investigation location

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CLIENT.:	GROUND INVESTIGATIONS IRELAND LTD
DRAWING NO:	AGP24105_R5
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

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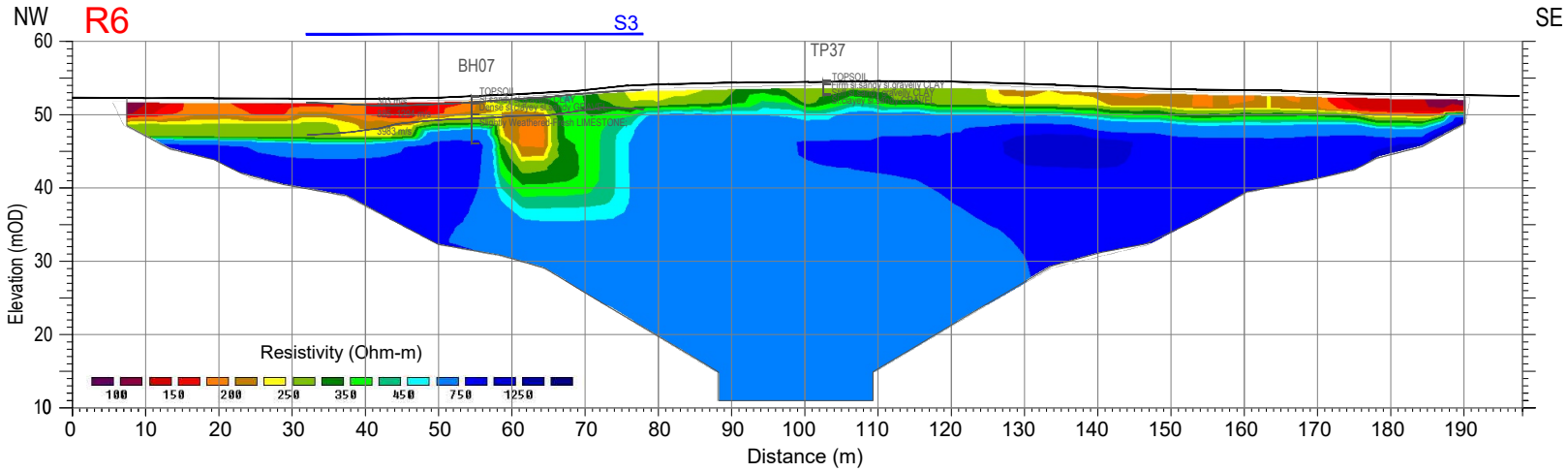
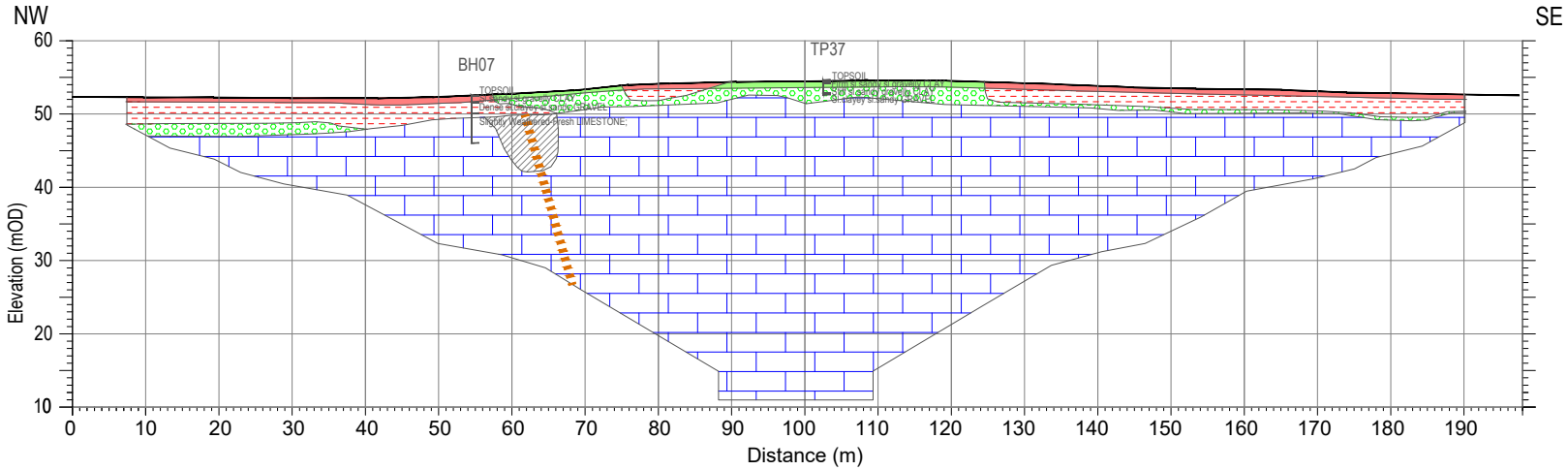
01	06-12-2024	SC	TL

RESULTS & INTERPRETATION - R6 & S3

SCALE 1:1000





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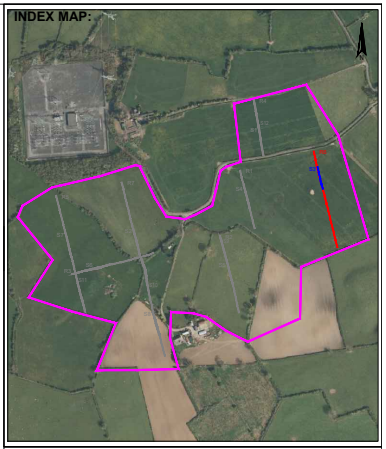

LEGEND:

- Soft sandy gravelly CLAY
- Firm-Stiff Sandy gravelly CLAY
- Loose clayey SAND/GRAVEL
- Medium dense-Dense clayey SAND/GRAVEL or Highly to Moderately weathered ROCK
- Slightly weathered-Fresh MUDSTONE/SHALE
- Slightly weathered-Fresh dark LIMESTONE with thin interbedded Shales
- Possible Fault
- BH1 Direct investigation location

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CLIENT.:	GROUND INVESTIGATIONS IRELAND LTD
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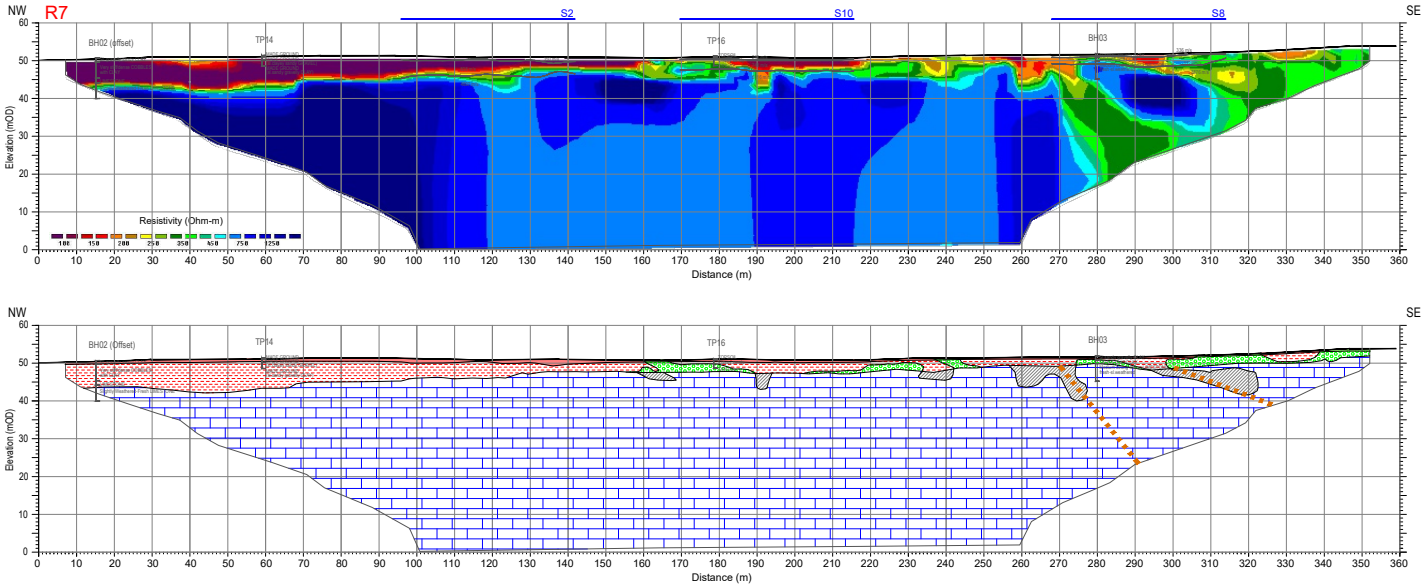
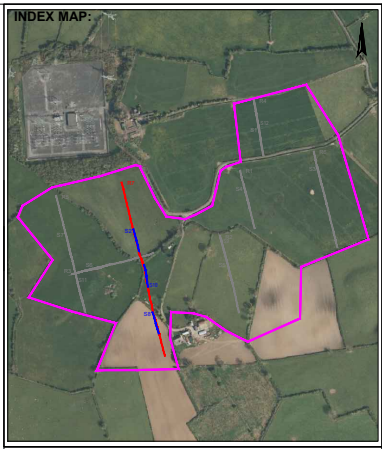
RESULTS & INTERPRETATION - R7, S2, S10 & S8

SCALE 1:2000





LEGEND:

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- Firm-Stiff Sandy gravelly CLAY
- Loose clayey SAND/GRAVEL
- Medium dense-Dense clayey SAND/GRAVEL or Highly to Moderately weathered ROCK
- Slightly weathered-Fresh MUDSTONE/SHALE
- Slightly weathered-Fresh dark LIMESTONE with thin interbedded Shales
- Possible Fault
- BH1 — Direct investigation location

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DRAWING NO:	AGP24105_R7
SCALE:	AS INDICATED @ A4
DATE:	06-12-2024

Version:	Date:	Drawn By:	Checked:
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APPENDIX 8.2

STAGE 3 FLOOD RISK ASSESSMENT REPORT

– PROPOSED DEVELOPMENT (AS AMENDED)

ENVIROLOGIC

HYDROGEOLOGICAL · HYDROLOGICAL CONSULTING

Stage 3 Flood Risk Assessment

LOCATION:	Coolpowra, Ballynaheskeragh, Cooldorragha, Sheeaunrush and Gortlusky, Co. Galway
PREPARED FOR:	Halston
PREPARED BY:	Cian O'Sullivan (MSc)
REVIEWD BY:	Colin O'Reilly PhD (Hydrology)
DATE:	17th December 2025
REFERENCE:	3064C

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1 INTRODUCTION

The following flood risk assessment has been prepared by Cian O'Sullivan (MSc) and reviewed by Colin O'Reilly (PhD) of Envirologic Ltd. on behalf of Halston.

This report is intended to satisfy the requirements of Galway County Council, relating to a proposed development in the townlands of Coolpowra, Ballynaheskeragh, Cooldorragha, Gortlusky, and Sheeaunrush Co. Galway. The proposed development is being referred to as 'Project Coolpowra' and will consist of a Reserve Gas-Fired Power Generator, GIS Substation and Energy Storage System.

As per the Flood Risk Management Guidelines (2009), where flood risk may be an issue for any proposed development, a flood risk assessment (FRA) should be carried out that is appropriate to the scale and nature of the development and the risks arising. The flood risk assessment outlined herein is intended to be sufficiently detailed to quantify the risks and effects of any flooding, necessary mitigation measures, together with recommendations on how to best manage any residual risks. As per the document 'The Planning System and Flood Risk Management (2009)' the flood risk assessment will consist of the following sections:

- Site description
- Site layout
- S-P-R model; sequential approach; justification test
- Determination of flood level
- Mitigation measures
- Conclusions

Site walkover and surveying of local hydrology was performed by Envirologic in May 2024 and October 2025.

1.1 OCTOBER 2025 REVISED FLOOD RISK ASSESSMENT

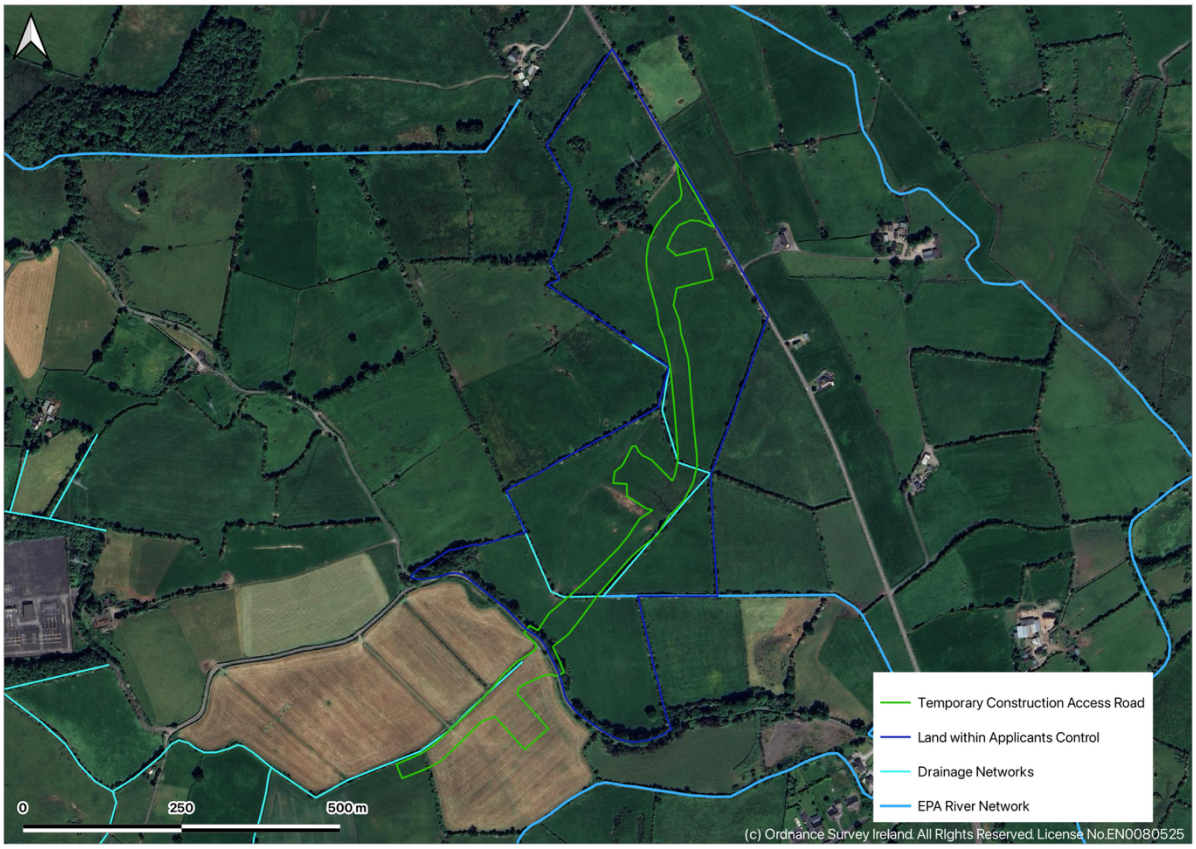
A Flood Risk Assessment prepared by Envirologic (Report No.: 3064; dated 30th April 2024) accompanied planning applications to Galway County Council (Pl. Ref. 24/60845) and An Bord Pleanála (Case Ref.: PA07.320095 and PA07.320095, lodged in July 2024. The overall development is referred to as 'Project Coolpowra'. This ESS planning application was refused by Galway County Council on 30th August 2024 and the applicant has subsequently appealed this decision to An Coimisiún Pleanála (ABP-302916024). In response to third party submissions, an alternative temporary construction access road (Figure 1) is proposed. As such, Envirologic have been commissioned to update the original Stage 3 FRA with the following:

i. Measure flood risk pertaining to this temporary construction access road;

ii. Measure flood risk along the original site access route;

iii. Identify any stream crossing points required and propose suitable structures. Four Section 50 applications have been deemed necessary and are included in this report.

Figure 1 – Temporary Construction Access Road



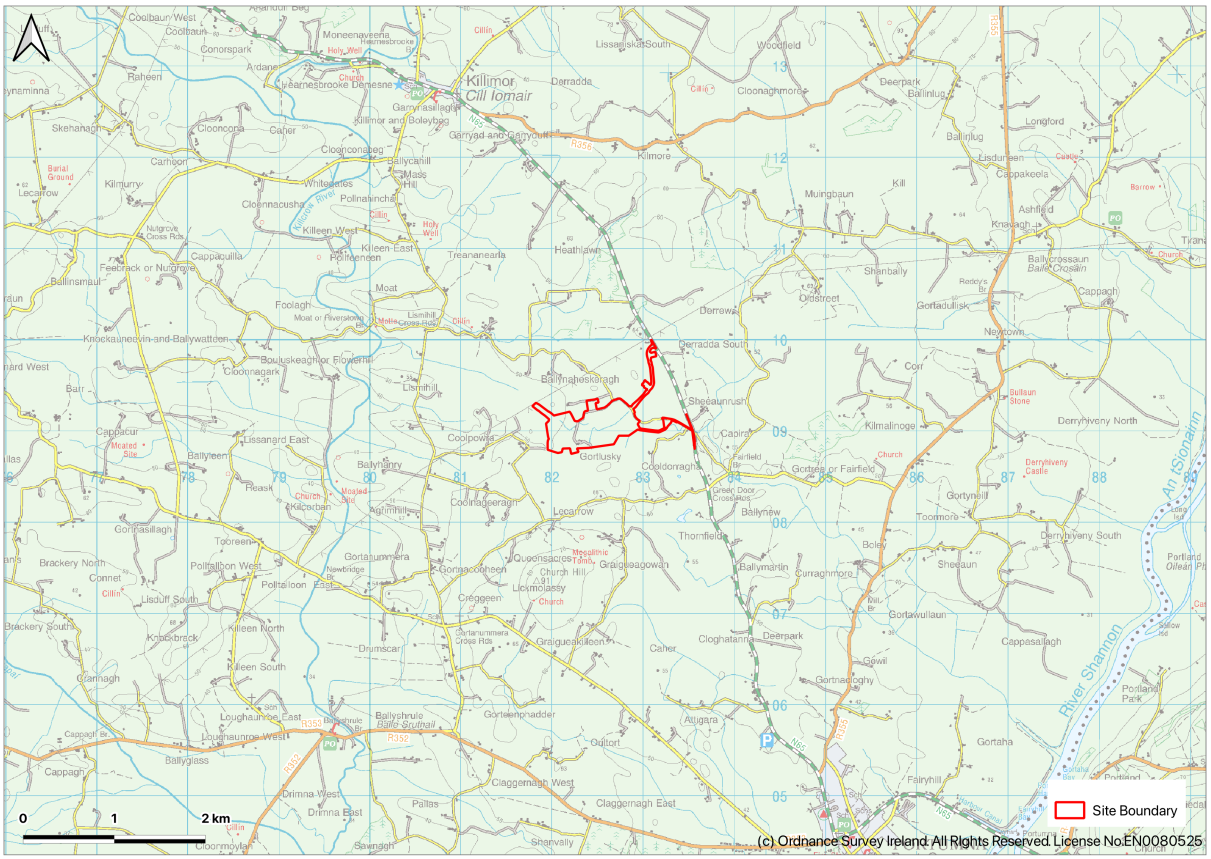
2 SITE DESCRIPTION

2.1 SITE LOCATION

The subject site is located in the townlands of Coolpowra, Ballynaheskeragh, Cooldoorragha, Gortlusky and Sheeaunrush, Co. Galway, approximately 5 km northwest of Portumna town (Figure 2). The main portion of the site is positioned 500 m west of the N65, with an internal site access road providing connection between the two.

The regional topography is considered flat to gently undulating. The 1:50,000 OS Discovery map shows that the nearest topographical feature of note in the locality is a small hummock at Churchill (91 mOD), 2 km to the south. The surrounding landscape is dominated by moderate intensity grassland agriculture.

Figure 2 - Site Location and Topography

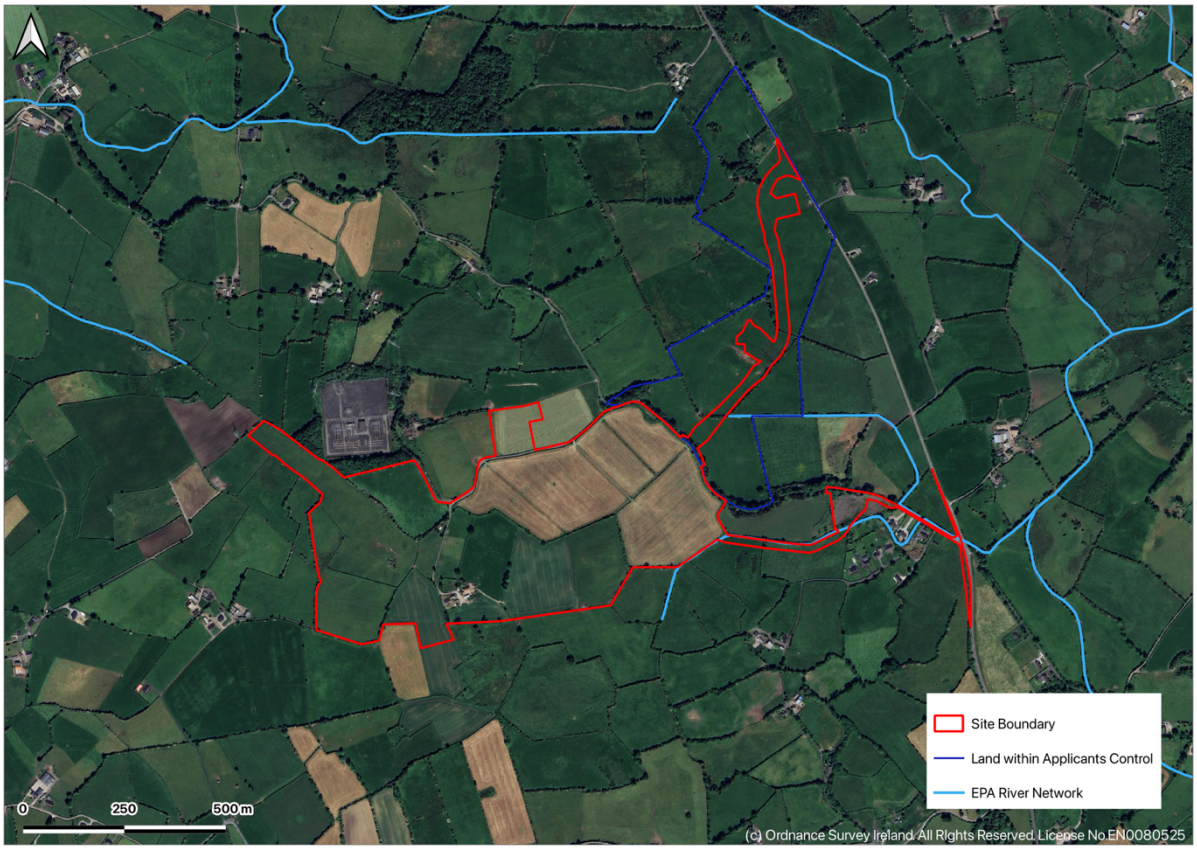


2.2 SITE LAYOUT

The proposed development site, including the alternative temporary construction access road, has an area of 45 ha. The site can be described as having an irregular shape comprised of (i) a central area which has an east-west length of 995 m and north-south width of 415 m, this area is bounded to the east by a local road; (ii) an internal access road which connects the eastern end of this central area with the N65; (iii) a 230 m northwestern spur; and (iv) the N65 to the north of the main site area. An existing 400kv GIS substation is located adjacent to the northeast boundary of the site. There is one detached house standing within the site boundary, with farmyard infrastructure present (Figure 3). It is intended to demolish existing infrastructure on the site and construct the following:

- A Reserve Gas-Fired Generator comprised of three OCGT Units;
- Upgrade and replacement of the existing 400kV AIS substation with a 400kV GIS substation;
- Alternative Technology infrastructure such as Long Duration Energy Storage (LDES) and a Synchronous Condenser.
- An alternative temporary construction access road from the N65

Figure 3 - Current Site Layout with EPA river network overlain

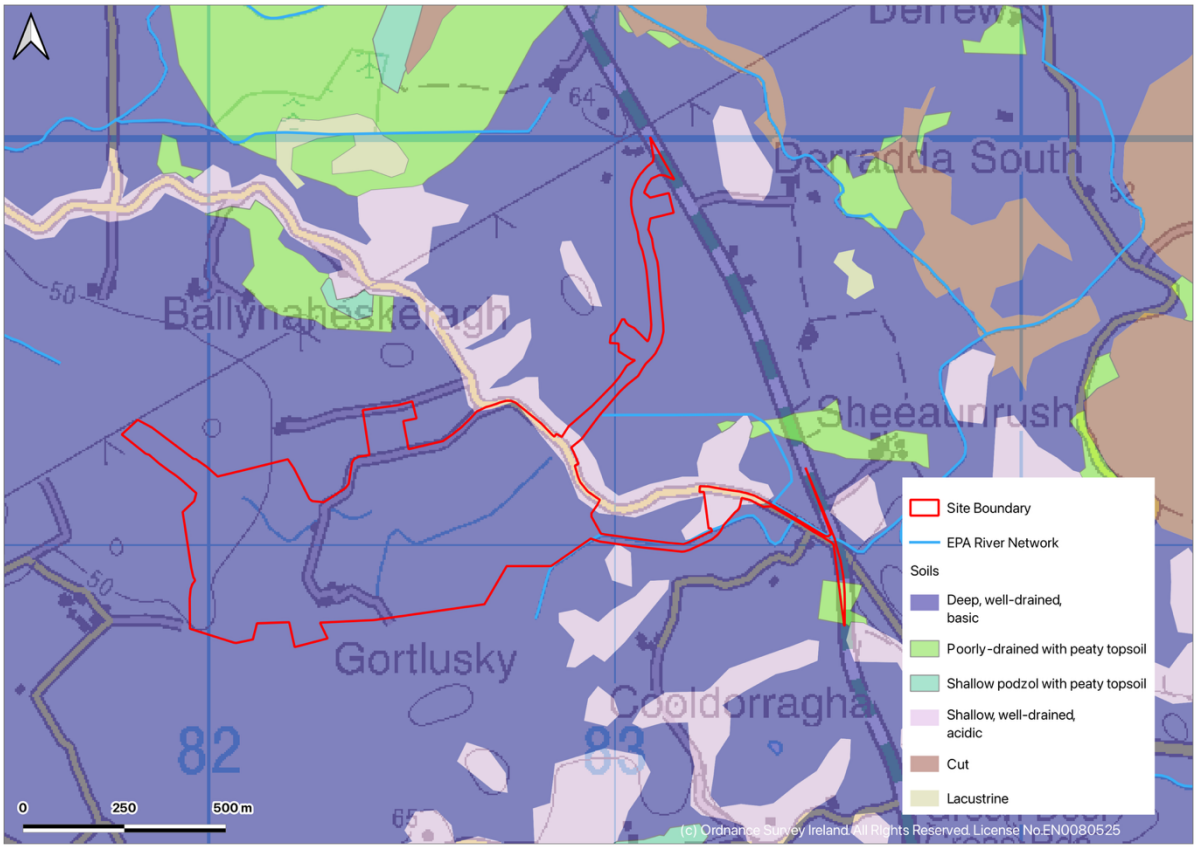


2.3 SOILS & GEOLOGY

2.3.1 Soils

Teagasc soil maps indicate that the soil within the application boundary is a uniform cover of deep, well-drained mineral soil with a basic chemical signature (Figure 4). The soil group can be described as a Grey Brown Podzolic or Brown Earth.

Figure 4 - General Soil Classification

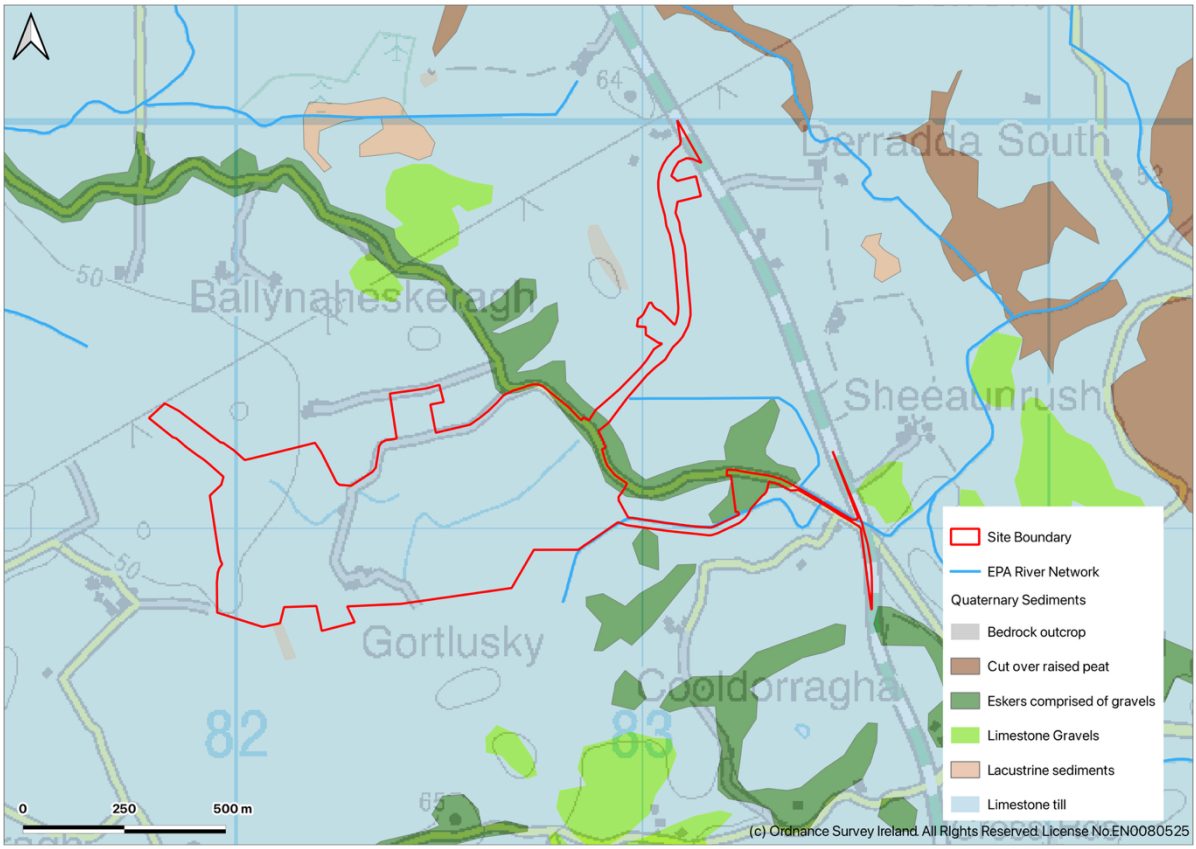


2.3.2 Quaternary Deposits

The quaternary period encompasses the last 1.6 million years and deals with the subsoils and sediments that were deposited over the bedrock described below. The Pleistocene (1.6 million years – 10,000 years ago) is commonly known as the last Ice Age, which was a period of intense glaciation separated by warmer inter-glacial periods, and it is during this period that the quaternary sediments seen today were deposited. Large amounts of ponded water were present at this stage resulting in considerable fluvioglacial sedimentation.

The majority of the site is underlain by glacial till derived from limestone. Some isolated mounds of limestone gravels are present in the area along with a graded ridge of esker sands and gravels which underlie the local road to the east (Figure 5). This combination of deposit type is characteristic of sub-glacial mechanisms resulting in well drained soils of homogenous nature.

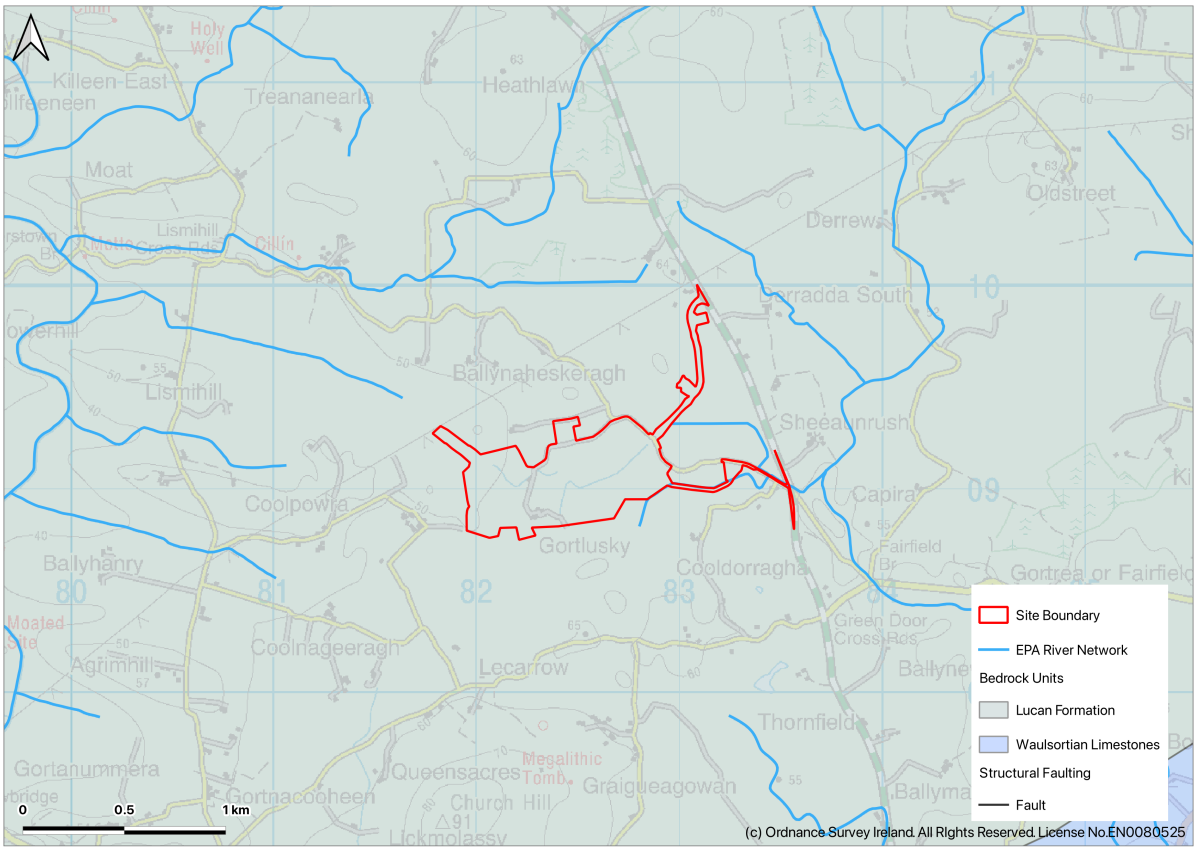
Figure 5 - Quaternary Deposits



2.3.3 Bedrock & Structural Geology

The site is underlain by the Lucan Formation. This formation consists of impure bedded limestone with shale and/or clay impurities. There are no structural geological features such as faulting mapped in the immediate vicinity of the site, as demonstrated in Figure 6.

Figure 6 - Geology of the Surrounding Area



2.4 HYDROLOGY

2.4.1 Catchment Description

The two dominant sub-catchments in the area are the Gortaha (Catchment 025B), which drains to the east, and the Kilcrow (Catchment 025C), which drains to the west. These rivers are both part of the Lower Shannon Hydrometric Area.

The EPA River Network database suggests that the divide between the Gortaha and Kilcrow river catchments lies within the site boundary, near the current Oldstreet Substation. Subsequent ground truthing and consultation of the OPW Drainage Maps indicate however that the catchment divide is just east of the main site area and that all rainfall-runoff generated on the site drains westwards, outfalling to the Kilcrow River, 2 km to the west.

2.4.1.1 Kilcrow Catchment

The drainage network serving the site is dominated by an east to west flowing central channel which itself becomes the Treananearla Stream (first order stream) a short distance downstream of the site. This central channel originates at the eastern end of the central site area, stopping just short of the local road. This catchment was delineated by topographical contours, reference to the OPW and EPA drainage network maps, and ground truthing as part of the site walkover. The catchment area contributing run-off to the downgradient site boundary has an area of 2.0 km^2 (see Figure 7).

There are two culverts in place along the central channel within the site boundary. These provide road crossings for access to farm land and a dwelling. Both culverts have a diameter of 950 mm.

There are several field boundary drains present within the site that contribute to the stream flows at its downstream end. The largest of these drains extends 950 m south, outfalling to the central stream just east of the on-site dwelling. This drainage channel has a sub-catchment of 0.675 km^2. There are two culverts present on this tributary, with pipe diameters of 650 mm and 500 mm. The 500 mm culvert lies immediately upstream of the confluence of the tributary and the main channel whilst the 650 mm culvert acts as a field crossing further upstream. There is a 1 m drop from the invert of the tributary channel to the invert of the main channel, resulting in a high velocity cascading flow regime at the confluence. The combined flows then continue westward. There are no other drainage channels that contribute significant flow to the central channel within the site.

2.4.1.2 Gortaha Catchment

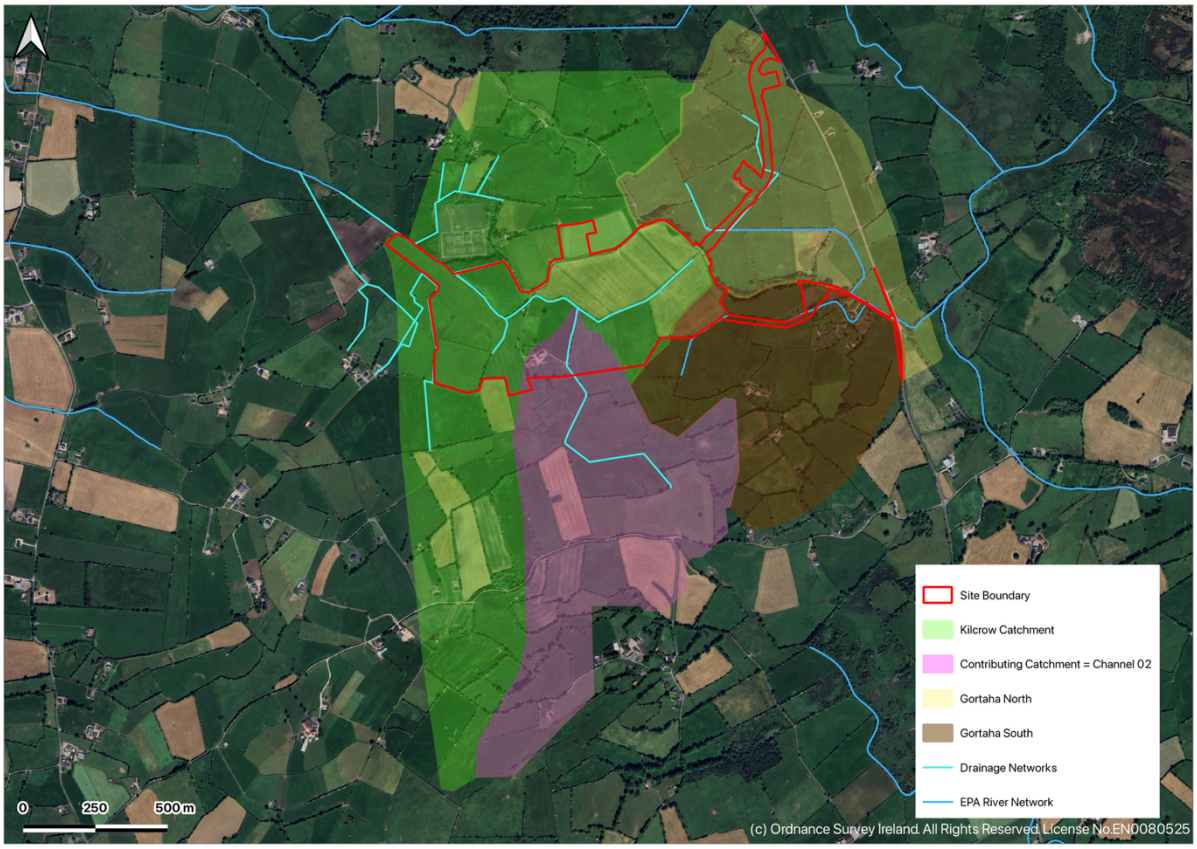
The eastern extents of the site lie within the Gortaha catchment, which has an area of 1.06 km^2 where it flows beneath the N65, east of the site boundary.

There are two EPA mapped streams within this area. The Sheeaunrush Stream, which drains what will be referred to as the Gortaha South catchment, flows from agricultural land to the south of the application site and joins the Ballynaheskeragh Stream as it flows along the original site access route. The Ballynaheskeragh network is mapped incorrectly on the EPA database. The correct flow network following groundtruthing is presented in Figure 7. It will be referred to herein as draining the Gortaha North catchment.

There are two structures present in the Gortaha North catchment. The culvert which crosses the N65 is a 0.5 m diameter circular concrete culvert. There is also one small field crossing culvert along the Ballynaheskeragh Stream which consists of a 0.3 m diameter pipe. A 0.45 m diameter circular culvert transmits water under the L8763 road and marks the confluence of the Sheeaunrush and Ballynaheskeragh streams.

There are several field boundary drains present in the Gortaha North catchment. During the site walkover it was noted that the upper reaches had no discernible flow direction, with standing water noted at multiple locations. Blockages were common, either from silted up channels or infilled areas permitting field crossings. Envirologic will present mitigation measures to regrade channels and improve conveyance alonng these field boundaries.

Figure 7 - Contributing Catchment to Local Watercourses



2.4.2 Designated Areas

Designated areas that are hydrologically connected to the site boundary are presented in Table 1. The River Shannon and Lough Derg are hydrologically connected to the site via downstream drainage. There are a number of sites associated with Lough Derg to the south, as well as the Ardgraigue Bog SAC to the north.

Table 1– Summary of Designated Sites Within a 15 km Radius of the Site

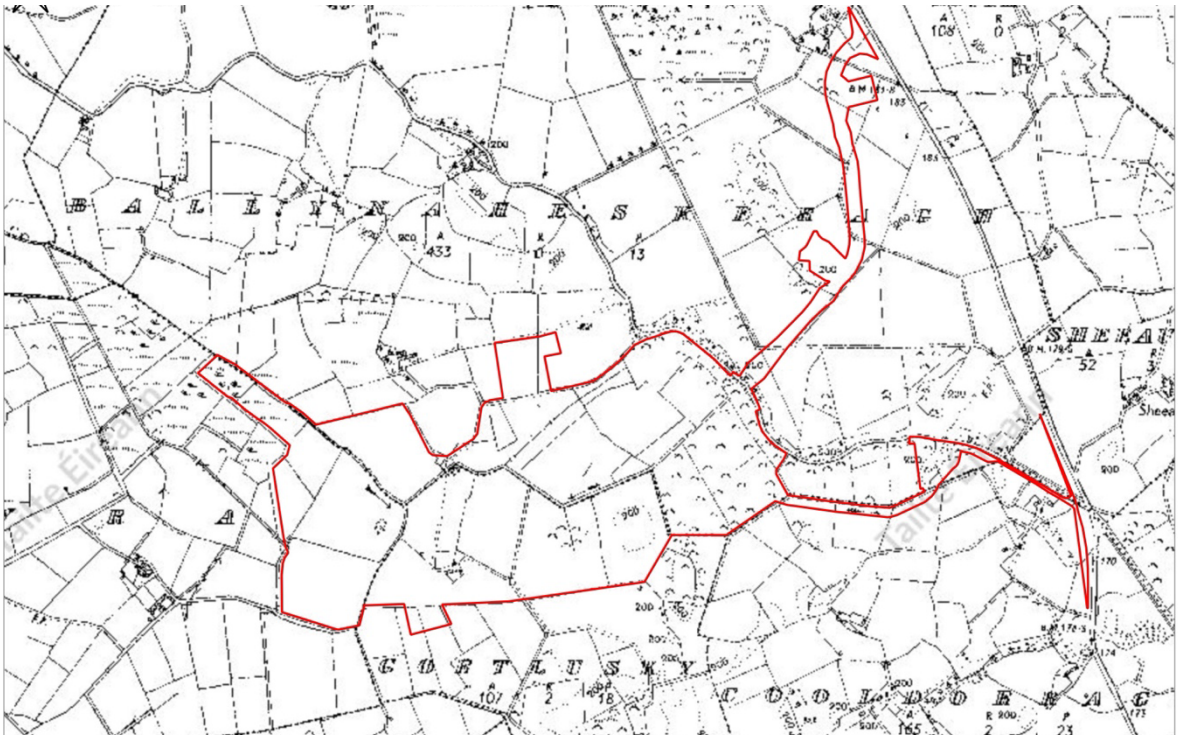
Natura 2000 Site	Site Code	Location at Closest Point to the Proposed Project
River Shannon Callows SAC	000216	5.6 km south east
Middle Shannon Callows SPA	004096	5.6 km south east
Lough Derg, North East Shore SAC	002241	8.8 km south
Lough Derg SPA	004058	8.8 km south
Baroughter Bog SAC	000231	9.1 km south-west

2.4.3 Flooding History

2.4.3.1 Historical OSI Maps

The historical 6" OSI maps (1830 -1930) show no evidence of historical flooding at the application site (Plate 1). It is noted from the historical 6" maps that flow direction on the central channel is towards the centre of the site but the flow direction from this point is unclear. It is likely that subsequent arterial drainage works deepened drains to promote a westerly flow direction.

Plate 1 - Historical 6" OSI maps (1830 – 1930)



2.4.3.2 OPW Flood Hazard Mapping

Consultation of the OPW flood hazard mapping tool shows that no previous flood events occurred within or near the site. Two flood events have been reported within 5 km of the site boundary. The nearest of these was in 1995, 3 km to the southwest where the Kilcrow River passes through Newbridge Bridge at Gortanummera. It was recommended at the time that additional drainage maintenance works be deemed a priority for the area.

2.4.4 Flood Risk Indicators

2.4.4.1 National Indicative Fluvial Mapping (NIFM)

The OPW National Indicative Fluvial Mapping (NIFM) tool shows that narrow margins flanking the Gortaha River and Kilcrow River, 200 m west and 1.7 km east of the site, respectively, are potentially at risk of fluvial flooding. The drainage channels within the application site and immediate surrounds have not been covered by the OPW NFIM programme.

2.4.5 CFRAM

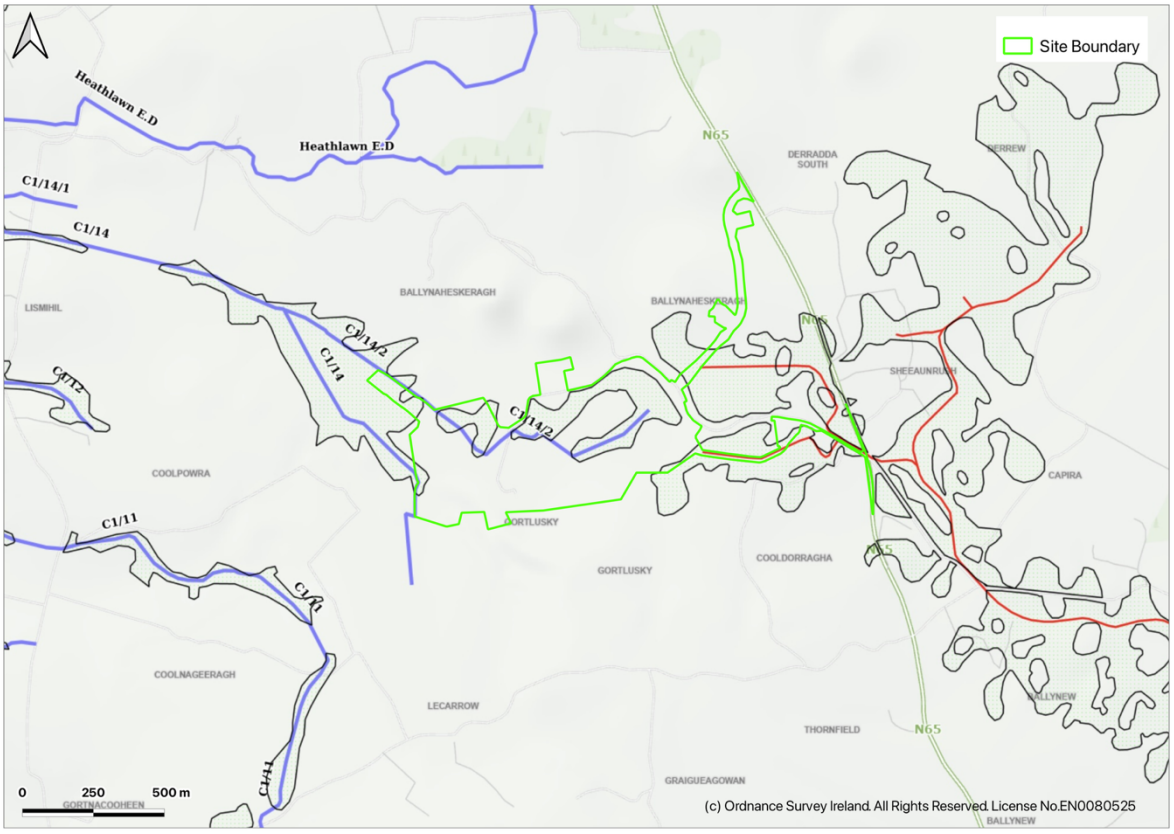
The OPW FloodInfo resource shows that neither the site nor the Kilcrow or Gortaha Rivers have been covered by detailed CFRAM hydraulic modelling.

2.4.6 Benefiting Lands

Plate 2 shows that parts of the application area lie within benefitting lands. These maps were prepared to identify areas that would benefit from land drainage schemes and typically indicate low lying land near watercourses that would be prone to flooding. The emphasis of these schemes was the improvement of agricultural land.

With respect to the application site the benefitting lands map confirms that the central west-flowing channel is maintained as part of the Killimor Arterial Drainage Scheme (Channel 14/2). Benefiting lands are also present in the Gortaha catchment. Of relevance to the application site these are either side of drainage channels that pass under both the proposed access route and the temporary construction access route. No information is available regarding their nomenclature, but they are under the local county council jurisdiction with respect to maintenance. It is noted that the OPW Drainage Map also corresponds with the drainage network layout that was groundtruthed as part of the site walkover. This is further evidence that the EPA river network is incorrect.

Plate 2 - Drainage Channels and Benefitting lands proximal to the application site



3 SEQUENTIAL TEST & VULNERABILITY MATRIX

3.1 SEQUENTIAL APPROACH

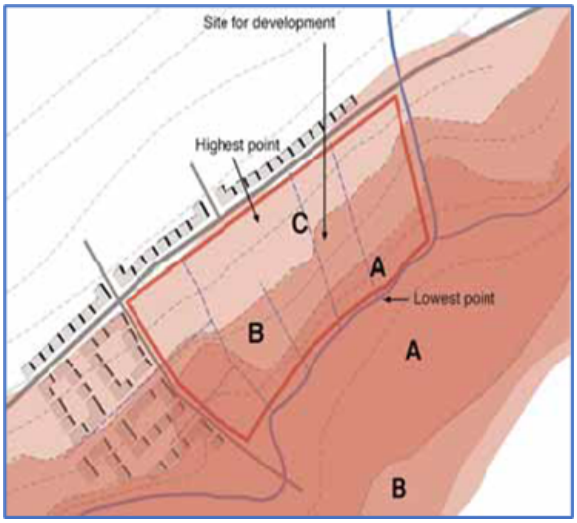
The 'Planning System and Flood Risk Management Guidelines for Planning Authorities (2009)' require the planning system at national, regional, and local levels to:

- Avoid development in areas at risk of flooding by not permitting development in flood risk areas, particularly floodplains, unless where it is fully justified that there are wider sustainability grounds for appropriate development and unless the flood risk can be managed to an acceptable level without increasing flood risk elsewhere and where possible, reducing flood risk overall.
- Adopt a sequential approach to flood risk management based on avoidance, reduction and then mitigation of flood risk as the overall framework for assessing the location of new development in the development planning processes; and
- Incorporate flood risk assessment into the process of making decisions on planning applications and planning appeals.

The sequential approach is used to assess flood risk at the site and, where there is variability, to assign appropriate zones in accordance with the Guidelines (DoEHLG, 2009). As shown in Plate 3, Zone A, applied to areas with a high probability of flooding, defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100). Development in this zone should be avoided and/or only considered in exceptional circumstances. Development should only be permitted in areas at risk of flooding when there are no alternative, reasonable sites available in areas at lower risk that also meet the objectives of proper planning and sustainable development. Zone B is applied to areas with a moderate probability of flooding from rivers. (i.e. a 0.1% to 1% probability or between 1 in 1000 and 1 in 100), with Zone C having a low probability of flooding.

With respect to coastal flooding Zone A is applied to areas with the highest risk of coastal flooding (i.e. more than 0.5% probability or more than 1 in 200 year return period). Development in this zone should be avoided and/or only considered in specified circumstances. Zone B is applied to areas with a moderate probability of coastal flooding (between 1 in 200 and 1 in 1000), with Zone C having a low probability of coastal flooding (less than 0.1% or 1 in 1000). The Flood Risk Assessment will clarify within which zone the site lies.

Plate 3 – Schematic map showing use of the Sequential Approach to assign Flood Risk Zones (DoEHLG, 2009)



3.2 VULNERABILITY MATRIX

Clause 2.16 of the Flood Management Guidelines (OPW, 2009) states: 'The classification of different land uses and types of development as highly vulnerable, less vulnerable and water-compatible is influenced primarily by the ability to manage the safety of people in flood events and the long-term implications for recovery of the function and structure of buildings.'

The Planning System and Flood Risk Management guidelines provide three vulnerability categories based on the development type. The proposed works fall into the following vulnerability categories as follows:

- **Highly vulnerable = residential, hospitals, schools, essential infrastructure, emergency service facilities.**
- Less vulnerable = buildings used for retail, warehousing, commercial, industrial and non-residential institutions.
- Water-compatible development = amenity open space, outdoor sport and recreation.

The proposed development is considered to be 'essential infrastructure' and therefore comes under 'highly vulnerable development'. Different types of development are appropriate in each of the Flood Zones, based on their vulnerability to flood risk. Hence:

- **Highly vulnerable: requires Justification test in Flood Zone A and Flood Zone B, appropriate in Flood Zone C;**
- Less vulnerable: requires Justification test in Flood Zone A; appropriate in Flood Zone B and Flood Zone C;
- Water-compatible: appropriate in Flood Zones A, B and C.

Highly vulnerable development should only be considered in zones A and B if adequate lands or sites are not available in Zone C and subject to a flood risk assessment to the appropriate level of detail to demonstrate that flood risk to and from the development can or will adequately be managed at the site.

Based on desktop information collected to this point the site is deemed to be within Flood Zone C. A conservative approach is being applied and the assessment will proceed to quantitative determination of flood levels in watercourses adjacent to the site. Unless the quantitative assessment shows the site to be in Flood Zone A or Flood Zone B then a Justification Test is not required.

3.3 S-P-R MODEL

The flood risk assessment is carried out using the source-pathway-receptor (S-P-R) model, as outlined below. The S-P-R model is used to identify the sources of flood water, the people and assets affected by potential flooding, and the pathways by which the flood water reaches those receptors.

Consideration will be given to the predominant sources, pathways and receptors in terms of the influence they have on site flooding, or the manner in which they may be impacted. The primary water sources on site are as follows:

Sources	Pathways	Receptors
Storm rainfall event (1 in 100 year)	Pluvial Flooding	Proposed Site
Kilcrow River Tributaries	Fluvial Flooding	Proposed Site Infrastructure
Gortaha River Tributaries	Road Runoff	Local Road
Runoff from upgradient lands		Third Party Lands and Property
Drainage/throughflow from upgradient lands		

Flooding mechanisms will be looked at in more detail to quantify flood risk from both the Kilcrow and Gortaha River catchments. Quantification of this risk will be achieved by firstly determining flood flows in the watercourses as they flow through/past the site.

Hydraulic modelling will then be utilised to facilitate estimation of flood levels within, and adjacent to, the site when these peak flows are passed through a series of surveyed cross sections. Mitigation measures will then be applied as appropriate.

4 SUBJECT SITE FLUVIAL FLOOD FLOW CALCULATIONS

4.1 OPW ADVICE

In selecting appropriate formulae reference has been made to an advisory response from OPW Hydrology Section and Work Package 4.2:

- For catchments between 5 km^2 and 25 km^2 the preferred equation is the 'FSU small catchments' equation. When using the small catchment equation, we generally advocate not using a pivotal site adjustment seeing as there is a very small pool of other small catchments from which to source a pivotal site.
- For catchments less than 25 km^2 we would always say that at least three methods should be explored and that the choice of the flow to be used is up to the practitioner.
- The WP4.2 report is intended to provide a further methodology for small catchment flood estimation. As far as we are concerned, it is the preferred method.
- For catchments less than 5 km^2 there is no FSU method applicable. For such 'small' catchments we would suggest that maybe the rational method or modified rational method could be used.

The catchment to the Kilcrow associated with the furthest downstream point of the site boundary has an area of 2.00 km^2. The OPW FSU method alone may therefore be deemed unsuitable for the calculation of potential flood flows in this instance. A sequence of flood flow calculations is presented below.

4.2 FLOOD FLOW CALCULATIONS: KILCROW CATCHMENT

4.2.1 OPW FSU - 7 Variable Equation

The ungauged method can be used to determine flood flows at the site using catchment characteristics, which are then corrected using a correlation against descriptors for gauged catchments. The median annual maximum flood magnitude (QMED), as outlined in the Flood Studies Update (FSU) (Nicholson & Bree 2013) is now preferred over the mean annual flood flow rate (Q_{bar}) parameter described in the Flood Studies Report (FSR) (NERC 1975). The preferred median method is less sensitive to large extreme floods and to flood measurement error in general. The estimation method for ungauged locations is based on a regression analysis relating observed QMED to physical catchment descriptors (PCDs) at gauged locations in Ireland, given by the following equation:

$$QMED_{rural} = 1.237x10^{-5} \cdot AREA^{0.937} \cdot BFI_{soil}^{-0.922} \cdot SAAR^{1.306} \cdot FARL^{2.217} \cdot DRAIND^{0.341} \cdot S^{0.185} \cdot (1 + ARTDRAIN2)^{0.408}$$

The PCDs applicable to the subject site are shown in Table 2.

Table 2 - Physical Catchment Descriptors Applicable to the Subject Site

PCD	Description	Units	Value
AREA	Catchment area	km^2	2.00
SAAR	Average annual rainfall	mm	938.91
BFIsoil	Baseflow index derived from soils data		0.6908
FARL	Flood attenuation from reservoirs and lakes		1
DRAIND	Ratio of river network to catchment area	$no./km^2$	0.212
S_{1085}	Slope of the main stream between the 10 and 85 percentiles	m/km^2	1.034
ARTDRAIN2	Proportion of river network included in drainage schemes		0.9404
URBEXT			0
$QMED_{rural}$		m^3/s	0.198
$QMED_{urban}$		m^3/s	0.198

A principal of the FSU is the concept of a pivotal site, however no pivotal sites were considered suitable for application to such a small catchment. The return-period flood flow (Q_T) is determined by an index flood method, whereby a growth factor as determined from an EV1 distribution plot is applied. In this case:

$$Q_t = QMED \times 2.51$$

$$Q_{100} = 0.198\ m^3/s \times 2.51$$

$$Q_{100} = 0.496\ m^3/s$$

Finally, a climate change growth factor of 20 % is applied:

$$Q_{100} = 0.496 \times 1.2$$

$$\mathbf{Q_{100} = 0.596\ m^3/s}$$

Using the standard OPW FSU approach the climate adjusted Q_{1000} flow in the watercourse as it passes the downstream site boundary is equal to:

Q_{1000} = QMED x 3.33

Q_{1000} = 0.198 m^3/s x 3.33

Q_{1000} = 0.658 m^3/s

Finally, a climate change growth factor of 20% is applied:

Q_{1000} = 0.658 x 1.2

Q_{1000} = 0.790 m^3/s

4.2.2 OPW FSU – Small Catchments

The updated Flood Studies Update (Nicholson and Bree, 2013) presents the formula suited to catchments less than 25 km^2:

$$QMED_{rural} = 2.0951x10^{-5} \cdot AREA^{0.9245} \cdot BFIsoil^{-0.9030} \cdot SAAR^{1.2695} \cdot FARL^{2.3163} \cdot S^{0.2513}$$

The same PCDs shown in Table 2 are again applied. This equation yields a Q_{MED} value of 0.328 m^3/s. As per the OPW Guidelines a pivotal site adjustment factor is not being applied to the outcome of the small catchments equation.

In this case the Q_{100} flood flow is determined as follows:

QT = QMED x growth factor

Q_{100} = 0.328 $m^3\ s^{-1}$ x 2.51

Q_{100} = 0.823 $m^3\ s^{-1}$

Finally, a climate change growth factor of 20% is applied:

Q_{100} = 0.823 x 1.2

Q_{100} = 0.987 $m^3\ s^{-1}$

In this case the Q_{1000} flood flow is determined as follows:

Q_{1000} = QMED x 3.33

Q_{1000} = 0.328 m^3/s x 3.33

Q_{1000} = 1.091 m^3/s

Finally, a climate change growth factor of 20 % is applied:

Q_{1000} = 1.091 x 1.2

Q_{1000} = 1.309 m^3/s

4.2.3 OPW FSU – 3 Variable Method

The FSU 3-variable equation was developed as part of the FSU. It was developed as a 'short cut' equation for the estimation of flow in ungauged catchments:

$$QMED = 0.000302.AREA^{0.829} . SAAR^{0.898} . BFI^{1.539}$$

$$QMED = 0.14\ m^3/s$$

Application of the relevant growth factors as per above and 20% climate change adjustment factor results in:

$$\mathbf{Q_{100} = 0.428\ m^3/s}$$

$$\mathbf{Q_{1000} = 0.568\ m^3/s}$$

4.2.4 Flood Studies Report, FSR (NERC 1974)

This is the original FSR method, with the regression coefficient for Ireland. Estimates from this equation should be treated with extreme caution. Growth factor of 1.96 was applied to determine Q_{100}. It is recommended that these equations should be used only for preliminary flood estimates.

$$QBAR = 0.0172.AREA^{0.94} . STMFRQ^{0.27} . S1085^{0.16} . SOIL^{1.23} . RSMD^{1.03} . (1 + LAKE)^{-0.85}$$

Table 3 - Calculations of Q_{100} – FSR Ungauged Catchments

Area, km^2	STMFRQ, jn/km^2	S_{1085}, m/km	SOIL	RSMD	LAKE	Q_{BAR} m^3/s	Q_{BAR} x 1.96 gf m^3/s	Q_{100} x 1.47 sfe m^3/s	Q_{100} x x cc (1.2), m^3/s
2.004	0.499	1.034	0.35	35.991	0	0.303	0.594	0.8745	**1.049**

Using a growth factor of 2.6 to convert from Q_{BAR} to Q_{1000}, the resulting Q_{1000} flow which includes a 20% climate change factor is estimated as **1.392** m^3/s.

4.2.5 Institute of Hydrology Report (IH)124 (1994)

Report No. 124 derives an equation to estimate flood flows for small rural catchments (less than 25 km^2). The equation has a standard factorial error (SFE) of 1.65.

$$Qbar_{rural} = 0.00108\ (AREA^{0.89} x\ SAAR^{1.17} x\ SOIL^{2.17})$$

Table 4 - Calculations of Q_{100} – IH124

Area, km^2	SAAR	SOIL	Q_{BAR} m^3/s	Q_{BAR} x 1.96 gf m^3/s	Q_{100} x 1.65 sfe m^3/s	Q_{100} x x cc (1.2), m^3/s
2.004	938.91	0.35	0.617	1.210	1.997	**2.396**

Without implementing the SFE (1.65), the Q_{100} rate plus 20% climate change factor was:

$$Q_{100} = 1.211\ m^3/s\ x\ 1.2 = 1.45\ m^3/s.$$

Using a growth factor of 2.59 to convert from Q_{BAR} to Q_{1000}, the resulting Q_{1000} flow which includes a 20% climate change factor is estimated as **3.167** m^3/s.

This method was developed for small catchments (< 25 km^2) in the UK. Its derivation did not include any Irish catchments. The equation tends to overestimate QBAR for the smallest of the UK catchments used. This value is not comparable to results derived from other formulae.

4.2.6 Modified IH 124 (Cawley & Cunnane 2003)

Irish researchers at NUIG (Cawley & Cunnane 2003) developed a Modified Institute of Hydrology 124 methodology and formula as follows:

$$Qbar_{rural} = 0.000036 (AREA^{0.94} \times SAAR^{1.58} \times SOIL^{1.87})$$

Table 5 - Calculations of Q_{100} – Modified IH124

Area, km^2	SAAR	SOIL	Q_{BAR} m^3/s	Q_{BAR} x 1.96 gf m^3/s	Q_{100} x 1.65 sfe m^3/s	Q_{100} x x cc (1.2), m^3/s
2.00	938.9	0.35	0.483	0.947	1.563	**1.875**

Using a growth factor of 2.59 to convert from Q_{BAR} to Q_{1000}, the resulting Q_{1000} flow which includes a 20% climate change factor is estimated as **2.47** m^3/s.

4.2.7 Modified Rational Method

FSU Work Package 4.2 shows that the UK only apply the Rational Method to catchments from 2 to 4 km^2. In Ireland this method is more commonly used to determine stormwater attenuation requirements. It is calculated using the formula:

$$QT = 2.78 \times C_v \times C_r \times I \times A$$

where:

Q_T = design peak flow, l s^{-1}

T = return period in years = 100

C_v = runoff coefficient = 0.84 (winter)

C_r = peaking/routing factor = 1.3 (arbitrary value)

A = 2.004 km^2

$I_{tc, T}$ = hourly rainfall intensity for design duration of tc (hours) and return period T (years) = 29.2 mm *1.36 = 39.712 mm

t_c= time of concentration defined as the travel time from the furthest point on the catchment to the outlet (mins):

$$t_c = 0.0195 \times L^{0.77} \times S^{-0.385}$$

L = length of stream = 1600 m

S = catchment gradient, m m^{-1} = 0.001

tc = 81.6 minutes = 1.36 hours

Hence:

$$Q_{100} = 2.78 \times 0.84 \times 1.3 \times 0.0292 \times 2.004$$

$$Q_{100} = 0.348 \text{ m}^3 \text{ s}^{-1}$$

$$Q_{100} + 20\% \text{ cc} = \mathbf{0.417} \text{ m}^3 \text{ s}^{-1}$$

$$Q_{1000} + 20\% \text{ cc} = \mathbf{0.552} \text{ m}^3 \text{ s}^{-1}$$

4.2.8 Summary of Flood Flow Calculations

Results from the various flood estimation methods on the central, west-flowing stream through the main site area are summarised below in Table 6. In taking a conservative approach, the flood flow values selected for use in the hydraulic model were those calculated using the IH124 method, as these were the maximum values. The respective Q_{100} and Q_{1000} values being equal to 2.40 m^3/s and 3.16 m^3/s, respectively. These values include a 20% factor for climate change.

Table 6 - Summary of Calculated Flood Flows (includes 20% Climate Change Factor)

Methodology	Q_{100} + 20% cc (m^3/s)	Q_{1000} + 20% cc (m^3/s)
FSU Standard	0.60	0.79
FSU small catchments	0.99	1.09
FSU – 3 variable	0.43	0.57
FSR 6 – including SFE	1.04	1.39
IH124 – including SFE	**2.40**	**3.16**
Modified IH124 – including SFE	1.88	2.48
Modified rational method	0.42	0.55
Minimum	0.42	0.55
Maximum	2.40	3.16
Average (n = 7)	1.11	1.43

4.3 FLOOD FLOW CALCULATIONS: GORTAHA CATCHMENT

The above process was repeated for the flows generated in the eastern part of the site, which drain to the Gortaha catchment. The physical catchment descriptors applicable to the Gortaha Catchment are shown in Table 7, these being at the eastern extent of the site boundary, just downstream of the N65.

Table 7 - Physical Catchment Descriptors Applicable to the Subject Site

PCD	Description	Units	Value
AREA	Catchment area	km^2	1.06
SAAR	Average annual rainfall	mm	924.6
BFIsoil	Baseflow index derived from soils data		0.691
FARL	Flood attenuation from reservoirs and lakes		1
DRAIND	Ratio of river network to catchment area	$no./km^2$	2.455
S_{1085}	Slope of the main stream between the 10 and 85 percentiles	m/km^2	0.1
ARTDRAIN2	Proportion of river network included in drainage schemes		0.3172
URBEXT			0
$QMED_{rural}$		m^3/s	0.114
$QMED_{urban}$		m^3/s	0.115

Results from the various methods used to estimate flood flows in the Gortaha Stream are summarised below in Table 8. In taking a conservative approach, the flood flow values selected for use in the hydraulic model were those calculated using the Modified IH124 method, as this method was developed using Irish catchment characteristics. The Q_{100+cc} and $Q_{1000+cc}$ values were estimated as 1.33 m^3/s and 1.76 m^3/s, respectively.

Table 8 - Summary of Calculated Flood Flows (includes 20% Climate Change Factor)

Methodology	Q_{100} + 20% cc (m^3/s)	Q_{1000} + 20% cc (m^3/s)
FSU Standard	0.41	0.54
FSU small catchments	0.96	1.28
FSU – 3 variable	0.25	0.33
FSR 6 – including SFE	0.46	0.61
IH124 – including SFE	**1.33**	**1.76**
Modified IH124 – including SFE	1.00	1.33
Modified rational method	0.28	0.37
Minimum	0.25	0.33
Maximum	1.33	1.76
Average (n = 7)	0.67	0.88

The above flood flows apply to the catchment to the eastern extent of the site boundary. In order to estimate flood flows in the northern and southern sub-catchments in the area the flows were divided based on their respective contributing areas. This resulted in flood flow estimations of 0.75 m^3/s and 0.93 m^3/s for the Q_{100} and Q_{1000} in the Gortaha North catchment (0.57 km^2) and flows of 0.63 m^3/s and 0.83 m^3/s for the Q_{100} and Q_{1000} in the Gortaha South catchment (0.49 km^2).

4.4 PROPOSED BRIDGE CROSSINGS

In order to facilitate site layout works several new bridge crossings are required. Two new structures are proposed in the Kilcrow catchment (Figure 10) in addition to four new structures proposed in the Gortaha catchment (Figure 15). Hydraulic modelling works shall be performed to ensure these proposed bridge crossings are appropriately sized.

The bridge crossings in the Kilcrow catchment are referred to as BR1 and BR2 whilst the proposed bridge crossings in the Gortaha catchment are labelled BR3, BR4, BR5 and BR6.

Flood flows corresponding to the catchment upstream of each proposed bridge crossing were calculated using the IH124 method and the appropriate contributing catchment, and are outlined below in Table 9. In the final column a drainage factor of 1.6 has been applied to the Q_{100+cc} flood flow value, as per OPW Section 50 specifications for design flows in maintained channels.

Table 9 – Flood Flows for each proposed bridge in the Gortaha Catchment

Catchment	Bridge Reference	Area to Structure (km^2)	Q_{100} + 20% cc (m^3/s)	(Q_{100} + 20% cc) x 1.6 (m^3/s)
Kilcrow	BR1	0.80	0.96	1.54
Kilcrow	BR2	0.92	1.1	1.76
Gortaha	BR3	0.14	0.17	0.27
Gortaha	BR4	0.13	0.16	0.26
Gortaha	BR5	0.19	0.24	0.38
Gortaha	BR6	0.11	0.14	0.23

The above flood flows will inform bridge design as per OPW specifications which stipulate:

- a bridge or culvert must be capable of passing a fluvial flood flow with a 1% AEP, or 1 in 100 year flow, without significantly changing the hydraulic characteristics of the watercourse;
- a bridge must be capable of operating under the above design conditions while maintaining a freeboard of at least 300 mm;
- a culvert diameter, height and width must not be less than 900 mm in order to facilitate maintenance access and to reduce the likelihood of debris blockage.

Proposed bridge specifications are presented further in the report.

5 HYDRAULIC MODEL

5.1 MODEL CONCEPT

A site-specific hydraulic model was constructed using Flood Modeller (version 6.1), an industry standard hydraulic modelling software package for which Envirologic maintains a full license. This software package is designed to perform one dimensional (1D) hydraulic simulations for networks of natural or constructed water channels. In addition to the one-dimensional hydraulic solver the software also utilises a two-dimensional solver (2D) which models water flow and depth in situations where flood levels overtop the bank-full capacity of the surveyed channels

and spill onto the adjoining floodplain. Construction of the 1D–2D linked model relies on four primary inputs summarised as follows:

- Geometric Data: Surveyed cross-sectional data of the main channel through the site boundary;
- Geometric Data: A georeferenced digital elevation model of the site and surrounding landscape to cover potential adjoining flood plain upstream and downstream of the site location;
- Upstream Boundary Conditions - Q_{100} & Q_{1000} flood flow volumes for the upstream catchment of the site;
- Inclusion of Manning Roughness Coefficient values, used to calculate frictional forces within the flood model.

5.2 MODEL BUILD – EXISTING DRAINAGE REGIME: KILCROW CATCHMENT

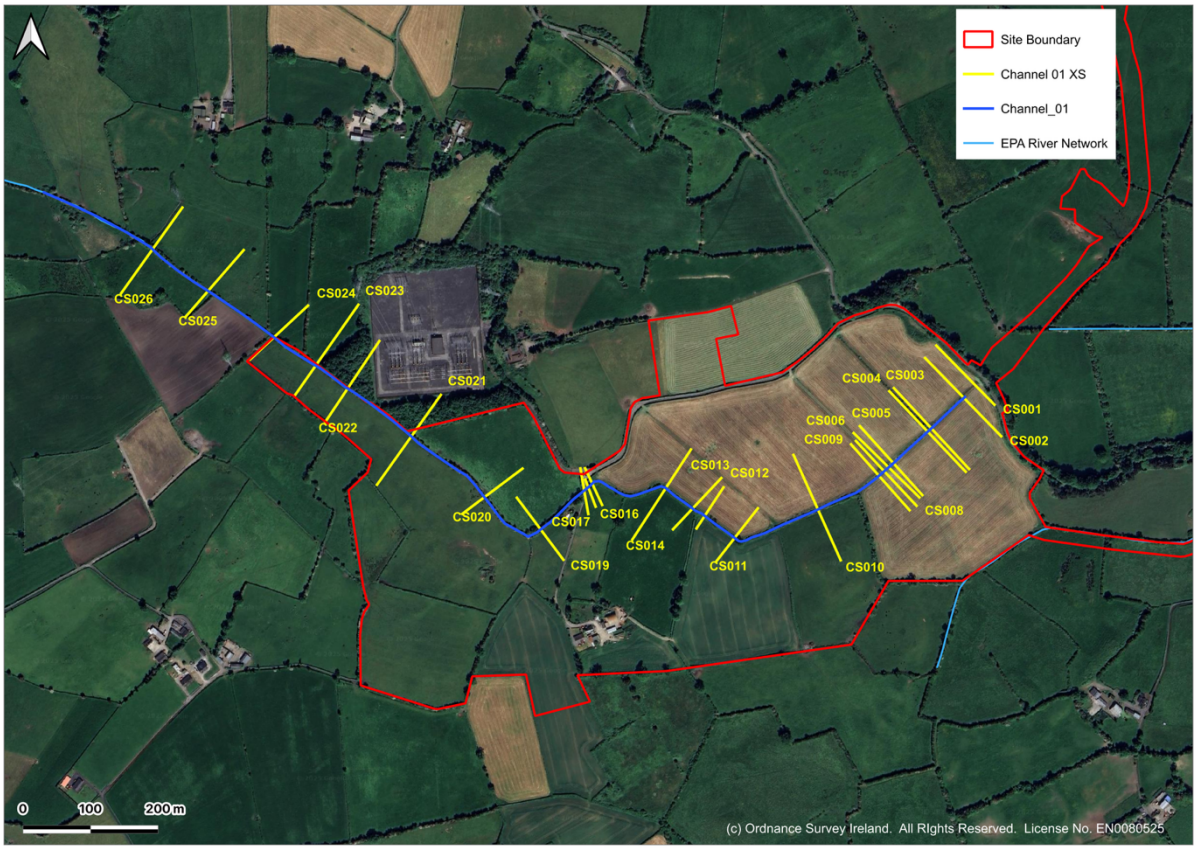
5.2.1 Cross Sections

This 1D model was compiled using twenty-six evenly spaced cross sections along the central channel within the site boundary, as shown in Figure 8. These sections were surveyed manually using Trimble RTK VRS technique. As stated previously the surface water catchment to this central channel as it passes the downgradient site boundary is 2.00 km^2.

A further 19 cross sections were surveyed within drainage ditches that run perpendicular, and outfall to the central channel within the site. Only one of these was considered as contributing flows high enough that it should be included in the flood model; this being a drainage tributary that extends 950 m south and has a catchment of approximately 0.68 km^2. Nine cross sections were surveyed along this southern drainage tributary. Accordingly, 34% of the Q_{100} and Q_{1000} flow values were attributed to this southern drainage tributary, based on its proportional area within the overall site catchment.

For reference, the model refers to the central channel as Channel_01 (Figure 8) and the southern drainage tributary as Channel_02 (Figure 9).

Figure 8 – Kilcrow Catchment: Central Channel Cross Section Locations



5.2.2 Flow Boundaries

The IH124 $Q_{1000+cc}$ flow value of 3.16 m^3/s was selected as the design flood flow through the central channel. This was introduced to the modelled central channel as inflows of 2.09 m^3/s at node CS001 and 1.06 m^3/s at node CS100. The combined flow of 3.16 m^3/s is then routed through all remaining downstream cross sections. The same modelling concept approach was applied in relation to the Q_{100} flow (2.94 m^3/s).

5.2.3 Roughness Coefficients & Gradients

A Manning's roughness coefficient of 0.03 was applied to open river channel bed sections (noted as silty/gravelly) and a value of 0.045 applied to riverbanks. The central channel (Channel 01) is noted on the OPW drainage network database as being maintained as part of the Killimor arterial drainage district. It was observed during the site visit that the channel profiles generally have steep banks and channel beds with a low hydraulic gradient, generally 0.02%. This steepened to a maximum gradient of 1.18% in the western part of the site.

5.2.4 Existing Structures

There are four structures currently in place along the modelled reaches. Culvert specifications are noted as follows:

- CS006 = Culvert field crossing along Channel 01:

    - 1 no. circular concrete culvert with an opening of 900 mm
    - Length = 6.0 m
    - Pipe crown elevation = 52.05 mOD
    - Pipe invert elevation = 51.15 mOD
    - Upstream top of wall elevation = 53.32 mOD
    - Culvert deck level = 53.21 mOD
- CS016 = Culvert crossing on Channel 01 for access road to existing dwelling:
    - 1 no. concrete culvert with an opening of 950 mm
    - Length = 7.5 m
    - Pipe crown elevation = 51.18 mOD
    - Pipe invert elevation = 50.18 mOD
    - Upstream top of wall elevation = 51.70 mOD
    - Culvert deck level = 51.87 mOD
- CS102 = Culvert crossing on Channel 02 for access between fields:
    - 1 no. concrete culvert with an opening of 650 mm
    - Length = 4.0 m
    - Pipe crown elevation = 52.95 mOD
    - Pipe invert elevation = 52.30 mOD
    - Upstream top of wall elevation = 53.31 mOD
    - Culvert deck level = 53.40 mOD
- CS110 = Culvert on Channel 02 immediately upstream of outfall to Channel 01:
    - 1 no. concrete culvert with an opening of 500 mm
    - Length = 0.5 m
    - Pipe crown elevation = 51.95 mOD
    - Pipe invert elevation = 51.45 mOD
    - Upstream top of wall elevation = 52.72 mOD
    - Culvert deck level = 52.72 mOD

5.2.5 Existing Drainage Regime: Simulations

Modelling simulations were run to represent the following scenarios:

- Validation of the model build using observed vs modelled water levels
- 1 in 100-year fluvial flood event

- 1 in 1000-year fluvial flood event

5.2.6 Simulation: Validation

Surface water levels were recorded on 1st and 2nd May 2024 as part of the topographical survey. These surveyed water levels were compared with water levels modelled by the hydraulic simulation, with results shown in Table 10. A flow of 0.2 m^3/s provided the least amount of error between the surveyed and modelled water levels and was deemed representative of flows observed on the day.

Validation results showed that the model was extremely accurate throughout the modelled reach of the central channel, with the difference generally below 60 mm. There was a slight increase in divergence of up to 200 mm at CS022 and CS023 with this being attributed to the sharp increase in hydraulic gradient towards the end of the model. Another slightly higher difference between observed and predicted water levels of 120 mm occurred immediately upstream of culvert CS016. During surveying it was noted that there was a large amount of silt and vegetation at the culvert inlet which was not accounted for in the model.

The results of the validation exercise confirm that the model is valid and accurate and is appropriate for predicting flood flows through the application site.

Table 10 - Surface Water Levels Validation

Cross Section	Surveyed Surface Water Level (mOD)	Modelled Water Level at 0.2 m^3/s (mOD)	Difference (m)
CS002	51.62	51.64	-0.02
CS003	51.60	51.63	-0.04
CS004	51.58	51.61	-0.03
CS005	51.58	51.61	-0.03
CS007	51.58	51.60	-0.02
CS008	51.58	51.60	-0.02
CS009	51.52	51.54	-0.02
CS010	51.17	51.24	-0.07
CS011	50.81	50.80	0.02
CS012	50.76	50.73	0.03
CS013	50.70	50.66	0.03
CS014	50.40	50.50	-0.12
CS015	50.37	50.48	-0.12
CS017	50.1	50.18	-0.08
CS018	49.78	49.70	0.09
CS019	48.39	48.28	0.11
CS020	45.84	45.90	-0.06
CS021	43.78	43.84	-0.06
CS022	43.18	42.96	0.22
CS023	42.82	42.63	0.19
CS024	42.45	42.45	0.00
CS025	42.31	42.38	-0.08
CS026	42.25	42.26	0.00

5.2.7 Simulation: Flood Flows

The conveyance capacity of all surveyed cross sections along the existing stream were assessed for suitability to transmit Q_{100} and Q_{1000} flood flows, with a 20% allowance included for climate change. The design flows are as follows:

- Central channel (Channel 01) Q_{100} = 1.59 m^3/s
- Central channel (Channel 01) Q_{1000} = 2.10 m^3/s
- Southern tributary (Channel 02) Q_{100} = 0.80 m^3/s
- Southern tributary (Channel 02) Q_{1000} = 1.06 m^3/s

The predicted surface water elevations from the Flood Modeller 1D simulation under steady-state conditions are presented in Table 11.

The results showed that under flood conditions waters are maintained within the central channel profile. There is surcharging upstream of the culvert at CS016 but these upstream waters remain confined within the channel profile.

Full surcharging occurs at the inlets of both culverts on the southern tributary under Q_{100} flows, these being positioned at CS102 and CS110. As proposed works involve realignment of this channel it was not deemed necessary to construct a full 1D-2D flood simulation to assess of the fate of waters that spill onto the floodplain. The southern tributary (Channel 02) was capable of safely transmitting 0.6 m^3/s with the existing culverts in place.

Table 11 - Hydraulic Model Flow Simulation Outputs for existing hydraulic regime for Central Channel

Cross Section	Channel 01			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
CS001	1.59	52.57	2.10	52.72
CS002	1.59	52.38	2.10	52.56
CS003	1.59	52.39	2.10	52.58
CS004	1.59	52.37	2.10	52.55
CS005	1.59	52.36	2.10	52.55
CS006UP	1.59	52.28	2.10	52.43
CS006DN	1.59	52.29	2.10	52.44
CS007	1.59	52.29	2.10	52.44
CS008	1.59	52.29	2.10	52.44
CS009	1.59	52.20	2.10	52.34
CS010	1.59	51.73	2.10	51.84
CS011	1.59	51.40	2.10	51.56
CS012	2.40	51.64	3.16	51.85
CS013	2.40	51.58	3.16	51.79
CS014	2.40	51.41	3.16	51.64

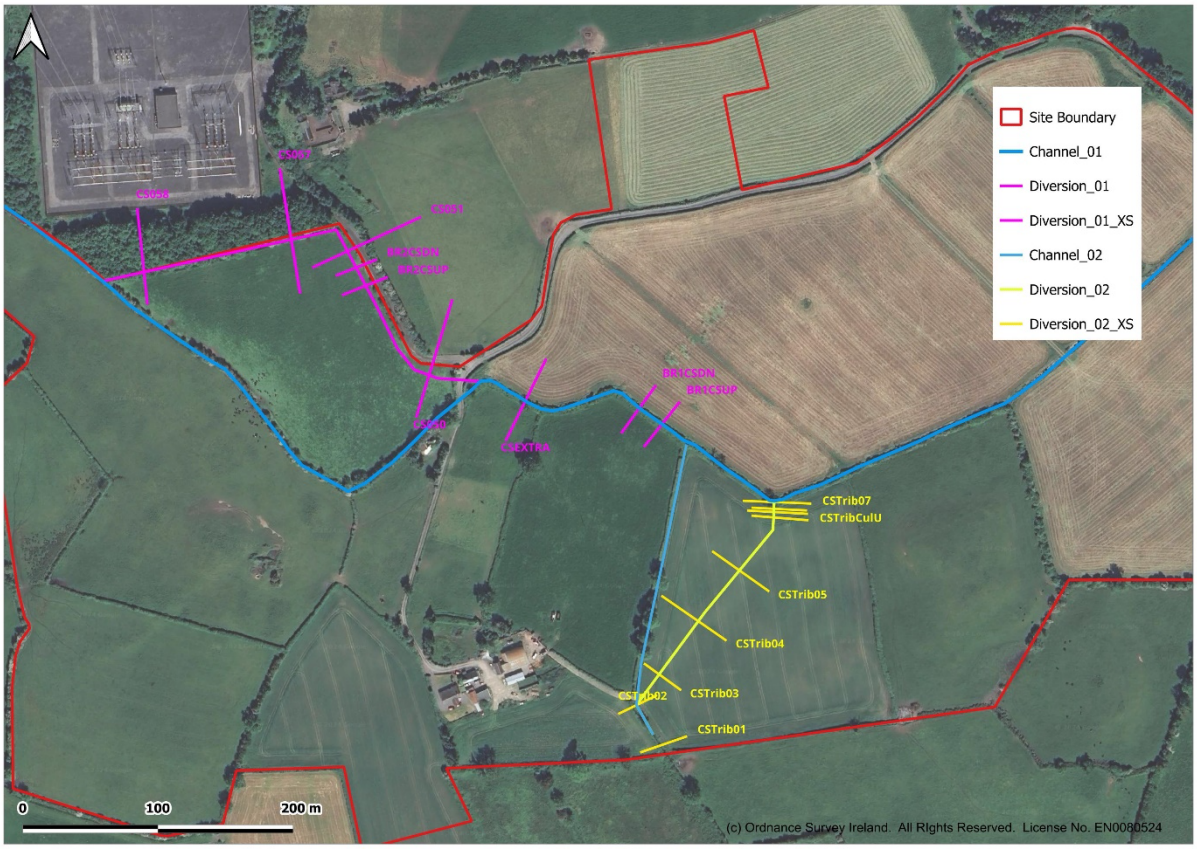
Cross Section	Channel 01			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
CS015	2.40	51.40	3.16	51.63
CS016UP	2.40	50.69	3.16	50.81
CS016DN	2.40	50.66	3.16	50.77
CS017	2.40	50.66	3.16	50.77
CS018	2.40	50.18	3.16	50.28
CS019	2.40	48.67	3.16	48.74
CS020	2.40	46.37	3.16	46.47
CS021	2.40	44.32	3.16	44.42
CS022	2.40	43.55	3.16	43.71
CS023	2.40	43.33	3.16	43.49
CS024	2.40	43.14	3.16	43.28
CS025	2.40	42.99	3.16	43.10
CS026	2.40	42.48	3.16	42.88

5.3 MODEL BUILD – REALIGNED DRAINAGE REGIME

In order to facilitate efficient site layout design the proposed development works include for the realignment of the local drainage network at two separate channel reaches, as indicated in Figure 9:

1. Realignment 01 – Channel 01. The reach between CS016 and CS020 will be diverted north and then west for 350 m. The culvert currently in place at CS016 shall be decommissioned.
2. Realignment 02 – Channel 02. The southern drainage tributary will be diverted northeastwards from where it currently flows past the on-site dwelling. The culverts currently in place at CS102 and CS110 shall be decommissioned. A new culvert will be installed to facilitate a proposed access road just before the southern tributary outfalls to the central channel.
3. Invert levels along the realigned drainage channels have been derived at the cross sections shown in Figure 9, based on a uniform bed gradient between the start and end of each realigned channel reach.

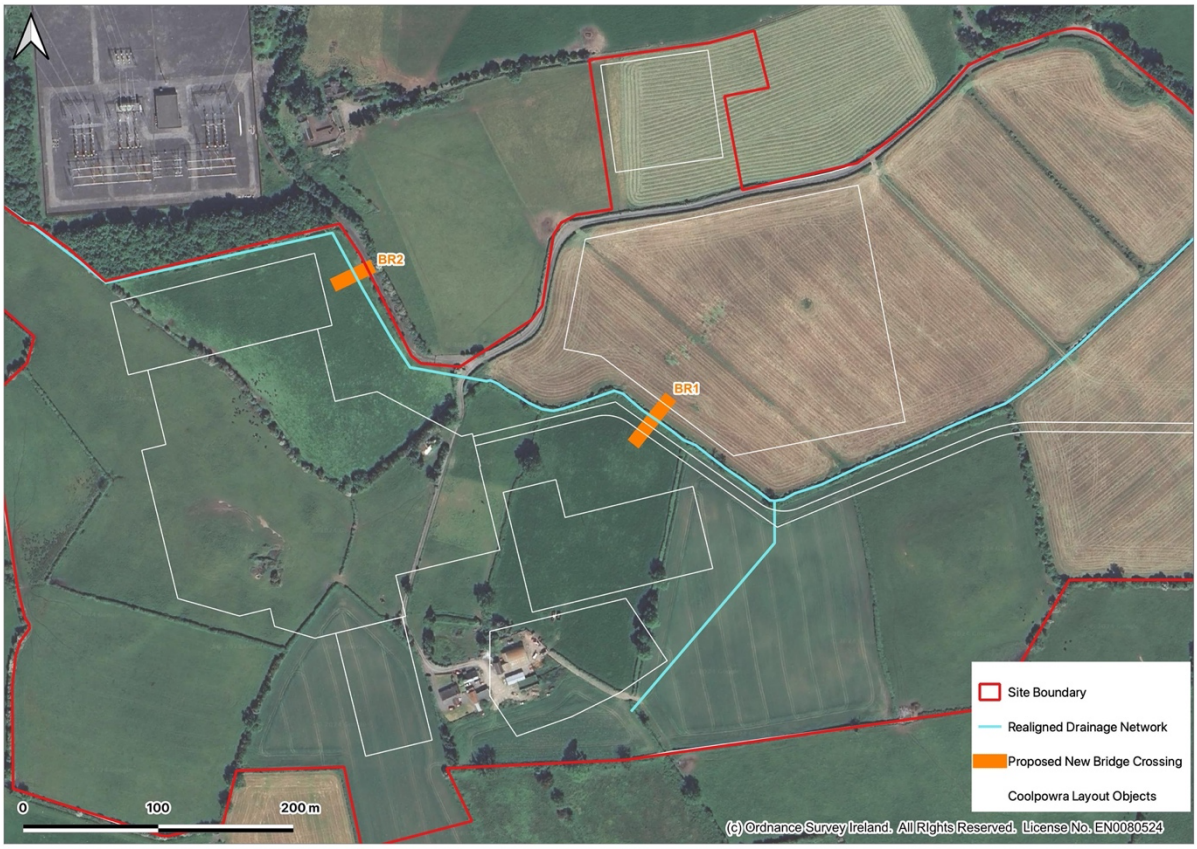
Figure 9 - Location of diverted channels and cross sections



5.4 PROPOSED STRUCTURES: KILCROW CATCHMENT

In addition to the above realignment works, two new bridges are proposed to facilitate new internal access roads, these will be installed (i) on the central channel between CS012 and CS013, and (ii) on the northern limb of Realignment 01 (BR2). Locations of the proposed bridges are shown in Figure 10.

Figure 10 - Location of Proposed Bridges: Kilcrow Catchment



The proposed replacement culvert structure will be located on Realigned Channel 02, just upstream of its confluence with Channel 01. It will have the following specifications:

- CSTribCul = New culvert upstream of confluence of Realignment 02 and Channel 01:
    - 1 no. circular concrete culvert with an opening of 1,200 mm
    - Width = 6 m
    - Pipe crown elevation = 52.45 mOD
    - Pipe invert elevation = 51.25 mOD
    - Culvert deck level = new access road elevation

The design specifications for the two new proposed bridges require a freeboard of 300 mm for the water level corresponding to the Q_{100} flow + climate change Q_{100} flow + climate change x 1.6 Drainage Factor. Each bridge structure shall consist of a precast concrete deck. Stone gabions will act as a foundation to the concrete base of the deck level, which will be set back approximately 1m from the top of the channel bank. There will be a minimum clearance of 400 mm from the top of the channel bank to the bridge soffit.

- BR1 = Proposed bridge along Channel 01 between CS012 and CS013:
    - Precast concrete bridge deck
    - Length = 6 m

- Soffit elevation = 53.0 mOD
- Spring elevation = Ground elevation
- Bridge deck level = 53.5 mOD

- BR2 = Proposed bridge on northern limb of Realignment 01
  - Precast concrete bridge deck
  - Width = 6 m
  - Soffit elevation = 51.0 mOD
  - Spring elevation = Ground elevation
  - Bridge deck level = 51.5 mOD

5.4.1 Proposed Drainage Regime Flood Scenarios

The conveyance capacity of all surveyed and realigned cross sections along the existing stream and realigned channel reaches were re-assessed for suitability to transmit Q_{100} and Q_{1000} flood flows, with a 20% allowance included for climate change. The design flows are as per previous. The predicted surface water elevations from the Flood Modeller 1D-model under steady-state conditions are presented in Table 12.

Table 12 - Hydraulic Model Flow Simulation Outputs for Channel 01 with diversions 01 and 02 incorporated

Cross Section	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
CS001	1.59	52.57	2.10	52.72
CS002	1.59	52.38	2.10	52.56
CS003	1.59	52.39	2.10	52.58
CS004	1.59	52.37	2.10	52.55
CS005	1.59	52.37	2.10	52.55
CS006UP	1.59	52.28	2.10	52.43
CS006DN	1.59	52.29	2.10	52.44
CS007	1.59	52.29	2.10	52.44
CS008	1.59	52.29	2.10	52.44
CS009	1.59	52.20	2.10	52.34
CS010	2.40	51.93	3.16	52.08
CS011	2.40	51.74	3.16	51.90
CS012	2.40	51.75	3.16	51.92
BR1CSUP	2.40	51.70	3.16	51.87
BR1CSDN	2.40	51.69	3.16	51.86
CS013	2.40	51.68	3.16	51.85
CSEXTRA	2.40	51.40	3.16	51.53
CS014	2.40	50.87	3.16	50.98
CS050	2.40	50.80	3.16	50.92
BR2CSUP	2.40	49.66	3.16	49.63
BR2CSDN	2.40	49.81	3.16	49.89
CS051	2.40	49.07	3.16	49.12
CS057	2.40	48.09	3.16	48.19
CS058	2.40	46.89	3.16	46.99
CS020	2.40	46.37	3.16	46.47
CS021	2.40	44.32	3.16	44.42
CS022	2.40	43.55	3.16	43.71
CS023	2.40	43.33	3.16	43.49
CS024	2.40	43.14	3.16	43.28
CS025	2.40	42.99	3.16	43.10
CS026	2.40	42.48	3.16	42.88
CSTrib01	0.80	53.18	1.06	53.24
CSTrib02	0.80	52.85	1.06	52.91
CSTrib03	0.80	52.46	1.06	52.52
CSTrib04	0.80	52.09	1.06	52.26
CSTrib05	0.80	52.04	1.06	52.23
CSTribCulUp	0.80	51.94	1.06	52.09
CSTribCulDn	0.80	51.93	1.06	52.08
CSTrib06	0.80	51.93	1.06	52.08
CSTrib07	0.80	51.93	1.06	52.08

The results showed that under flood conditions waters are maintained within the re-aligned central channel and the realigned tributary to the south. There is no surcharging upstream of any of the proposed structures. As the floodwaters were contained within the 1D model it was not necessary to develop a 1D-2D linked hydraulic model.

The longitudinal profiles of Channel 01, including the realignment and proposed bridges, are shown for the Q_{100} and Q_{1000} scenarios in Plate 4 and Plate 5, respectively.

The longitudinal profiles of Channel 02, including the upgraded culvert, are shown for the Q_{100} and Q_{1000} scenarios in Plate 6 and Plate 7, respectively.

Plate 4 – Longitudinal Profile of Channel 01 with Realigned Channel under Q_{100} scenario

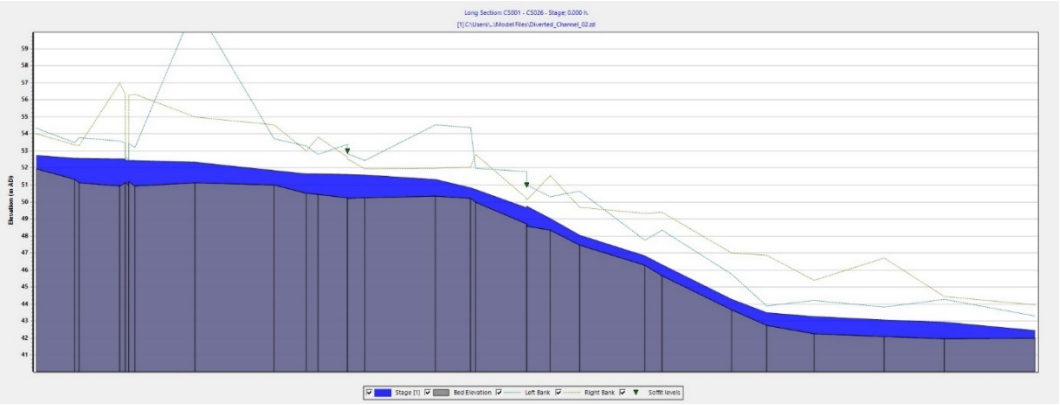


Plate 5 – Longitudinal Profile of Channel 01 with Realigned Channel under Q_{1000} scenario

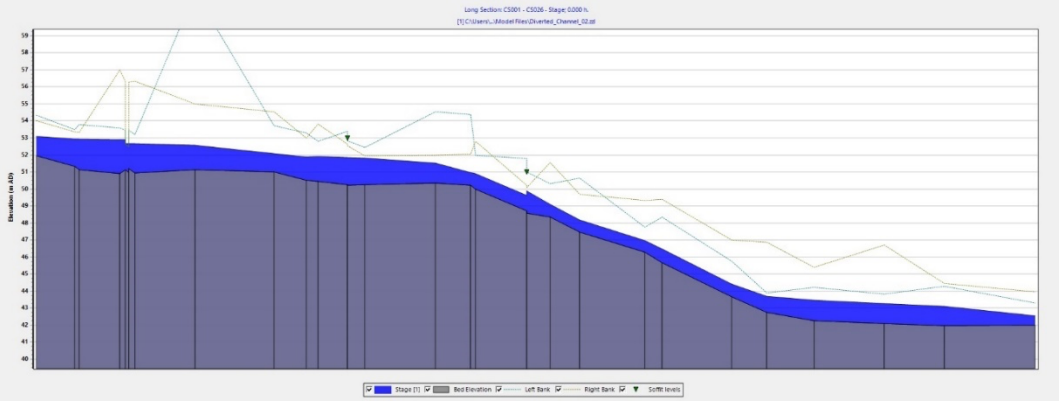


Plate 6 – Longitudinal Profile of Channel 02 with Realigned Channel under Q_{100} scenario

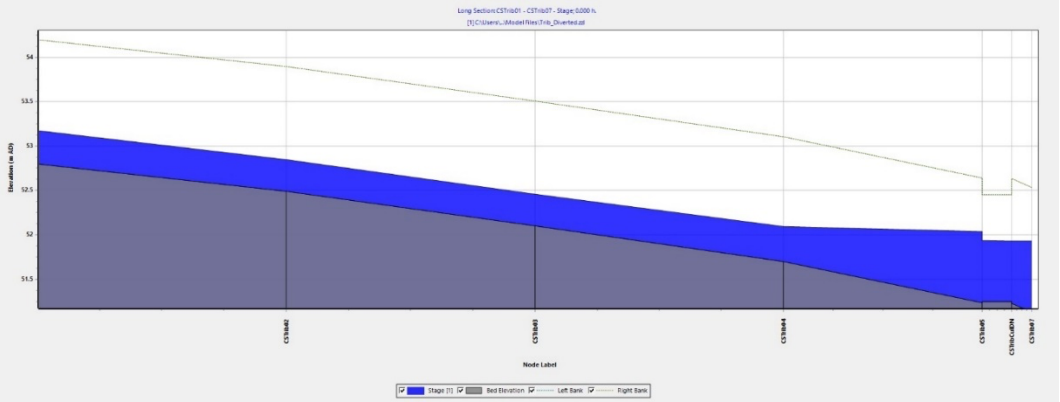
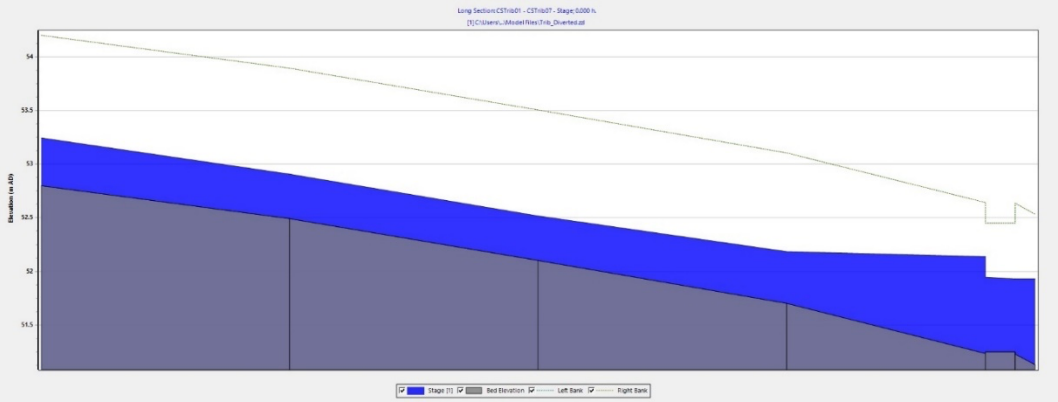


Plate 7 – Longitudinal Profile of Channel 02 with Realigned Channel under Q_{1000} scenario



5.5 MODEL BUILD: EXISTING DRAINAGE REGIME: GORTAHA CATCHMENT

The 1D model for the eastern part of the application site, which drains to the Gortaha catchment, centred around two primary watercourses. For the purposes of this study these have been referred to as the Gortaha North and the Gortaha South (indicated as CS GNo and CS GSo in node nomenclature). The 1D hydraulic model for the Gortaha catchment was compiled using forty evenly spaced cross sections surveyed along these two watercourses. Cross section locations for the Gortaha North and Gortaha South are shown in Figure 11 and Figure 12, respectively.

Figure 11 – Gortaha North Cross Sections

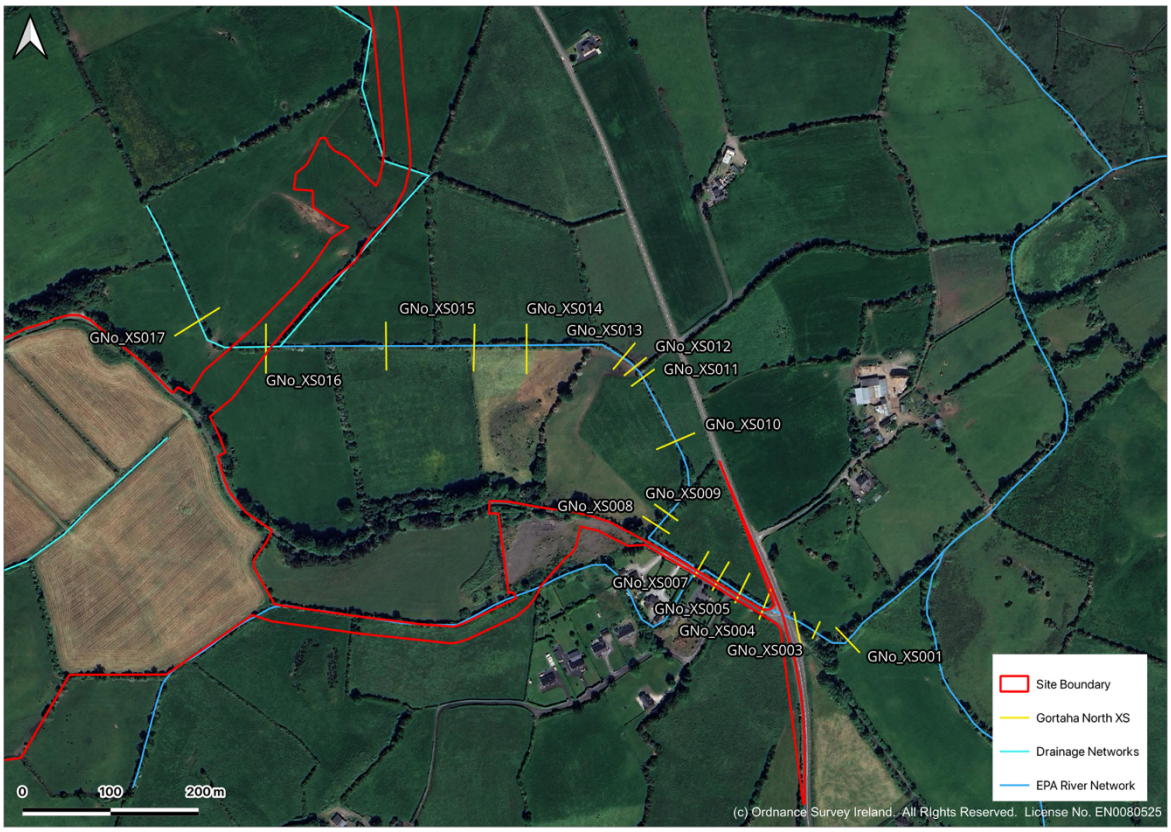
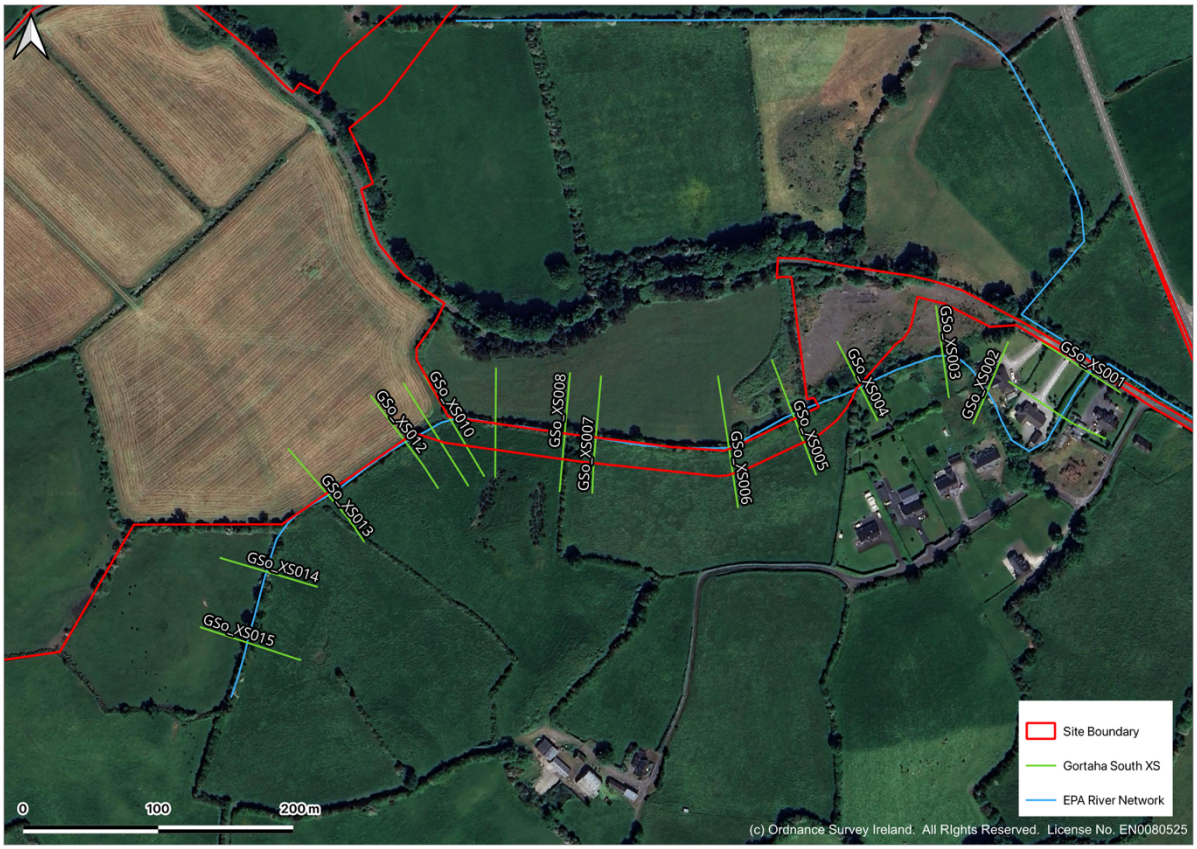


Figure 12 – Gortaha South Cross Sections



5.5.1 Flow Boundaries

The IH124 Q_{100+cc} & $Q_{1000+cc}$ flows presented previously were used as the design flood flows through each channel. The Gortaha North channel was modelled first to determine the downstream head boundary for the Gortaha South channel under flood conditions. The combined flow of 1.33 m^3/s (Q_{100+cc}) and 1.76 m^3/s ($Q_{1000+cc}$) was applied to the model downstream of the confluence.

5.5.2 Roughness Coefficients & Gradients

A Manning's roughness coefficient of 0.03 was applied to open river channel bed sections (noted as silty/gravelly) and a value of 0.045 applied to riverbanks. The channels throughout the Gortaha Catchment are characterised as having trapezoidal shape, with steep banks and flat channel bottoms. Both channels are mapped as being part of a Drainage District.

5.5.3 Existing Structures

There are three structures in place along the modelled channels in the Gortaha Catchment. Culvert specifications are as follows:

- GNo_Cul01 = Culvert crossing under the N65
    - 1 no. circular concrete culvert with an opening of 500 mm
    - Length = 42.0 m

    - Upstream Pipe crown elevation = 48.45 mOD
    - Upstream Pipe invert elevation = 47.95 mOD
    - Downstream Pipe crown elevation = 48.30 mOD
    - Downstream Pipe invert elevation = 47.80 mOD
    - Upstream top of wall elevation = ground level = 49.68 mOD
    - Culvert deck level (spill point) = 50.01 mOD
- GNo_Cul02 = Culvert supporting a field crossing
    - 1 no. circular concrete culvert with an opening of 300 mm
    - Length = 4.5 m
    - Upstream Pipe crown elevation = 50.25 mOD
    - Upstream Pipe invert elevation = 49.95 mOD
    - Downstream Pipe crown elevation = 50.20 mOD
    - Downstream Pipe invert elevation = 49.90 mOD
    - Upstream top of wall elevation = ground level = 50.70 mOD
    - Culvert deck level (spill point) = 50.7 mOD
- GSo_Cul01= Culvert crossing under the L8763
    - 1 no. circular concrete culvert with an opening of 450 mm
    - Length = 11.0 m
    - Upstream Pipe crown elevation = 49.03 mOD
    - Upstream Pipe invert elevation = 48.58 mOD
    - Downstream Pipe crown elevation = 48.93 mOD
    - Downstream Pipe invert elevation = 48.42 mOD
    - Upstream top of wall elevation = ground level = 49.944 mOD
    - Culvert deck level (spill point) = 49.944 mOD

5.5.4 Existing Drainage Regime: Simulations

Modelling simulations were run to represent the following scenarios:

- 1 in 100 year fluvial flood event;
- 1 in 1000 year fluvial flood event.

A validation exercise was not carried out due to the previously mentioned channel blockages in both Gortaha North and South channels. This would have resulted in water levels being returned as excessively high in the upper sections, and subsequently, excessively low in the lower sections to appropriately assess model divergence.

5.5.5 Simulation: Flood Flows

The conveyance capacity of all surveyed cross sections along the Gortaha North and South channels were assessed for suitability to transmit Q_{100} and Q_{1000} flood flows, with a 20% allowance included for climate change. As previously mentioned, the design flows are as follows:

- Gortaha North Q_{100} = 0.75 m^3/s
- Gortaha North Q_{1000} = 0.93 m^3/s
- Gortaha South Q_{100} = 0.63 m^3/s
- Gortaha South Q_{1000} = 0.83 m^3/s

The flows for each catchment merge at a confluence downstream of culvert GSo_Cul01 (culvert transmits water under the L8763) , resulting in cumulative Q_{100} and Q_{1000} flows of 1.33 m^3/s and 1.76 m^3/s, respectively. The predicted surface water elevations from the Flood Modeller 1D-model under steady-state conditions are presented for each of the Gortaha channels in Table 13 and Table 14.

Table 13 – Gortaha North Predicted Fluvial Flood Flow Elevations

Cross Section	Gortaha North			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
GNo_XS017	0.75	52.15	0.93	52.21
GNo_XS016	0.75	52.07	0.93	52.13
GNo_XS015	0.75	51.75	0.93	51.81
GNo_XS014	0.75	51.33	0.93	51.40
GNo_XS013	0.75	50.75	0.93	50.75
GNo_XS012	0.75	50.75	0.93	50.75
GNo_Cul02 us	0.75	50.75	0.93	50.75
GNo_Cul02 ds	0.75	50.75	0.93	50.75
GNo_XS011	0.75	50.20	0.93	50.26
GNo_XS010	0.75	50.08	0.93	50.15
GNo_XS009	0.75	50.06	0.93	50.08
GNo_XS008	0.75	50.06	0.93	50.08
GNo_XS007	1.33	50.06	1.76	50.08
GNo_XS006	1.33	50.06	1.76	50.08
GNo_XS005	1.33	50.06	1.76	50.08
GNo_XS004	1.33	50.06	1.76	50.08
GNo_Cul01 us	1.33	50.06	1.76	50.08
GNo_Cul01 ds	1.33	50.06	1.76	50.08

Cross Section	Gortaha North			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
GNo_XS003	1.33	48.42	1.76	48.49
GNo_XS002	1.33	48.34	1.76	48.42
GNo_XS001	1.33	48.14	1.76	48.22

Table 14 – Gortaha South Predicted Fluvial Flood Flow Elevations

Cross Section	Gortaha South			
	Q_{100} Flow (m^3/s)	Q_{100} fluvial flood levels (mOD)	Q_{1000} Flow (m^3/s)	Q_{1000} fluvial flood levels (mOD)
GSo_XS015	0.63	52.97	0.83	53.02
GSo_XS014	0.63	52.79	0.83	52.86
GSo_XS013	0.63	52.45	0.83	52.52
GSo_XS012	0.63	52.15	0.83	52.23
GSo_XS011	0.63	52.13	0.83	52.22
GSo_XS010	0.63	52.13	0.83	52.21
GSo_XS009	0.63	52.10	0.83	52.18
GSo_XS008	0.63	52.07	0.83	52.15
GSo_XS007	0.63	51.98	0.83	52.05
GSo_XS006	0.63	51.73	0.83	51.80
GSo_XS005	0.63	51.29	0.83	51.36
GSo_XS004	0.63	50.85	0.83	50.87
GSo_XS003	0.63	50.21	0.83	50.28
GSo_XS002	0.63	50.09	0.83	50.28
GSo_XS001	0.63	50.06	0.83	50.08
GSo_Cul01 us	0.63	50.06	0.83	50.08
GSo_Cul01 ds	0.63	50.06	0.83	50.08
GNo_XS007	Head Boundary	50.06	Head Boundary	50.08

The results showed that under flood conditions, the culverts in the Gortaha North catchment surcharge and increase water levels upstream. Spill points linked to the deck level or field crossing level of each culvert were inserted to permit the flow of surcharge waters over the top of the structure and into the section immediately downstream of the culvert outlet. In the case of the GNo_Cul01 the deck level of the field crossing was lower than that of the left and right bank elevation, resulting in flood waters being maintained within channel bounds. No flood zones were therefore returned at GNo_Cul01.

At GNo_Cul02, significant culvert surcharge occurs. A spill level of 50.01 mOD, relating to the N65 road level downstream of the culvert was applied. As a result flood levels were predicted to rise to 50.06 mOD and 50.08 mOD immediately upstream of this structure for the Q_{100} and Q_{1000} flood event respectively. As flood waters exceeded bank elevation at this point, it was necessary to complete a linked 1D-2D hydraulic model to evaluate the fate of flood waters and their respective depths. This is described in more detail below.

Longitudinal profiles for Gortaha North and South channels are presented below as Plate 8 and Plate 9.

Plate 8 – Gortaha North Longitudinal Profile (Q_{100} = green line; Q_{1000} = blue line)

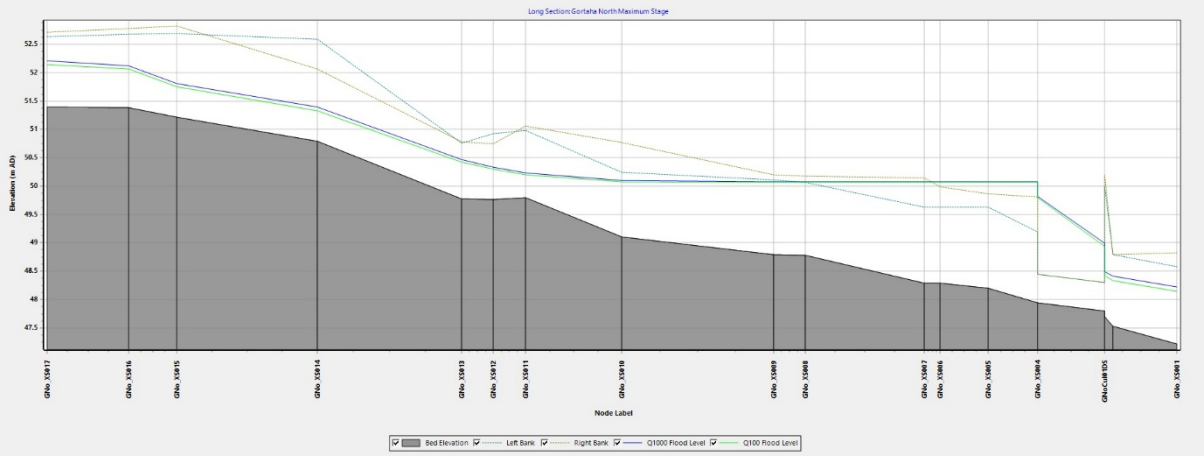
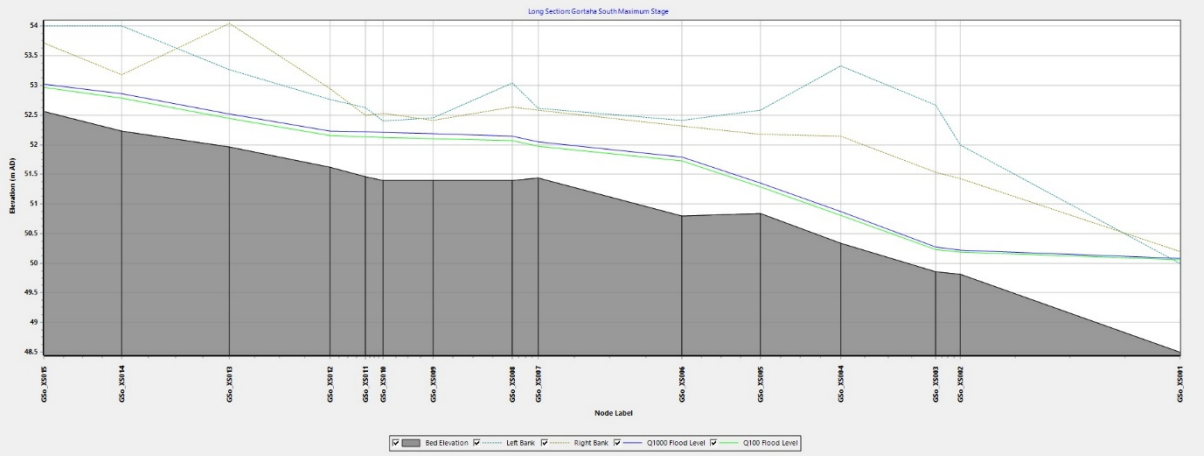


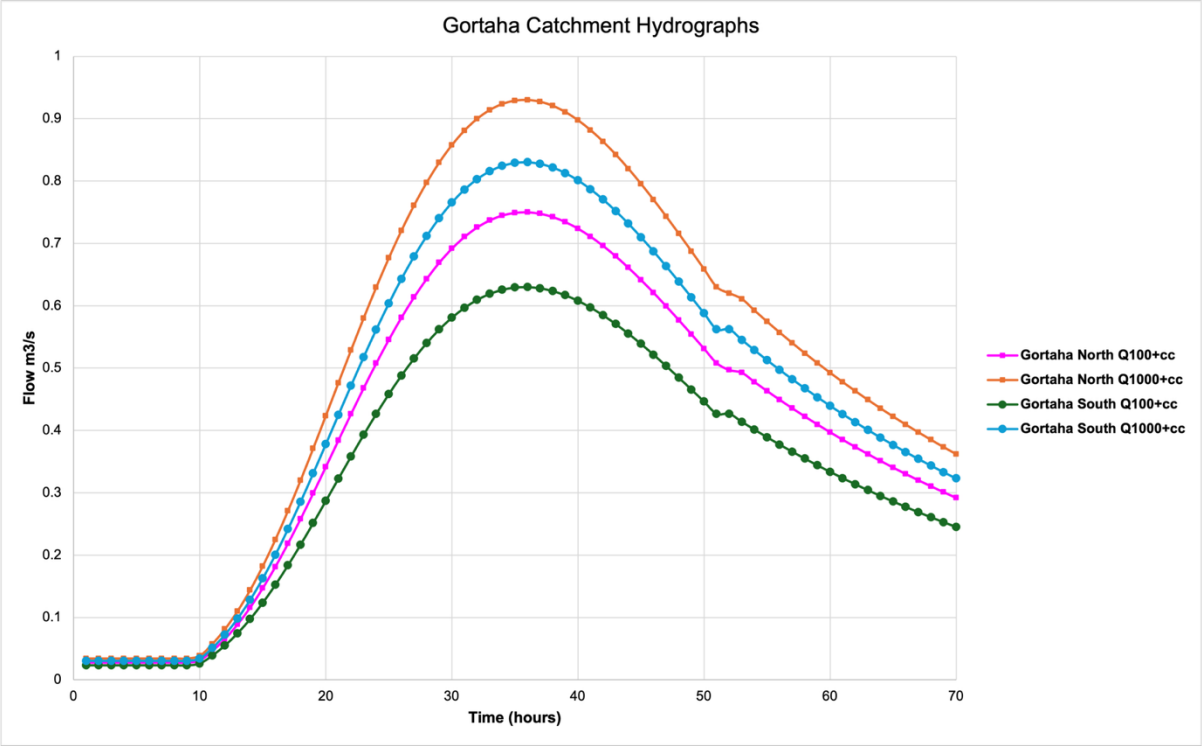
Plate 9 – Gortaha South Longitudinal Profile (Q_{100} = green line; Q_{1000} = blue line)



5.5.6 Simulation: 1D-2D Linked Hydraulic Model

A Digital Terrain Model with 0.25 m accuracy was acquired to investigate the fate of flood waters as they surcharge at section GNo_Cul01, which is the structure crossing the N65 road. Seventy-hour hydrographs for each channel and flood flow scenario were developed and are shown in Graph 1. Time to peak characteristics have been derived from the FSU portal and are representative of how 'flashy' the rainfall-runoff response is in each catchment.

Graph 1 – Hydrographs for each catchment and flood flow scenario



5.5.7 2D Flood Extents: Gortaha Catchment

The 1D model showed that under the current scenario flood waters surcharge upstream of the N65 culvert crossing (GNo_Cul01) to a maximum elevation of 50.06 mOD (Q_{100}) and 50.08 mOD (Q_{1000}).

Flood Modeller Pro was used to run a 1D-2D linked model simulation to view how the floodplain expands and contracts as the hydrograph progresses. The animation showed that in the initial stages the field upstream and north of the N65 culvert becomes inundated, as it lies lower than the N65 to the east. As flood water elevations continue to rise the floodplain expands across agricultural lands to the south, before finally spilling over the N65 at a low point on the road approximately 100 m south of the culvert. Floodwaters then continue to flow downstream (eastwards) from the N65.

Maximum flood water depths and extents are outlined in Figure 13 and Figure 14. Flood depths and extents are broadly similar for both the Q_{100} and Q_{1000} flood scenarios. Flood depths along the N65 vary from 0.1 m depth to 0.60 m depth, with the greater depths occurring on the southern side of the junction with the L8763. There is a 17 m long x 3 m wide portion of road extending north of the junction between the N65 and L8763 junction that has a maximum flood depth of 0.32 m. Flood depths along the submerged part of the L8763 do not exceed 0.3 m depth under both flow regimes.

The flood maps show that fluvial flood waters do not pose any risk to residential properties in the vicinity.

Figure 13 – Q_{100} Maximum Flood Depths and Extents

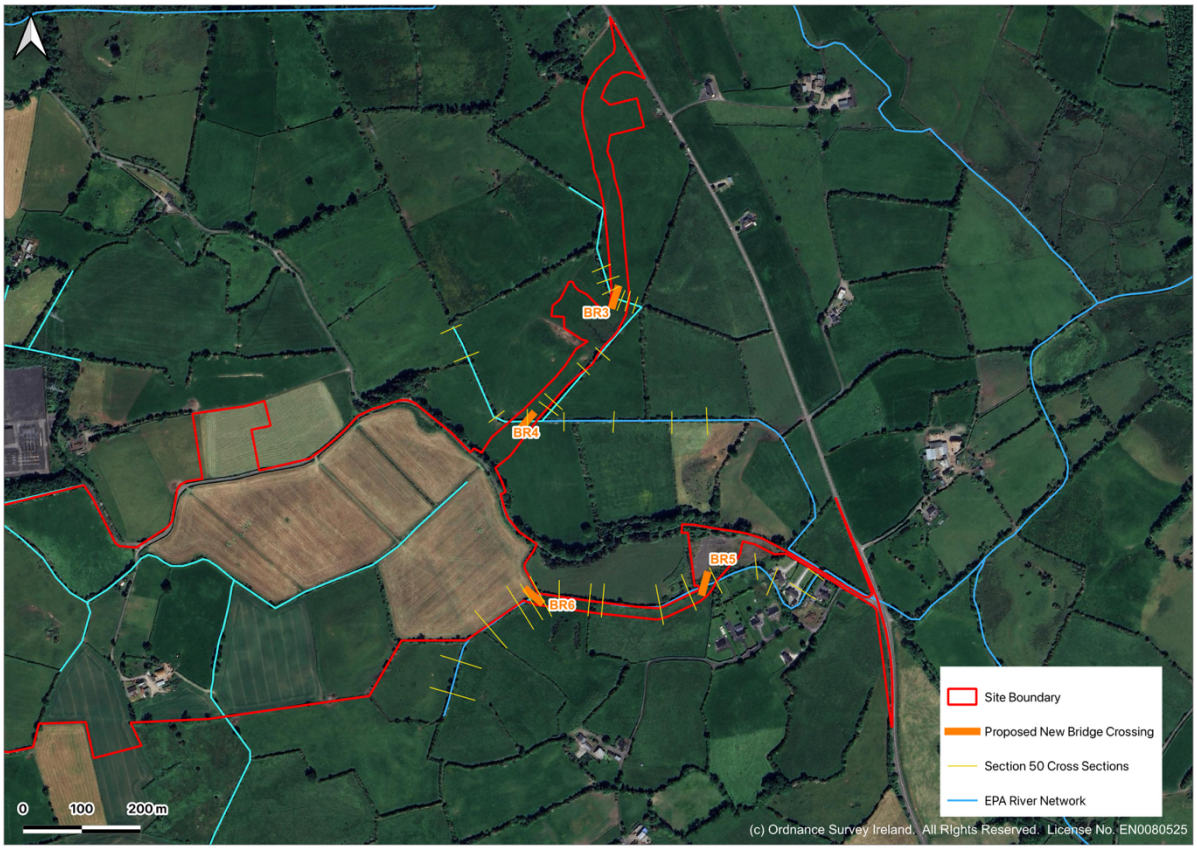
Figure 14 – Q_{1000} Maximum Flood Depths and Extents

5.6 GORTAHA CATCHMENT: PROPOSED STRUCTURES

The design specifications for the four new proposed bridges in the eastern part of the application site require a freeboard of 300 mm for the water level corresponding to the Q_{100} flow + climate change x 1.6 Drainage Factor. It is proposed that each bridge structure shall consist of a precast concrete deck. Stone gabions will act as a foundation to the concrete base of the deck level, which will be set back approximately 1m from the top of the channel bank. There will be a minimum clearance of 400 mm from the top of the channel bank to the bridge soffit. Proposed bridge crossing locations are shown in Figure 15.

- BR3 = Proposed bridge crossing the Gortaha North channel to facilitate temporary construction access route
    - Precast concrete bridge deck
    - Span Length = 8 m
    - Soffit elevation = 53.02 mOD
    - Spring elevation = Ground elevation (53.02 mOD)
    - Bridge deck level = 53.52 mOD
- BR4 = Proposed bridge crossing the Gortaha North channel to facilitate temporary construction access route
    - Precast concrete bridge deck
    - Span Length = 10 m
    - Soffit elevation = 52.8 mOD
    - Spring elevation = Ground elevation (52.8 mOD)
    - Bridge deck level = 53.3 mOD
- BR5 = Proposed bridge crossing the Gortaha South channel to facilitate primary access route
    - Precast concrete bridge deck
    - Span Length = 10 m
    - Soffit elevation = 52.20 mOD
    - Spring elevation = Ground elevation (52.20 mOD)
    - Bridge deck level = 52.70 mOD
- BR6 = Proposed bridge crossing the Gortaha South channel to facilitate primary access route
    - Precast concrete bridge deck
    - Span Length = 9 m
    - Soffit elevation = 52.49 mOD
    - Spring elevation = Ground elevation (52.49 mOD)
    - Bridge deck level = 52.79 mOD

Figure 15 – Location of Proposed Bridge Crossings: Gortaha Catchment



6 MITIGATION

6.1 BRIDGE CROSSINGS: OPW SECTION 50

A total of six bridge crossings are required to facilitate the proposed development, with two of these in the west-flowing Kilcrow catchment, and the remaining four in the east flowing Gortaha catchment. As all of the six proposed bridge crossings are over channel maintained as part of an arterial drainage scheme or drainage district permission must be sought from the OPW by way of a Section 50 application. This is typically implied as a Condition of Planning. The proposed bridges have been designed to meet OPW criteria, i.e. that a where a channel is maintained as part of an arterial drainage scheme the opening must be capable of transmitting the Q_{100} plus 20% climate change factor plus a 1.6 drainage factor.

As outlined in detail above all six bridge crossings have been designed to satisfy OPW criteria.

6.2 EMERGENCY ACCESS AND EGRESS

There are multiple access and egress points to the site (see Figure 3).

The primary route is via the N65 and L8763. Under flood conditions there is a 17 m long x 3 m wide portion of road extending north of the junction between the N65 and L8763 junction that has a maximum flood depth of 0.32 m. Flood depths along the submerged part of the L8763 do not exceed 0.3 m depth under both flow regimes. Hence

there is passage for access/egress of emergency vehicles to the site under floods conditions providing such a vehicle can pass through water depth of 320 mm. This is generally considered acceptable.

In the event that the N65/L8763 route is impassable there are two alternative routes for access/egress of emergency vehicles:

- the temporary construction access road which is entirely in Flood Zonne C;
- via the northern end of the L8763 which reconnects to the N65 and which is entirely in Flood Zone C.

6.3 FINISHED FLOOR LEVELS

In order to minimise potential flood risk at the development minimum finished floor level of any new building shall satisfy the 300 mm freeboard requirement above Q_{1000} flood levels, which have been adjusted for climate change.

Finished floor levels of specified proposed buildings and associated structures were assessed to see if this criteria was satisfied, through a comparison with the $Q_{1000 + cc}$ at the nearest adjacent cross section. The structure numbers correspond with those shown in Halston Drawing No. CPA-HAL-MP-XX-DR-PL-1000. This analysis is presented in Table 15 which shows that:

- proposed FFL at structures numbered 3, 4, 5 and 6 needs to be raised 70 mm, from 51.15 mOD to 51.22 mOD;
- proposed FFL at structure numbered 22 needs to be raised 220 mm, from 51.00 mOD to 51.22 mOD.

Proposed FFL at all other structures are appropriate and satisfy the requirements of the Flood Risk Guidelines (2009).

Table 15 – Analysis of Proposed Finished Floor Levels

Item Number	Building/Item	Proposed FFL, mOD	Adjacent Cross Section	Q_{1000} + cc Flood Level	Amend Proposed FFL, mOD
1	400 kV Substation	49.65	CS057	48.19	
2	AIS 400 kV	50.25/53.00	Br2CSUp	49.63	
3	Transformers (OCGT)	51.15	CS050	50.92	51.22
4	House Transformers	51.15	CS050	50.92	51.22
5	OCGT Building	51.15	CS050	50.92	51.22
6	Admin./Control Building	51.15	CS050	50.92	51.22
9	Emergency Generators	51.50	CS050	50.92	
10	Firewater Pumphouse	51.50	CS050	50.92	
11	Fire Water Tanks	51.50	CS050	50.92	
12	Workshop & Storage	51.50	CS050	50.92	
13	Fuel Polishing Unit	51.50	CS050	50.92	
14	Fuel Storage Tanks	51.50	CS050	50.92	
15	Fuel Unloading	51.50	CS050	50.92	
19	IPP Building	53.15	Br1CSDn	51.86	
20	Transformer	53.00	Br1CSDn	51.86	
21	Temporary Construction Compound	53.50	Br1CSUp	51.87	

Item Number	Building/Item	Proposed FFL, mOD	Adjacent Cross Section	Q_{1000} + cc Flood Level	Amend Proposed FFL, mOD
22	Gas Heater Compound	51.00	CS050	50.92	51.22
24	AGI Compound	54.50	Br1CSDn	51.86	
26	ESB Rural Supply	53.15	CS010	52.08	

6.4 STREAM REALIGNMENT METHOD STATEMENT

6.4.1 Introduction

The following method statement shall be made available to Galway County Council, National Parks and Wildlife Service, and Inland Fisheries Ireland for review prior to works commencing.

The method statement intends to describe programme of works relating to two drainage channel diversions and the subsequent infilling of existing drainage channels, outlining in broad terms the manner in which the different aspects of the work will be undertaken. These works are required to accommodate development works as part of Project Coolpowra.

The aim of this programme of works are as follows:

a. Excavate proposed realignment channels;

b. Decommission redundant stretches and structures;

c. Construction of two bridges along Channel 01

d. Installation of a new culvert on Channel 02;

e. Maximise potential for development of ecological habitat in the recommissioned channels. This will include suitability for fish passage, and provision of areas suitable for spawning;

f. Minimise the amount of damage to existing habitat when diverting flow from channel currently in use to new channel reach.

6.4.2 Cleaning Original Channels

The banks and bed of the original channel are heavily overgrown and require cleaning. This is necessary to ensure the cross-sectional area provides adequate conveyance capacity to transmit flood flows. All vegetation and excess silt in the original channel will be removed using an excavator.

It is acknowledged that there will be a temporary adverse impact to habitat associated with the removal of this vegetation. Once new vegetation is established, the longer-term impact will be positive.

6.4.3 Channel 01 Realigned Section Invert Levels

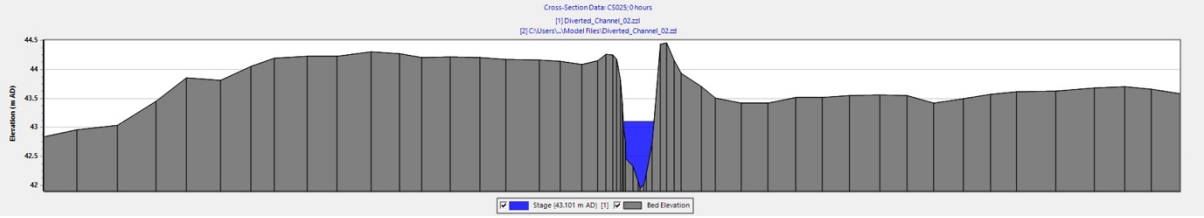
The gradient for the realigned channel in Channel 01 is 1.4%. Proposed inverts for each cross section along this reach are shown in Table 16.

Table 16 – Proposed Invert Levels on Specified Sections on Channel 01 Realigned Reach

Cross Section	Proposed Invert Elevation (mOD)
CS014	53.18
CS050	52.85
BRCSUP	52.46
BR2CSDN	52.09
CS051	52.04
CS057	51.94
CS058	51.93
CS020	51.93

The realigned Channel 01 will have a general cross section profile as shown in Plate 10.

Plate 10 – Proposed cross section dimensions in realigned section of Channel 01



6.4.4 Channel 02 Realigned Section Invert Levels

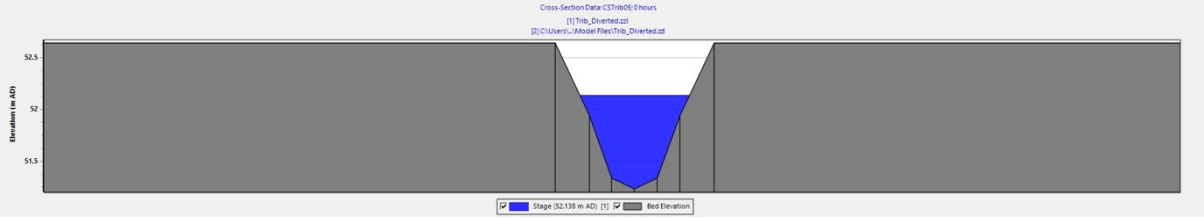
Proposed inverts for each cross section along Channel 02 reach are shown in Table 17.

Table 17 – Proposed Invert Levels on Specified Sections on Channel 01 Realigned Reach

Cross Section	Proposed Invert Elevation (mOD)
CSTrib01	52.80
CSTrib02	52.49
CSTrib03	52.10
CSTrib04	51.70
CSTrib05	51.25
CSTribCulUP	51.25
CSTribCulDN	51.25
CSTrib07	51.24

The realigned Channel 02 will have a general cross section profile as shown in Plate 11.

Plate 11 – Proposed cross section dimensions in realigned section of Channel 02

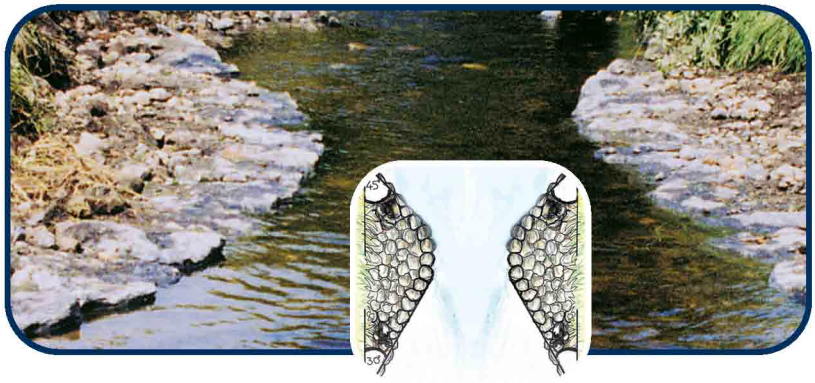


6.4.5 General Channel Modifications

The gradient across the Channel 01 route is moderate to high which means there is potential for introducing oxygen to the stream by way of cascades and turbulent zones. Velocity, and turbulence, can be increased slightly at minor narrowed sections in a low flow channel, as per Plate 12.

Rows of larger stones/boulders will be placed on the stream bed in flatter sections to create riffles. Where possible, the channel will be deepened on the outer side of any bends to create pools.

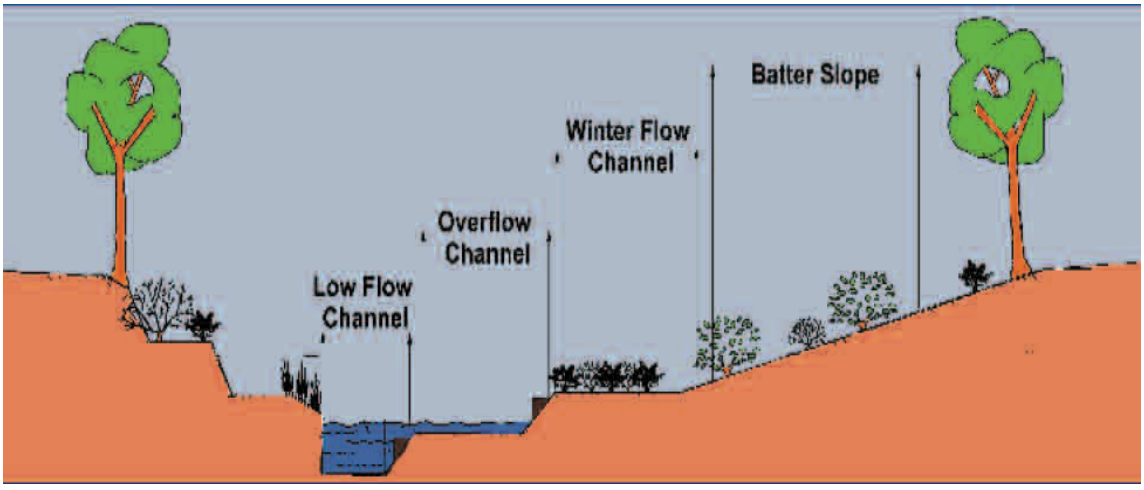
Plate 12 – Narrow river channel in low flow (IFI & OPW, 2010)



6.4.6 Channel Cross Sections

The width of the river channel will be reduced from the river bed to a height of 300 mm. This reduced width will be around 0.5 – 1.0 m. This has the effect of maintaining higher velocities in the wetted channel during normal and low flow regimes. The upper section of the profile will be wider, to provide a conveyance capacity capable of transmitting flood flows. A schematic is presented in Plate 13.

Plate 13 – Schematic of stream cross sectional profile (ERFB, 2011)



The inside of any channel bends will be landscaped with sloping marginal benches, as shown in Plate .

Plate 14 – Example of stepped bend of river bend

6.4.7 Channel Bank Vegetation

Any excavated soils will be stockpiled temporarily and used to cap the banks of the rehabilitated channel. This will promote establishment of vegetation.

The rehabilitated channel bank will be planted with native species that can be controlled/maintained to ensure conveyance capacity of channel is not significantly reduced by overgrowth in future. Grass and juvenile, native trees are deemed suitable. Trees will provide cover to pooled sections of the river channel. Bank gradients should be such that no bank failure or slippages will occur in future.

6.4.8 Channel Opening

Works on the diverted channels will commence from the downstream end. Once the diverted channels and structures are fully complete, the existing channels can then be diverted and sealed off from any flow and infilled. Upon flow entering the diverted channels, a cofferdam should be placed at the downstream end of each diverted channel to trap excess sediment and prevent it entering the watercourses downstream of the site. Straw bales can be placed at increments along each diverted channel to trap sediment. Sediment removal can occur periodically over the first number of weeks following flow entering the diverted channels.

6.4.9 Hydrocarbons

Hydrocarbon spill kits will be on-site during works. Any fuels and lubricants will be stored in bunded compounds. Refuelling will be carried out safely and securely away from the river environs. Machinery will be fully inspected prior to, and during, the course of works for suitability. Support vehicles will remain on the tarmac / hard-core roadway.

6.4.10 Timing of Works

All works within the river channel shall be carried out between the months of August to September, to coincide with low stream flows and to avoid interference with spawning runs.

Bank maintenance works on existing sections, primarily involving the removal of scrub, should take place between October and March.

Following opening of the diverted channels, water flow will be maintained in the existing channels for a minimum period of 24 hours, to facilitate downstream migration of any insects/fish.

6.4.11 Invasive Species

Standard precautionary measures to be practiced for protection against risk of invasive species. Any machinery, including excavator and dumper will be cleaned with a pressure washer prior to arriving on site, and upon leaving site.

7 JUSTIFICATION TEST

Flood flow simulations were performed using a hydraulic model of the channels within the application site that drain westwards towards the Kilcrow River and eastwards towards the Gortaha River. The use of 1D-2D hydraulic modelling has enabled any identified flood zones to be accurately delineated. The results of these simulations showed that Flood Zones A/B/C are currently present within the application site boundary. Under these circumstances the sequential approach and vulnerability matrix require that development, deemed to be highly vulnerable, must pass the Justification Test.

7.1 DEVELOPMENT MANAGEMENT JUSTIFICATION TEST

The Development Management Justification Test is used at the planning stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land. It is an assessment of whether a development proposal within an area at risk of flooding meets specific criteria for proper planning and sustainable development and demonstrates that it will not be subject to unacceptable risk, nor will it increase flood risk elsewhere. Demonstration that the proposed development on the application site passes the Justification Test for Development Management is shown in Table 18.

Table 18 – Requirements of Part 1 of the Justification Test

Requirement		Site Specific Response
Part 1		
	The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of the flood risk guidelines.	According to the Galway County Development Plan 2022 – 2028 the application area is not zoned. The area can be described as rural with agricultural lands dominating and with linear ribbon development along the L8763. The zoning objective for Rural Areas (RA) is to protect and promote in a balanced way, the development of agriculture, forestry and rural-related enterprise, biodiversity, the rural landscape and the built and cultural heritage. Residential development is permitted within RA, subject to compliance with the Rural Settlement Strategy.
Part 2		
(i)	The development proposed will not increase flood risk elsewhere and, if possible, will reduce overall flood risk.	Flood Zones A and B were recorded at the junction between the N65 and L8763 due to the presence of an undersized culvert. There is no planned development upstream of this culvert that would increase flood flow rates and flood levels at this junction. There are no plans to raise road levels in this area so there will be no loss of floodplain as a result of the development, ensuring no loss of storage or increased risk to downstream receptors.
(ii)	The development proposal includes measures to minimise flood risk to people, property and the economy and the environment as far as reasonably possible.	The measures included in the flood risk assessment include raising of the finished floor levels to 300 mm above the nearest modelled flood level for the Q_{1000} scenario, adjusted for climate change. The proposed bridges are proposed to be clear span, limiting interaction with the channel bed and having minimal effect on the conveyance capacity of stream networks during flood events.
(iii)	The development proposal includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures of the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.	The proposed works will not remove any existing flood plain storage. No surface water flow pathways will be severed. Any hardstanding run-off will be attenuated on site to reduce the peak flow during flood events. The maximum depth of flooding that an emergency vehicles has to pass through at the N65 and L8763 junction is 320 mm which is considered passable. In the event that it is impassable there are alternative routes (i) where the L8763 reconnects to the N65 at its northern end and (ii) along the temporary construction route, both of which are in Flood Zone C. Following the provision of the alternative temporary construction access road, all vehicles associated with site development works will pass through Flood Zone C.
(iv)	The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.	The proposed development satisfies the requirements of the Flood Risk Guidelines (2009) and the Galway County Development Plan 2022 – 2028.

8 SUMMARY

Development works are proposed at a site in Coolpowra, Portumna, Co.Galway. The development consists of an upgrade and replacement of the existing 500kV AIS substation with a 400kV GIS substation, a reserve Gas-Fired Generator comprised of three OCGT Units and various alternative technology infrastructure.

Following groundtruthing it was confirmed that the proposed development site lies within two distinct catchments, the Kilcrow and the Gortaha. The majority of site run-off will drain westwards to the Kilcrow River. That area of the site draining to the Kilcrow River does so via a central channel that runs through the site from the eastern to the western boundary. This channel is maintained as part of the Killimor Arterial Drainage Scheme with the result that many of the cross sections are deep and narrow. The surface water catchment to the downstream boundary on the western part of the site is 2.0 km^2. Multiple field boundary drainage channels outfall to this central channel, with one in particular noted as having a significant flow contribution to the overall site run-off.

The eastern part of the site which drains to the Gortaha River is characterised by two main channels, the Ballynaheskeragh and Sheeaunrush Streams. These two streams merge upstream of the N65, from which they continue eastwards and enter join the Gortaha River. The Gortaha Catchment has an overall area of 1.06 km^2 to where the eastern site boundary meets the N65.

A thorough desktop study confirmed that there are no indicators of historical flooding at the site nor is the site deemed to be within an area at risk of fluvial, pluvial or groundwater flooding.

Given the small catchment sizes the IH124 method was selected to estimate flood flows in within local watercourses. Suitable adjustment factors, growth factors and climate change factors (+20%) were applied and the resultant Q_{100} and Q_{1000} flows were used as the inflow to 1D and 1D-2D linked hydraulic models.

A 1D-hydraulic model was compiled using site-specific data. Evenly spaced cross sections were surveyed along the central channel throughout the site and a tributary which extends to the south. The surveyed cross sections extended approximately 400 m downstream of the application site boundary for the Kilcrow simulation and 200 m downstream for the Gortaha simulation.

The conveyance capacity of all surveyed cross sections in the Kilcrow Catchment (central channel = Channel 01; southern tributary = Channel 02), were assessed for suitability to transmit Q_{100} and Q_{1000} flood flows, with a 20% allowance included for climate change. The simulation output showed that under Q_{1000} conditions the existing culverts at CS006 and CS016 are vulnerable to surcharge, but floodwaters are maintained within the upstream bank profile. Under the proposed development works, the culvert at CS016 is to be decommissioned following the proposed channel diversion upstream of the CS016 culvert.

Two culverts on the southern tributary surcharged, resulting in bank overtopping. The more southerly of these culverts is to be decommissioned while the culvert at the northern end of Channel 02 shall be upgraded.

The modelled reaches are to be re-aligned in two locations to facilitate efficient site layout. Two new bridge crossings are also proposed. Detailed design specifications are included for new bridge structures and the cross sections and longitudinal profiles of the realigned channel reaches. Additional mitigation measures are outlined to enhance habitat quality and biodiversity in the new channel reaches.

Following incorporation of the culvert upgrade, two channel realignments, and two new bridge structures modelling showed that that there will be no surcharge of flood water outside of the stream channel under Q_{1000} conditions, with a climate change factor included. Therefore, it can be confirmed that that part of the application site positioned in the Kilcrow Catchment is currently in Flood Zone C and will remain in Flood Zone C following proposed works

(i.e. not at risk of flooding). The proposed works will not result in an increased flood risk within the site or downstream.

The conveyance capacity of all surveyed cross sections in the Gortaha Catchment (Gortaha North and Gortaha South) were assessed for suitability to transmit Q_{100} and Q_{1000} flood flows, with a 20% allowance included for climate change. The simulation output showed that under Q_{100} and Q_{1000} flood flows, out of bank flooding was recorded at the inlet to the culvert that flows under the N65. This resulted in flood waters exceeding both the left and right bank and inundating lands proximal to the culvert. Whilst there was no risk noted to residential properties, flood depths of up to 0.6 m along the N65 were predicted.

The maximum depth of flooding that an emergency vehicles has to pass through at the N65 and L8763 junction is 320 mm which is considered passable. In the event that it is impassable there are alternative routes (i) where the L8763 reconnects to the N65 at its northern end and (ii) along the temporary construction route, both of which are in Flood Zone C.

No flooding was recorded along the alternative temporary construction road, therefore it is located in Flood Zone C.

Subject to the proposed works being carried out in accordance with the specifications presented in this assessment, it can be concluded that the proposed development will not have a negative impact, in terms of flood risk, on the local drainage network, on local private property, or to the surrounding environment and human health.

Permission for the proposed bridges shall be sought from the OPW by way of Section 50 license applications.

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APPENDIX 8.3

WATER FRAMEWORK DIRECTIVE ASSESSMENT REPORT

– PROPOSED DEVELOPMENT (AS AMENDED)

ENVIROLOGIC

HYDROGEOLOGICAL · HYDROLOGICAL CONSULTING

Project Coolpowra
Water Framework Directive Assessment Report

LOCATION:	Coolpowra, Ballyneheskeragh, Cooldorragha, Gortlusky and Sheeaunrush Co. Galway
PREPARED FOR:	Halston
PREPARED BY:	Cian O'Sullivan (MSc); Callum Walsh
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DATE:	18th December 2025
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1 INTRODUCTION

1.1 BRIEF

The following Water Framework Directive Assessment Report has been prepared by Cian O'Sullivan (MEngSc) of Envirologic Ltd. on behalf of Halston, in relation to proposed development works at Coolpowra, Ballynaheskeragh, Cooldorragha, Gortlusky and Sheeaunrush Co. Galway.

This report is intended to satisfy the requirements of Galway County Council, relating to a proposed development in the townlands of Coolpowra, Ballynaheskeragh, Cooldorragha, Gortlusky and Sheeaunrush, Co. Galway. The proposed development is being referred to as 'Project Coolpowra' and will consist of a Reserve Gas-Fired Power Generator, GIS Substation and Energy Storage System.

Component parts of the proposed development are detailed elsewhere in the EIAR.

The purpose of this WFD assessment is to determine whether the proposed development has the potential to:

(i) result in a deterioration in the status of any river waterbody or groundwater body,

(ii) compromise WFD objectives and the achievement of at least good surface water or groundwater status, or restoration to High Status waters where required by the River Basin Management Plan 2022 - 2027 (DoEHLG, 2024) and the associated Water Action Plan (2024).

This assessment will identify any water bodies that could potentially be impacted upon, prescribe any mitigation measures required and assess any residual impacts of the development. The potential impacts to a range of designated sites in the region are also assessed.

The WFD Assessment Report is intended to supplement a wider and more detailed assessment of potential impacts that the development may have on ecological, hydrological and hydrogeological receptors as set out in the accompanying EIAR. This WFD Assessment Report has been completed with full consideration of the report detailing the AA Screening for the application.

1.2 STATEMENT OF AUTHORITY

The WFD Assessment has been prepared by Cian O'Sullivan of Envirologic Ltd. Cian has an undergraduate degree in Earth Sciences and a master's degree in civil engineering titled Water Waste and Environmental Engineering. He was the recipient of the Michael Mac Carthaigh research project award for his work on hydrological modelling in various climate change scenarios. This was awarded by the School of Civil Engineering, UCD. He has four year's professional and field based experience working in the field of Hydrology. Cian is an active member of the International Association of Hydrogeologists (Irish Group).

The WFD Assessment has been reviewed by Dr. Colin O'Reilly of Envirologic Ltd. Dr. Colin O'Reilly has a doctorate degree in soil systems and hydrology, awarded by the Centre for Water Resources Research, School of Architecture, Landscape and Civil Engineering, UCD, while a recipient of a Teagasc Walsh Fellowship. He has over 20 years of professional and field-based experience.

Since 2010 Colin has been the managing director of Envirologic, which has key competencies in hydrogeology and hydrology with expertise in flood risk assessments in addition to assessment of quarries and industrial facilities

across a range of diverse hydrogeological conditions across Ireland. Colin is a current and active member of Engineers Ireland and International Association of Hydrogeologists (Irish Group).

Envirologic have compiled, or participated in the compilation of WFD assessments for bedrock quarry extensions in coastal and inland settings, meat processing plants and energy facilities.

1.3 WATER FRAMEWORK DIRECTIVE

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ('WFD'), was established to protect and, where necessary, restore water bodies in order to reach at least Good Status and to prevent deterioration. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003) and subsequent other associated legislation referred to as the Surface Water Regulations (2009, as amended), the Groundwater Regulations (2010, as amended) and the Water Abstraction and Impoundments Regulations (2024).

The WFD requires that all member states protect and improve water quality in all waters, with the aim of achieving at least good status by 2027. Good status refers to both hydromorphological, physical, chemical, ecological and quantitative characteristics of water bodies, be they surface water or groundwater. The potential for any new development to impact upon the status of waterbodies and achievement of WFD objectives must be considered.

The WFD is implemented through the River Basin Management Plans (RBMP) which comprises a six-yearly cycle of planning, action and review. RBMPs include details identifying river basin districts, water bodies, protected areas, pressures and risks, monitoring and environmental objectives. In Ireland the first RBMP covered the period from 2010 to 2015 with a second cycle plan covering the period from 2018 to 2021. The current plan covering the period 2022 to 2027 was published on 4 September 2024 with an associated Water Action Plan 2024.

The key objectives of the River Basin Management Plan (2022 - 2027) include:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration;
- Meet the water standards and objectives for designated protected areas;
- Protect high-status waters;
- Implement targeted actions and pilot schemes in focus sub-catchments aimed at (i) targeting water bodies close to meeting their objective and (ii) addressing more complex issues that will build knowledge for future cycles.

More details are available at https://www.gov.ie/en/policy-information/8da54-river-basin-management-plan-2022-2027/.

1.4 RIVER BASIN PLAN, PROGRAMMES OF MEASURES & PRIORITY AREAS FOR ACTION

In September 2024 the Department of Housing, Local Government and Heritage launched The Water Action Plan 2024 and its launch stated that the "River Basin Management Plan for Ireland sets out the measures that are

necessary to protect and restore water quality in Ireland. The overall aim of the plan is to ensure that our natural waters are sustainably managed and that freshwater resources are protected so as to maintain and improve Ireland's water environment. The principal causes of the decline in Ireland's water quality are the increasing loss into water of polluting phosphorus and nitrogen from farmland, inadequately treated waste water and physical impacts on water bodies, due to river barriers, and drainage of lands and rivers".

The Water Action Plan (WAP) 2024 is available at https://www.gov.ie/en/policy-information/8da54-river-basin-management-plan-2022-2027/ and Appendix 2 sets out the Programme of Measures with an associated excel spreadsheet.

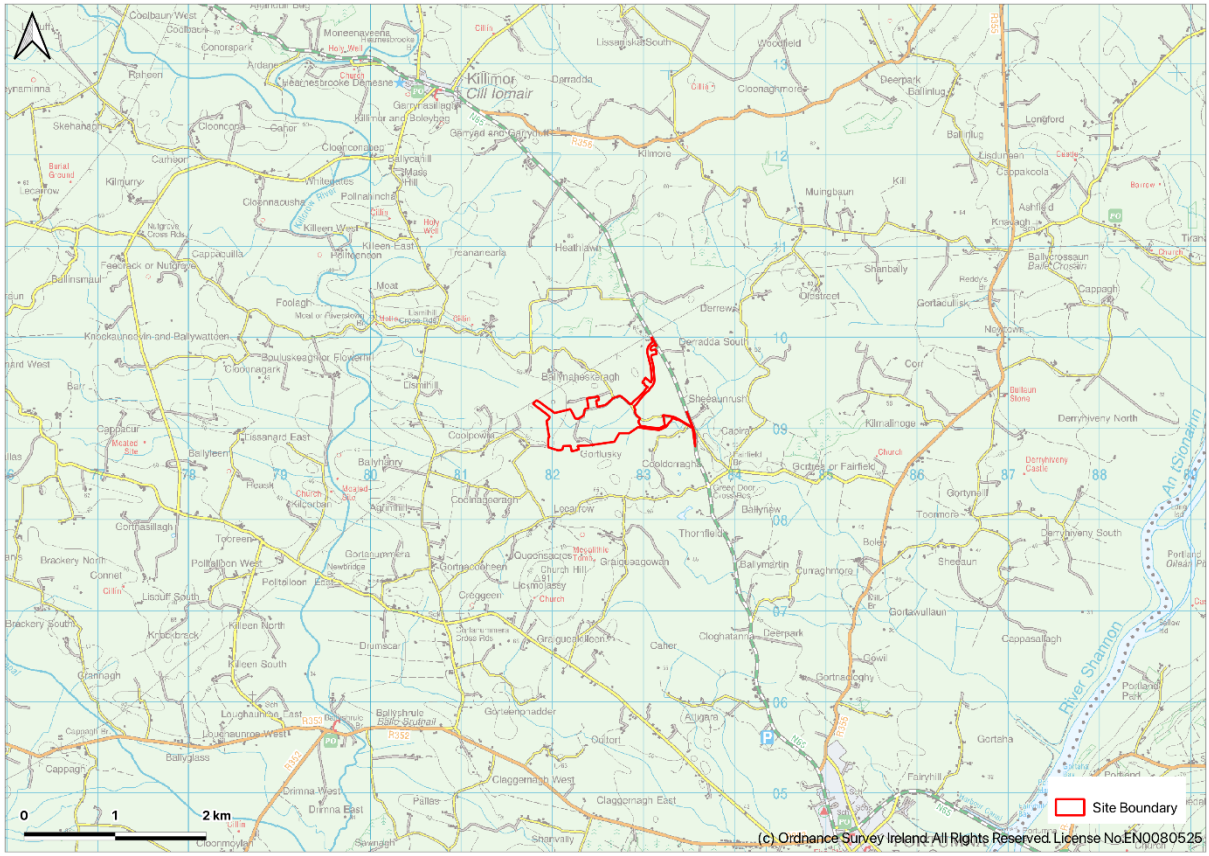
2 SITE LOCATION & ENVIRONMENTAL SETTING

2.1 SITE LOCATION

The subject site is located in the townlands of Coolpowra, Ballynaheskeragh, Cooldorragha, Gortlusky and Sheeaunrush Co. Galway, approximately 5 km northwest of Portumna town (Figure 1). The main portion of the site is positioned 500 m west of the N65, with an internal site access road providing connection between the two.

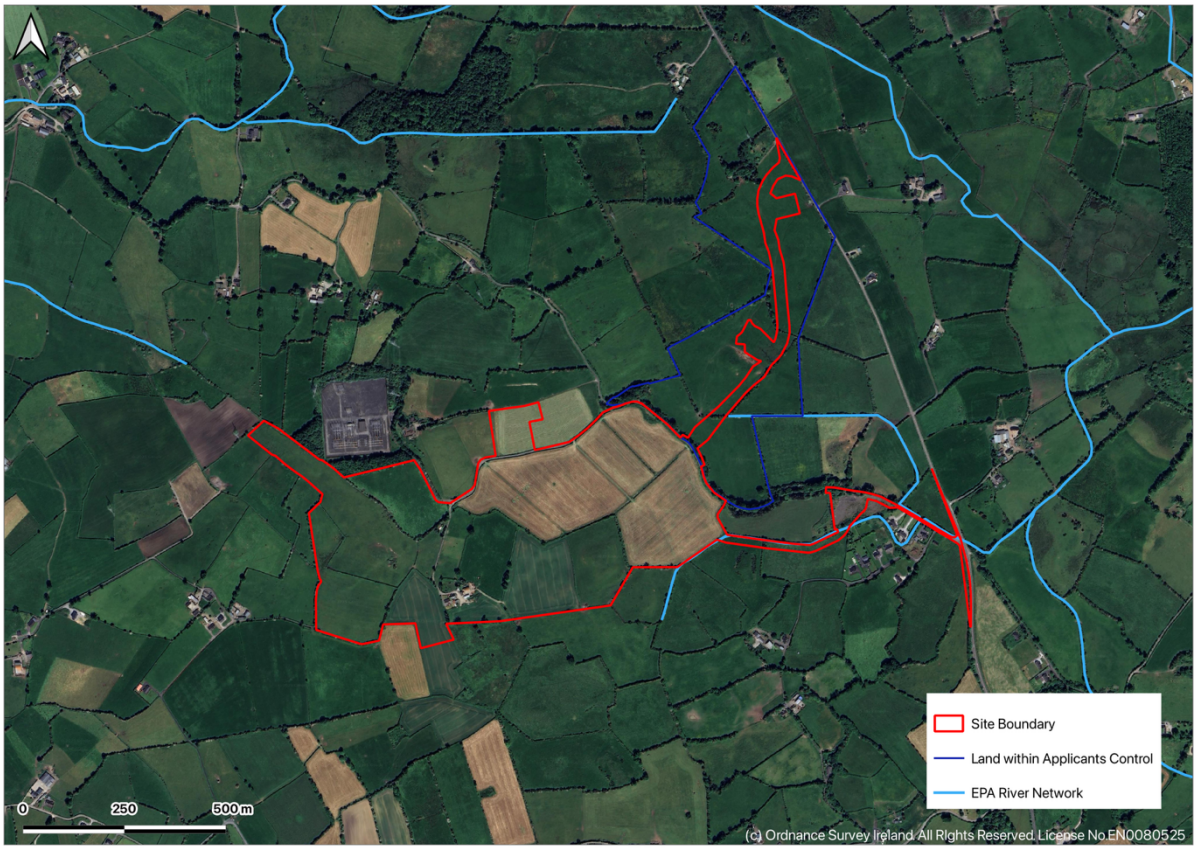
The regional topography is considered flat to gently undulating. The 1:50,000 OS Discovery map shows that the nearest topographical feature of note in the locality is a small hummock at Churchill (91 mOD), 2 km to the south. The surrounding landscape is dominated by moderate intensity grassland agriculture.

Figure 1 - Site Location and Topography



2.2 SITE LAYOUT

The proposed development site has an area of c.42 ha. The site can be described as having an irregular shape comprised of (i) a central area which has an east-west length of 995 m and north-south width of 415 m. This area is bounded to the east by a local road, (ii) an internal access road which connects the eastern end of this central area with the N65, (iii) a 230 m northwestern spur, and (iv) a temporary construction access route which connects to the N65. An existing 400kv GIS substation is located adjacent to the northern site boundary. There is one detached house standing within the site boundary, with attached farmyard infrastructure (Figure 2).

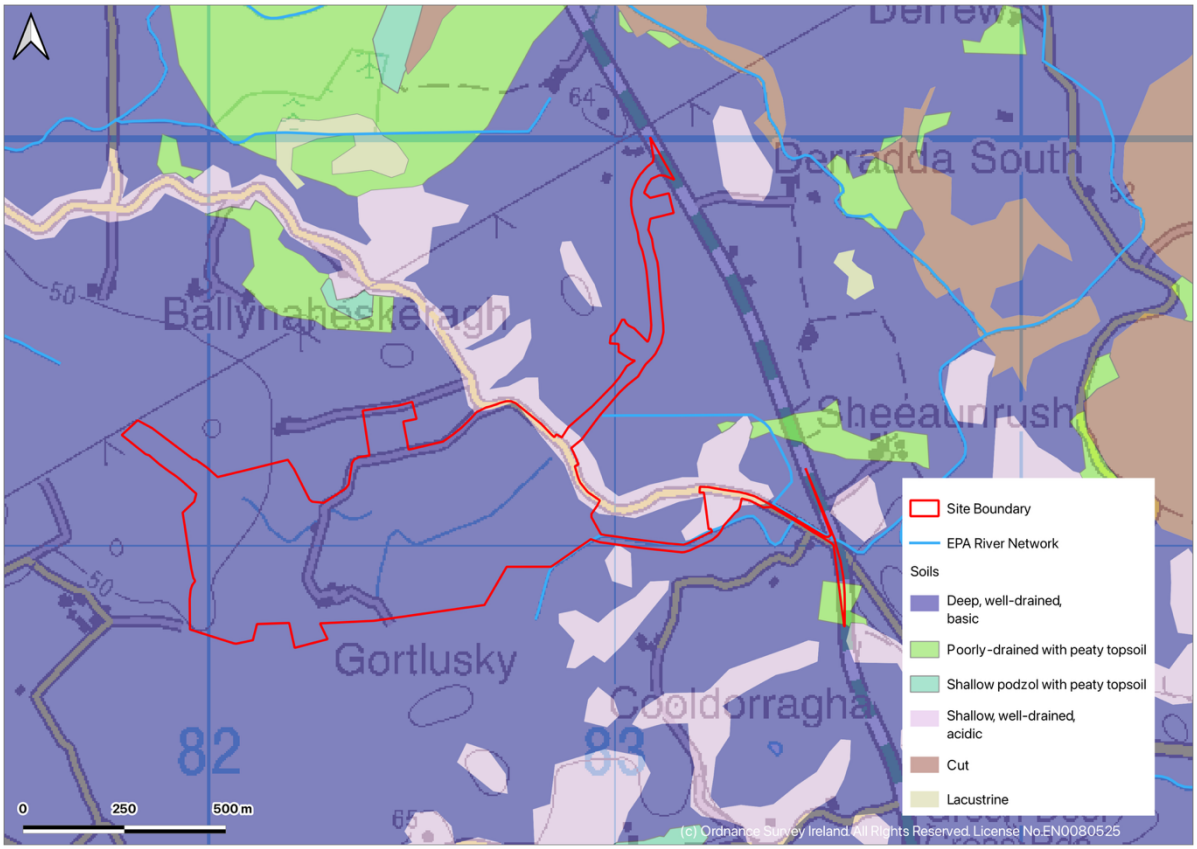


2.3 SOILS & GEOLOGY

2.3.1 Soils

Teagasc soil maps indicate that the soil within the application boundary is a uniform cover of deep, well-drained mineral soil with a basic chemical signature (Figure 3). The soil group can be described as a Grey Brown Podzolic or Brown Earth.

Figure 3 - General Soil Classification

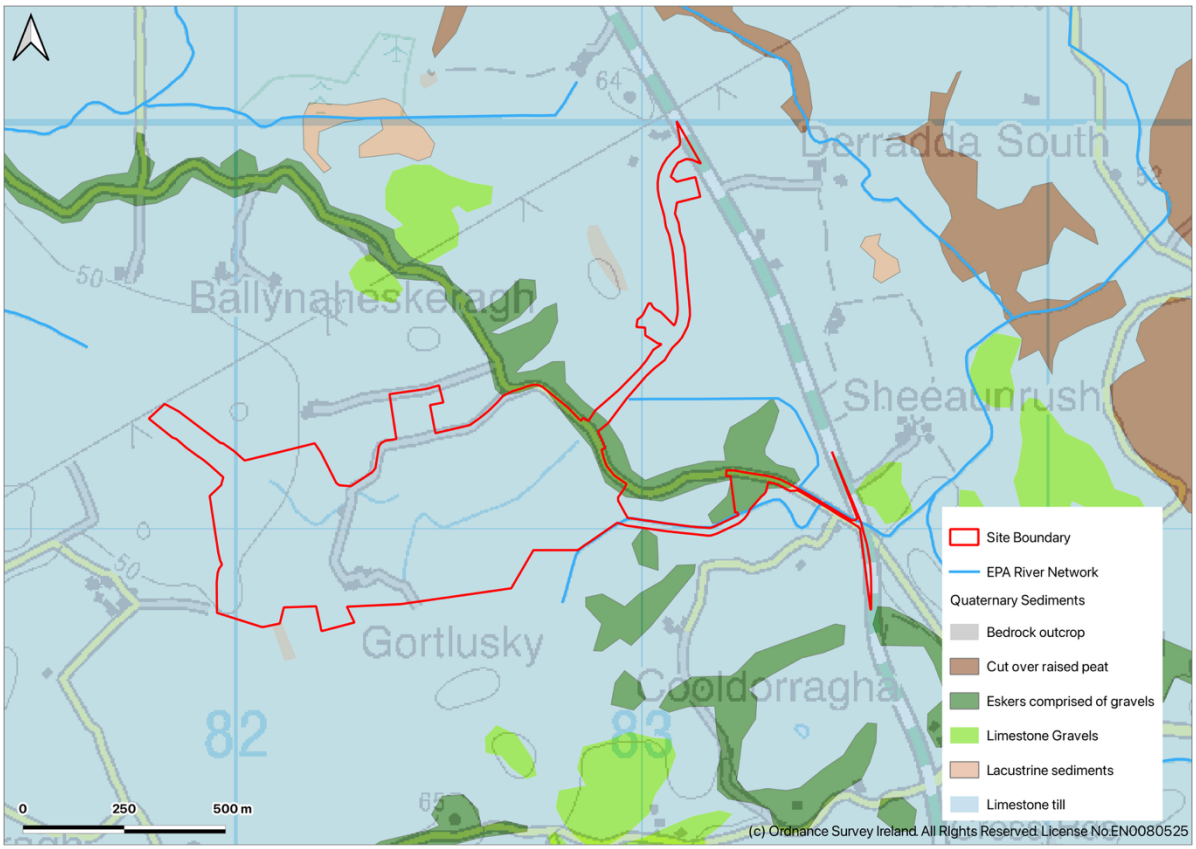


2.3.2 Quaternary Deposits

The quaternary period encompasses the last 1.6 million years and deals with the subsoils and sediments that were deposited over the bedrock described below. The Pleistocene (1.6 million years – 10,000 years ago) is commonly known as the last Ice Age, which was a period of intense glaciation separated by warmer inter-glacial periods, and it is during this period that the quaternary sediments seen today were deposited. Large amounts of ponded water were present at this stage resulting in considerable fluvioglacial sedimentation.

The majority of the site is underlain by glacial till derived from limestone. Some isolated mounds of limestone gravels are present in the area along with a graded ridge of esker sands and gravels which underlie the local road to the east (Figure 4). This combination of deposit type is characteristic of sub-glacial mechanisms resulting in well drained soils of homogenous nature.

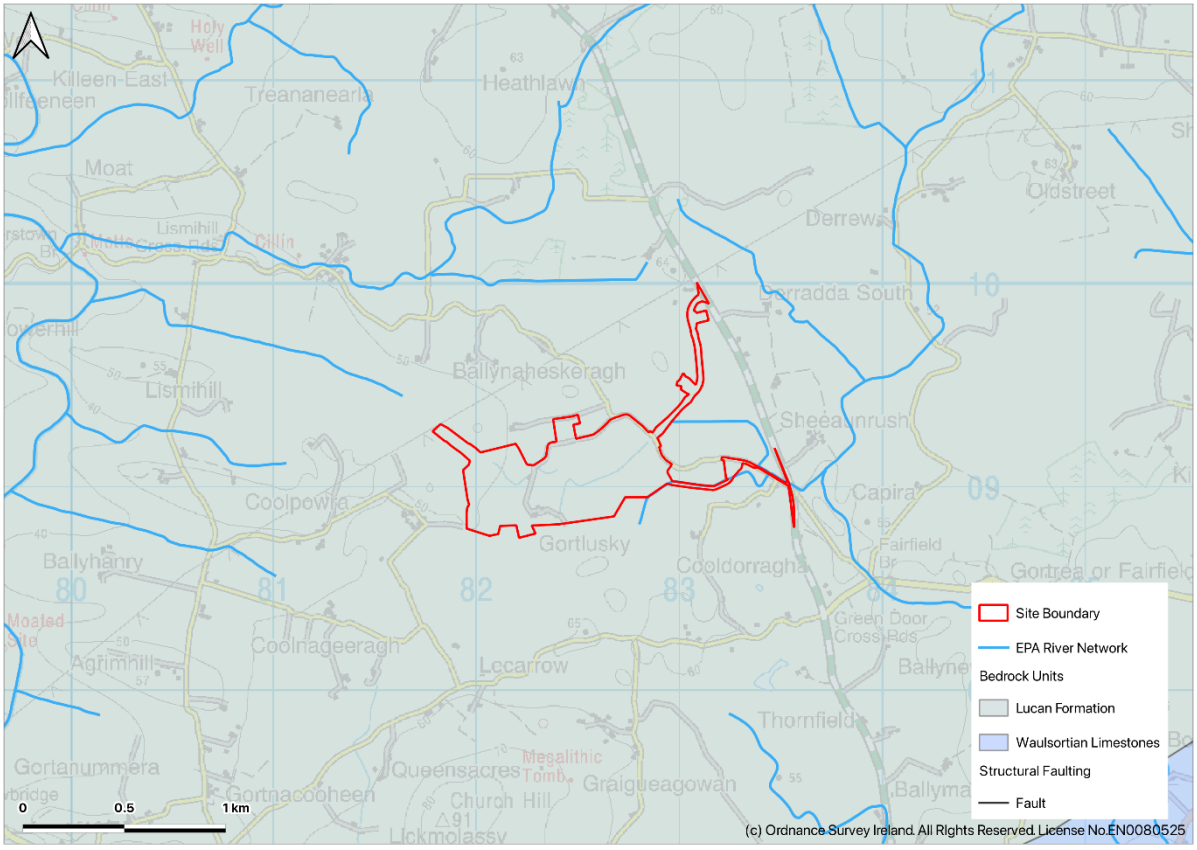
Figure 4 - Quaternary Deposits



2.3.3 Bedrock & Structural Geology

The site is underlain by the Lucan Formation, characterised as Dinantian Upper Impure Limestones. This formation consists of impure bedded limestone with shale and/or clay impurities. There are no structural geological features such as faulting mapped in the immediate vicinity of the site, as demonstrated in Figure 5.

Figure 5 – Bedrock Geology



2.4 HYDROLOGY

2.4.1 WFD Catchments

The site is bisected by a boundary separating two WFD catchments, these being Hydrometric Area 25C (Lower Shannon) to the west and Hydrometric Area 25B (Lower Shannon) to the east.

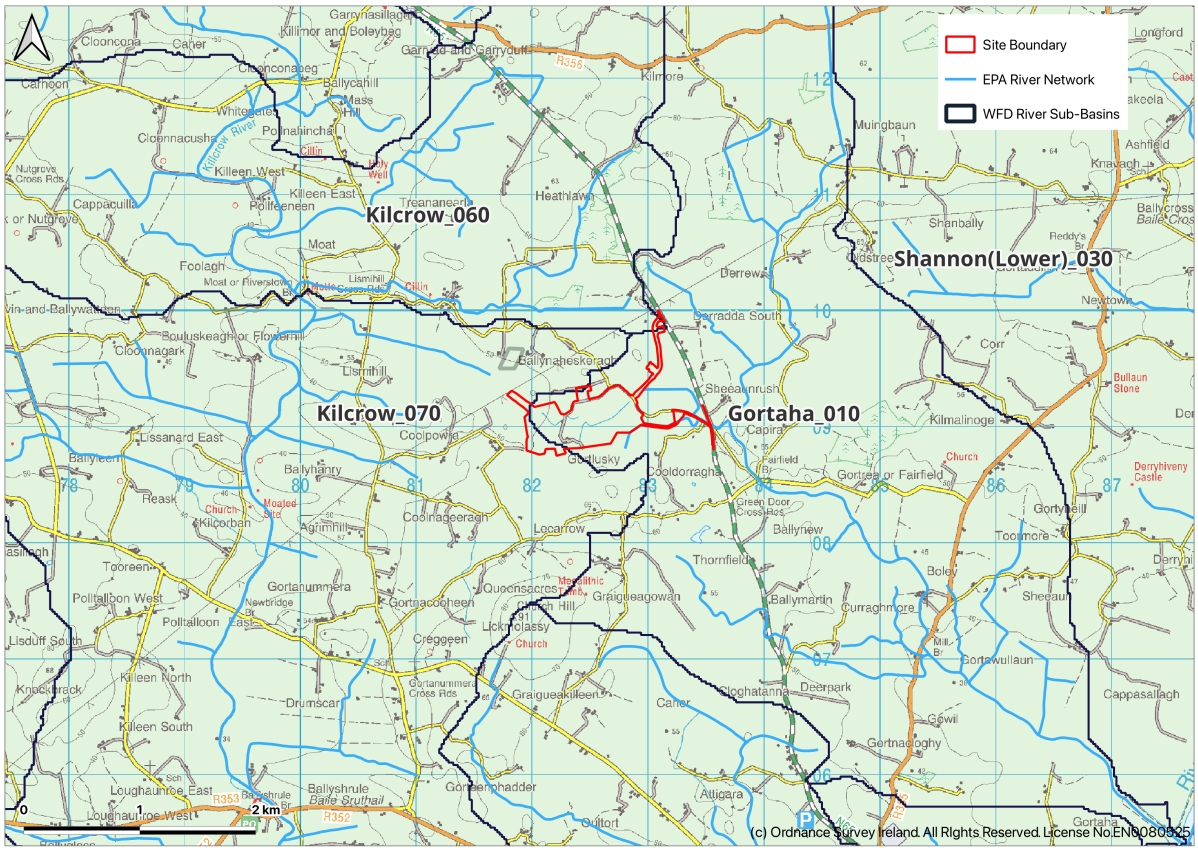
2.4.2 WFD Sub-Catchments

At the WFD sub-catchment scale the same boundary also separates two management areas as follows, Sub-Catchment Kilcrow_SC_010 to the west (Sub-Catchment ID: 25C_12) and Sub-Catchment Shannon (Lower)_SC_050 to the east (Sub-Catchment ID: 25B_4).

2.4.3 WFD Sub-Basins

At the WFD sub-basin scale the same boundary also separates two management areas as follows, Sub-Basin Kilcrow_070 to the west (Sub-Basin ID: IE_SH_25K010700) and Sub-Basin Gortaha_010 to the east (Sub-Basin ID: IE_SH_25G560730), as shown in Figure 6.

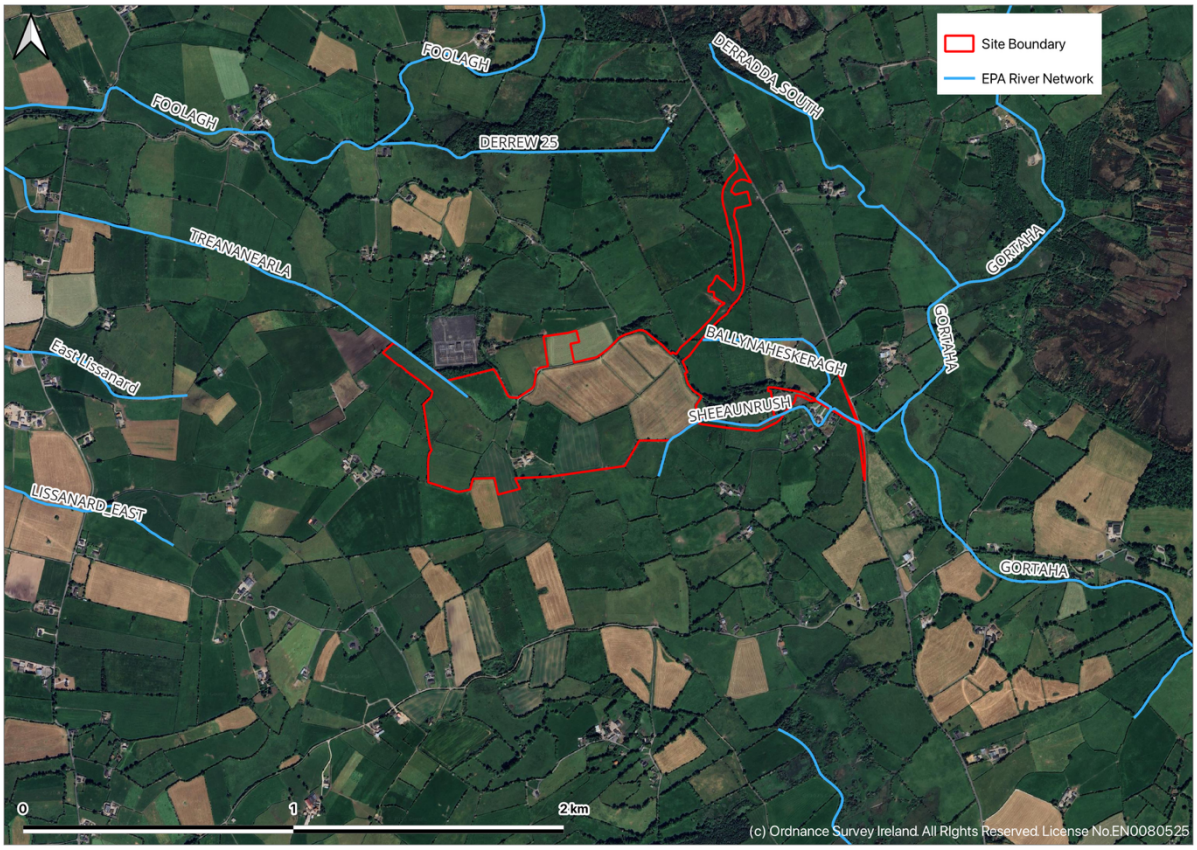
Figure 6 – WFD River Sub-Basins



The EPA mapping portal suggests that the hydrological divide between these sub-basins lies within the site boundary, near the current Oldhill Substation. However, subsequent ground truthing by Envirologic and consultation of the OPW Drainage Maps indicate that the catchment divide lies to the east of the main body of the application site and that all rainfall-runoff generated on the main development area will drains westwards, ultimately outfalling to the Kilcrow River system, 2 km to the west.

In this report the catchment that drains to the east will be referred to as the Gortaha catchment, based on the local river that rainfall-runoff generated on the access routes ultimately drains to (Figure 7).

Figure 7 – Mapped EPA River Network



2.4.4 Western (Kilcrow) Catchment Description

The drainage network serving the site is dominated by an east to west flowing central channel which itself becomes the Treananearla Stream (first order stream) a short distance downstream of the site. This central channel originates at the eastern end of the central site area, stopping just short of the local road L8763. This catchment was delineated by Envirologic using analysis of Digital Elevation Model (DEM) topographical contours, ground truthing as part of the site walkover, and reference to the OPW and EPA drainage network maps. The catchment area contributing run-off to the downgradient site boundary has an area of 2.0 km^2 (Figure 8).

There are two 950 mm diameter culverts in place along the central channel within the site boundary. These provide road crossings for access to farm land and a dwelling.

There are several field boundary drains present within the site that contribute to the runoff at its downstream end. The largest of these drains extends 950 m south, outfalling to the central stream just east of the on-site dwelling. This drainage channel has a sub-catchment of 0.675 km^2. There are two culverts present on this tributary, with pipe diameters of 650 mm and 500 mm. The 500 mm culvert lies immediately upstream of the confluence of the tributary and the main channel whilst the 650 mm culvert acts as a field crossing further upstream. There is a 1 m drop from the invert of the tributary channel to the invert of the main channel, resulting in a high velocity cascading flow regime at the confluence. The combined flows then continue westward. There are no other drainage channels that contribute significant flow to the central channel within the site.

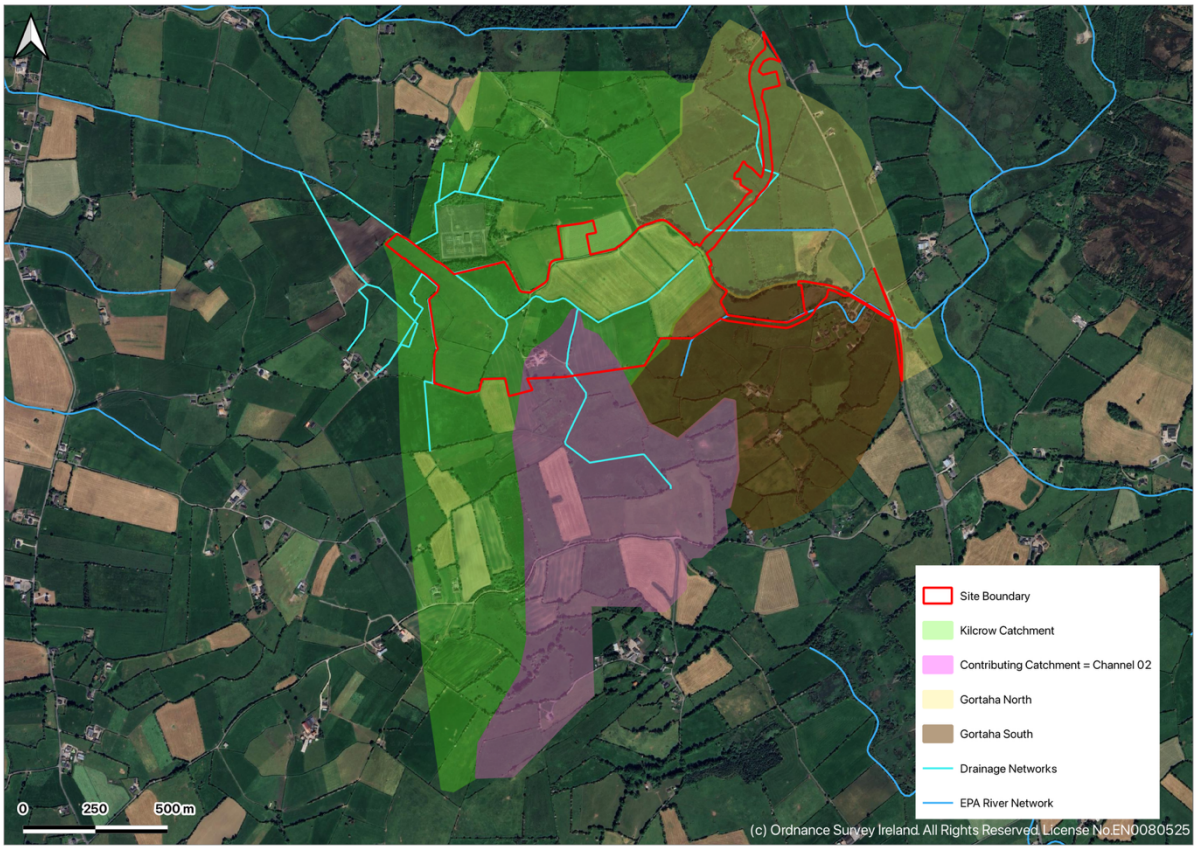
2.4.4.1 Eastern (Gortaha) Catchment Description

Rainfall runoff generated on the areas proposed for the site access route and temporary construction access route drains eastwards towards the Gortaha River.

There are two mapped EPA watercourses that flow eastwards. The Sheeaunrush stream, which will be referred to herein as draining the Gortaha South catchment, flows from agricultural land to the south of the site boundary and joins the Ballynaheskeragh Stream as it passes along the original site access route. The mapped Ballynaheskeragh Stream route is incorrect on the EPA database. The correct channel routing is presented in Figure 8 and will be referred to herein as draining the Gortaha North catchment. There are two culverts present in the Gortaha North catchment. The culvert which services the N65 is a 0.5 m diameter circular culvert. There is one additional field crossing culvert along the Ballynaheskeragh Stream measuring 0.3 m in diameter. A 0.45 m diameter circular culvert transmits water under L8763 road and acts as the confluence between the Sheeaunrush and Ballynaheskeragh streams.

There are several field boundary drains present in the Gortaha North catchment. During the site walkover it was noted that the upper reaches had no discernible flow direction, with standing water noted at multiple locations. Blockages were common, either from silted up channels or infilled areas permitting field crossings. Envirologic will present mitigation measures to regrade channels, improving conveyance through these field boundaries.

Figure 8 - Contributing Catchment to Site Run-off.



2.5 HYDROGEOLOGY

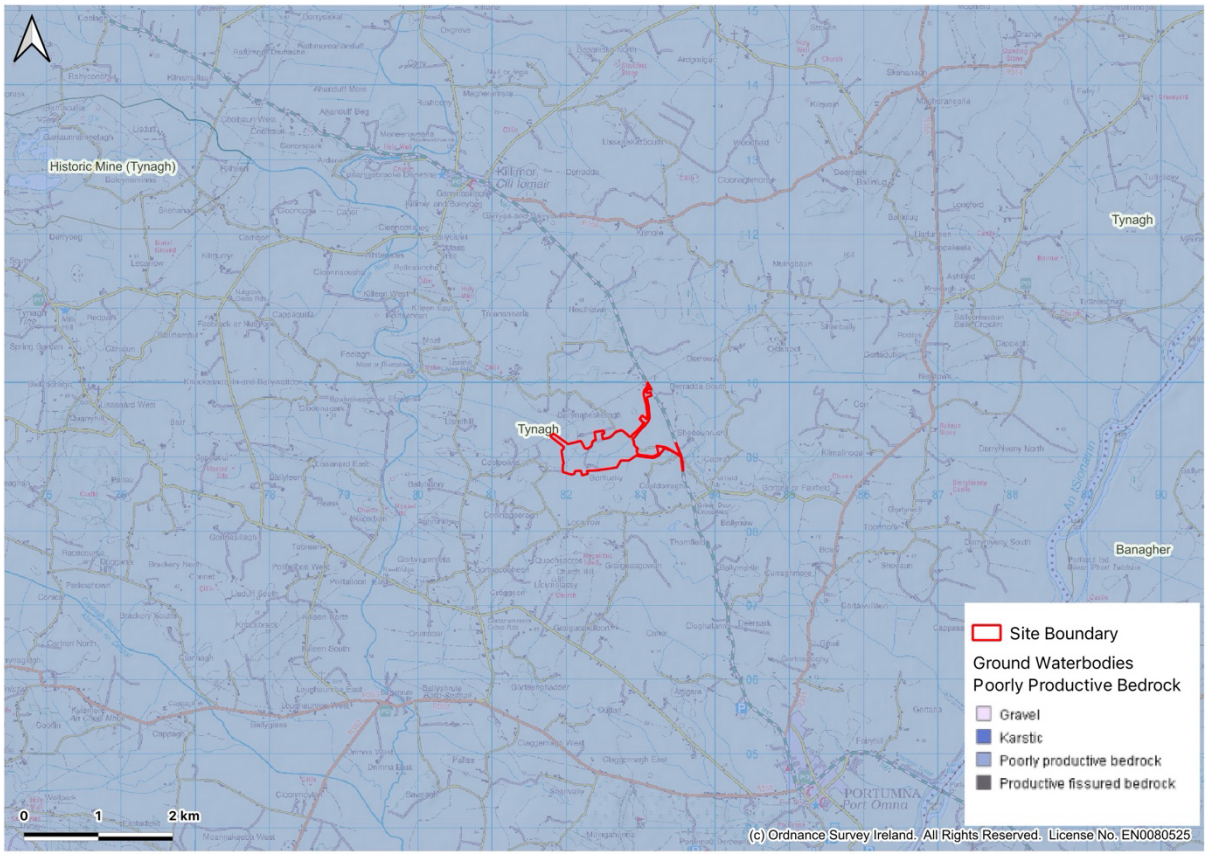
2.5.1 Aquifer Classification

The Lucan Formation is considered to be a locally important aquifer, consisting of bedrock which is moderately productive only in local zones (Ll). This type of aquifer is considered to have a limited and relatively poorly connected network of fractures, fissures and joints, giving a low fissure permeability which tends to decrease further with depth. A shallow zone of high permeability may exist within the top few metres of weathered rock. Higher permeability may occur along fault zones, with these zones able to provide larger 'locally important' supplies of water. Due to the low permeability and storage capacity the aquifer has a low recharge acceptance.

2.5.2 WFD Groundwater Body

With respect to groundwater underlying the site, the Groundwater Body (GWB) underlying the site is the Tynagh GWB (IE_SH_G_236) (Figure 9). This GWB is shaped roughly like an upside-down triangle, and elevations range from 30 mOD along the shore of Lough Derg to 378 mOD at Cappaghbaun Mountain in the southwest of the GWB. The topography ranges from mountainous in areas underlain by sandstones and mudstones of Devonian origin to flat lying areas underlain by impure limestones. Associated river flow directions are predominantly southwards and eastwards towards Lough Derg and the River Shannon. Due to shallow groundwater flow in this aquifer the groundwater and surface water interaction is high and closely linked. Springs are located close to breaks of slope where groundwater intercepts the surface.

Figure 9 – WFD Groundwater Bodies Map



The GWB report (GSI, 2004) states that within the Dinantian Lower Impure Limestones, transmissivities are likely to be in the range 2-20 m^2/d, with most values at the lower end of the range. The lower impure limestone aquifers are more than several hundred metres thick. However, the effective flowing thickness of these aquifers is usually 15 m, this thickness comprising a weathered zone of a few metres and a connected fracture zone below this.

A recharge coefficient of 60% is applied to the application site, though a recharge cap of 200 mm is applied at the bedrock head.

2.5.3 Groundwater Vulnerability

Groundwater vulnerability is a measure of the risk that a potential groundwater contamination event may have on the ground water beneath. It is a measure of how vulnerable groundwater is to a potential contamination event. The vulnerability of groundwater is a function of the nature of the underlying soil cover, the presence and nature of the subsoil, the nature of strata, and the thickness of overburden above the water table.

The vulnerability categories, and methods for determination, are presented in Groundwater Protection Schemes (1999). The guidelines state that 'as all groundwater is hydrologically connected to the land surface, it is the effectiveness of this connection that determines the relative vulnerability to contamination. Groundwater that readily and quickly receives water (and contaminants) from the land surface is considered to be more vulnerable than groundwater that receives water (and contaminants) more slowly and in lower quantities. The travel time, attenuation capacity and quantity of contaminants are a function of the following natural geological and hydrogeological attributes of any area:

1. the subsoils that overlie groundwater;
2. the type of recharge - whether point or diffuse;
3. the thickness of the unsaturated zone through which the contaminant moves.

The GSI have assigned main body of the application site as having a groundwater vulnerability of Moderate (M).

2.5.4 Source Protection Area

There are two source protection areas for groundwater drinking water supply sources within close proximity to the site boundary. Both of these Group Water Schemes (GWS) are managed by the National Federeation of Grouo Water Schemes (NFWGS).The Oldthort GWS (IE_GSI_ZOC_30) is located 3 km to the south and the Killeen/Poulatoon GWS is located 4.3 km to the south west.

The Oldthort GWS is potentially downstream of the site boundary in terms of groundwater flow direction.

3 WFD WATERBODIES STATUS & RISK

3.1 WFD SURFACE WATER BODIES

WFD surface water body status and risk for local streams and sub-catchments are summarised in Table 1.

Table 1 – Summary of WFD River Waterbody Status & Risk

WFD Surface Waterbody	GORTAHA_010	KILCROW_070
WFD Sub-Catchment	25B_4 Shannon(lower)_SC_050	25C_12 Kilcrow_SC_010
Risk Status (2nd Cycle)	Not At Risk	At Risk
Risk Status (3rd Cycle)	Review	At Risk
Overall Status (2013-2018)	Good	Moderate
Overall Status (2016-2021)	Moderate	Moderate
Overall Status (2019-2024)	Moderate	Poor
Significant Pressures (3rd Cycle)	None	Anthropogenic Pressures

The EPA characterisation Report entitled WFD Cycle 2 Catchment Lower Shannon Sub-catchment Shannon Lower_SC_050 (EPA, 2018) provides an evaluation of priority sub-catchment Information as follows on the Gortaha_010:

- The Gortaha_010 is *Not at Risk*, due to Good status and/or no pressures.

The EPA characterisation Report entitled WFD Cycle 2 Catchment Lower Shannon Sub-catchment Kilcrow_SC_010 (EPA, 2019) provides an evaluation of priority sub-catchment issues as follows:

- The Kilcrow_070 river is at Moderate status, the invertebrate community indicate Good status but the fish community indicate Moderate status. There are no apparent significant pressures. Further work is needed to investigate the cause of the fish status failure.

3.2 WFD GROUNDWATER BODIES

WFD groundwater body status and risk are summarised in Table 2.

Table 2 – Summary of WFD Ground Waterbody Status & Risk

WFD Groundwater Body	Tynagh
Risk Status (2nd Cycle)	Not at Risk
Risk Status (3rd Cycle)	Not at Risk
Overall Status (2013-2018)	Good
Overall Status (2016-2021)	Good
Overall Status (2019-2024)	Good

There are two groundwater monitoring points within the GWB, these being at Whitegate (GWIE_SH_G_23603000005) and Scariff (GWIE_SH_G_23603000003). These are mapped by the EPA as being approximately 24 km southeast of the site boundary.

4 DESIGNATED SITES

The site itself is not located within any Special Area of Conservation (SAC), Special Protection Area (SPA), Natural Heritage Area (NHA) or proposed Natural Heritage Area (pNHA). The closest Conservation Objective (CO) features are outlined below.

4.1 NATURE CONSERVATION DESIGNATIONS

Figure 10 shows that, with respect to designations, none of the watercourses in the vicinity of the site are designated areas. However, the KILCROW_070 and GORTAHA_010 waterbodies contribute to the River Shannon system, which is mapped as part of the Lough Derg Northeast Shore SAC (002241) and further downstream the Lower Shannon SAC (Site Code: 002165). There is also a Statutory Instrument associated with the Lower River Shannon SAC.

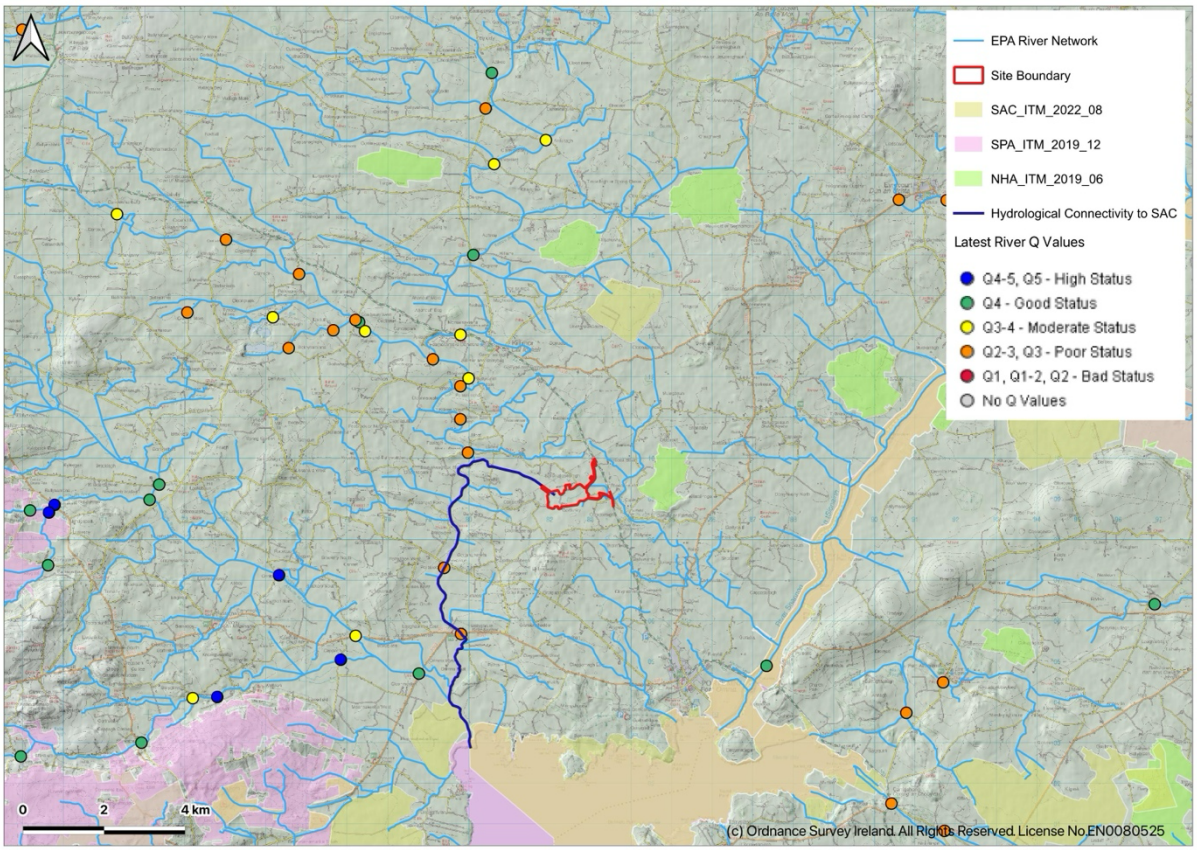
Designated areas within the area are presented in Table 3 and illustrated in Figure 10. There are a number of sites associated with Lough Derg to the south such as the Barroughter Bog SAC to the south west.

There is potential for hydrological connectivity between the application site and Lough Derg and Lower Shannon designated areas via the Kilcrow and Gortaha river networks. The Gortaha River flows into the River Shannon upstream of Lough Derg while the Kilcrow flows directly into Lough Derg. The main part of the application site drains westwards towards the Kilcrow River; this route of hydrological connectivity is shown in Figure 10.

Table 3 – Summary of Designated Sites Within a 15 km Radius of the Site

Natura 2000 Site	Site Code	Location at Closest Point to the Proposed Project
River Shannon Callows SAC	000216	5.6 km south east
Middle Shannon Callows SPA	004096	5.6 km south east
Lough Derg, North East Shore SAC	002241	8.8 km south
Lough Derg SPA	004058	8.8 km south
Baroughter Bog SAC	000231	9.1 km south-west

Figure 10 – Designated Areas & Latest Q-Ratings



4.2 BATHING WATER

Bathing waters identified under the Bathing Water Regulations (2008) are applicable to surface waters where the local authority expects a large number of people to bathe. A bathing waters location is mapped at Portumna (IESHBWL25_191a_0100) and achieved excellent water quality in 2024.

4.3 NUTRIENT SENSITIVE AREA

Nutrient Sensitive Areas (NSA) comprise Nitrate Vulnerable Zones and polluted waters designated under the Nitrates Directive (91/676/EEC and areas designated as sensitive areas under the Urban Wastewater Treatment Directive (UWWTD)(91/271/EEC). Sensitive areas under the UWWTD are water bodies affected by eutrophication associated with elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

The nearest nutrient sensitive area downstream of the site boundary is Lough Derg, which is under nutrient pressure from urban waste water inputs. The Nenagh River flows into the eastern side of Lough Derg which is also a nutrient sensitive area due to an urban wastewater treatment agglomeration.

4.4 SHELLFISH AREAS

The Shellfish Waters Directive (2006/113/EC) aims to protect or improve shellfish waters in order to support shellfish life and growth.

There are no shellfish protected area sites within the vicinity of the proposed development. The closest shellfish protected area is at the Shannon Estuary, between Kiloher Head to Leck point and Corlis Point to Beal Point.

4.5 DRINKING WATER PROTECTION AREAS

Lough Derg is the closest DWPA to the site boundary. All GWB's are considered as Drinking Water Protection Areas (DWPA). The Tynagh GWB that underlies the site contain seven mapped public drinking water supply sources or source protection zones. The nearest Irish Water source protection zones to groundwater supply sources are locates at Scariff and Whitegate at the southern extent of Lough Derg.

EPA envision mapping presents DWPA information, as shown in Table 4.

Table 4 – Drinking Water Protection Area (DWPA) information

Name	Drinking Protection Type	EU Priority Area (PA) Type	EU PA Code
Derg TN	Lake Waterbody	Article 7 Abstraction for Drinking Water	IEPA1_SH_25_191a
Tynagh GWB	Groundwater	Article 7 Abstraction for Drinking Water	IEPA1_SH_G_236

5 WFD SCREENING

5.1 SURFACE WATER BODIES

As described previously, rainfall-runoff generated on the application site currently drains to the Kilcrow_070 and Gortaha_010. The River Shannon and Lough Derg are to be screened appropriately given their proximity to the site boundary.

5.2 GROUNDWATER BODIES

As described above, the GWB underlying the site boundary is the Tynagh (IE_SH_G_236).

5.3 TRANSITIONAL WATERS

There are no transitional waters or coastal waters to be included in the screening assessment.

5.4 PROTECTED AREAS

Five protected areas and designated sites have been highlighted as being potentially hydrologically connected to the downstream site boundary. A Natura Impact Statement including Appropriate Assessment was compiled by Moore Group – Environmental Services (dated 29th May 2024) and accompanied the recent application.

With respect to Barroughter Bog SAC (000231), Moore Group state that:

- *'Barroughter Bog SAC (Site Code 000231) lies close to the Kilcrow River, 5.3 km to the southwest. The Kilcrow River runs along the eastern edge of the SAC boundary before it outfalls into Lough Derg. Given the location of the SAC in relation to the proposed development and the nature of the qualifying interests for which it is designated (terrestrial habitats) no viable source-pathway-receptor links are identified and therefore no potential for significant effects to this European site, and it is screened out.'*

With respect to Lough Derg North East Shore SAC (002241) and Lough Derg (Shannon) SPA (004058), the Kilcrow_070 (Treananearla Stream) provides connectivity with the application site. Considering the proposed works involve stream realignment, as outlined in the Flood Risk Assessment compiled by Envirologic (dated: 30th April 2024), Moore Group state that:

- *'The potential for significant adverse effects on the Lough Derg North-east Shore SAC (Site Code 002241) and the Lough Derg (Shannon) SPA (Site Code 004058) is uncertain in the absence of control of potential pollution of surface water during construction. The project will require the implementation of management measures to avoid potential adverse effects on the Lough Derg North-east Shore SAC and the Lough Derg (Shannon) SPA and as such Stage 2 AA is required.'*

With respect to the Gortaha_010 catchment, there are no stream realignments proposed. The construction of four bridges to facilitate site access will not involve instream construction works. Mitigation measures to reduce

sediment mobilisation whilst construction operations are taking place in around the proposed bridge locations have been outlined in the Flood Risk Assessment provided by Envirologic (dated: 30th April 2024) and the Natura Impact Statement provide by Moore Group (dated: 29th May 2024). Moore Group state that:

- *'A drainage ditch which runs under the L8763 local road close to its junction with the N65 drains a small section of the southeast of the site which has connectivity to a watercourse which enters the River Shannon north of Portumna, and thus has connectivity with the River Shannon Callows SAC (Site Code 000216) and Middle Shannon Callows SPA (Site Code 004096), 4.6km to the southeast. However, there are no works proposed that will have any impact on this drainage ditch and in the absence of a pathway and connectivity, these two sites are screened out at this stage of the assessment.'*

5.5 DRINKING WATER

Envirologic analysis with respect to connectivity of the site boundary to any Drinking Water Sources or Drinking Water Protection Areas, is noted in Table 5.

Table 5 – Drinking Water Abstractions

Name	EU PA Code	Envirologic Screening Note
Derg TN	IEPA1_SH_25_191a	The site boundary is sufficiently proximal to the Derg TN to be screened in.
Tynagh GWB	IEPA1_SH_G_236	There is an onsite well located within the site boundary that will be used for operational purposes.

It is concluded here that the proposed development is sufficiently proximal to Lough Derg, an EU Priority Area Type Article 7 Abstraction for Drinking Water, to be screed in. The site is significantly remote from any NFGWS Group Scheme Source Protection Areas. The impact and subsequent mitigation measures relating to the Derg TN will be screened in and investigated further.

6 WATER FRAMEWORK DIRECTIVE SCREENING SUMMARY

A summary of the WFD screening exercise is presented in Table 6.

Table 6 - Water Framework Directive Screening Summary

Feature Type	WFD Classification	Feature Name/ID	Included in Screening (Y/N)	Justification
Surface Water Body	River	Gortaha_010 [IE_SH_25G560730] in Sub Catchment Shannon[Lower]_SC_050	Y	The Gortaha_010 surface waterbody flows through the eastern portion of the site. Development works will take place proximally to the watercourse, along with four bridge crossings during the construction phase. It is therefore screened in.
	River	Kilcrow_070 [IE_SG_25K010700] in Sub Catchment Kilcrow_SC_010	Y	The Kilcrow_070 surface waterbody flows through the western portion of the site boundary. Development works will take place proximally to the watercourse, along with two bridge crossings and realignment works during the construction phase. It is therefore screened in.
	River	River Shannon [IE_SH_25S012350]	Y	The River Shannon is located 5.6 km downstream of the site boundary. It is therefore screened in.
	Lake	Lough Derg [IE_SH_25_191a]	Y	Lough Derg is located 8.8 km downstream of the site boundary. It is therefore screened in.
Groundwater Body	Groundwater	Tynagh [IE_SG_G_236]	Y	The Tynagh GWB has been screened in as it directly underlies the site boundary.

Transitional Water Body	Transitional	River Shannon and River Fergus Estuaries [IE_SH_060_0800]	N	Transitional waters associated with the River Shannon and River Fergus are considered too distant from the application site and are therefore screened out.
Coastal Water Body	Coastal	Mouth of the River Shannon [SH_060_0000]	N	Coastal waters downstream of Limerick City are considered too distant from the site and are therefore screened out.
Protected Area	Designated Site	River Shannon Callows SAC (000216)	Y	Distance of hydrological connectivity between the site boundary and the River Shannon Callows SAC is 5.6 km. This is considered sufficiently close to the site to be screened in.
		Middle Shannon Callows SPA (004096)	Y	Distance of hydrological connectivity between the site boundary and the Middle Shannon Callows SPA is 5.6 km. This is considered sufficiently close to the site and is screened in.
		Baroughter Bog SAC (000231)	N	Distance between the site boundary and the Baroughter Bog SAC is 9.1 km. This is considered sufficiently distant from the site boundary and is screened out. It is understood to be fed by groundwaters that flow beneath the application site.
		Lough Derg, North East Shore SAC (002241)	Y	Distance of hydrological connectivity between the site boundary and the River Shannon Callows SAC is 8.8 km. This is considered sufficiently distant from the site boundary and is screened in.
		Lough Derg SPA (004058)	Y	Distance of hydrological connectivity between the site boundary and the River Shannon Callows SAC is 8.8 km. This is considered sufficiently distant from the site boundary and is screened in.
	Bathing Water	Portumna	Y	Distance of hydrological connectivity between the site boundary and Portumna Bathing Area is 9.3 km. This is considered sufficiently distant from the site boundary and is screened in.

	Nutrient Sensitive Area	Lough Derg (Lake)	N	There will no nutrients managed or imported/exported to/from the application site.
	Shellfish	Shannon Estuary	N	The shellfish waters downstream of the site boundary are considered too distant from the site to be affected by the proposed development.
	EU Priority Area (PA) Type Article 7 Abstraction for Drinking Water	Derg TN	Y	Lough Derg is hydrologically connected 8.8 km downstream from the site boundary and is considered to be an EU PA.
		Tynagh GWB	Y	The site boundary is located within this GWB. However, the site boundary is not within any mapped Zones of Contribution or Source Protection Areas of any Water Supply Sources. A quantitative assessment will be carried out to assess the Tynagh GWB recharge rates and how the proposed development will interact with the GWB from an abstraction aspect.
	Source Protection Area	Oldthort GWS	Y	This GWS is located sufficiently close to the site boundary, and is potentially downstream in terms of groundwater flow direction.
		Killeen/Poulatoon GWS	N	This GWS is located sufficiently close to the site boundary. However is not located downstream in terms of groundwater flow direction from the site boundary.

7 WFD COMPLIANCE ASSESSMENT

7.1 PROPOSED DEVELOPMENT

The project relates to the proposed development titled 'Project Coolpowra' which intends to develop grid-connected energy support projects on lands in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway. The proposed development is designed to increase security of supply and keep the electricity grid stable and reliable in the face of growing demand. The development includes different flexible technologies, which were chosen to compliment and support the integration of further renewable generation technologies.

It is intended to demolish an existing dwelling and farmhouse on the site and construct the following:

- A Reserve Gas-Fired Generator comprised of three OCGT Units;
- Upgrade and replacement of the existing 400kV AIS substation with a 400kV GIS substation;
- Alternative Technology infrastructure such as Long Duration Energy Storage (LDES) and a Synchronous Condenser.

Each of the above proposed developments relates to a separate planning application. To facilitate development the following will also be included in the planning application:

- An alternative temporary construction access road from the N65

The proposed site layout is highlighted in Figure 11. There is an existing groundwater extraction well located to the east of the existing dwelling. This well was drilled in the 1960's to a depth of approximately 30 m below ground level and was used as a potable water supply for dwelling and surrounding farm buildings. It is proposed to retain this well and use it as the primary source of water for site operations. Specific required water supply quantities will be assessed in this report. Rising mains water supply pipes at the well shall supply the proposed fire hydrants located across the application site boundary, three fire water tanks and the operational facilities. All surface water generated on hardstanding will be directed towards the fire water retention tank and the two settlement ponds before entering the Kilcrow_070 watercourse.

Figure 11 – Proposed Site Layout

7.2 POTENTIAL EFFECTS

7.2.1 Construction Phase (Unmitigated)

7.2.1.1 River Water Bodies: Qualitative Impacts

Sediment Loss

In an unmitigated scenario there is potential for sediment-laden waters from exposed subsoils to enter the Kilcrow and Gortaha watercourses.

Hydrocarbon Loss

In an unmitigated scenario there is potential for leakages and spillages of hydrocarbons from construction traffic to enter the Kilcrow and Gortaha watercourses.

Substrate Quality

In an unmitigated scenario, there is potential for stream realignment construction phase works to negatively impact surface water quality. Mitigation and substrate improvement measures have been presented in the method statement contained in Chapter 6 of the Flood Risk Assessment.

7.2.1.2 River Water Bodies: Qualitative Impacts

There will no alteration of surface water catchment boundaries during the construction phase.

7.2.1.3 Groundwater Body: Qualitative Impacts

There is a potential impact to groundwater quality with the use of machinery and equipment during the construction with possible loss/spillage of hydrocarbons to the environment, where they may enter the underlying groundwater body. The quantity of hydrocarbons present in machinery and plant is relatively minor, however, and the potential risk and severity associated with construction phase activities is therefore deemed low.

7.2.1.4 Groundwater Bodies: Quantitative Impacts

There will be no significant groundwater abstractions or discharges to groundwater during the construction phase.

7.2.2 Operational Phase (Unmitigated)

7.2.2.1 River Water Bodies: Qualitative Impacts

Sediment Loss

In an unmitigated scenario there is potential for sediment-laden waters to enter the Kilcrow and Gortaha watercourses from trafficked areas or exposed overburden.

Hydrocarbon Loss

In an unmitigated scenario there is potential for hydrocarbons from employee vehicles and haulage vehicles to enter the Kilcrow and Gortaha watercourses.

Stream Gradient and Substrate Quality

In an unmitigated scenario, there is potential for the realigned stream to negatively impact stream substrate quality Mitigation and substrate improvement measures have been presented in the method statement contained in Chapter 6 of the Flood Risk Assessment.

7.2.2.2 Groundwater Body: Qualitative Impacts

There is a potential impact to groundwater quality with the use of machinery and equipment during the operational phase with possible loss/spillage of hydrocarbons to the environment, where they may enter the underlying groundwater body. The quantity of hydrocarbons present in machinery and plant is relatively minor, however, and the potential risk and severity associated with construction phase activities is therefore deemed low.

7.2.2.3 River Water Bodies: Quantitative Impacts

In its greenfield condition, i.e. prior to any development, the site boundary sat within the Kilcrow and Gortaha catchments. Commencement and progression of the proposed development will not result in any alterations to existing surface water catchment boundaries, i.e. there will no alteration to areas contributing to run-off for either catchment. There will be no transfer of surface waters across existing catchment boundaries.

Surface waters released from proposed settlements ponds ensure that discharge rates are equal to or below pre-development greenfield run-off rates. Excess waters will be stored in SuDS devices accordingly.

7.2.2.4 Groundwater Bodies: Quantitative Impacts

It is a usual part of an impact assessment to complete a GWB and aquifer scale hydrogeological quantitative impact assessment. As previously discussed, there is one groundwater well present within the site boundary. This well will be used in the following capacity:

Processing: A limited volume of wash water will arise during annual maintenance. This will arise as water from washing the gas turbine compressors and will contain some detergent. The volume of wastewater generated will be approximately 5 m^3 per event (i.e., 1 m^3 per GT). The requirement for washing will be very low and it is anticipated that this will occur on average once per year generating 5 m^3 of effluent (maximum twice per annum – 10 m^3). The washdown will be performed using a dilute detergent "soap" such as Turbotech 950 (SDS attached) or similar manufacturer approved product. The effluent arising from the process will be contained and drained to an Intermediate Bulk Container (IBC). The wastewater will be transported off site by a permitted contractor and will be disposed of at a licensed facility.

Potable Use: Approximately 15-20 operatives, employed over three shifts are related to the operation of the Energy Storage Facility and GIS compounds. Taking a conservative approach at 22 litres per day per operative, the highest demand required across the entire development will be 0.44 m^3 per day.

Applying a conservative approach and combining the two GW requirements mentioned above, the maximum daily requirement for water on site will be 5.44 m^3 Table 7 and Table 8 provide an assessment of how operating procedures interacts with the Tynagh GWB.

Table 7 – Quantitative analysis of flows in groundwater bodies

Key areas		
GSI assigned area for Tynagh GWB	km^2	824
GSI assigned area for Tynagh GWB	m^2	824,000,000
GWB Annual Average Rainfall/Recharge Rates		
GSI Effective Rainfall	mm/yr	531
GSI Groundwater Recharge	mm/yr	319
GSI Groundwater Recharge Cap	mm/yr	200
GSI GWB Groundwater Recharge Rate	m/yr	0.2
Recharge to WFD GWB		
Average daily groundwater recharge to Tynagh GWB	m^3/yr	164,800,000
Average daily groundwater recharge to Tynagh GWB	m^3/d	451,506
Development Abstraction		
Future anticipated maximum daily GW abstraction from the development	m^3/d	5.44
Annual abstraction	m^3/yr	1,985
Envirologic Calculation		
Proportion of development abstraction volume as % of Tynagh GWB annual recharge to bedrock aquifer	%	0.0012

EPA Register of all other abstractions from Tynagh GWB	m^3/yr	123,370
Existing abstractions + proposed development abstraction as a percentage of available groundwater in the Tynagh GWB	%	0.075

With reference to the GW5 (WFD Irl, 2004) evaluation criteria reproduced as Table 8, the preliminary 'Groundwater Body' quantitative test results of Table 8 suggests that the volume of groundwater being abstracted at the proposed development might account for only 0.075% of the annual average recharge to the GWB. It is taken that the calculated % is in the <2% bracket according to GW5 criteria, resulting in a conclusion of '**No Potential Impact'**.

Table 8 - Groundwater Thresholds for rivers and large lakes (Table 4, GW5 Guidance Document: Guidance on Abstractions; WFD Working Group, 2004).

	Average Specific Yield or Storage of GW Screening Unit	
Groundwater Abstraction vs Average Recharge	**Low Storage (< 5%)**	**High Storage (>=10%)**
>30%, i.e. if groundwater abstraction is greater than 30% of long-term recharge	High Potential Impact	High Potential Impact
	High Potential Impact	Moderate Potential Impact
10 – 20%	Moderate Potential Impact	Low Potential Impact
2 – 10%	Low Potential Impact	Low Potential Impact
< 2%	**No Potential Impact**	No Potential Impact

8 MITIGATION

The potential negative effects to the WFD Surface Waterbodies and Groundwater Bodies in terms of quantitative and quantitative status have been outlined above. Where required the following measures will be implemented to mitigate against the potential effects. Mitigation measures have been proposed in the following documents submitted with the planning application:

- '*Coolpowra EIAR Volume 2: Section 8.5 Mitigation Measures*' prepared by Halston;
- '*Project Coolpowra Natura Impact Statement: Section 3.5 Mitigation Measures*' prepared by Moore Group Environmental Services;
- '*Stage 3 Flood Risk Assessment: Section 6*' prepared by Envirologic.

Mitigation measures for each associated potential effect during the construction and operational phases are listed in Table 9 and Table 10, respectively. Measures to mitigate against unplanned events are outlined in Table 11.

Table 9 – Mitigation Measures: Construction Phase

POTENTIAL IMPACT				MITIGATION MEASURES	RESIDUAL EFFECT FOLLOWING MITIGATION	
Scenarios where impacts may arise	**Activity**	**Attribute**	**Character of Potential Impact**	**Description of Mitigation**	**Significance or quality of Effect**	**Probability**
Construction Phase	Contamination from spills or leaks of fuel/oil and hazardous substances stored onsite	Groundwater Bodies: Tynagh GWB Surface Water Bodies: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Deterioration in groundwater and surface water quality Moderate Impact	Construction compounds will be located at least 30 m from any surface watercourses within the site boundary. Dedicated area of hard standing for material deliveries separated a minimum of 10m from adjacent watercourses. Concrete will be mixed off–site and imported to the site. Dedicated area of hard standing for vehicle washout. Specific areas for oil storage and refueling, separated a minimum of 10m from adjacent watercourses and comply with legislation, including providing bunds which contain 110% of on-site fuel storage capacity. Use spill kits, fill point drip trays, bunded pallets and secondary containment units. Enclosed and secured site and fuel storage areas will be secondarily secured. Develop a Construction Waste Management Plan. Develop a site-specific Incident Response Plan.	Imperceptible	Unlikely

				Works involving the use of chemicals which are potentially harmful to the aquatic environment will be undertaken in a contained or lined area. Excavation and disposal off-site of contaminated soils (where required). Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the project site, and the proper use, storage and disposal of many substances used on construction sites, such as lubricants, fuels and oils and their containers can prevent soil contamination.		
Construction Phase	Realignment of part of the Treananearla Stream. Construction of 6 bridge crossings over surface watercourses	Surface Waters: Kilcrow_070 Lough Derg	Deterioration of Surface water quality from sediment input disrupting sensitive riverine and lacustrine habitats Moderate Impact	Realignment of the water channel will be undertaken at the start of development work. Works will be sequenced, i.e. the new channel will be dug in accordance with an agreed specification and best practice, and the water will be rediverted. The redundant channel (once isolated from the downstream watercourse) will then be infilled. As the stream is a part of an arterial drainage scheme, OPW will be consulted in advance of the proposed works. A method statement will be developed and agreed with all stakeholders. Silt fencing and other controls will be installed to prevent any impact on the downstream receptor.	Imperceptible	Unlikely
Construction Phase	Earthworks have the potential to result in overland run-off of sediment laden water to watercourses	Surface Waters: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Deterioration of Surface Water quality from sediment input disrupting sensitive riverine and lacustrine habitats	Minimisation of exposed ground and soil stockpiles, through careful earthworks design. Minimising the time that ground is exposed and excavations are open through careful construction programming. Stockpiles will be located away from watercourses, limited in height to 3m (topsoil) and the surface smoothed. Silt fences will be placed around the stockpiles where required to limit the potential for rainfall to wash fines into the drainage system (GIS compound	Imperceptible	Unlikely

			Moderate Impact	area). These comprise a technical filter fabric positioned as a fence around the exposed soil and sediment to catch fines within the runoff and reduce the input of fine sediment to the drainage system. Stockpiles which may be present for some time will be covered or seeded. Areas around infrastructure will be landscaped and restored with topsoil and revegetated as soon as possible. Track drainage, designed to prevent the interception of large volumes of water, will be porous and act as soak ways thereby minimising any direct discharge to watercourses. Wheel washing activities will be conducted in designated areas, with runoff waters being conducted to soak ways constructed according to best practice. Use of buffer zones, silt traps and settlement ponds to avoid sediment reaching watercourses		
Construction Phase	Contamination of groundwater by concrete, cement paste or grout	Groundwater Bodies: Tynagh GWB	Deterioration of groundwater quality Moderate Impact	A suitable casing will be used where wet concrete is proposed to ensure protection of groundwater until concrete has set.	Imperceptible	Unlikely
Construction Phase	Increased vulnerability of the aquifer as a result of soil removal	Groundwater Bodies: Tynagh GWB	Deterioration of groundwater quality. Moderate Impact	Land disturbance is expected to be minimised and quickly re-stabilised during the construction. Due to the limited soil and superficial cover present onsite, it is not thought that large quantities of soils and superficial deposits will be moved during construction. During construction, areas where the bedrock aquifer is exposed should be protected from surface activities through utilisation of appropriate surface coverings.	Imperceptible	Unlikely

Table 10 – Mitigation Measures: Operational Phase

POTENTIAL IMPACT				MITIGATION MEASURES	RESIDUAL EFFECT FOLLOWING MITIGATION	
Scenarios where impacts may arise	**Activity**	**Attribute**	**Character of Potential Impact**	**Description of Mitigation**	**Significance or quality of Effect**	**Probability**
Operational Phase	Contamination from spills or leaks of fuel/oil and hazardous substances stored onsite	Groundwater Bodies: Tynagh GWB Surface Water Bodies: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Deterioration in groundwater and surface water quality. Moderate Impact	Dedicated indoor chemical storage areas within the three projects are provided for the storage of chemicals. The secondary fuel and other oils will be stored in bunds. Specific areas for oil storage and refueling are provided and are separated from local drainage. Secondary containment (bunding) is designed to comply with best practice – the greater of (a)110% of the largest tank or drum within the bund or 25% of the total volume of substance within the bund. Bunds floor fall to internal sump areas which will allow bunds to be emptied via pump only. Bund sumps will have impermeable surfaces Pumps will either be permanently fitted in sumps / bunds (submersible) or dry mounted at bund wall height with suction lift (self-priming). Mobile pumps will also be used for smaller bunded structures as and when required.	Imperceptible	Unlikely

				Site drainage networks are designed in consideration of SUDS principles. Stormwater moving through 'dirty' site areas (e.g., parking, deliveries) to pass through oil interceptor prior to being infiltrated. Spill kits, fill point drip trays, bunded pallets and secondary containment units provided will be provided across all projects. Enclosed and secured site and fuel storage areas will be secondarily secured. A site-specific Incident Response Plan will be put in place for each project. Works involving the use of chemicals which are potentially harmful to the aquatic environment will be undertaken in a contained or lined area. All roads are designed to drain to the filter drains running parallel with the proposed access road and shown on the drainage drawings. This system shall allow runoff to filter down through the stone media providing filtering and delay and storage action. This stone shall be wrapped in a permeable membrane allowing runoff to infiltrate into the surrounding soils thus providing reduction action.		
Operational Phase	Contamination of waters due to leaks/spills from pipework and storage plant/tanks	Groundwater Bodies: Tynagh GWB Surface Water Bodies: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Deterioration in groundwater and surface water quality. Moderate Impact	Engineered controls included within the design to contain and recover spills. Water-efficient techniques will be used at source where possible to maximise reuse. Water will be recycled within the process from which it issues. The drainage system is designed to ensure separation and isolation of 'contaminated' surface water with 'uncontaminated' surface water. In order to ensure that uncontaminated surface drains are not mixing with possibly contaminated surface drains, risk areas will be discharged into a separate system. Small areas that have the potential for causing contamination of surface drain water are separated from the overall surface water drainage.	Imperceptible	Unlikely

				Appropriate surfacing and containment or drainage facilities for all operational areas are designed taking into consideration collection capacities, surface thicknesses, strength/reinforcement, falls, materials of construction, permeability, resistance to chemical attack, and inspection and maintenance procedures. Bunded (secondary containment) is provided for all storage tanks – site areas where tanks located fully bunded. Interceptors containing oil contaminated rainwater will be contained before being exported off-site for suitable disposal. The application for EPA licensing (IE License) associated with Project 1 will be progressed and put in place in advance of operation.		
Operational Phase	Use of settlement ponds	Surface Waters: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Removal and entrapment of particulate matter entrained in site waters. Moderate Impact	Surface water generated on hard standing will pass through multiple settlement ponds. This feature will clarify waters prior to them entering surface watercourses.	Imperceptible	Unlikely
Operational Phase	Cleaning of settlement ponds	Surface Waters: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Improves efficiency of settlement ponds and capacity. Moderate Impact	Particulate matter captured in settlement ponds to be transferred to landscaped perimeter bunds.	Imperceptible	Unlikely

			Mobilisation and migration of suspended solids			
Operational Phase	Use of wheel wash	Surface Waters: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Removal and entrapment of particulate matter attached to vehicles. Positive Impact	Positive impact so no mitigation required.	Positive	Unlikely
Operational Phase	Wheelwash maintenance	Surface Waters: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Improves of wheel wash Mobilisation and migration of suspended solids. Moderate Impact	The wheel wash is to be maintained in accordance with manufacturer's specifications.	Imperceptible	Unlikely
Operational Phase	Use & maintenance of hydrocarbon interceptors	Surface Waters: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Entrapment of hydrocarbons lost during movement of site waters. Positive Impact	Positive impact so no mitigation required. Oil that accumulates within hydrocarbon interceptors shall be regularly removed by an appropriately licensed contractor. The hydrocarbon interceptors shall be appropriately maintained in accordance with the manufacturer's specifications.	Positive	Unlikely

Operational Phase	Monitoring	Groundwater Bodies: Tynagh GWB Surface Water Bodies: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Monitoring of surface water quality, groundwater quality Positive Impact	Regular visual monitoring of the settlement lagoons will continue as per present to ensure no visual oil or fuel contamination. Hydrocarbons are monitored regularly in on-site groundwaters and nearby surface waters. Monitoring will continue as per current regime.	Imperceptible	Unlikely
Operational Phase	Abstraction	Groundwater Bodies: Tynagh GWB Oldthort GWS	Dewatering of Groundwater Body	As specified in Table 7 and Table 8, the operational requirement of Project Coolpowra accounts for only 0.075% of the annual average recharge to the Tynagh GWB	Imperceptible	Unlikely

Table 11 – Mitigation Measures: Unplanned Scenarios

POTENTIAL IMPACT				MITIGATION MEASURES	RESIDUAL EFFECT FOLLOWING MITIGATION	
Scenarios where impacts may arise	**Activity**	**Attribute**	**Character of Potential Impact**	**Description of Mitigation**	**Significance or quality of Effect**	**Probability**
Unplanned Scenario	Major Spillage	Groundwater Bodies: Tynagh GWB Surface Water Bodies: Kilcrow_070 Gortaha_010 Lough Derg River Shannon	Hydrocarbon contamination. Significant impact.	All runoff generated on potentially at-risk areas pass through a hydrocarbon interceptor prior to leaving the site. The outlet of the hydrocarbon interceptor will be fitted with a shutoff valve to facilitate manual containment of a significant spill. A contained spillage will be disposed of appropriately by a licensed contractor. Potentially harmful chemicals stored on site (e.g. lubricants) to be stored under cover on bund trays.	Imperceptible	Unlikely
	Intense Rainfall Events	Surface Water Bodies: Kilcrow_070 Gortaha_010	On-site & off-site flooding. Significant impact.	The flood risk assessment submitted as part of the planning application has adopted a conservative approach which incorporates the Q_{100} and Q_{1000} flood event. An allowance for climate change has also been included in the flood flow calculations for each catchment. There is no increased risk to downstream receptors as a result of the proposed development.	Imperceptible	Unlikely

9 SUMMARY

The proposed development, as outlined in this document, is necessary to increase security of energy supply and to keep the electricity grid stable and reliable in the face of growing demand. The development includes different flexible technologies, which were chosen to compliment and support the integration of further renewable generation technologies.

It is intended to demolish an existing dwelling and farmhouse on the site and construct the following:

- A Reserve Gas-Fired Generator comprised of three OCGT Units;
- Upgrade and replacement of the existing 400kV AIS substation with a 400kV GIS substation;
- Alternative Technology infrastructure such as Long Duration Energy Storage (LDES) and a Synchronous Condenser.

The predicted status change from proximal surface waterbodies and underlying groundwater bodies, arising from potential quantitative and qualitative impacts during the construction and operational phases of the proposed development are outlined in Table 12.

It is confirmed that the proposed development, along with its predicted abstraction volume, will not propagate a change to current WFD status of the Tynagh GWB or local surface waterbodies. Proposed stream realignment will improve hydrogeomorphology in the Kilcrow River network, creating potential new spawning grounds. The sub-catchment report (EPA, 2019) states that the Kilcrow_070 is at Moderate status, which contradicts the EPA maps portal which infers that current status in the Kilcrow_070 is Poor.

Table 12 – Potential Impacts to Qualitative and Quantitative Status of WFD Water Bodies

WFD Water Body	Tynagh GWB	Kilcrow_070	Gortaha_010
Current Overall WFD Status	Good	Poor	Moderate
Predicted Overall WFD Status	Good	Poor	Moderate

Predicted status change to the receiving watercourses and local sub-catchments, arising from quantitative and qualitative impacts during the construction, operational and restoration stages of the proposed development is outlined in Table 12, which concludes no potential to change the current Status. Both ‘Risk Status’ associated with the River Shannon (Shannon[Lower]_SC_050) were under review at the time of writing this report, hence are not assessed for predicted change to WFD status.

In In summary, the proposed development:

- Will not cause deterioration to any flowing surface water body, transitional water body or coastal waterbody.
- Will not impact any mapped or reported Drinking Water Area, Bathing Water, Shellfish Water or any other site.
- Will not cause a deterioration in the mapped ‘Good’ status of the underlying Tynagh GWB.
- Will not jeopardise the objectives to maintain the current status of the Tynagh GWB, the Gortaha_010 waterbody, the Kilcrow_070 waterbody, Lough Derg, or the River Shannon.

- Will not jeopardise the condition or protections provided to any downgradient designated site, or their future enhancement.
- Does not present any potential for impediment to the Programme of Measures associated with the River Basin Management Plan 2022 – 2027 or the Water Action Plan (WAP) 2024. The site boundary is not within any mapped Zones of Contribution or Source Protection Areas of any Water Supply Sources.
- Similarly, there are no High Status Objective sites connected to the development site.
- Is compliant with the requirements of the Water Framework Directive (2000/60/EC).

This document has been prepared by Envirologic for sole use by our client in accordance with generally accepted consultancy principles, the budget for fees and the agreed terms of reference. No third party may rely upon this document without the prior and express written agreement of Envirologic.

This report refers, within the limitations stated, to the condition of the site(s) at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the sites(s). The report is based on a visual site inspection and the physical investigation as detailed. Envirologic take no responsibility for conditions that have not been revealed due to lack of access. Whilst every effort has been made to interpret the conditions observed, such information is only indicative, and liability cannot be accepted for its lack of accuracy in representing geological/hydrological/hydrogeological conditions.

APPENDIX 12.3

LANDSCAPE MITIGATION PLAN

– ALTERNATIVE CONSTRUCTION ACCESS ROAD

NATIVE HEDGEROW SPECIES:

Planted as a triple staggered row at 600mm centres 50% of the primary structure to be planted as 8-10cm g standard trees

Botanical name	Common name	Size	%
Primary structure;			
Crataegus monogyna	Hawthorn	1+2tr 90-120cm / 10-12cm girth 3m br standard trees	60%
Secondary structure;			
Prunus spinosa	Blackthorn	1+2tr 90-120cm	15%
Ilex aquifolium	Holly	1+2tr 90-120cm	15%
Shrub species structure;			
Rubus fruticosus	Bramble	1+1tr 60-90cm	2.5%
Corylus avellana	Hazel	1+1tr 60-90cm	2.5%
Rosa canina	Dog-rose	1+1tr 60-90cm	2.5%
Euonymus europaeus	Spindle	1+1tr 60-90cm	2.5%

VEGETATION REMOVAL
Up to c. 120 m of existing roadside hedgerow removed to facilitate the proposed site access and sightlines

PROPOSED NATIVE HEDGEROW
New native hedgerow planting established along the allignment of the proposed access. Hedgerow to comprise native whips and advanced nursery stock.

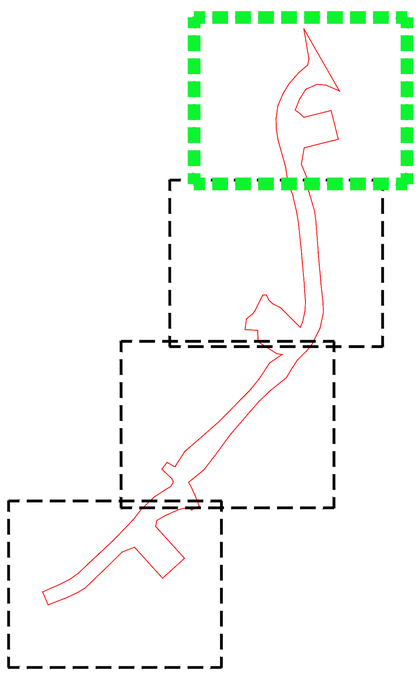
PROPOSED NATIVE TREES
Proposed native trees planted at c. 15m centres along the allignment of the proposed hedgerow. Trees planted as advanced heavy standards and selected in line with the All Ireland Pollinator Plan

NATIVE MEADOWS
The residual space between the road corridor and the boundary hedgerow will be established and managed as native meadow for biodiversity purposes.

0m 10m 25m 50m

N

CONTEXT MAP:



Registered Landscape Architect

macroworks APEM Group

LEGEND

- PROPOSED NATIVE TREES
- PROPOSED NATIVE HEDGEROW
- PROPOSED NATIVE MEADOW
- SITE BOUNDARY
- OWNERSHIP BOUNDARY

NOTES

It is imperative to use native Irish species in so far as possible as they are adapted to Irish conditions and therefore more likely to thrive compared to imported stock. Selected species should also represent woodland and hedgerows in the surrounding environs although non-native species are not to be used, unless otherwise agreed with the Planning Authority.

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REVISIONS:

1.		
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Prepared by:
MACRO WORKS,

HIBERNIA HOUSE,
CHERRYWOOD BUSINESS PARK,
LOUGHLINSTOWN, DUBLIN 18
00353 (01) 2303585
info@macroworks.ie

Site location:
COOLPOWRA, COUNTY GALWAY

Drawing Title:
LANDSCAPE PLAN

Project:
COOLPOWRA ACCESS ROAD

Drawn by: CD

Checked by: RB

Drawing Ref: LD.CLPWRA_ACCESS 1.1

Scale: 1:500 @ A1

Date: DECEMBER 2025

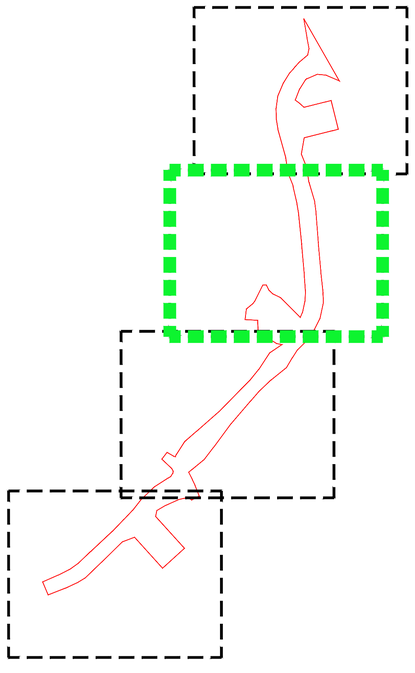
ISSUED

NATIVE HEDGEROW SPECIES:

Planted as a triple staggered row at 600mm centres 50% of the primary structure to be planted as 8-10cm g standard trees

Botanical name	Common name	Size	%
Primary structure;			
Crataegus monogyna	Hawthorn	1+2tr 90-120cm / 10-12cm girth 3m br standard trees	60%
Secondary structure;			
Prunus spinosa	Blackthorn	1+2tr 90-120cm	15%
Ilex aquifolium	Holly	1+2tr 90-120cm	15%
Shrub species structure;			
Rubus fruticosus	Bramble	1+1tr 60-90cm	2.5%
Corylus avellana	Hazel	1+1tr 60-90cm	2.5%
Rosa canina	Dog-rose	1+1tr 60-90cm	2.5%
Euonymus europaeus	Spindle	1+1tr 60-90cm	2.5%

CONTEXT MAP:



PROPOSED NATIVE HEDGEROW
New native hedgerow planting established along the allignment of the proposed access. Hedgerow to comprise native whips and advanced nursery stock.

PROPOSED NATIVE TREES
Proposed native trees planted at c. 15m centres along the allignment of the proposed hedgerow. Trees planted as advanced heavy standards and selected in line with the All Ireland Pollinator Plan

NATIVE MEADOWS
The residual space between the road corridor and the boundary hedgerow will be established and managed as native meadow for biodiversity purposes.

VEGETATION REMOVAL
Up to c. 32 linear meters of existing hedgerow removaed to faciliate the full footprint of the proposed site access

0m 10m 25m 50m

N

Registered Landscape Architect

macroworks APEM Group

LEGEND

- PROPOSED NATIVE TREES
- PROPOSED NATIVE HEDGEROW
- PROPOSED NATIVE MEADOW
- SITE BOUNDARY
- OWNERSHIP BOUNDARY

NOTES

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Site location:
COOLPOWRA, COUNTY GALWAY

Drawing Title:
LANDSCAPE PLAN

Project:
COOLPOWRA ACCESS ROAD

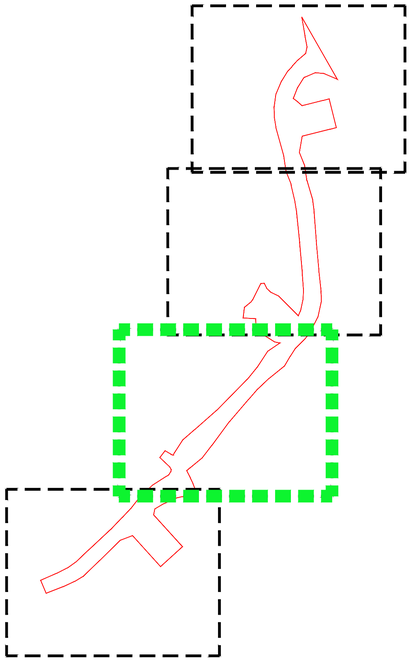
Drawn by:	Checked by:
CD	RB

Drawing Ref: **LD.CLPWRA_ACCESS 1.2**

Scale:	Date:
1:500 @ A1	DECEMBER 2025

ISSUED

CONTEXT MAP:



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New native hedgerow planting established along the allignment of the proposed access. Hedgerow to comprise native whips and advanced nursery stock.

PROPOSED NATIVE TREES
Proposed native trees planted at c. 15m centres along the allignment of the proposed hedgerow. Trees planted as advanced heavy standards and selected in line with the All Ireland Pollinator Plan

VEGETATION REMOVAL
Up to c. 44 linear meters of existing hedgerow removed to facilitate the full footprint of the proposed site access

NATIVE MEADOWS
The residual space between the road corridor and the boundary hedgerow will be established and managed as native meadow for biodiversity purposes.

Proposed hedgerows to tie into the existing roadside hedgerows

VEGETATION REMOVAL
Up to c. 90 linear meters of existing hedgerow removed to facilitate the full footprint of the proposed site access

VEGETATION REMOVAL
Up to c. 88 linear meters of existing hedgerow removed to facilitate the full footprint of the proposed site access

0m 10m 25m 50m

N

Registered Landscape Architect

macroworks APEM Group

LEGEND:

- PROPOSED NATIVE TREES
- PROPOSED NATIVE HEDGEROW
- PROPOSED NATIVE MEADOW
- SITE BOUNDARY
- OWNERSHIP BOUNDARY

NOTES:

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Site location:
COOLPOWRA, COUNTY GALWAY

Drawing Title:
LANDSCAPE PLAN

Project:
COOLPOWRA ACCESS ROAD

Drawn by: CD
Checked by: RB

Drawing Ref: **LD.CLPWRA_ACCESS 1.3**

Scale: 1:500 @ A1
Date: DECEMBER 2025

ISSUED

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PROPOSED NATIVE TREES
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NATIVE MEADOWS
The residual space between the road corridor and the boundary hedgerow will be established and managed as native meadow for biodiversity purposes.

Proposed hedgerows to tie into the existing roadside hedgerows

Previous access road allignment

Proposed hedgerows to tie into the hedgerows proposed as part of the proposed Coolpowra Flexgen development

LANDS WITHIN THE PROPOSED COOLPOWRA FLEXGEN DEVELOPMENT (GCC PLANNING REF: 2460845, ACP PLANNING REF: PL07.320916)

0m 10m 25m 50m

N

NATIVE HEDGEROW SPECIES:

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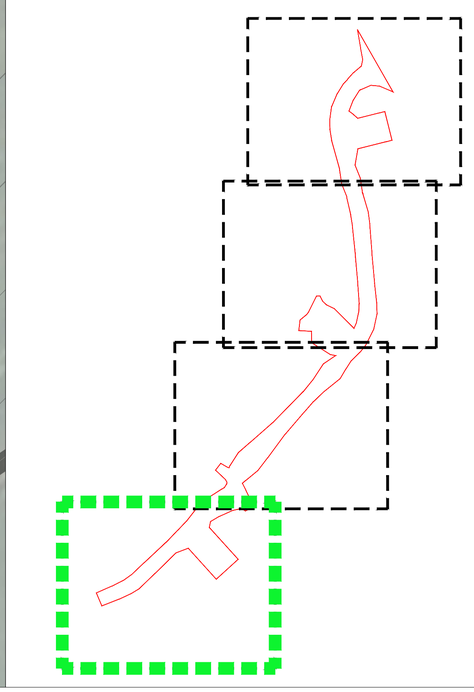
CONTEXT MAP:



Registered Landscape Architect

macroworks APEM Group

LEGEND

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Site location:
COOLPOWRA, COUNTY GALWAY

Drawing Title:
LANDSCAPE PLAN

Project:
COOLPOWRA ACCESS ROAD

Drawn by: CD
Checked by: RB

Drawing Ref: **LD.CLPWRA_ACCESS 1.4**

Scale: 1:500 @ A1
Date: DECEMBER 2025

ISSUED

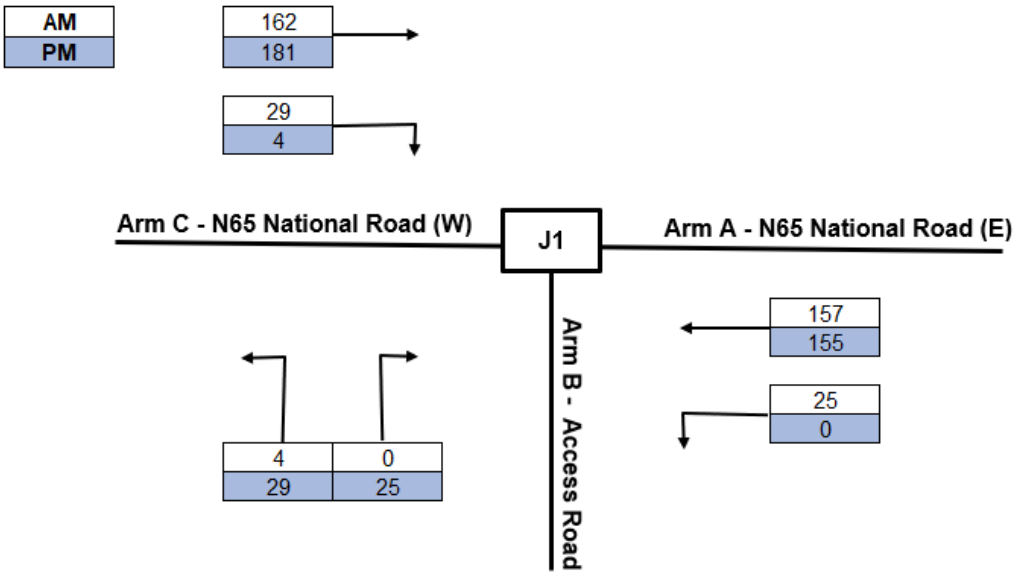
APPENDIX 13.6

TRAFFIC CALCULATIONS

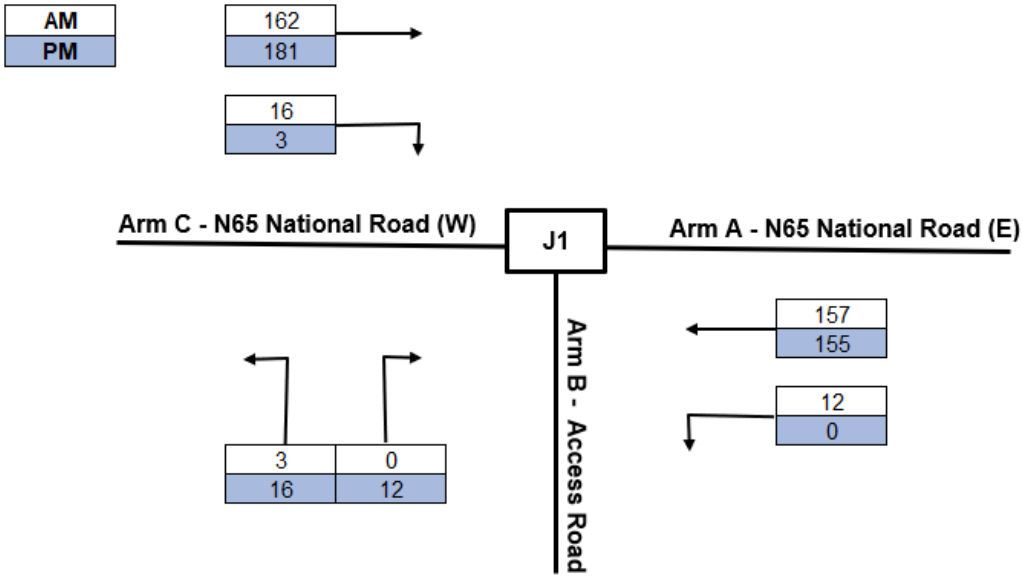
– ALTERNATIVE CONSTRUCTION ACCESS ROAD

N65 National Road/Access Road New Priority T-Junction

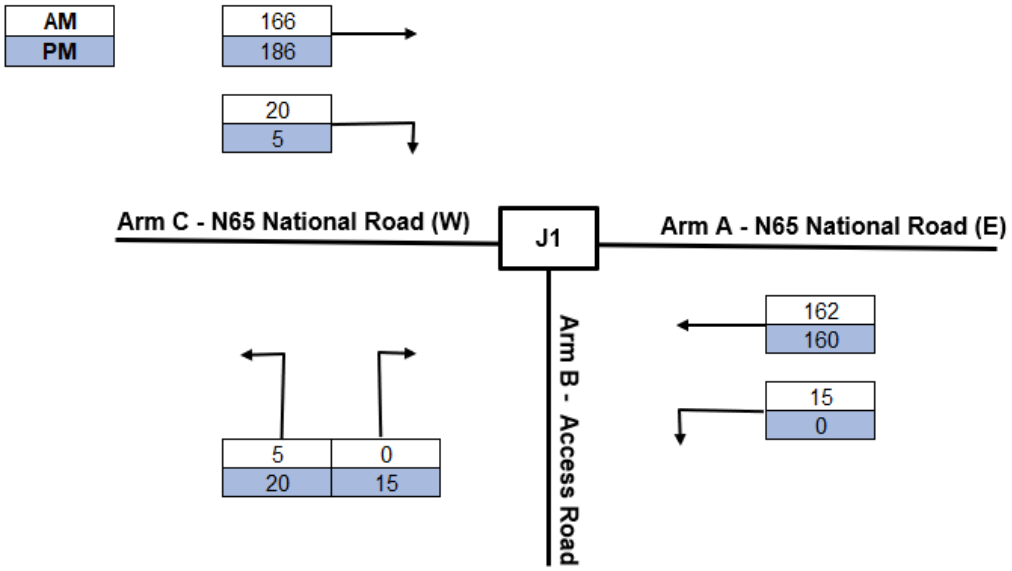
2027 - Traffic Data - Generator Construction



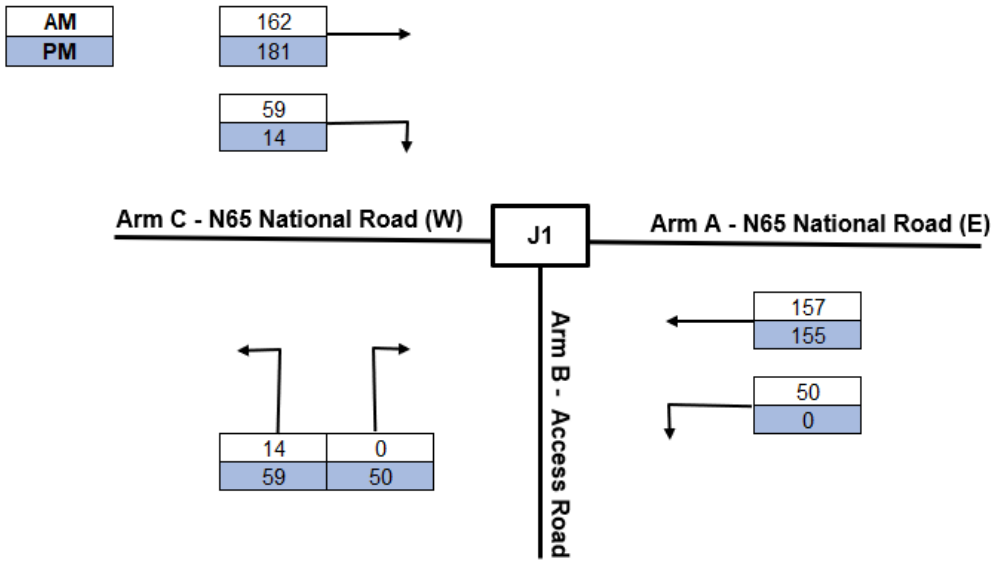
2027 - Traffic Data - GIS Construction



2028 - Traffic Data - ESS Construction

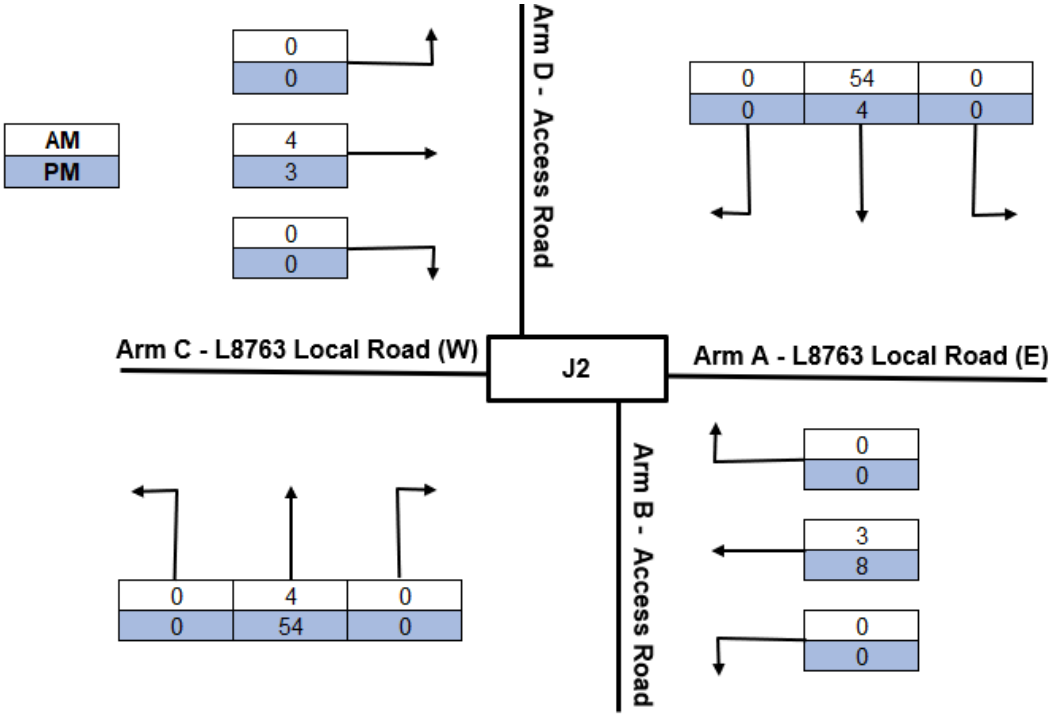


2027 - Traffic Data - Cumulative Construction

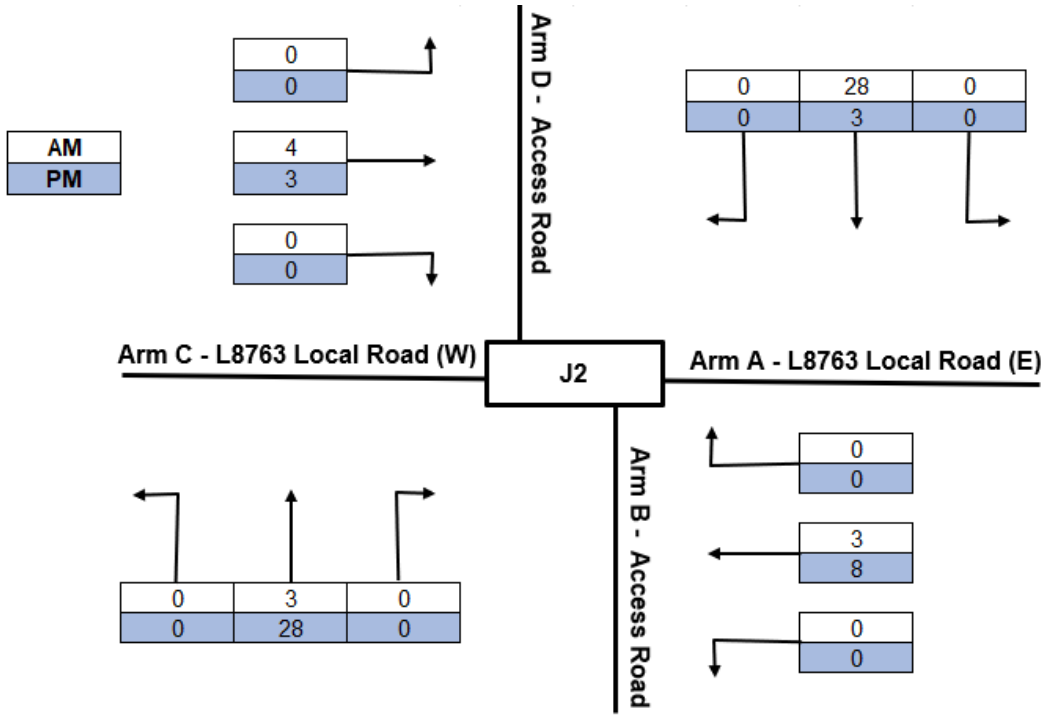


L8763 Local Road/Access Road New Priority Crossroad Junction

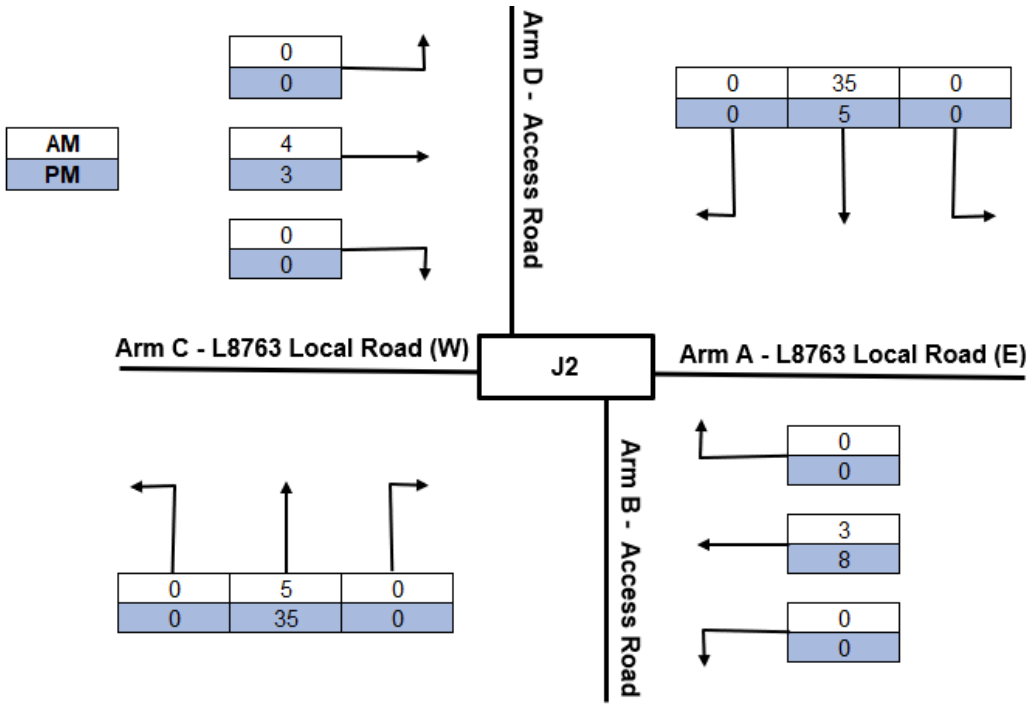
2027 - Traffic Data - Generator Construction



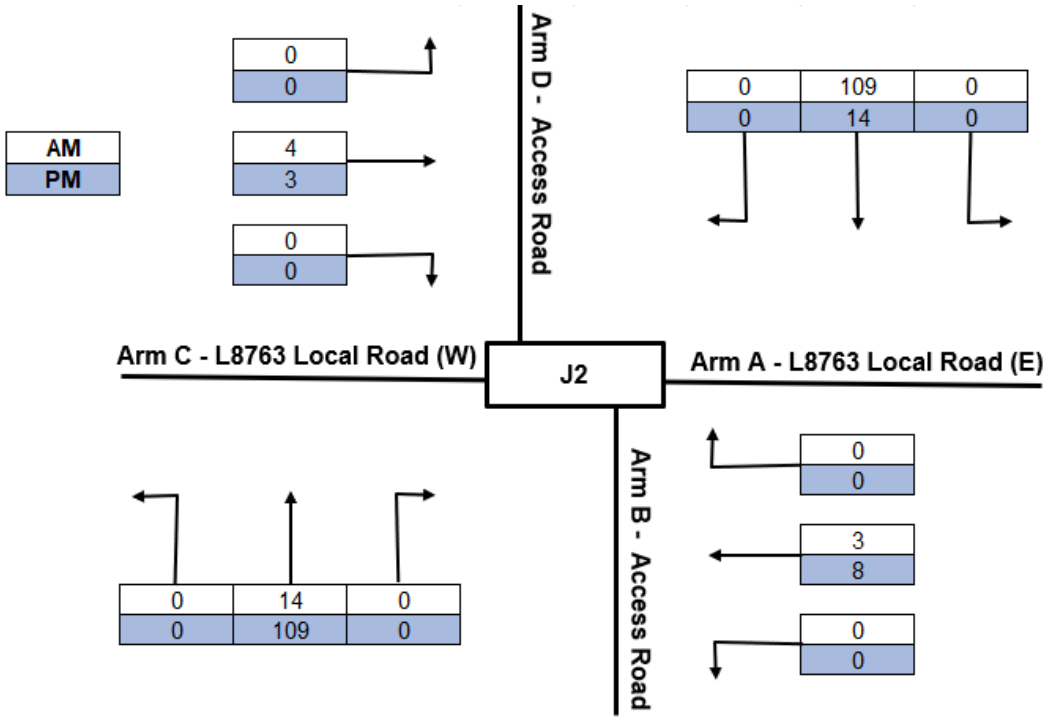
2027 - Traffic Data - GIS Construction



2028 - Traffic Data - ESS Construction



2027 - Traffic Data - Cumulative Construction



APPENDIX 13.7

PICADY ANALYSIS

– ALTERNATIVE CONSTRUCTION ACCESS ROAD

Junctions 11

PICADY 11 - Priority Intersection Module

Version: 11.1.0.2307
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+44 (0)1344 379777 software@trl.co.uk trlsoftware.com

The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution

Filename: Junction 1.j11
Path: T:\01 Trasky\06 Trasky Projects\2025\500582 - Coolpowra SID Energy Project - Road Design & Traffic Services\07 Calculations\02 Traffic Analysis
Report generation date: 14/11/2025 11:22:21

»D1 - 2027 | Generator Construction | AM
»D2 - 2027 | GIS Construction | AM
»D3 - 2028 | ESS Construction | AM
»D4 - 2027 | Cumulative Construction | AM
»D5 - 2027 | Generator Construction | PM
»D6 - 2027 | GIS Construction | PM
»D7 - 2028 | ESS Construction | PM
»D8 - 2027 | Cumulative Construction | PM

Summary of junction performance

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
	2027 - Generator Construction																	
Stream B-AC	D1	0.0	~1	0.00	0.00	A	0.52	A	671 % [Stream C-AB]	D5	0.1	0.6	8.33	0.09	A	1.02	A	310 % [Stream B-AC]
Stream C-AB		0.1	0.6	6.62	0.05	A					0.0	0.5	6.36	0.01	A			
	2027 - GIS Construction																	
Stream B-AC	D2	0.0	~1	0.00	0.00	A	0.31	A	900 % []	D6	0.1	0.6	7.69	0.05	A	0.64	A	401 % [Stream B-AC]
Stream C-AB		0.0	0.5	6.46	0.03	A					0.0	0.5	6.36	0.01	A			
	2028 - ESS Construction																	
Stream B-AC	D3	0.0	0.5	6.41	0.01	A	0.45	A	793 % [Stream C-AB]	D7	0.1	0.6	7.84	0.07	A	0.79	A	359 % [Stream B-AC]
Stream C-AB		0.0	0.5	6.53	0.03	A					0.0	0.5	6.38	0.01	A			
	2027 - Cumulative Construction																	
Stream B-AC	D4	0.0	0.5	6.54	0.02	A	1.11	A	415 % [Stream C-AB]	D8	0.3	1.5	9.39	0.21	A	2.43	A	170 % [Stream B-AC]
Stream C-AB		0.1	0.6	6.93	0.10	A					0.0	0.5	6.42	0.02	A			

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

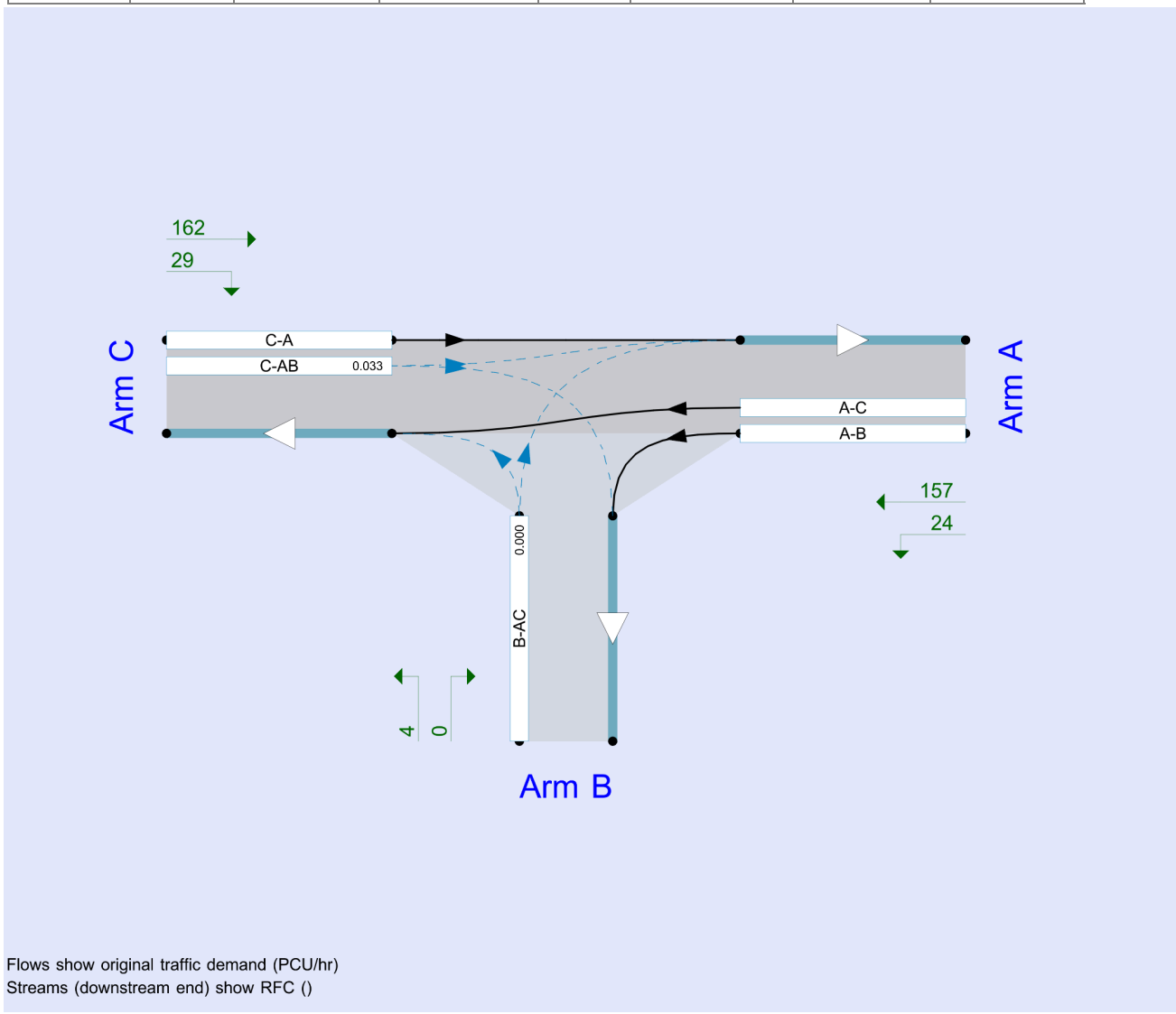
File summary

File Description

Title	Junction 1
Location	N65 National Road
Site number	1
Date	10/11/2025
Version	
Status	
Identifier	
Client	
Jobnumber	
Enumerator	DESKTOP-GDBF06V\jason
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin



Flows show original traffic demand (PCU/hr)
Streams (downstream end) show RFC ()

The junction diagram reflects the last run of Junctions.

Analysis Options

PICADY short flare model	Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Show lane queues in feet / metres	Show all PICADY stream intercepts	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)	Use simulation for HCM roundabouts	Use iterations for HCM roundabouts
JUNCTIONS 11.1	5.75	✓				✓	Delay	0.85	36.00	20.00		

Demand Set Summary

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2027	Generator Construction	AM	ONE HOUR	08:15	09:45	15	✓
D2	2027	GIS Construction	AM	ONE HOUR	08:15	09:45	15	✓
D3	2028	ESS Construction	AM	ONE HOUR	08:15	09:45	15	✓
D4	2027	Cumulative Construction	AM	ONE HOUR	08:15	09:45	15	✓
D5	2027	Generator Construction	PM	ONE HOUR	17:00	18:30	15	✓
D6	2027	GIS Construction	PM	ONE HOUR	17:00	18:30	15	✓
D7	2028	ESS Construction	PM	ONE HOUR	17:00	18:30	15	✓
D8	2027	Cumulative Construction	PM	ONE HOUR	17:00	18:30	15	✓

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	✓	100.000	100.000

D1 - 2027 | Generator Construction | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	Junction 1	T-Junction	Two-way	Two-way	Two-way		0.52	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	671	Stream C-AB	0.52	A

Arms

Arms

Arm	Name	Description	Arm type
A	N65 National Road (E)		Major
B	Access Road		Minor
C	N65 National Road (W)		Major

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right-turn storage	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
C	6.00			215.0	✓	1.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B	One lane	3.50	70	70

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for C-A	Slope for C-B
B-A	562	0.102	0.259	0.163	0.370
B-C	701	0.108	0.272	-	-
C-B	698	0.271	0.271	-	-

The slopes and intercepts shown above include custom intercept adjustments only.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2027	Generator Construction	AM	ONE HOUR	08:15	09:45	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	181	100.000
B		ONE HOUR	✓	4	100.000
C		ONE HOUR	✓	191	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	24	157
	B	0	0	4
	C	162	29	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To		
		A	B	C
From	A	10	15	10
	B	15	10	15
	C	10	15	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.00	0.00	0.0	~1	A	0	0
C-AB	0.05	6.62	0.1	0.6	A	27	41
C-A						148	222
A-B						22	33
A-C						144	216

Main Results for each time segment

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	573	0.000	0	0.0	0.0	0.000	A
C-AB	22	6	0.00	668	0.033	22	0.0	0.0	6.404	A
C-A	122	30	0.00			122				
A-B	18	5	0.00			18				
A-C	118	30	0.00			118				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	563	0.000	0	0.0	0.0	0.000	A
C-AB	26	7	0.00	663	0.040	26	0.0	0.0	6.496	A
C-A	145	36	0.00			145				
A-B	22	5	0.00			22				
A-C	141	35	0.00			141				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	549	0.000	0	0.0	0.0	0.000	A
C-AB	33	8	0.00	658	0.050	33	0.0	0.1	6.616	A
C-A	178	44	0.00			178				
A-B	26	7	0.00			26				
A-C	173	43	0.00			173				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	549	0.000	0	0.0	0.0	0.000	A
C-AB	33	8	0.00	658	0.050	33	0.1	0.1	6.616	A
C-A	178	44	0.00			178				
A-B	26	7	0.00			26				
A-C	173	43	0.00			173				

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	563	0.000	0	0.0	0.0	0.000	A
C-AB	26	7	0.00	663	0.040	26	0.1	0.0	6.499	A
C-A	145	36	0.00			145				
A-B	22	5	0.00			22				
A-C	141	35	0.00			141				

09:30 - 09:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	573	0.000	0	0.0	0.0	0.000	A
C-AB	22	6	0.00	668	0.033	22	0.0	0.0	6.410	A
C-A	122	30	0.00			122				
A-B	18	5	0.00			18				
A-C	118	30	0.00			118				

Queue Variation Results for each time segment

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.04	0.00	0.00	0.04	0.04			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.05	0.03	0.29	0.52	0.55			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.06	0.03	0.30	0.53	0.56			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.06	0.00	0.00	0.06	0.06			N/A	N/A

09:15 - 09:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.05	0.00	0.00	0.05	0.05			N/A	N/A

09:30 - 09:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.04	0.00	0.00	0.04	0.04			N/A	N/A

D2 - 2027 | GIS Construction | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	Junction 1	T-Junction	Two-way	Two-way	Two-way		0.31	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	900		0.31	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2027	GIS Construction	AM	ONE HOUR	08:15	09:45	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	159	100.000
B		ONE HOUR	✓	3	100.000
C		ONE HOUR	✓	178	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	12	147
	B	0	0	3
	C	162	16	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To		
		A	B	C
From	A	10	15	10
	B	15	10	15
	C	10	15	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.00	0.00	0.0	~1	A	0	0
C-AB	0.03	6.46	0.0	0.5	A	15	22
C-A						149	223
A-B						11	17
A-C						135	202

Main Results for each time segment

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	578	0.000	0	0.0	0.0	0.000	A
C-AB	12	3	0.00	670	0.018	12	0.0	0.0	6.292	A
C-A	122	30	0.00			122				
A-B	9	2	0.00			9				
A-C	111	28	0.00			111				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	569	0.000	0	0.0	0.0	0.000	A
C-AB	14	4	0.00	665	0.022	14	0.0	0.0	6.361	A
C-A	146	36	0.00			146				
A-B	11	3	0.00			11				
A-C	132	33	0.00			132				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	557	0.000	0	0.0	0.0	0.000	A
C-AB	18	4	0.00	659	0.027	18	0.0	0.0	6.454	A
C-A	178	45	0.00			178				
A-B	13	3	0.00			13				
A-C	162	40	0.00			162				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	556	0.000	0	0.0	0.0	0.000	A
C-AB	18	4	0.00	659	0.027	18	0.0	0.0	6.457	A
C-A	178	45	0.00			178				
A-B	13	3	0.00			13				
A-C	162	40	0.00			162				

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	569	0.000	0	0.0	0.0	0.000	A
C-AB	14	4	0.00	665	0.022	15	0.0	0.0	6.361	A
C-A	146	36	0.00			146				
A-B	11	3	0.00			11				
A-C	132	33	0.00			132				

09:30 - 09:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	0	0	0.00	578	0.000	0	0.0	0.0	0.000	A
C-AB	12	3	0.00	670	0.018	12	0.0	0.0	6.295	A
C-A	122	30	0.00			122				
A-B	9	2	0.00			9				
A-C	111	28	0.00			111				

Queue Variation Results for each time segment

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.03	0.03	0.29	0.52	0.55			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

09:15 - 09:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

09:30 - 09:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

D3 - 2028 | ESS Construction | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	Junction 1	T-Junction	Two-way	Two-way	Two-way		0.45	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	793	Stream C-AB	0.45	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2028	ESS Construction	AM	ONE HOUR	08:15	09:45	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	177	100.000
B		ONE HOUR	✓	5	100.000
C		ONE HOUR	✓	186	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	15	162
	B	0	0	5
	C	166	20	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To		
		A	B	C
From	A	10	15	10
	B	15	10	15
	C	10	15	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.01	6.41	0.0	0.5	A	5	7
C-AB	0.03	6.53	0.0	0.5	A	19	28
C-A						152	228
A-B						14	21
A-C						149	223

Main Results for each time segment

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	4	0.94	0.00	667	0.006	4	0.0	0.0	6.240	A
C-AB	15	4	0.00	667	0.023	15	0.0	0.0	6.347	A
C-A	125	31	0.00			125				
A-B	11	3	0.00			11				
A-C	122	30	0.00			122				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	4	1	0.00	660	0.007	4	0.0	0.0	6.311	A
C-AB	18	5	0.00	662	0.027	18	0.0	0.0	6.426	A
C-A	149	37	0.00			149				
A-B	13	3	0.00			13				
A-C	146	36	0.00			146				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	6	1	0.00	651	0.008	5	0.0	0.0	6.411	A
C-AB	22	6	0.00	655	0.034	22	0.0	0.0	6.534	A
C-A	182	46	0.00			182				
A-B	17	4	0.00			17				
A-C	178	45	0.00			178				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	6	1	0.00	651	0.008	6	0.0	0.0	6.411	A
C-AB	22	6	0.00	655	0.034	22	0.0	0.0	6.534	A
C-A	182	46	0.00			182				
A-B	17	4	0.00			17				
A-C	178	45	0.00			178				

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	4	1	0.00	660	0.007	5	0.0	0.0	6.313	A
C-AB	18	5	0.00	662	0.027	18	0.0	0.0	6.430	A
C-A	149	37	0.00			149				
A-B	13	3	0.00			13				
A-C	146	36	0.00			146				

09:30 - 09:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	4	0.94	0.00	667	0.006	4	0.0	0.0	6.243	A
C-AB	15	4	0.00	667	0.023	15	0.0	0.0	6.348	A
C-A	125	31	0.00			125				
A-B	11	3	0.00			11				
A-C	122	30	0.00			122				

Queue Variation Results for each time segment

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.01	0.29	0.52	0.55			N/A	N/A
C-AB	0.03	0.03	0.29	0.52	0.55			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.04	0.03	0.29	0.52	0.55			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.04	0.00	0.00	0.04	0.04			N/A	N/A

09:15 - 09:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

09:30 - 09:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

D4 - 2027 | Cumulative Construction | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	Junction 1	T-Junction	Two-way	Two-way	Two-way		1.11	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	415	Stream C-AB	1.11	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2027	Cumulative Construction	AM	ONE HOUR	08:15	09:45	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	207	100.000
B		ONE HOUR	✓	14	100.000
C		ONE HOUR	✓	241	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	50	157
	B	0	0	14
	C	182	59	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To		
		A	B	C
From	A	10	15	10
	B	15	10	15
	C	10	15	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.02	6.54	0.0	0.5	A	13	19
C-AB	0.10	6.93	0.1	0.6	A	56	84
C-A						165	248
A-B						46	69
A-C						144	216

Main Results for each time segment

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	11	3	0.00	665	0.016	10	0.0	0.0	6.322	A
C-AB	45	11	0.00	669	0.068	45	0.0	0.1	6.620	A
C-A	136	34	0.00			136				
A-B	38	9	0.00			38				
A-C	118	30	0.00			118				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	13	3	0.00	658	0.019	13	0.0	0.0	6.411	A
C-AB	55	14	0.00	667	0.082	54	0.1	0.1	6.754	A
C-A	162	41	0.00			162				
A-B	45	11	0.00			45				
A-C	141	35	0.00			141				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	15	4	0.00	649	0.024	15	0.0	0.0	6.538	A
C-AB	68	17	0.00	665	0.102	68	0.1	0.1	6.925	A
C-A	198	49	0.00			198				
A-B	55	14	0.00			55				
A-C	173	43	0.00			173				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	15	4	0.00	649	0.024	15	0.0	0.0	6.538	A
C-AB	68	17	0.00	664	0.102	68	0.1	0.1	6.926	A
C-A	198	49	0.00			198				
A-B	55	14	0.00			55				
A-C	173	43	0.00			173				

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	13	3	0.00	658	0.019	13	0.0	0.0	6.411	A
C-AB	55	14	0.00	666	0.082	55	0.1	0.1	6.756	A
C-A	162	41	0.00			162				
A-B	45	11	0.00			45				
A-C	141	35	0.00			141				

09:30 - 09:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	11	3	0.00	665	0.016	11	0.0	0.0	6.322	A
C-AB	45	11	0.00	669	0.068	45	0.1	0.1	6.628	A
C-A	136	34	0.00			136				
A-B	38	9	0.00			38				
A-C	118	30	0.00			118				

Queue Variation Results for each time segment

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.08	0.00	0.00	0.08	0.08			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.02	0.29	0.52	0.55			N/A	N/A
C-AB	0.10	0.03	0.30	0.54	0.57			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.03	0.00	0.00	0.03	0.03			N/A	N/A
C-AB	0.13	0.03	0.30	0.54	0.57			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.03	0.00	0.00	0.03	0.03			N/A	N/A
C-AB	0.14	0.03	0.29	0.52	0.55			N/A	N/A

09:15 - 09:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.11	0.00	0.00	0.11	0.11			N/A	N/A

09:30 - 09:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
C-AB	0.09	0.00	0.00	0.09	0.09			N/A	N/A

D5 - 2027 | Generator Construction | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	Junction 1	T-Junction	Two-way	Two-way	Two-way		1.02	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	310	Stream B-AC	1.02	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D5	2027	Generator Construction	PM	ONE HOUR	17:00	18:30	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	155	100.000
B		ONE HOUR	✓	44	100.000
C		ONE HOUR	✓	185	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	155
	B	25	0	19
	C	181	4	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To		
		A	B	C
From	A	10	15	10
	B	15	10	15
	C	10	15	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.09	8.33	0.1	0.6	A	40	61
C-AB	0.01	6.36	0.0	0.5	A	4	6
C-A						166	249
A-B						0	0
A-C						142	213

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	33	8	0.00	568	0.058	33	0.0	0.1	7.739	A
C-AB	3	0.75	0.00	668	0.005	3	0.0	0.0	6.223	A
C-A	136	34	0.00			136				
A-B	0	0	0.00			0				
A-C	117	29	0.00			117				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	40	10	0.00	558	0.071	39	0.1	0.1	7.980	A
C-AB	4	0.90	0.00	663	0.005	4	0.0	0.0	6.281	A
C-A	163	41	0.00			163				
A-B	0	0	0.00			0				
A-C	139	35	0.00			139				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	48	12	0.00	545	0.089	48	0.1	0.1	8.327	A
C-AB	4	1	0.00	655	0.007	4	0.0	0.0	6.362	A
C-A	199	50	0.00			199				
A-B	0	0	0.00			0				
A-C	171	43	0.00			171				

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	48	12	0.00	545	0.089	48	0.1	0.1	8.331	A
C-AB	4	1	0.00	655	0.007	4	0.0	0.0	6.362	A
C-A	199	50	0.00			199				
A-B	0	0	0.00			0				
A-C	171	43	0.00			171				

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	40	10	0.00	558	0.071	40	0.1	0.1	7.984	A
C-AB	4	0.90	0.00	662	0.005	4	0.0	0.0	6.284	A
C-A	163	41	0.00			163				
A-B	0	0	0.00			0				
A-C	139	35	0.00			139				

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	33	8	0.00	568	0.058	33	0.1	0.1	7.750	A
C-AB	3	0.75	0.00	668	0.005	3	0.0	0.0	6.225	A
C-A	136	34	0.00			136				
A-B	0	0	0.00			0				
A-C	117	29	0.00			117				

Queue Variation Results for each time segment

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.00	0.00	0.07	0.07			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.09	0.03	0.29	0.52	0.55			N/A	N/A
C-AB	0.01	0.01	0.29	0.52	0.55			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.11	0.03	0.30	0.54	0.57			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:45 - 18:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.11	0.03	0.29	0.52	0.55			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

18:00 - 18:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.09	0.00	0.00	0.09	0.09			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

18:15 - 18:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.00	0.00	0.07	0.07			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

D6 - 2027 | GIS Construction | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	Junction 1	T-Junction	Two-way	Two-way	Two-way		0.64	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	401	Stream B-AC	0.64	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D6	2027	GIS Construction	PM	ONE HOUR	17:00	18:30	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	155	100.000
B		ONE HOUR	✓	28	100.000
C		ONE HOUR	✓	184	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	155
	B	12	0	16
	C	181	3	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To		
		A	B	C
From	A	10	15	10
	B	15	10	15
	C	10	15	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.05	7.69	0.1	0.6	A	26	39
C-AB	0.01	6.36	0.0	0.5	A	3	4
C-A						166	249
A-B						0	0
A-C						142	213

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	21	5	0.00	590	0.036	21	0.0	0.0	7.275	A
C-AB	2	0.57	0.00	668	0.003	2	0.0	0.0	6.218	A
C-A	136	34	0.00			136				
A-B	0	0	0.00			0				
A-C	117	29	0.00			117				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	25	6	0.00	581	0.043	25	0.0	0.1	7.446	A
C-AB	3	0.68	0.00	662	0.004	3	0.0	0.0	6.276	A
C-A	163	41	0.00			163				
A-B	0	0	0.00			0				
A-C	139	35	0.00			139				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	31	8	0.00	569	0.054	31	0.1	0.1	7.690	A
C-AB	3	0.83	0.00	654	0.005	3	0.0	0.0	6.357	A
C-A	199	50	0.00			199				
A-B	0	0	0.00			0				
A-C	171	43	0.00			171				

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	31	8	0.00	569	0.054	31	0.1	0.1	7.692	A
C-AB	3	0.83	0.00	654	0.005	3	0.0	0.0	6.357	A
C-A	199	50	0.00			199				
A-B	0	0	0.00			0				
A-C	171	43	0.00			171				

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	25	6	0.00	581	0.043	25	0.1	0.1	7.447	A
C-AB	3	0.68	0.00	662	0.004	3	0.0	0.0	6.279	A
C-A	163	41	0.00			163				
A-B	0	0	0.00			0				
A-C	139	35	0.00			139				

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	21	5	0.00	590	0.036	21	0.1	0.0	7.282	A
C-AB	2	0.57	0.00	668	0.003	2	0.0	0.0	6.221	A
C-A	136	34	0.00			136				
A-B	0	0	0.00			0				
A-C	117	29	0.00			117				

Queue Variation Results for each time segment

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.03	0.29	0.52	0.55			N/A	N/A
C-AB	0.00	0.00	0.29	0.52	0.55			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.03	0.30	0.53	0.56			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:45 - 18:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.00	0.00	0.07	0.07			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

18:00 - 18:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

18:15 - 18:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
C-AB	0.00	0.00	0.00	0.00	0.00			N/A	N/A

D7 - 2028 | ESS Construction | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	Junction 1	T-Junction	Two-way	Two-way	Two-way		0.79	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	359	Stream B-AC	0.79	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2028	ESS Construction	PM	ONE HOUR	17:00	18:30	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	160	100.000
B		ONE HOUR	✓	35	100.000
C		ONE HOUR	✓	191	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	160
	B	15	0	20
	C	186	5	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To		
		A	B	C
From	A	10	15	10
	B	15	10	15
	C	10	15	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.07	7.84	0.1	0.6	A	32	48
C-AB	0.01	6.38	0.0	0.5	A	5	7
C-A						171	256
A-B						0	0
A-C						147	220

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	26	7	0.00	588	0.045	26	0.0	0.1	7.366	A
C-AB	4	0.94	0.00	667	0.006	4	0.0	0.0	6.236	A
C-A	140	35	0.00			140				
A-B	0	0	0.00			0				
A-C	120	30	0.00			120				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	31	8	0.00	579	0.054	31	0.1	0.1	7.559	A
C-AB	5	1	0.00	662	0.007	5	0.0	0.0	6.297	A
C-A	167	42	0.00			167				
A-B	0	0	0.00			0				
A-C	144	36	0.00			144				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	39	10	0.00	566	0.068	38	0.1	0.1	7.839	A
C-AB	6	1	0.00	654	0.008	6	0.0	0.0	6.381	A
C-A	205	51	0.00			205				
A-B	0	0	0.00			0				
A-C	176	44	0.00			176				

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	39	10	0.00	566	0.068	39	0.1	0.1	7.841	A
C-AB	6	1	0.00	654	0.008	6	0.0	0.0	6.381	A
C-A	205	51	0.00			205				
A-B	0	0	0.00			0				
A-C	176	44	0.00			176				

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	31	8	0.00	579	0.054	32	0.1	0.1	7.564	A
C-AB	5	1	0.00	662	0.007	5	0.0	0.0	6.297	A
C-A	167	42	0.00			167				
A-B	0	0	0.00			0				
A-C	144	36	0.00			144				

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	26	7	0.00	588	0.045	26	0.1	0.1	7.373	A
C-AB	4	0.94	0.00	667	0.006	4	0.0	0.0	6.236	A
C-A	140	35	0.00			140				
A-B	0	0	0.00			0				
A-C	120	30	0.00			120				

Queue Variation Results for each time segment

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.03	0.29	0.52	0.55			N/A	N/A
C-AB	0.01	0.01	0.29	0.52	0.55			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.08	0.03	0.30	0.54	0.57			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

17:45 - 18:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.08	0.00	0.00	0.08	0.08			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

18:00 - 18:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.07	0.00	0.00	0.07	0.07			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

18:15 - 18:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
C-AB	0.01	0.00	0.00	0.01	0.01			N/A	N/A

D8 - 2027 | Cumulative Construction | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
1	Junction 1	T-Junction	Two-way	Two-way	Two-way		2.43	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	170	Stream B-AC	2.43	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2027	Cumulative Construction	PM	ONE HOUR	17:00	18:30	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	155	100.000
B		ONE HOUR	✓	109	100.000
C		ONE HOUR	✓	195	100.000

Origin-Destination Data

Demand (PCU/hr)

		To		
		A	B	C
From	A	0	0	155
	B	50	0	59
	C	181	14	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To		
		A	B	C
From	A	10	15	10
	B	15	10	15
	C	10	15	10

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-AC	0.21	9.39	0.3	1.5	A	100	150
C-AB	0.02	6.42	0.0	0.5	A	13	19
C-A						166	249
A-B						0	0
A-C						142	213

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	82	21	0.00	583	0.141	81	0.0	0.2	8.239	A
C-AB	11	3	0.00	671	0.016	11	0.0	0.0	6.270	A
C-A	136	34	0.00			136				
A-B	0	0	0.00			0				
A-C	117	29	0.00			117				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	98	24	0.00	574	0.171	98	0.2	0.2	8.694	A
C-AB	13	3	0.00	666	0.019	13	0.0	0.0	6.334	A
C-A	163	41	0.00			163				
A-B	0	0	0.00			0				
A-C	139	35	0.00			139				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	120	30	0.00	561	0.214	120	0.2	0.3	9.375	A
C-AB	16	4	0.00	660	0.024	16	0.0	0.0	6.420	A
C-A	199	50	0.00			199				
A-B	0	0	0.00			0				
A-C	171	43	0.00			171				

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	120	30	0.00	561	0.214	120	0.3	0.3	9.388	A
C-AB	16	4	0.00	660	0.024	16	0.0	0.0	6.423	A
C-A	199	50	0.00			199				
A-B	0	0	0.00			0				
A-C	171	43	0.00			171				

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	98	24	0.00	574	0.171	98	0.3	0.2	8.711	A
C-AB	13	3	0.00	666	0.019	13	0.0	0.0	6.337	A
C-A	163	41	0.00			163				
A-B	0	0	0.00			0				
A-C	139	35	0.00			139				

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-AC	82	21	0.00	583	0.141	82	0.2	0.2	8.270	A
C-AB	11	3	0.00	671	0.016	11	0.0	0.0	6.273	A
C-A	136	34	0.00			136				
A-B	0	0	0.00			0				
A-C	117	29	0.00			117				

Queue Variation Results for each time segment

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.19	0.00	0.00	0.19	0.19			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.23	0.00	0.00	0.23	0.23			N/A	N/A
C-AB	0.02	0.02	0.29	0.52	0.55			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.31	0.03	0.29	0.53	0.56			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

17:45 - 18:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.31	0.03	0.35	1.10	1.47			N/A	N/A
C-AB	0.03	0.00	0.00	0.03	0.03			N/A	N/A

18:00 - 18:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.24	0.00	0.00	0.24	0.24			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

18:15 - 18:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-AC	0.19	0.00	0.00	0.19	0.19			N/A	N/A
C-AB	0.02	0.00	0.00	0.02	0.02			N/A	N/A

Junctions 11

PICADY 11 - Priority Intersection Module

Version: 11.1.0.2307
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Filename: Junction 2.j11
Path: T:\01 Trasky\06 Trasky Projects\2025\500582 - Coolpowra SID Energy Project - Road Design & Traffic Services\07 Calculations\02 Traffic Analysis
Report generation date: 14/11/2025 11:24:08

»D1 - 2027 | Generator Construction | AM
»D2 - 2027 | GIS Construction | AM
»D3 - 2028 | ESS Construction | AM
»D4 - 2027 | Cumulative Construction | AM
»D5 - 2027 | Generator Construction | PM
»D6 - 2027 | GIS Construction | PM
»D7 - 2028 | ESS Construction | PM
»D8 - 2027 | Cumulative Construction | PM

Summary of junction performance

	AM									PM								
	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity	Set ID	Queue (PCU)	95% Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Network Residual Capacity
	2027 - Generator Construction																	
Stream B-ACD	D1	0.0	~1	0.00	0.00	A	6.94	A	770 % [Stream CD-AB]	D5	0.1	0.5	5.75	0.09	A	5.27	A	810 % [Stream AB-CD]
Stream AB-CD		0.0	~1	0.00	0.00	A					0.1	~1	6.34	0.09	A			
Stream D-ABC		0.1	0.6	6.58	0.09	A					0.0	~1	0.00	0.00	A			
Stream CD-AB		0.1	~1	7.30	0.09	A					0.0	~1	0.00	0.00	A			
	2027 - GIS Construction																	
Stream B-ACD	D2	0.0	~1	0.00	0.00	A	5.76	A	900 % []	D6	0.0	0.5	5.50	0.04	A	4.49	A	900 % []
Stream AB-CD		0.0	~1	0.00	0.00	A					0.1	~1	6.04	0.05	A			
Stream D-ABC		0.0	0.5	5.48	0.04	A					0.0	~1	0.00	0.00	A			
Stream CD-AB		0.1	~1	6.05	0.05	A					0.0	~1	0.00	0.00	A			
	2028 - ESS Construction																	
Stream B-ACD	D3	0.0	0.5	5.27	0.01	A	5.80	A	900 % []	D7	0.1	0.5	5.56	0.06	A	4.84	A	900 % []
Stream AB-CD		0.0	~1	5.80	0.01	A					0.1	~1	6.12	0.06	A			
Stream D-ABC		0.1	0.5	5.54	0.06	A					0.0	0.5	5.27	0.01	A			
Stream CD-AB		0.1	~1	6.13	0.06	A					0.0	~1	5.82	0.01	A			
	2027 - Cumulative Construction																	
Stream B-ACD	D4	0.0	0.5	5.35	0.02	A	6.60	A	344 % [Stream CD-AB]	D8	0.2	0.7	6.36	0.17	A	6.21	A	347 % [Stream AB-CD]
Stream AB-CD		0.0	~1	5.89	0.02	A					0.2	~1	7.09	0.19	A			
Stream D-ABC		0.2	0.7	6.33	0.17	A					0.0	0.5	5.35	0.02	A			
Stream CD-AB		0.2	~1	7.11	0.19	A					0.0	~1	5.92	0.02	A			

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages. Network Residual Capacity indicates the amount by which network flow could be increased before a user-definable threshold (see Analysis Options) is met.

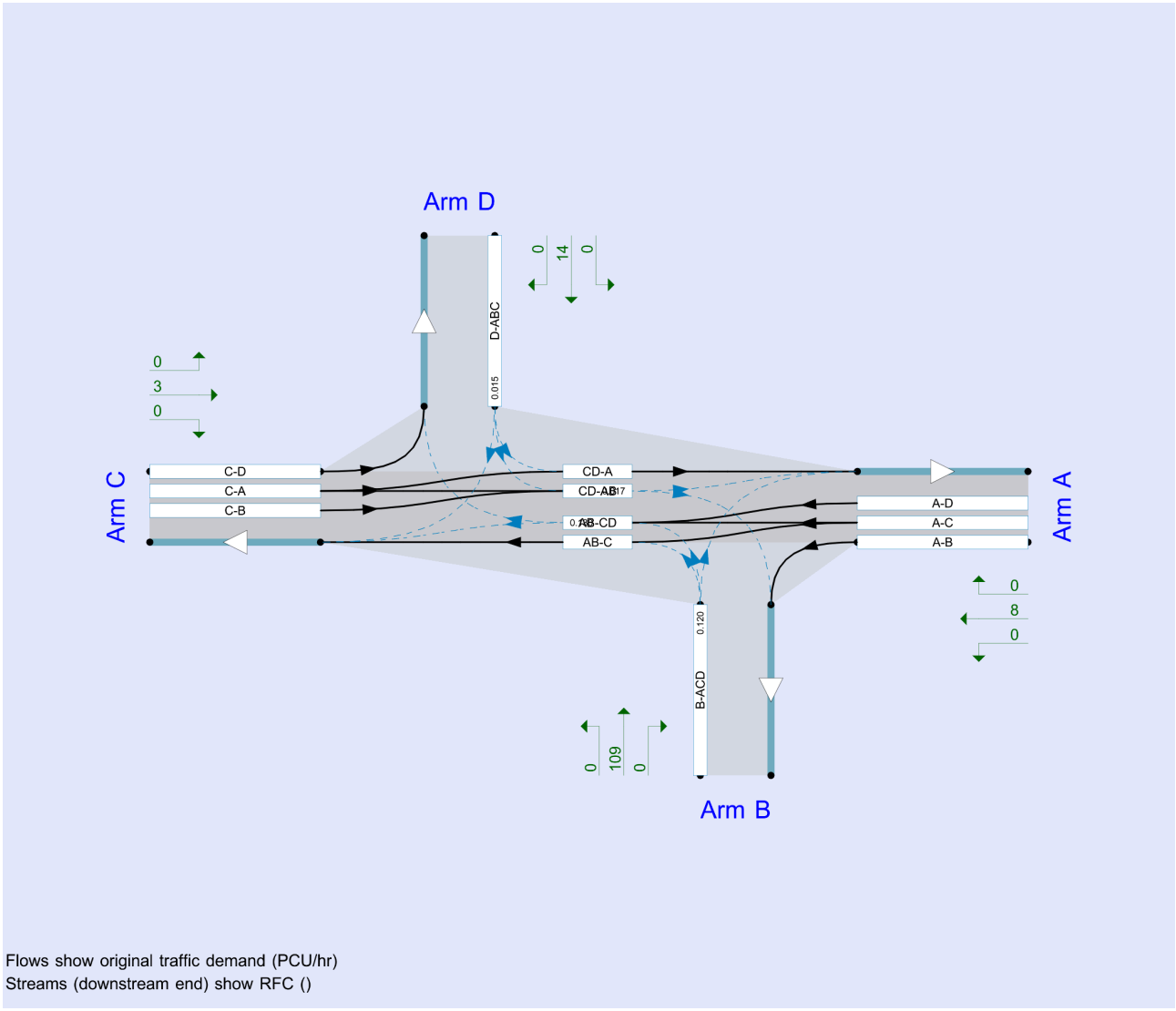
File summary

File Description

Title	Junction 2
Location	L8763 Local Road
Site number	1
Date	10/11/2025
Version	
Status	
Identifier	
Client	
Jobnumber	
Enumerator	DESKTOP-GDBF06V\jason
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	kph	PCU	PCU	perHour	s	-Min	perMin



Flows show original traffic demand (PCU/hr)
Streams (downstream end) show RFC ()

The junction diagram reflects the last run of Junctions.

Analysis Options

PICADY short flare model	Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Show lane queues in feet / metres	Show all PICADY stream intercepts	Calculate residual capacity	Residual capacity criteria type	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)	Use simulation for HCM roundabouts	Use iterations for HCM roundabouts
JUNCTIONS 11.1	5.75	✓				✓	Delay	0.85	36.00	20.00		

Demand Set Summary

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2027	Generator Construction	AM	ONE HOUR	08:15	09:45	15	✓
D2	2027	GIS Construction	AM	ONE HOUR	08:15	09:45	15	✓
D3	2028	ESS Construction	AM	ONE HOUR	08:15	09:45	15	✓
D4	2027	Cumulative Construction	AM	ONE HOUR	08:15	09:45	15	✓
D5	2027	Generator Construction	PM	ONE HOUR	17:00	18:30	15	✓
D6	2027	GIS Construction	PM	ONE HOUR	17:00	18:30	15	✓
D7	2028	ESS Construction	PM	ONE HOUR	17:00	18:30	15	✓
D8	2027	Cumulative Construction	PM	ONE HOUR	17:00	18:30	15	✓

Analysis Set Details

ID	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A2	✓	100.000	100.000

D1 - 2027 | Generator Construction | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Major arm width	Arm A - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Major arm width	Arm C - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Arm D Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
2	Junction 2	Left-Right Stagger	Two-way	Two-way	Two-way	Two-way		6.94	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	770	Stream CD-AB	6.94	A

Arms

Arms

Arm	Name	Description	Arm type
A	L8763 Local Road (E)		Major
B	Access Road		Minor
C	L8763 Local Road (W)		Major
D	Access Road		Minor

Major Arm Geometry

Arm	Width of carriageway (m)	Has kerbed central reserve	Has right-turn storage	Visibility for right turn (m)	Blocks?	Blocking queue (PCU)
A	5.50			90.0	✓	1.00
C	5.50			90.0	✓	1.00

Geometries for Arm C are measured opposite Arm B. Geometries for Arm A (if relevant) are measured opposite Arm D.

Minor Arm Geometry

Arm	Minor arm type	Lane width (m)	Visibility to left (m)	Visibility to right (m)
B	One lane	3.50	50	50
D	One lane	3.50	50	50

Slope / Intercept / Capacity

Priority Intersection Slopes and Intercepts

Stream	Intercept (PCU/hr)	Slope for A-B	Slope for A-C	Slope for A-D	Slope for B-C	Slope for B-D	Slope for C-A	Slope for C-B	Slope for C-D	Slope for D-A	Slope for D-B
AB-D	626	-	-	-	-	-	0.248	0.248	0.248	-	-
B-A	544	0.101	0.256	0.256	-	-	0.161	0.366	-	0.161	0.366
B-CD	688	0.108	0.272	0.272	-	-	-	-	-	-	-
CD-B	626	0.248	0.248	0.248	-	-	-	-	-	-	-
D-AB	688	-	-	-	-	-	0.272	0.272	0.108	-	-
D-C	544	-	0.161	0.366	0.161	0.366	0.256	0.256	0.101	-	-

The slopes and intercepts shown above include custom intercept adjustments only.
Streams may be combined, in which case capacity will be adjusted.
Values are shown for the first time segment only; they may differ for subsequent time segments.

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D1	2027	Generator Construction	AM	ONE HOUR	08:15	09:45	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	3	100.000
B		ONE HOUR	✓	4	100.000
C		ONE HOUR	✓	4	100.000
D		ONE HOUR	✓	54	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	0	3	0
	B	0	0	0	4
	C	4	0	0	0
	D	0	54	0	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To			
		A	B	C	D
From	A	5	5	5	5
	B	5	5	5	15
	C	5	5	5	5
	D	5	15	5	5

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-ACD	0.00	0.00	0.0	~1	A	0	0
A-B						0	0
A-C						0	0
A-D						0	0
AB-CD	0.00	0.00	0.0	~1	A	0	0
AB-C						0	0
D-ABC	0.09	6.58	0.1	0.6	A	50	74
C-D						0	0
C-A						0	0
C-B						0	0
CD-AB	0.09	7.30	0.1	~1	A	50	74
CD-A						0	0

Main Results for each time segment

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	599	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1209	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	41	10	0.00	688	0.059	40	0.0	0.1	6.387	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	40	10	0.00	626	0.064	40	0.0	0.1	7.061	A
CD-A	0	0	0.00			0				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	597	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1209	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	49	12	0.00	688	0.071	48	0.1	0.1	6.471	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	48	12	0.00	626	0.077	48	0.1	0.1	7.166	A
CD-A	0	0	0.00			0				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	594	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1209	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	59	15	0.00	688	0.086	59	0.1	0.1	6.583	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	59	15	0.00	626	0.095	59	0.1	0.1	7.304	A
CD-A	0	0	0.00			0				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	594	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1209	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	59	15	0.00	688	0.086	59	0.1	0.1	6.583	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	59	15	0.00	626	0.095	59	0.1	0.1	7.305	A
CD-A	0	0	0.00			0				

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	597	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1209	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	49	12	0.00	688	0.071	49	0.1	0.1	6.475	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	49	12	0.00	626	0.078	49	0.1	0.1	7.173	A
CD-A	0	0	0.00			0				

09:30 - 09:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	598	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1209	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	41	10	0.00	688	0.059	41	0.1	0.1	6.396	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	41	10	0.00	626	0.065	41	0.1	0.1	7.073	A
CD-A	0	0	0.00			0				

Queue Variation Results for each time segment

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.07	0.00	0.00	0.07	0.07			N/A	N/A
CD-AB	0.08	~1	~1	~1	~1			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.09	0.03	0.29	0.52	0.55			N/A	N/A
CD-AB	0.10	~1	~1	~1	~1			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.11	0.03	0.30	0.54	0.57			N/A	N/A
CD-AB	0.12	~1	~1	~1	~1			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.11	0.00	0.00	0.11	0.11			N/A	N/A
CD-AB	0.12	~1	~1	~1	~1			N/A	N/A

09:15 - 09:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.09	0.00	0.00	0.09	0.09			N/A	N/A
CD-AB	0.10	~1	~1	~1	~1			N/A	N/A

09:30 - 09:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.07	0.00	0.00	0.07	0.07			N/A	N/A
CD-AB	0.08	~1	~1	~1	~1			N/A	N/A

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Data Errors and Warnings

Severity	Area	Item	Description
Warning	Major arm width	Arm A - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Major arm width	Arm C - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Arm D Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
2	Junction 2	Left-Right Stagger	Two-way	Two-way	Two-way	Two-way		5.76	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	900		5.76	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D2	2027	GIS Construction	AM	ONE HOUR	08:15	09:45	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	3	100.000
B		ONE HOUR	✓	3	100.000
C		ONE HOUR	✓	4	100.000
D		ONE HOUR	✓	28	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	0	3	0
	B	0	0	0	3
	C	4	0	0	0
	D	0	28	0	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To			
		A	B	C	D
From	A	10	15	10	0
	B	15	10	15	0
	C	10	15	10	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-ACD	0.00	0.00	0.0	~1	A	0	0
A-B						0	0
A-C						0	0
A-D						0	0
AB-CD	0.00	0.00	0.0	~1	A	0	0
AB-C						0	0
D-ABC	0.04	5.48	0.0	0.5	A	26	39
C-D						0	0
C-A						0	0
C-B						0	0
CD-AB	0.05	6.05	0.1	~1	A	26	39
CD-A						0	0

Main Results for each time segment

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	603	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1377	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	21	5	0.00	688	0.031	21	0.0	0.0	5.395	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	21	5	0.00	626	0.033	21	0.0	0.0	5.946	A
CD-A	0	0	0.00			0				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	602	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1377	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	25	6	0.00	688	0.037	25	0.0	0.0	5.428	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	25	6	0.00	626	0.040	25	0.0	0.0	5.989	A
CD-A	0	0	0.00			0				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	601	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1377	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	31	8	0.00	688	0.045	31	0.0	0.0	5.475	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	31	8	0.00	626	0.049	31	0.0	0.1	6.046	A
CD-A	0	0	0.00			0				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	601	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1377	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	31	8	0.00	688	0.045	31	0.0	0.0	5.475	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	31	8	0.00	626	0.049	31	0.1	0.1	6.047	A
CD-A	0	0	0.00			0				

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	602	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1377	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	25	6	0.00	688	0.037	25	0.0	0.0	5.429	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	25	6	0.00	626	0.040	25	0.1	0.0	5.991	A
CD-A	0	0	0.00			0				

09:30 - 09:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	0	0	0.00	603	0.000	0	0.0	0.0	0.000	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	0	0	0.00	1377	0.000	0	0.0	0.0	0.000	A
AB-C	0	0	0.00			0				
D-ABC	21	5	0.00	688	0.031	21	0.0	0.0	5.398	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	21	5	0.00	626	0.034	21	0.0	0.0	5.952	A
CD-A	0	0	0.00			0				

Queue Variation Results for each time segment

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.03	0.00	0.00	0.03	0.03			N/A	N/A
CD-AB	0.03	~1	~1	~1	~1			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.04	0.03	0.25	0.45	0.48			N/A	N/A
CD-AB	0.04	~1	~1	~1	~1			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.05	0.03	0.26	0.46	0.48			N/A	N/A
CD-AB	0.05	~1	~1	~1	~1			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
CD-AB	0.05	~1	~1	~1	~1			N/A	N/A

09:15 - 09:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
CD-AB	0.04	~1	~1	~1	~1			N/A	N/A

09:30 - 09:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.00	0.00	0.00	0.00	0.00			N/A	N/A
AB-CD	0.00	~1	~1	~1	~1			N/A	N/A
D-ABC	0.03	0.00	0.00	0.03	0.03			N/A	N/A
CD-AB	0.04	~1	~1	~1	~1			N/A	N/A

D3 - 2028 | ESS Construction | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Major arm width	Arm A - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Major arm width	Arm C - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Arm D Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
2	Junction 2	Left-Right Stagger	Two-way	Two-way	Two-way	Two-way		5.80	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	900		5.80	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D3	2028	ESS Construction	AM	ONE HOUR	08:15	09:45	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	3	100.000
B		ONE HOUR	✓	5	100.000
C		ONE HOUR	✓	4	100.000
D		ONE HOUR	✓	35	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	0	3	0
	B	0	0	0	5
	C	4	0	0	0
	D	0	35	0	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To			
		A	B	C	D
From	A	10	15	10	0
	B	15	10	15	0
	C	10	15	10	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-ACD	0.01	5.27	0.0	0.5	A	5	7
A-B						0	0
A-C						0	0
A-D						0	0
AB-CD	0.01	5.80	0.0	~1	A	5	7
AB-C						0	0
D-ABC	0.06	5.54	0.1	0.5	A	32	48
C-D						0	0
C-A						0	0
C-B						0	0
CD-AB	0.06	6.13	0.1	~1	A	32	48
CD-A						0	0

Main Results for each time segment

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	4	0.94	0.00	688	0.005	4	0.0	0.0	5.259	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	4	0.94	0.00	626	0.006	4	0.0	0.0	5.783	A
AB-C	0	0	0.00			0				
D-ABC	26	7	0.00	688	0.038	26	0.0	0.0	5.436	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	26	7	0.00	626	0.042	26	0.0	0.0	5.998	A
CD-A	0	0	0.00			0				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	4	1	0.00	688	0.007	4	0.0	0.0	5.264	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	4	1	0.00	626	0.007	4	0.0	0.0	5.790	A
AB-C	0	0	0.00			0				
D-ABC	31	8	0.00	688	0.046	31	0.0	0.0	5.480	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	31	8	0.00	626	0.050	31	0.0	0.1	6.053	A
CD-A	0	0	0.00			0				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	6	1	0.00	688	0.008	5	0.0	0.0	5.272	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	5	1	0.00	626	0.009	5	0.0	0.0	5.800	A
AB-C	0	0	0.00			0				
D-ABC	39	10	0.00	688	0.056	38	0.0	0.1	5.540	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	38	10	0.00	626	0.061	38	0.1	0.1	6.126	A
CD-A	0	0	0.00			0				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	6	1	0.00	688	0.008	6	0.0	0.0	5.272	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	6	1	0.00	626	0.009	6	0.0	0.0	5.800	A
AB-C	0	0	0.00			0				
D-ABC	39	10	0.00	688	0.056	39	0.1	0.1	5.540	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	39	10	0.00	626	0.062	39	0.1	0.1	6.126	A
CD-A	0	0	0.00			0				

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	4	1	0.00	688	0.007	5	0.0	0.0	5.266	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	5	1	0.00	626	0.007	5	0.0	0.0	5.791	A
AB-C	0	0	0.00			0				
D-ABC	31	8	0.00	688	0.046	32	0.1	0.0	5.481	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	32	8	0.00	626	0.050	32	0.1	0.1	6.055	A
CD-A	0	0	0.00			0				

09:30 - 09:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	4	0.94	0.00	688	0.005	4	0.0	0.0	5.259	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	4	0.94	0.00	626	0.006	4	0.0	0.0	5.786	A
AB-C	0	0	0.00			0				
D-ABC	26	7	0.00	688	0.038	26	0.0	0.0	5.439	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	26	7	0.00	626	0.042	26	0.1	0.0	6.003	A
CD-A	0	0	0.00			0				

Queue Variation Results for each time segment

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.01	0.00	0.00	0.01	0.01			N/A	N/A
AB-CD	0.01	~1	~1	~1	~1			N/A	N/A
D-ABC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
CD-AB	0.04	~1	~1	~1	~1			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.01	0.01	0.25	0.45	0.48			N/A	N/A
AB-CD	0.01	~1	~1	~1	~1			N/A	N/A
D-ABC	0.05	0.03	0.25	0.45	0.48			N/A	N/A
CD-AB	0.05	~1	~1	~1	~1			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.01	0.00	0.00	0.01	0.01			N/A	N/A
AB-CD	0.01	~1	~1	~1	~1			N/A	N/A
D-ABC	0.06	0.03	0.26	0.46	0.49			N/A	N/A
CD-AB	0.07	~1	~1	~1	~1			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.01	0.00	0.00	0.01	0.01			N/A	N/A
AB-CD	0.01	~1	~1	~1	~1			N/A	N/A
D-ABC	0.06	0.00	0.00	0.06	0.06			N/A	N/A
CD-AB	0.07	~1	~1	~1	~1			N/A	N/A

09:15 - 09:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.01	0.00	0.00	0.01	0.01			N/A	N/A
AB-CD	0.01	~1	~1	~1	~1			N/A	N/A
D-ABC	0.05	0.00	0.00	0.05	0.05			N/A	N/A
CD-AB	0.05	~1	~1	~1	~1			N/A	N/A

09:30 - 09:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.01	0.00	0.00	0.01	0.01			N/A	N/A
AB-CD	0.01	~1	~1	~1	~1			N/A	N/A
D-ABC	0.04	0.00	0.00	0.04	0.04			N/A	N/A
CD-AB	0.04	~1	~1	~1	~1			N/A	N/A

D4 - 2027 | Cumulative Construction | AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Major arm width	Arm A - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Major arm width	Arm C - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Arm D Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
2	Junction 2	Left-Right Stagger	Two-way	Two-way	Two-way	Two-way		6.60	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	344	Stream CD-AB	6.60	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D4	2027	Cumulative Construction	AM	ONE HOUR	08:15	09:45	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	3	100.000
B		ONE HOUR	✓	14	100.000
C		ONE HOUR	✓	4	100.000
D		ONE HOUR	✓	109	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	0	3	0
	B	0	0	0	14
	C	4	0	0	0
	D	0	109	0	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To			
		A	B	C	D
From	A	10	15	10	0
	B	15	10	15	0
	C	10	15	10	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-ACD	0.02	5.35	0.0	0.5	A	13	19
A-B						0	0
A-C						0	0
A-D						0	0
AB-CD	0.02	5.89	0.0	~1	A	13	19
AB-C						0	0
D-ABC	0.17	6.33	0.2	0.7	A	100	150
C-D						0	0
C-A						0	0
C-B						0	0
CD-AB	0.19	7.11	0.2	~1	A	100	150
CD-A						0	0

Main Results for each time segment

08:15 - 08:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	11	3	0.00	688	0.015	10	0.0	0.0	5.311	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	10	3	0.00	626	0.017	10	0.0	0.0	5.847	A
AB-C	0	0	0.00			0				
D-ABC	82	21	0.00	688	0.119	82	0.0	0.1	5.929	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	82	20	0.00	626	0.130	81	0.0	0.1	6.597	A
CD-A	0	0	0.00			0				

08:30 - 08:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	13	3	0.00	688	0.018	13	0.0	0.0	5.327	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	13	3	0.00	626	0.020	13	0.0	0.0	5.867	A
AB-C	0	0	0.00			0				
D-ABC	98	24	0.00	688	0.142	98	0.1	0.2	6.096	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	98	24	0.00	626	0.156	98	0.1	0.2	6.811	A
CD-A	0	0	0.00			0				

08:45 - 09:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	15	4	0.00	688	0.022	15	0.0	0.0	5.350	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	15	4	0.00	626	0.025	15	0.0	0.0	5.894	A
AB-C	0	0	0.00			0				
D-ABC	120	30	0.00	688	0.174	120	0.2	0.2	6.332	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	120	30	0.00	626	0.191	120	0.2	0.2	7.104	A
CD-A	0	0	0.00			0				

09:00 - 09:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	15	4	0.00	688	0.022	15	0.0	0.0	5.350	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	15	4	0.00	626	0.025	15	0.0	0.0	5.894	A
AB-C	0	0	0.00			0				
D-ABC	120	30	0.00	688	0.174	120	0.2	0.2	6.334	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	120	30	0.00	626	0.192	120	0.2	0.2	7.112	A
CD-A	0	0	0.00			0				

09:15 - 09:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	13	3	0.00	688	0.018	13	0.0	0.0	5.328	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	13	3	0.00	626	0.020	13	0.0	0.0	5.867	A
AB-C	0	0	0.00			0				
D-ABC	98	24	0.00	688	0.142	98	0.2	0.2	6.102	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	98	25	0.00	626	0.157	98	0.2	0.2	6.823	A
CD-A	0	0	0.00			0				

09:30 - 09:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	11	3	0.00	688	0.015	11	0.0	0.0	5.313	A
A-B	0	0	0.00			0				
A-C	0	0	0.00			0				
A-D	0	0	0.00			0				
AB-CD	11	3	0.00	626	0.017	11	0.0	0.0	5.850	A
AB-C	0	0	0.00			0				
D-ABC	82	21	0.00	688	0.119	82	0.2	0.1	5.940	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	82	21	0.00	626	0.131	82	0.2	0.2	6.621	A
CD-A	0	0	0.00			0				

Queue Variation Results for each time segment

08:15 - 08:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.02	0.00	0.00	0.02	0.02			N/A	N/A
AB-CD	0.02	~1	~1	~1	~1			N/A	N/A
D-ABC	0.13	0.00	0.00	0.13	0.13			N/A	N/A
CD-AB	0.15	~1	~1	~1	~1			N/A	N/A

08:30 - 08:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.02	0.02	0.25	0.45	0.48			N/A	N/A
AB-CD	0.02	~1	~1	~1	~1			N/A	N/A
D-ABC	0.16	0.00	0.00	0.16	0.16			N/A	N/A
CD-AB	0.18	~1	~1	~1	~1			N/A	N/A

08:45 - 09:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.02	0.00	0.00	0.02	0.02			N/A	N/A
AB-CD	0.03	~1	~1	~1	~1			N/A	N/A
D-ABC	0.21	0.03	0.26	0.46	0.48			N/A	N/A
CD-AB	0.23	~1	~1	~1	~1			N/A	N/A

09:00 - 09:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.02	0.00	0.00	0.02	0.02			N/A	N/A
AB-CD	0.03	~1	~1	~1	~1			N/A	N/A
D-ABC	0.21	0.03	0.27	0.48	0.67			N/A	N/A
CD-AB	0.24	~1	~1	~1	~1			N/A	N/A

09:15 - 09:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.02	0.00	0.00	0.02	0.02			N/A	N/A
AB-CD	0.02	~1	~1	~1	~1			N/A	N/A
D-ABC	0.17	0.00	0.00	0.17	0.17			N/A	N/A
CD-AB	0.19	~1	~1	~1	~1			N/A	N/A

09:30 - 09:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.02	0.00	0.00	0.02	0.02			N/A	N/A
AB-CD	0.02	~1	~1	~1	~1			N/A	N/A
D-ABC	0.14	0.00	0.00	0.14	0.14			N/A	N/A
CD-AB	0.15	~1	~1	~1	~1			N/A	N/A

D5 - 2027 | Generator Construction | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Major arm width	Arm A - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Major arm width	Arm C - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Arm D Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
2	Junction 2	Left-Right Stagger	Two-way	Two-way	Two-way	Two-way		5.27	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	810	Stream AB-CD	5.27	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D5	2027	Generator Construction	PM	ONE HOUR	17:00	18:30	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	8	100.000
B		ONE HOUR	✓	54	100.000
C		ONE HOUR	✓	3	100.000
D		ONE HOUR	✓	4	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	0	8	0
	B	0	0	0	54
	C	3	0	0	0
	D	0	4	0	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To			
		A	B	C	D
From	A	10	15	10	0
	B	15	10	15	0
	C	10	15	10	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-ACD	0.09	5.75	0.1	0.5	A	50	74
A-B						0	0
A-C						7	11
A-D						0	0
AB-CD	0.09	6.34	0.1	~1	A	50	74
AB-C						7	11
D-ABC	0.00	0.00	0.0	~1	A	0	0
C-D						0	0
C-A						0	0
C-B						0	0
CD-AB	0.00	0.00	0.0	~1	A	0	0
CD-A						0	0

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	41	10	0.00	687	0.059	40	0.0	0.1	5.571	A
A-B	0	0	0.00			0				
A-C	6	2	0.00			6				
A-D	0	0	0.00			0				
AB-CD	40	10	0.00	626	0.065	40	0.0	0.1	6.137	A
AB-C	6	1	0.00			6				
D-ABC	0	0	0.00	598	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1213	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	49	12	0.00	686	0.071	48	0.1	0.1	5.644	A
A-B	0	0	0.00			0				
A-C	7	2	0.00			7				
A-D	0	0	0.00			0				
AB-CD	49	12	0.00	627	0.077	48	0.1	0.1	6.227	A
AB-C	7	2	0.00			7				
D-ABC	0	0	0.00	596	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1212	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	59	15	0.00	686	0.087	59	0.1	0.1	5.746	A
A-B	0	0	0.00			0				
A-C	9	2	0.00			9				
A-D	0	0	0.00			0				
AB-CD	59	15	0.00	627	0.095	59	0.1	0.1	6.344	A
AB-C	9	2	0.00			9				
D-ABC	0	0	0.00	593	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1212	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	59	15	0.00	686	0.087	59	0.1	0.1	5.746	A
A-B	0	0	0.00			0				
A-C	9	2	0.00			9				
A-D	0	0	0.00			0				
AB-CD	60	15	0.00	627	0.095	60	0.1	0.1	6.344	A
AB-C	9	2	0.00			9				
D-ABC	0	0	0.00	593	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1212	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	49	12	0.00	686	0.071	49	0.1	0.1	5.645	A
A-B	0	0	0.00			0				
A-C	7	2	0.00			7				
A-D	0	0	0.00			0				
AB-CD	49	12	0.00	627	0.078	49	0.1	0.1	6.230	A
AB-C	7	2	0.00			7				
D-ABC	0	0	0.00	596	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1212	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	41	10	0.00	687	0.059	41	0.1	0.1	5.575	A
A-B	0	0	0.00			0				
A-C	6	2	0.00			6				
A-D	0	0	0.00			0				
AB-CD	41	10	0.00	626	0.065	41	0.1	0.1	6.149	A
AB-C	6	1	0.00			6				
D-ABC	0	0	0.00	598	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1213	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

Queue Variation Results for each time segment

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.06	0.00	0.00	0.06	0.06			N/A	N/A
AB-CD	0.07	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.08	0.03	0.25	0.45	0.48			N/A	N/A
AB-CD	0.08	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.09	0.03	0.26	0.47	0.49			N/A	N/A
AB-CD	0.10	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

17:45 - 18:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.09	0.00	0.00	0.09	0.09			N/A	N/A
AB-CD	0.10	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

18:00 - 18:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.08	0.00	0.00	0.08	0.08			N/A	N/A
AB-CD	0.08	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

18:15 - 18:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.06	0.00	0.00	0.06	0.06			N/A	N/A
AB-CD	0.07	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

D6 - 2027 | GIS Construction | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Major arm width	Arm A - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Major arm width	Arm C - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Arm D Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
2	Junction 2	Left-Right Stagger	Two-way	Two-way	Two-way	Two-way		4.49	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	900		4.49	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D6	2027	GIS Construction	PM	ONE HOUR	17:00	18:30	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	8	100.000
B		ONE HOUR	✓	28	100.000
C		ONE HOUR	✓	3	100.000
D		ONE HOUR	✓	3	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	0	8	0
	B	0	0	0	28
	C	3	0	0	0
	D	0	3	0	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To			
		A	B	C	D
From	A	10	15	10	0
	B	15	10	15	0
	C	10	15	10	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-ACD	0.04	5.50	0.0	0.5	A	26	39
A-B						0	0
A-C						7	11
A-D						0	0
AB-CD	0.05	6.04	0.1	~1	A	26	39
AB-C						7	11
D-ABC	0.00	0.00	0.0	~1	A	0	0
C-D						0	0
C-A						0	0
C-B						0	0
CD-AB	0.00	0.00	0.0	~1	A	0	0
CD-A						0	0

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	21	5	0.00	687	0.031	21	0.0	0.0	5.408	A
A-B	0	0	0.00			0				
A-C	6	2	0.00			6				
A-D	0	0	0.00			0				
AB-CD	21	5	0.00	626	0.033	21	0.0	0.0	5.944	A
AB-C	6	2	0.00			6				
D-ABC	0	0	0.00	603	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1213	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	25	6	0.00	686	0.037	25	0.0	0.0	5.444	A
A-B	0	0	0.00			0				
A-C	7	2	0.00			7				
A-D	0	0	0.00			0				
AB-CD	25	6	0.00	626	0.040	25	0.0	0.0	5.987	A
AB-C	7	2	0.00			7				
D-ABC	0	0	0.00	601	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1212	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	31	8	0.00	686	0.045	31	0.0	0.0	5.495	A
A-B	0	0	0.00			0				
A-C	9	2	0.00			9				
A-D	0	0	0.00			0				
AB-CD	31	8	0.00	627	0.049	31	0.0	0.1	6.042	A
AB-C	9	2	0.00			9				
D-ABC	0	0	0.00	600	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1212	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	31	8	0.00	686	0.045	31	0.0	0.0	5.495	A
A-B	0	0	0.00			0				
A-C	9	2	0.00			9				
A-D	0	0	0.00			0				
AB-CD	31	8	0.00	627	0.049	31	0.1	0.1	6.043	A
AB-C	9	2	0.00			9				
D-ABC	0	0	0.00	600	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1212	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	25	6	0.00	686	0.037	25	0.0	0.0	5.445	A
A-B	0	0	0.00			0				
A-C	7	2	0.00			7				
A-D	0	0	0.00			0				
AB-CD	25	6	0.00	626	0.040	25	0.1	0.0	5.991	A
AB-C	7	2	0.00			7				
D-ABC	0	0	0.00	601	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1212	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	21	5	0.00	687	0.031	21	0.0	0.0	5.411	A
A-B	0	0	0.00			0				
A-C	6	2	0.00			6				
A-D	0	0	0.00			0				
AB-CD	21	5	0.00	626	0.034	21	0.0	0.0	5.948	A
AB-C	6	2	0.00			6				
D-ABC	0	0	0.00	602	0.000	0	0.0	0.0	0.000	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	0	0	0.00	1213	0.000	0	0.0	0.0	0.000	A
CD-A	0	0	0.00			0				

Queue Variation Results for each time segment

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.03	0.00	0.00	0.03	0.03			N/A	N/A
AB-CD	0.03	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.04	0.03	0.25	0.45	0.48			N/A	N/A
AB-CD	0.04	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.05	0.03	0.26	0.46	0.48			N/A	N/A
AB-CD	0.05	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

17:45 - 18:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.05	0.00	0.00	0.05	0.05			N/A	N/A
AB-CD	0.05	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

18:00 - 18:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.04	0.00	0.00	0.04	0.04			N/A	N/A
AB-CD	0.04	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

18:15 - 18:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.03	0.00	0.00	0.03	0.03			N/A	N/A
AB-CD	0.04	~1	~1	~1	~1			N/A	N/A
D-ABC	0.00	0.00	0.00	0.00	0.00			N/A	N/A
CD-AB	0.00	~1	~1	~1	~1			N/A	N/A

D7 - 2028 | ESS Construction | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Major arm width	Arm A - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Major arm width	Arm C - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Arm D Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
2	Junction 2	Left-Right Stagger	Two-way	Two-way	Two-way	Two-way		4.84	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	900		4.84	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D7	2028	ESS Construction	PM	ONE HOUR	17:00	18:30	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	8	100.000
B		ONE HOUR	✓	35	100.000
C		ONE HOUR	✓	3	100.000
D		ONE HOUR	✓	5	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	0	8	0
	B	0	0	0	35
	C	3	0	0	0
	D	0	5	0	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To			
		A	B	C	D
From	A	10	15	10	0
	B	15	10	15	0
	C	10	15	10	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-ACD	0.06	5.56	0.1	0.5	A	32	48
A-B						0	0
A-C						7	11
A-D						0	0
AB-CD	0.06	6.12	0.1	~1	A	32	48
AB-C						7	11
D-ABC	0.01	5.27	0.0	0.5	A	5	7
C-D						0	0
C-A						0	0
C-B						0	0
CD-AB	0.01	5.82	0.0	~1	A	5	7
CD-A						0	0

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	26	7	0.00	687	0.038	26	0.0	0.0	5.449	A
A-B	0	0	0.00			0				
A-C	6	2	0.00			6				
A-D	0	0	0.00			0				
AB-CD	26	7	0.00	626	0.042	26	0.0	0.0	5.995	A
AB-C	6	2	0.00			6				
D-ABC	4	0.94	0.00	688	0.005	4	0.0	0.0	5.259	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	4	0.94	0.00	625	0.006	4	0.0	0.0	5.797	A
CD-A	0	0	0.00			0				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	31	8	0.00	686	0.046	31	0.0	0.0	5.497	A
A-B	0	0	0.00			0				
A-C	7	2	0.00			7				
A-D	0	0	0.00			0				
AB-CD	31	8	0.00	626	0.050	31	0.0	0.1	6.050	A
AB-C	7	2	0.00			7				
D-ABC	4	1	0.00	688	0.007	4	0.0	0.0	5.264	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	4	1	0.00	624	0.007	4	0.0	0.0	5.807	A
CD-A	0	0	0.00			0				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	39	10	0.00	686	0.056	38	0.0	0.1	5.561	A
A-B	0	0	0.00			0				
A-C	9	2	0.00			9				
A-D	0	0	0.00			0				
AB-CD	39	10	0.00	627	0.061	38	0.1	0.1	6.121	A
AB-C	9	2	0.00			9				
D-ABC	6	1	0.00	688	0.008	5	0.0	0.0	5.272	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	5	1	0.00	624	0.009	5	0.0	0.0	5.820	A
CD-A	0	0	0.00			0				

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	39	10	0.00	686	0.056	39	0.1	0.1	5.561	A
A-B	0	0	0.00			0				
A-C	9	2	0.00			9				
A-D	0	0	0.00			0				
AB-CD	39	10	0.00	627	0.062	39	0.1	0.1	6.121	A
AB-C	9	2	0.00			9				
D-ABC	6	1	0.00	688	0.008	6	0.0	0.0	5.272	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	6	1	0.00	624	0.009	6	0.0	0.0	5.820	A
CD-A	0	0	0.00			0				

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	31	8	0.00	686	0.046	32	0.1	0.0	5.498	A
A-B	0	0	0.00			0				
A-C	7	2	0.00			7				
A-D	0	0	0.00			0				
AB-CD	32	8	0.00	626	0.050	32	0.1	0.1	6.051	A
AB-C	7	2	0.00			7				
D-ABC	4	1	0.00	688	0.007	5	0.0	0.0	5.266	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	5	1	0.00	624	0.007	5	0.0	0.0	5.810	A
CD-A	0	0	0.00			0				

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	26	7	0.00	687	0.038	26	0.0	0.0	5.454	A
A-B	0	0	0.00			0				
A-C	6	2	0.00			6				
A-D	0	0	0.00			0				
AB-CD	26	7	0.00	626	0.042	26	0.1	0.0	6.003	A
AB-C	6	2	0.00			6				
D-ABC	4	0.94	0.00	688	0.005	4	0.0	0.0	5.259	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	4	0.94	0.00	625	0.006	4	0.0	0.0	5.798	A
CD-A	0	0	0.00			0				

Queue Variation Results for each time segment

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.04	0.00	0.00	0.04	0.04			N/A	N/A
AB-CD	0.04	~1	~1	~1	~1			N/A	N/A
D-ABC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
CD-AB	0.01	~1	~1	~1	~1			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.05	0.03	0.25	0.45	0.48			N/A	N/A
AB-CD	0.05	~1	~1	~1	~1			N/A	N/A
D-ABC	0.01	0.01	0.25	0.45	0.48			N/A	N/A
CD-AB	0.01	~1	~1	~1	~1			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.06	0.03	0.26	0.46	0.49			N/A	N/A
AB-CD	0.07	~1	~1	~1	~1			N/A	N/A
D-ABC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
CD-AB	0.01	~1	~1	~1	~1			N/A	N/A

17:45 - 18:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.06	0.00	0.00	0.06	0.06			N/A	N/A
AB-CD	0.07	~1	~1	~1	~1			N/A	N/A
D-ABC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
CD-AB	0.01	~1	~1	~1	~1			N/A	N/A

18:00 - 18:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.05	0.00	0.00	0.05	0.05			N/A	N/A
AB-CD	0.05	~1	~1	~1	~1			N/A	N/A
D-ABC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
CD-AB	0.01	~1	~1	~1	~1			N/A	N/A

18:15 - 18:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.04	0.00	0.00	0.04	0.04			N/A	N/A
AB-CD	0.04	~1	~1	~1	~1			N/A	N/A
D-ABC	0.01	0.00	0.00	0.01	0.01			N/A	N/A
CD-AB	0.01	~1	~1	~1	~1			N/A	N/A

D8 - 2027 | Cumulative Construction | PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Major arm width	Arm A - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Major arm width	Arm C - Major arm geometry	For two-way major roads, please interpret results with caution if the total major carriageway width is less than 6m.
Warning	Queue variations	Analysis Options	Queue percentiles may be unreliable if the mean queue in any time segment is very low or very high.

Junction Network

Junctions

Junction	Name	Junction type	Arm A Direction	Arm B Direction	Arm C Direction	Arm D Direction	Use circulating lanes	Junction Delay (s)	Junction LOS
2	Junction 2	Left-Right Stagger	Two-way	Two-way	Two-way	Two-way		6.21	A

Junction Network

Driving side	Lighting	Network residual capacity (%)	First arm reaching threshold	Network delay (s)	Network LOS
Left	Normal/unknown	347	Stream AB-CD	6.21	A

Traffic Demand

Demand Set Details

ID	Year	Scenario	Time period	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time segment length (min)	Run automatically
D8	2027	Cumulative Construction	PM	ONE HOUR	17:00	18:30	15	✓

Demand overview (Traffic)

Arm	Linked arm	Profile type	Use O-D data	Average Demand (PCU/hr)	Scaling Factor (%)
A		ONE HOUR	✓	8	100.000
B		ONE HOUR	✓	109	100.000
C		ONE HOUR	✓	3	100.000
D		ONE HOUR	✓	14	100.000

Origin-Destination Data

Demand (PCU/hr)

		To			
		A	B	C	D
From	A	0	0	8	0
	B	0	0	0	109
	C	3	0	0	0
	D	0	14	0	0

Vehicle Mix

HV data entry mode	PCU Factor for a HV (PCU)
HV Percentages	2.00

Heavy Vehicle %

		To			
		A	B	C	D
From	A	10	15	10	0
	B	15	10	15	0
	C	10	15	10	0
	D	0	0	0	0

Results

Results Summary for whole modelled period

Stream	Max RFC	Max Delay (s)	Max Queue (PCU)	Max 95th percentile Queue (PCU)	Max LOS	Average Demand (PCU/hr)	Total Junction Arrivals (PCU)
B-ACD	0.17	6.36	0.2	0.7	A	100	150
A-B						0	0
A-C						7	11
A-D						0	0
AB-CD	0.19	7.09	0.2	~1	A	100	150
AB-C						7	11
D-ABC	0.02	5.35	0.0	0.5	A	13	19
C-D						0	0
C-A						0	0
C-B						0	0
CD-AB	0.02	5.92	0.0	~1	A	13	19
CD-A						0	0

Main Results for each time segment

17:00 - 17:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	82	21	0.00	687	0.120	82	0.0	0.1	5.945	A
A-B	0	0	0.00			0				
A-C	6	2	0.00			6				
A-D	0	0	0.00			0				
AB-CD	82	20	0.00	627	0.130	81	0.0	0.1	6.589	A
AB-C	6	1	0.00			6				
D-ABC	11	3	0.00	688	0.015	10	0.0	0.0	5.311	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	10	3	0.00	625	0.017	10	0.0	0.0	5.861	A
CD-A	0	0	0.00			0				

17:15 - 17:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	98	24	0.00	686	0.143	98	0.1	0.2	6.116	A
A-B	0	0	0.00			0				
A-C	7	2	0.00			7				
A-D	0	0	0.00			0				
AB-CD	98	25	0.00	627	0.156	98	0.1	0.2	6.800	A
AB-C	7	2	0.00			7				
D-ABC	13	3	0.00	688	0.018	13	0.0	0.0	5.327	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	13	3	0.00	624	0.020	13	0.0	0.0	5.884	A
CD-A	0	0	0.00			0				

17:30 - 17:45

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	120	30	0.00	686	0.175	120	0.2	0.2	6.359	A
A-B	0	0	0.00			0				
A-C	9	2	0.00			9				
A-D	0	0	0.00			0				
AB-CD	120	30	0.00	628	0.191	120	0.2	0.2	7.087	A
AB-C	8	2	0.00			8				
D-ABC	15	4	0.00	688	0.022	15	0.0	0.0	5.350	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	15	4	0.00	624	0.025	15	0.0	0.0	5.915	A
CD-A	0	0	0.00			0				

17:45 - 18:00

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	120	30	0.00	686	0.175	120	0.2	0.2	6.361	A
A-B	0	0	0.00			0				
A-C	9	2	0.00			9				
A-D	0	0	0.00			0				
AB-CD	120	30	0.00	628	0.192	120	0.2	0.2	7.095	A
AB-C	8	2	0.00			8				
D-ABC	15	4	0.00	688	0.022	15	0.0	0.0	5.350	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	15	4	0.00	624	0.025	15	0.0	0.0	5.915	A
CD-A	0	0	0.00			0				

18:00 - 18:15

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	98	24	0.00	686	0.143	98	0.2	0.2	6.124	A
A-B	0	0	0.00			0				
A-C	7	2	0.00			7				
A-D	0	0	0.00			0				
AB-CD	98	25	0.00	627	0.157	99	0.2	0.2	6.812	A
AB-C	7	2	0.00			7				
D-ABC	13	3	0.00	688	0.018	13	0.0	0.0	5.328	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	13	3	0.00	624	0.020	13	0.0	0.0	5.887	A
CD-A	0	0	0.00			0				

18:15 - 18:30

Stream	Total Demand (PCU/hr)	Junction Arrivals (PCU)	Pedestrian demand (Ped/hr)	Capacity (PCU/hr)	RFC	Throughput (PCU/hr)	Start queue (PCU)	End queue (PCU)	Delay (s)	Unsignalised level of service
B-ACD	82	21	0.00	687	0.120	82	0.2	0.1	5.959	A
A-B	0	0	0.00			0				
A-C	6	2	0.00			6				
A-D	0	0	0.00			0				
AB-CD	82	21	0.00	627	0.131	82	0.2	0.2	6.614	A
AB-C	6	1	0.00			6				
D-ABC	11	3	0.00	688	0.015	11	0.0	0.0	5.313	A
C-D	0	0	0.00			0				
C-A	0	0	0.00			0				
C-B	0	0	0.00			0				
CD-AB	11	3	0.00	625	0.017	11	0.0	0.0	5.864	A
CD-A	0	0	0.00			0				

Queue Variation Results for each time segment

17:00 - 17:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.13	0.00	0.00	0.13	0.13			N/A	N/A
AB-CD	0.15	~1	~1	~1	~1			N/A	N/A
D-ABC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
CD-AB	0.02	~1	~1	~1	~1			N/A	N/A

17:15 - 17:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.17	0.00	0.00	0.17	0.17			N/A	N/A
AB-CD	0.18	~1	~1	~1	~1			N/A	N/A
D-ABC	0.02	0.02	0.25	0.45	0.48			N/A	N/A
CD-AB	0.02	~1	~1	~1	~1			N/A	N/A

17:30 - 17:45

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.21	0.03	0.26	0.46	0.48			N/A	N/A
AB-CD	0.24	~1	~1	~1	~1			N/A	N/A
D-ABC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
CD-AB	0.03	~1	~1	~1	~1			N/A	N/A

17:45 - 18:00

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.21	0.03	0.27	0.48	0.70			N/A	N/A
AB-CD	0.24	~1	~1	~1	~1			N/A	N/A
D-ABC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
CD-AB	0.03	~1	~1	~1	~1			N/A	N/A

18:00 - 18:15

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.17	0.00	0.00	0.17	0.17			N/A	N/A
AB-CD	0.19	~1	~1	~1	~1			N/A	N/A
D-ABC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
CD-AB	0.02	~1	~1	~1	~1			N/A	N/A

18:15 - 18:30

Stream	Mean (PCU)	Q05 (PCU)	Q50 (PCU)	Q90 (PCU)	Q95 (PCU)	Percentile message	Marker message	Probability of reaching or exceeding marker	Probability of exactly reaching marker
B-ACD	0.14	0.00	0.00	0.14	0.14			N/A	N/A
AB-CD	0.15	~1	~1	~1	~1			N/A	N/A
D-ABC	0.02	0.00	0.00	0.02	0.02			N/A	N/A
CD-AB	0.02	~1	~1	~1	~1			N/A	N/A

APPENDIX 13.8

ROAD SAFETY AUDIT REPORT

– ALTERNATIVE CONSTRUCTION ACCESS ROAD

Halston Environmental & Planning Ltd

New Access Road, N65, Co. Galway

Stage 1 Road Safety Audit

January 2026

Halston Environmental & Planning Ltd

New Access Road, N65, Co. Galway

Stage 1 Road Safety Audit

Document Ref:	P25266-PMCE-XX-XX-RP-SA-3_0001

Rev	Prepared By	Reviewed By	Approved By	Issue Date	Reason for Revision
2.0	AOR	XY	AOR	26th Jan. 2026	Final
1.0	XY	AOR	AOR	5th Dec. 2025	Draft Report

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1 Introduction

1.1 General

This report results from a Stage 1 Road Safety Audit on the proposed New Access Road, on the N65, in Co. Galway carried out at the request of Colm Staunton of Halston Environmental & Planning Ltd.

The members of the Road Safety Audit Team are independent of the design team, and include:

Mr. Alan O'Reilly
(BA, BAI, MSc, PGDip(PM), RSACert, CEng, MIEI)
Road Safety Audit Team Leader

Ms. Xue Yan
(BEng, MSc, MIEI)
Road Safety Audit Team Member

The Road Safety Audit took place during November and December 2025 and comprised an examination of the documents provided by the designers (see Appendix A). In addition to examining the documents supplied the Road Safety Audit Team visited the site of the proposed measures on the 12th November 2025. Weather conditions during the site visit were wet and the road surface was wet. Traffic volumes during the site visit were low, pedestrian and cyclist volumes were low and traffic speeds were considered to be generally within the posted speed limit.

Where problems are relevant to specific locations these are shown on drawing extracts within the main body of the report and their locations are shown in Appendix B. Where problems are general to the proposals sample drawing extracts are included within the main body of the report, where considered necessary.

This Stage 1 Road Safety Audit has been carried out in accordance with the requirements of GE-STY-01024 - Road Safety Audit (May 2025), contained on the Transport Infrastructure Ireland (TII) Publications website.

The scheme has been examined and this report compiled in respect of the consideration of those matters that have an adverse effect on road safety and considers the perspective of all road users. It has not been examined or verified for compliance with any other standards or criteria. The problems identified in this report are considered to require action in order to improve the safety of the scheme and minimise collision occurrence.

If any of the recommendations within this road safety audit report are not accepted, a written response is required, stating reasons for non-acceptance. Comments made within the report under the heading of Observations are intended to be for information only. Written responses to Observations are not required.

2 Project Description

The project involves the construction of a new alternative temporary access road to allow for construction of the three Coolpowra Energy Projects – Reserve Gas Fired Generator, GIS and ESS. The proposed access road will extend for approximately 1.1km between the N65 and L87632, in a northeast-southwest direction, and cross the L8763 at a new staggered junction. It is proposed to include one 3.5m wide traffic lane and 2m wide verge (which would include a filter drain) in each direction on the access road. The access road would intersect the N65 at a priority controlled T-junction, the L8763 at a new staggered junction and the L87632 at a T-junction.

FIGURE 2.1: LOCATION PLAN (SOURCE: WWW.OPENSTREETMAP.ORG)

The N65 National Road is a single carriageway road with a width of between 5.8m and 6m, and no hard shoulders, in the vicinity of the proposed new access junction. There is a maintained verge bounding the road to the east and a verge with a mix of bushes and trees bounding the road to the west. There is a posted speed limit of 100kph on the N65, and no public lighting is provided on the N65 at this location.

The L8763 is a two-way single carriageway road with a width of approx.. 4.5m. There are no road markings and no hard shoulders on the L8763. It includes high-side vegetation and trees on both sides of the road, and has a posted speed limit of 60kph.

The proposed works would include:

- Provision of a new priority controlled T-junction on the N65 National Road for a new 7m wide access road serving the development.
- Provision of junction radii appropriate for the vehicle types utilising the access junction.
- Minor widening (300 – 350mm) of the N65 to the immediate north of the access to provide a 6m carriageway in the vicinity of the proposed access junction.
- Partial removal of existing boundary bushes and trees to provide junction visibility.
- Provision of traffic signs and road markings for the new N65 junction.

- Staggered junction design where the new access roads intersect, and cross, the L8763.

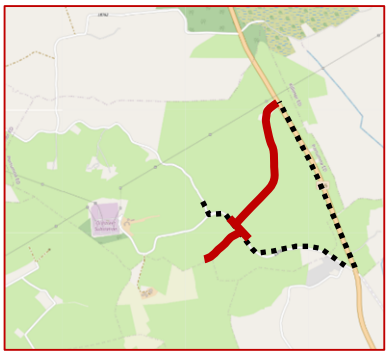
No amendments are proposed to be carried out to the vertical alignment, gradient, or crossfall of the N65 to accommodate the proposed access junction.

3 Items Arising from the Audit

3.1 Unauthorised Access to New Access Road

Location: *General Problem*

Summary: *The proposed access road may attract public traffic as it may be perceived as a short cut, and better quality road, between the L8763 and the N65, rather than using the existing route between these two roads.*



It is unclear what measures, if any, would be provided at each end of the proposed access road to prevent unauthorised access. The Audit Team are concerned that drivers may perceive the proposed new access road as a short cut between the L8763 and the N65, and a wider and better quality carriageway, resulting in unauthorised traffic using the road.

If measures are not provided to prevent public traffic from using the proposed access road it may lead to additional traffic using the road and travelling through the new junctions, which may lead to an increased risk of collisions with construction/site machinery, or junction capacity issues at the new junctions if not designed for use by public traffic also.

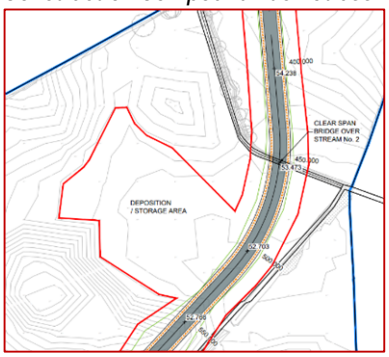
Recommendation

Measures should be provided to prevent unauthorised access onto the proposed access road.

3.2 Access/Egress To/From Storage Area/Construction Compound

Location: *Drawing no. CPA-HAL-NR-XX-DR-PL-2000 (Rev.P03) – General Problem*

Summary: *Information regarding the layout of the Deposition/Storage Areas, and the Construction Compound has not been provided to the Audit Team.*



Information regarding the layout of the Deposition/Storage Areas, and the Construction Compound, particularly their access/junction layout, has not been provided to the Audit Team. It is, therefore, unclear if the proposed layout would support HGVs safely entering, turning around within, and exiting these areas. If the junction layout, and internal road space, provided at these locations is not sufficient to support the movement of HGVs it may lead to collisions with roadside boundaries, or plant and machinery, resulting in material damage.

As the Deposition/Storage Areas, and the Construction Compound, would be located on the inside of a horizontal curve on the proposed access road, drivers leaving these areas may have restricted visibility towards approaching vehicles. This may lead to drivers exiting these areas when it is unsafe to do so resulting in a risk of side-on collisions.

Recommendation

The layout of the access junctions at, and internal space within, the proposed Deposition/Storage Areas, and the Construction Compound, should be sufficient to safely accommodate the swept path of HGVs entering, traversing within, and exiting, these areas.

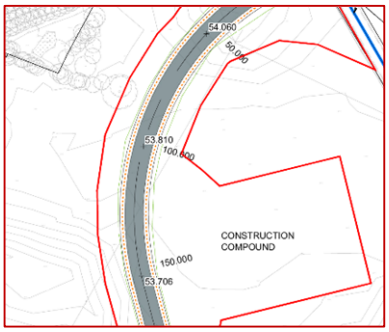
Clear, unobstructed visibility should also be provided for drivers exiting these areas.

3.3 Two HGVs Passing Each Other on Access Road

Location: *Drawing no. CPA-HAL-NR-XX-DR-PL-2000 (Rev. P03) – General Problem*

Summary: *It is unclear if the horizontal curves on the proposed access road would safely accommodate two HGVs passing each other.*

The width of the proposed access road is indicated as 7m wide. While this would likely be sufficient to accommodate two opposing HGVs passing each other on straight sections of the access road, it is unclear if two opposing HGVs can pass each other at horizontal curves on the access road. A failure to provide sufficient widening at horizontal curves may lead to HGVs encroaching into the opposing traffic lane as they traverse the curve resulting in an increased risk of side swipe collisions should an opposing vehicle be travelling through the curve simultaneously.



Recommendation

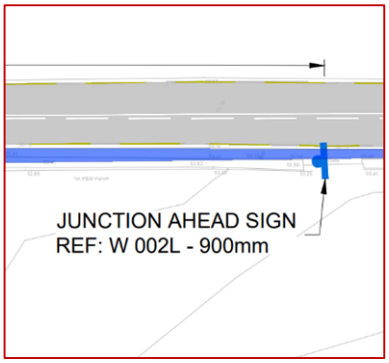
Undertake a swept path analysis at the horizontal curves on the proposed access road to determine if additional carriageway widening is necessary at these locations.

3.4 Location of Warning Sign

Location: *Drawing no. CPA-HAL-NR-XX-DR-PL-5001 (Rev. P01)*

Summary: *The proposed warning signs on the N65 and L6873 are located such that they appear to encroach into the carriageway, which may increase the risk of the sign being struck, or to the sign being within the visibility splay of a driver exiting the access road, restricting their visibility to oncoming vehicles.*

The proposed warning signs indicated on the N65 and L6873 are located such that they appear to encroach into the adjacent carriageway. A failure to sufficiently set back traffic signs from the edge of the carriageway may lead to an increased risk of the sign being struck, particularly by high-sided vehicles, resulting in material damage, or to the sign no longer being visible to approaching drivers.



In addition, the proposed 'Junction Ahead' warning sign, facing northbound drivers, is indicated within the visibility splay for exiting drivers at the new access road junction. The sign may, therefore, restrict visibility for a driver exiting the access road resulting in them turning onto the N65 when it is unafe to do so, and side-on collisions.

Recommendation

The proposed warning signs, including both the signpost and sign face, should be set back a minimum of 450mm from the edge of the carriageway.

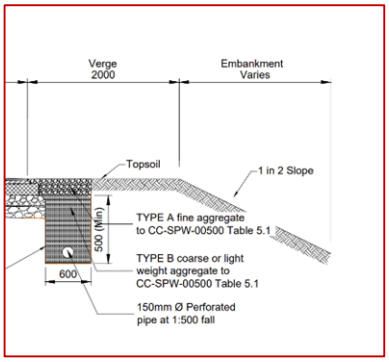
In addition, relocate the 'Junction Ahead' warnng sign on the N65 outside the visibility splay.

3.5 Unprotected Embankment Slope

Location: *Drawing no. CPA-HAL-NR-XX-PL-4000 (Rev. P01)*

Summary: *An unprotected embankment with a gradient of 1V:2H is indicated on one side of the access road and, should an errant driver descend this embankment, it may lead to them being unable to recover their vehicle, or to their vehicle overturning.*

An unprotected embankment with a gradient of 1V:2H is indicated on one side of the proposed access road. Should a drivers lose control of their vehicle and descend the embankment, they may be unable to recover their vehicle, or be at risk of a high-sided vehicle overturning, resulting in increased injury severity for vehicle occupants.



Recommendation

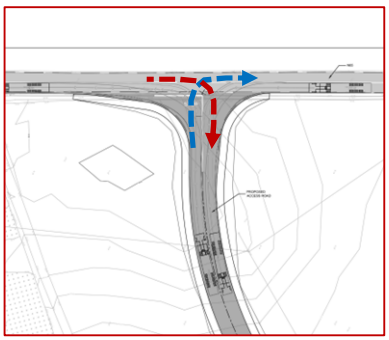
The slope of the embankment should be regraded to a minimum of 1V:3H, or a sufficient vehicle restraint system provided at the top of the embankment.

3.6 Right Turns from the N65 onto the New Access Road

Location: *Drawing no. CPA-HAL-NR-XX-DR-PL-5002 (Rev. P01)*

Summary: *It is unclear if the proposed access road/N65 junction can accommodate the swept path of a right-turning vehicle when entering or exiting the access road.*

Information regarding the swept path of right-turning vehicles entering/exiting the new access road at its junction with the N65 has not been provided to the Audit Team. It is, therefore, unclear if the proposed junction layout would accommodate the swept path of right-turning HGVs when entering/exiting the access road.



If sufficient space is not provided within the junction to accommodate these turning movements it may lead a risk of collisions with roadside boundaries, and material damage, or to HGVs having to undertake multiple point turns to complete these movements resulting in an increased risk of collisions with other road users.

Recommendation

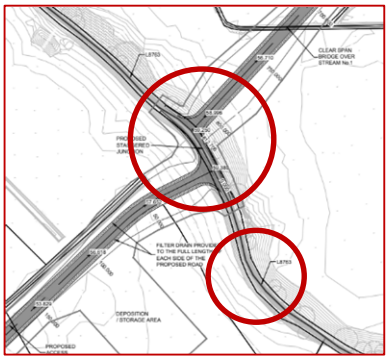
Undertake a swept path analysis to confirm that the proposed access road/N65 junction can safely accommodate right-turning vehicles entering/exiting the access road.

3.7 Restricted Visibility at Staggered Junction

Location: *Drawing no. CPA-HAL-NR-XX-PL-3000 (Rev. P01) & CPA-HAL-NR-XX-DR-PL-2000 (Rev. P03)*

Summary: *Inter-visibility between drivers exiting the proposed access road onto the L8673, and drivers approaching the new staggered junction on the L8763, may be restricted by the horizontal curves on both sides of the junction.*

According to the swept path analysis provided, it appears likely that a HGV will travel through the staggered junction on the L6763, between the two sections of the proposed access road, in a single movement, without stopping on the L8763 before undertaking the subsequent right turn manoeuvre. The swept path also indicates a HGV requiring the full width of the L8763 carriageway when travelling from one section of the access road to the other.



Inter-visibility between drivers exiting the proposed access road onto the L8673, and drivers approaching the new staggered junction on the L8763, however, may be restricted by the horizontal curves on the L8673, particularly to the south, leading to drivers entering the local road when it is unsafe to do so, resulting in side-on collisions with other road users on the L8763.

This problem may be exacerbated should a driver approach the staggered junction on the L8763 particularly while a HGV is completing their turn from one section of the access road to the other, but after they have left the access road junction.

Recommendation

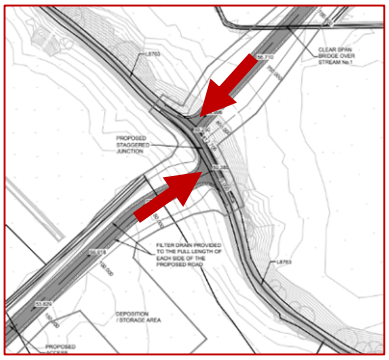
Provide sufficient inter-visibility between HGV drivers travelling between the two sections of access road and oncoming drivers on the L8763, or consider controlling this manoeuvre via a flagman.

3.8 Restricted Forward Visibility on L8763

Location: *Drawing no. CPA-HAL-NR-XX-PL-3000 (Rev. P01) & CPA-HAL-NR-XX-DR-PL-2000 (Rev. P03)*

Summary: *The crest in the vertical align of the proposed access road on both approaches to the junctions with the L8763 may restrict a driver's forward visibility to a vehicle stopped at the junction, or towards a vehicle turning into the access road.*

A vertical crest, and steep uphill gradient (7%), is indicated on the new access road on both approaches to the junctions with the L8763. This may lead to a driver's forward visibility towards a vehicle stopped at the junction, or a vehicle turning into the new access road, being restricted, resulting in them failing to moderate their speed on approach and rear end shunts with vehicles stopped at the junction, or head-on/side swipe collisions with vehicles entering the access road.



This problem would be exacerbated should a HGV be turning into the access road at the same time as an opposing vehicle approaches the junction as the swept path for this movement indicates these vehicles encroaching into the opposing traffic lane when turning from the L8763

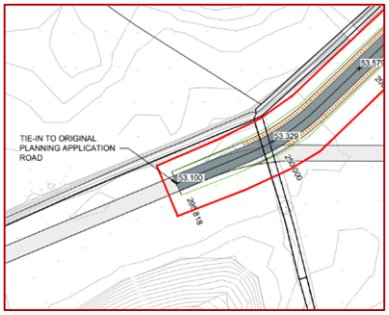
Recommendation

Sufficient forward visibility should be provided on the new access road on the approaches to its junctions with the L8763.

3.9 Construction Plan

Location: *Drawing no.CPA-HAL-NR-XX-DR-PL-2000 (Rev.P03)*

Summary: *It is unclear if the Original Planning Application Road will still be constructed, and operate, at the same time as the proposed new access road, as no junction control has been indicated at their intersection.*



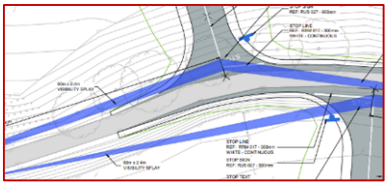
Information regarding the Original Planning Application Road has not been provided to the Audit Team, and this is indicated as intersecting/tying-into the proposed new access road at its south-western extents. It is, therefore, unclear if the Original Planning Application Road will be constructed, or operate, at the same time as the proposed new access road. If both roads are to be used simultaneously, no junction control, and thus priority, is indicated at their intersection. Should both roads operate at the same time, the absence of junction control may lead to drivers misunderstanding the priority at this location resulting in the risk of opposing drivers entering the junction simultaneously and an increased risk of side-on collisions.

In addition, there is a potential risk of sight through for outbound drivers on the proposed access road onto the Original Planning Application Road due to the road layout at this location. If both roads are in operation simultaneously this may lead to outbound drivers inadvertently entering the Original Planning Application Road where there is a risk of head-on collisions with opposing vehicles

Recommendation

If both roads are to operate simultaneously, modify the junction layout and provide appropriate junction control measures, such that priority is clear to drivers at this location.

4 Observations



4.1 Trees have been indicated within the visibility splays on the N65 and the L8673, on both sides of the new junctions, as per drawing no. CPA-HAL-NR-XX-DR-PL-5002 (Rev. P01). However, no existing vegetation, or hedgerow, is indicated as being removed on the drawing.

To avoid confusion during construction. the drawing should be annotated to advise that existing vegetation within the visibility splay will be removed and maintained regularly.

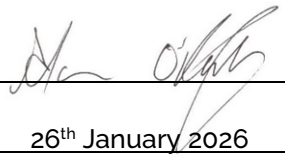
5 Audit Team Statement

We certify that we have examined the drawings referred to in this report. The examination has been carried out with the sole purpose of identifying any features of the design that could be removed or modified in order to improve the safety of the scheme.

The problems identified have been noted in this report together with associated safety improvement suggestions, which we would recommend should be studied for implementation.

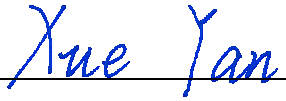
No one on the Road Safety Audit Team has been involved with the design of the scheme.

ROAD SAFETY AUDIT TEAM LEADER

Alan O'Reilly Signed: 

Dated: 26th January 2026

ROAD SAFETY AUDIT TEAM MEMBER

Xue Yan Signed: 

Dated: 26th January 2026

6 Road Safety Audit Feedback Form

Road Safety Audit Feedback Form

Scheme: New Access Road, N65, Co. Galway

Route No.: N65, L8763

Audit Stage: 1 **Date Audit Completed:** 04/12/2025

	To be Completed by Designer			To be Completed by Audit Team Leader
Paragraph No. in Safety Audit Report	**Problem Accepted (Yes/No)**	**Recommended Measure(s) Accepted (Yes/No)**	**Describe Alternative Measure(s). Give reasons for not accepting recommended measure. Only complete if recommended measure is not accepted**	**Alternative Measures or Reasons Accepted by Auditors (Yes/No)**
3.1	Y	Y		
3.2	Y	Y		
3.3	Y	Y		
3.4	Y	Y		
3.5	Y	N	As part of detailed design, a Safety Barrier Risk Assessment will be undertaken to determine the need for the provision of safety barrier or mitigation measures to eliminate the need for safety barrier.	Yes
3.6	Y	Y		
3.7	Y	N	Traffic management control will be provided at the stagger junction to mitigate impacts between construction traffic and traffic on the public road.	Yes
3.8	Y	N	Traffic management control will be provided at the stagger junction to mitigate impacts between construction traffic and traffic on the public road.	Yes

Road Safety Audit Feedback Form

Scheme: New Access Road, N65, Co. Galway

Route No.: N65, L8763

Audit Stage: 1 **Date Audit Completed:** 04/12/2025

	To be Completed by Designer			To be Completed by Audit Team Leader
Paragraph No. in Safety Audit Report	Problem Accepted (Yes/No)	Recommended Measure(s) Accepted (Yes/No)	Describe Alternative Measure(s). Give reasons for not accepting recommended measure. Only complete if recommended measure is not accepted	Alternative Measures or Reasons Accepted by Auditors (Yes/No)
3.9	Y	N	The original planning application road will be utilised for operation purposes only.	Yes

Jason Walsh (Trasky Ltd.)

Signed: _____ Designer **Date** 09/01/2026

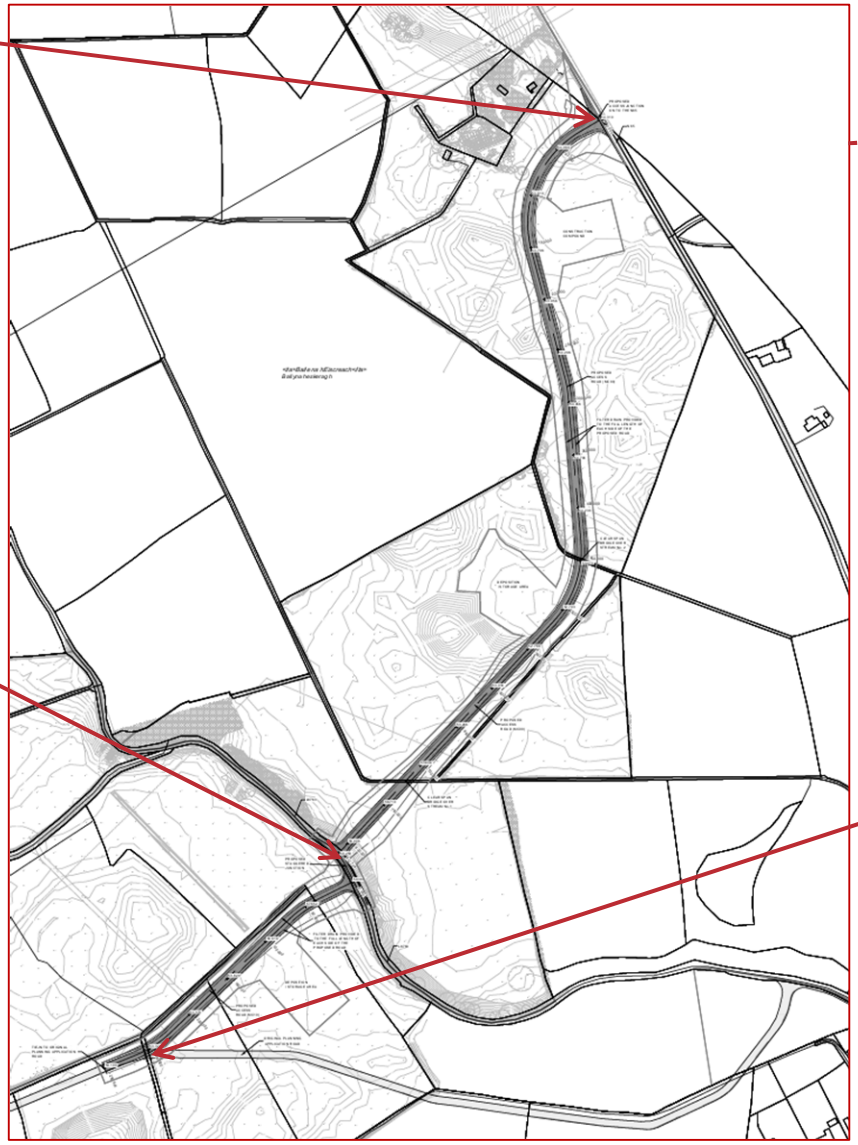
Signed: _____ Audit Team Leader **Date** 26th January 2026

Signed: _____ Employer **Date** _____

Appendix A - Documents Submitted to the Road Safety Audit Team

DOCUMENT/DRAWING TITLE	DOCUMENT/DRAWING NO.	REV.
Proposed Site Location	CPA-HAL-NR-XX-DR-PL-1000	P03
New Access Road Layout	CPA-HAL-NR-XX-DR-PL-2000	P03
Longitudinal Sections Roads	CPA-HAL-NR-XX-PL-3000	P01
Access Road Typical Details	CPA-HAL-NR-XX-PL-4000	P01
N65 Junction & Staggered Junction Layout	CPA-HAL-NR-XX-DR-PL-5000	P01
Proposed Junction Road Markings and Visibility Splays	CPA-HAL-NR-XX-DR-PL-5001	P01
Swept Path Analysis	CPA-HAL-NR-XX-DR-PL-5002	P01
Stream Crossing Details	CPA-HAL-NR-XX-PL-6000	P01
Appendix 13.6 – Construction Access Option 2 – Traffic Calculations		
Appendix 13.7 – Construction Access Option 2 – Modelling Results		

Appendix B – Problem Locations


Problem 3.6
General Problem 3.1
General Problem 3.2
General Problem 3.3
General Problem 3.4
General Problem 3.5
Problem 3.8
Problem 3.7
Problem 3.9

APPENDIX 17.1

ENVIRONMENTAL RISK ASSESSMENT

COMAH SUPPORT FOR PROJECT COOLPOWRA

Project Coolpowra Environmental Risk Assessment

Halston Environmental and Planning Limited

Report No.: 2, Rev. 2
Document No.: 2246099
Date: 2026-02-02

Project name:	COMAH SUPPORT FOR PROJECT COOLPOWRA	DNV Services UK Limited
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Project No.:	10510406	
Organisation unit:	Manchester Risk Advisory	
Report No.:	2, Rev. 2	
Document No.:	2246099	

Applicable contract(s) governing the provision of this Report: 1236811

Objective:

To carry out an environmental risk assessment of the Project Coolpowra planning application stage

Prepared by:	Verified by:	Approved by:
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Keywords:

ERA, CDOIF, Environmental, COMAH

Rev. No.	Date	Reason for Issue	Prepared by	Verified by	Approved by
0	2024-05-20	First issue	J Fraser	M Simms	M Simms
1	2024-05-24	Draft Second issue incorporating update to hydrology information	J Fraser		
2	2026-01-30	Incorporation of TLUP Guidance	J Fraser	T Owolabi	A Hynds

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1 EXECUTIVE SUMMARY

This report presents the Environmental Risk Assessment for the Project Coolpowra planning application stage.

The ERA methodology follows the Source-Pathway-Receptor model outlined in the Chemical and Downstream Oil Industries Forum (CDOIF) Guideline on Environmental Risk Tolerability for COMAH Establishments. The source of environmental risk identified was diesel from three liquid fuel tanks with a capacity of 7333m^3 each.

One Source-Pathway-Receptor trio with MATTE potential was identified as the release of approximately 6196 tonnes of diesel stored in 7333m^3 liquid fuel tank capacity impacting on the Kilcrow River

The overall unmitigated level of risk posed by the establishment from the release of diesel to the Kilcrow River was found to be in the tolerable if ALARP (TifALARP) on the CDOIF risk matrix. Following the identification of the control measures in place and their probability of failure on demand, it was found that the level of mitigated risk posed by the establishment to the Kilcrow River falls into the Broadly Acceptable region.

2 INTRODUCTION

Project Coolpowra is a proposed Reserve Gas-Fired Power Generator, GIS Electrical Substation and Energy Storage System.

Halston Environmental and Planning Limited (Halston) is to produce an environmental risk assessment (ERA) as part of its COMAH HSE submission on behalf of Coolpowra Flex Gen Limited (the Applicant). The Health and Safety Authority (HSA) can request it to see the ERA. DNV has been subcontracted by Halston Environmental and Planning Limited to carry out the ERA in support of the Environmental Impact Assessment Report (EIAR) and Land Use Planning application. The EIAR contains 3 planning applications as follows:

- Project 1: a Reserve Gas-Fired Generator, which was lodged with the Commission on 04 July 2024 (Case Ref.: PA07.320095) under Section 37A of the Planning and Development Act 2000 (as amended) (hereafter referred to as “the P&D Act”),
- Project 2: An Energy storage system (ESS) facility, which was lodged with Galway County Council (GCC) on 08 July 2024 (GCC Case Ref. 2460845) under Section 34 of the P&D Act. An appeal to the Commission (Case Ref. PL07.320916) was lodged by the applicant on 26 September 2024 following the decision of GCC to refuse permission for the development, and
- Project 3: a 400kV Gas Insulated Switchgear (GIS) substation, which was lodged with the Commission on 04 July 2024 (Case Ref. PA07.320094) under Section 182A of the P&D Act.

The Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015) (the “COMAH Regulations”) (Ref. /1/), implement the Seveso III Directive (2012/18/EU) and aim to prevent and mitigate the effects of major accidents involving dangerous substances which can cause serious harm to people and/or the environment, with the overall objective of providing a high level of protection in a consistent and effective manner. The site development qualifies as a “lower tier” site under the COMAH Regulations 2015 as it holds quantities of dangerous substances above threshold quantities specified in Schedule 1 of the COMAH Regulations 2015 (Ref. /1/).

The ERA outlined in this document has been undertaken in accordance with the Chemical and Downstream Oil Industries Forum (CDOIF) Guideline on Environmental Risk Tolerability for COMAH Establishments (Ref. /2/), the Guide to the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015) (Ref. /3/) and the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Enforcement Regulations, 2008 (Ref. /4/). The CDOIF guideline for carrying out ERAs is an industry wide accepted methodology.

3 RISK ASSESSMENT METHODOLOGY

3.1 What is a Major Accident to the Environment?

It is not possible to provide a scientific definition of changes in the environment caused by an event at an establishment that would constitute a major accident to the environment. However, the more extensive the areas and quantities of natural and semi-natural resource damaged, the longer the effects are likely to last, and the more intense or severe these effects, then the more likely it is that the event will be regarded as a major accident to the environment by the competent authority. Moreover, if the event affects national or international sites designated for nature conservation purposes then the event is likely to be regarded as a major accident at lower thresholds than those that apply to other designated areas, amenity areas, the wider countryside or the more common types of agricultural land. As a general rule, the specific threshold levels that apply to other designated sites, scarce habitats and more widespread habitats vary in relation to the importance of the particular type of site.

In the most general terms, major accident hazards to the environment will be those where events have the potential to: (i) pose knock-on threats to human health by contamination of food or drinking water or impacts on sewage treatment regimes; (ii) affect large areas of land designated for conservation, amenity or planning purposes. Note that large in an ecological sense may include extensive agglomerations of fragmented habitats; (iii) be long-term or persistent and/or inhibit natural processes of regeneration; (iv) be severe by causing significant permanent or long-term damage to the ecosystem (direct, indirect, or knock-on), such as reduced breeding success of protected species, or reduced biodiversity of protected habitats (including local or national extinctions of protected species), or destruction/reduction in quality of a significant proportion of the area of a rare habitat (Ref. /5/).

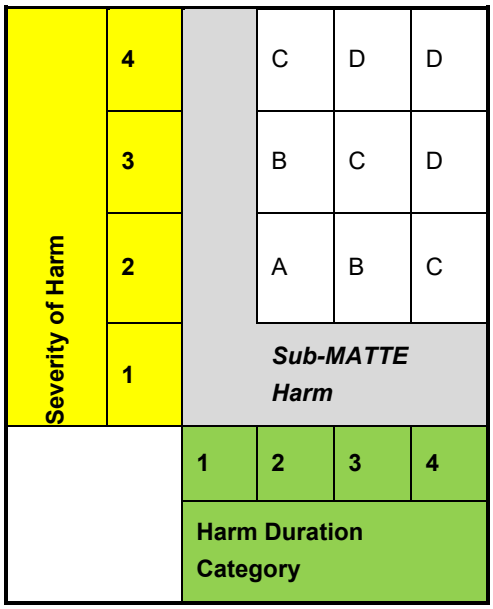
3.2 Environmental Risk Assessment Approach

DNV's environmental risk assessment methodology follows the Source-Pathway-Receptor model that is outlined in the CDOIF (Ref. /2/) and DETR Guidelines (Ref. /5/). The assessment involves the following steps which are described below:

1. **Source-pathway-receptor assessment -** The first stage involves a detailed assessment of the materials stored on site, identification of the natural and man-made receptors surrounding the site and the pathways leading from the site to these receptors.

2. **Determination of the severity and duration of harm to receptors** – to determine the consequence level for each unmitigated liquid, gaseous and ignited release event, the severity levels, S1, S2, S3 and S4 for significant, severe, major and catastrophic respectively were established.

Three approaches are used to determine the severity of harm caused by liquid releases. These include an oil slick approach and an LC_{50} approach for releases on water and analysis of a representative pool diameter for releases on land. These are described later in Section 3.2.1. For particular species, the severity of harm is based on an estimate of the proportion of the national population which is affected, if a release impacts the receptor where the species is resident. Once established, these severity levels are then compared with the likely duration of harm D1, D2, D3 and D4 for short term, medium term, long term and very long term respectively to establish a consequence level between A and D as shown in the matrix presented in Figure 3-1. The reference tables from the CDOIF guidelines (Ref. /2/) used to establish the consequence levels and the duration of harm categories associated with each MAH scenario are shown in Appendix A. The method used for predicting the duration of harm caused by the release scenarios to the environmental receptors is presented in Section 3.2.2.



Frequency at which the CDOIF consequence level is reached or exceeded	Frequency per receptor per establishment per year	
	Intolerable (greater than)	Broadly Acceptable (less than)
A	1.0 E-02	1.0 E-04
B	1.0 E-03	1.0 E-05
C	1.0 E-04	1.0 E-06
D	1.0 E-05	1.0 E-07

Figure 3-1: Method and matrix for determining MATTE consequence level and corresponding receptor frequency tolerability thresholds

3. **Quantification of unmitigated risk to receptors –** the frequencies of the unmitigated occurrences of any scenarios qualifying as MATTEs are determined using site specific or generic quantitative risk assessment (QRA) data. This includes similar releases of the material which could follow the same pathway to the receptor. These frequencies are aggregated to determine the total unmitigated risk posed to each receptor by the establishment. A comparison of the unmitigated risk posed to each receptor against the criteria in the risk matrix presented in Figure 3-2 to establish whether the risk is intolerable, tolerable if as low as reasonably practicable (TifALARP) or broadly acceptable.

	Frequency per establishment per receptor per year						
Frequency at which CDOIF Consequence Level is equalled or exceeded	10^{-8} - 10^{-7}	10^{-7} - 10^{-6}	10^{-6} - 10^{-5}	10^{-5} - 10^{-4}	10^{-4} - 10^{-3}	10^{-3} - 10^{-2}	>10^{-2}
D- MATTE						Intolerable	
C- MATTE				TifALARP			
B - MATTE	Broadly Acceptable						
A- MATTE							
Sub MATTE	Tolerability not considered by CDOIF						

Figure 3-2: CDOIF Risk Matrix

4. **Quantification of mitigated risk to receptors –** the frequencies of the unmitigated MATTE scenarios are multiplied by the probability of failure on demand (PFD) of any relevant protection layers on the site. These mitigated frequencies are aggregated to determine the total mitigated risk posed to each receptor by the establishment. The mitigated risks posed to each receptor are again compared to the criteria in the risk matrix presented in Figure 3-2 to establish whether the risk is intolerable, TifALARP or broadly acceptable.

5. **ALARP demonstrations if necessary -** Operators may be required to conduct a ALARP demonstration if the mitigated level of risk posed by the establishment to any of the surrounding receptors is found to be intolerable or TifALARP.

3.2.1 Determining Severity of Harm to Receptors

Harm to Water Receptors

Two approaches are used to determine the severity of harm caused by a liquid release to a water based environmental receptor. These are based on a lethal concentration (LC_{50}) of material in the receptor and the critical thickness of an oil slick. The type of approach applied depends on the properties of the material being released. For releases onto land, an approach based on a representative diameter for liquid pool is used.

If a release can reach a receptor where particular species can be found, the severity of harm is assessed using the MATTE tolerability tables in Appendix A.

1. LC_{50} Approach

An LC_{50} approach can be used to determine the severity of harm caused by water soluble substances which can exert toxic effects on aquatic life. The median lethal concentration, LC_{50} (lethal concentration, 50%) is the concentration of a substance required to kill half of the members of a tested population after a specified test duration. The value may be obtained by direct observation or from interpolation. LC_{50} values are a useful indicator of the substance's ecotoxicity with lower values indicative of increased toxicity. LC_{50} values can therefore define maximum allowable toxicant concentrations. As a general rule the longer the exposure time for a particular species, the lower the LC_{50} value. The reason for this observation is that it takes time for the compound to penetrate the bodies of test organisms to affect harm.

The following simple equation is then used to determine the minimum amount of material which could credibly cause a MATTE scenario:

$$\text{Mass of material for MATTE potential} = \text{Area of receptor} \times \text{Water depth} \times LC_{50}\ \text{value} \qquad (1)$$

2. Oil Slick Approach

The fate and behaviour of oil in the marine environment depends on many processes including dissolution, emulsification, oxidation and destruction, physical transport and the marine environment. According to "Offshore Environment" (Ref. /6/), it is stated that an oil slick with a thickness of less than 0.1 mm in the marine environment will tend to disintegrate into separate fragments and spread over larger and more distant areas. It is therefore assumed that a critical thickness greater than or equal to 0.1 mm is feasible for an oil slick that has the potential to cause a MATTE.

To calculate the minimum volume of material required to cause a MATTE to a receptor, the critical thickness of 0.1 mm is multiplied by the defined minimum threshold area for a MATTE in the receptor (Ref. /2/).

In addition, the way in which an oil slick breaks up and dissipates depends largely on how persistent the oil is. Light products such as kerosene tend to evaporate, dissipate quickly and naturally and rarely need cleaning up. Such products are termed non-persistent oils. Persistent oils, such as many crude oils, break up and dissipate more slowly and usually require a clean-up response. An oil slick usually drifts in the same direction as the wind, and as it does, it dissipates and thins.

Harm to Land Receptors

Liquid spills on land surfaces will spread to form pools, the extent of which will depend on a number of factors such as the ground surface and topography.

Low viscosity liquids (e.g. light distillates) spilt on concrete are assumed to spread to form pools with a uniform thickness of 5 mm. DNV's Safeti software is used for quantified risk assessment and sets this thickness value as a default for pools. This value is used for releases to areas of made ground within the site area. Liquids with higher viscosities (e.g. middle distillates and crude / heavy oils) that are spilt on concrete are assumed to spread to form pools with a uniform thickness of 20 mm. If liquid hydrocarbons are spilt onto unmade ground that is covered with vegetation they will form pools with significantly greater thicknesses due to the liquid hold-up provided by the vegetation. A value of 50 mm has been assumed in the case where crude oil is spilt onto unmade ground.

Harm to Soil and Groundwater Receptors

Liquids which are released to permeable ground will migrate downwards through the soil and potentially into groundwater layers due to the effect of gravity and capillary forces. For hydrocarbon releases, the depth and size of the plume depends on (Ref. /7/):

1. Properties of the hydrocarbon material – heavier hydrocarbons show lower rates of permeation through the soil due to their higher viscosity and tendency to adsorb to soil particles. On the other hand, BTEX (benzene, toluene, ethylbenzene and xylene) have lowest soil sorption coefficients and move quickly through the soil;
2. Properties of the soil – porosity and permeability are the two most important factors which influence liquid flow through the ground. Soils such as sand with high porosities and permeabilities allow for the fastest rates of permeation.

Hydrocarbons that have been released into the ground break down over time due to vaporisation and the action of bacteria in the soil. The length of time that the hydrocarbons remain in the ground depends on the molecular weight of the compound, with heavier hydrocarbons being more resistant to degradation than lighter ones. Hydrocarbons also degrade more quickly in hot and humid climates. In general, sub-surface hydrocarbon releases tend to degrade quite quickly – a field study of a crude oil spill site in India indicated that up to 75% of the hydrocarbons could be degraded within a year (Ref. /7/).

Accurately predicting the subsurface spread of hydrocarbons is difficult even with complex modelling solutions. DNV will employ a simplified semi-quantitative approach to determine the severity and duration of harm of releases. This approach will involve the following steps:

1. Determine if the released hydrocarbons have the potential to permeate through the soil layer and enter the groundwater layer depending on the properties of the released material and the properties and thickness of the soil layer.
2. If the hydrocarbon release can permeate into the groundwater layer, any BTX components and light hydrocarbons present in the material will be assumed to be able to spread indefinitely in the groundwater until they occupy a volume with a concentration greater than the legal or recommended concentration of the pollutant in question. It will be assumed that middle distillates and heavy hydrocarbons will not be able to spread easily within the groundwater layers due to their higher viscosities. The following simple equation is then used to determine the minimum amount of material which could credibly cause a MATTE scenario:

   Mass of material for MATTE potential = Groundwater area x Groundwater table depth x Legal limit of pollutant (2)

3.2.2 Determining Duration of Harm

The overall receptor tolerability for MATTE, as defined in Figure 3-1, is dependent on the level of harm caused by the incident and also the duration of that harm. A supporting document to the CDOIF guidance has been produced by ENVIRON titled 'Environmental Recovery Guide' - Supporting Guide to the Environmental Risk Tolerability for COMAH Establishments Guideline' (Ref. /8/). This document lays out a straightforward method for determining harm duration for any environmental release based on the chemical and receptor type under analysis. The guidance in the document is based on a review of around 300 case studies of environmental incidents in the CDOIF related industries and a review of monitoring studies of the Exxon Valdez incident.

The environmental recovery guidance document provides two flow charts, which are based on water habitats and land habitats, allowing the assessor to determine the harm duration. The flowcharts contain all 60 of the chemicals listed in the COMAH Regulations and split these substances by their ability to be broken down or dispersed in the natural environment. The flowchart then splits up different habitat (receptor) types by their ability to regenerate and their environmental sensitivity i.e. a river is classed as a different type of habitat to a coral reef. A harm duration category is then selected, for each potential MATTE event, based on the categories of chemical and habitat.

The recovery flowchart for water and land receptors is provided in Figure 3-3 and Figure 3-4 respectively. The method presented in Figure 3-3 is not applicable for firewater, so engineering judgement was used to determine the harm duration category.

The recovery time for each particular species is taken as the breeding lifecycle. The harm duration category is selected based on the relevant water or land habitat flowchart provided in Figure 3-3 or Figure 3-4.

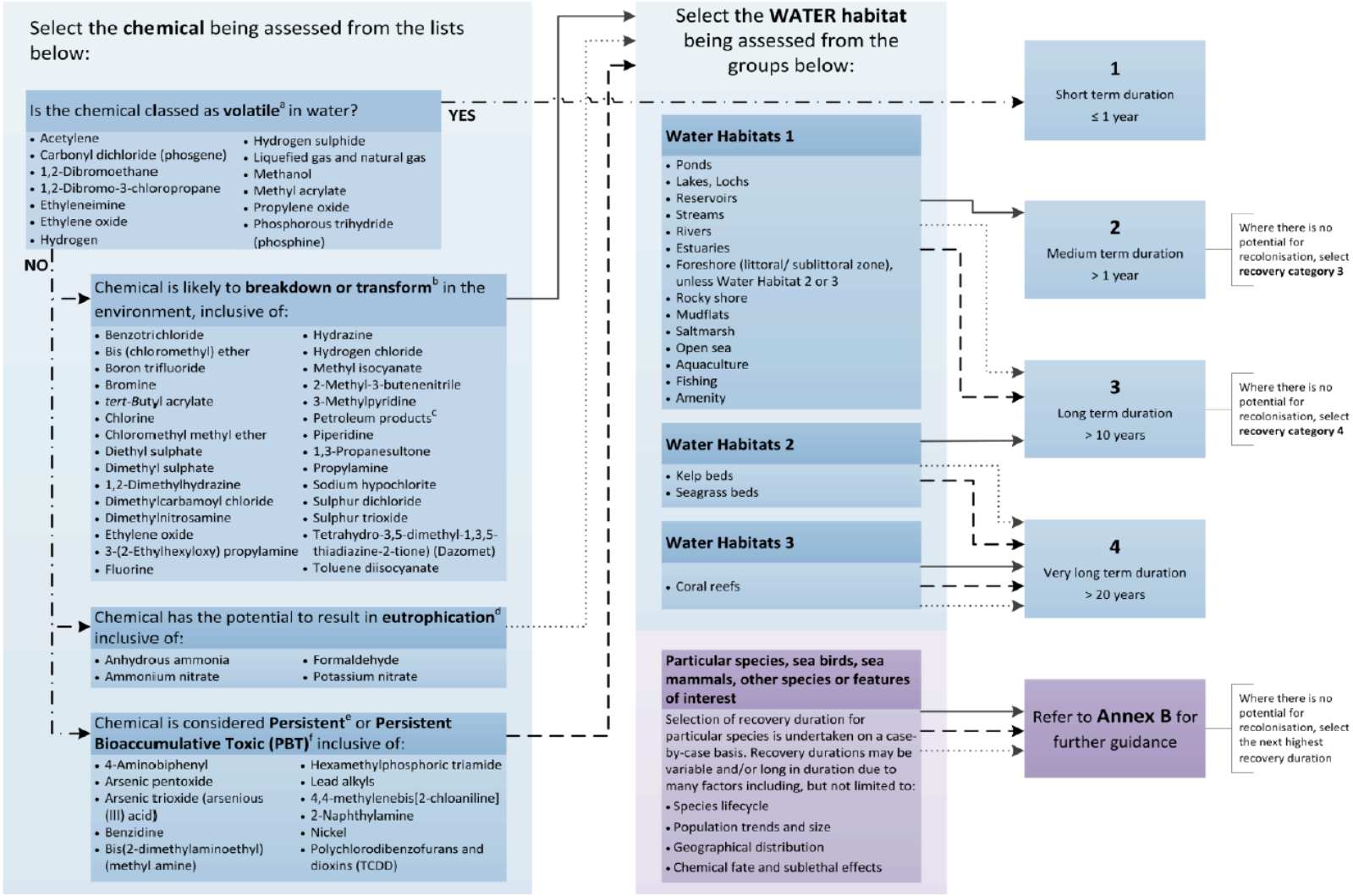


Figure 3-3: Recovery flowchart for water receptors (Ref. /8/)

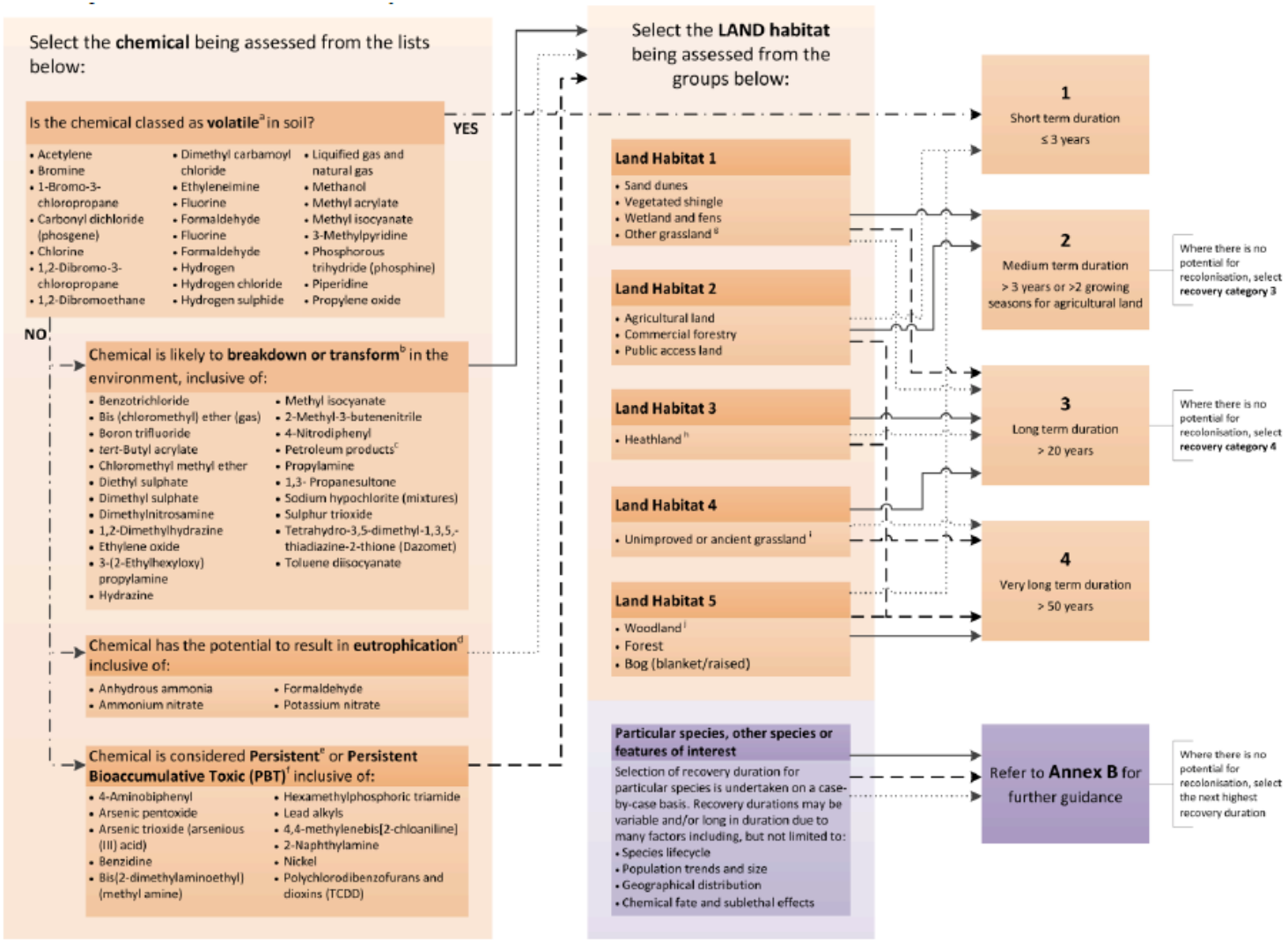


Figure 3-4: Recovery flowchart for land receptors (Ref. /8/)

4 SITE DESCRIPTION

The proposed development is located in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway, and is located approximately 4km north of Portumna and 3.1km south of Killimor. See Figure 4-1 for site location and Figure 4-2 for site layout plan.

The project includes a Reserve Gas-Fired Generator which comprises three opencycle gas-fired generator (OCGT) units located within a turbine hall, accompanied by auxiliary equipment, with secondary fuel (gas oil) stored in a bunded structure outside the turbine hall, alongside cooling equipment and other electrical plant items (e.g. transformers). The Reserve Gas-Fired Generator will include an above ground installation (AGI) compound.

An underground gas pipeline, designed to operate at pressures of 16bar or higher, will be established by Gas Networks Ireland (GNI) through a separate planning application. This pipeline will be directed to the proposed AGI at the development site from the nearest connection point on the gas transmission network.

The project includes a 400kV Gas Insulated Switchgear (GIS) Substation comprising a two-storey building positioned and secured within a palisade fenced compound. The proposed GIS will upgrade and replace the existing air insulated switchgear (AIS) substation with a new gas GIS substation at Oldstreet. The GIS substation will facilitate connection of the reserve gas fired generator and ESS to the existing node on the transmission network.

Finally, the project includes an energy Storage System which includes: (i) a long duration energy storage (LDES) battery (200MW) positioned in an outdoor compound and (ii) a synchronous condenser (400MVA electrical rating) positioned within a building. The technology is designed to complement and support the reserve gas fired generator by providing zero carbon, instantaneous power and balancing power to the grid.

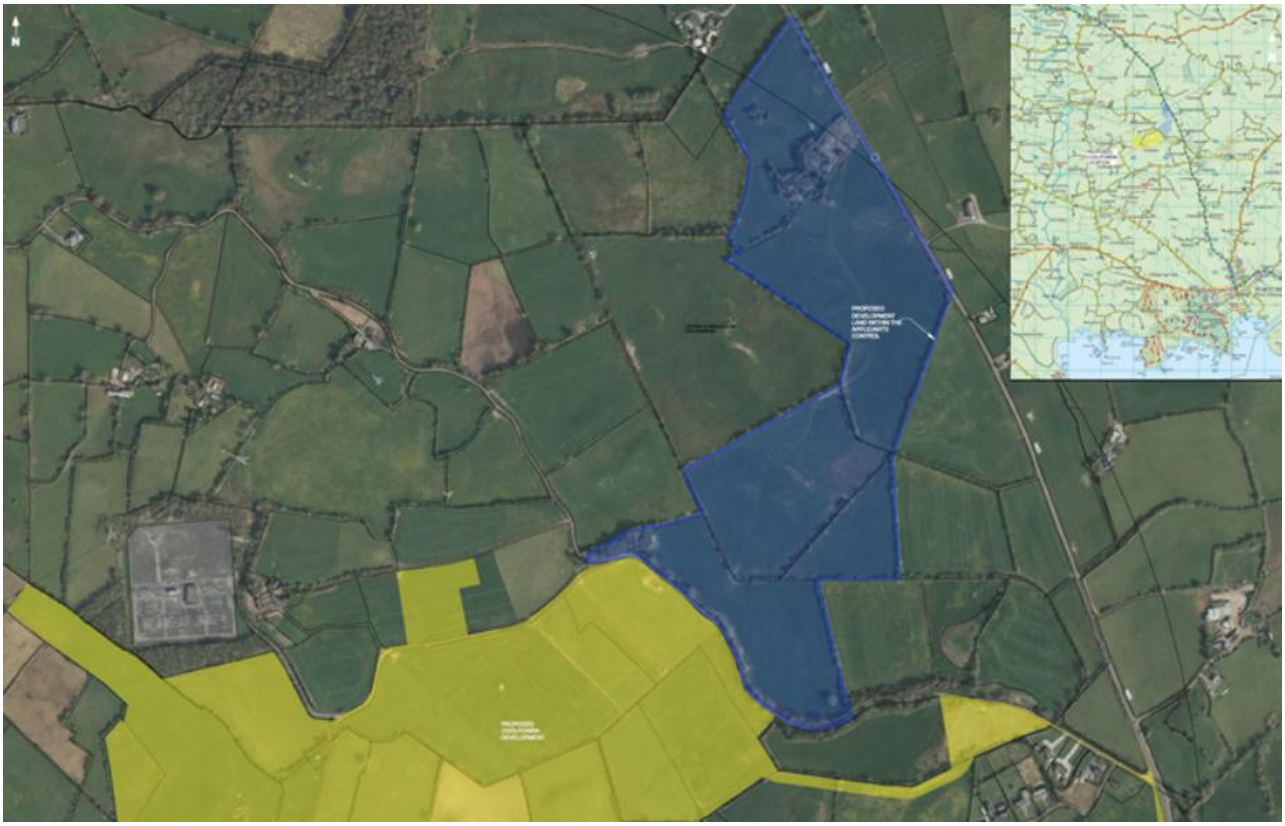


Figure 4-1 Site Location Plan

Figure 4-2 Site Layout Plan

5 BASELINE DESCRIPTION OF THE LOCAL ENVIRONMENT

The site setting descriptions are detailed in the Summary Description of Receiving Environment (Ref. /9/) and summarised in the following sections.

5.1 Topography

Lands within the development site boundary are in agricultural use and include a farmhouse and outbuildings which will be demolished. The proposed lands are situated at an elevation of c. 51-54m.

5.2 Geology

Bedrock Formation Beneath the site is Visean basinal limestone "Calp" described as Dark-grey argillaceous & cherty limestone & shale. Soils on the site are described as Mullabane (Teagasc Code 1100q) and described as mostly Brown Earths and Calcareous Brown Eaths on drift with limestones, associated with Luvisols and some inclusions of Rendzinas and peat.

5.3 Soil and Sediment

The soils are classed as well drained (Type BminSW). The Killimor Esker (Code GY078), a moderate-sized ridge comprised of esker sands and gravels, deposited under the ice sheet and trends east west is located 2.6km north of the site at its nearest point.

5.4 Groundwater

The bedrock aquifer beneath the site is a locally important aquifer with bedrock which is moderately productive only in local zones (Aquifer Category Ll). Aquifer vulnerability is classed as moderate mainly with the exemption of the south-western corner of the site where vulnerability is classed as high with some outcropping rock /rock near the surface,

There are no karst features (including Turloughs) within the boundary of the proposed development lands; the closest karst feature being Pollnabreeka Spring, an enclosed depression approximately 2.8km south of the site. There are no known (recorded by GSI) groundwater abstraction wells within 4km of the site.

5.5 Hydrology

The site is within the Lower Shannon Hydrometric Area (River Basin District IEGBNISH), which has an area of 5,032km^2. The application site is primarily within the Lower Shannon catchment (catchment ID 25B) with the western part of the site bordering Lower Shannon catchment ID 25B. Desktop studies show that the proposed development lands are contained in the Gortaha_010 and Kilcrow_070 WFD River subbasins. There are a number of field ditches and streams within the proposed development site. The main watercourse within the development land is the Ballynaheskeragh stream (also known as GORTAHA_010) which is shown (see Figure 5-1) to be flowing generally in a north western and discharges to the Kilcrow River.

The Kilcrow River is located approximately 1.8km west of the development land boundary and it flows generally in a southern direction and through Barroughter Bog SAC approximately 9km downstream of the site, before flowing into Lough Derg (Shannon) SPA (Code 004058) /Lough Derg, North-east Shore SAC (Code 002241) a further 1.1km downstream of Barroughter Bog SAC.

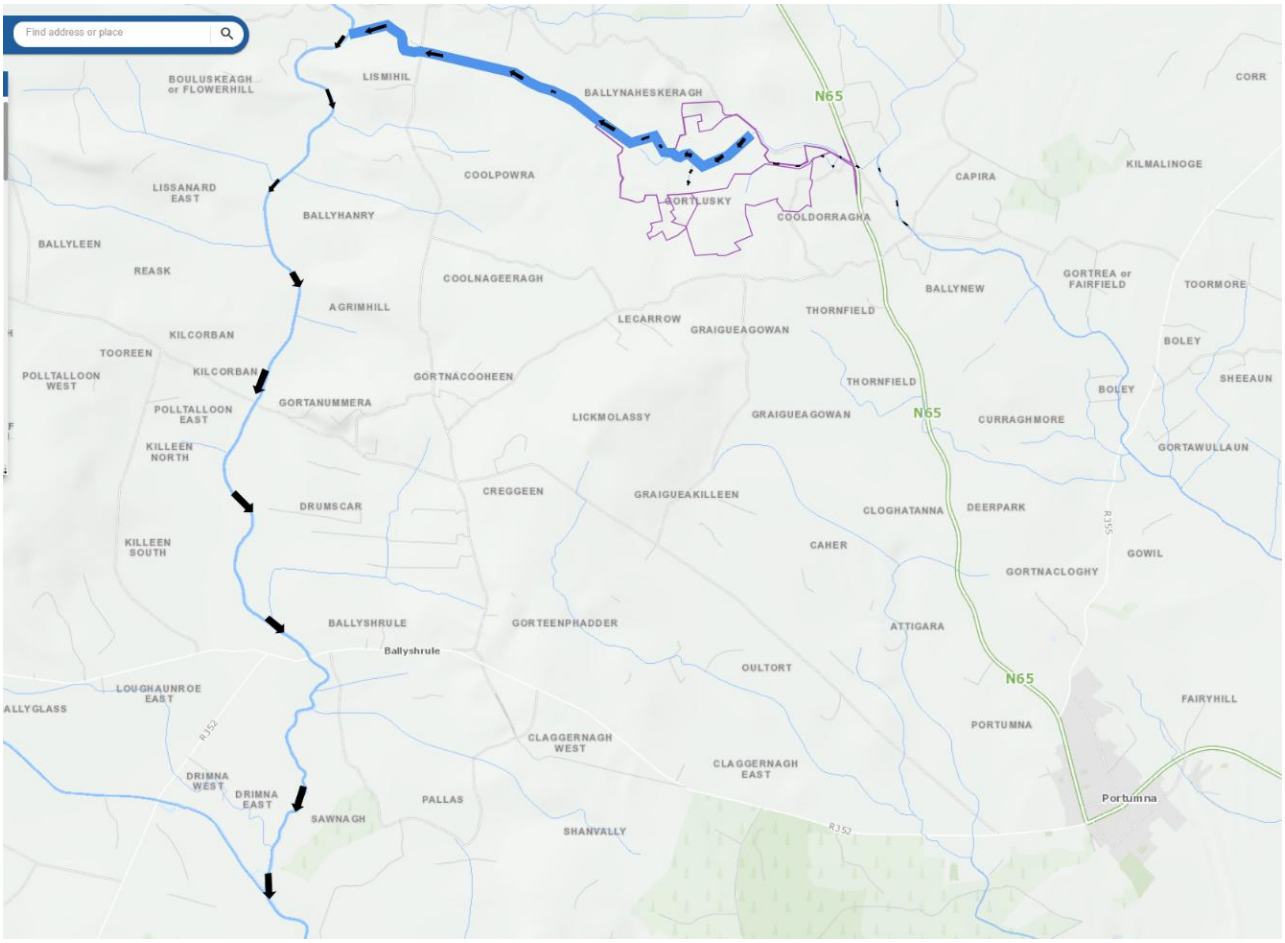


Figure 5-1: Ballynaheskeragh Stream and Kilcrow River Flow Path

5.5.1 Flooding

The application site boundary is located within (fluvial) Flood Zone C (low probability of flooding) as confirmed by a review of Office of Public Works(OPW) available flood mapping. Historical flood events are recorded by OPW. A review of the online historical data indicates that there is no record of past flooding events mapped within a 2km radius of the application site. The application site is located on lands with clear drainage paths away from the site, so the risk of pluvial flooding is categorised as low. There is no groundwater flood risk as identified from a review of Groundwater Flood Probability Maps prepared by Geological Survey Ireland. No Areas of Further Assessment (AFA) are identified at the proposed site in the Strategic Flood Risk Assessment (SFRA) for the Galway CDP 2022-2028.

5.6 Cultural Heritage

There are no listed or known architectural heritage, archaeological monuments or geological heritage sites within the proposed development site.

5.7 Biodiversity, Flora and Fauna

There are no protected sites within the development land. Capira/Derrew Bog NHA (Site code 001240) is 1.3km east of the site and is the closest designed site. Ardgraigue Bog SAC (Site Code 002356)/pNHA (Site Code 01224) is 3.7km northwest of the site and Middle Shannon Callows SPA (Site Code 004096) /River Shannon Callows SAC/pNHA (Site Code 000216) is 5.2km at its closest point southeast of the site.

A map showing the location of European Sites (SAC, SPA) within a 15km radius of the proposed development lands is presented in Figure 5-2.

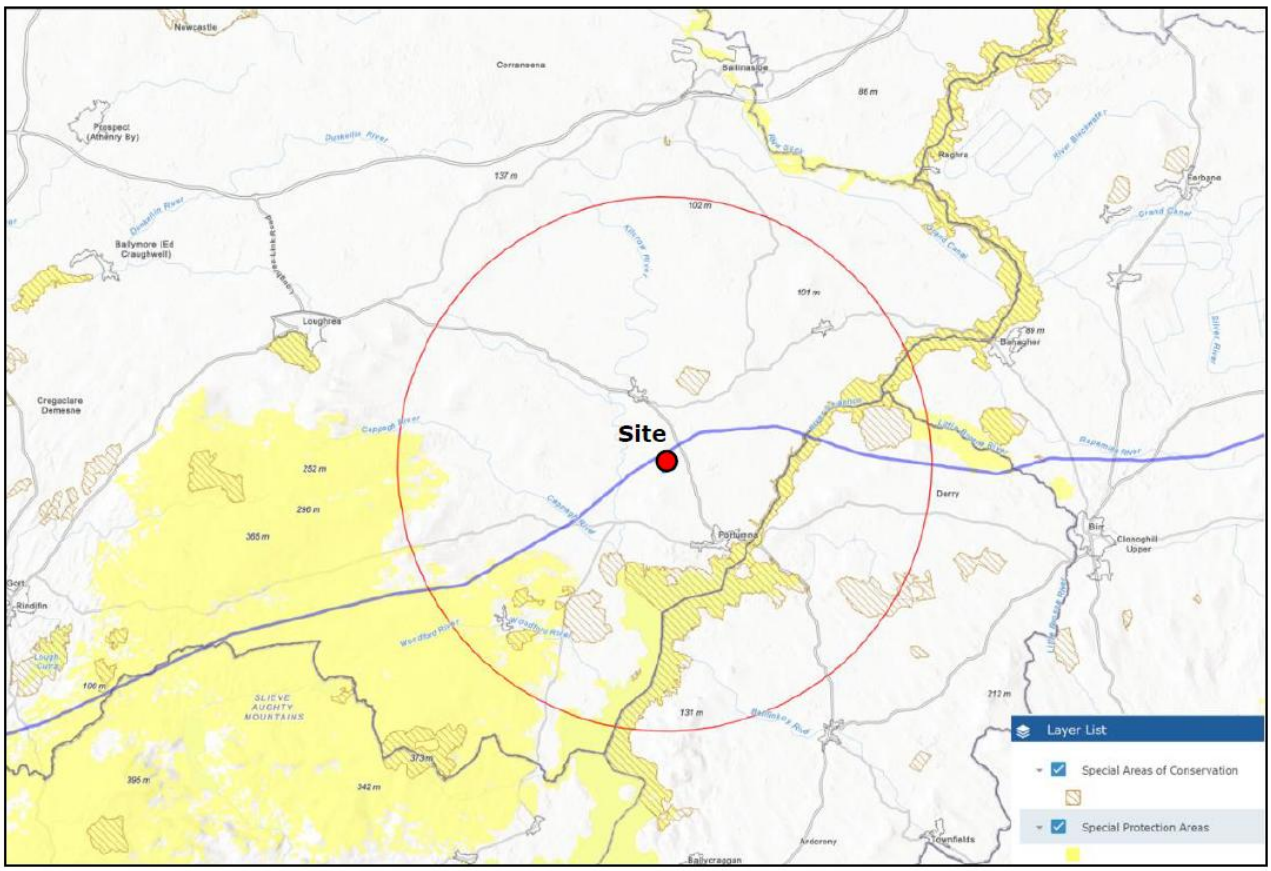


Figure 5-2 European Sites (15km radius from the site presented) along with the 400kV power line

5.8 Landscape and Visual

The proposed development is located within the 'Eastern Plains Region', which 'derives most of its character from the covering blanket of glacial soils that give rise to extensive, level plains of grasslands, with many areas of bog in the north'. Within this landscape region, the site is within the 'Central Galway Complex Landscape' Type, described as 'Level plain of productive grassland containing many settlements and dwellings'. The site sensitivity is classed as 'Low', the lowest degree of sensitivity, and defined as 'unlikely to be adversely affected by change'. Whilst a considerable number of designated scenic routes are located throughout County Galway, according to the Galway CDP 2022-2028 none of these occur within the 2km study area. The area in which the proposed development site is located is typical productive rural landscape that is not considered rare or distinctive at national or regional level.

The proposed development will be located adjacent to, and south of, the existing operational 400kV AIS electricity substation (Oldstreet). The proposed site was chosen as the preferred site following analysis of sites along the two 400kV transmission lines which runs from Moneypoint to the east coast of Ireland. The site adjoins the 400kV line which routes from Moneypoint to Oldstreet (an intermediate substation) and then to Woodland, where there is a connection to the East West Interconnector (EWIC)1. Oldstreet is the only substation along the HV line between Moneypoint and Woodland.

5.9 Air Quality and Climate

The site is located in Air Zone D (rural Ireland, i.e. remainder of the state excluding Zones A, B and C). According to the Environmental Protection Agency (EPA), the Air Quality Index is classed as 3 (Good).

6 SOURCE TERM

All of the materials handled on the site must be identified and assessed in order to determine whether they have the potential to cause a MATTE to any of the environmental receptors surrounding the site. In this section, the identified materials are assessed in a preliminary substance screening step in which materials are screened out if their release quantities or parameters related to their behaviour in the environment (e.g. ecotoxicity, degradability, water solubility, etc.) are deemed insufficient to result in environmental harm.

The only dangerous material continuously present on the site that has been identified is the secondary fuel (diesel). The material parameters are detailed in Table 6-1.

6.1 Preliminary Substance Screening

A preliminary substance screening process is conducted using the following criteria:

1. Where the material does not have any physical, chemical, toxic or eco-toxic properties that could adversely affect the environment following a release, the material is screened out.
2. Where the material does not meet a minimum inventory criterion of 250 litres (equivalent to a single barrel), the material is screened out. The 250 litre minimum inventory criterion has been set based on engineering judgement.

The ERA considers the worst-case unignited catastrophic (full-inventory) failures of the liquid fuel tanks (diesel) stored on site. All releases are assumed to be unignited for the purposes of the preliminary substance screening. The site has three liquid fuel tanks with a capacity of 7333m^3 each. The calculated tonnage of diesel stored in each tank is calculated as 6196 tonnes based on a diesel density of 845 kg/m^3.

There is also the potential for ignited release of natural gas as per Coolpowra Project - Proposed gas-fired generator which will combust natural gas supplied from the GNI transmission system. This is discussed in Sections 9.3 and 9.4.

The proposed 400kV Gas Insulated Switchgear (GIS) Electrical Substation may contain a greenhouse gas such as sulphur hexafluoride which is identified as a non-flammable and non-toxic gas and unlikely to cause a MATTE.

Finally, thermal runaway of the of the LDES batteries is likely to result in the evolution of toxic gases particularly Hydrogen Fluoride. Other gases such as Hydrogen, Methane, Ethylene and Carbon Monoxide may also be produced. Based on Classification, Labelling and Packaging (CLP) none of these are formally classified as hazardous to the environment. However, Hydrogen fluoride readily dissolves in water or moisture to form corrosive hydrofluoric acid. Hydrofluoric acid, whilst not formally classified as hazardous to the environment can result in damage through soil acidification, groundwater contamination, and harm to aquatic/terrestrial life. Therefore, firewater runoff from a LDES battery fire is considered a Source Term and is discussed in Section 9.2.

6.2 Summary of Representative MATTE Scenarios

The representative scenario is the release of approximately 6196 tonnes of diesel stored in one of the liquid fuel tanks or road tanker on the site. This is the worst-case unignited catastrophic (full-inventory) release scenario. The release of diesel representative scenario will be assessed to determine whether it has the potential to cause a MATTE to one of the identified environmental receptors surrounding the site.

Table 6-1 List of Materials Held on Site with Chemical Properties

Material	CAS No.	Composition	Solubility in Water	Other Physical and Chemical Properties	Toxicity	Aquatic Toxicity	Degradability	Bioaccumulation	Comment
Diesel		Mixture of C9-C25 hydrocarbons	Insoluble	State (ambient conditions): liquid Boiling point: 170-390 °C Flash point: 55-75 °C Density: 820-845 kg/m^3 Flammability: flammable	Rat (inhalation): LC_{50} 4.1 mg/L (4 h)	Invertebrates: *Daphnia magna* (water flea): EL_{50} (48 h) 68 mg/l Fish: LL_{50} (96 h) 65 mg/l	Biodegradable	Not expected to bioaccumulate	Spillages may penetrate the soil and accumulate in sediments.

7 PATHWAY TERM

The pathways describe how unignited and ignited releases can potentially make their way offsite and into the surrounding environment via air, water and land pathways. At this stage of the assessment, it is assumed that no mitigation measures (for example bunds and tertiary containment) are in place.

7.1 Releases to Atmosphere

For substances that are released to atmosphere, the pathway of dispersion through air and subsequent deposition is viable. Atmospheric release scenarios include:

1. Transmission of thermal radiation, flame and overpressure through the atmosphere.
2. Dispersion and subsequent deposition of gaseous/vapour releases (including fire plume gases) through the atmosphere.
3. Atmospheric deposition of solids/liquids (for example from boilover events).

7.2 Releases to Water

There is potential for a release to the Ballynaheskeragh stream which flows within the proposed development land. Any release into this water course then has potential to continue to the Kilcrow River

7.3 Releases to Ground

For scenarios that result in releases with the potential for environmental damage that are transported by land, the existence of a complete source-pathway-receptor linkage is more complex and the pathway component of the linkage may be scenario location specific. The following land pathways have been considered:

1. Overland flow of the substance from point of release to receptor. This is more likely to occur where the ground at the point of release is impermeable, either through the presence of made ground or natural conditions.
2. Throughflow of material through the ground – the substance is released onto permeable ground and then flows laterally through the sub-surface over a short distance to surrounding environmental receptors. In this case, the soil layer would be considered to be both a receptor and a pathway.
3. Groundwater flow – the substance is released onto permeable ground and percolates through the surface layers into groundwater. Further dispersion through the groundwater may then occur, potentially leading to the exposure of more distant environmental receptors. In these cases, the groundwater can be both a receptor and a pathway.
4. Flow of released material offsite via the drainage system.

A discussion on whether the abovementioned land pathways present credible pathways that can result in the transportation of released material from specific points of release on site to any of the surrounding environmental receptors is given in the subsections below.

7.3.1 Overland Flow

Released liquids will be able to reach the surrounding environmental receptors via overland flow if the gradient of the land slopes in the direction of the receptors, the flow pathway is not excessively long and there are no significant impediments to flow (e.g. vegetation).

The site development is within agricultural pastures and the overall topography of the site has been considered to be flat. Any liquid releases are therefore expected to spread out form circular pools around their point of release.

7.3.2 Throughflow and Groundwater Flow

The three liquid fuel tanks storing diesel have a bund. Which is designed to contain at least 110% capacity of a single tank within. Pumping of water from bunds can only be manually initiated by an operator following inspection of the water within the bund. In the event of a spillage from an unloading fuel tanker the liquid will runoff into a central gully. The spill will be detected by a below ground forecourt oil separator which will contain and store the liquid for removal off site. The retention separator will be capable of retaining the maximum spillage likely to occur for road tanker delivery. The below ground separator is designed to accommodate 150% of this volume.

However, there are areas outside of the tank bunds through which liquids can permeate. Where bund overtopping may occur, diesel is not expected to percolate quickly through the ground due to the viscosity dependence on outside temperature.

7.3.3 Releases via Site Drainage System

The structure of the site's drainage system is assessed to determine if there is a potential for collected material to be discharged offsite and into any of the surrounding receptors.

The drainage system is incorporates below-ground oil interceptors, a firewater retention tank, stormwater attenuation pond, silt sumps (at gully positions) and infiltration trenches. Large external areas/compounds at the site will be surfaced with stone /grassed areas to allow rainwater to percolate to the underlying soils (e.g., AIS compound, AGI and areas beyond the main compound areas but within the development site boundary).

The access roads to the site are to be drained utilising filter drains. These are to run longitudinally along the road and allow the stormwater to filter directly to ground /soils via infiltration trenches. Surface water collected from impermeable areas will be delivered to the site stormwater drainage system. Surface water will be routed via the fire wastewater retention tank and an oil/water interceptor prior to entering an attenuation pond. The outfall from the attenuation pond will be controlled using a hydrobrake which will limit the discharge of stormwater to the receiving watercourse to 9.4l/s (4l/s per hectare).

During times when chemicals are handled, isolation valves in the drainage system will be closed. This is to assure that accidently spilled chemicals do not enter the storm water drain. The isolation valves will only be opened again once it has been assured that contamination of the downstream system can be excluded.

Any overwhelming which occurs will follow the flow path discussed in Section 7.3.1 and 7.3.2. It is assumed that a flow pathway from the site to the Kilcrow River via the drainage system therefore exists.

8 RECEPTOR TERM

The receptors which are located nearest to the site development are considered to be at the highest risk of harm from unignited and ignited releases. An overview of the sensitive features that are found in the receptors that have been identified to be at the highest risk of harm from the site are given in the subsections below.

8.1 Kilcrow River

The Kilcrow flows from north to south, before joining the Duniry River which subsequently joins Lough Derg/River Shannon. The River Shannon empties into the Atlantic Ocean through the Shannon Estuary. The Kilcrow River is located approximately 1.8km which then flows for about 9km and meets Duniry River approximately 1km upstream of Lough Derg. Lough Derg is approximately 11km from the site.

8.2 Agricultural Land

The site development is within agricultural pastures and releases from the site may impact the agricultural pastures assumed to 200 ha of land surrounding the site.

8.3 Soil

The soil located below the site area within agricultural pastures is considered as a separate environmental receptor as per the CDOIF Guidelines (Ref./3/). This receptor group refers to the material at the earth's surface to a depth of 1 m.

8.4 Groundwater

The site development is located above an aquifer classed as being of moderate vulnerability and located within a locally important aquifer. The bedrock is moderately productive in local zones.

The flow of groundwater in the area is assumed to be from north to south, in line with the Kilcrow River flow direction. There are no groundwater drinking water protection areas within, or close to, the proposed site development lands.

For the purposes of this assessment, a single groundwater receptor with a depth of 12 m will be considered with properties equivalent to the Dinantian Pure Unbedded Limestone – Waulsortian Limestone aquifer.

8.5 Heritage Sites

There are no listed or known architectural heritage, archaeological monuments or geological heritage sites within the proposed development site.

8.6 Designated Areas

There are no protected sites within the development lands. Capira/Derrew Bog NHA (Site code 001240) is 1.3km east of the site and is the closest designed site. Ardgraigue Bog SAC (Site Code 002356)/pNHA (Site Code 01224) is 3.7km northwest of the site and Middle Shannon Callows SPA (Site Code 004096) /River Shannon Callows SAC/pNHA (Site Code 000216) is 5.2km at its closest point southeast of the site.

8.7 Summary of Receptors at Risk of Harm from Site

The environmental receptors that have been deemed to be at potential risk of harm from operations at the site are listed in Table 8-1 below. Details on the size and CDOIF designation of each receptor are also provided.

Table 8-1: Environmental receptors which may potentially be affected by Site Development

Receptor ID	Receptor Name	Size	CDOIF Designation
R1	Kilcrow River / Lough Derg	Kilcrow River - 22 km length, (9km under consideration) Lough Derg – 118km^2	Fresh and estuarine water habitats
R2	Agricultural Land	200 ha	Widespread Habitat – non-designated Land
R3	Soil	N/A	Soil or sediment
R4	Dinantian Pure Unbedded Limestone – Waulsortian Limestone aquifer	12 m depth	Not a groundwater source of drinking water
R5	Capira/Derrew Bog NHA	119 ha	Designated Area
R6	Ardgraigue Bog SAC	24.3 ha	Designated Area
R7	Middle Shannon Callows SPA	3750 ha	Designated Area
R8	River Shannon Callows SAC	5856 ha	Designated Area

9 DETERMINING MATTE POTENTIAL

The MATTE potentials of the unmitigated liquid and unignited gaseous release scenarios are determined in this section. The first step taken was to establish which of the surrounding receptors can be affected and then it was checked whether the quantity of material that is predicted to reach the receptor is sufficient to cause a MATTE. If the potential for a MATTE exists, the level of harm caused to the affected receptor is determined by establishing the severity of harm caused and the likely duration of harm of the effects of the release on the impacted receptor.

9.1 Unignited Liquid Scenario

The first step taken was to determine whether the released liquid have the potential to affect the surrounding environmental receptors by establishing whether flow pathways exist between the sources and receptors. The severity of harm caused to the affected receptors by the released material was then determined using the approaches described in Section 3.2.1 (LC_{50} approach, oil slick approach, etc.). The duration of harm caused to the affected receptors was then determined using the approach outlined in Section 3.2.2. The severity and duration of harm were then used to establish the MATTE consequence level to each receptor between A and D as shown in the matrix presented in Figure 3-1.

The representative unignited liquid scenario is the release of approximately 6196 tonnes of diesel stored in 7333m^3 liquid fuel tank capacity identified in the preliminary screening stage. The scenario is assessed to determine if there is a potential for a MATTE to any of the surrounding receptors. This scenario examines the release of diesel following a catastrophic failure of a 7333m^3 tank and represents the largest worst case single release of diesel. Details of the maximum releasable inventory and pool radius are presented in Table 9-1 below.

Table 9-1: Scenario of Diesel Release Details

Scenario Description	Release Location	Worst Case Quantity Released		Pool Radius (m)
		m^3	Tonnes	
Catastrophic failure of a diesel tank	Fuel Tank Bund Area	7333	6196	683
Failure over 10 minutes from diesel tank *				
10mm leak over 30minutes from diesel tank*				
Catastrophic failure of a diesel road tanker	Road Tanker Area	40	34	4
Leak from the largest connection of diesel road tanker				
Rupture of loading/unloading hose diesel road tanker				
Leak of loading/unloading hose of diesel road tanker				

* Worst case quantity released is assumed for both these scenarios for conservatism.

The diesel storage tanks are located in a bund with at least 110% capacity of a single storage tank; therefore overtopping is not considered a credible scenario.

The surface of the site is considered to be flat and the release is expected to spread out in a circular pool with an assumed thickness of 20 mm from its point of origin. A conservative assumption has been made for the purposes of simplification that there will be no flash-off of any of the light components in the released material and there will be no reduction in the mass of liquid. The released material may potentially impact the following environmental receptors:

- **R1 Kilcrow River / Lough Derg** – in the absence of containment measures i.e., the bund, the released diesel is expected to either:
    - Spread across the surface until it flows into the Ballynaheskeragh stream which flows within the proposed development land. Any release into this water course then has potential to continue to Kilcrow River. No direct flow of the released material into the Kilcrow River is expected to occur due to the distance of the site to the river itself.
    - Spread across the surface of the site until it is infiltrated to the below ground fire wastewater retention tank or intercepted via upgradient of infiltration. The diesel, if it is not infiltrated into the below ground wastewater retention tank or intercepted there, will be routed into the Ballynaheskeragh stream which flows within the proposed development land. Any release into this water course then has potential to continue to the Kilcrow River . No direct flow of the released material into the Kilcrow River is expected to occur due to the distance of the site to the river itself.
- **R2 Agricultural Land and R3 Soil** – the released diesel is not expected to flow far enough to impact the agricultural land or its soil. Therefore, no significant environmental harm to these receptors is expected to occur.
- **R4 Groundwater –** some of the released diesel will spread to areas of unmade ground and the well on the site. However, the material is expected to permeate into the ground slowly. This will allow the majority of the spill to be cleaned up before a significant volume can permeate into the ground. A small percentage of the released diesel will enter the sub-surface but this is expected to remain above the groundwater layer due to the low solubility of its components in water. Therefore, no significant environmental harm to this receptor is expected to occur.

The potential environmental harm to the Kilcrow River (R1) is discussed in the following sub-section and the findings are summarised in Table 9-2.

9.1.1 Potential Impacts on R1 – Kilcrow / Lough Derg

A release of diesel into the waters of the Kilcrow River may potentially cause harm via the formation of an oil slick on the surface of the water. Thus, the oil slick approach has been used to assess the potential level of environmental harm. The length of the Kilcrow River that would be covered if a slick of slop oil spread evenly across the width of the river with a thickness of 0.1 mm and an assumed average width of 5m was calculated as:

$$Length\ of\ river\ affected\ (m) = \frac{Volume\ released\ (m^3)}{Slick\ thickness\ (m) \times Width\ of\ River\ (m)} \quad (9.1)$$

The calculations show that a release of 7333m^3 of diesel will cover the entire 9km length of the Kilcrow River under consideration with a 0.1 mm slick. The slick will therefore continue into Lough Derg where the remain diesel will cover a 14.6km length of Lough Derg. This is the equivalent to approximately 63% of Lough Derg, which constitutes a severity level of 3 (Major) as per Table A-1. It is expected that it will be possible to remove the majority of the released oil from the water in the river/lough within a year. However, it is expected that due to the very high release volume, a significant quantity of the released oil may mix with sediments and vegetation on the banks of the river and create effects which last longer than 1 year. A medium-term duration of harm (>1 year) was therefore selected as per Table A-2. The overall consequence level is therefore a level B MATTE.

A release from a road tanker is predicted to only cover <1% of Lough Derg and therefore is judged to have a severity level of 1. As with a release from the storage tanks, a medium-term duration of harm (>1 year) was selected. The overall consequence level for a road tanker release is therefore a level sub-MATTE and no longer considered in this analysis.

Table 9-2: MATTE Assessment results for Release of Diesel Scenario

Receptor	Minimum Area Required for MATTE	Min. Release Quantity Required for MATTE	Area Affected by Full Inventory Release	Severity Rating	Duration Category	MATTE Consequence Level
R1 – Kilcrow River (oil slick approach)	2 km	8.45 te	9km of Kilcrow River 14.6km length of Lough Derg	3	2	B
			80m of Kilcrow River	1	2	Sub-MATTE

9.2 Releases of Firewater

Firewater systems present on site will provide an immediate response to events that involve fires. The release of firewater will be assumed to only occur following releases of flammable materials or occurrences of fires on the site, e.g. LDES fire.

Firewater itself does not have the potential to cause environmental harm. However, firewater run-off from the site can contain combusted and un-combusted forms of the substances involved in the fire. Therefore, in the event of a fire, any fire wastewater generated will drain through the system and be held in a below ground tank (fire wastewater holding tank), which will accord with EPA requirements (3,690m3 capacity). An actuated penstock valve will be positioned on the outlet of the below ground tank which will be activated to close upon the activation of the fire alarm within the development. The contaminated water will be subsequently tested and appropriately disposed of. Gaseous extinguishing systems will also be provided for use on electrical systems.

The application of firewater can increase the potential for the release of diesel to reach the surrounding receptors via run-off from the site and it is assumed that the flow pathways will remain the same. It is difficult to estimate exactly how much further release of diesel will spread if firewater is applied simultaneously. It is expected that the spill radii will increase slightly but will not increase in the MATTE levels determined previously.

The BESS Compound includes one proprietary fire water storage tank with a capacity of 500 cubic metres (500m3), located adjacent to the IPP building to ensure an adequate firefighting water supply. Surface finishes within the LDES compound comprise clean permeable stone fill. Firewater collected from impervious areas such as the IPP building and limited bitumen macadam roads will be collected and routed through a below ground interceptor.The firewater supply system provides a cooling of nearby structures only in the event of a fire thus limiting the contaminants within the firewater as it will not be applied directly to a battery that is on fire. Therefore the level of harm caused is not likely to be significant enough to result in a MATTE. Furthermore, any contamination of water or ground sources due to firewater the harm will have a short recovery time thus is not considered a MATTE.

Further details of the firewater and drainage systems are provided within the Fire Risk Assessment (Ref. /14/) and Environmental Impact Assessment Report Addendum (EIAR Addendum) (Ref. /15/).

9.3 Ignited Scenarios

Environmental receptors can be harmed by ignited events, either as a result of direct flame engulfment or, outside the flame, by short or long-term exposure to elevated levels of thermal radiation transmitted through the atmosphere. Overpressure generated by an explosion can also result in environmental impacts.

A variety of consequence types are considered including jet fire, flash fire, fireball, pool fire and vapour cloud explosion. The consequence types and the potentially affected receptors are presented in Table 9-3.

The assessment show that the only ignited consequence types that have the potential to impact the surrounding environmental receptors are:

- Flash fires – flash fires may impact the Agricultural Land (R2). However, any land or vegetation which is burnt is expected to recover within a year which will avoid the potential for a MATTE being realised;
- Overpressure events – an overpressure of 0.1 bar is typically strong enough to break glass on buildings but is not strong enough to cause harm to flora and fauna and generally predict that stronger overpressure levels are not expected to extend for significant distances.

It should be noted that diesel is difficult to ignite. In general diesel needs a sustained naked flame with a heat source to ignite. Therefore ignited events from the site are therefore not expected to result in any MATTEs to the surrounding receptors.

Table 9-3: Receptors potentially impacted by ignited events

Consequence Type	Receptors Potentially Affected	Notes
Jet fire	-	Consequence effects not expected to impact any of the surrounding receptors.
Flash fire	R2	Affected receptors are expected to recover in <1 year. No potential for MATTE.
Fireball	-	Consequence effects not expected to impact any of the surrounding receptors.
Pool fire	-	Consequence effects not expected to impact any of the surrounding receptors.
Vapour cloud expansion (0.1 bar)	R2	No harm to flora or fauna expected to be caused by an overpressure of 0.1 bar.

9.4 Combustion Products

Combustion products are the materials produced as a result of the decomposition of the material involved in a fire including intermediate breakdown products, smoke and particulates. The likely fall-out products following a fire or explosion will mainly be limited to CO, CO_2, H_2O and a number of partially oxidised products such as soot and smoke etc. Polycyclic Aromatic Hydrocarbons (PAHs) may also be produced during the combustion of natural gas. Thermal runaway of the of the LDES batteries is likely to result in the evolution of toxic gases particularly Hydrogen Fluoride.

Soot formation is expected to be an issue with fires involving solid or liquid fuels such as crude oil. Soot is generated by the incomplete combustion of hydrocarbons and it can be transported as fine particulates through the air. Particulate

matter is also expected to be produced if the fire from an ignited event burns the ground, vegetation or other structures on or off the site.

There is a wide spectrum of particle sizes released during a fire. Smaller sized particles tend to travel further distances than the larger sized particles. In general, within a few kilometres of the site, material with diameters of a few millimetres to even centimetres will settle. Particles with diameters of a few to tens of micrometres may be transported up to ten kilometres away from the source (Ref. /11/). Particles may be deposited directly on to land or surface water sources, or washed out of the atmosphere by precipitation and indirectly deposited. The extent of environmental damage will depend on the meteorological conditions (e.g. the wind direction, wind speed, atmospheric stability and rainfall) and generally decreases non-linearly with distance from the site of the release.

Wind direction will influence the likely environmental receptors; the wind speed will influence the dispersion rate and the extent that a material is carried downwind. Similarly, rainfall can have differing impacts on an atmospheric release. The reactivity and solubility of a material will influence whether it is likely to undergo hydrolysis or deposition through precipitation. Deposition onto land could result in soil contamination or percolation into groundwater causing contamination. The properties of the material, such as its persistence and ecotoxicity will also influence the extent of environmental damage. Soot can also impact surface water receptors either via direct deposition or via land run-off.

Any combuston fall-out, which reaches the surrounding receptors, may result in some short-term impacts but particle degradation is likely to occur relatively quickly. Therefore, a release of combustion products via the atmosphere is unlikely to result in a MATTE.

10 FREQUENCY ASSESSMENT OF UNMITIGATED CONSEQUENCES

The frequency assessment follows the approach defined in Section 6.2 of the CDOIF guidance (Ref. /2/). It is undertaken by assigning an unmitigated event frequency to the release of diesel scenario that has the potential to cause a MATTE to the Kilcrow River/Lough Derg. The unmitigated event frequency for the release of diesel is used to establish the unmitigated risk posed by the establishment to the identified receptor.

10.1 Unmitigated Scenario Frequency and Risk Summary

The unmitigated event frequency for the release of diesel scenario identified to have the potential to cause a MATTE is summarised in Table 10-1. The sources of the frequency data used is also stated in the table.

Table 10-1: Unmitigated event frequencies for each potential MATTE scenario

Scenario Description	Receptor	MATTE Consequence Level	Frequency (event per year)	Source of Frequency data
Catastrophic failure of a diesel tank	R1 – Kilcrow River / Lough Derg	B	5×10^{-6}	HSA Guidance on technical land-use planning advice Table 48, Rev 2.
Failure over 10 minutes from diesel tank *			5×10^{-6}	
10mm leak over 30minutes from diesel tank*			1×10^{-4}	
Release of Diesel Total Frequency for all 3 tanks			$1.1 \times 10^{-4} \times 3 =$ **3.3×10^{-4}**	

The unmitigated event frequency is the total unmitigated risk posed by the establishment to the receptor identified. The establishment risk to the receptor is plotted against the CDOIF tolerability criteria for event frequency per receptor per year in Figure 10-1 and found to be in the tolerable if ALARP (TifALARP) on the CDOIF risk matrix.

	Frequency per establishment per receptor per year (unmitigated)						
Frequency at which CDOIF Consequence Level is equalised or exceeded (events/year)	10^{-8} - 10^{-7}	10^{-7} - 10^{-6}	10^{-6} - 10^{-5}	10^{-5} - 10^{-4}	10^{-4} - 10^{-3}	10^{-3} - 10^{-2}	>10^{-2}
D - MATTE							
C - MATTE							
B - MATTE					**R1**		
A - MATTE							
Sub-MATTE	Tolerability not considered by CDOIF						

Figure 10-1: Unmitigated frequency per establishment per receptor per year

11 MITIGATED FREQUENCIES

The layers of protection in place to prevent the release scenario from reaching the surrounding environmental receptors are considered, in order to determine the mitigated levels of risk from the site. The mitigated frequency of harm caused to the surrounding environmental receptors is calculated by multiplying the unmitigated frequency by the probability of failure on demand (PFD) values of any layers of protection which may potentially stop the release from making its way to the receptor.

A description of the relevant layers of protection in place to prevent the scenario identified as having the potential to cause a MATTE to the surrounding receptor is given below.

11.1 Release Impacting R1 – Kilcrow River/ Lough Derg

The layers of protection relevant to releases from the site which have been identified to have the potential to cause MATTEs to the Kilcrow River / Lough Derg are:

- Tank bund.
- Fire wastewater retention tank.

A description and the PFD values allocated to each of these layers of protection are provided in the table below.

Table 11-1: Layers of protection relevant to preventing releases to the Kilcrow River / Lough Derg

Layer of Protection	Description	PFD
Tank bund	The diesel fuel tanks surrounded by a concrete bund which provide capacity for at least 110% of the contents of the tanks. Tank releases may breach the containment provided by the bund following a structural failure of the bund walls, overtopping of the bund walls or if the bund drain valve has been left open. Tank is fitted with level monitoring and CCTV coverage.	0.01 (Ref. /13/)
Fire wastewater retention tank	The catastrophic failure of one of the diesel fuel tanks will result in the release of a very large volume of diesel which has the potential to spread and form a pool from the release point. Collection and infiltration to the below ground fire wastewater retention tank occurs around the site. In addition, there are a number of interceptors (oil/water separators) upgradient of the infiltration points which are also routed to the fire wastewater retention tank.	0.3 (Ref. /13/)

The event tree which illustrates the layers of protection that are in place to prevent the release of diesel from causing a MATTE in the Lough Derg are shown in Figure 11-1. The event tree is used to calculate the risk reduction factors that the layers of protection expected to provide to reduce the unmitigated frequencies of the scenarios.

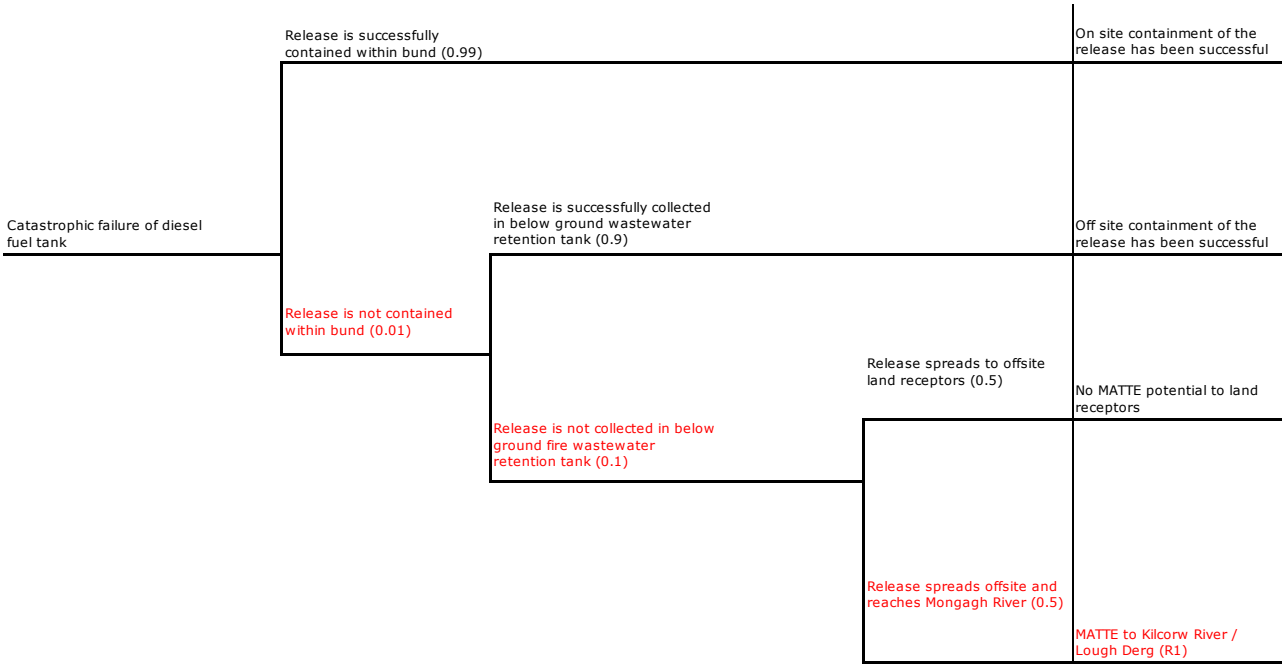


Figure 11-1: Event tree for catastrophic failure of diesel tank in bunded area

11.2 Mitigated Event Frequency Calculations

The mitigated event frequency for the MATTE scenario was calculated by multiplying the unmitigated event frequency by the risk reduction factor associated with the layers of protection in place for the scenario.

Table 11-2: Mitigated event frequencies for each potential MATTE scenario

Receptor	Scenario Description	MATTE Consequence Level	Unmitigated Frequency (per year)	Risk Reduction Factor	Mitigated Frequency (per year)
R1 – Kilcrow River / Lough Derg	Release of Diesel	B	3.3E-04	5.00E-04	1.65E-07

11.3 Mitigated Risk Summary

The mitigated event frequency for release of diesel scenario as reported in Table 11-2 is used to establish the mitigated risk posed by the establishment to the identified receptor.

The mitigated establishment risk per receptor per consequence level is summarised in

Table **11-3**. The establishment risk to the identified receptor was then plotted against the CDOIF tolerability criteria for event frequency per receptor per year in Figure 11-2 and found to be in the Broadly Acceptable Region of the CDOIF risk matrix.

Table 11-3: Mitigated establishment risk

Receptor	MATTE Consequence Level	Total Mitigated MATTE Frequency (events/year)
R1 – Kilcrow River / Lough Derg	B	1.65E-07

	Frequency per establishment per receptor per year (mitigated)						
Frequency at which CDOIF Consequence Level is equalised or exceeded (events/year)	10^{-8} - 10^{-7}	10^{-7} - 10^{-6}	10^{-6} - 10^{-5}	10^{-5} - 10^{-4}	10^{-4} - 10^{-3}	10^{-3} - 10^{-2}	>10^{-2}
D - MATTE							
C - MATTE							
B - MATTE		**R1**					
A - MATTE							
Sub-MATTE	Tolerability not considered by CDOIF						

Figure 11-2: Mitigated frequency per establishment per receptor per year

12 CONCLUSIONS

One Source-Pathway-Receptor trio with MATTE potential was identified as the release of approximately 6196 tonnes of diesel stored in 7333m^3 liquid fuel tank capacity impacting on the Kilcrow River / Lough Derg

The overall unmitigated level of risk posed by the establishment from the release of diesel to the Kilcrow River / Lough Derg was found to be in the tolerable if ALARP (TifALARP) on the CDOIF risk matrix. Following the identification of the control measures in place and their probability of failure on demand, it was found that the level of mitigated risk posed by the establishment to Kilcrow River / Lough Derg falls into the Broadly Acceptable region.

13 REFERENCES

/1/ The Chemicals Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015) (the “COMAH Regulations”), Health and Safety Authority, 2015

/2/ Guideline – Environmental Risk Tolerability for COMAH Establishments, Version 2.0, Chemical and Downstream Oil Industries Forum.

/3/ A Guide to the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015

/4/ The REACH Enforcement Regulations 2008, European Parliament No. 1906/2006.

/5/ Guidance on the Interpretation of Major Accident to the Environment for the Purpose of the COMAH Regulations 1999, Department of the Environment, Transport and the Region (DETR), 1999.

/6/ Oil Spills in the Sea, Offshore Environment, S. Patin. Available at: http://www.offshore-environment.com/oil.html.

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/8/ Supporting Guide to the Environmental Risk Tolerability for COMAH Establishments Guideline - Environmental Recovery Guide, ENVIRON, 2015.

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/10/ https://www.epa.ie/our-services/licensing/air/

/11/ Using Science to Create a Better Place – Review of Emission Factors for Incident Fires, Environment Agency, 2009.

/12/ OGP Risk Assessment Data Directory, Storage Incident Frequencies, Report No 434-3, March 2010

/13/ CCPS LOPA guidance by DNV, 2010

/14/ Halston Environmental, Fire Risk Assessment (FRA), Version 1 January 2026

/15/ Halston Environmental, Environmental Impact Assessment Report Addendum (EIAR Addendum). Version 4, January 2026

APPENDIX A
MATTE Tolerability Tables

Table A-1: Severity of harm criteria for environmental receptors (Ref. /2/)

Row	Receptor Type	Severity of Harm				Reference to	Comments
		Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria – the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration/ Recovery row in Table A-2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
	Severity Level →	**1**	**2**	**3**	**4**		
1	Designated Land/Water Sites (Nationally important)	<0.5ha or <10%	>0.5ha or 10-50% of site area, associated linear feature or population	>50% of site area, associated linear feature population	*N/A*	Land or Surface Water	NNR, SSSI, MNR
2	Designated Land/Water Sites (Internationally important)	<0.5ha or <5% (<5% LF/Pop)	>0.5ha or 5-25% of site area or 5-25% of associated linear feature or population	25-50% of site area, associated linear feature or population	>50% of site area, associated linear feature or population	Land or Surface Water	SAC, SPA, RAMSAR
3	Other Designated Land	<10ha or <10%	10-100ha or 10-50% of land	>100ha or >50% of land	*N/A*	Land	ESA, AONB, National Park, etc.
4	Scarce Habitat	<2ha or <10%	2-20ha or 10-50% of habitat	>20ha or >50% of habitat	*N/A*	Land or Surface Water	BAP habitats, geological features

Row	Receptor Type	Severity of Harm				Reference to	Comments
		Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria – the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration/ Recovery row in Table A-2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
	Severity Level →	**1**	**2**	**3**	**4**		
5	Widespread Habitat – Non-designated Land	<10ha	Contamination of 10-100ha of land, preventing growing of crops, grazing of domestic animals or renders the area inaccessible to the public because of possible skin contact with dangerous substances. Alternatively, contamination of 10ha or more of vacant land.	100 – 1000ha (applied as per text under 'Severe')	>1000ha (applied as per text under 'Severe')	Land	Land/water used for agriculture, forestry, fishing or aquaculture
6	Widespread Habitat – Non-designated Water		Contamination of aquatic habitat which prevents fishing or aquaculture or renders is inaccessible to the public.	*N/A*	*N/A*	Surface Water	Land/water used for agriculture, forestry, fishing or aquaculture

Row	Receptor Type	Severity of Harm				Reference to	Comments
		Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria – the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration/ Recovery row in Table A-2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
	Severity Level →	**1**	**2**	**3**	**4**		
7	Source of Public or Private Drinking Water (Groundwater or Surface Water)	Interruption of drinking water supply <1000 person-hours or For England & Wales only <1ha SPZ	Interruption of drinking water supplied from a ground or surface source (where persons affected x duration in hours [at least 2] >1,000) or For England & Wales only 1-10ha of SPZ where drinking water standards are breached	>1 x 10^7 person-hours interruption of drinking water (a town of ~100,000 people losing supply for month) or For England & Wales only 10-100ha SPZ drinking water standards breached	>1 x 10^9 person-hours interruption of drinking (~1 million people losing supply for 1 month) or For England & Wales only >100ha SPZ drinking water standards breached	Groundwater body or Surface Water Public Drinking Water Source	In England the area of groundwater, used for public drinking water, at risk from pollution is mapped using Source Protection Zones (SPZs). In Scotland, there is not an equivalent mapping of SPZs and only the interruption criteria should be used.

Row	Receptor Type	Severity of Harm				Reference to	Comments
		Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria – the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration/ Recovery row in Table A-2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
	Severity Level →	**1**	**2**	**3**	**4**		
8	Groundwater Body (non-Drinking Water Source)	<1ha	1-100ha of groundwater body where the WFD status has been lowered	100-10,000ha	>10,000ha	Groundwater body or Surface Water Public Drinking Water Source	UKTAG has determined that to qualify as a body of groundwater, an aquifer must be capable of supplying $10m^3$ per day or 50 people (on a continuous basis) and that such aquifers/groundwater bodies have future resource value which must be protected. Groundwater Bodies have been identified and mapped in accordance with guidance under the Water Framework Directive – see 3.2.3 and Appendix 3 for further information
9	Other Groundwater (outside of groundwater bodies)	Groundwater not a pathway to another receptor.	*Where the groundwater is a pathway for another receptor assess against relevant criteria for the receptor.*			*N/A*	

Row	Receptor Type	Severity of Harm				Reference to	Comments
		Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria – the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration/ Recovery row in Table A-2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
	Severity Level →	**1**	**2**	**3**	**4**		
10	Soil or sediment (i.e. as receptor rather than purely a pathway)	Contamination not leading to environmental damage (as per ELD), or not significantly, affecting overlying water quality.	Contamination of 10-100ha of land etc. as per Widespread Habitat; Contamination sufficient to be deemed environmental damage (Environmental Liability Directive)	Contamination of 100-1000ha of land, as per Widespread Habitat; Contamination rendering the soil immediately hazardous to humans (e.g. skin contact) or the living environment, but remediation available.	Contamination of >1000ha of land, as per Widespread Habitat; Contamination rendering the soil immediately hazardous to humans (e.g. skin contact) or the living environment and remediation difficult or impossible.	Land	
11	Built environment	Damage below a level at which designation of importance would be withdrawn.	Damage sufficient for designation of importance to be withdrawn.	Feature of built environment subject to designation of importance entirely destroyed.	*N/A*	Built environment	This is limited to Grade 1 / Cat A Listed buildings, scheduled ancient monuments, conservation area, etc.
12	Various receptors. Should not be used to identify and assess MATTE.	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	Refer to DETR. Standards relating to continuous emissions, contained in other EU legislation.

Row	Receptor Type	Severity of Harm				Reference to	Comments
		Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria – the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration/ Recovery row in Table A-2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
	Severity Level →	**1**	**2**	**3**	**4**		
12	Particular species (Note – these criteria apply nationally – i.e. England, Wales, Scotland)	Loss of <1% of animal or <5% of plant ground cover in a habitat.	Loss of 1-10% of animal or 5-50% of plant ground cover.	Loss of 10-90% of animal or 50-90% of plant ground cover.	Total loss (>90%) of animal or plant ground cover.	Land	
14	Marine	<2ha littoral or sub-littoral zone, <100ha of open sea benthic community, <100 dead sea birds (<500 gulls), <5 dead/significantly impaired sea mammals.	2-20ha littoral or sub-littoral zone, 100-1000ha of open sea benthic community, 100-1000 dead sea birds (500-5000 gulls), 5-50 dead/significantly impaired sea mammals.	20-200ha littoral or sub-littoral zone, 100-10,000ha of open sea benthic community, 1000-10,000 dead sea birds (5,000-50,000 gulls), 50-500 dead/significantly impaired sea mammals.	>200ha littoral and sub-littoral zone, >1000ha of open sea benthic community, >10000 dead sea birds (>50000 gulls), >500 dead/significantly impaired sea mammals.	Surface Water	

Row	Receptor Type	Severity of Harm				Reference to	Comments
		Significant *While this level of harm might be significant pollution, it is not considered a MATTE.*	**Severe** *DETR Criteria – the lowest level of harm that might be considered MATTE.*	**Major**	**Catastrophic**	*Corresponding Harm/Duration/ Recovery row in Table A-2*	*The 'Severe' to 'Catastrophic' levels of harm are considered to be included as 'Serious' with respect to the COMAH definition of a major accident.* *Receptors include:*
	Severity Level →	**1**	**2**	**3**	**4**		
15	Fresh and estuarine water habitats	Impact below that of Severity level 2	WFD Chemical or ecological status lowered by one class for 2-10km of watercourse or 2-20ha or 10-50% area of estuaries or ponds. Plus interruption of drinking supplies, as per DETR Table 6.	WFD Chemical ecological status lowered by one class for 10-200km of watercourse or 20-200ha or 50-90% area of estuaries and ponds. Plus interruption of drinking water supplies, as per DETR Table 6.	WFD Chemical or ecological status lowered by one class for >200km of watercourse or >200ha or >90% area of estuaries and ponds. Plus interruption of drinking water supplies, as per DETR Table 6.	Surface Water	

Table A-2: Duration / recovery criteria (based on unmitigated consequence) (Ref. /2/)

	Short term	Medium term	Long term	Very long term
Description	Harm with such short recovery is not considered a MATTE.			
Harm Duration Category →	**1**	**2**	**3**	**4**
LAND	≤ 3 years	> 3 years or > 2 growing seasons for agricultural land	> 20 years	> 50 years
SURFACE WATER (ALL EXCEPT PUBLIC OR PRIVATE DRINKING WATER SOURCE)	≤ 1 year	> 1 year	> 10 years	> 20 years
GROUNDWATER BODY OR SURFACE WATER PUBLIC OF PRIVATE DRINKING WATER SOURCE	*N/A*	Harm affecting non-public drinking water source.	Harm affecting public drinking water source or SPZ.	*N/A*
BUILT ENVIRONMENT	Can be repaired in < 3 years, such that its designation can be reinstated.	Can be repaired in > 3 years, such that its designation can be reinstated.	Feature destroyed, cannot be rebuilt, all features except world heritage site.	Feature destroyed, cannot be rebuilt, world heritage site

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APPENDIX 17.2

CONSEQUENCE AND TLUP ASSESSMENT REPORT

COMAH SUPPORT FOR PROJECT COOLPOWRA

Consequence Study and TLUP Assessment Report

Halston Environmental and Planning Limited

Rev. 2
Document no.: 2246462
Date: 2026-02-02

Project name:	COMAH Support for Project Coolpowra	DNV Services UK Limited Energy Systems Manchester Risk Advisory Applicon House, Exchange St. Stockport SK3 0EY United Kingdom Tel: GB 440 60 13 95
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Date of issue:	2026-02-02	
Project no.:	10510406	
Organisation unit:	Manchester Risk Advisory	
Rev.	2	
Document no.:	2246462	

Applicable contract(s) governing the provision of this Report:

Objective:

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Keywords: Project Coolpowra, Consequence Modelling, QRA.

Rev. no.	Date	Reason for issue	Prepared by	Verified by	Approved by
0	2024-05-24	Issued for Review	AC	TN	MS
1	2024-05-28	Issued following client comments	AC	TN	MS
2	2026-02-02	Update to include TLUP Assessment	JF	TO	AH

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Abbreviations

AGI	Above Ground Installation
AIS	Air Insulated Switchgear
ALARP	As Low as Reasonably Practicable
CFD	Computational Fluid Dynamics
CIA	Chemical Industries Association
DAL	Dimensioning Accidental Load
FBR	Full Bore Rupture
GIS	Gas Insulated Switchgear
GNI	Gas Networks Ireland
HCRD	Hydrocarbon Leak Frequency Database
HSA	Health and Safety Authority
HSE	Health and Safety Executive
IOGP	International Association of Oil and Gas Producers
LDES	Long Duration Energy Storage
LFL	Lower Flammability Limit
MATTE	Major Accident to the Environment
OCGT	Open Cycle Gas-Fired Generators
PFD	Process Flow Diagram
QRA	Quantitative Risk Assessment
TLUP	Technical Land Use Planning
UG	Underground

1 EXECUTIVE SUMMARY

1.1 Background

The aim of Project Coolpowra is to design, develop, and expand Ireland's 400kV transmission system to improve the reliability, resilience, and efficiency of the electricity supply, supporting the transition to greener energy. It facilitates the integration of renewable energy sources, aligning with Ireland's goals to reduce greenhouse gas emissions and combat climate change.

This study originally conducted a preliminary consequence modelling, which by its nature, results in typically **worst-case hazard contours**. In order to provide context to the results, a semi-quantitative risk assessment has been carried out based on DNVs experience in assessing similar industrial facilities.

The original consequence study covers:

- Quantitatively model a set of identified major accident hazards, at a level of detail commensurate with the design data currently available.
- Both full bore pipework ruptures and catastrophic vessel ruptures are modelled, as well as smaller (5mm diameter) leaks, giving an indication as to the likely extent of hazard ranges associated with the project.
- Risk to people and asset in terms of flammable leak major accident hazards (i.e. potential fire and explosion loads to the plant itself and surrounding facilities) will be assessed at a high level to give an early indication of the risk profile of the facility.

Subsequently, the study has been updated to include a Technical Land Use Planning (TLUP) Assessment where LUP zones are determined based on individual risk. The TLUP Assessment approach aligns with the Guidance on Technical Land-Use Planning Advice Version 2.

The TLUP assessment builds upon the original consequence modelling study to:

- Include event frequencies and ignition probabilities.
- Alignment of failure cases, vulnerability and exposure criteria with Guidance on Technical Land-Use Planning Advice Version 2.
- Production of LUP zones as contours overlayed on a map of the local area.

1.2 Conclusions

1.2.1 Consequence Model

The consequences derived have been both for small 5 mm releases and full bore/catastrophic releases. There are no notable consequences for any small leak scenario, except for the firewater tanker locations. Given the high flash point of diesel, it is difficult to ignite and this is reflected by the low likelihoods associated with the ignited diesel scenarios in the risk assessment.

The following conclusions are made from this study:

- **Risk**: None of the risks associated with the facility are considered intolerable. A high-level semi-quantitative risk assessment has not highlighted any serious concerns at this point, and given that further risk assessment studies are planned for further stages of the project (detailed design), it is likely that all risks will be demonstrated to be tolerable.

- **Off-site risk:** No natural gas or diesel hazards have been identified with the potential to impact off-site populations. Given the proposed safeguards and control measures associated with the long duration energy storage (LDES) compound (including fire water application, spacing, and inert gas application), a full scale LDES compound fire, which may have the potential to result in smoke passing the site boundary, is considered unlikely.

- **Consequence Results:** Consequence modelling results are considered representative of worst-case scenarios. Still, no off-site impacts have been identified during the consequence modelling. Furthermore, a full risk-based study (such as a quantitative risk assessment, QRA, to be undertaken in detailed design) is likely to demonstrate that the safety risk from the proposed facility is tolerable both on and off-site.
  - **Pool Fires:** In the highly unlikely event of a catastrophic rupture of a diesel road tanker resulting in a pool fire, the thermal radiation intensity is at levels sufficient to cause multiple fatalities at the administration/control building. Furthermore, there is potential for fuel tank pool fires to escalate to the adjacent tanks, or to cause catastrophic damage to the fire water tanks.
  - **Jet Fires:** There is potential for the 37.5 kW/m^2 contours to extend across a large section of the facility, which suggests that there is potential for escalation due to jet fires associated with the natural gas system on-site. There is also potential for personnel situated outside (e.g. walking between areas of the site) to be fatally injured from natural gas jet fires. There is also potential (based on unmitigated risk) for escalation of jet fires originating in the AGI (Above Ground Installation) or on-site pipeline to the LDES compound, however given the protective systems at the LDES compound, a compound-wide fire is considered unlikely.
  - **Fireballs:** The hazard contours associated with fireballs are relatively large, however these are short lived events and therefore do not contribute greatly to escalation, and the likelihood of a fireball has been deemed improbable over the lifetime of the facility.
  - **Flash Fires:** Flash fires can have far reaching effects; however, cloud shapes can be seen to be much smaller than the entire cloud envelope. The ½ LFL cloud can impact the majority of the site such that muster points could be considered compromised.
  - **LDES System:** The safety risk posed by LDES systems must not be underestimated, and there is potential for very large fires should propagation between containers occur. Should an LDES fire be contained to a single container (as is likely the case given the protective measures proposed for the facility), there is potential for localised asset damage and safety risk to first responders.
  - **Off-site impacts:** Natural gas and fuel oil consequence modelling has highlighted no particular concerns to third-party buildings or properties outside of the site boundary. In the unlikely event that a large-scale LDES compound fire occurs, with the fire propagating across multiple containers, there is potential for off-site impacts from smoke and evolved gases.

1.2.2 TLUP Assessment

- No LUP Zone contours are expected to impact on local populations. Both the
  - maximum tolerable risk of fatality to a member of the public of 1 x 10^{-6} per year, and
  - maximum tolerable risk of fatality to a person at an offsite work location of 5 x10^{-6} per year.

  is not foreseen to be exceeded.
- No Level 1, 2, 3 or 4 developments are located within the LUP zones.
- No offsite populations, nor the neighbouring existing substation are within the 1 x 10^{-9} per year risk contour.
- The development aims to prevent MATTEs due to a loss of containment of diesel through the use of an appropriate diesel storage tank designed in accordance with all relevant codes and standards, a dedicated

bund with a minimum capacity of 110% of a single tank, and a wastewater retention tank with oil/water interceptors which would collect any diesel not contained within the bund (i.e. due to bund failure/leak).

- The ERA (Ref. /14/) demonstrates that appropriate measures are in place to prevent a MATTE and reduce the risk to 'Broadly Acceptable' levels.

1.3 Recommendations

The following recommendations are made:

1. Consider fire protection strategies for the tanker unloading and fuel oil storage areas, which could include separate bunds for each storage tank, deluge (sprinkler) systems, and/or foam application on confirmation of a fire. Also consider relocation of the fire water tanks to a location away from all flammable inventories to ensure they are not impacted by fire events.
2. There is currently potential two occupied buildings (security and administration/control building) to be within the 37.5 kW/m^2 hazard ranges associated with jet fires and pool fires. If possible, Halston Lumcloom should consider relocating these buildings to an area outside all hazard contours – which would be considered an inherently safe solution.
3. Ensure any muster points are located outside of the ½ LFL clouds, as shown in Section 5.4.
4. If possible, the spacing between the natural gas-containing systems and the LDES compound should be increased to reduce the likelihood of a natural gas jet fire escalating to a large-scale battery fire, which could potentially have off-site impacts.
5. Undertake further risk assessments in later design stages and review the input data and assumptions. This should primarily address any uncertainties or assumptions in process information, as these will be more accurately defined as the design progresses. Particular attention should be given to fire and explosion risk within the LDES compound - ensuring and demonstrating that all applicable design standards have been followed to minimise the risk associated with stored electrical energy.

Note, these recommendations aim to further reduce any risk associated with Project Coolpowra, however other risk reduction measures may be deemed more appropriate as the design develops

2 INTRODUCTION

Halston Lumcloon Energy is designing, developing, and expanding Ireland's 400kV transmission system to improve the reliability, resilience, and efficiency of the electricity supply, supporting the transition to greener energy. It facilitates the integration of renewable energy sources, aligning with Ireland's goals to reduce greenhouse gas emissions and combat climate change.

Halston have developed a proposal, which consists of units such as reserve gas-fired generators, Gas Insulated Switchgear Substations, long duration energy storage batteries and more. The first site for application of the plant concept is a facility in Ireland, and the modules and components are designed for use with gas oil. Natural gas is present in the underground pipelines and equipment associated with integration into Gas Network Ireland's network.

This document has bene prepared by DNV for Halston Environmental & Planning Limited (Halston) on behalf of Coolpowra Flex Gen Limited. Environmental Impact Assessment Report (EIAR) and Land Use Planning application. The EIAR contains 3 planning applications as follows:

- Project 1: a Reserve Gas-Fired Generator, which was lodged with the Commission on 04 July 2024 (Case Ref.: PA07.320095) under Section 37A of the Planning and Development Act 2000 (as amended) (hereafter referred to as "the P&D Act"),
- Project 2: An Energy storage system (ESS) facility, which was lodged with Galway County Council (GCC) on 08 July 2024 (GCC Case Ref. 2460845) under Section 34 of the P&D Act. An appeal to the Commission (Case Ref. PL07.320916) was lodged by the applicant on 26 September 2024 following the decision of GCC to refuse permission for the development, and
- Project 3: a 400kV Gas Insulated Switchgear (GIS) substation, which was lodged with the Commission on 04 July 2024 (Case Ref. PA07.320094) under Section 182A of the P&D Act.

2.1 Study Scope

The scope of the studies within this document can be split into two distinct parts:

1. Original consequence modelling to inform on the layout and design, with determination of worst-case hazard contours. This was conducted in 2024 by DNV.
2. 2026 update to include a Technical Land Use Planning (TLUP) Assessment.

The original consequence study covers:

- Quantitatively model a set of identified major accident hazards, at a level of detail commensurate with the design data currently available.
- Both full bore pipework ruptures and catastrophic vessel ruptures are modelled, as well as smaller (5mm diameter) leaks, giving an indication as to the likely extent of hazard ranges associated with the project.
- Risk to people and asset in terms of flammable leak major accident hazards (i.e. potential fire and explosion loads to the plant itself and surrounding facilities) will be assessed at a high level to give an early indication of the risk profile of the facility.

The following aspects were excluded from the original study scope:

- Risk during construction, commissioning or other phases not representing normal operation of the facilities.
- Risks to the environment and of business interruption / remediation / reputation.

The original Study Scope is presented in Section 4 to 6, with conclusions in Section 8.

2.1.1 Technical Land Use Planning (TLUP) Assessment

The TLUP assessment builds upon the original consequence modelling study to:

- Include event frequencies and ignition probabilities
- Alignment of failure cases, vulnerability and exposure criteria with Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/
- Production of LUP zones as contours overlayed on a map of the local area.

Approximation of individual risk, societal risk and risk to nearby buildings/sites. The TLUP assessment is presented in Section 7, with conclusions in Section 8.

2.2 Study Objectives

The objectives of the report are:

- Conduct a high-level risk study (consequence modelling and semi-quantitative risk assessment) to highlight any preliminary siting or layout concerns for the facility based on the current layout.
- To understand the potential risk exposure of site personnel, key buildings, offsite populations, and other siting aspects.
- Determine extent of LUP zones.
- Alignment with Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/).

3 DESCRIPTION AND STUDY BASIS

The assumptions for this study were derived from the project description and discussion with project team members, which are summarised below:

The key inputs defining the design as modelled in this study are:

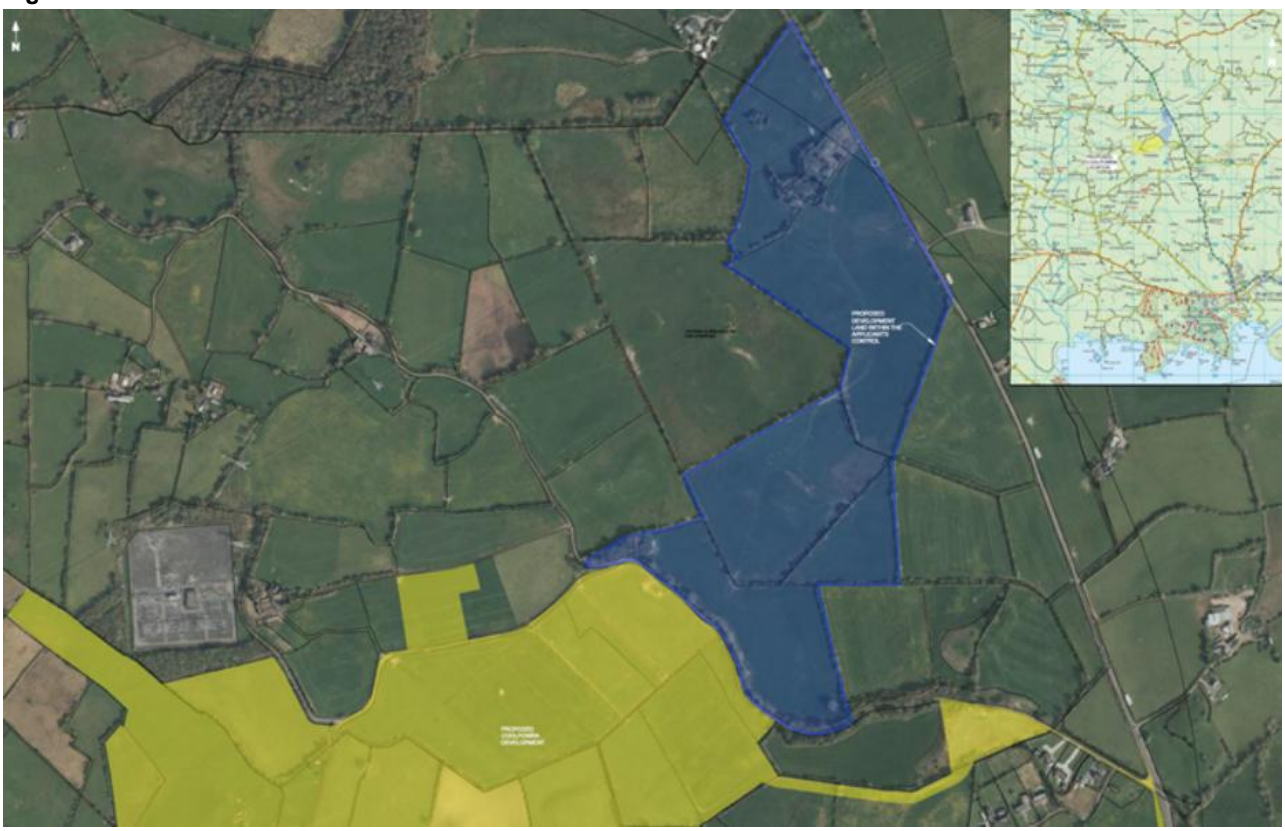
- Process details are given by the Project Description document /1/ and discussion with the project team
- The overall process structure and major equipment items are given by the Project Description /1/.

Other data provided by Halston, and public information sources provide underlying basis for the study modelling as discussed in the remainder of this section.

3.1 Site Location

The proposed development is located approximately 4km north of Portumna and 3.1km south of Killimor. Lands within the development site boundary are in agricultural use and include a farmhouse and outbuildings which will be demolished. The proposed lands are situated at an elevation of c. 51-54m AOD and are accessed by road via the N65 (National Road) and the L8763 (local road). The N65 connects the towns of Loughrea and Portumna. The proposed development will be located adjacent to, and south of, the existing operational 400kV AIS electricity substation (Oldstreet).

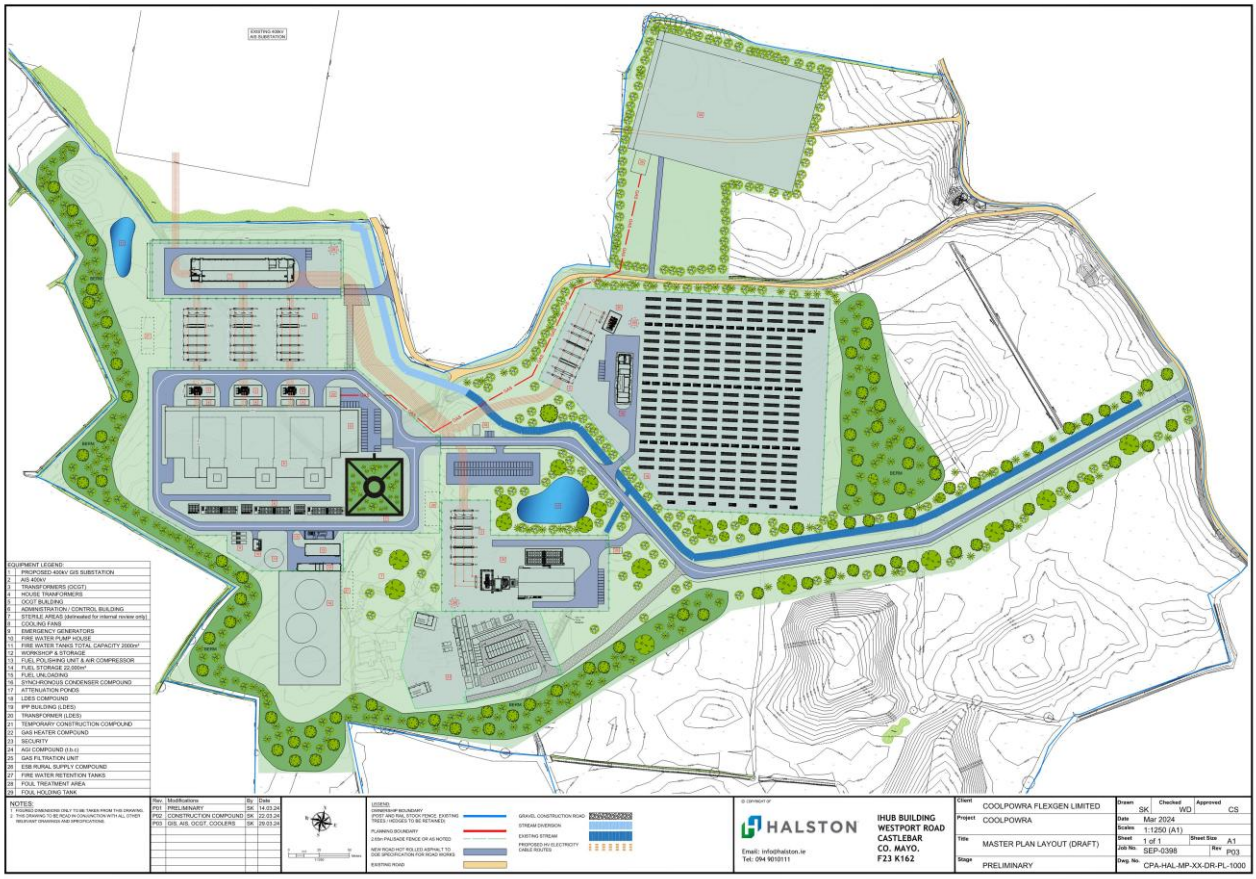
Figure 3-1 Location of the Halston Plant



3.2 Site Layout

The facility layout shown in Figure 3-2 is used as the basis for this study.

Figure 3-2 Layout of the Halston Site



3.3 Process Description

The plant processing equipment within the scope of this study is defined within Table 3-1. Note that not all of these items present hazards that form part of the consequence modelling.

Table 3-1 Summary of The Plant Processing Equipment and Systems

System	Description
Reserve Gas-Fired Generator	Three OCGT units, 1,125 MW (3 x 375 MW) Output will connect to the electricity system via the gas insulated switchgear (GIS).
Under Ground Gas Pipeline	Delivers gas to proposed AGI on site. Operating at pressures of 16 bar or higher, established by Gas Networks Ireland (GNI) through separate planning application at the time of this report. Around 400m run-length across the site in zig-zag formation.
Gas Insulated Switchgear (GIS) Substation	Forms part of the Electricity Transmission System. Two-storey building positioned and secured within a palisaded fenced compound. The proposed GIS will upgrade and replace the existing air insulated switchgear (AIS) substation with a new gas GIS substation at Oldstreet. The GIS substation will facilitate connection of the reserve gas fired generator and ESS to the existing node on the transmission network thereby securing energy supply into the future
Energy Storage System Energy – Grid Stability	LDES with 200 MW / 800 MWh Output. Synchronous Condenser with 400 MVA output. Both connect to electricity system via the GIS. The technology is designed to complement and support the reserve gas fired generator by providing zero carbon, instantaneous power and balancing power to the grid.
Diesel Storage Tanks	Three vessels containing gas oil, with a gross maximum inventory of 22,000 m^3.
Diesel Road Tanker	Located between the OCGT units and the diesel storage tanks, assumed to have an internal capacity of 40m^3
Grid Connection AGI	Connects to the main gas pipeline run by Gas Networks Ireland
Diesel Transfer Pumps	For safe delivery of diesel from tanks to process.
Foul Holding Tank	For use with the foul treatment area

3.4 Ambient Conditions

It is necessary to define certain meteorological constants as inputs to the consequence modelling. These values are summarised in Table 3-2, based typical values for facilities located in the United Kingdom.

Table 3-2 Meteorological Parameters

Parameter	Value	Notes and References
Atmospheric Temperature	10°C	Based on average annual temperatures.
Relative Humidity	70%	Typical annual average for Ireland.
Surface Temperature	10°C	Taken to be the same as atmospheric temperature

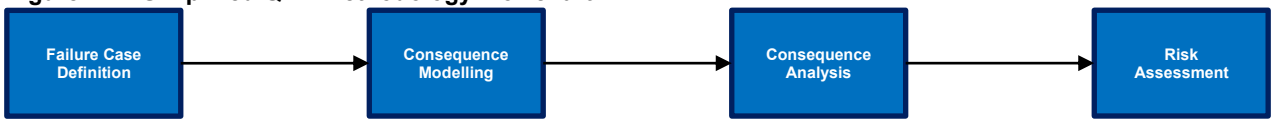
The contribution of solar flux to thermal radiation is not accounted for risks from fires (as is typical for these studies).

Those parameters above which are not based on any available site/ project specific data source are assumed values, selected based on experience or using model defaults, with the intention of providing the most appropriate modelling results whilst still taking a conservative approach so as not to underestimate any of the risk levels.

4 CONSEQUENCE MODEL METHODOLOGY

The outline methodology to be adopted for this preliminary consequence modelling is shown in Figure 4-1 and is described in more detail in in the following sections.

Figure 4-1 Simplified QRA Methodology Flowchart



4.1 Software

DNV Phast software v9.0 is used to carry out the study. A summary of global modelling parameters to be applied in the study are provided in Table 4-1. Other values not mentioned in this document can be assumed to remain as default settings in the software.

Table 4-1 General Phast Parameters to be Used for Modelling

Parameter	Value	Notes
Software version	V9.0	Latest version
Height of interest	1 m	Population is assumed to be located at ground level with a receptor height of 1 m (equal to release height); this applies to the whole population identified for the study.
Default leak direction for above-ground releases	Horizontal	Releases from any containerised equipment are considered as impinged. Modelling all releases as horizontal is somewhat conservative, however is typical practice for QRA studies.
Default release elevation	1.5 m	Typical standard value representing 'head height'
Surface Type	Concrete	
Surface Roughness	183 mm	Affects the turbulence in the air reaching the release source and is related to effective average obstacle height over the terrain. 183 mm is the Phast default and is suitable for occasional large obstacles, and is selected as the site has neither open, flat terrain (typically assigned a value of 30 mm), nor a significantly built-up area (typically assigned a value of 500 mm or more) in close proximity to the site.
Flammable averaging time	18.75 sec	Phast default value for flammable dispersion.
Flammable vapour cloud extent allowing ignition	Lower Flammability Limit (LFL)	Effects are calculated at effect height rather than the default cloud centreline height (affects buoyant cloud delayed ignition risk)

4.2 Failure Cases

Normal operating conditions for each failure case have been assumed, namely pressure, temperature, and operating flowrate.

Table 4-2 Operating parameters and parameters assumed for modelling.

Vessel/Equipment	Parameter	Value used
Diesel Storage Tanks	Temperature	20 °C
Diesel Storage Tanks	Volume inventory (per tank)	7333.3 m3
Diesel Road Tanker	Pressure	Atmospheric
Diesel Road Tanker	Temperature	20 °C
Diesel Road Tanker	Volume inventory	40 m^3
Diesel Transfer Pumps	Pressure	2 barg
Diesel Transfer Pumps	Temperature	20 °C
Diesel Transfer Pumps	Maximum Diameter	6 inches (full bore)
Diesel Transfer Pumps	Flow Rate	0.5 kg/s
Grid Connection AGI	Pressure	25 barg
Grid Connection AGI	Temperature	20 °C
Grid Connection AGI	Maximum Diameter	6 inches (full bore)
Gas Pipeline	Pressure	16 barg
Gas Pipeline	Temperature	20 °C

4.2.1 Leak Sizes

A range of representative leak sizes has been modelled as shown in Table 4-3.

Table 4-3 Representative Leak Sizes Modelled

Leak Size Name	Representative Hole Diameter (mm)	Hole Size Range for Frequency Analysis (mm)
Medium Leak	5	3-10
Full-Bore Rupture (FBR)	Line Size	Residual from total frequency for component

Additionally, catastrophic rupture of all vessels has been modelled, which is representative of vessel failure e.g. due to vehicle impact of mechanical defects.

4.2.2 Locations

A single representative leak location is defined per failure case, based on the plot plans and information provided.

The gas pipeline was modelled as an extended line source with potential leak locations along the pipeline length, however only the worst-case results are reported in this document.

4.3 Consequence Analysis

This section outlines the approach to be used for consequence modelling analysis.

4.3.1 Process Fluid Compositions

Some key assumptions have been made when defining the process fluid compositions to be modelled:

- The natural gas feed is assumed to be 100% methane.
- Secondary fuel oil (gas oil) is modelled as diesel.

4.3.2 Discharge

The discharge parameters have been determined within Phast on the basis of the defined failure case parameters (pressure, temperature). Where releases occur downstream of equipment such as a pump or compressor, the release rate will typically be driven by the normal flow rate of the section in forward flow. Therefore, the release rates are capped at a maximum of 150% of the inflow rate.

Detection and isolation are not modelled at this stage.

4.3.3 Dispersion

Releases have been modelled with a “horizontal” release direction, accounting for the open nature of the facility, with limited opportunity for direct impingement to adjacent equipment.

A default representative release height of 1.5 m applies for all failure cases, as is typical QRA practice.

4.3.4 Fire Modelling

Standard Phast models for flash fires and fireballs are used.

4.3.5 Explosion Modelling

Explosions are assumed to have the potential to occur where a vapour cloud with concentration within the flammable range is ignited and there is simultaneously a mechanism to accelerate the flame front. Such explosion scenarios require delayed ignition of the vapour cloud.

The potential detonation of natural gas in the open (i.e. outside areas of congestion/confinement) is not considered credible, and therefore a single area of congestion has been defined in the model, this being the Transformers shown by location 20 in Figure 3-2.
The approach to modelling a vapour cloud explosion (VCE) associated with a flammable cloud interacting with these transformers is to calculate the mass of methane associated with filling the transformer area with a stoichiometric mixture of methane in air, in this case approximately 80 kg of methane, and assuming ignition in the centre of this location. All explosion results outlined in this report are based on an explosion in this transformer compound.

4.3.6 Ignition Modelling

For the sake of consequence modelling, it is always assumed that the natural gas and secondary fuel (diesel) are ignited and the worst-case results are presented in Section 5. In reality, diesel is difficult to ignite - having a flash point of between 52 and 96ºC, it is classified as ‘combustible’ rather than ‘flammable’. This means that diesel is not readily ignited with a naked flame and requires sustained energy input (or atomisation) for it to ignite.
As a result, although the consequences of a diesel fire can appear severe, the likelihood of this event occurring can be considered less than for a more readily ignitable fluid (such as petrol or gases such as natural gas). This is reflected in the high-level risk assessment presented in Section 6.

4.3.7 Long Duration Energy Storage Modelling

At the time of conducting the consequence modelling, DNV were unable to model fires associated with battery energy storage systems (BESSs), however a qualitative assessment was undertaken for the likely impacts of BESS fires, based on DNVs experience in risk assessment of these systems.

4.4 Vulnerability Criteria

This section covers the integration of the consequence and frequency modelling to provide risk estimates for human receptors. The vulnerability criteria in Table 4-4 are for information only and provide context to the choice of hazard levels reported in this document.

The vulnerability criteria within this section were used for the original consequence study only. For the specific TLUP Assessment criteria, see Section 7.2.

Table 4-4 Vulnerability Criteria

Hazard	Effect Threshold (model ≥ threshold)	Fatality Probability				Notes
		Outdoor	Indoor CIA 4*	Indoor CIA 3*	Indoor CIA 2*	
Flash fire	LFL	100%	50%	20%	20%	DNV internal guidance.
Jet fire	4.7 kW/m^2	0%	0%	0%	0%	4.7 kW/m^2 is considered the 'safe limit' for on-site personnel. 6.3 kW/m^2 is considered the point at which escape routes are considered impaired. 37.5 kW/m^2 is considered the point at which process equipment can sustain damage.
	6.3 kW/m^2	0%	0%	0%	0%	
	12.5 kW/m^2	50%	25%	25%	25%	
	37.5 kW/m^2	100%	100%	50%	50%	
Fireball	4 kW/m^2	0%	0%	0%	0%	0% at lower radiation thresholds to account for the short exposure duration.
	12.5 kW/m^2	0%	0%	0%	0%	
	37.5 kW/m^2	100%	100%	50%	50%	
Pool fire	4 kW/m^2	0%	0%	0%	0%	4.7 kW/m^2 is considered the 'safe limit' for on-site personnel. 6.3 kW/m^2 is considered the point at which escape routes are considered impaired. 37.5 kW/m^2 is considered the point at which process equipment can sustain damage.
	12.5 kW/m^2	50%	25%	25%	25%	
	37.5 kW/m^2	100%	100%	50%	50%	
Explosion overpressure (side-on)	0.07 bar	0%	3%	2%	0%	Linearly interpolated between thresholds. 0% below lowest threshold. Outdoors represents people adjacent to buildings. Indoors from IOGP /11/ based on Chemical Industries Association (CIA) guidance.
	0.14 bar	0%	15%	8%	3%	
	0.35 bar	30%	90%	55%	70%	
	0.5 bar	100%	100%	65%	80%	
Toxicity	-	-	-	-	-	No toxic components have been identified for this study.

Note*: CIA4: 'Portacabin' type timber construction, single storey, CIA3: Typical domestic building: two-storey, brick, walls, timber floors, CIA2: Typical office block: four storey, concrete frame and roof, brick block wall panels.

4.5 Tolerability of Risk

The Health and Safety Authority (HSA) in Ireland follow a similar approach to the Health and Safety Executive (HSE) in the United Kingdom in respect to tolerability of risk, and the ALARP principle (Ref /12/). Risks can be designated into one of three categories:

a) **Broadly Acceptable**, whereby the individual risk is calculated to be below 1x10^{-6} per year. As long as it can be demonstrated that good practice has been followed in terms of management of these risks, no further action is required.

b) **Tolerable if ALARP.** Individual risk calculated to lie between 1x10^{-6} and 1x10^{-3} /1x10^{-4} for on-site and off-site populations respectively are considered tolerable if it can be demonstrated that further risk reductions are not

practicable. In practice, this would mean demonstrating that further risk mitigation measures could not be justified in terms of cost (monetary or time/effort) against the level of risk reduction gained.

c) **Intolerable**. If the risk is found to exceed $1x10^{-3}$ /$1x10^{-4}$ for on-site and off-site populations respectively, risk reduction measures must be implemented regardless of cost, to bring the risk into the Tolerable if ALARP region before operation can continue.

Note, the quantitative figures outlined above are typically the outcome of a full QRA. This is outside the scope of the scope of this document given the early stage of the project however a QRA is planned for detailed design. The risk ranking matrix used in this semi-quantitative assessment aims to map the identified hazards across the three categories listed above.

5 CONSEQUENCE ASSESSMENT

Note, these results are for consequences only and do not consider the likelihood of the initial release, ignition probability, or any other conditional modifiers such as occupancy. They are necessarily coarse given the relatively early design maturity, and it is likely that any risk results derived during detailed design will give less severe contours.

5.1 Pool Fire Thermal Radiation

The thermal radiation consequence contours representing all diesel pool fires (irrespective of duration) are shown in Figure 5-1 to Figure 5-6. It can be seen from the shape of the contours that:

- The control room is located outside of all pool fire contours for all scenarios except for the catastrophic rupture of the Diesel Road Tanker where it lies within the 6.3 kW/m^2 contour, but this only impairs escape routes and leads to no fatalities.
- The radiative flux of 37.5 kW/m^2 is the key thermal load in terms of escalation and the risk effects. Any pool fire could escalate to any of the adjacent equipment (i.e. a single pool fire from any storage tank would cause all of the other storage tanks, the diesel road tanker and diesel transfer pump, and vice versa).
- Catastrophic rupture of the road tanker with subsequent pool ignition could result in high thermal loads on the OCGT building, however the effects of drainage in mitigating pool formation have not been modelled.
- The fire water retention tanks lay within the pool fire contours at 12.5 kW/m^2 for all catastrophic ruptures of any fuel storage tanks, road tanker and diesel transfer pumps, however this level of thermal flux is unlikely to cause damage to the fire water tanks.
- Given that all three fuel storage tanks currently share a bund, it is possible that catastrophic failure of one vessel could escalate to a large fire resulting in catastrophic damage to all three tanks. Furthermore, the integrity of the firewater tanks could be compromised in such an event which would result in loss of a key protective safeguard.

Recommendation – Assess the potential to relocate the fire water tanks to an area where they are unlikely to sustain damage in the event of a fire.

Figure 5-1: Contours for Pool Fire Radiation at category 5/D for Diesel Storage Tank (Southern) Catastrophic Rupture in kW/m^2

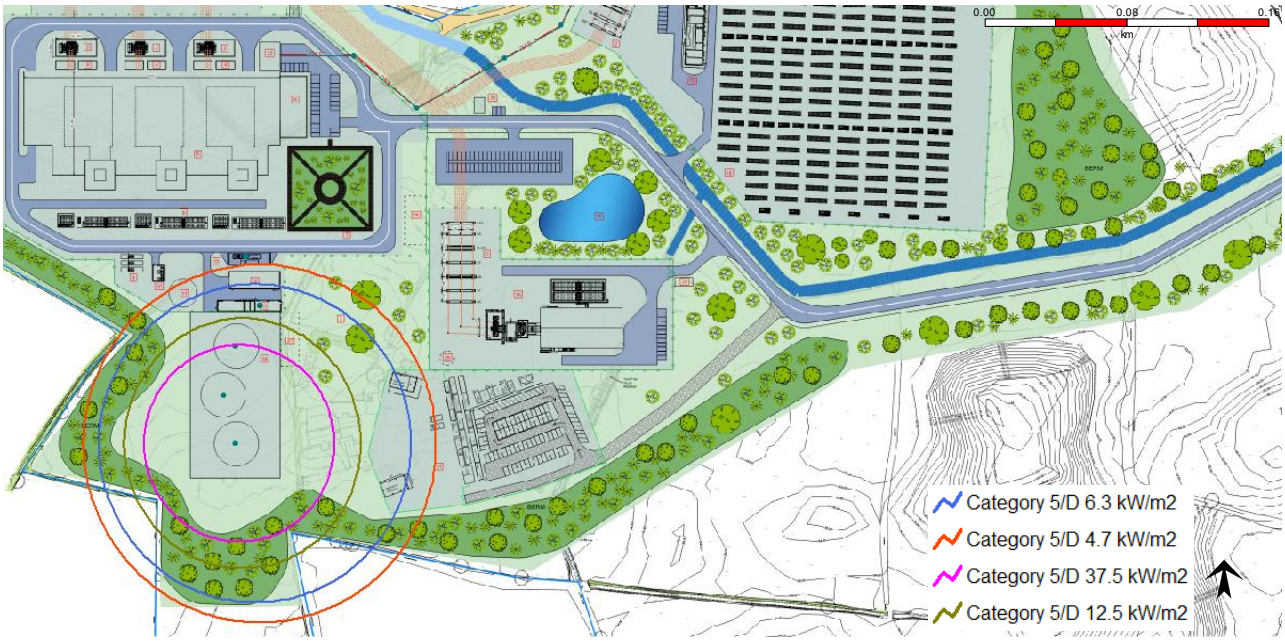


Figure 5-2: Contours for Pool Fire Radiation at category 5/D for Diesel Storage Tank (Central) Catastrophic Rupture in kW/m^2

Figure 5-3: Contours for Pool Fire Radiation at category 5/D for Diesel Storage Tank (Northern) Catastrophic Rupture in kW/m^2

Figure 5-4: Contours for Pool Fire Radiation at category 5/D for Diesel Storage Tank (Northern) for a small 5mm hole size leak in kW/m^2

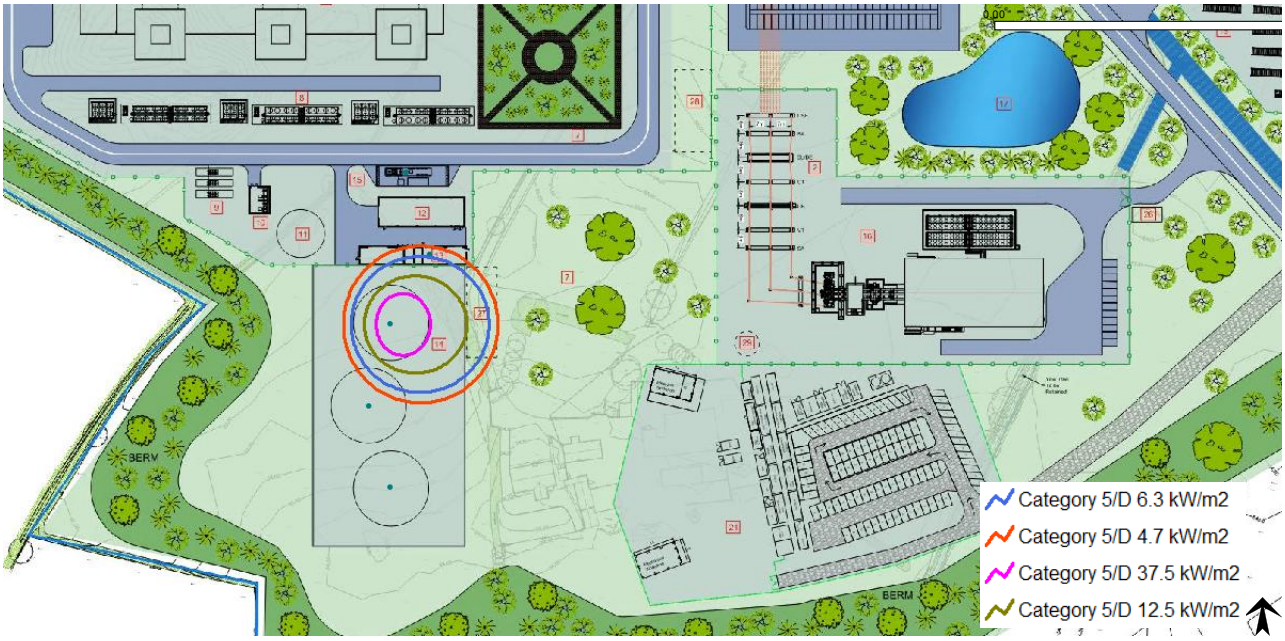


Figure 5-5: Contours for Pool Fire Radiation at category 5/D for Diesel Road Tanker Catastrophic Rupture in kW/m^2

Figure 5-6: Contours for Pool Fire Radiation at category 5/D for Diesel Transfer Pump Full Bore Rupture in kW/m²

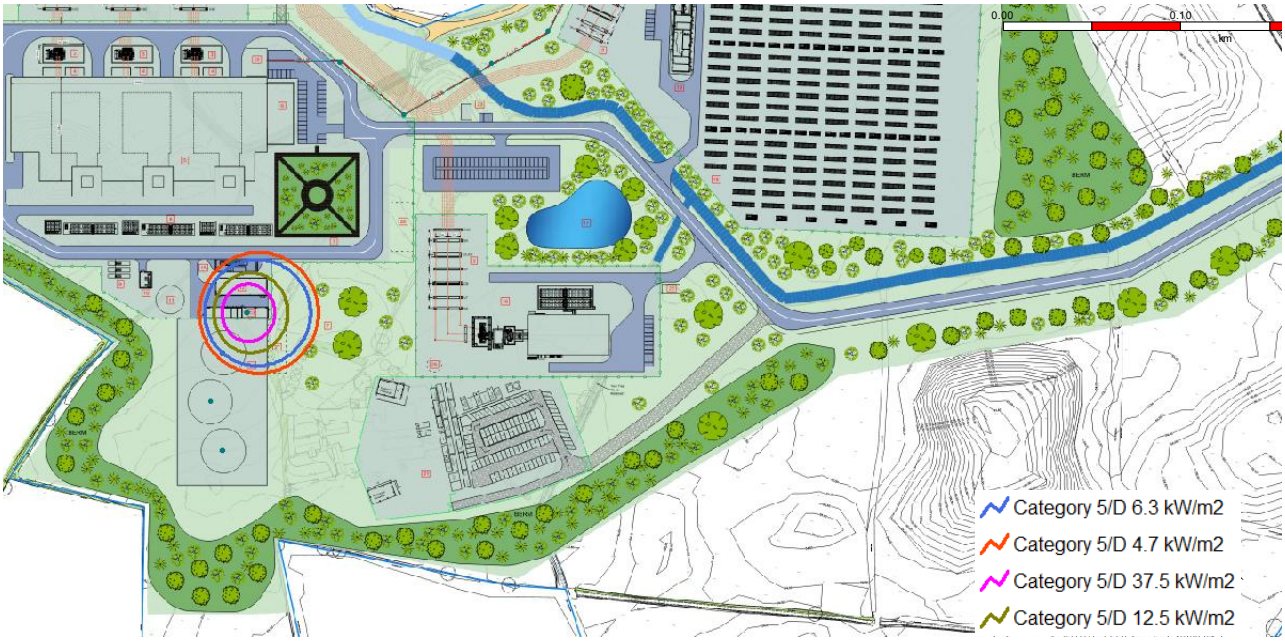
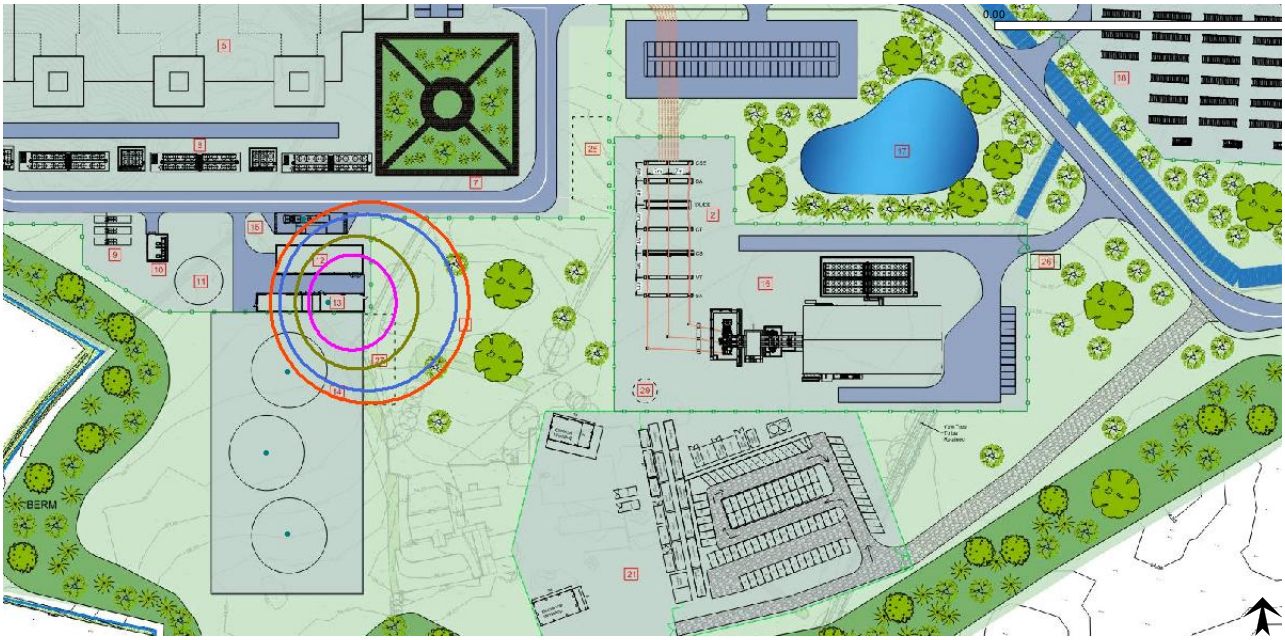


Figure 5-7: Contours for Pool Fire Radiation at category 5/D for Diesel Transfer Pump small 5mm hole leak in kW/m²



5.2 Jet Fire Thermal Radiation

The thermal radiation consequence contours representing all jet fires (irrespective of duration) are shown in Figure 5-8 and Figure 5-9. Jet fires form following ignition of a high momentum natural gas leak, assumed to occur at the facility AGI or on the buried gas pipeline. It can be seen from the shape of the contours that:

- The control room is located outside of all jet fire contours for the AGI.
- The control room is located outside of the long pipeline rupture's 37.5 kW/m^2 hazard frequency contours (corresponding to 100% chance of fatality for occupants for a portakabin style building) and outside the 12.5 kW/m^2 hazard frequency contours (corresponding to 25% chance of fatality for occupants for a portakabin style building). It is within the 6.3 kW/m^2 contour, but this only impairs escape routes and is unlikely to lead to fatalities.
- Security building lies within the 37.5 kW/m^2 contour of the long pipeline rupture and thus if any personnel are present during this event, there could be fatalities.
- There is potential for jet fires to escalate to the adjacent LDES compound, which could result in large fires within the system.

Figure 5-8: Contours for Jet Fire Radiation at category 5/D for Grid Connection AGI in kW/m^2

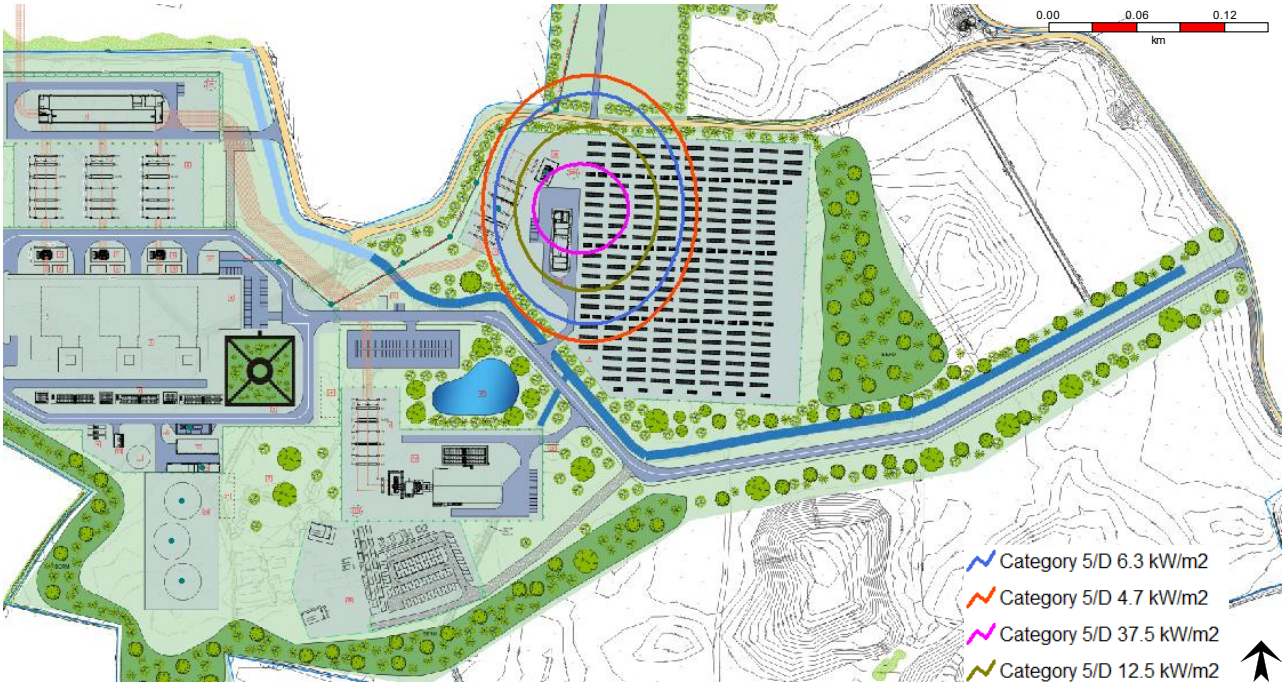
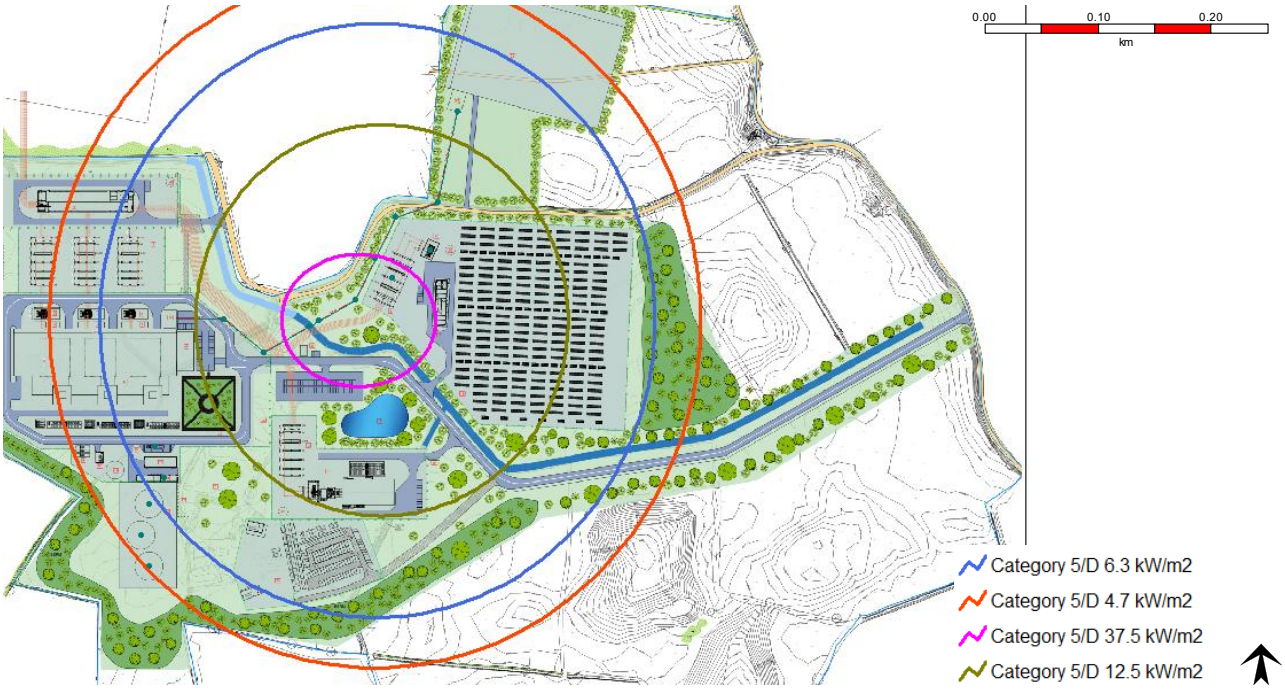


Figure 5-9: Contours for Jet Fire Radiation at category 5/D for Long Pipeline Full Bore in kW/m^2

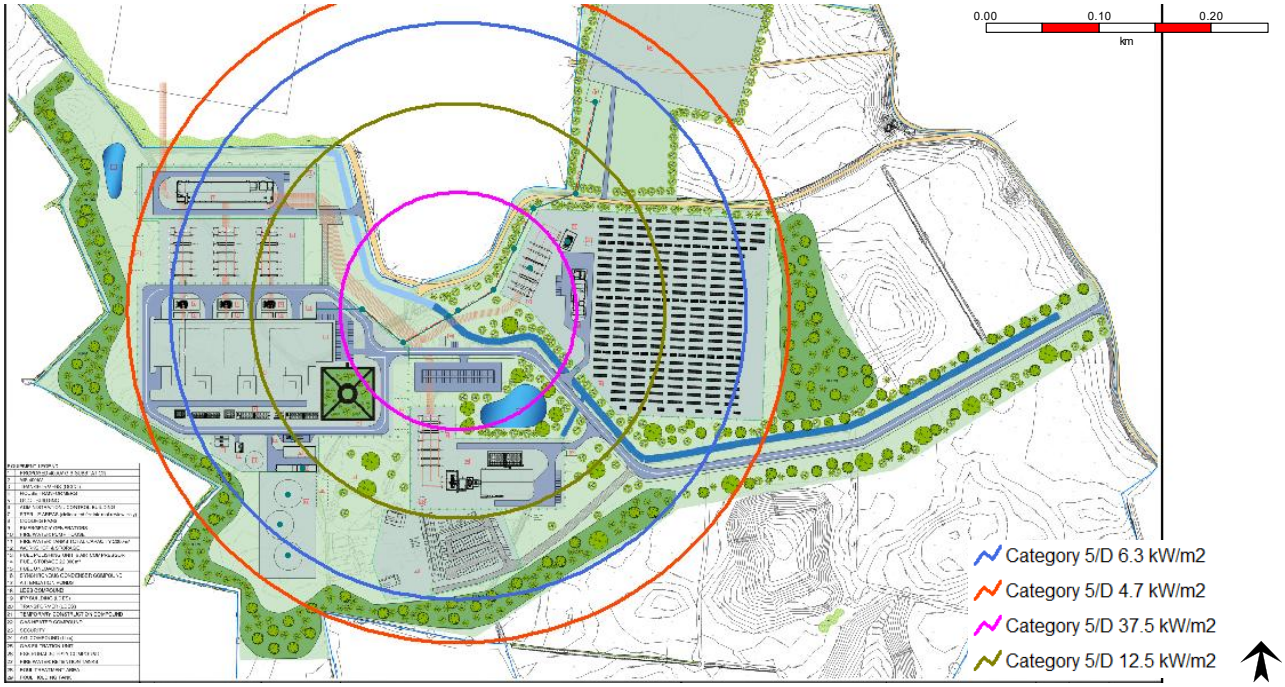


5.3 Fireball Thermal Radiation

The thermal radiation hazard frequency contours representing thermal loading from fireballs is shown in Figure 5-10. Fireballs are typically short duration events associated with catastrophic loss of containment. In the case of the buried pipeline, these are considered highly unlikely.

Security building lies within the 37.5 kW/m^2 and thus if any personnel are present during this event, there could be fatalities. The control room lies within the 12.5 kW/m^2 contour which does not lead to any causalities from fireballs

Figure 5-10: Contours for 5/D Fireball Radiations (kW/m^2) of long pipeline



5.4 Flash Fires

The vapour dispersion / flash fire to LFL hazard contours are shown in Figure 5-11 to Figure 5-16. These provide an indication of the flammable dispersion extents from the plant.

Flash fires associated with the fuel storage systems generally remain very localised, this is due to the fluid being a liquid at ambient temperature with a relatively high flash point. The flash fires associated with releases upstream of the AGI appear to have the potential to engulf the majority of the site within the 1/2LFL envelope, however the shape of the cloud is extremely thin, as shown in Figure 5-15, and the overall risk is consequently reduced.

Figure 5-11: Flash Fire at 5/D for both 3500 and 7000 ppm for catastrophic rupture of Diesel Storage Tank (northern)

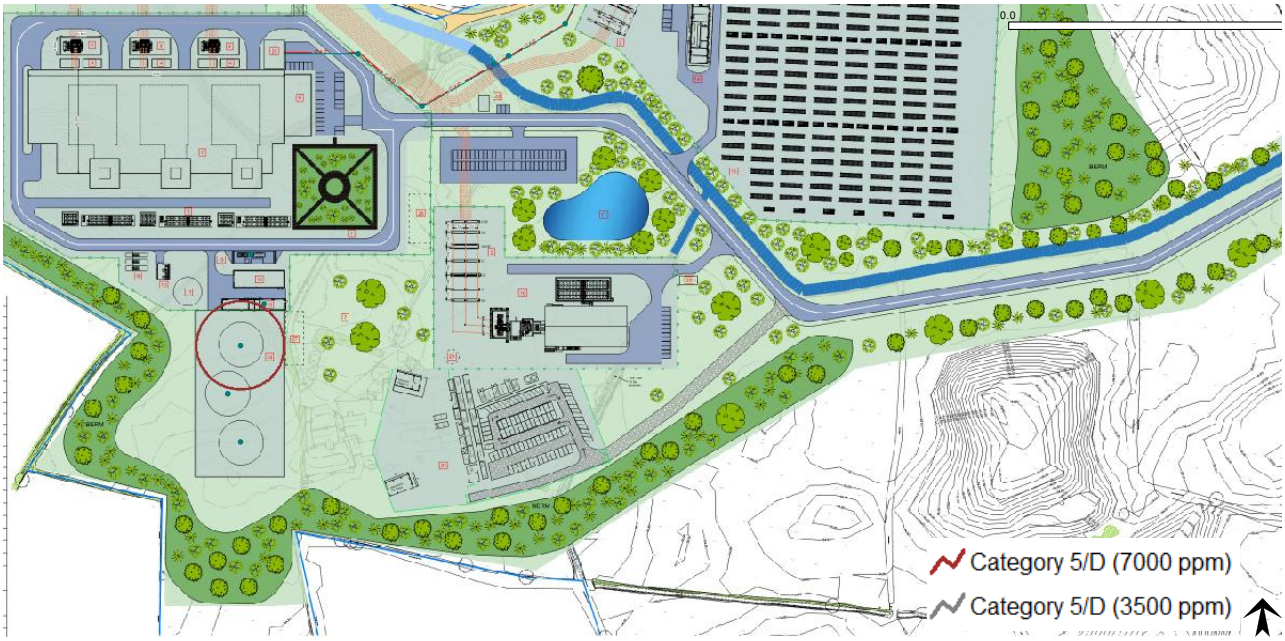


Figure 5-12: Flash Fire at 5/D for both 2500 and 5000 ppm for catastrophic rupture of Diesel Road Tanker

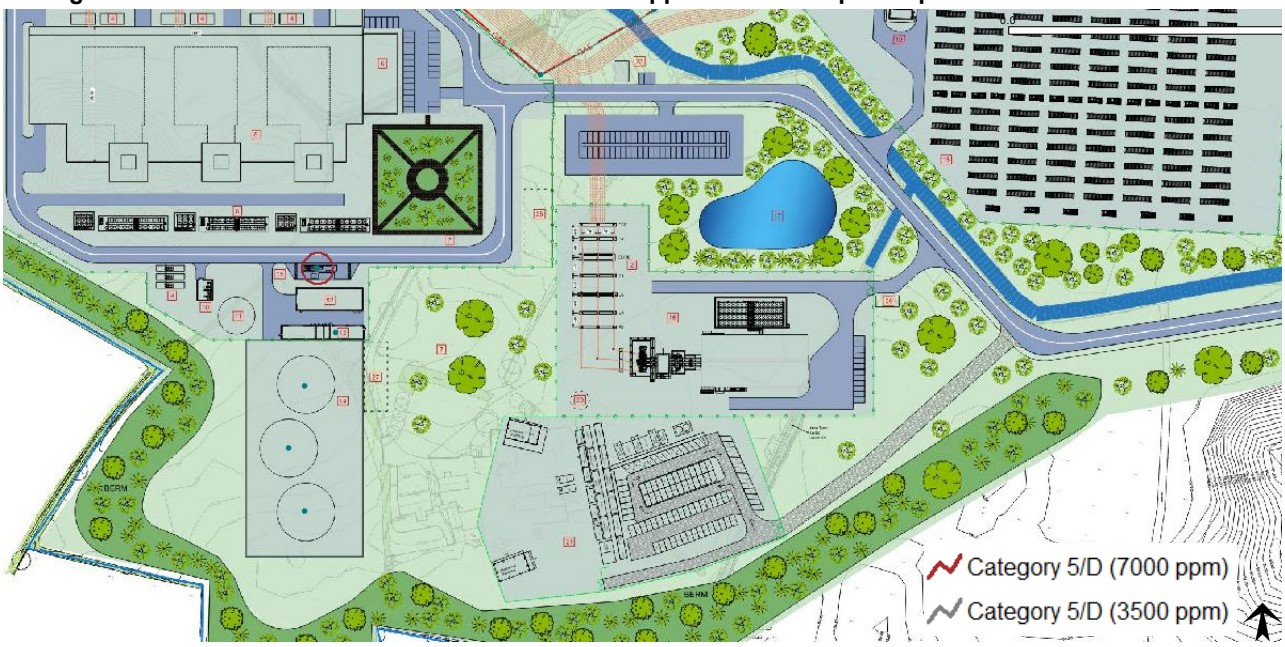


Figure 5-13: Flash Fire at 5/D for both 2500 and 5000 ppm for catastrophic rupture of Diesel Transfer Pump

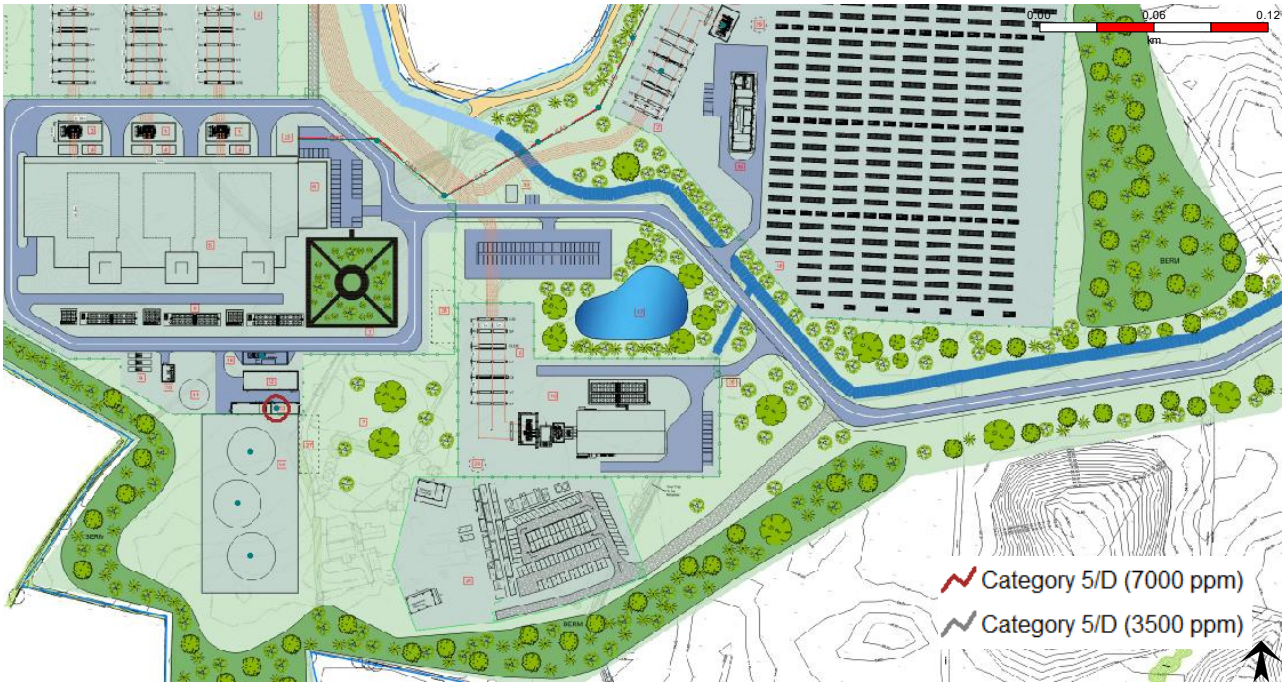


Figure 5-14: Flash Fire at 5/D for both 25000 and 50000 ppm for full bore (6 inch) of AGI grid connection

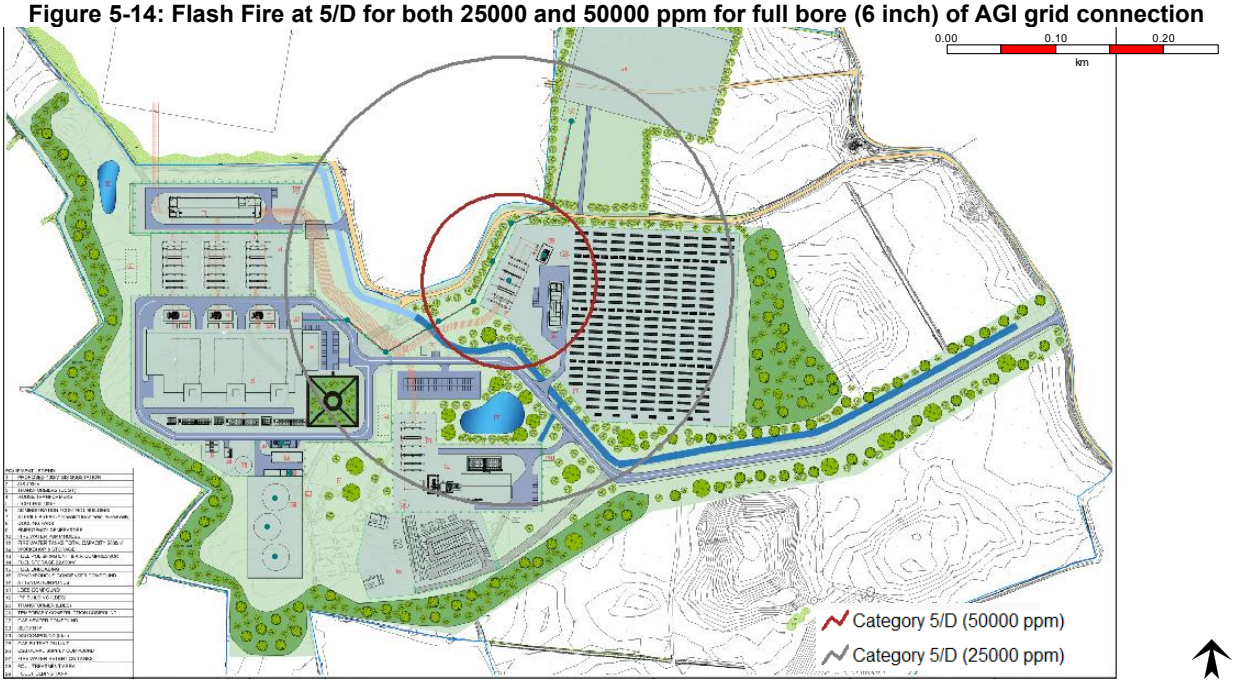
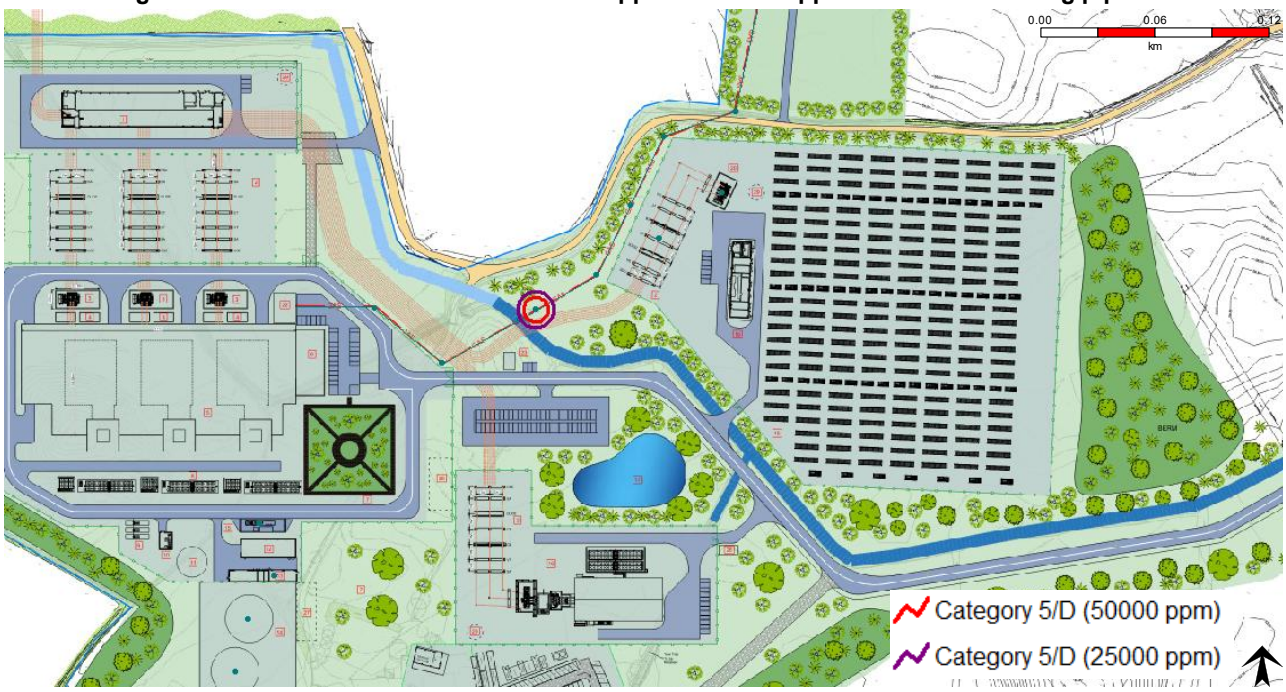


Figure 5-15: Shape of LFL and ½ LFL cloud shown for a release at the AGI.

Figure 5-16 Flash Fire at 5/D for both 25000ppm and 50000 ppm for full bore of long pipeline



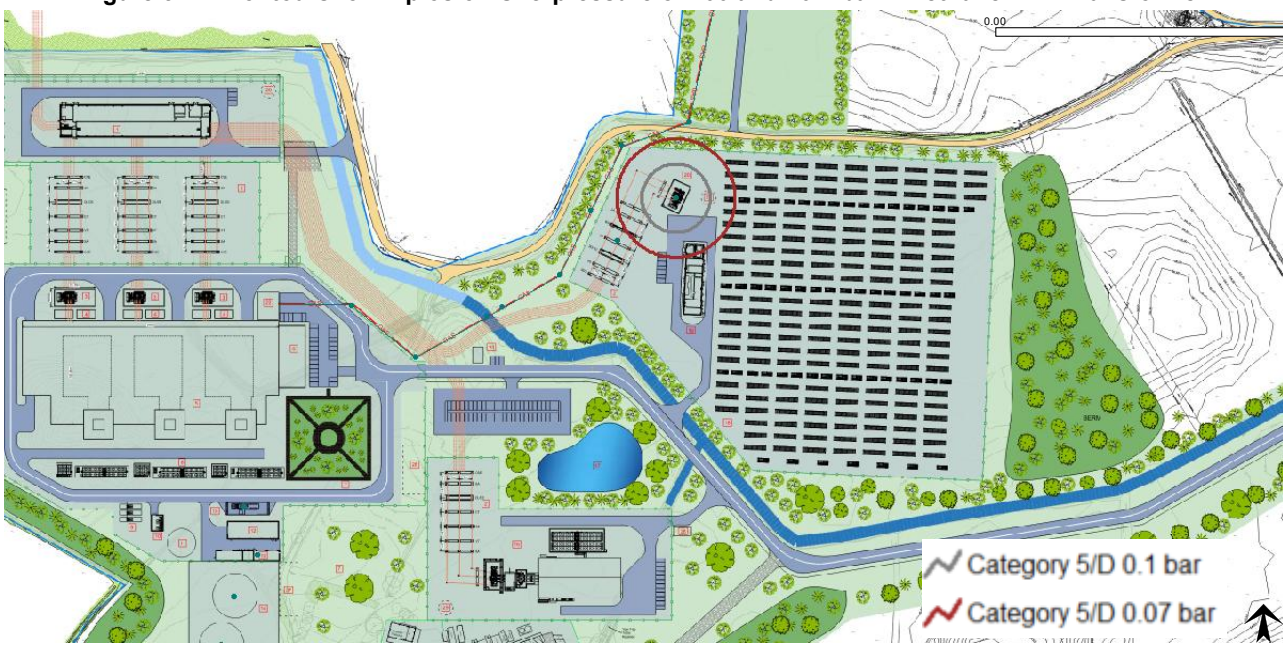
5.5 Explosion Overpressures

The explosion overpressure contours are shown in Figure 5-17 for overpressures of 0.1 bar and 0.07 bar.

The key observations from these contours are:

- The overpressure hazard contours remain localised to the transformer area, however the 0.07 bar contour does reach the IPP building, and there is therefore potential for damage to this building.

Figure 5-17: Contours for Explosion Overpressure of 100 and 70 mbar – Methane VCE Transformer



5.6 Long Duration Energy Storage (LDES) Battery System

Battery Energy Storage Systems (BESS) present significant safety risks through fire and explosion (thermal runaway). In case of the proposed development, the aggregate stored energy will likely exceed 1 GWh (assuming 400 MW with at least 5 hours of capacity); making it one of the largest installations under development globally.

Should a fire occur in one of the LDES battery containers, there is potential that the fire propagates through the entire system, which would have catastrophic consequences in terms of asset loss and potential risk to personnel and first responders. Proper fire management design should be followed during the design of the LDES system such that the potential for a fire to propagate from one container to the next is reduced to ALARP. It is likely that the LDES system will be of particular interest to regulators and insurers, and as such, DNV recommend specific risk assessment for the system when the design is sufficiently mature.

6 PRELIMINARY RISK ASSESSMENT

Given the early stage of this project, and the resulting lack of engineering design detail, a full quantitative risk assessment (QRA) cannot be undertaken. However, based on engineering judgement and experience of assessing other similar industrial facilities, DNV have conducted a preliminary risk assessment using the consequence results reported above to allow for prioritisation of risk as High, Medium and Low.

The following basis is taken for assessing the severity (S) of the modelled scenarios:

Table 6-1: Severity ranking categories.

Severity Category	Criteria
S5	Multiple Fatalities or one off-site fatality
S4	Multiple serious injuries or one fatality
S3	Serious (life altering) Injury
S2	Serious (non-life altering) injury
S1	Minor injury

The following basis is used for assessing the likelihood (L) of the modelled scenarios:

Table 6-2: Likelihood ranking categories.

Likelihood Category	Criteria
L5	Can occur multiple times per year
L4	Can occur once in a year
L3	Can occur once during the lifetime of the facility
L2	Potential to occur once in 100 years
L1	Unlikely to occur once in 100 years

And the following risk matrix is proposed to rank risks at this stage.

Figure 6-1: Proposed risk matrix

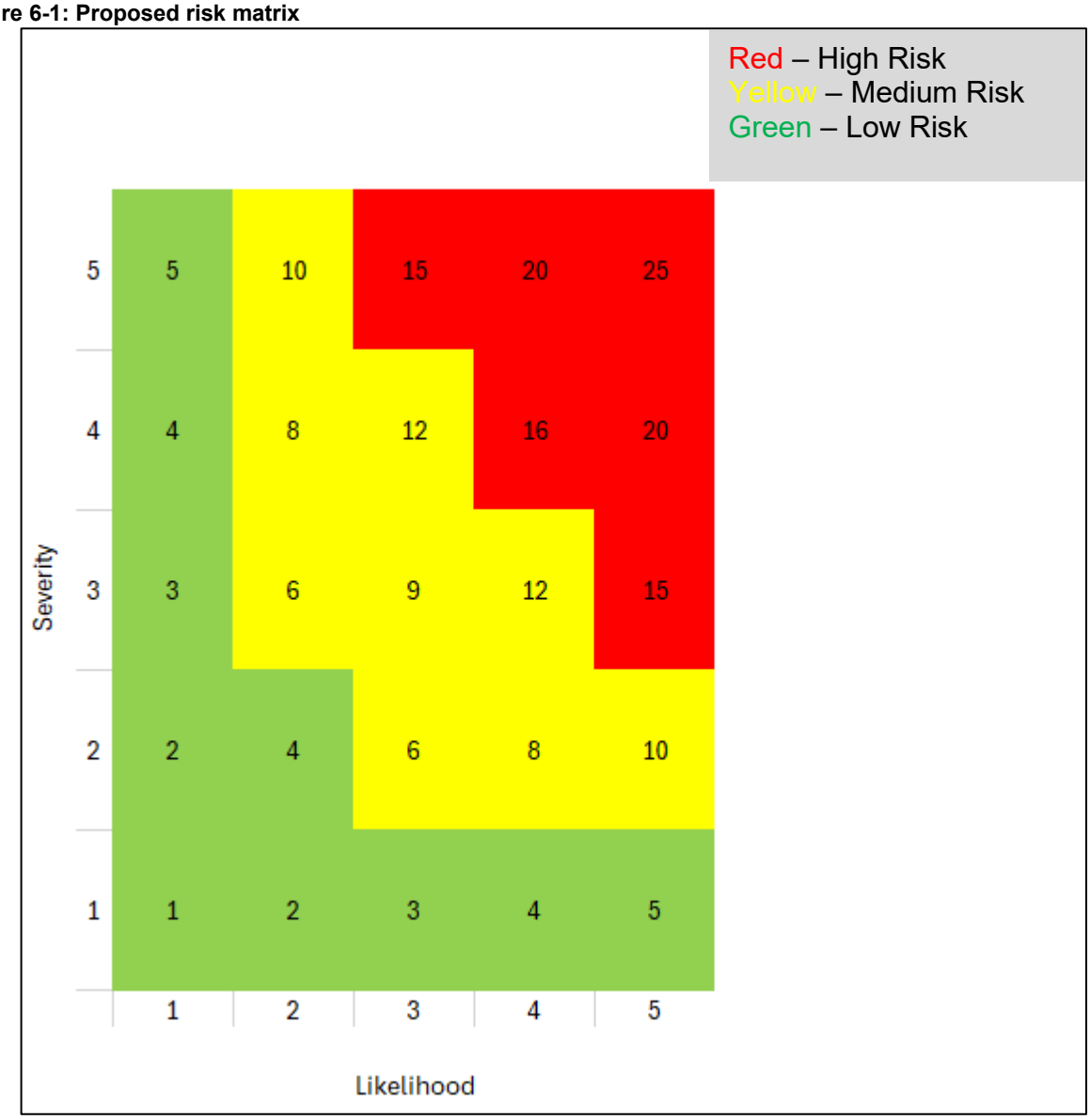


Table 6-3: Semi-quantitative risk assessment of modelled scenarios.

System	Scenario	Severity	Likelihood	Risk
Diesel Storage Tanks	Catastrophic rupture with pool fire	5	1	5
	Small leak with pool fire	3	2	6
Diesel Road Tanker	Catastrophic rupture with pool fire	5	1	5
	Small leak with pool fire	3	2	6
Diesel Transfer Pumps	Small leak with pool fire	3	2	6
	Full bore rupture with pool fire	3	1	3
Grid Connection AGI	Small leak with jet fire/flash fire/VCE	3	3	9
	Full bore rupture with jet fire/flash fire/VCE	5	2	10
Long Pipeline	Small leak with jet fire/flash fire/VCE	3	2	6
	Full bore rupture with jet fire/flash fire/VCE	5	2	10
VCE	Explosion	4	2	8
LDES Battery	Single container fire	4	3	12
	Multi-container fire	5	2	10

At this stage, no High risks have been identified. However, the facility operator will be required to demonstrate that all risks have been managed and that all reasonably practicable measures have been implemented to reduce the risk. The ALARP demonstration principle is a key feature of the Control of Major Accident Hazards (COMAH) regulations, and further risk assessments will be required as the design of the facility matures, such that the control of risk can be adequately demonstrated in accordance with the HSA guidance related risk tolerability Ref. /12/.

7 TLUP ASSESSMENT

"The Seveso-III Directive (2012/18/EU) requires that the objectives of preventing major accidents and limiting their consequences should be taken into account in land use policy. As implemented by the COMAH Regulations 2015, the objectives are to be achieved through controls on:

- the siting and development of new establishments,
- modifications to existing establishments,
- development in the vicinity of establishments" (Ref. /13/).

To ensure that the requirements of the Seveso-III Directive (2012/18/EU) are met, the Health and Safety Authority (HSA) developed a risk-based TLUP advice methodology to be used for TLUP advice required by the Seveso Directive, and for development of LUP zones around COMAH (Seveso) establishments.

Therefore, Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/) provides a consistent methodology that can be followed to demonstrate that risks are at an acceptable level for a new COMAH site. This Section details that demonstration.

7.1 LUP Risk Criteria

7.1.1 Individual Risk

Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/) sets out two criteria for new establishments:

- A maximum tolerable risk of fatality to a member of the public of 1 x 10^{-6} per year.
- A maximum tolerable risk of fatality to a person at an offsite work location of 5 x10^{-6} per year.

Further to these criteria, consultation distances (CD) around establishments, that correspond to three zones of risk are also defined:

- Zone 1 – risk of fatality for inner zone of 1 x10^{-5} per year.
- Zone 2 – risk of fatality of middle zone of 1 x10^{-6} per year.
- Zone 3 – risk of fatality of outer zone of 1 x10^{-7} per year.

Associated with these zones are then four levels of development, which have an increasing sensitivity to major hazards as follows:

- Level 1 – Workplaces and car parks, e.g. offices, factories, farm buildings, builder's yards, etc.
- Level 2 – Developments for use by the general public e.g. housing, hotels, restaurants, roads, etc.
- Level 3 – Developments for use by vulnerable people e.g. hospitals, schools, nursing homes, sheltered housing, etc.
- Level 4 – very large and/or sensitive developments e.g. very large development of the above examples, sports stadiums, arenas, etc.

These zones and levels are then combined (Table 7-1) to determine whether the Competent Authority 'Advises Against (AA)' or 'Does Not Advise Against (DAA)' an establishment.

Table 7-1: TLUP Advice for Each Zone

	Zone 1	Zone 2	Zone 3
Level 1	DAA	DAA	DAA
Level 2	AA	DAA	DAA
Level 3	AA	AA	DAA
Level 4	AA	AA	AA

7.1.2 Societal Risk

Societal risk is the relationship between frequency and the number of people from a given population who may be affected (to a specified level of harm) by major accidents from specified hazards. It is used to demonstrate the potential for certain, rare major hazard events to affect large numbers of people and can be used to target different types of risk reduction measures.

Both the individual and societal risk criteria must be satisfied when considering a new development. If the individual risk criterion is met, then the societal risk level has to be considered. Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/) provides the criteria for societal risk as follows:

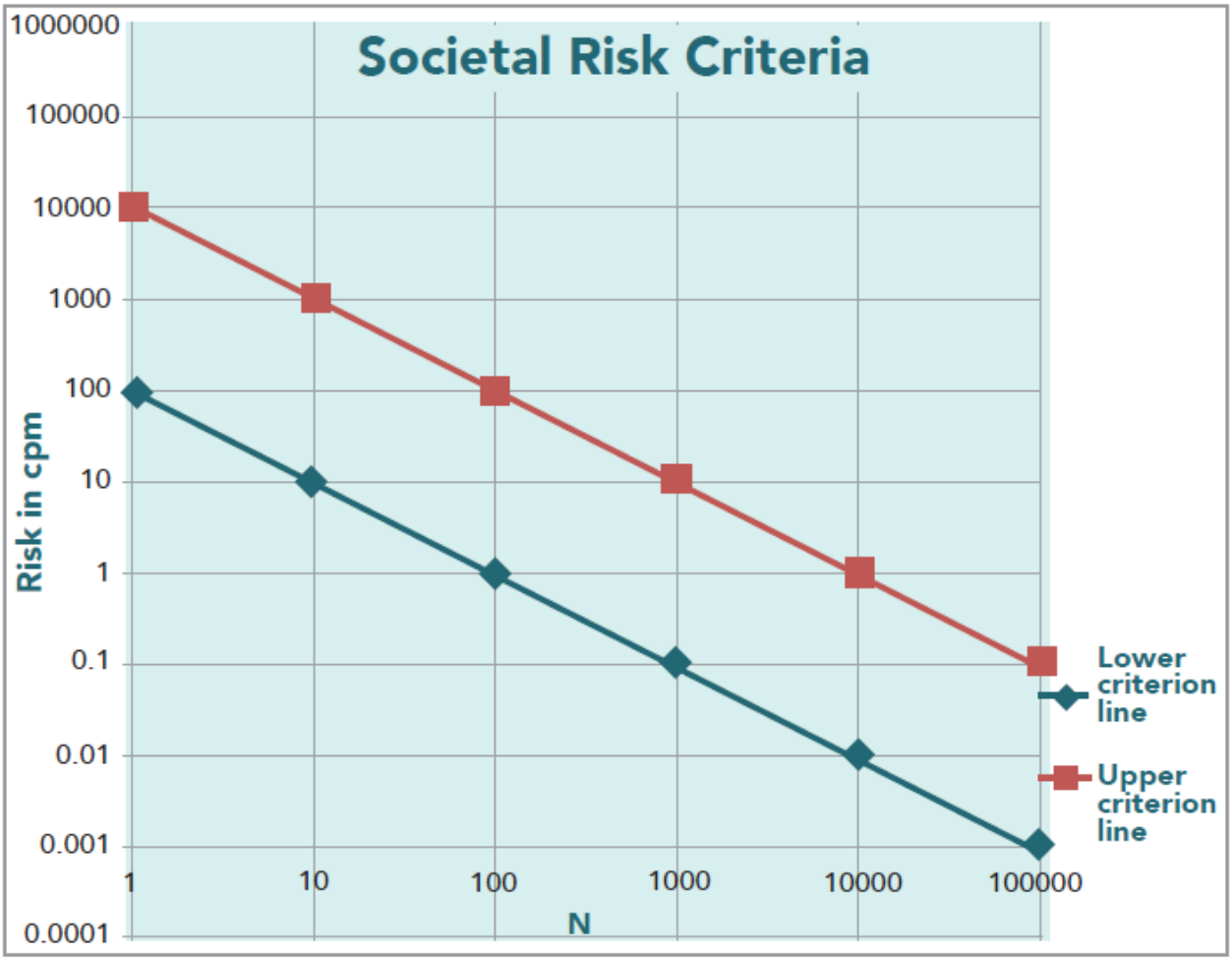


Figure 7-1: Societal Risk Criteria (Ref. /13/)

7.2 Vulnerability Criteria

Vulnerability criteria based on established literature and engineering good practice are already defined in Section 4.4. However, in some instances these do not correspond to those used within the Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/). Therefore, to ensure alignment with the guidance, the vulnerabilities stated within this section were used for the TLUP Assessment.

Table 7-2: TLUP Vulnerability Criteria

Hazard	Effect Threshold (model ≥ threshold)	Fatality Probability		Notes
		Outdoor	Indoor	
Flash fire	LFL	100%	10%	
Jet and Pool fire	8.02 kW/m^2	1%	0%[1]	1. People are assumed to be protected, and therefore there is a 0% fatality probability for radiative heat flux below 12.7 kW/m^2. 2. People are assumed to have escaped outdoors, and therefore have a risk of fatality corresponding to that of people outdoors for radiative hat flux below 25.6 kW/m^2
	10.09 kW/m^2	10%	0%[1]	
	15.9 kW/m^2	50%	50%[2]	
	25.6 kW/m^2	N/A	100%	
Fireball	N//A			Due to the dominating effects of fireballs, it is used exclusively in determining BLEVE effects for TLUP. No BLEVEs are considered within this TLUP assessment.
Explosion overpressure (side-on)	0.07 bar	N/A	2%	Indoors from IOGP /11/ based on a Category 3 Building in Chemical Industries Association (CIA) guidance. Category 3 building used as conservative estimate.
	0.14 bar	N/A	8%	
	0.168	1%	N/A	
	0.35 bar	N/A	55%	
	0.365	0.1	N/A	
	0.5 bar	N/A	65%	
	0.942	0.5	N/A	
Toxicity	N/A			No toxic components have been identified for this TLUP Assessment
Risk to Buildings				

7.3 Model Assumptions

In addition to the vulnerability criteria, other modelling assumptions were also adjusted to ensure alignment with the Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/).

Table 7-3: Parameters Used in TLUP Assessment

Parameter	Value	Notes
Software version	V9.0	Same version as consequence model
Height of interest	1 m	Population is assumed to be located at ground level with a receptor height of 1 m (equal to release height); this applies to the whole population identified for the study.
Default leak direction for above-ground releases	Horizontal impinged	Releases from any containerised equipment are considered as impinged. Modelling all releases as horizontal is somewhat conservative, however is typical practice for QRA studies.
Default release elevation	1.5 m	Typical standard value representing 'head height'
Surface Type	Concrete	
Surface Roughness	100 mm	Chosen as conservative approach
Flammable averaging time	18.75 sec	Phast default value for flammable dispersion.
Flammable vapour cloud extent allowing ignition	Lower Flammability Limit (LFL)	Effects are calculated at effect height rather than the default cloud centreline height (affects buoyant cloud delayed ignition risk)
Wind Direction Probability	See	Derived from simulated wind data for Coolpowra (Ref. /17/).
Wind Speeds	2m/s 5m/s	
Ambient temperature	15°C for 5D weather conditions 10°C for 2F weather conditions	
Fraction of Time indoors	90%	
Domino effects	-	No domino effects to neighbouring sites, or between the diesel inventory and natural gas line have been identified for this TLUP Assessment. However, it is deemed possible for a domino impact from a tanker pool fire resulting in escalation to the northern diesel storage tank.
Maximum Pool Size	100m	
Surface Emissive Power	Methane – 265 kW/m^2 Diesel – 140 kW/m^2	Note that Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/) sates 130 kW/m^2 for diesel, therefore the 140 kW/m^2 is seen a more conservative. All pool fire s are modelled using a two-zone model to determine an average surface emitted flux based on the fluxes from the lower and upper layer of the pool fire.

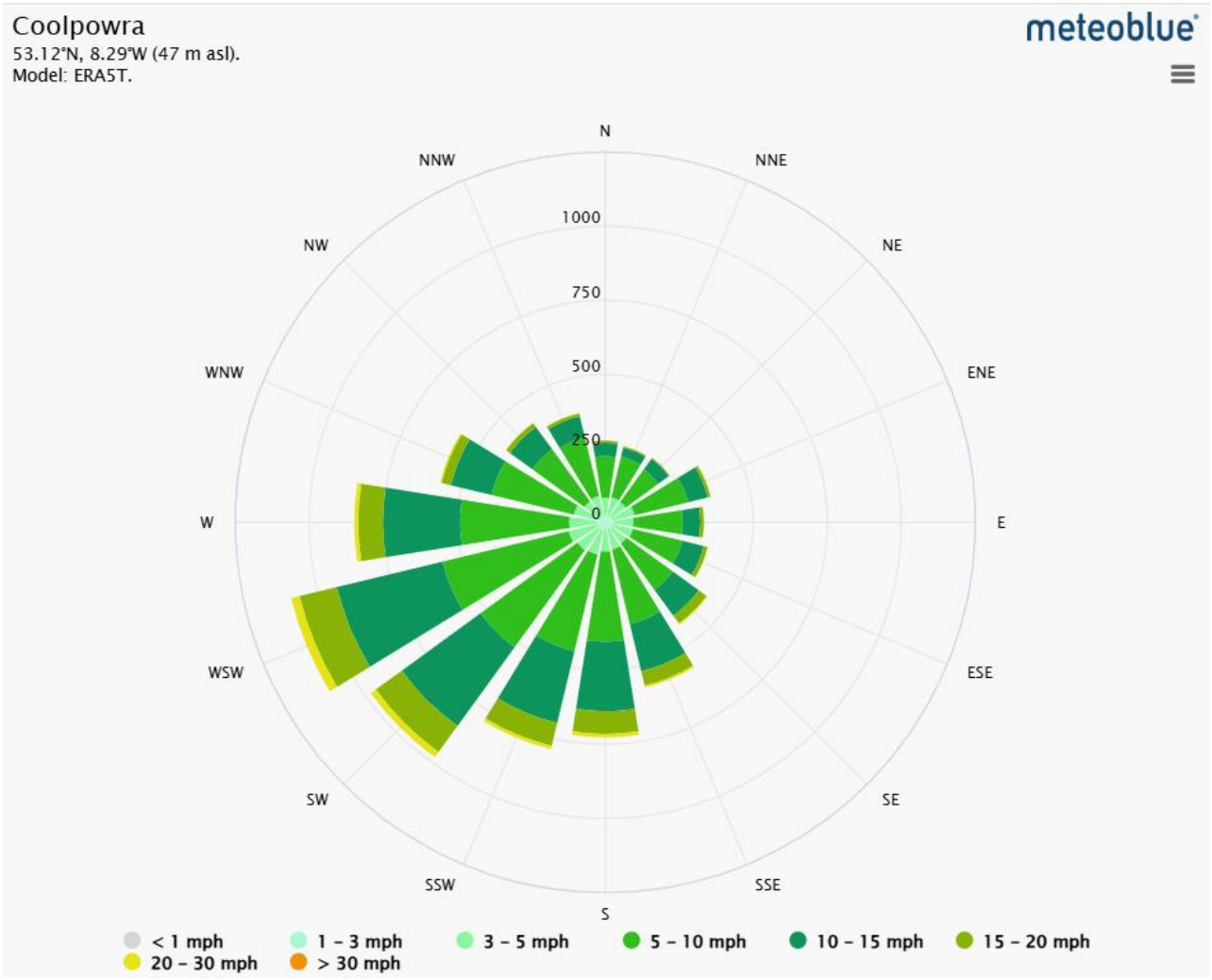


Figure 7-2: Coolpowra Wind Rose (Ref. /17/).

7.4 Failure Cases and Frequency Analysis

Section 4.2 describes the normal operating conditions for each failure case that has been assumed, namely pressure, temperature, and operating flowrate. These conditions remain valid for the TLUP assessment with the exception of temperature which has been adjusted as per Table 7-3.

A range of representative leak sizes has been modelled as shown in Table 4-3. Again, to ensure alignment with the Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/) these have been adjusted as follows:

Table 7-4 Failure Cases, Leak sizes and Event Frequencies

Vessel/Equipment	Leak Size/LOC Scenario	Event Frequency (per year)	Consequence	Consequence Frequency (per year)	Notes
Diesel Storage Tanks	Instantaneous Failure / Catastrophic rupture	5×10^{-6}	Pool Fire	5×10^{-8}	Diesel is classified as a Category 3 substance and any credible spill will remain on-site, however Pool Fires have conservatively been included in the TLUP assessment. Frequencies are as per a category 2 liquid – Table 48 (Ref. /13/)
	Failure over 10 minutes	5×10^{-6}	Pool Fire	5×10^{-8}	
	10 mm pipe leak over 30 minutes	1×10^{-4}	Pool Fire	1×10^{-6}	
	Domino Event – Tanker pool fire	5.8×10^{-8}			This frequency is applied to all Diesel storage tank consequences frequencies
Diesel Road Tanker	Instantaneous Failure / Catastrophic rupture	1×10^{-5}	Pool Fire	1×10^{-7}	Diesel is classified as a Category 3 substance and any credible spill will remain on-site, however Pool Fires have conservatively been included in the TLUP assessment. Frequencies are as per a category 2 liquid – Tables 51 and 52 (Ref. /13/) A 24-hour a day operation has conservatively been assumed for the TLUP assessment
	Leak from largest connection	5×10^{-7}	Pool Fire	5×10^{-9}	
	Rupture of loading/unloading hose	3×10^{-8} (per hour)	Pool Fire	3×10^{-10} (per hour)	
	Leak of loading/unloading hose	3×10^{-7} (per hour)	Pool Fire	3×10^{-9} (per hour)	
Grid Connection AGI	Above ground Pipeline Rupture	1×10^{-7} (per metre)	Jet Fire/Fireball	1×10^{-8} (per metre)	Frequencies for an above ground pipeline with diameter greater than 150mm. Total pipeline length on the site is 381m. Probability of consequences determined as per table 42 (Ref. /13/).
			Flash Fire	3.6×10^{-8} (per metre)	
			Explosion	5.4×10^{-8} (per metre)	
Grid Connection AGI	Above ground Pipeline Leak	5×10^{-7} (per metre)	Jet Fire/Fireball	5×10^{-8} (per metre)	
			Flash Fire	1.8×10^{-7} (per metre)	
			Explosion	2.7×10^{-7} (per metre)	
Gas Pipeline	Below ground Pipeline Rupture	1×10^{-8} (per metre)	Jet Fire/Fireball	1×10^{-9} (per metre)	Frequencies for a below ground pipeline with diameter greater than 150mm. Total pipeline length on the site is 381m. Probability of consequences determined as per table 42 (Ref. /13/).
			Flash Fire	3.6×10^{-9} (per metre)	
			Explosion	5.4×10^{-9} (per metre)	
Gas Pipeline	Below ground Pipeline Leak	5×10^{-8} (per metre)	Jet Fire/Fireball	5×10^{-9} (per metre)	
			Flash Fire	1.8×10^{-8} (per metre)	
			Explosion	2.7×10^{-8} (per metre)	

A single representative leak location is defined per failure case, based on the plot plans and information provided. The gas pipeline was modelled as an extended line source with potential leak locations along the pipeline length.

The diesel transfer pumps have been excluded from the TLUP assessment as no data is available for their assessment within the Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/). Based on the results of the original

consequence assessment, it is not anticipated that events associated with the Diesel Transfer Pumps would noticeably alter the determined LUP zones, and results in Section 7.5

7.5 TLUP Assessment Results

This section details the risk results and extent of LUP zones. The detailed consequences to the thresholds specified in by Section 2 of the Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/) are presented in Appendix F.

7.5.1 Individual Risk

Figure 7-3 shows the calculated LUP Zone risk contours for the development. No contours are expected to impact on local populations. Both the following criteria are not foreseen to be exceeded.

- maximum tolerable risk of fatality to a member of the public of 1 x 10^{-6} per year, and
- maximum tolerable risk of fatality to a person at an offsite work location of 5 x10^{-6} per year.

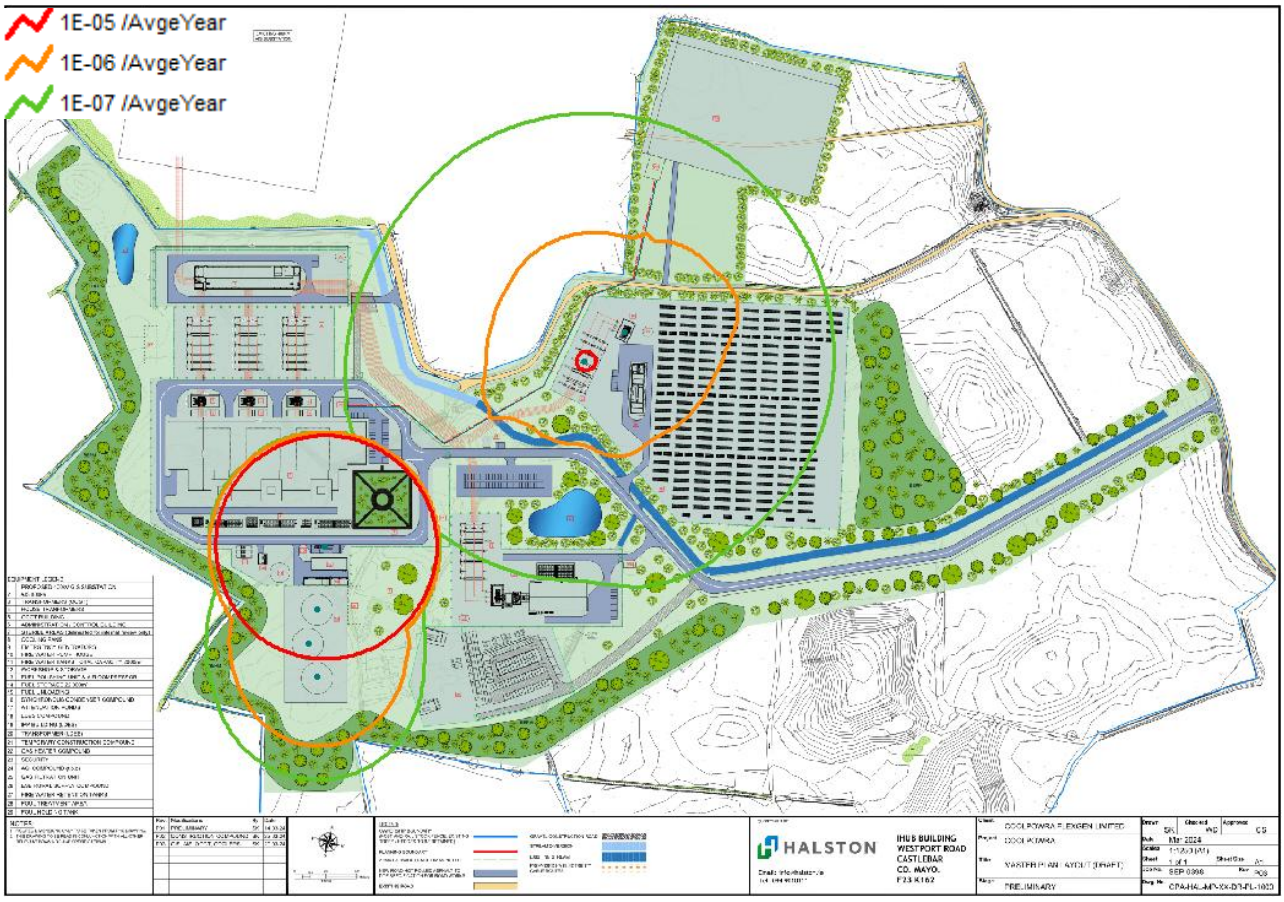


Figure 7-3: LUP Zones

Consultation distances (CD) around establishment, that correspond to three zones of risk are also defined:

- Zone 1 – risk of fatality for inner zone of 1 x10^{-5} per year does not extend beyond the site boundary and is centred around the pipeline AGI and the tanker loading area.
- Zone 2 – risk of fatality of middle zone of 1 x10^{-6} per year extends beyond the site boundary in the vicinity of the pipeline AGI, however it is unlikely to impact on local populations.
- Zone 3 – risk of fatality of outer zone of 1 x10^{-7} per year extends beyond the site boundary in the vicinity of the pipeline AGI and the diesel storage area, however unlikely to impact on local populations.

No Level 1, 2, 3 or 4 developments are located within the contours.

7.5.1.1 One in a Billion Chance of Fatality

When establishing new CDs, the Guidance on Technical Land-Use Planning Advice Version 2 (Ref. /13/) also requires the 1 x 10^{-9} (1 in a billion) fatality risk contour to be determined. This is presented in Figure 7-4 and shows that no offsite populations, nor the neighbouring existing substation are within the contour.

As no there are no buildings or sites within the 1 x 10^{-9} contour, no analysis to the impact on offsite buildings or structures has been deemed necessary as part of the TLUP assessment.

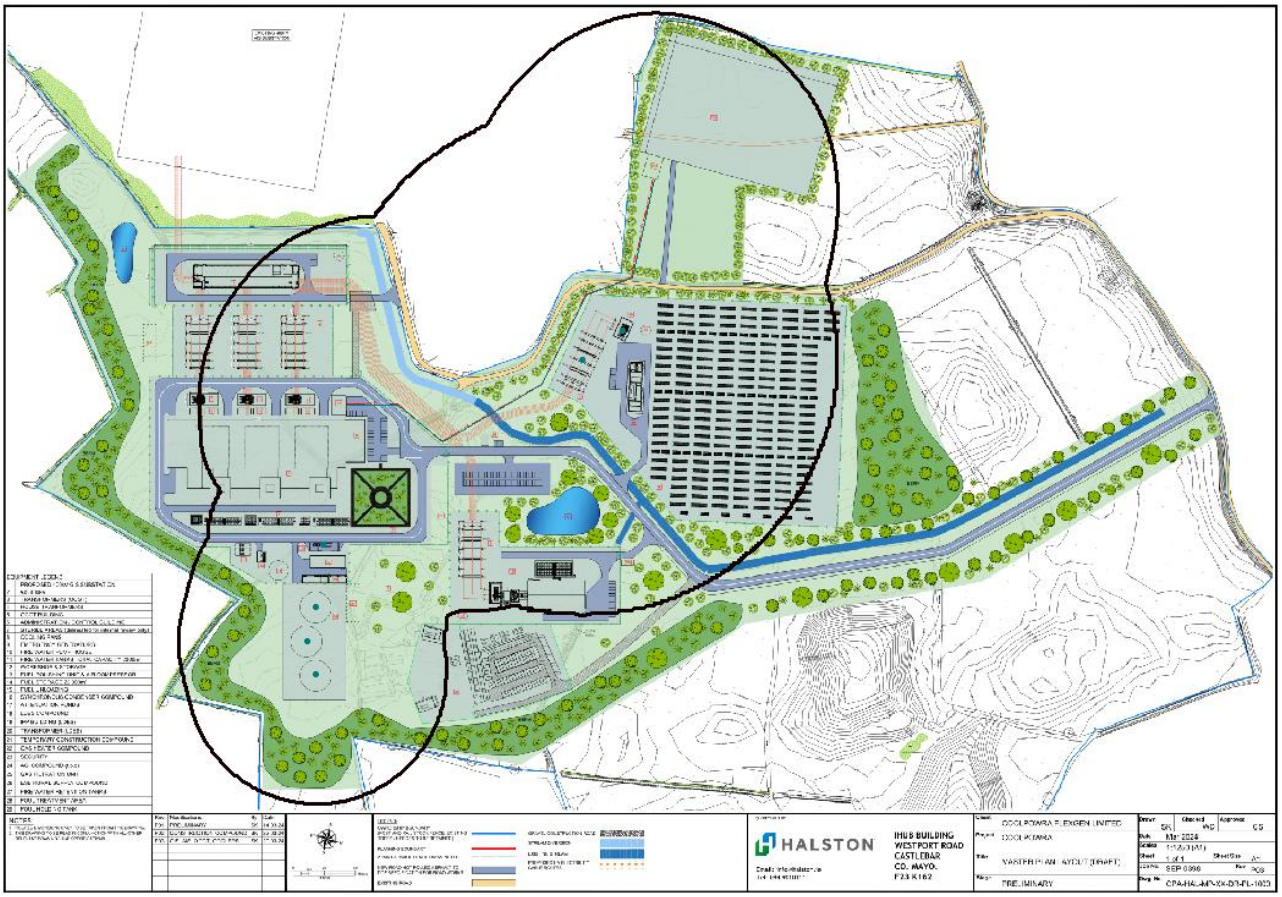


Figure 7-4: One in a Billion Chance of Fatality Contour

7.5.2 Societal Risk

The Societal Risk was determined based on census data for the local area (Ref. /16/), using an onsite population of 20 that is equally distributed around the site and offsite population of 52 people per km^2. No individual dwellings or populations were noted within the immediate vicinity of the development.

The FN Curve for the establishment is presented in Figure 7-5. This includes risk to all populations identified on and off-site. This chart highlights no intolerable risks, with fatalities of 1 to 2 onsite personnel being within the tolerable if ALARP regions. Fatalities of 3 or more onsite personnel is within the broadly acceptable region. No offsite fatalities are anticipated.

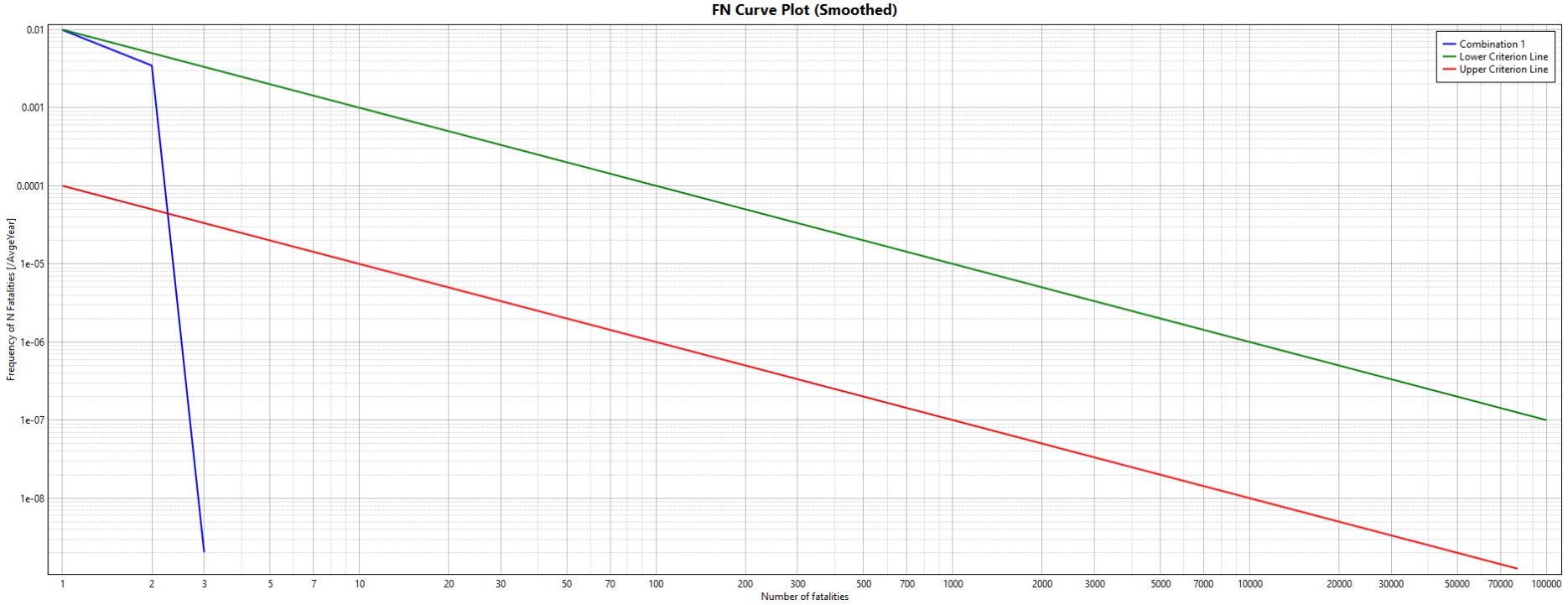


Figure 7-5: Societal Risk FN Curve

7.6 Environmental TLUP Assessment

In the context of LUP, the prevention of Major Accidents to the Environment (MATTEs) is the primary objective and it is expected that accident pathways will be prevented. The assessment of major accidents to the environment focuses on the specific risks to sensitive receptors within the local environment, the extent of consequences to such receptors and the ability of such receptors to recover.

For new establishments, the focus is on the removal of accident pathways to receptors (i.e. through the use of additional technical measures: e.g. appropriate containment, within the confines of current good practice and ALARP, etc.). To support the demonstration that the accident pathway to receptors has been adequately removed, an Environmental Risk Assessment (Ref. /14/) has been conducted in accordance with risk-based approach developed by the Chemical and Downstream Oil Industries Forum (CDOIF) (Ref. /15/).

The potential MATTE identified to the site is a Catastrophic failure of a diesel tank which reaches the Kilcrow River (MATTE Type B). The ERA demonstrates that the risk levels for the development are below the risk criteria for new COMAH establishments in relation to MATTEs:

Table 7-5: Broadly Acceptable Levels for MATTEs

MATTE Type	Broadly Acceptable Risk Less than
A	1.0 x10^{-4} per year
B	1.0 x10^{-5} per year
C	1.0 x10^{-6} per year
D	1.0 x10^{-7} per year

The calculated risk for a Catastrophic failure of a diesel tank which reaches the Kilcrow River is 1.65 x10^{-7} per year.

The development aims to prevent such events from occurring through the use of an appropriate diesel storage tank designed in accordance with all relevant codes and standards, and a dedicated bund with capacity of 150% of a single tank. The bund is also fitted with level monitoring. There is a wastewater retention tank designed to collect any diesel not contained within the bund (i.e. due to bund failure/leak). An oil/water interceptor will also be installed to prevent any diesel entering an attenuation pond.

The ERA (Ref. /14/) demonstrates that appropriate measures are in place to prevent a MATTE and reduce the risk to 'Broadly Acceptable' levels, as such double containment tanks are not required and any benefit gained would be grossly disproportionate to the cost. As the bund contains at least 110% of a single tank's contents overtopping of the bund is not deemed a credible event to cause a MATTE.

8 CONCLUSIONS & RECOMMENDATIONS

8.1 Conclusions

8.1.1 Consequence Model

The consequences derived have been both for small 5 mm releases and full bore/catastrophic releases. Despite there being no notable consequences for any small leaks except for the firewater tank locations.

The following conclusions are made from this study:

- **Risk**: All facility risks are, at this point in time, considered tolerable if ALARP. Halston Lumcloom energy will be required to demonstrate that all risks have been controlled as low as reasonably practicable before the facility can be operational.
- **Pool Fire Radiation:** In the event of a catastrophic rupture of a diesel road tanker resulting in a pool fire, the thermal radiation intensity is at levels sufficient to cause multiple fatalities at the administration/control building. Furthermore, there is potential for fuel tank pool fires to escalate to the adjacent tanks, or to cause catastrophic damage to the fire water tanks.
- **Jet Fires:** There is potential for the 37.5 kW/m^2 contours to extend across a large section of the facility, which suggests that there is potential for escalation due to jet fires associated with the natural gas system on-site. There is also potential for personnel situated outside (e.g. walking between areas of the site) to be fatally injured from natural gas jet fires. There is also potential for escalation of jet fires originating in the AGI or on-site pipeline to the LDES compound.
- **Fireballs:** The hazard contours associated with fireballs are relatively large, however these are short lived events and therefore do not contribute greatly to escalation, and the likelihood of a fireball has been deemed improbably over the lifetime of the facility.
- **Flash Fires:** Flash fires can have far reaching effects, as seen in Figure 5-14, however Figure 5-15 provides an indication as to the shape of the flammable cloud which can be seen to be much smaller than the entire cloud envelope. However, the ½ LFL cloud can impact the majority of the site such that any muster points could be considered compromised.
- **LDES System:** The safety risk posed by LDES systems must not be underestimated, and there is potential for very large fires should propagation between containers occur. Should an LDES fire be contained to a single container (as should be the case for properly designed systems), there is potential for localised asset damage and safety risk to first responders.
- **Off-site impacts:** Natural gas and fuel oil consequence modelling has highlighted no particular concerns to third-party buildings or properties outside of the site boundary. In the unlikely event that a large-scale LDES compound fire occurs, with the fire propagating across multiple containers, there is potential for off-site impacts from smoke and evolved gases.

8.1.2 TLUP Assessment

- No LUP Zone contours are expected to impact on local populations. Both the
    - maximum tolerable risk of fatality to a member of the public of 1 x 10^{-6} per year, and
    - maximum tolerable risk of fatality to a person at an offsite work location of 5 x10^{-6} per year.

  is not foreseen to be exceeded.
- No Level 1, 2, 3 or 4 developments are located within the contours.
- No offsite populations, nor the neighbouring existing substation are within the 1 x 10^{-9} contour.

- The development aims to prevent MATTEs due to a loss of containment of diesel through the use of an appropriate diesel storage tank designed in accordance with all relevant codes and standards, a dedicated bund with a minimum capacity of 110% of a single tank, and a wastewater retention tank with oil/water interceptors which would collect any diesel not contained within the bund (i.e. due to bund failure/leak).
- The ERA (Ref. /14/) demonstrates that appropriate measures are in place to prevent a MATTE and reduce the risk to 'Broadly Acceptable' levels.

8.2 Recommendations

The following recommendations are made:

1. Consider fire protection strategies for the tanker unloading and fuel oil storage areas, which could include separate bunds for each storage tank, and deluge (sprinkler) systems, and/or foam application on confirmation of a fire. Also consider relocation of the fire water tanks to a location away from all flammable inventories to ensure they are not impacted by fire events.
2. There is currently potential for occupied buildings (security and administration/control building) to be within the 37.5 kW/m^2 hazard ranges associated with jet fires and pool fires. If possible, Halston Lumcloom should consider relocating these buildings to an area outside all hazard contours – which would be considered an inherently safe solution.
3. Ensure any muster points are located outside of the ½ LFL clouds, as shown in Section 5.4.
4. If possible, the spacing between the natural gas-containing systems and the LDES compound should be increased to reduce the likelihood of a natural gas jet fire escalating to a large-scale battery fire, which could potentially have off-site impacts.
5. Undertake further risk assessments in later design stages and review the input data and assumptions. This should primarily address any uncertainties or assumptions in process information, as these will be more accurately defined as the design progresses. Particular attention should be given to fire and explosion risk within the LDES compound - ensuring that all applicable design standards have been followed to minimise the risk associated with stored electrical energy.

Note, these recommendations aim to further reduce any risk associated with Project Coolpowra, however other risk reduction measures may be deemed more appropriate as the design develops.

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APPENDIX A
Flammable Dispersion Results

Scenario	Weather	Hole size (mm)	Distance to LFL fraction (m)	Distance to LFL (m)
Diesel Storage (central) - Catastrophic rupture	Category 1.5/F	Full rupture	22	22
Diesel Storage (central) - Catastrophic rupture	Category 1.5/D	Full rupture	22	22
Diesel Storage (central) - Catastrophic rupture	Category 5/D	Full rupture	25	25
Diesel Storage (central) - leak	Category 1.5/F	5	Not reached at height of interest	Not reached at height of interest
Diesel Storage (central) - leak	Category 1.5/D	5	Not reached at height of interest	Not reached at height of interest
Diesel Storage (central) - leak	Category 5/D	5	Not reached at height of interest	Not reached at height of interest
Road tanker - Catastrophic rupture	Category 1.5/F	Full rupture	6	6
Road tanker - Catastrophic rupture	Category 1.5/D	Full rupture	6	6
Road tanker - Catastrophic rupture	Category 5/D	Full rupture	7	7
Road tanker - Leak	Category 1.5/F	5	Not reached at height of interest	Not reached at height of interest
Road tanker - Leak	Category 1.5/D	5	Not reached at height of interest	Not reached at height of interest
Road tanker - Leak	Category 5/D	5	Not reached at height of interest	Not reached at height of interest
Diesel Transfer Pumps - Leak	Category 1.5/F	5	Not reached at height of interest	Not reached at height of interest
Diesel Transfer Pumps - Leak	Category 1.5/D	5	Not reached at height of interest	Not reached at height of interest
Diesel Transfer Pumps - Leak	Category 5/D	5	Not reached at height of interest	Not reached at height of interest
Diesel Transfer Pumps - Catastrophic rupture	Category 1.5/F	Full rupture	5	5
Diesel Transfer Pumps - Catastrophic rupture	Category 1.5/D	Full rupture	5	5
Diesel Transfer Pumps - Catastrophic rupture	Category 5/D	Full rupture	6	6
Grid Connection AGI - Leak	Category 1.5/F	5	Not reached at height of interest	Not reached at height of interest

Scenario	Weather	Hole size (mm)	Distance to LFL fraction (m)	Distance to LFL (m)
Grid Connection AGI - Leak	Category 1.5/D	5	Not reached at height of interest	Not reached at height of interest
Grid Connection AGI - Leak	Category 5/D	5	Not reached at height of interest	Not reached at height of interest
Grid Connection AGI - Full bore rupture	Category 1.5/F	152	187	83
Grid Connection AGI - Full bore rupture	Category 1.5/D	152	182	77
Grid Connection AGI - Full bore rupture	Category 5/D	152	205	80
Long pipeline (single point) - 5mm	Category 1.5/F	5	1	1
Long pipeline (single point) - 5mm	Category 1.5/D	5	1	1
Long pipeline (single point) - 5mm	Category 5/D	5	Not reached at height of interest	Not reached at height of interest
Long pipeline (single point) - Full bore	Category 1.5/F	914	Not reached at height of interest	Not reached at height of interest
Long pipeline (single point) - Full bore	Category 1.5/D	914	6	5
Long pipeline (single point) - Full bore	Category 5/D	914	9	6

APPENDIX B
Jet fire results

Scenario	Weather	Hole size (mm)	Flame emissive power (kW/m2)	Distance downwind to intensity level 1 (4.7 kW/m2) (m)	Distance downwind to intensity level 2 (6.3 kW/m2) (m)	Distance downwind to intensity level 3 (12.5 kW/m2) (m)	Distance downwind to intensity level 4 (37.5 kW/m2) (m)	Ellipse area at intensity level 1 (4.7 kW/m2) (m2)
Diesel Storage (central) - leak	Category 1.5/F	5	33	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
Diesel Storage (central) - leak	Category 1.5/D	5	33	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
Diesel Storage (central) - leak	Category 5/D	5	64	1	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	1
Road tanker - Leak	Category 1.5/F	5	21	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
Road tanker - Leak	Category 1.5/D	5	22	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
Road tanker - Leak	Category 5/D	5	50	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
Diesel Transfer Pumps - Leak	Category 1.5/F	5	39	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
Diesel Transfer Pumps - Leak	Category 1.5/D	5	40	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest
Diesel Transfer Pumps - Leak	Category 5/D	5	78	1	Not reached at height of interest	Not reached at height of interest	Not reached at height of interest	1
Grid Connection AGI - Leak	Category 1.5/F	5	40	4	4	Not reached at height of interest	Not reached at height of interest	3
Grid Connection AGI - Leak	Category 1.5/D	5	40	4	4	Not reached at height of interest	Not reached at height of interest	3
Grid Connection AGI - Leak	Category 5/D	5	37	4	4	Not reached at height of interest	Not reached at height of interest	2
Grid Connection AGI - Full bore rupture	Category 1.5/F	152	350	134	124	106	82	20943
Grid Connection AGI - Full bore rupture	Category 1.5/D	152	350	134	124	106	82	20943
Grid Connection AGI - Full bore rupture	Category 5/D	152	350	135	126	108	88	20639
Long pipeline (single point) - 5mm	Category 1.5/F	5	42	4	4	2	1	29
Long pipeline (single point) - 5mm	Category 1.5/D	5	42	4	4	2	1	29
Long pipeline (single point) - 5mm	Category 5/D	5	70	6	5	4	4	34
Long pipeline (single point) - Full bore	Category 1.5/F	914	184	300	248	132	15	232841
Long pipeline (single point) - Full bore	Category 1.5/D	914	184	300	248	132	15	232841
Long pipeline (single point) - Full bore	Category 5/D	914	286	335	295	219	102	274608

APPENDIX C
Pool fire results

Scenario	Weather	Hole size (mm)	Pool diameter (m)	Distance downwind to intensity level 1 (4.7 kW/m2) (m)	Distance downwind to intensity level 2 (6.3 kW/m2) (m)	Distance downwind to intensity level 3 (12.5 kW/m2) (m)	Distance downwind to intensity level 4 (37.5 kW/m2) (m)
Diesel Storage (central) - Catastrophic rupture	Category 1.5/F	Full rupture	94	104	91	69	54
Diesel Storage (central) - Catastrophic rupture	Category 1.5/D	Full rupture	94	104	91	69	54
Diesel Storage (central) - Catastrophic rupture	Category 5/D	Full rupture	94	112	98	71	55
Diesel Storage (central) - leak	Category 1.5/F	5	14	34	30	22	13
Diesel Storage (central) - leak	Category 1.5/D	5	14	34	30	22	13
Diesel Storage (central) - leak	Category 5/D	5	14	36	33	25	13
Road tanker - Catastrophic rupture	Category 1.5/F	Full rupture	101	107	94	71	57
Road tanker - Catastrophic rupture	Category 1.5/D	Full rupture	101	107	94	72	57
Road tanker - Catastrophic rupture	Category 5/D	Full rupture	101	117	103	74	59
Road tanker - Leak	Category 1.5/F	5	11	28	25	19	10
Road tanker - Leak	Category 1.5/D	5	11	28	25	19	10
Road tanker - Leak	Category 5/D	5	11	30	27	22	10
Diesel Transfer Pumps - Leak	Category 1.5/F	5	17	35	32	23	15
Diesel Transfer Pumps - Leak	Category 1.5/D	5	17	36	32	24	15
Diesel Transfer Pumps - Leak	Category 5/D	5	17	38	35	26	16
Diesel Transfer Pumps - Catastrophic rupture	Category 1.5/F	Full rupture	50	60	53	39	30
Diesel Transfer Pumps - Catastrophic rupture	Category 1.5/D	Full rupture	50	60	53	39	30
Diesel Transfer Pumps - Catastrophic rupture	Category 5/D	Full rupture	50	66	58	40	31

APPENDIX D
Fireball results

Scenario	Weather	Hole size (mm)	Distance downwind to intensity level 1 (4.7 kW/m2) (m)	Distance downwind to intensity level 2 (6.3 kW/m2) (m)	Distance downwind to intensity level 3 (12.5 kW/m2) (m)	Distance downwind to intensity level 4 (37.5 kW/m2) (m)
Long pipeline (single point) - Full bore	Category 1.5/F	914	292	254	182	104
Long pipeline (single point) - Full bore	Category 1.5/D	914	292	254	182	104
Long pipeline (single point) - Full bore	Category 5/D	914	292	254	182	104

APPENDIX E
Explosion results

Scenario	Weather	Material	Distance downwind to overpressure 1 (0.07 bar) (m)	Distance downwind to overpressure 2 (0.1 bar) (m)	Distance downwind to overpressure 3 (0.35 bar) (m)
Methane VCE - Transformer	Category 1.5/F	METHANE	33	19	Not reachable
Methane VCE - Transformer	Category 1.5/D	METHANE	33	19	Not reachable
Methane VCE - Transformer	Category 5/D	METHANE	33	19	Not reachable

APPENDIX F
TLUP Assessment Consequence Results

This appendix details the consequence results relevant to the TLUP Assessment only. The distances downwind presented are the maximum values, irrespective of weather conditions.

Vessel/Equipment	Leak Size/LOC Scenario	Pool Fire Results				Jet Fire Results				Flash Fire Results	Explosion Results					
		8.02kW/m^2	10.9kW/m^2	15.9kW/m^2	25.6kW/m^2	8.02kW/m^2	10.9kW/m^2	15.9kW/m^2	25.6kW/m^2	Distance to LFL (m)	0.07 bar	0.14 bar	0.168 bar	0.35 bar	0.365 bar	0.5 bar
Diesel Storage Tanks	Instantaneous Failure / Catastrophic rupture	94m	82m	72m	66m	N/A				N/A	N/A					
	Failure over 10 minutes	105m	94m	84m	78m	N/A				N/A	N/A					
	10 mm pipe leak over 30 minutes	37m	32m	28m	25m	N/A				N/A	N/A					
Diesel Road Tanker	Instantaneous Failure / Catastrophic rupture	89m	77m	67m	62m	N/A				N/A	N/A					
	Leak from largest connection	91m	80m	70m	65m	N/A				N/A	N/A					
	Rupture of loading/unloading hose	91m	80m	70m	65m	N/A				N/A	N/A					
	Leak of loading/unloading hose	29m	25m	18m	15m	N/A				N/A	N/A					
Grid Connection AGI	Above ground Pipeline Rupture	N/A				119m	111m	103m	94m	78	33m	18m	17m	Not reached	Not reached	Not reached
Grid Connection AGI	Above ground Pipeline Leak	N/A				11m	11m	10m	9m	Not reached	33m	18m	17m	Not reached	Not reached	Not reached
Gas Pipeline	Below ground Pipeline Rupture	N/A				97m	91m	85m	77m	59m	33m	18m	17m	Not reached	Not reached	Not reached
Gas Pipeline	Below ground Pipeline Leak	N/A				9m	8m	8m	Not reached	Not reached	33m	18m	17m	Not reached	Not reached	Not reached

About DNV

DNV is the independent expert in risk management and assurance, operating in more than 100 countries. Through its broad experience and deep expertise DNV advances safety and sustainable performance, sets industry benchmarks, and inspires and invents solutions.

Whether assessing a new ship design, optimizing the performance of a wind farm, analysing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to make critical decisions with confidence.

Driven by its purpose, to safeguard life, property, and the environment, DNV helps tackle the challenges and global transformations facing its customers and the world today and is a trusted voice for many of the world's most successful and forward-thinking companies.

APPENDIX 17.3

FIRE RISK ASSESSMENT AND EMERGENCY RESPONSE PLAN

COOLPOWRA BESS
FIRE RISK ASSESSMENT

Version 1
JANUARY 2026

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1 INTRODUCTION

1.1 The Author

Lumcloon Energy was founded in 2008 as a project development company focused on flexible power and energy assets. Lumcloon Energy identified flexibility as a key component to address the changing needs of the evolving power systems, which are transitioning from fossil-based generation to renewable-based generation.

Lumcloon Energy is highly experienced in energy project development and continues to maintain an interest in assets that have been successfully delivered, from early development and ongoing commercial operation. Lumcloon Energy developed several grid scale Battery Energy Storage Systems, the first of which has been in operation since 2021.

1.2 Purpose

This Fire Risk Assessment (FRA) has been prepared for the proposed Battery Energy Storage System (BESS) facility on lands located in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway. The primary purpose of this assessment is to identify and evaluate potential fire hazards associated with the design, installation, and operation of the facility and to propose appropriate fire risk mitigation measures.

The FRA aims to ensure that fire safety is achieved to the highest practical standard, minimising risk to life, property, and the environment, in accordance with good engineering practice and the requirements of relevant Irish and international standards. This document will also support the client's due diligence obligations and facilitate compliance with planning and local fire authority requirements.

1.3 Document Use

This Fire Risk Assessment is intended for use by the client, their contractors, and relevant regulatory or emergency services personnel. It will form a key component of the facility's safety case, planning permit documentation, and ongoing safety management framework.

1.4 Document Review

A review of this Fire Risk Assessment shall be conducted and documented at minimum on an annual basis by site operator. The document shall also be reviewed and amended whenever there is a change in facility design, construction, operation, or maintenance that

affects emergency response planning. When outside resources are changed or modified the document shall be reviewed and updated to reflect the changes that may affect this plan.

1.5 Scope

The scope of this Fire Risk Assessment encompasses all site infrastructure and equipment associated with the Coolpowra BESS, including but not limited to:

- One hundred and thirty-eight (138) battery storage containers arranged in a configured layout.
- One hundred and thirty-eight (138) Medium Voltage Power Stations (MVPS) serving as the grid interface units.
- One Independent Power Producer (IPP) building housing control, protection, metering, and communications equipment.
- BESS compound fire water storage tank and hydrants.
- Vehicle access roads, turning areas, and perimeter fencing.
- equipment such as fire detection, alarm, and suppression systems, as well as ventilation and explosion relief features.

This assessment considers fire hazards relating to battery electrochemistry (including thermal runaway), electrical faults, site-specific operational and environmental factors, and the potential impact on the surrounding community and environment.

1.6 Location and Setting

The proposed development as amended is located on a 46 hectares (ha) site in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway. The site is located approximately 5km north of the town of Portumna and 3.7km south of Killimor.

Lands within the development site boundary are in agricultural use and include a farmhouse and outbuildings which will be demolished as part of development works. The proposed lands are situated at an elevation of c. 51-54m AOD and are accessed by public road via the N65 (National Road) and the L8763 (local road). The proposed development is located adjacent to, and south of, the existing operational 400kV AIS electricity substation (Oldstreet). The proposed site was chosen as the preferred site following analysis of alternative sites along the two 400kV transmission lines, which traverse the country from west to east. The are a limited number of residential properties within the surrounding rural area and these are described as one-off housing with a total of 40 recorded within 1km offset from the main development with the proposed development lands. The closest residential dwelling to the proposed BESS compound boundary is approximately 500m to the north.

1.7 Standards and Guidance Referenced

This assessment has been developed with reference to a comprehensive suite of national and international codes, standards, and best-practice guidance, including but not limited to:

- NSAI I.S. 10101 – National Rules for Electrical Installations in Ireland
- NFPA 855 (2026) – Standard for the Installation of Stationary Energy Storage Systems
- UL 9540A – Standard Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
- FPA Zurich RE1 – Battery Storage Fire Safety Guidance
- ESB Networks Grid Code and Connection Standards relevant to medium-voltage infrastructure
- Local and regional fire authority regulations and planning conditions
- NFCC: Grid Scale Battery Energy Storage System Planning – Guidance for FRS

2 BESS DESCRIPTION

2.1 Battery Enclosures

The Coolpowra BESS site comprises one hundred and thirty-eight battery enclosures (containers) and one hundred and thirty-eight MVPS enclosures (containers) in twenty-five rows and nine columns, covering an approximate footprint of 178.5 meters by 156.5 meters. Each battery measures approximately 12.272 meters in length, 2.487 meters in width, and 4.032 meters in height, with an estimated total weight of 48.8 tonnes including battery modules and enclosure.

Each enclosure houses approximately eighteen battery racks, delivering a total energy capacity of approximately 4.9 MWh per container. The battery systems operate within ambient temperature ranges of -25 °C to +45 °C and incorporate thermal insulation designed to mitigate thermal runaway propagation between cells. The enclosures are equipped with an HVAC cooling system consisting of six wall-mounted units providing a total cooling capacity of approximately 61.2 kW to maintain safe operating temperatures. Fire safety features include integrated smoke, heat, and carbon monoxide detectors; manual fire alarm pull stations; horn and strobe alarms; and a solid aerosol fire suppression system supplemented by deflagration relief panels and active ventilation to evacuate hazardous gases during fire events.

Spacings between battery enclosures are consistent with fire safety guidelines and

insurance requirements, with columns spaced 4.5 meters apart on centres of 6.9 meters and rows spaced 4.5 meters apart. This spacing supports adequate fire separation distances and emergency vehicle access throughout the battery storage area.

Surface finishes within the BESS compound will comprise clean permeable stone fill. Stormwater collected from impervious areas such as the IPP building and limited bitumen macadam roads will be directed to a below ground oil interceptor and attenuation /infiltration structure (volume of c.90m^3) before being discharged via a hydrobrake (which will limit flow to 1l/s (4l/s per hectare)) to the open drain /stream which runs to the south of the compound. Foul wastewater generated from welfare facilities within the BESS compound will be discharged to a sealed foul holding tank. The holding tank will be emptied and suitably disposed of periodically by a local waste permitted contractor. A foul holding tank is recommended due to low occupancy of the facility once operational. There is no requirement for the use of water in the process.

2.2 Medium Voltage Power Stations (MVPS)

One hundred and thirty-eight battery enclosures Medium Voltage Power Stations (MVPS) enclosures are installed on site as modular containerised substations to serve as the interface between the battery system and the medium-voltage grid.

These MVPS units are approximately 6.06 meters wide, 2.90 meters high, and 2.44 meters deep, weighing less than 18 tonnes. They are rated for DC input voltages up to 1,500 V and deliver AC medium-voltage output typically ranging between 10 kV and 35 kV with nominal power ratings between 4,000 kVA and 4,200 kVA.

Key electrical safety features include arc-fault resistant switchgear compliant with IEC 62271-202, vacuum circuit breakers, surge protection devices, galvanic isolation, and integrated oil spill containment systems with filtration and early detection capabilities. Strict installation and maintenance procedures are followed to mitigate fire and electrical hazards, including adherence to precise torque specifications for live bolted connections, establishing arc-fault exclusion zones during maintenance, and employing personal protective equipment (PPE) protocols to avoid shock and burn injuries.

2.3 IPP Building

The IPP building is a purpose-built facility serving as the primary control and grid interface centre of the BESS site. The building footprint measures approximately 40.0 meters in length and 10meters in width, housing the medium voltage switchgear, protection panel, meters, SCADA and communications equipment, and auxiliary power systems.

The internal layout is divided into functional compartments including the Control Room (x3), Switchgear Room, Communications Room, ESB Room, Store Rooms (x2), Mess Room. a small WC. The building is constructed with insulated block cavity walls offering robust fire compartmentalisation, finished externally with non-combustible plaster and a timber truss roof clad with synthetic slate tiles.

Electrical systems within the IPP building operate at voltages up to 20kV for the medium voltage equipment and 230V for building systems such as lighting and control devices. The facility incorporates fire detection and suppression systems designed to protect critical electrical infrastructure and personnel safety.

2.4 Storm water Drainage

The proposed design separates the site into distinct drainage/containment zones, as follows:

- BESS compound (container/enclosure area): Full infiltration strategy using a clean, open-graded stone compound surface (SuDS source control). No point source outfall from this area.
- Impervious areas (IPP building roof and paved road /parking): Managed collection and controlled discharge of stormwater from these limited impervious areas via underground drainage incorporating an underground petrol /oil interceptor to I.S. EN 858 performance expectations (Class I full retention, as appropriate to the discharge sensitivity).
- MVPS (transformer-containing equipment): Local containment at source for transformer oil hazards (bunding and controlled dewatering /oil separation), consistent with Irish utility substation practice and relevant standards.
- AIS - transformer-containing equipment): Local containment at source for transformer oil hazards (bunding and controlled dewatering /oil separation), consistent with Irish utility substation practice and relevant standards.

2.4.1 SuDS surface water management rationale

Rainfall is managed in accordance with Sustainable Drainage Systems (SuDS) principles, prioritising source control, runoff reduction, and water quality protection. The primary design basis is CIRIA C753 (The SuDS Manual), supported by relevant Irish planning guidance on flood risk and surface water runoff management.

2.4.1.1 BESS compound – clean stone infiltration surface

The BESS enclosure compound will be finished in clean, open-graded stone over an engineered granular sub-base. This provides a stable, non-ponding surface suitable for

electrical compounds and promotes infiltration of normal rainfall. The infiltration-led approach reduces the frequency and volume of surface runoff, limits the need for piped drainage, and avoids standing water in proximity to electrical equipment and access routes.

2.4.1.2 Impervious areas – controlled collection and discharge via interceptor

Stormwater from the limited impervious areas (IPP roof drainage and the paved road /parking around the IPP) will be collected via conventional underground drainage and discharged in a controlled manner. To protect water quality, the system will incorporate an underground petrol/oil interceptor designed and installed to recognised separator standards (I.S. EN 858).

This targeted approach applies enhanced treatment where traffic /plant-related hydrocarbons could credibly arise, while avoiding unnecessary treatment of rainfall falling on the BESS infiltration compound where routine contamination sources are not present.

2.4.1.3 Local containment for MVPS transformer oil hazards

MVPS units contain oil-filled transformers and local containment is provided at source. This comprises a proprietary self-bunded enclosure (or equivalent containment arrangement) sized to retain the relevant oil volume.

This is consistent with Irish transmission/substation civil standards that specify oil-sensitive bund dewatering systems and Class I full retention oil separators certified to I.S. EN 858 for external transformer bund drainage. The purpose is to prevent oil releases from completing a pollution linkage to soil, groundwater or surface waters.

2.4.2 Firewater

The BESS Compound includes one proprietary fire water storage tank with a capacity of 500 cubic metres (500m3), located adjacent to the IPP building to ensure an adequate firefighting water supply. A fire hydrant is positioned to the north and south of the IPP building enabling fire service intervention.

Vehicle access is provided to the compound in the southwestern area of the BESS compound and turning areas are located adjacent to the IPP building. Access roads and vehicle paths are maintained at a minimum width of 4.5 meters to accommodate emergency vehicles. The entire battery storage area is enclosed by a 2.65-meter-high palisade fence.

The design recognises that, in the unlikely event of a BESS fire incident, water may be used by the fire service for defensive operations such as exposure cooling and boundary

protection. Firefighting water that becomes contaminated is an emergency-condition effluent and is not treated as a routine discharge stream.

Accordingly, the development does not rely on full-compound containment and managed release of all stormwater as the primary control. Instead, it relies on the suite of controls set out in the Fire Risk Assessment and Emergency Response Plan, developed with reference to NFPA 855 (2026) and associated recognised guidance. These controls are incorporated and design embedded to prevent escalation /propagation, support safe incident management, and provide practicable environmental protection measures that can be deployed under incident command.

The Fire Risk Assessment /management plan controls relevant to firewater risk include, as applicable:

- Design and layout measures to reduce escalation and limit event size (e.g., separation, thermal barriers where required, and listed equipment).
- Detection, monitoring and system safety features, and documented site operating procedures.
- Emergency Response Plan information for the which will be discussed and agreed with the local fire authority, including contact protocols, site access, and isolation arrangements.
- Temporary containment capability (portable bunding/berms, absorbent booms, drain covers where relevant) and procedures to collect and remove contaminated liquids via authorised contractors.

3 HAZARD IDENTIFICATION

This section identifies and describes the key fire-related hazards associated with the Coolpowra BESS facility components, operational activities, and site context. It provides the foundation for risk assessment and mitigation planning.

3.1 Fire Hazards in Battery Enclosures

3.1.1 Thermal Runaway in Lithium-ion Batteries

Lithium-ion battery cells inherently carry the risk of thermal runaway, a rapid, uncontrolled release of heat and gas caused by internal cell failure or external damage. This may lead to smoke, fire, and potentially explosions within battery modules.

3.1.2 Propagation Risk:

Without adequate thermal insulation and fire suppression, thermal runaway propagation between cells or modules can escalate a localized fire into a container-wide or site-wide incident.

3.1.3 Gas Emissions:

Venting of flammable and toxic gases such as hydrogen and electrolyte vapors during thermal runaway events creates explosion and health hazards, necessitating active ventilation and gas detection systems.

3.1.4 Electrical Faults:

Internal electrical faults—including short circuits, over-temperature conditions, and arc faults—may trigger or amplify fire incidents.

3.1.5 Cooling System Failures:

HVAC failure or blockage may cause abnormal temperature increases, elevating the risk of cell thermal incidents.

3.2 Electrical and Fire Hazards in Medium Voltage Power Stations (MVPS)

3.2.1 Arcing Faults:

Arc faults occurring in high-voltage compartments can generate intense localized heat, pressure waves, and ignition sources for fires. Proper maintenance procedures, arc-resistant switchgear, and exclusion zones mitigate these risks.

3.2.2 Thermal Overloads and Overheating:

Transformers and switchgear may overheat due to overload, component failure, or inadequate cooling, potentially causing oil or insulation fires.

3.2.3 Oil Spill and Fire Risk:

MV transformers containing mineral or ester-based insulating fluids introduce fire hazards; oil containment systems reduce spill and fire propagation risks.

3.2.4 Electrical Shock Hazards:

High voltages (up to 33 kV) create shock and arc flash risks, necessitating strict PPE use and lockout/tagout procedures.

3.2.5 Maintenance and Operational Procedure Risks:

Incorrect torquing of live electrical connections or foreign objects left in live compartments amplify fire hazard potential.

3.3 Fire Risks Associated with IPP Building

3.3.1 High-Voltage Electrical Equipment:

Switchgear, protection panels, and metering devices operating at up to 33 kV can generate electrical faults, arc flashes, or overheating incidents.

3.3.2 Combustible Building Components:

The timber truss roof assembly poses a structural fire risk unless appropriately fire-treated or protected by suppression systems.

3.3.3 Internal Compartmentation:

Absence of adequate compartmentation between functional areas (Switch Room, Control Room, Comms Room, and Store) could facilitate fire spread if doors are left open or unsealed.

3.3.4 HVAC and Auxiliary Systems:

Malfunctions or failures could provide ignition sources or hinder smoke and heat removal.

3.4 Environmental Risks and Impact on Local Community

3.4.1 Proximity to Sensitive Receptors:

The are a limited number of residential properties within the surrounding rural area and these are described as one-off housing with a total of 40 recorded within 1km offset from the overall Coolpowra development. The closest residential dwelling to the proposed development boundary is approximately 500m north of the BESS site. Firewater runoff, smoke plumes, or toxic gas releases pose environmental and health concerns.

The closest watercourse to the BESS facility is the Treananearla stream which flows southwest of the compound. The Treananearla stream flows northwest from the site and enters the Kilcrow River (1.9km west of the development lands at Coolpowra). The Kilcrow River flows generally south for approximately 11km, discharging into Lough Derg at Stonyisland Bay.

3.4.2 Firewater Runoff Management:

Firefighting water is provided for the purposes of cooling (in the event of a fire) only. The

drainage /containment strategy of the BESS facility has been developed to be commensurate with risk using a source-pathway-receptor (SPR) model, consistent with Irish environmental risk assessment practice for discharges to groundwater. Under the SPR concept, an adverse effect requires a credible contaminant source, a migration pathway, and a sensitive receptor.

Applying the SPR model to the proposed development:

- Routine rainfall on the BESS compound: A credible contaminant source is not expected during normal operation; therefore, the appropriate control is SuDS source control and infiltration (subject to groundwater protection checks), rather than treating all rainfall as contaminated effluent.
- Transformer oil at MVPS: A credible pollutant source exists (hydrocarbon oil). The design therefore provides local containment and controlled bund drainage to prevent completion of a pathway to receptors.
- Stormwater from impervious /traffic-influenced areas around the IPP: A limited credible hydrocarbon source may exist (vehicle/plant leakage). The design therefore provides targeted collection and treatment via an interceptor prior to controlled discharge.
- Emergency-condition firewater: There is a potential for contamination soil and water by firefighting water mixed with electrolyte but this is a low-frequency, abnormal event. It is managed primarily through prevention /mitigation measures and emergency procedures within the Fire Risk Assessment and Emergency Response Plan, rather than by permanently bunding the entire compound.

3.4.3 Airborne Emissions:

Smoke and gases released during a fire may include hazardous substances requiring monitoring and notification protocols for nearby residents and emergency responders.

4 RISK ASSESSMENT AND ANALYSIS

4.1 Likelihood and Consequence of Fire Events

The potential fire scenarios at the BESS facility range from localised cell failures in battery modules to large-scale site-wide fires involving multiple containers and associated electrical infrastructure.

4.1.1 Localised Thermal Runaway:

A failure of a single battery cell or module can initiate a thermal runaway event. The likelihood of occurrence is low due to robust cell manufacturing standards, battery

management systems (BMS), and thermal insulation. However, if initiated, the consequences include heat generation, toxic gas release, and potential spread to adjacent cells or racks.

4.1.2 Enclosure /Container-Level Fire:

Inadequate detection or suppression inside a container could allow a fire to escalate to a full container event. The presence of aerosol suppression and active ventilation significantly reduces this risk. Consequences include damage to battery modules, container structure, and potential gas emissions affecting adjacent containers.

4.1.3 Inter-Container Fire Propagation:

Insufficient spacing or failure of fire barriers may permit fire spread between containers, risking a multi-container incident. The site's layout and fire compartmentalisation measures reduce this likelihood.

4.1.4 MVPS and IPP Electrical Fires:

Electrical faults such as arc faults, short circuits, or transformer overheating within MVPS or IPP building have moderate likelihood due to high-voltage operation and complex electrical systems. Consequences may involve equipment damage, fire spread in enclosed spaces, and electrical hazards to staff.

4.1.5 Environmental and Community Impact:

Fires releasing smoke, toxic gases, or firewater runoff pose potential consequences to nearby residents, local ecosystems and site workers.

4.2 Risk Rating

The risk profile is calculated considering both the likelihood of each event and its potential consequences, following a qualitative matrix approach consistent with industry guidance.

Risk Scenario	Likelihood	Consequence	Risk Rating	Comments
Single Cell Thermal Runaway	Low	Moderate	Medium	Mitigated by BMS, insulation, and suppression systems.
Full Container Fire	Very Low	High	Medium-High	Aerosol suppression and detection reduce event escalation
Fire Between Containers	Very Low	Very High	Medium-High	Fire separation and spacing designed to prevent propagation.
MVPS Electrical Fault	Low to Medium	High	Medium-High	Maintenance and engineering controls

Fire				mitigate occurrence and impact.
IPP Building Electrical Fire	Low	High	Medium	Fire compartmentalisation and detection reduce impact.
Environmental Contamination	Very Low	Moderate	Low	Firewater containment systems limit environmental risks.

4.3 Summary of Key Risk Drivers

- Battery cell chemical and thermal instability during fault conditions.
- Potential failure or delay in activation of fire detection and suppression systems.
- Electrical fault potential within medium and low voltage infrastructure.
- Site layout limitations including spacing and access for emergency response.
- Environmental exposure risks from firewater runoff and gas emissions

4.4 Risk Mitigation Effectiveness

Proposed design and operational controls; including thermal insulation, aerosol suppression, HVAC cooling systems, arc-resistant switchgear, oil containment, and comprehensive fire detection—substantially reduce the inherent fire risks. Regular operational maintenance, inspections, and emergency preparedness training further ensure risks are managed to ALARP (As Low As Reasonably Practicable) levels.

5 PROPOSED FIRE PREVENTION AND PROTECTIVE MEASURES

5.1 Structural Fire Protection and Compartmentalisation

- The battery containers feature fire-resistant enclosure materials with mineral wool insulation designed to prevent thermal propagation between cells and modules.
- Container spacing and site layout adhere to fire safety guidelines to maintain adequate separation distances, minimizing fire spread risk between battery units.
- The Independent Power Producer (IPP) building is constructed using insulated block cavity walls providing robust compartmentalisation between rooms, limiting fire spread within critical high-voltage and control areas.
- Steel insulated doors, presumed fire-rated, will provide further fire separation between building compartments and to the external environment.

5.2 Fire Detection Systems

- Early warning systems encompass smoke, heat, and carbon monoxide detectors installed inside battery containers, MVPS enclosures, and the IPP building.
- Hydrogen gas detectors are incorporated for early detection of electrolyte off-gassing during cell failure events.
- Manual fire alarm pull stations are located strategically within operational areas, supplemented by audible horn and visual strobe alarms to alert onsite personnel.

5.3 Fire Suppression Systems

- Solid aerosol fire suppression systems are installed inside the battery containers and modular steel houses to rapidly suppress incipient fires before spread.
- MVPS containers are equipped with arc-fault resistant switchgear and may be fitted with gaseous or water mist suppression systems to protect electrical components.
- The IPP building is designed for appropriate fire suppression, likely including gaseous or sprinkler systems, protecting MV switchgear and control equipment.

5.4 Ventilation and Explosion Relief

- Active inlet and exhaust ventilation systems in battery containers manage ambient temperature and rapidly expel smoke, explosive, and toxic gases during fire events.
- Deflagration panels provide safe overpressure relief for containers during rapid gas expansion or explosion scenarios, positioned to vent gases away from personnel and critical infrastructure.

5.5 Firewater Storage and Hydrant Provision

The Coolpowra BESS facility's firewater supply infrastructure has been designed and installed to meet recognised Fire & Rescue Service (FRS) guidance and to support effective firefighting operations:

- One proprietary firewater storage tank with a capacity of 500 cubic meters (totaling 500,000 litres), is sited adjacent to the Independent Power Producer (IPP) building to ensure sufficient water availability.
- Fire hydrants are positioned close to the IPP (north and south) near the vehicle turning area which will provide reliable water delivery points. These hydrants have been designed and maintained to supply a minimum flow rate of 1,900 liters per minute for at least two hours, consistent with NFCC recommendations for grid-scale Battery Energy Storage Systems.

- The location and accessibility of hydrants and water tanks have been coordinated with local fire and rescue services to facilitate unimpeded vehicle access and operational deployment.
- Mechanical protection, such as bollards, will be installed around hydrants and outlets to reduce risk of accidental damage.
- Surface finishes within the BESS compound comprise clean permeable stone fill. Stormwater collected from impervious areas such as the IPP building and limited bitumen macadam roads will be collected and routed through a below ground interceptor (Klargester NSBP004 AquaOil Bypass MDPE & Full Retention GRP Separator) in the vicinity of the IPP building, MVPS units are self contained (bunded to prevent transformer oil losses to ground).

The water supply system provides a robust and compliant firefighting resource (cooling of nearby structures only in the event of a fire), ensuring readiness for emergency fire response.

5.6 Emergency Vehicle Access and Site Design

- The site provides vehicle access and turning areas enabling fire service entry and manoeuvrability.
- Access roads maintain minimum widths of 4.5 meters, free of obstructions and compatible with emergency vehicles.
- Vegetation control around battery containers and critical infrastructures maintains clear, fire-resistant zones.

5.7 Operational Procedures and Training

- Strict maintenance protocols for battery and electrical equipment installation, including torque specifications and exclusion zones during live work, reduce fire initiation risks.
- Onsite personnel will be trained in fire detection system operation, alarm response, and emergency fire procedures.
- Regular fire drills, system testing, and active monitoring will be employed to ensure readiness and safety compliance.

5.8 Emergency Response Plan Overview

The Coolpowra BESS facility will implement a detailed Emergency Response Plan (ERP) that addresses prevention, preparedness, response, and recovery from fire and other emergency situations. The ERP is designed to protect life, minimize property and environmental damage, and ensure rapid, effective response by onsite personnel and

offsite emergency services. The full Emergency Response Plan (ERP) is included in Appendix E of this document.

The ERP includes clearly defined roles and responsibilities, communication protocols, and procedures for evacuation, fire suppression, and incident management. It is developed in collaboration with local fire authorities, emergency services, and other stakeholders to ensure coordinated and efficient response.

5.9 Access and Egress for Emergency Services

Site design provides extensive access for emergency vehicles, along with designated turning areas near battery container rows and critical infrastructure buildings such as the IPP.

Clear signage and site maps will be posted at entry points and critical locations to guide first responders. The location of firewater storage tanks, hydrants, electrical isolation points, and hazardous areas will be clearly identified.

Emergency egress routes for personnel will be maintained free from obstruction, with adequately marked escape paths within all containers, buildings, and site areas.

5.10 Staff Training, Communication, and Alarm Systems

All site personnel will receive comprehensive training covering fire hazard recognition, detection system operation, initial incident response procedures, and evacuation protocols. Regular fire drills and safety exercises will be conducted to build competency and preparedness.

The integrated fire detection and alarm systems; including smoke, heat, and gas detectors alongside signalling via horns and strobes; ensure rapid notification to onsite staff and remote monitoring centres. Manual pull stations provide additional alert capacity for personnel.

Continuous communication lines between onsite operators, emergency coordinators, and local fire services will be established, including provision of facility schematics, hazard information, and contact details for subject matter experts.

5.11 Coordination with Local Fire and Emergency Services

Proactive engagement and collaboration with local fire brigades and emergency responders are core to the ERP. This includes:

- Pre-incident site familiarization visits and training sessions for first responders.
- Sharing hazard analyses, Standard Operating Procedures (SOPs), and Emergency Response Plans.
- Coordinated incident command structures during emergencies to ensure safety and operational efficiency.
- During a fire or other emergency, responding personnel will use thermal imaging, gas detectors, and incident monitoring tools to assess hazards and manage the situation with full situational awareness.

5.12 Incident Management and Post-Incident Procedures

The ERP establishes an Incident Command System (ICS) structure for managing emergencies methodically from arrival through resolution. Life safety is prioritized, followed by containment and mitigation of damage.

After extinguishment or incident stabilization, the ERP calls for a fire watch of no less than 24 hours to monitor for reignition or hazardous conditions. Incident investigation and root cause analysis will follow to inform any required operational or design improvements.

6 SUMMARY AND RECOMMENDATIONS

6.1 Summary

This Fire Risk Assessment has comprehensively evaluated fire hazards, risks, and mitigation measures associated with the proposed Coolpowra Battery Energy Storage System (BESS) facility. The assessment covers the battery enclosures, Medium Voltage Power Station (MVPS) enclosures, Independent Power Producer (IPP) building, fire water infrastructure, and site access provisions.

Key findings include:

- The inherent fire risks primarily stem from lithium-ion battery thermal runaway, electrical faults in high-voltage equipment, and their potential for fire propagation if uncontrolled.
- Proposed mitigation measures—such as robust container insulation, solid aerosol suppression, arc-fault resistant MV switchgear, ventilation with deflagration relief, and comprehensive fire detection—reduce risks to an acceptable level consistent with recognised safety standards.
- Site layout, spacing, and compartmentalisation strategies further minimise fire spread potential and support emergency access.
- Environmental and community risks around toxic gas emissions and firewater

runoff have been addressed through containment, detection, and coordination with local authorities.

- An Emergency Response Plan tailored to site-specific hazards and operational scenarios will ensure readiness and effective incident management.

7 RECOMMENDATIONS

To maintain and enhance fire safety at the facility, the following actions are recommended

- Design and Construction:

Complete installation of all proposed fire prevention and protection systems as specified, including fire-rated enclosure materials, suppression systems, and ventilation controls.

- Maintenance and Testing:

Establish rigorous maintenance schedules for all fire detection and suppression equipment, electrical systems, and ventilation infrastructure. Include periodic simulation exercises and functional tests.

- Training and Drills:

Conduct regular training programs for on-site personnel focusing on fire hazard awareness, emergency response procedures, and use of fire safety equipment. Regular fire drills should be implemented to maintain high preparedness.

- Coordination with Emergency Services:

Maintain active engagement with local fire and emergency services through familiarization sessions, sharing of site plans and hazard information, and joint exercises.

- Monitoring and Review:

Implement continuous monitoring of fire risk factors such as battery conditions, electrical system status, and environmental parameters. Review and update the Fire Risk Assessment and Emergency Response Plan at least annually or following any significant changes.

- Environmental Controls:

Ensure firewater containment and drainage systems remain fully functional and compliant with environmental protection standards to prevent contamination. By adhering to these recommendations, the Coolpowra BESS will uphold a robust fire safety posture, protecting personnel, assets, and the local community while aligning with statutory and best-practice requirements.

8 APPENDICES

8.1 Appendix A: Site Layout Plan and Battery Container Arrangement

- Detailed site layout plans showing the configuration of battery containers, MVPS units, IPP building, fire water tank, hydrants, access roads, and fencing.
- Spacing dimensions and access pathways for emergency vehicle circulation.
- Location of fire detection and suppression system components.

Figure 8.1 Coolpowra BESS Layout

Figure 8.2 Water Main Layout

8.2 Appendix B: Technical Specifications for Equipment

- Manufacturer datasheets and technical details for:
  - Battery storage containers including battery module composition and HVAC system.
  - SMA Medium Voltage Power Stations (MVPS) models with electrical and fire safety features.
  - Independent Power Producer (IPP) building design, electrical system architecture, and fire safety installations.

AVAILABLE AND PROVIDED UPON REQUEST

8.3 Appendix C: Fire Detection and Suppression System Details

- Descriptions and design basis for all fire detection devices (smoke, heat, CO, hydrogen sensors).
- Solid aerosol fire suppression system specifications, including coverage, discharge mechanisms, and testing protocols.
- Ventilation system schematics, including deflagration panel placement and flow direction.

8.4 Appendix D: Relevant Standards and Guidance Documents

List of referenced standards, codes, and guidelines utilized in this FRA including:

- NSAI I.S. 10101:2020 + Amendment 1:2024 (National Rules for Electrical Installations, Ireland)

The latest edition, incorporating updates through 2024, this standard governs the design, erection, and verification of low-voltage electrical installations in Ireland including require ments relevant for BESS electrical infrastructure.

- NFPA 855 (2020) – Standard for the Installation of Stationary Energy Storage Systems

  Recognised international standard defining fire risk management, detection, suppression, and emergency response criteria specific to stationary battery energy storage installations.
- UL 9540A – Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

  Defines laboratory testing procedures to characterize thermal runaway propagation and aids the design of fire suppression and containment systems.

- FPA Zurich RE1 – Battery Storage Fire Safety Guidance
  Practical guidance on risk management and insurance considerations for battery storage facilities.
- ESB Networks Grid Code and Connection Standards
  National grid operator requirements relevant to MV and LV infrastructure interfacing with the utility grid.
- Local Fire Authority Regulations and Planning Conditions
  Requirements from local authorities and An Bord Pleanála mandating fire risk assessments, fire prevention measures, and emergency planning as conditions of development consent.

8.5 Appendix E: Emergency Response Plan (ERP)

This appendix contains the comprehensive Emergency Response Plan for the facility, detailing all aspects critical to effective emergency management. It includes clearly defined roles and responsibilities, communication protocols, and comprehensive evacuation procedures supported by detailed site maps. Emergency contact information is provided to ensure rapid coordination with external responders.

Additionally, this section covers site access and egress routes designed to facilitate safe and efficient emergency service response. It also documents staff training programs and records of emergency drills and exercises conducted to maintain readiness and continual improvement of response capabilities.

COOLPOWRA BESS

EMERGENCY RESPONSE PLAN

EMERGENCY RESPONSE PLAN
Version 1
JANUARY 2026

LUMCLOONENERGY

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1 INTRODUCTION

This Emergency Response Plan (ERP) has been prepared for the proposed Coolpowra Battery Energy Storage System (BESS) facility on lands located in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway.

The purpose of this ERP is to establish procedures and responsibilities for the effective management of emergencies occurring within the BESS facility. This plan aims to protect life, minimise damage to property and the environment, and ensure timely notification and efficient response by site personnel and external emergency services.

The following emergency response procedures are provided so that all personnel understand the practices that are to be followed to be prepared for and to provide immediate and effective response to emergencies that might arise at the facility. Because the safety of employees is of primary concern, the Emergency Response Coordinator and each member of the staff are committed to providing a safe, healthy work environment and are responsible for ensuring implementation of these procedures. Life safety of personnel shall be the highest priority during any event.

1.1 The Author

Lumcloon Energy was founded in 2008 as a project development company focused on flexible power and energy assets. Lumcloon Energy identified flexibility as a key component to address the changing needs of the evolving power systems, which are transitioning from fossil-based generation to renewable-based generation.

Lumcloon Energy is highly experienced in energy project development and continues to maintain an interest in assets that have been successfully delivered, from early development and ongoing commercial operation. Lumcloon Energy developed several grid scale Battery Energy Storage Systems, the first of which has been in operation since 2021.

1.2 Document Use

This ERP is intended for use by the client, their contractors, and relevant regulatory or emergency services personnel. It will form a key component of the facility's safety case, planning permit documentation, and ongoing safety management framework. The FRA should be reviewed and updated periodically or following any significant changes to facility design, equipment, or operational procedures.

1.3 Document Review

A review of this ERP shall be conducted and documented at minimum on an annual basis by site operator. The document shall also be reviewed and amended whenever there is a change in facility design, construction, operation, or maintenance that affects emergency response planning. When outside resources are changed or modified the document shall be reviewed and updated to reflect the changes that may affect this plan.

2 COOLPOWRA BESS

2.1 Location and Setting

The proposed development as amended is located on a 46 hectares (ha) site in the townlands of Coolpowra, Cooldorragha, Ballynaheskeragh, Gortlusky and Sheeaunrush, County Galway. The site is located approximately 5km north of the town of Portumna and 3.7km south of Killimor.

Lands within the development site boundary are in agricultural use and include a farmhouse and outbuildings which will be demolished as part of development works. The proposed lands are situated at an elevation of c. 51-54m AOD and are accessed by public road via the N65 (National Road) and the L8763 (local road). The proposed development is located adjacent to, and south of, the existing operational 400kV AIS electricity substation (Oldstreet). The proposed site was chosen as the preferred site following analysis of alternative sites along the two 400kV transmission lines, which traverse the country from west to east. The are a limited number of residential properties within the surrounding rural area and these are described as one-off housing with a total of 40 recorded within 1km offset from the main development with the proposed development lands. The closest residential dwelling to the proposed BESS compound boundary is approximately 500m to the north.

2.2 BESS Description

2.2.1 Battery Enclosures

The Coolpowra BESS site comprises one hundred and thirty-eight battery enclosures (containers) and one hundred and thirty-eight MVPS enclosures (containers) in twenty-five rows and nine columns, covering an approximate footprint of 178.5 meters by 156.5 meters. Each battery measures approximately 12.272 meters in length, 2.487 meters in width, and 4.032 meters in height, with an estimated total weight of 48.8 tonnes including battery modules and enclosure.

Each enclosure houses approximately eighteen battery racks, delivering a total energy capacity of approximately 4.9 MWh per container. The battery systems operate within ambient temperature ranges of -25 °C to +45 °C and incorporate thermal insulation designed to mitigate thermal runaway propagation between cells. The enclosures are equipped with an HVAC cooling system consisting of six wall-mounted units providing a total cooling capacity of approximately 61.2 kW to maintain safe operating temperatures. Fire safety features include integrated smoke, heat, and carbon monoxide detectors; manual fire alarm pull stations; horn and strobe alarms; and a solid aerosol fire

suppression system supplemented by deflagration relief panels and active ventilation to evacuate hazardous gases during fire events.

Spacings between battery enclosures are consistent with fire safety guidelines and insurance requirements, with columns spaced 4.5 meters apart on centres of 6.9 meters and rows spaced 4.5 meters apart. This spacing supports adequate fire separation distances and emergency vehicle access throughout the battery storage area.

Surface finishes within the BESS compound will comprise clean permeable stone fill. Stormwater collected from impervious areas such as the IPP building and limited bitumen macadam roads will be directed to a below ground oil interceptor and attenuation /infiltration structure (volume of c.90m^3) before being discharged via a hydrobrake (which will limit flow to 1l/s (4l/s per hectare)) to the open drain /stream which runs to the south of the compound. Foul wastewater generated from welfare facilities within the BESS compound will be discharged to a sealed foul holding tank. The holding tank will be emptied and suitably disposed of periodically by a local waste permitted contractor. A foul holding tank is recommended due to low occupancy of the facility once operational. There is no requirement for the use of water in the process.

2.2.2 Medium Voltage Power Stations (MVPS)

One hundred and thirty-eight battery enclosures Medium Voltage Power Stations (MVPS) enclosures are installed on site as modular containerised substations to serve as the interface between the battery system and the medium-voltage grid.

These MVPS units are approximately 6.06 meters wide, 2.90 meters high, and 2.44 meters deep, weighing less than 18 tonnes. They are rated for DC input voltages up to 1,500 V and deliver AC medium-voltage output typically ranging between 10 kV and 35 kV with nominal power ratings between 4,000 kVA and 4,200 kVA.

Key electrical safety features include arc-fault resistant switchgear compliant with IEC 62271-202, vacuum circuit breakers, surge protection devices, galvanic isolation, and integrated oil spill containment systems with filtration and early detection capabilities. Strict installation and maintenance procedures are followed to mitigate fire and electrical hazards, including adherence to precise torque specifications for live bolted connections, establishing arc-fault exclusion zones during maintenance, and employing personal protective equipment (PPE) protocols to avoid shock and burn injuries.

2.2.3 IPP Building

The IPP building is a purpose-built facility serving as the primary control and grid interface centre of the BESS site. The building footprint measures approximately 40.0 meters in

length and 10meters in width, housing the medium voltage switchgear, protection panel, meters, SCADA and communications equipment, and auxiliary power systems.

The internal layout is divided into functional compartments including the Control Room (x3), Switchgear Room, Communications Room, ESB Room, Store Rooms (x2), Mess Room. a small WC. The building is constructed with insulated block cavity walls offering robust fire compartmentalisation, finished externally with non-combustible plaster and a timber truss roof clad with synthetic slate tiles.

Electrical systems within the IPP building operate at voltages up to 20kV for the medium voltage equipment and 230V for building systems such as lighting and control devices. The facility incorporates fire detection and suppression systems designed to protect critical electrical infrastructure and personnel safety.

2.2.4 Fire Water Infrastructure

The BESS Compound includes one proprietary fire water storage tank with a capacity of 500 cubic metres (500m3), located adjacent to the IPP building to ensure an adequate firefighting water supply. A fire hydrant is positioned to the north and south of the IPP building enabling fire service intervention.

Vehicle access is provided to the compound in the southwestern area of the BESS compound and turning areas are located adjacent to the IPP building. Access roads and vehicle paths are maintained at a minimum width of 4.5 meters to accommodate emergency vehicles. The entire battery storage area is enclosed by a 2.65-meter-high pa lisade fence.

2.3 Overall Organisation

Overall responsibility for the Emergency Response Plan (ERP) lies with the Emergency Response Coordinator. The Emergency Response Coordinator or their designee is responsible for program implementation, including designating evacuation routes and employee assembly points, coordinating severe weather activities, communicating emergency response procedures to site personnel, contracting with emergency response organizations, and contractor coordination.

2.4 Roles and Responsibilities

Specific management personnel will assume leadership roles for emergency responses. The Emergency Response Coordinator, Site Manager, and/or Lead Technicians will assist in the implementation of this plan by knowing and communicating evacuation routes to workers during emergency evacuation and reporting the status of the evacuation to the

Fire Department. The Emergency Response Coordinator is responsible for seeing that this plan is implemented and will appoint an adequate number of personnel to enforce the plan, assure everyone is familiar with this plan and act as a liaison with the local Fire Department(s).

All facility personnel have a responsibility to immediately report emergency situations to the Lead Technician on duty or local emergency responder personnel when appropriate. There shall be no delay to report emergency events that require the local emergency responders.

A subject matter expert (SME) shall be contactable at all times by telephone. This person and a designated secondary SME contact should be readily available to first responders in the case of emergency situations. The SME shall be versed in the battery's failure modes and hazards. A working knowledge of incident command systems will allow the SME to integrate into the emergency response operations when needed.

2.5 Emergency Routes

A evacuation sheet shall be posted and orally communicated to site personnel. These procedures shall be discussed at periodic safety meetings in addition to being covered during new employee orientation. Personnel are to know at least two exits whenever possible and be familiar with the evacuation routes posted in the location indicated on the site map.

Depending upon the degree of emergency, weather and/or site conditions, roadways as designated on the site map will be used for routes of evacuation. In the event of an evacuation, all personnel will meet at the designated muster point for further information. If the primary muster point is inaccessible or hazardous, personnel shall gather at the secondary muster point and inform the emergency coordinator (if not present) by radio or telephone. The emergency response coordinator shall inform personnel of a diversion to the secondary muster point by such mean as are available, to include radio or loud hailer. If personnel are unable to make it to the designated muster points, they should seek shelter wherever possible and contact their supervisor for further instructions. Accountability of personnel shall be of the upmost importance and be conducted in a timely manner. Responder access points shall be kept unobstructed at all times so first responders will not be hindered in their operations when responding to emergencies within the site.

2.6 Operator Safety & Equipment

2.6.1 General recommendations for operator safety

- Inspect equipment daily for unsafe conditions.
- Keep hands away from exposed electrical connections.
- Keep hands away from hot surfaces.
- Observe all high voltage warnings.
- Any outstanding observations shall be reported to their supervisor immediately and documented.

2.6.2 Personal Protective Equipment

The operation or maintenance of specific equipment may have different safety requirements. There are different levels of PPE that must be checked and maintained. All personnel who wear levels of protection above and beyond their normal everyday attire must be trained in that PPE. All training of PPE shall be conducted by a competent person and documented. Some PPE have a SCAM (selection, care and maintenance) document that will instruct the end user on the limitations of the PPE and the proper maintenance of the PPE. Always be aware of individual equipment operational requirements and hazards as well as out of service dates. For example,

- Safety glasses with side shields (no dark glasses are permitted except those approved for welding or cutting)
- Face shields for cutting & grinding
- Approved safety toe shoes
- Approved hearing protection
- Approved hardhat
- Approved gloves
- Long sleeve shirt
- Long pants

All PPE is required to be worn at all times for the working being conducted. Any PPE that is compromised or no longer considered viable for protection shall be discarded and replaced. Any PPE that comes in contact with hazardous material shall be properly decontaminated and inspected for functionality before being returned to service.

2.7 Safety Training

Initial training for all site personnel with respect to the contents of this ERP shall be undertaken upon the start of employment or substantial changes in duties. Refresher

training of the ERP to site personnel shall be conducted at least annually. Documentation of ERP training is to be maintained in site files.

A variety of emergency response drills are to be held at minimum on a quarterly basis and shall be documented. Table-top exercises are encouraged to familiarize relevant response personnel with procedures for different types of emergencies that could be encountered at the site.

The site Emergency Response Coordinator and Lead Technicians are trained in their specific duties upon being assigned these roles or beginning their employment. All building occupants have been instructed in actions to take in case of an emergency through their copies of procedures and training, as needed.

Operator personnel should receive supplier / manufacturer approved training on the specific characteristics of the energy storage system. Applicable common standards (e.g. on electrical safety) should be taken into account.

All personnel who wear levels of protection above and beyond their normal everyday attire must be trained in that PPE. All training of PPE shall be conducted by a competent person and documented.

All hazardous materials incident emergency responders and workers at hazardous materials facilities, transport companies, waste treatment facilities, storage facilities and disposal facilities will be provided training which meets federal and state standards. Such training will be commensurate with their employer’s or organization’s plan and policies.

Initial and refresher training regarding warning systems and alarms shall be conducted at least annually. Documentation of training is to be maintained in site files.

3 EMERGENCY RESPONSE

3.1 Analyse, Plan, Implement, Evaluate

The phases of emergency response may be categorized under the 'APIE' scheme for handling an emergency: Analyse, Plan, Implement, Evaluate.

- Analyse: Analysing the response is the phase in which the notification takes place to emergency responders.
- Plan: Planning the response is the phase in which the proper resources and equipment are called to the emergency scene and a plan is developed to mitigate the emergency.
- Implement: Once a plan is developed and the proper resources and equipment are there, then the Emergency Response Coordinator will make the determination to implement the plan.
- Evaluate: Once the plan is implemented, it shall be evaluated for safety and effectiveness. If the plan is not safe or effective, then the process should start over again with Analyse, Plan, Implement, and Evaluate.

No employee is required or permitted to place himself or herself in harm's way in order to facilitate extinguishment, evacuation, or rescue. All rescue operations will be performed by trained professionals upon their arrival. Rescue operations will only be conducted after a risk-reward analysis is done and proper PPE is used to protect against any adverse hazards that may be encountered.

Incidents where local fire department personnel are involved will be managed under a system established by the fire department, called 'Incident Command System.' This establishes a primary incident commander and a liaison to or for the Emergency Response Coordinator.

3.1.1 Analyse

Without entering an immediate hazard area, the employee who first discovers an emergency should identify the following:

- Is there a fire, spill, explosion, or other incident happening?
- Does medical assistance appear to be needed?
- Who/what is at risk: people, the environment, or property?
- What are the weather and terrain conditions and risks?

The employee will also isolate the area to keep people away from the scene until trained responders arrive, as long as it is safe to do so. An employee who has not received training

in emergency response should take no actions beyond notification, isolation of the area, and personal safety precautions. Any efforts made to rescue persons, protect property, or protect the environment must be weighed against the possibility of becoming part of the problem. Attempts to rescue others shall only be attempted with proper PPE, proper training, and in a manner that does not create significant risk to rescuer or others. Persons at the scene must not contact spilled material or inhale fumes, smoke, or vapours.

3.1.2 Plan

After all life hazards are no longer a threat, a plan of operation shall be devised for remediation of the event. The plan shall be communicated to all responders and safety of all responders shall be paramount. A staging area, if needed, shall be identified for extra personnel and equipment that may be needed to accomplish the plan's objectives. All responders that will enter the hot zone (affected area) must be made aware of any decontaminated area upon their exit of the hot zone. Trained responders will be called to the scene by the O&M Manager and/or Lead Technicians to begin the process of hazard assessment and to establish objectives and priorities. The hot zone shall be identified, and all non-essential personnel shall not be permitted to enter this area without proper training and permission of the Emergency Response Coordinator.

3.1.3 Implement

The initial response phase starts with notification, which activates the emergency response system. Anyone who observes or receives information regarding an emergency at BESS should immediately notify available personnel using the radio network or their issued cell phones. The Emergency Response Coordinator and/or Lead Technician will then ensure fire department is notified. At BESS plant, employees are notified of emergencies by cell phone/radio and word of mouth from the Emergency Response Coordinator and/or Lead Technicians. Appendix 4 provides a list of emergency notification information for BESS plant personnel.

If an event has the potential to impact the local community, BESS plant will contact local fire/police to make community notifications. The Emergency Response Coordinator and/or Lead Technicians will coordinate any media efforts through the BESS plant Asset Manager and Company Legal Department.

The incident command post will be set up in a location free of contaminants and located upwind uphill and upstream. The Emergency Response Coordinator or designee shall remain at the incident command post to serve as a liaison to the Incident Commander designated by emergency responders. Trained responders may enter a 'hot zone' only when wearing appropriate protective equipment. Personnel entering the hot zone shall be

briefed on the plan before entering. All communication devices shall be tested prior to entry into the hot zone. A decontamination corridor shall be established prior to entry into the hot zone. There shall be accountability taken of all personnel entering and leaving the hot zone. A back up team that has the same PPE shall be at the ready in the event of the entry team needs quick assistance. A decontamination team shall be ready to for after exiting the location (warm zone). There shall be a doffing station that is set up immediately at the end of the decontamination section that will allow the responders a safe place to remove their PPE. Only trained responders are authorized to risk exposure to chemicals for purposes of containing or stopping the material release.

The Emergency Response Coordinator or a designee will be responsible for notifying the appropriate regulatory agencies and, if necessary, the Emergency Response Contractor or mutual aid groups. The incident will be documented and kept on file.

3.1.4 Evaluate

During the implementation phase of the emergency, response, action and progress shall be analysed by the Emergency Response Coordinator constantly. If the plan seems to be ineffective or unsafe the responders shall be removed from the hot zone and the plan shall be revised. The new plan shall be implemented, and that revised plan shall be analyzed for safety effectiveness again.

3.2 Evacuation Procedures

When notified to evacuate, site personnel shall do so in a calm and orderly fashion, keeping the following instructions in mind:

- Walk, don’t run. Help others who need assistance as long as doing so does not put you at greater risk.
- Stay upwind, upstream, and uphill whenever possible.
- Watch for other traffic and equipment on access roads and roadways.
- Be aware of ice/snow and loose gravel conditions.
- Drive safely.

Site personnel shall go to the primary designated muster area as identified.

If employees are unable to make it to the muster area, they should divert to the secondary muster area and immediately contact their supervisor for further instructions.

During evacuation, the Emergency Response Coordinator and/or Lead Technicians should ensure that every person on his/her crew has been notified and that evacuation routes are clear. Any person with a disability (mobility, hearing, sight, etc.) who requires assistance

to evacuate is responsible for pre-arranging with someone in their immediate work area to assist them in the event of an emergency. Anyone knowing of a person with a disability or injury who was not able to evacuate will report this fact immediately to their supervisor. This information shall be communicated to emergency responders immediately upon their arrival if the disabled person has not been evacuated.

Once an evacuation is complete, the Emergency Response Coordinator or Lead Technician should account for all personnel. This accountability information shall be communicated to the emergency responders immediately upon their arrival. When a person is unaccounted for, the following information shall be communicated to the emergency responders:

- Name of the individual
- Disabled or not disabled
- Work location
- Last known location

4 FIRE INCIDENTS

All personnel working at BESS plant are to be trained and should know how to prevent and respond to a fire emergency. All on-site personnel shall:

- Complete an on-site training program identifying the fire risks at BESS plant.
- Understand the protocol and follow emergency procedures should an event occur.
- Review and report potential fire hazards to the Emergency Response Coordinator.

No employee is required or permitted to place himself or herself in harm's way in order to facilitate extinguishment, evacuation, or rescue. All rescue operations will be performed by trained professionals upon their arrival.

4.1 Response to a Fire Incident

In the event of an incipient stage (beginning, small) fire, employees should notify adjacent individuals of this situation and exit the area. Only employees trained in the use of fire extinguishers or other manual fire suppression systems should attempt to use an extinguisher or system. Employees are not expected or authorized to respond to fires beyond the incipient stage (i.e., fires that are beyond the beginning stage and which cannot be extinguished using a hand-held, portable fire extinguisher). The fire department should be immediately notified by dialing fire department when any type of unintended fire has taken place. Site management shall also be immediately notified of any emergency.

4.1.1 Fire Internal/External to Battery Container

- Call fire department and report as an 'ETHANE' message, the followings:
  - E - Exact location: The precise location of the incident,
  - T - Type: The nature of the incident, including how many vehicles, buildings and so on are involved,
  - H - Hazards: Both present and potential,
  - A - Access: Best route for emergency services to access the site, or obstructions and bottlenecks to avoid.
  - N - Numbers: Numbers of casualties, dead and uninjured on scene
  - E - Emergency services: Which services are already on scene, and which others are required
- Make sure the immediate area of the fire is clear of personnel.
- Account for all employees, contractors, and visitors who were working in the immediate area of the fire. If any personnel are unaccounted for from the immediate fire area, a communication shall be made through out the facility in attempt to locate the person(s) missing. If the person(s) is equipped with a facility radio then an emergency transmission shall be communicated in attempt to locate the person(s).
- Contact the O&M Manager (if present) and Emergency Response Coordinator (if not the O&M Manager) immediately.
- Remove any obstructions (vehicles, material, etc.) that might impede response to the scene.
- Station available personnel at road intersections to stop traffic flow into the fire scene.
- Evacuate the energy storage system area immediately if the fire warning alarm sounds or fire warning lights illuminate.
- Proceed to the designated muster point for head count.

- If onsite, the designated Emergency Response Coordinator will do a head count and relay any information/instructions.
- If you encounter heavy smoke, stay low and breathe through a handkerchief or other fabric; move away from the area.
- Assist anyone having trouble leaving the area so long as doing so does not put the assistor at additional risk.
- Attempt to extinguish the fire ONLY if you have had the appropriate training and proper firefighting agent for the type of fire.
- The energy storage system is not to be accessed until the O&M Manager or designated Emergency Response Coordinator gives authorization.

4.1.2 After a Fire

Hazards after a fire should be identified at the time of installation such that recommendations for personal protective equipment (PPE) are available for clean-up crews and hazardous materials (HAZMAT) teams. This may include respirators to protect personnel from toxic gas that continues to be generated from hot cells. Firewater retention and cleanup measures may be required by local regulations.

In addition to the gas generation risk, cells that remain hot also pose a delayed ignition risk, whereby heat in the cell may transfer to undamaged adjacent cells or remaining active material and reignite the fire. As such, fire-damaged equipment must remain monitored for a period identified in consultation with equipment manufacturer.

Care should be taken to ensure that damaged batteries containing energy have been safety de-energized in accordance with disposal procedures, if possible, before handling and disposal. If unable to completely de-energize batteries involved in a fire, care should be taken with handling or dismantling battery systems involved in fires as they may still contain hazardous energy levels.

5 APPENDICES

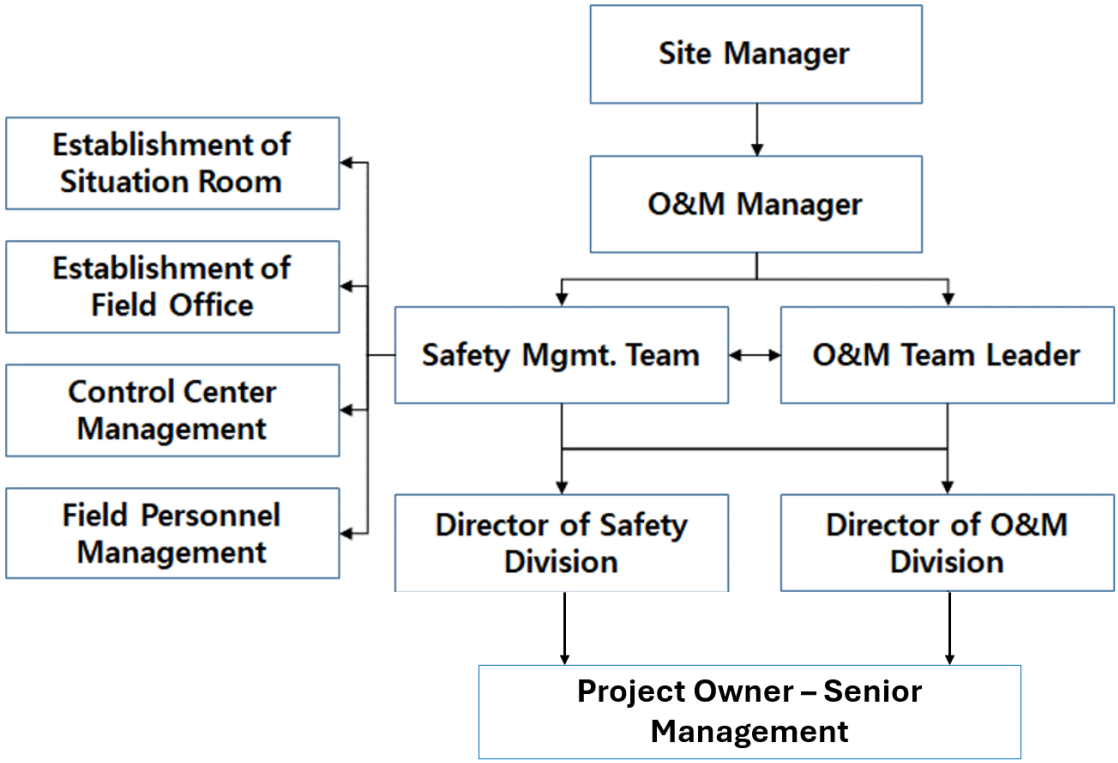
5.1 Appendix 1: Emergency Contacts (T.B.D)

TITLE	COMPANY	INDIVIDUAL	TELEPHONE	EMAIL
Project Owner				
Project Owner				
O&M Manager (Main)				
O&M Manager (Sub)				
Site Manager (Main)				
Site Manager (Sub)				
Trading Agent				
EPC Contractor (PM)				
EPC Contractor (Lead Engineer)				
EPC Owners Engineer				
Construction Contractor				
BESS Supplier				
Battery Supplier				

5.2 Appendix 2: Emergency Services & Contractors (T.B.D)

TITLE	TEL /EMAIL
Fire Office (Emergency)	
Fire Department (Non-Emergency)	
Police (Emergency)	
Police Department (Non-Emergency)	
Ambulance (Emergency)	
Hospital / (Name)	
Hazardous Material Safety Administration	
Equipment Assistance	

5.3 Appendix 3: Emergency Reporting Procedure



5.4 Appendix 4: Escape Routes (T.B.D)