DART+ Coastal North

Public Consultation No.2

Annex 3.2 F: Traction Power Study Report

NTA
Údarás Náisiúnta Iompair
National Transport Authority

Rialtas na hÉireann
Government of Ireland

Tionscadal Éireann
Project Ireland
2040

Iarnród Éireann
Irish Rail

CONTENTS

Tables

Figures

ABBREVIATIONS

Abbreviation	Definition
ACA	Architectural Conservation Area
CAF	Common Appraisal Framework
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
FCC	Fingal County Council
GSI	Geological Survey Ireland
HA	High Amenity
HLC	Historic Landscape Character
IÉ	Irish Rail/ Iarnród Éireann
IEL	Industrial Emissions License
IPC	Integrated Pollution Control
IPPC	Integrated pollution prevention and control
LAP	Local Area Plan
MCA	Multi-criteria analysis
MOS	Manually Operated Switch
NIAH	National Inventory of Architectural Heritage
OHLE	Overhead line equipment
OLE	Overhead line electrification
OPW	Office of Public Works
OS	Open Space
pNHA	Proposed Natural Heritage Area
RA/RS	Residential
RPS	Record of Protected Structures
SAC	Special Area of Conservation
SPA	Special Protected Area
TC	Town Centre
TSS	Traction Substation Study
WFD	Water Framework Directive

1. INTRODUCTION

The purpose of the report is to provide the technical input to the Option Selection Report for substation locations to facilitate Overhead Line Equipment (OHLE) as part of the works delivering an electrified railway between Malahide and Drogheda. This aspect of design is considered separately from the general adopted OHLE methodology due to the bespoke locations for the substations.

The substations are required to deliver power to the overhead line electrification at regular intervals and ensure sufficient supply over the entire route. Their spacing is derived from a technical power study, carried out using specialized software, which has validated the approximate locations required. This study resulted in 8 areas along the proposed electrification line requiring a substation. A number of options have been developed for the specific substation location within these generalised areas. The areas under consideration are as follows:

- Donabate;
- Rush & Lusk;
- Skerries South;
- Skerries North;
- Balbriggan;
- Gormanston;
- Bettystown;
- Drogheda.

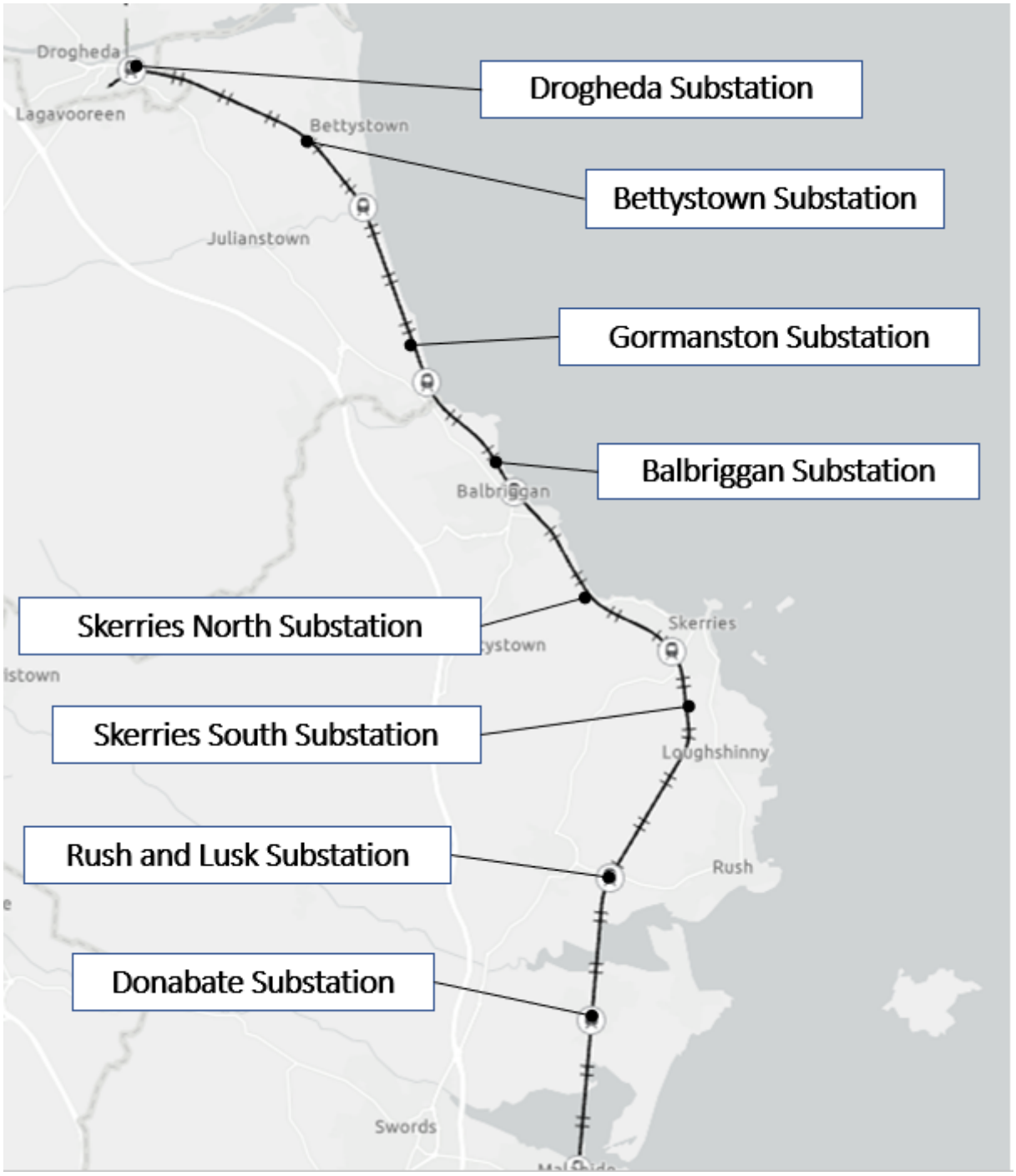

Figure 1-1 Map of substation location (Map data © OpenStreetMap contributors, Map layer by Esri)

This report provides the technical assessment of substation positioning at each of these locations from option selection through to the Preferred Option, including the options considered and how a Preferred Option was chosen.

For each location, the report includes:

- An introduction and description of the study;
- A summary of the option assessment approach undertaken;

- A description of the existing situation;
- The requirements;
- The relevant constraints;
- The option assessment containing:
  - Longlist of options;
  - Sifting of longlist of options;
  - Summary and details of the shortlisted options;
  - Multi-criteria analysis (MCA)(where applicable);
- The Preferred Option.

1.1 Packages of work

The scope of work for DART+ Coastal North covers a wide range of interventions on the Northern Line needed in order to meet the Train Service Specification (TSS) requirements. To appropriately assess options against each other, the works have been split into separate work packages, as detailed in the relevant Annexes. Where appropriate, the works have then been further split down into sections which define the system which has been subject to the optioneering and design process.

This document is a section of the Annex 3.2: Electrification of the Northern Line. Please refer to Table 1-1 for a list of the different sections which make up the electrification package of work issued for Public Consultation 2.

Table 1-1 List of key documents associated with Electrification of the Northern Line between Malahide and Drogheda

Annex	Section	Title
3.2	A	OHLE System
	B	OHLS foundation solutions
	C	OHLE foundation solutions at underbridges
	D	Bridge parapet modification
	E	OHLE Bridge Clearance works
	E1	OBB39 Option Selection Report
	E2	OBB44 Option Selection Report
	E3	OBB55 Option Selection Report
	E4	OBB78 Option Selection Report
	E5	OBB80/80A/80B Option Selection Report
	E6	OBB81 Option Selection Report
	F	Traction Power Supply
	H	Fencing and lineside safety
	I	Drogheda Station Canopies

1.2 References

This report should be read in conjunction with the following related optioneering reports:

Table 1-2: List of key documents associated with this report

Annex	Title	Description
N/A	DART+ Coastal North Option Selection Report: Preferred Option Report	This report summarises the Preferred Option.
N/A	DART+ Coastal North Option Selection Report: Technical Report	This is the report which summarises the preferred options for the different packages on the DART+ Coastal North project.
1	Schematic Drawings	Schematic drawings of each preferred option, to support the Preliminary Option Selection Report.
2.1	Policy Context	This presents a detailed review of the European, National, Regional and Local policy context for the DART+ Programme and the DART+ Coastal North Project
2.2	Useful Links	Useful links to documents/websites relating to the DART+ Coastal North project.
3.1	Constraints Report	This report reviews the DART+ Coastal North constraints.

1.3 Option Assessment Approach

The works proposed have been assessed using the Department of Transport's Common Appraisal Framework for Transport Projects and Programmes (CAF) as the options have the potential to be geographically different from each other and have a material difference on external parties or the environment. Further details can be found in the Option Selection Process section of the Option Selection Report.

2. REQUIREMENTS

2.1 Specific Requirements

The distribution of the traction substations on the route has been determined by a power study developed by Ardanuy. On average for a 1500VDC system a spacing of about 5km with a maximum of 6km is expected. The distance between the electrical traction substations is limited by the minimum voltage level available in the OHLE with which the train's electric motor can work. This value is defined in the standards and all train manufacturers take it into account when designing their vehicles.

The greater the number of trains circulating on the line, the greater the electricity demand and the greater the voltage drop, making it necessary for the substations to be closer together or compensated by the provision of additional cables between the substations within practical limits.

Traction Substations shall not be constructed in areas with a flood Zone A rating. Zone C shall be the preferable zones. If there is no alternative, a substation may be constructed in a location with a flood Zone B rating, but the floor will be raised above the predicted flood level along with the provision of steps and landing area outside the substation's door.

24-hour unimpeded access for IÉ maintenance staff and ESB Networks staff is essential. This access should be from a public road, as vehicular access to the substation is required at any time of the day or night.

Substations shall be designed to accommodate a supply connection of 38kV from the ESBN utility as the preferred voltage level. However, the actual connection will depend on the capacity and location of the nearby network. As part of the substation infrastructure, an ESBN substation will be constructed adjacent to the IE traction substation. The ESBN substation will receive the 38 kV supply and provide the necessary protection and metering. Basic requirements for the ESBN substation include the possibility of 4.5m width access road and sufficient space for turning of trucks.

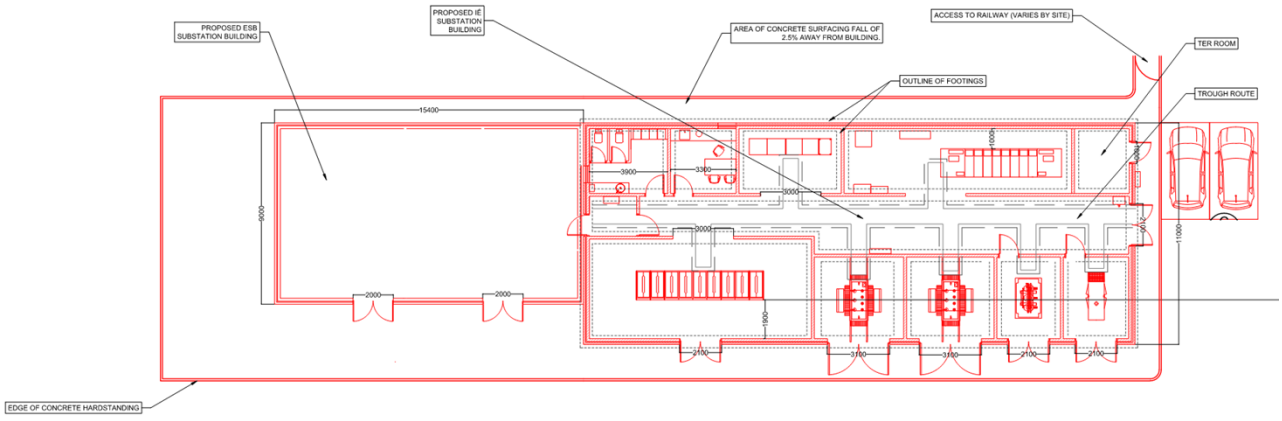

Figure 2-1 Typical Substation layout

Welfare facilities may also need to be provided that are chiefly mandated by ESBN requirements to support extended staff presence and comply with workplace requirements. However, the extent of

the welfare facilities will be dependent on the availability of nearby equivalents and the feasibility of providing these within the substation.

The works required to be undertaken by ESBN to deliver the power and cables to the substation sites are not covered in this report.

2.2 Systems Infrastructure and Integration

The traction substations supply the OHLE. This is done through feeder cables that connect the substation to the OHLE through lineside switches (Manually Operated Switch - MOS).

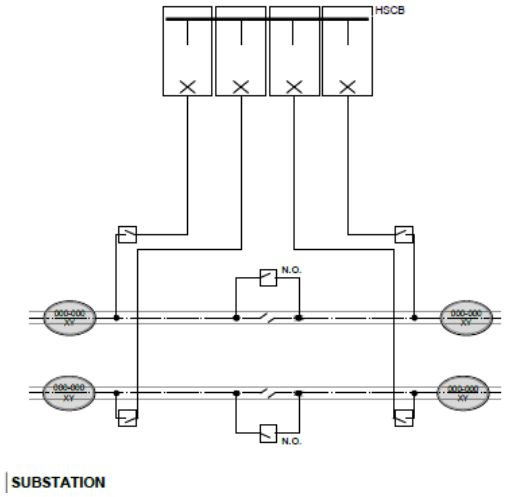

Figure 2-2 OHLE Feeder Connection outside station area

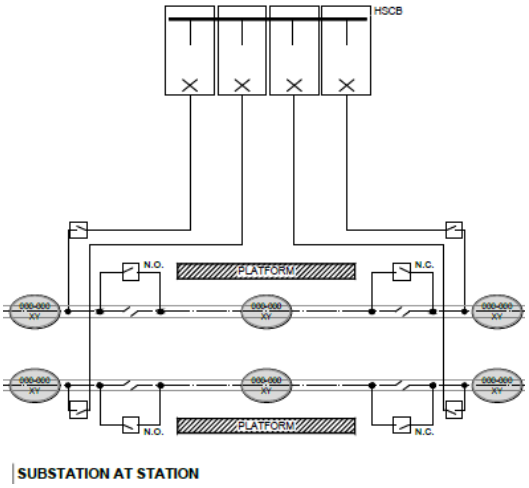

Figure 2-3 OHLE Feeder Connection at station

The configuration of the feeder connections are arranged to provide maximum flexibility in the event of sectional isolations allowing trains to continue to operate in the energised sections.

2.3 Design Standards

Design principles for traction substations are contained in the IE's Functional Requirements Specification document which defines the standardised approach to the substation design. This document also lists the applicable legislation and IE technical standard which apply to the design of various aspects of the substation.

3. DONABATE SUBSTATION OPTIONEERING SELECTION PROCESS

3.1 Existing Situation and Constraints

The requirements described in Section 2 have dictated the need for a substation in the Donabate area. The area under consideration extends from directly south of the overbridge for the R126 to the northern boundary of the station car park.

3.1.1 Utilities

Substations shall be supplied from the ESBN 38kV network and each substation will include ESBN infrastructure to manage the incoming supply and necessary protection. ESBN will require unfettered access to their protection equipment accommodated in a secure dedicated building.

Substations are expected to be equipped with welfare facilities for maintenance staff and will require a fresh water supply and foul water drainage.

Existing utilities are a constraining factor to the project when considering the various design options for the construction of substations. It is often cheaper, easier, and quicker for a project to change the design than to divert a utility. Existing utilities should be taken into consideration from an early stage in the project, and where possible worked around and only diverted where necessary. Appropriate arrangements must be made with the various utility providers long before construction of the substation commences.

Utility records have been gathered from the utility providers in the area. The following utility companies have infrastructure within the area of interest:

- Eir;
- BT Ireland;
- Virgin Media ;
- Gas Networks Ireland;
- ESB;
- Irish Water;
- Irish Rail; and
- Enet

The figure below shows the utility records that Arup has for the proposed substation sites.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring.

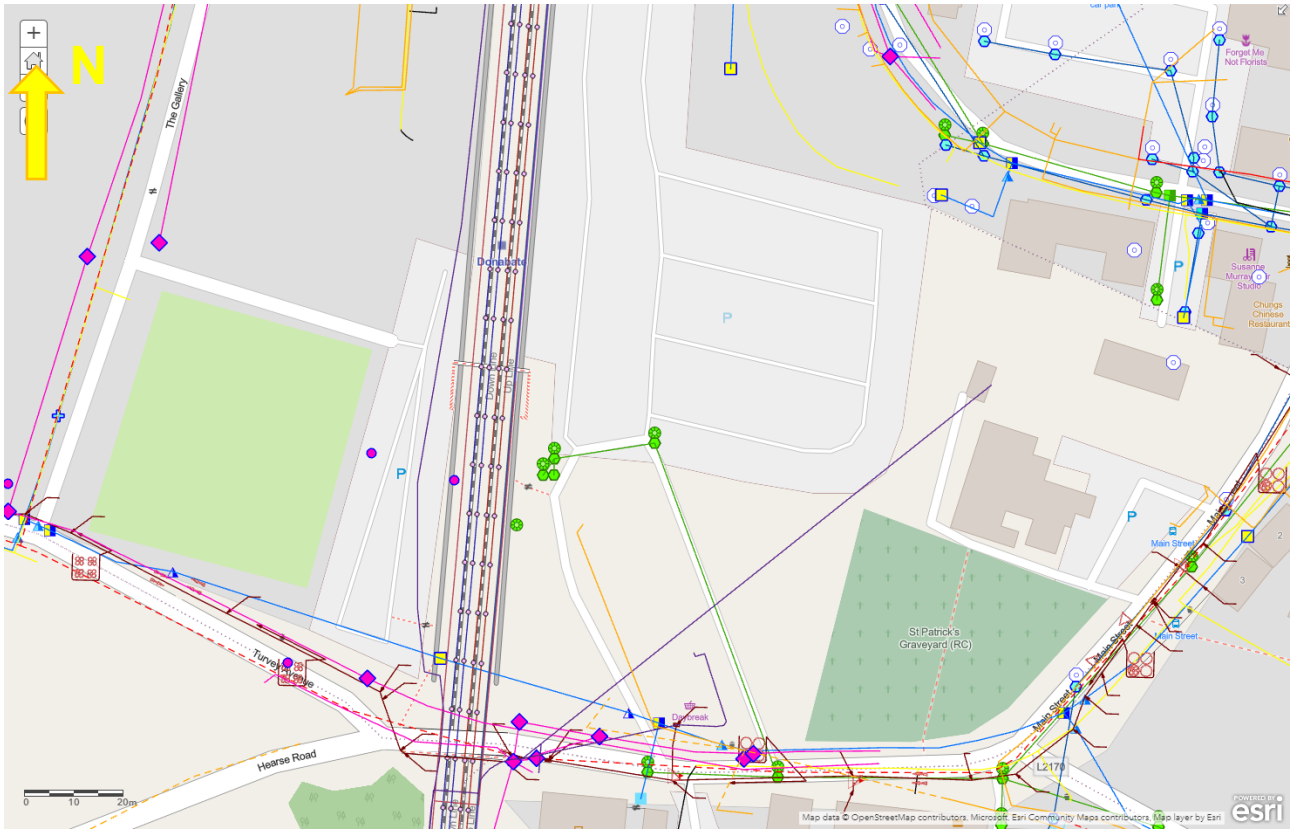

Figure 3-1 Existing Utilities around Donabate Station

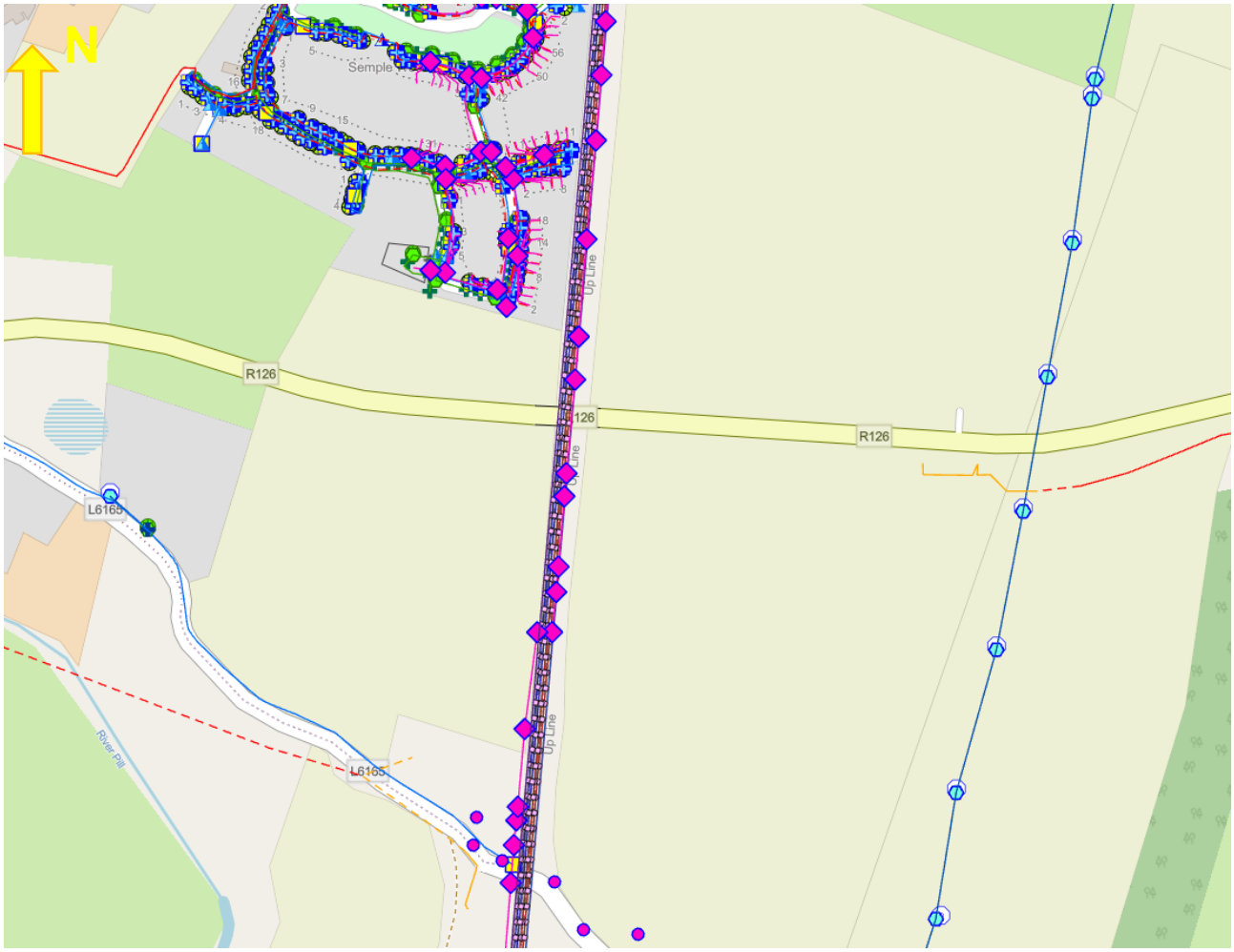

Figure 3-2 Existing Utilities to the south of Donabate

3.1.2 Environmental

3.1.2.1 Traffic and transportation

The nearest road link of strategic importance in this area is the R126 which connects with the M1 in the west. The road is 6m wide and should be suitable to serve construction traffic.

The existing parking, pedestrians and cyclists need to be accommodated at the Donabate Park & Ride. The planned Broadmeadow Greenway is in proximity to the area but there should not be any significant impact. It is also noted that there is a planned walkway in the southeast that links Donabate Beach through Corballis with Donabate Town Centre. Due to the low volume of operational traffic to be generated by the substation and the temporary nature of the construction period these are not considered to be constraints.

3.1.2.2 Landscape and visual quality

Lands to the south of the recently constructed Donabate Distributor Road are zoned HA – High Amenity. Lands to the north leading to Donabate village are zoned RA – Residential and are subject to recent / on-going and planned development. Areas within the village, including surrounding the train station are zoned TC – Town and District Centre, with some RA and RS – Residential and OS – Open Space. The entire area is described as Highly Sensitive Landscape.

The existing train station is located at the centre of the village, with St Patrick's Parish Hall and Donabate Old Graveyard to the east. A mature tree-line provides for separation between the Hall / Graveyard and a small area of open space with mature trees and the rail station.

Key constraints are residential amenity, open space and local landscape features including mature trees.

3.1.2.3 Archaeology and cultural heritage

Previously unknown prehistoric evidence was identified during preconstruction excavation in the townland of Beaverstown, adjacent to Donabate Train Station (Hagen, 02E1708). The Early Neolithic period (c. 4000–3500BC) was represented by a pit and three postholes, while a single posthole and two pits belonged to the Beaker period (c. 2400–2200BC). The site, a domestic enclosure c. 25m diameter, appears to have been abandoned after the Beaker period until the commencement of the later stages of the Bronze Age (c. 1500-500BC).

As part of a suite of investigation works for the placement of the Donabate Distributor Road, a geophysical survey (Leigh 2006) of the agricultural fields and test excavation along the preferred route of the scheme took place. Along with scanning, detailed areas of geophysical survey took place and no anomalies of an archaeological strength was revealed in the environs of the proposed substation locations to the south of Donabate.

Donabate grew up around the medieval ecclesiastical foundation in Donabate townland, which includes the present church, located on the site of the medieval parish church (DU012-005/01), the graveyard (DU012-005/03), a memorial slab (DU012-005/04) and the tower house (DU012-005/02). The medieval church is mentioned in 1230 when it was granted to the monastery of Grane.

Archaeological test excavations were carried out in 1999 in the glebe field to the west of the Donabate church. This revealed a considerable amount of activity, ranging in date from the medieval, late medieval and post-medieval periods. Finds included a sixteenth century coin, as well as pits containing food debris, bone and shell, which may date to the late medieval period (Walsh 2000).

Several artefacts have been recovered during metal detecting in Donabate and are recorded in the topographical files of the National Museum of Ireland. Finds include buttons, a spur, harness and shoe buckles, the foot of a vessel and a musket ball (NMI refs. 1999:127-136 and 1999:302-303).

The present St. Patrick's Catholic Church, built of Portmarnock brick with cut stone dressing, was opened in 1903. It was built on a site donated by John Smyth of Bridge House Pub (Bates 2001).

3.1.2.4 Architectural Heritage

Donabate Cemetery, which is at the east of the proposed site, was established c.1850. The associated RC T-Plan Chapel is now in use as a parish hall. It is included in Fingal County Council's Record of Protected Structures (FCC RPS 861). It is not included in the NIAH, though the Cemetery is included (Reference NIAH 11336016). The cemetery is rated of Regional importance by the NIAH for reasons of artistic and social interest.

Smyth's public house, which is to the south of the proposed site is also included in Fingal County Council's Record of Protected Structures (FCC RPS 509). It is also included in the NIAH (NIAH 11336022) where it is rated of Regional importance for reasons of architectural interest.

Donabate Railway Station with signal box, (FCC RPS 511) and Donabate Station Master's House (FCC RPS 510) are included in Fingal County Council's Record of Protected Structures. They are also included in the NIAH where they are rated of regional importance for reasons of architectural, artistic, social and technical interest.

A single arch limestone railway bridge to the south of the station is also included in the NIAH (NIAH 11336014). It is rated of regional importance for reasons of architectural and technical interest.

There was a late-eighteenth century linear settlement of cottages lining both sides of the road from Main Street to Ballisk Commons.

There are buildings and features to the south of the road, and within the vicinity of the Proposed Site, which may be associated with this early settlement, which would be of architectural heritage value. These include one structure included in Fingal County Council' Record of Protected Structures (FCC RPS 514). This is a thatched cottage, described as a *late 18th or early 19th century three-bay single-storey thatched dwelling.* The building is also included in the NIAH (Reference NIAH 11329015), where it is rated of regional importance for reasons of architectural, social and technical interest.

While many of the other buildings along this road appear to be modern replacements, there are some which correspond to the footprints shown on the 1907 OS maps for Donabate, which was called Ballisk at that time.

There are historic property boundaries indicated on the first edition Ordnance Survey maps for the proposed site, corresponding to the modern site boundaries. These walls require site inspections to verify whether or not they are of architectural heritage interest.

The overpass appears to have been largely reconstructed in modern times, it may be provisionally rated of local importance but a site inspection is required to confirm its architectural heritage value.

There appear to be some historic cottages marked Ballisk Common on the 1907 OS map, the remains of which survive. Ahead of a site inspection, they should be considered to be of local importance.

There was a signal post to the north of the proposed site, and a Good's Shed to the south, both of which appear to have been demolished in the late twentieth century.

Newbridge Demesne is designated as an Architectural Conservation Area (ACA) and is located to the west of the train line, approximately 150m away at the nearest point. None of the Options under review would impact on the setting of the ACA.

3.1.2.5 Noise and Vibration

Donabate is a small town, and the noise and vibration environment in the vicinity of the rail line will be dominated by noise from passing trains. Electrification of this train line will reduce diesel engine noise from passing trains.

3.1.2.6 Air Quality and climate

The development of a substation will have no operational air quality impacts. There is the potential for air quality impacts during the construction phase where works take place in proximity to sensitive receptors. However, the construction works will be of a small scale.

3.1.2.7 Agricultural and non-agricultural

To the south and east of the area there is good quality agricultural land which is a combination of pasture and non-irrigated arable. The sensitivity of the agricultural land is medium due to the absence of dairy and equine enterprises. The area near Donabate Station is non-agricultural – i.e. urban.

3.1.2.8 Geology and Soils

A review of historic mapping (OSi Historic 6" and 25" Maps) and aerial photography shows that the study area was originally agricultural land with embankments for the eventual railway line which was in progress. No significant development within the vicinity was noted. Beyond 1888, significant developments were observed notably the completion of works for the railway line and the construction of Donabate station and surrounding houses and buildings.

The Corine Land Cover 2018 categorises the land cover for most of the site as agricultural areas with pastures and non-irrigated arable land. The land use for some minor regions to the north are described as artificial surfaces with discontinuous urban fabric. No historic pits, quarries or IPPC, IPC and IEL licensed facilities were identified within the study area and its surrounding.

The EPA National Soil map indicates the presence of made ground at Donabate station and extends approximately 600m to the east and west respectively.

The EPA waterbodies map (2021) shows that no waterbodies traverse the site or are located within the vicinity and as such associated soft soils or deposits are therefore not expected across the site.

The GSI Quaternary sediment mapping shows the presence of glacial deposits comprising Irish Sea till derived from Lower Palaeozoic sandstones and shales predominating across the study area. Recent deposits comprising topsoil, alluvial, estuarine silts and glacial deposits were noted at 400m to the south of Donabate station and to the south-west of the overbridge OBB32A. Additionally, subglacial lineation such as drumlins crossing the site were noted.

GSI bedrock mapping show that the site is underlain by argillaceous bioclastic limestone and shale of the Malahide formation; red coarse sandstone and conglomerate of the Donabate formation; andesite, tuff, pebbly mudstone and shale of the Portrane volcanic formation. Bedrock structural linework notably anticlinal and synclinal fold axes and an unconformity cross the site.

3.1.2.9 Water resources

Surface water bodies

The study area is located in the Turvey_010 (IE_EA_08T020700) river sub-basin. The River Pill (Turvey_010) watercourse flows in a south-easterly direction 500m southwest of the study area towards Malahide Bay. Under the Water Framework Directive (WFD, 2000/60/EC) the status of the Turvey_010 is unassigned and the waterbody is classified as 'At Risk'. The Malahide Bay coastal

waterbody is at 'Moderate' status for the 2013-2018 monitoring cycle and 'At Risk', indicating that the waterbody may not maintain or achieve that status on the next WFD cycle. The minimum objectives for a water body under the WFD are to achieve at least 'Good' status (or 'Good potential' for artificial/ highly modified water bodies), and no deterioration of existing status.

Malahide Bay is part of the Malahide Estuary Special Area of Conservation (SAC), Special Protected Area (SPA) and proposed Natural Heritage Area (pNHA).

Groundwater

The study area is underlain by bands of Dinantian Lower Impure Limestone, Dinantian Sandstones and Ordovician Volcanics. The Dinantian Lower Impure Limestone aquifer is classified as a Locally Important (Ll) Aquifer which is Moderately Productive only in Local Zones. The Dinantian Sandstone aquifer is classified as a Locally Important (Lm) Aquifer which is Generally Moderately Productive. The Ordovician Volcanic aquifer is a Poor Aquifer which is Generally Unproductive except for Local Zones. The groundwater vulnerability at the site is classified as Low in the southern part of the study area and increases to High in the northern part of the study area.

There are no significant karst features identified near the site. There are also no high yielding water supply springs and wells i.e. public water supplies or group water scheme supplies within the site. No Source Protection Zones associated with public or group groundwater supply schemes are located with the site.

The study area lies within the Swords groundwater body (IE_EA_G_011). The Swords groundwater body is currently at 'Good' WFD Status for the 2013-2018 monitoring cycle and currently 'Not at Risk' with regard to achieving its WFD objectives.

Flooding

Historical flooding has been assessed by examining reports and maps from National Flood Hazard mapping by the Office of Public Work (OPW). There are records of reoccurring flooding near the northern part of the area on Ballisk Lane (Flood ID No 1709 and 1457). In 2002, 300m of surface water ponding was reported to occur in low lying areas under the Railway Bridge, 100m north of option 7. During the same event, flooding was reported along Hearst Road (Flood ID 1710). The exact location is not reported.

3.1.2.10 Biodiversity

The works location is set within the urban centre of Donabate, approximately halfway between the estuarine environment of the Malahide Estuary to the south, and Rogerstown Estuary to the north. The Broadmeadow Water and Rogerstown Estuary are designated as Special Area of Conservations (SAC), Special Protection Areas (SPA) and proposed Natural Heritage Areas (pNHA).

The key ecological constraints in this area are the Malahide Estuary SAC, Rogerstown Estuary SAC Malahide Estuary SPA, Rogerstown Estuary SPA and proposed Natural Heritage Area designation which are designated for marine habitats and overwintering birds. These designated areas are of international and national biodiversity importance.

The qualifying interests (reasons for designation) of the Malahide Estuary SAC and SPA, and Rogerstown Estuary SAC and SPA are listed in Table 3-1.

Table 3-1 Table of Qualifying Interests for Malahide Estuary and Rogerstown (SAC and SPAs)

Malahide Estuary SAC	Malahide Estuary SPA
1140 Mudflats and sandflats not covered by seawater at low tide 1310 *Salicornia* and other annuals colonising mud and sand 1320 Spartina swards (*Spartinion maritimae*) 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1410 Mediterranean salt meadows (*Juncetalia maritimi*) 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)*	A005 Great Crested Grebe *Podiceps cristatus* A046 Brent Goose *Branta bernicla hrota* A048 Shelduck *Tadorna tadorna* A054 Pintail *Anas acuta* A067 Goldeneye *Bucephala clangula* A069 Red-breasted Merganser *Mergus serrator* A130 Oystercatcher *Haematopus ostralegus* A140 Golden Plover *Pluvialis apricaria* A141 Grey Plover *Pluvialis squatarola* A143 Knot *Calidris canutus* A149 Dunlin *Calidris alpina* A156 Black-tailed Godwit *Limosa limosa* A157 Bar-tailed Godwit *Limosa lapponica* A162 Redshank *Tringa totanus* A999 Wetland
Rogerstown Estuary SAC	**Rogerstown Estuary SPA**
1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1310 Salicornia and other annuals colonising mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1410 Mediterranean salt meadows (*Juncetalia maritimi*) 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)*	A043 Greylag Goose *Anser anser* A046 Brent Goose *Branta bernicla hrota* A048 Shelduck *Tadorna* A056 Shoveler *Anas clypeata* A130 Oystercatcher *Haematopus ostralegus* A137 Ringed Plover *Charadrius hiaticula* A141 Grey Plover *Pluvialis squatarola* A143 Knot *Calidris canutus* A149 Dunlin *Calidris alpina* A156 Black-tailed Godwit *Limosa* A162 Redshank *Tringa totanus* A999 Wetlands

Other potential ecological constraints include:

- Vegetation (scrub, hedgerows or treelines) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals)
- Potential for the railway and habitats adjacent to support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature
- Potential for invasive species to occur along/near the railway line
- Potential for roosting bats in buildings adjacent to works areas

3.1.3 Planning

The lands on which the various options are located, have similar zonings in both the current Fingal Development Plan 2107-2022 and the Draft Fingal Development Plan 2023-2029:

- G3/High Amenity: Protect and enhance high amenity areas.
- R1/Residential Area: Provide for new residential communities subject to the provision of the necessary social and physical infrastructure
- M2/Town and District Centre: Protect and enhance the special physical and social character of town and district centres and provide and/or improve urban facilities.

There are no pending planning applications or undeveloped planning permissions that are affected by the various options.

3.2 Longlist Options

The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. Locations considered are shown in Figure 3-3.

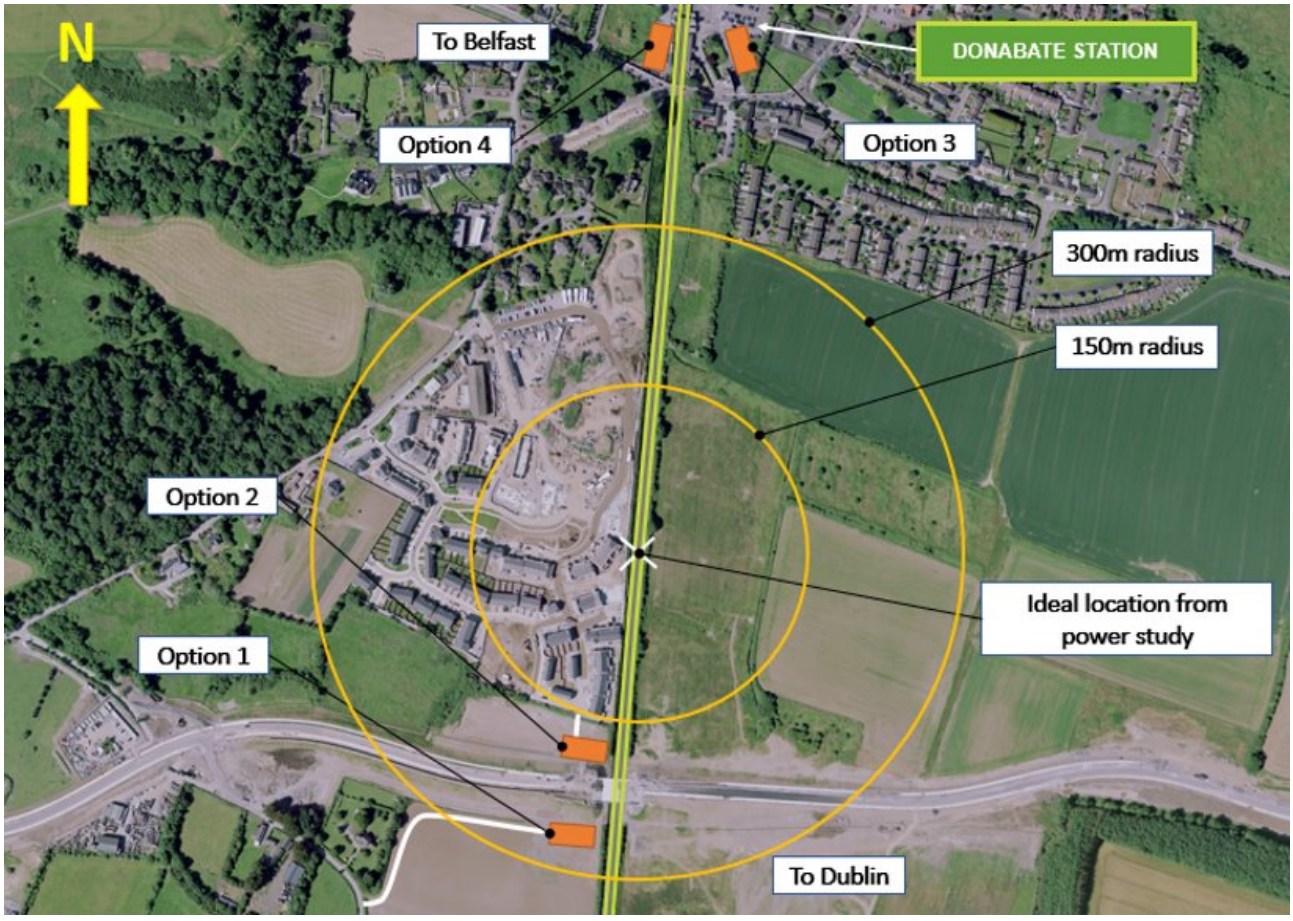

Figure 3-3: Donabate Substation Options

Note no options have been proposed to the east of the railway corridor, between Donabate station and the road R126, as this area is noted as strategic housing development with area dedicated for a school.

3.2.1 Option 0- Do nothing

No substation provided

3.2.2 Option 1

Option 1 comprises construction of a substation on agricultural land south of the R126, west of the railway line. An access road would be required from the lane south-west of the proposed location.

3.2.3 Option 2

Option 2 comprises construction of a substation on agricultural land north of the R126, west of the railway line. An access road would be required from the housing development direction north of the site.

3.2.4 Option 3

Option 3 comprises construction of a substation on a grassed area at the entrance to the station car park, east of the railway line, located on IÉ owned land.

3.2.5 Option 4

Option 4 comprises construction of a substation on undeveloped land west of the station. It is envisaged access would be provided through the station west car park.

3.3 Sifting of longlist of options

Assessment is provided in Table 3-2.

Table 3-2: Assessment of longlist of options against project objectives and requirements (options "do-nothing" to 4)

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3		Option 4	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	No impact due to 'do-nothing' approach.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned access and land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of land
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Fail	Lack of substation does not allow delivery of electrified route in accordance with standards. I.e., non-compliant	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	No impact due to 'do-nothing' approach.	Pass	Likely to extend outside highway affected land into agricultural land	Pass	Likely to extend outside highway affected land into agricultural land	Pass	Some tree loss Likely brownfield site Vicinity to graveyard boundary Loss of parking	Pass	Site is allocated in town centre development plan, not considered compatible as wouldn't fit within car park
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	No impact due to 'do-nothing' approach.	Pass	Majority of works can be carried out away from the railway line. Some road impact may occur due to construction of new access road. Current landowners will be affected	Pass	Majority of works can be carried out away from the railway line. Some road impact may occur due to construction of new access road. Current landowners will be affected	Pass	Majority of works can be carried out away from the railway line. Disruption to car park during construction Some loss of parking spaces	Pass	Majority of works can be carried out away from the railway line. Some loss of car parking
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No impact due to 'do-nothing' approach.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Likely brownfield site, but some tree loss	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Brownfield site

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3		Option 4	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	No infrastructure intervention considered as part of 'do-nothing' approach.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged from 'do-nothing' approach.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Fail	Insufficient location and number of substations for delivery of an electrified route.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	No clearance issues associated with 'do-nothing' approach.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Safety not impacted by 'do-nothing' approach. Protection of substation infrastructure not required.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

3.3.1 Summary of longlist sifting

Table 3-3: Summary of Longlist Sifting

Option	Screening Result	Summary
" Do- nothing"	**FAIL**	• Fails to provide electrical railway between Malahide and Drogheda • Fails to provide adequate number and location of substations
Option1	**PASS**	Meets project objectives and requirements
Option 2	**PASS**	Meets project objectives and requirements
Option 3	**PASS**	Meets project objectives and requirements
Option 4	**PASS**	Meets project objectives and requirements

3.4 Shortlisted options

The following options have been taken forward to the shortlist and to the MCA process:

- Option 1
- Option 2
- Option 3
- Option 4

For further detailed drawings of the shortlisted options please refer to drawing D+WP56-ARP-ZZ-NL-DR-HV-000030 to D+WP56-ARP-ZZ-NL-DR-HV-000037 in Appendix B.

3.5 Multi-criteria analysis

3.5.1 Methodology

For each individual entity an assessment has been made against the MCA criteria. Each option has been relatively compared against the others based on the five-point colour coded ranking scale in

Table 3-6.

3.5.2 MCA summary table

A multi-criteria analysis table is presented in this section. This has been developed to reflect the relative rankings for all sub-criteria for each of the options assessed and is presented as a summary of the key issues considered.

A more detailed table is provided in Appendix A to this report with the full detailed rationale behind the scoring of each criteria and option.

Table 3-4 MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 2	Option 3	Option 4
	CAPEX				
	OPEX				
	Train Operations Functionality/Economic Benefit				
	Traffic functionality and associated economic activities and opportunities				
Safety	Employer's Safety				
	Public safety				
Environment	Landscape and Visual Quality				
	Biodiversity				
	Noise and Vibration				
	Water resources				
	Archaeology, Architectural and Cultural Heritage				
	Geology and Soils (includes waste)				
	Agricultural and non-agricultural				
	Air Quality & Climate Change				
Accessibility & Social Inclusion	Accessibility				
	Social Inclusion				
Integration	Adaptability in the future				
	Transport Integration				
	Land Use Integration				
	Government policy integration				
	Geographical integration				
Physical Activity	Walking/cycling opportunities				

Table 3-5 Overall criteria MCA summary table

Criteria Summary	Option 1	Option 2	Option 3	Option 4
Economy				
Safety				
Environment				
Accessibility & Social Inclusion				
Integration				
Physical Activity				

Table 3-6: Legend for MCA Summary Tables

Significant comparative advantage over other options
Some comparative advantage over other options
Comparable to other options / neutral
Some comparative disadvantage over other options
Significant comparative disadvantage over other options

3.5.3 Economy

Economy has been divided into four sub-criteria which are considered below.

CAPEX

Option 1 is seen to have some comparative disadvantages to the other options as this option has the longest access road requirement – approximately 200m. When comparing the other options – Options 3 and 4 have no requirement of a new access road as the current station car park will be used and Option 2's access road is of minimal length.

OPEX

Although there are minor differences, for example length of access road could affect maintenance costs, these are not perceived as being materially different for the purposes of optioneering and therefore the options are comparable/neutral to each other.

Train operations functionality/economic benefits

All options are considered comparable from the perspective of train operations. All options provide a substation which will allow the electrification of the Northern Line.

Traffic functionality and associated economic activities and opportunities

Option 3 and 4 have some comparative disadvantages to the other options as they impact existing parking, pedestrians and cyclists at the Donabate Station. Option 2 also has some comparative disadvantages when compared with other options as the access through the residential estate will impact local traffic, pedestrians and cyclists during construction.

3.5.4 Safety

Safety has been divided into two sub-criteria which are considered below. It should be noted that all options are safe, but some will have the potential for greater residual risks to remain. This criterion considers relative advantages of each option on the criteria of safety.

Employer's Safety

There are no material differences between the options when comparing the employer's safety. All substation options have the same designs to ensure employer's safety is considered and maintained.

Public Safety

Similar to employer's safety, there is no material difference between the substation option designs.

3.5.5 Environment

Section 3.1.2 sets out a description of the existing environment, under key environmental criteria, and considers the key environmental constraints associated with this study area. Below is a summary of the key findings of the MCA under the various environmental criteria, with an emphasis on differentiating aspects for the options considered.

3.5.5.1 Landscape and visual quality

Options 1 and 2 are located immediately west of the railway to either side of the R126, which is set on high embankment. Therefore, the two sites are set into the corner between the railway and the elevated road. Option 1 is in a more remote location within high amenity lands immediately south of the R126. Good screening could be provided. Option 2 is north of the R126 and is closer to residential development at The Park.

Options 3 and 4 are to either side of the rail station located in the centre of the village. Option 3 to the east is located partly on existing open space and partly on carpark area. This would involve loss of green area and mature trees and potential impact on the mature tree boundary to the west of the Parish Hall and Old Graveyard. Option 4 is located on an existing carpark area to the west of the railway. The location is overlooked by existing residential development.

Despite its location within a high amenity area, Option 1 has significant comparative advantages over other options as it is located along the embankment of the R126, is remote from properties, and affords opportunities for good screening. Despite its proximity to residential properties, Option 2 has some comparative advantages over other options being located along the embankment of the R126 and having opportunities for good screening.

Option 4 has some comparative disadvantages over other options being located with the village centre and overlooked by other development. Option 3 has significant disadvantages over other options, with direct impact on open space and mature trees and potential for further impact on a mature tree-line on the boundary with the Parish Hall and Old Graveyard in the centre of the village.

3.5.5.2 Biodiversity

All of the proposed options have potential to indirectly impact on the Malahide Estuary SAC, SPA and pNHA, and Rogerstown Estuary SAC, SPA and pNHA. Potential indirect impacts include construction related impacts (e.g. potential for water quality impacts or disturbance to birds) and new lighting which could impact on birds. The potential for these impacts is similar across all options, however; Options 3 and 4 are slightly further from European site boundaries than Options 1 and 2, and so impacts may be slightly reduced in these Options.

Other potential ecological constraints include vegetation removal with potential for removal of habitat of value (scrub, hedgerows or treelines) and which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals).

The likelihood of vegetation removal appears to be highest in option 1, which would require possible grassland removal at the TSS location, and hedgerow/treeline removal east of this for the development of access roads. The TSS itself is within agricultural lands which are typically low value habitat, however rare and/or protected plant species could occur here due to the calcareous nature of the adjacent railway substrate. Option 3 would also require hedgerow and tree removal adjacent to the graveyard. Option 2 requires slightly less habitat removal than Option 1 and 3, however the grassland where the TSS will be located appears to be good quality calcareous grassland (from satellite view) and may contain rare/protected species (will need to be assessed if this is the case in reality).

Some treeline/hedgerow removal will also be required for the access road. Option 4 requires no habitat removal as it is located in hard standing/artificial habitat, used as a carpark.

Option 3 is located adjacent to Donabate Old Graveyard, directly opposite this location is an old stone building (possibly derelict), that has high potential for roosting bats (from Google Street view). If this building was a confirmed bat roost, works could potentially disturb bats, and mitigation measures will be required. Options 1 and 2 are also located adjacent to OBB32a, which has potential for roosting bats. The potential for disturbance to commuting and/or foraging bats is equal amongst all options.

It is not known whether invasive species may occur along or near the railway line. If present, then there would be risk of spreading these to adjacent areas with the adjacent Malahide and Rogerstown Estuaries SAC and SPA being particularly sensitive receptors. Even if it were the case that invasive species are present in this area, the level of impact is likely to be similar across all options and might not be a significant differentiator between options.

3.5.5.3 Noise and Vibration

From a noise and vibration point of view, options that are further away from residential and other sensitive receivers are preferable. Construction and operational noise and vibration from the substations have the potential to disturb the acoustic amenity of nearby sensitive receivers.

Option 1 has significant comparative advantages over the other options as it is the furthest from any sensitive receivers.

Options 2 and 3 are the closest to sensitive residential receptors, and option 4 is close to sensitive commercial receptors (a Montessori school and a café).

3.5.5.4 Water Resources

With regard to groundwater and surface water all the options are considered to be comparable considering any excavations are relatively shallow and where standard practice is applied to prevent pollution from entering surface and groundwater bodies the impact to such waterbodies is imperceptible.

From a flooding perspective the options are similarly comparable with each other. All options are located in Zone C with limited flood risk.

3.5.5.5 Archaeology, architectural and cultural heritage

From an archaeological perspective Options 1 and 2 have some comparative advantage over Options 3 and 4 as they are located within a greenfield environment and have the potential to reveal subsurface archaeological remains during the construction of the substation.

Options 3 and 4 has some comparative disadvantage over other options as they are located within Donabate Village with Option 3 located immediately west of Donabate Cemetery and Option 4 partly located within the zone of notification for a recorded monument, an enclosure (DU012-067). It is considered that these options have a greater potential to reveal below ground remains compared to Options 1 and 2.

From an architectural heritage perspective Option 1, 2 and 4 have some comparative advantages over Option 3.

There are no features of heritage interest for Options 1 and 2. The substation would be located to the SW (Option 1) or NW (Option 2) of the bridge. The bridge is of recent construction and is not of heritage interest.

Under Option 3 the substation would be located to the west of Donabate Cemetery (NIAH 11336016, regional importance). There is potential for damage to the cemetery during construction and a negative visual impact on the setting of Donabate Cemetery during operation, the magnitude of which would be high. The proposed site is screened from the sensitive structures to the west and south, which include Donabate Station and signal box, Donabate Station Master's House, Donabate Railway Bridge and Smyth's Public House (all of regional importance), by an early twentieth century two-storey over basement building and the railway station carpark. The magnitude of impact on the setting of these structures would be Medium. Overall, this would have a Negative, Significant impact on the architectural heritage value of the site.

There are no architecturally sensitive features in the location of Option 4 which is to the west of the railway line at Donabate Station. There is a potential impact on setting of adjoining heritage structures, but it is minor.

Overall, the favoured options are Options 1 and 2 as they have some comparative advantage over the other options.

3.5.5.6 Geology and Soils

Options 1 and 2 are comparatively disadvantageous over Options 3 and 4 respectively.

For Options 1 and 2, there is potential for loss of topsoil/growing soil and the requirement for the construction of an access road through agricultural land with associated earthworks. Option 1 will require a longer access road and therefore more earthworks.

For Options 3 and 4, earthworks will be generally restricted to the footprint of the substations. As the area has previously been developed, made ground may be encountered at these locations which may require specialist recovery or disposal.

3.5.5.7 Agricultural and non-agricultural

Options 3 and 4 have significant comparative advantages compared to options 1 and 2 because options 3 and 4 are not located in agricultural land. Options 1 and 2 are located in good quality agricultural land which is medium sensitivity from an agricultural perspective (i.e. land used for grazing and tillage).

3.5.5.8 Air Quality and climate

Option 1 has the greatest separation from the substation site to the nearest sensitive receivers. The other options are in closer proximity, however, no significant impacts on air quality are likely during the construction phase. The development of a substation is required to electrify the railway between Malahide and Drogheda. This conversion will result in positive impacts on air quality and climate. Irish Rail is committed to the use of 80% renewables for DART+ which will result in even greater benefits.

3.5.6 Accessibility and Social Inclusion

All options are comparable as the operation and construction of the substation in all options has no impact on accessibility or social inclusion.

3.5.7 Integration

Integration has been assessed using the five sub-criteria described below.

Adaptability in the future

All options are comparable as the operation and construction of the substation in all options has no impact on future internal transport links.

Transport integration

Option 3 and 4 have some comparative disadvantages to the other options as they impact existing parking, pedestrians and cyclists at the Donabate Station permanently and during construction and mitigation measures will be required.

Land use integration

Option 1 is zoned G3/High Amenity. Option 2 is zoned R1/Residential. Option 3 and 4 are zoned M2/Town Centre. A substation on a High Amenity zoning would be the least preferable. Whilst Options 3 and 4 adjoin the railway station, the town centre zoning would suggest that a more densified use as opposed to a utility would be more desirable at this location.

Option 2 has a significant comparative advantage over the other options.

Government policy integration

All international, national, regional and local policies encourage improvements in relation to the efficiency of public transport. All the proposed options will facilitate the achievement of greater

efficiency in public transportation long part of the east coast of the country and therefore comply with government policy.

Geographical integration

All of the options are infrastructural buildings adjoining a railway line and are considered neutral when compared against each other.

3.5.8 Physical Activity

All options are comparable as the operation and construction of the substation in all options has no impact on physical activity.

3.6 Construction Considerations

Construction of any substation needs to consider at least the following factors:

- Access arrangements off the public highway
- Type and proximity of neighbouring activities (and their sensitivity to construction aspects such as noise, dust, vehicle movements and vibration)
- Type and proximity of nearby ecology (especially vegetation and animals)
- Space availability for worksite compound, i.e. beyond permanent substation footprint
- Ground conditions, with regard to operation of construction plant

With these factors in mind, views on the constructability of substation options at Donabate can be summarised accordingly:

- Option 1 has some advantages overall except access, due to the need to construct a relatively long access road off the public highway.
- Option 2 has particular disadvantages being that construction access would need to be through a residential area, and the same properties would be close receptors to construction noise, vibration and dust.
- Option 3 has negative impacts on local vegetation and local community (e.g. shop alongside), Relative advantages are good access (via an adjacent side road or station car park) and apparent ownership of the plot already by Irish Rail.
- Option 4 is positive for most construction factors except for the proximity of relatively new residential units to the north.

3.7 Summary and conclusions

3.7.1 Non- preferred options

Option 3 is not preferred due to:

- Loss of car parking spaces for the station
- Located within the urban area of Donabate – scores poorly for land use and traffic integration
- Scores poorly under a number of environmental parameters – including landscape, architecture and noise

Option 4 is not preferred due to:

- Located within the urban area of Donabate – scores poorly for land use and traffic integration
- Scores poorly under a number of environmental parameters – including landscape, architecture and noise

Option 2 is not preferred due to:

- Located next to a housing development which will impact the resident during construction and operation.
- Scores poorly under a number of environmental parameters, in particular under noise and vibration

3.7.2 Preferred option

Option 1 has been identified as the preferred option. It has advantages over a number of assessment criteria compared to the other options:

- Scores highly for transport integration, when compared to the other options – i.e. no impact on Donabate town and the residential estate.
- Has more impact on high amenity land but this could largely be mitigated by screening
- Scores highly for environmental parameters.

For further details of the preferred option refer to drawing D+WP56-ARP-P3-NL-DR-CX-000507 in Appendix C.

3.7.3 Key Risks/ Next Steps

The following key next steps are proposed:

- Complete environmental surveys of the proposed site
- Seek feedback from stakeholders on the preferred option.

4. RUSH AND LUSK SUBSTATION OPTION SELECTION

4.1 Existing Situation and Constraints

The requirements described in Section 2 have dictated the need for a substation in the Rush and Lusk area. The area under consideration extends from the southern boundary of the station car park to agricultural land directly adjacent to R128 Station Rd.

4.1.1 Utilities

Substations shall be supplied from the ESBN 38kV network and each substation will include ESBN infrastructure to manage the incoming supply and necessary protection. ESBN will require unfettered access to their protection equipment accommodated in a secure dedicated building.

Substations are expected to be equipped with welfare facilities for maintenance staff and will require a fresh water supply and foul water drainage.

Existing utilities are a constraining factor to the project when considering the various design options for the construction of substations. It is often cheaper, easier, and quicker for a project to change the design than to divert a utility. Existing utilities should be taken into consideration from an early stage in the project, and where possible worked around and only diverted where necessary. Appropriate arrangements must be made with the various utility providers long before construction of the substation commences.

Utility records have been gathered from the utility providers in the area. The following utility companies have infrastructure within the area of interest:

- Eir;
- Virgin Media
- ESB
- Irish Water
- Irish Rail
- Enet

The figure below shows the utility records that Arup has for the proposed substation sites.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring.

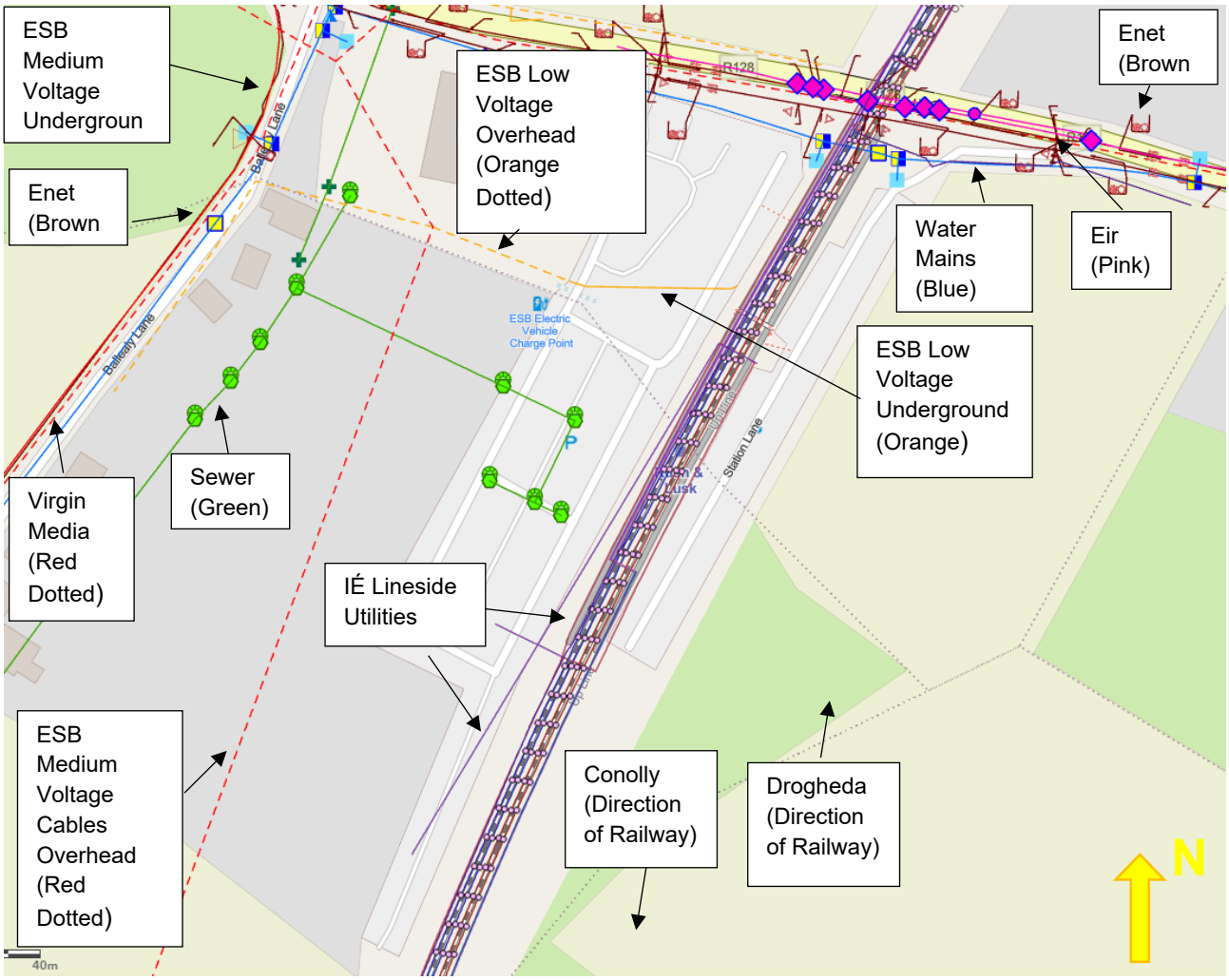

Figure 4-1 Existing Utilities around Rush & Lusk Station

4.1.2 Environmental

4.1.2.1 Traffic and Transportation

The nearest road link of strategic importance in this area is the R128 Whitestown Road which links Rush through to Lusk and connects with the M1 in the south-west, via the R127 and R132. The road is 6m wide and should be suitable to serve construction traffic.

The existing parking, pedestrians and cyclists need to be accommodated at the Rush and Lusk Park & Ride. It is noted that there is an indicative cycle / pedestrian route along R128 Whitestown Road in proximity to the area but there should not be any significant impact.

4.1.2.2 Landscape and visual quality

The existing Railway Station is located between Lusk to the west and Rush to the east. The area is generally rural, with a mix of arable and pasture lands enclosed by strong field boundaries and residential properties with mature gardens. The small residential 'Effelstown Rural Cluster' is located west / southwest of the Railway Station. There is an objective to preserve views along the R128 road to the north of the station. The landscape south of the R128 is described as being Highly Sensitive.

Key constraints are residential amenity, field and property boundaries and the objective to preserve views.

4.1.2.3 Archaeology and cultural heritage

There are no recorded monuments or finds located in the vicinity of the proposed substations for this area.

4.1.2.4 Architectural Heritage

Rush and Lusk Station and signal box are included in Fingal County Council's Record of Protected Structures (FCC RPS 288). They are also listed in the NIAH (NIAH 11323018 and 11323017) where they are rated of regional importance for reasons of architectural, artistic and technical interest. The NIAH also lists the Station Master's House, but this building appears to have been demolished subsequent to its inclusion in the Inventory.

The historic station building is screened from the site by the road bridge and existing mature trees. The historic railway bridge appears to have been rebuilt in recent times though a site inspection is required to ascertain its architectural heritage interest.

4.1.2.5 Noise and Vibration

The location of the Rush & Lusk substation is near the train station. The acoustic environment will include noise from train pass bys. Electric trains are expected to be less noisy than diesel trains.

There are some commercial premises in the vicinity of the train station that will also contribute to the acoustic environment of the site, including a car dealership.

Construction noise and vibration is likely to have the largest impact on the acoustic environment for all sensitive receivers in the vicinity, although tonal noise at low frequencies should be given due consideration for operational phase noise.

4.1.2.6 Air quality and climate

The development of a substation will have no operational air quality impacts. There is the potential for air quality impacts during the construction phase where works take place in proximity to sensitive receptors. However, the construction works will be of a small scale.

4.1.2.7 Agricultural and non-agricultural

No agricultural constraints present at this location.

4.1.2.8 Geology & Soils

A review of historic mapping (OSi Historic 6" and 25" Maps) and aerial photography show that the site was initially agricultural land with embankments for the eventual railway line which was in progress. No significant development within the vicinity was noted. Beyond 1888, developments were observed notably the completion of works for the railway line and the construction of Rush and Lusk station and surrounding units. A quarry was noted at approximately 200m to the east of the railway line after the station.

The Corine Land Cover 2018 categorises the land use for most of the site as agricultural areas with non-irrigated arable land with some regions to the west as heterogeneous agricultural areas with complex cultivation patterns. No historic pits, quarries or IPPC, IPC and IEL facilities were identified within the study area and its surrounding.

The EPA National Soil map indicates the presence of fine loamy drift with limestone (Elton series) across the study area.

The EPA waterbodies map (2021) shows that no stream/river crosses the site. However, there is Rathmooney stream crossing the line at approximately 200m from Rush & Lusk station.

The GSI Quaternary sediment mapping shows the presence of Irish sea till derived from Lower Palaeozoic sandstones and shales predominating at the site with alluvium deposits and bedrock outcrop located 325m and 225m to the north-west of Rush & Lusk station.

GSI bedrock mapping show that the site is underlain by conglomerate, shale and limestone of the Rush Conglomerate formation and calcareous shale, limestone conglomerate of the Tober Colleen formation.

4.1.2.9 Water Resources

Surface water bodies

The study area is located in the Palmerstown_010 (IE_EA_08P030930) river sub-basin. The watercourse flows in an easterly direction approximately 300m north of the site. Under the Water Framework Directive (WFD, 2000/60/EC) the status of the Palmerstown_010 is unassigned and the waterbody is classified as 'under review'.

The Palmerstown_010 watercourse discharges into the Rogerstown Estuary (IE_EA_050_0100) transitional waterbody which is at 'Bad' status for the 2013-2018 monitoring cycle and classified as 'At Risk'. Rogerstown Estuary is an SAC, SPA and pNHA.

Groundwater

The study area is underlain by Dinantian Mixed Sandstones, Shales and Limestones which is part of the Rush Conglomerate Formation. The aquifer is classified as Locally Important (Ll) Aquifer which is Moderately Productive only in Local Zones. The groundwater vulnerability at the site is classified as Moderate to Extreme.

There are no significant karst features identified near the site. There are also no high yielding water supply springs and wells i.e. public water supplies or group water scheme supplies within the site. No Source Protection Zones associated with public or group groundwater supply schemes are located with the study area.

The study area lies within the Swords groundwater body (IE_EA_G_011) and the Waste Facility (W0009-02) groundwater body (IE_EA_G_088). Both groundwater bodies are at 'Good' WFD Status for the 2013-2018 monitoring cycle and currently 'Not at Risk' with regard to achieving their WFD objectives

Flooding

Historical flooding has been assessed by examining reports and maps from the OPW's National Flood Hazard mapping. There are no records of flood events or potential for flooding in the vicinity of the study area.

4.1.2.10 Biodiversity

The works location is set within various locations close to Rush & Lusk train station, approximately halfway between Rush town to the east and Lusk Village to the west. The estuarine environment of the Rogerstown Estuary is approximately 1.2km south of the Rush and Lusk train station. The Rogerstown Estuary is designated as Special Area of Conservation (SAC), Special Protection Areas (SPA) and proposed Natural Heritage Area (pNHA).

The key ecological constraints in this area are the Rogerstown Estuary SAC, Rogerstown Estuary SPA and proposed Natural Heritage Area designation which are designated for marine habitats and overwintering birds. These designated areas are of international and national biodiversity importance.

The qualifying interests (reasons for designation) of the Rogerstown Estuary SAC and SPA are listed below:

Table 4-1: Table of Qualifying Interests for Rogerstown Estuary SAC & SPA

Rogerstown Estuary SAC	Rogerstown Estuary SPA
1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1310 Salicornia and other annuals colonising mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 1410 Mediterranean salt meadows (*Juncetalia 34etanus34)* 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)*	A043 Greylag Goose *34etanu 34etanu* A046 Brent Goose *Branta bernicla hrota* A048 Shelduck *Tadorna* A056 Shoveler *Anas clypeata* A130 Oystercatcher *Haematopus ostralegus* A137 Ringed Plover *Charadrius hiaticula* A141 Grey Plover *Pluvialis squatarola* A143 Knot *Calidris canutus* A149 Dunlin *Calidris alpina* A156 Black-tailed Godwit *Limosa* A162 Redshank *Tringa 34etanus* A999 Wetlands

Other potential ecological constraints include:

- Vegetation (scrub, hedgerows, treelines agricultural grassland) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals)
- Potential for roosting bats in buildings adjacent to works areas

4.1.3 Planning

The lands on which the various options are located, has the same zonings in both the current Fingal Development Plan 2107-2022 and the Draft Fingal Development Plan 2023-2029:

- R2/Rural Cluster: Provide for small scale infill development serving local needs while maintaining the rural nature of the cluster.
- P1/Rural: Protect and promote in a balanced way, the development of agriculture and rural-related enterprise, biodiversity, the rural landscape, and the built and cultural heritage

There are no pending planning applications or undeveloped planning permissions that are affected by the various options.

4.2 Longlist Options

The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. Locations considered are shown in Figure 4-2 below, noting all options are located on IÉ owned land.

Figure 4-2: Rush and Lusk Substation Options

4.2.1 Option 0 – Do nothing

No substation provided.

4.2.2 Option 1

Option 1 comprises construction of a substation within the southern boundary of the station car park, west of the railway line.

4.2.3 Option 2

Option 2 comprises construction of a substation within the southern boundary of the station car park, east of the railway line.

4.2.4 Option 3

Option 3 comprises construction of a substation within the station car park, which is closest to Station Road, west of the railway line. It is envisaged that access would be provided through the station car park.

4.3 Sifting of longlist of options

Assessment is provided in Table 4-2 below.

Table 4-2 Assessment of longlist of options against project objectives and requirements (options "do-nothing" to 3)

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	No impact due to 'do-nothing' approach.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land and access	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land and access	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land and access
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Fail	Lack of substation does not allow delivery of electrified route in accordance with standards. I.e., non-compliant	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	No impact due to 'do-nothing' approach.	Pass	Brownfield site Loss of some car parking/construction storage	Pass	Greenfield site, tree loss	Pass	Brownfield site Some tree loss Some loss of car parking
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	No impact due to 'do-nothing' approach.	Pass	Majority of works can be undertaken away from railway line Some loss of car parking/construction storage Contained within IÉ land	Pass	Majority of works can be undertaken away from railway line Contained within IÉ land	Pass	Majority of works can be undertaken away from railway line Some loss of car parking/construction storage Contained within IÉ land Disruption to car park during construction
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No impact due to 'do-nothing' approach.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Brownfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Brownfield site
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	No infrastructure intervention considered as part of 'do-nothing' approach.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged from 'do-nothing' approach.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Fail	Insufficient location and number of substations for delivery of an electrified route.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	No clearance issues associated with 'do-nothing' approach.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Safety not impacted by 'do-nothing' approach. Protection of substation infrastructure not required.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

4.3.1 Summary of longlist sifting

Table 4-3:Summary of Longlist Sifting

Option	Screening Result	Summary
"Do-Nothing"	**FAIL**	• Fails to provide electrified railway between Malahide and Drogheda • Fails to provide adequate number and location of substations
Option 1	**PASS**	Meets project objectives and requirements
Option 2	**PASS**	Meets project objectives and requirements
Option 3	**PASS**	Meets project objectives and requirements

4.4 Shortlisted options

The following options have been taken forward to the shortlist and to the MCA process:

- Option 1;
- Option 2; and
- Option 3.

For further detailed drawings of the shortlisted options please refer to drawing D+WP56-ARP-ZZ-NL-DR-HV-000030 to D+WP56-ARP-ZZ-NL-DR-HV-000037 in Appendix B.

4.5 Multi-criteria analysis

4.5.1 Methodology

For each individual entity an assessment has been made against the MCA criteria. Each option has been relatively compared against the others based on the five-point colour coded ranking scale in Table 4-6.

4.5.2 MCA summary table

A multi-criteria analysis table is presented in this section. This has been developed to reflect the relative rankings for all sub-criteria for each of the options assessed and is presented as a summary of the key issues considered.

A more detailed table is provided in Appendix A to this report with the full detailed rationale behind the scoring of each criterion and option.

Table 4-4 MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 2	Option 3
Economy	CAPEX			
	OPEX			
	Train Operations Functionality/Economic Benefit			
	Traffic functionality and associated economic activities and opportunities			
Safety	Employer's Safety			
	Public safety			
Environment	Landscape and Visual Quality			
	Biodiversity			
	Noise and Vibration			
	Water resources			
	Archaeology, Architectural and Cultural Heritage			
	Geology and Soils (includes waste)			
	Agricultural and non-agricultural			
	Air Quality & Climate Change			
Accessibility & Social Inclusion	Accessibility			
	Social Inclusion			
Integration	Adaptability in the future			
	Transport Integration			
	Land Use Integration			
	Government policy integration			
	Geographical integration			
Physical Activity	Walking/cycling opportunities			

Table 4-5 Overall criteria MCA summary table

Criteria Summary	Option 1	Option 2	Option 3
Economy			
Safety			
Environment			
Accessibility & Social Inclusion			
Integration			
Physical Activity			

Table 4-6: Legend for MCA Summary Table

Significant comparative advantage over other options
Some comparative advantage over other options
Comparable to other options / neutral
Some comparative disadvantage over other options
Significant comparative disadvantage over other options

4.5.3 Economy

Economy has been divided into four sub-criteria which are considered below.

CAPEX

As the cost of the substation and their compounds are the same across all options and therefore do not factor into the CAPEX review.

All options are comparable for CAPEX as all options are located on IÉ land and use existing road (station car parks) to access the substations.

OPEX

No comparable differences have been identified.

Train operations functionality/economic benefits

All options are considered comparable from the perspective of train operations. All options provide a substation which will allow the electrification of the Northern Line.

Traffic functionality and associated economic activities and opportunities

When operational, the scheme will have no visible impacts on the prevailing traffic conditions in the surrounding road networks.

Option 1 and 3 will have a minor impact on existing parking, pedestrians and cyclists at the Rush and Lusk Station during construction and mitigation measures will be required. Hence Option 1 and 3 are considered to have a comparable disadvantage to Option 2.

4.5.4 Safety

Safety has been divided into two sub-criteria which are considered below. It should be noted that all options are safe, but some will have the potential for greater residual risks to remain. This criterion considers relative advantages of each option on the criteria of safety.

Employer's Safety

There are no material differences between the options when comparing the employer's safety. All substation options have the same designs to ensure employer's safety is considered and maintained.

Public Safety

Similar to employer's safety, there is no material difference between the substation option designs.

4.5.5 Environment

4.5.5.1 Landscape and visual quality

Option 1 is located at the rear of private gardens on the west side of the railway and south of the station carpark. The location will have direct impact on the rear of private gardens and will be openly visible from residential properties.

Option 2 is located within a secluded area east of the railway. The area is enclosed by mature field boundaries and is well-screened.

Option 3 is located within the existing carpark close to the entrance off the R128. The area, which is currently in carparking with some young tree planting, is openly visible from the R128.

Given its secluded location Option 2 is preferred with significant comparative advantages over other options. Given its proximity to the R128, Option 3 has some comparative disadvantages overscores less favourably to other options. Given its impact on and proximity to residential properties, Option 1 is least preferred with significant comparative disadvantages over other options.

4.5.5.2 Biodiversity

Option 1 and 3 are comparatively advantageous over Option 2 for this substation location.

Option 1 has some comparative advantage over Option 2 due to construction related impacts. Potential for indirect impacts on nearby designated sites (Rogerstown Estuary SPA, SAC and pNHA), include potential for water quality impacts or disturbance to birds, also new lighting which could impact on birds. If noise generated is higher than what currently exists, further disturbance to birds may occur. The location is partially on artificial ground, but may require some vegetation removal of hedgerows adjacent, impacts on birds, bats, small mammals. If additional lighting required there is potential to disturb bats commuting and foraging along this hedgerow.

Option 3 has some comparative advantage over Option 2. Potential for indirect impacts on nearby designated sites (Rogerstown Estuary SPA, SAC and pNHA), include potential for water quality impacts or disturbance to birds, also new lighting which could impact on birds. If noise generated is higher than what currently exists, further disturbance to birds may occur.

Vegetation removal of low-quality hedgerow habitat within the station carpark, however already a very disturbed area so potential impacts would be low. Potential for bat roosts in buildings adjacent to works area. This would need to be assessed for suitability and evidence of bat roosts.

Option 2 is the least favoured option as it has some comparative disadvantage over other options. Potential for indirect impacts on nearby designated sites (Rogerstown Estuary SPA, SAC and pNHA), include potential for water quality impacts or disturbance to birds, also new lighting which could impact on birds. If noise generated is higher than what currently exists, further disturbance to birds may occur.

Vegetation removal significantly more for this option than other options. There are also potential impacts on birds (ground and tree nesting), and potentially bats if trees removed or extra lighting required and impacts on mammals.

4.5.5.3 Noise and Vibration

Option 3 is the most favourable substation location as it is the furthest from residential receptors. Option 1 is the closest to residential receptors, and therefore is the least favourable substation option.

4.5.5.4 Water Resources

From a water resources perspective, Options 1 and 3 are similarly comparable with each other. Option 2 has some comparative disadvantages over the other options since it is located in grasslands which will increase flood impact.

4.5.5.5 Archaeology, architectural and cultural heritage

From an archaeological perspective all options are considered to be equal. No known or recorded monument will be impacted by any substation option. There is the potential to reveal subsurface archaeological finds and deposits during ground breaking works associated with the construction of the site. All options (1-3) are comparable.

From an architectural heritage perspective, no buildings or features of architectural heritage interest were identified in the vicinity of options 1 and 2 so they have a comparative advantage over option 3.

Option 1 is located in what is currently a car park and option 2 is within a greenfield site. Option 3 is located in what is currently a car park. No direct negative impacts are anticipated. There is a potential visual impact on the Rush and Lusk Station buildings (FCC RPS 288, NIAH 11323018 and 11323017) during the operation phase.

Overall Options 1 and 2 have a slight comparative advantage over option 3 due to potential for visual impact on Rush and Lusk Station buildings.

4.5.5.6 Agricultural and non-agricultural

All options are comparable since they are not located on agricultural land and hence the sensitivity is low and very low

4.5.5.7 Geology and Soils

Option 2 is comparatively disadvantageous over Options 1 and 3 respectively since there is potential for loss of top/growing soil.

Options 1 and 3 will have minimal impacts from a geology and soils perspective.

4.5.5.8 Air quality and climate

All options are in proximity to sensitive receptors, however, no significant impacts on air quality are likely during the construction phase due to the scale of the proposals. The development of a substation is required to electrify the railway between Malahide and Drogheda.

This conversion will result in positive impacts on air quality and climate. Irish Rail is committed to the use of 80% renewables for DART+ which will result in even greater benefits.

4.5.6 Accessibility and Social Inclusion

All options are comparable as the operation and construction of the substation in all options has no impact on accessibility or social inclusion.

4.5.7 Integration

Integration has been assessed using the five sub-criteria described below.

Adaptability in the future

All options are comparable as the operation and construction of the substation in all options has no impact on future internal transport links.

Transport integration

Option 1 and 3 will have a minor impact on the long-term parking provision at the station. Hence Option 1 and 3 are considered to have a comparable disadvantage to Option 2.

4.5.8 Land use integration

Options 1 and 3 are zoned R2/Rural Cluster. Option 2 is zoned P1/Rural.

Utility installations are permitted in principle in the R2/Rural Cluster and P1/Rural zoning and thus there are considered to be no comparable differences from a zoning perspective.

Option 2 is zoned Green Belt.

Utility installations are permitted in principle in the Rural Cluster Zoning but only open for consideration in the Green Belt zone, and thus the preference would be for Options 1 and 3. Given that Option 3 would be more obscure from public view, it would be the optimal planning location.

Government policy integration

All international, national, regional and local policies encourage improvements in relation to the efficiency of public transport. All the proposed options will facilitate the achievement of greater efficiency in public transportation long part of the east coast of the country and therefore comply with government policy.

Geographical integration

All of the options are infrastructural buildings adjoining a railway line. As noted above some of the options will have a greater impact on others based on their location.

4.5.9 Physical Activity

The options are considered to be comparable with each other with regards to physical activity.

4.6 Construction Considerations

Construction of any substation needs to consider at least the following factors:

- Access arrangements off the public highway
- Type and proximity of neighbouring activities (and their sensitivity to construction aspects such as noise, dust, vehicle movements and vibration)
- Type and proximity of nearby ecology (especially vegetation and animals)
- Space availability for worksite compound, i.e. beyond permanent substation footprint
- Ground conditions, with regard to operation of construction plant

With these factors in mind, views on the constructability of substation options at Rush and Lusk can be summarised accordingly:

- Option 1: Scores well on all factors, assuming the site does not need to interfere with trees along the western flank. The plot is accessed via the station car park and has existing paved area to construct from.
- Option 2: Scores reasonably well, except some ecological impact is to be expected in creating the site and associate access route via the station car park. There are no nearby communities to beware of and local roads appear amenable to construction traffic. Whilst construction space is plentiful it is not known how firm the ground is for construction plant (assumed adequate).
- Option 3: Scores moderately, with the main impact being disruption to car park users on the plot during the works. There may also be some ecological damage, depending on the precise placement of the substation. The nearest neighbours appear to be a car sales/ servicing business, a short distance away.

4.7 Summary and conclusion

4.7.1 Non-preferred options

Option 1 is not preferred due to:

- Loss of car parking spaces to the south of the station

- Poor visual quality for residents whose gardens back onto this substation location.

Option 3 is not preferred due to:

- Loss of car parking spaces to the south of the station
- Impacts the visual quality as you enter the main station car park.

4.7.2 Preferred option

Option 2 has been identified as the preferred option. It has advantages over predominately all assessment criteria compared to the other options:

- There is no loss of car parking spaces
- The is direct access to the location via the station car park to the east of the railway, minimising disruption to station users
- The substation will be screened by the hedgerow which runs around the perimeter of the location proposed.

For further details of the preferred option refer to drawing D+WP56-ARP-P3-NL-DR-CX-000504 in Appendix C.

4.7.3 Key Risks/ Next Steps

The following key next steps are proposed

- Complete environmental surveys of the proposed site
- Seek feedback from stakeholders on the preferred option.

5. SKERRIES SOUTH SUBSTATION OPTION SELECTION

5.1 Existing Situation and Constraints

The requirements described in Section 2 have dictated the need for a substation south of the Skerries area. The area under consideration extends from agricultural land east of the southern boundary of Skerries Golf Club to agricultural land directly north of the overbridge for Golf Links Rd.

5.1.1 Utilities

Substations shall be supplied from the ESBN 38kV network and each substation will include ESBN infrastructure to manage the incoming supply and necessary protection. ESBN will require unfettered access to their protection equipment accommodated in a secure dedicated building.

Substations are expected to be equipped with welfare facilities for maintenance staff and will require a fresh water supply and foul water drainage.

Existing utilities are a constraining factor to the project when considering the various design options for the construction of substations. It is often cheaper, easier, and quicker for a project to change the design than to divert a utility. Existing utilities should be taken into consideration from an early stage in the project, and where possible worked around and only diverted where necessary. Appropriate arrangements must be made with the various utility providers long before construction of the substation commences.

Utility records have been gathered from the utility providers in the area. The following utility companies have infrastructure within the area of interest:

- ESB;
- Irish Water; and
- Irish Rail.

The figure below shows the utility records that Arup has for the proposed substation sites.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring.

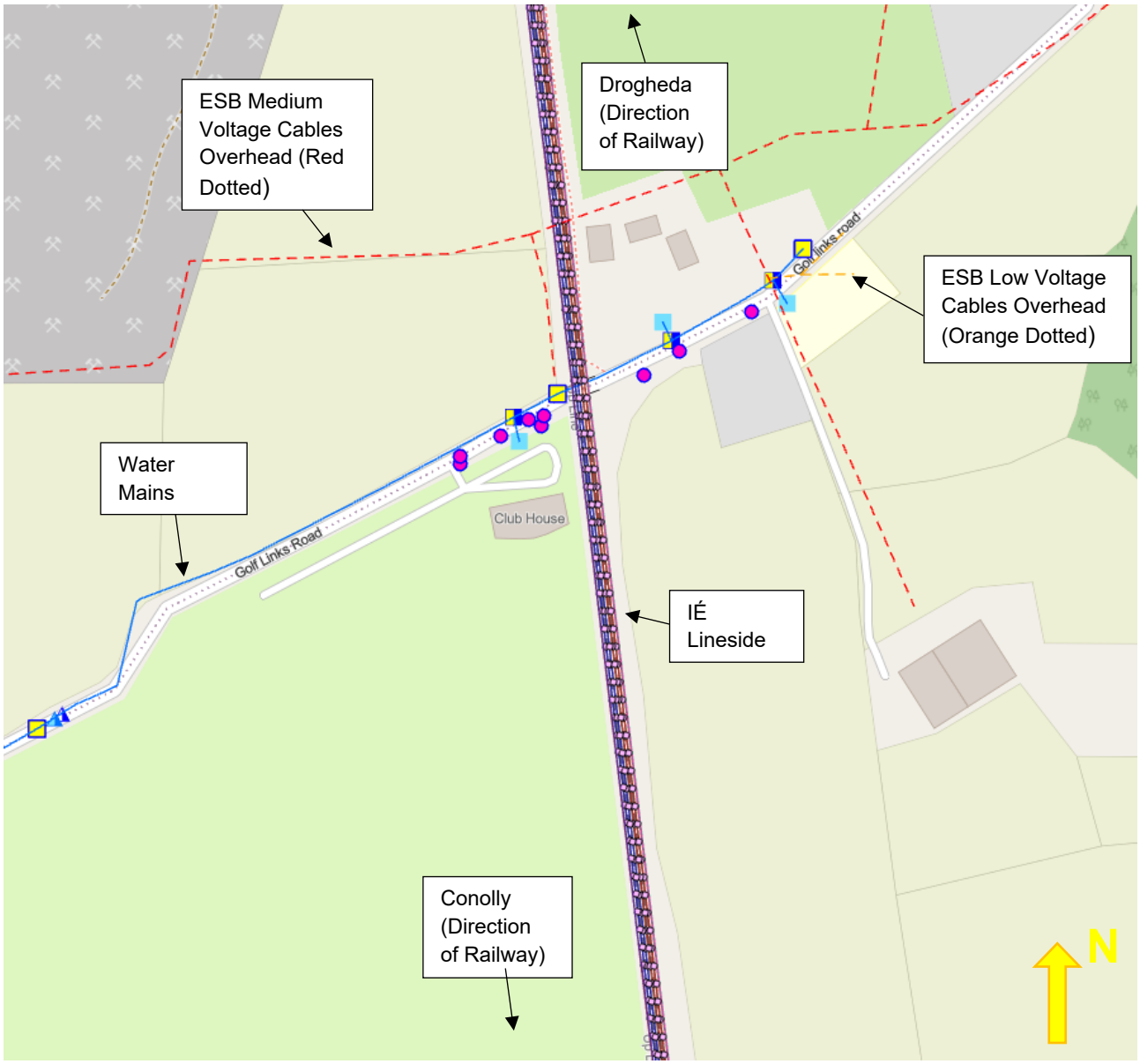

Figure 5-1 Existing Utilities to the south of Skerries

5.1.2 Environmental

5.1.2.1 Traffic and Transportation

The nearest road link of strategic importance in this area is the R127 which links Skerries to Lusk and connects with the M1 in the south-west via the R132. The road is 6m wide and should be suitable to serve construction traffic.

It is also noted that the Hackettstown LAP indicates a proposed a Southern Relief Road which follows a section of the Golf Links Road and coordination with its construction may be required. There may be some pedestrian activity at the golf course but this should not be a significant constraint. The regional road R128 adjacent to the site accommodates operational bus routes but there should not be any significant impact.

5.1.2.2 Landscape and visual quality

Lands comprising Skerries Golf Course located west of the railway and south of Golf Links Road are zoned OS – Open Space. Lands east of the railway and south of Golf Links Road are zoned GB – Greenbelt – and are generally agricultural with some residential properties and St. Michael's Special School.

Lands west of the railway and north of Golf Links Road are zoned RU – Rural and include Milverton Quarry. Landscape east of the rail and north of Golf Links Road are zoned RS – Residential and are subject to the preparation of a Local Area Plan. There is an objective to provide a road west of the railway connecting Golf inks Road to Skerries Road. All of the landscape is described as being Highly Sensitive.

Key constraints are golf course lands, residential amenity, field and property boundaries.

5.1.2.3 Archaeology and cultural heritage

There are no recorded monuments in the vicinity of the proposed options for a substation at Skerries. Within the agricultural fields of Milverton there is a tradition of burials 'stone coffins' being revealed, including a cist (DU005-032). A fragment of human skull (NMI 1986:140) was found as a surface find in a ploughed field in Milverton known as 'Danes Burial Ground'. This field was incorporated into the quarry at Milverton in the 1970s and there is now no visible trace.

5.1.2.4 Architectural Heritage

There are no protected structures and no NIAH structures within the vicinity of any of the proposed sites.

A designed landscape associated with Hacketstown House is included in the NIAH Garden Survey. The demesne, as indicated on the 1837 Ordnance Survey maps, was badly impacted by the construction of the railway line which cut off the lands to the east of the line. These are now in use as a golf club which was opened as a 9-hole course in 1905 and was extended to 18 holes in 1971.

The club house is on the site of the original but appears to be modern. There are stone walls surrounding the course and along Golf Links Road which are of architectural interest. A site inspection is required to properly assess their architectural heritage value.

There are buildings on the site of the historic Hacketstown House, but they are not protected or included in the NIAH. It is not clear what, if any, historic fabric survives. There is also an enclosure which corresponds with a walled garden shown on the 1837 OS map of the site.

There was a gate lodge on the east side of the bridge. Aerial photographs suggest that there are remains of this structure surviving.

For the purposes of this assessment, landscape features associated the Hacketstown House demesne are assumed to be of regional importance for reasons of architectural interest.

There is a road bridge over the tracks at Golf Links Road, which requires further assessment. The parapet walls appear to be modern limestone. For the purposes of this assessment, the bridge is assumed to be of local importance for reasons of architectural interest.

There is a complex of farm buildings to the east side of the Golf Links Road Railway Bridge. The cottages on the west side of the complex correspond to buildings shown on the first edition OS map surveyed c.1837. Further assessment is required to ascertain the architectural heritage value of the farm complex. For the purposes of this assessment, it is assumed to be of regional importance for reasons of architectural and social interest.

5.1.2.5 Noise and Vibration

The area in the vicinity of the Skerries South substation is mostly agricultural land, with detached housing and the Skerries Golf Course adjacent to the rail corridor. Electric train pass bys will be less noisy than diesel train pass bys.

Construction noise and vibration have the potential to impact nearby sensitive receptors more than operational noise, although low frequency tonal noise should be considered during the operational phase.

5.1.2.6 Air quality and climate

The development of a substation will have no operational air quality impacts. There is the potential for air quality impacts during the construction phase where works take place in proximity to sensitive receptors. However, the construction works will be of a small scale.

5.1.2.7 Agricultural and non-agricultural

The land to the east of the railway line is agricultural – i.e. arable land. To the west of the railway line the majority of the land is not agricultural (i.e. a golf course). However, in the north west (i.e. north of Golf Links Road) the land is agricultural – i.e. arable land.

The farm enterprise on the west of the railway line is medium sensitivity (tillage). On the eastern side of the railway line there is one medium sensitivity tillage enterprise and one medium-high sensitivity equine and tillage enterprise.

5.1.2.8 Geology & Soils

A review of historic mappings (OSi Historic 6" and 25" Maps) show that the site was initially agricultural land with embankments for the eventual railway line which was in progress. Some buildings together with Hacketstown House were noted to the east of the site. Beyond 1888, the construction works for the railway line and the overbridge OBB49 were completed. A well at the toe of the embankment was noted. Aerial photography shows the construction of a parking area to the west of OBB49 in 1995.

The Corine Land Cover 2018 categorises the land use for most of the site as agricultural areas with non-irrigated arable land with some regions to the west as artificial non-agricultural vegetated areas with sport and leisure facilities. No historic pits, quarries or IPPC, IPC and IEL facilities were identified within the study area and its environs.

The EPA waterbodies map (2021) shows that there are no streams/rivers crossing the site or within the vicinity and as such no associated soft deposits are therefore expected across the site.

The GSI Quaternary sediment mapping shows the presence of gravels derived from Lower Palaezoic sandstones and shales predominating at the site. Deglacial landforms such as hummocky sand and gravel was noted across the site. Additionally, the presence of kartsified bedrock outcrop 50m to the west of the railway line and crosses Golf Links Road was observed.

GSI bedrock mapping show that the site is underlain by conglomerate, shale and limestone of the Rush Conglomerate formation and calcareous shale, limestone conglomerate of the Tober Colleen formation.

5.1.2.9 Water Resources

Surface water bodies

There are no watercourses in the vicinity of the study area and drainage is directly into the North-western Irish Sea (HA08), east of the site. The North-western Irish Sea (HA08) waterbody is at 'High' status for the 2013-2018 monitoring cycle and classified as 'Not at Risk'.

Groundwater

The study area is underlain by Dinantian Pure Bedded Limestones which are part of the Holmpatrick Formation to the north and by Dinantian Upper Impure Limestones which are part of the Loughshinny Formation to the south. The Dinantian Pure Bedded Limestones aquifer is classified as a Locally Important (Lk) Aquifer which is karstified. The Dinantian Upper Impure Limestones is classified as a Locally Important (Lm) Aquifer which is Moderately Productive. The groundwater vulnerability at the site is classified as High to Extreme.

There are no significant karst features identified near the site. There are also no high yielding water supply springs and wells i.e. public water supplies or group water scheme supplies within the site. No Source Protection Zones associated with public or group groundwater supply schemes are located with the site.

The study area lies within the Lusk-Bog of the Ring groundwater body (IE_EA_G_014). The groundwater body is at 'Good' WFD Status for the 2013-2018 monitoring cycle and currently 'Not at Risk' in terms of not achieving its WFD objectives.

Flooding

Historical flooding has been assessed by examining reports and maps from the OPW's National Flood Hazard mapping. There are no records of flood events or potential for flooding in the vicinity of the study area.

5.1.2.10 Biodiversity

The works location is set within various locations within and adjacent/close to the Skerries Golf Course, approximately c. 1km south of Skerries Train Station, and Skerries town.

There are no significant ecological constraints in this area. The areas which would be affected by works are would require small amounts of vegetation removal (shrub, agricultural grassland, hedgerow, trees) and artificial land.

The closest designated sites are Skerries Island SPA and NHA, located c. 1.5km offshore east of the proposed works area. Rockabill to Dalkey Island SAC and Rockabill SPA are located adjacent to these sites, also offshore. Loughshinny Coast pNHA is the closest designated site (c. 1.6km east) located onshore.

Other potential ecological constraints include:

- Vegetation (scrub, hedgerows, treelines agricultural grassland) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals);
- Potential for roosting bats in bridges/buildings adjacent to works areas;
- Potential for invasive species to occur along the railway line; and
- Potential for the railway to support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature.

5.1.3 Planning

The lands on which the various options are located, have similar zonings in both the current Fingal Development Plan 2107-2022 and the Draft Fingal Development Plan 2023-2029:

- G3/Green Belt: Protect and provide for a Greenbelt.
- P1/Rural: Protect and promote in a balanced way, the development of agriculture and rural-related enterprise, biodiversity, the rural landscape, and the built and cultural heritage

There are no pending planning applications or undeveloped planning permissions that are affected by the various options.

5.2 Longlist Options

The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. Locations considered are shown in Figure 5-2.

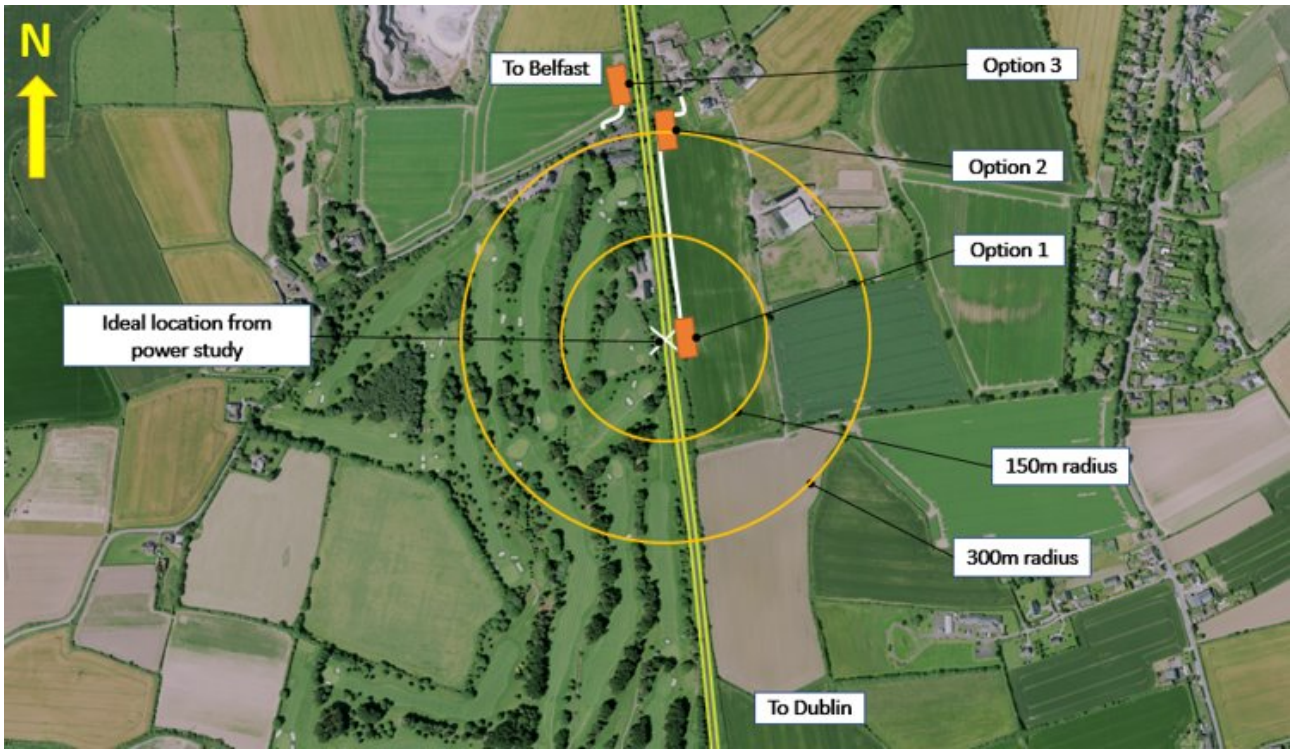

Figure 5-2: Skerries South Substation Options

5.2.1 Option 0 – Do nothing

No substation provided.

5.2.2 Option 1

Option 1 comprises construction of a substation in agricultural land, east of the railway and approx. 325m south of Golf Links Rd. An access road would be required from Golf Links Rd, parallel to the railway corridor along the boundary of the field.

5.2.3 Option 2

Option 2 comprises construction of a substation in agricultural land, east of the railway and directly south of Golf Links Rd. It is envisaged that access would be provided directly from Golf Links Rd.

5.2.4 Option 3

Option 3 comprises construction of a substation in agricultural land, west of the railway and directly north of Golf Links Rd. It is envisaged that access would be provided directly from Golf Links Rd.

5.3 Sifting of long list of options

Assessment is provided in Table 5-1 below.

Table 5-1 Assessment of longlist of options against project objectives and requirements (options "do-nothing" to 3)

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	No impact due to 'do-nothing' approach.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of long access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Fail	Lack of substation does not allow delivery of electrified route in accordance with standards. I.e., non-compliant	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	No impact due to 'do-nothing' approach.	Pass	Greenfield site	Pass	Greenfield site	Pass	Greenfield site
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	No impact due to 'do-nothing' approach.	Pass	Majority of works can be carried out away from the railway line. Some road impact may occur due to construction of new access road. Current landowners will be affected	Pass	Majority of works can be carried out away from the railway line. Some road impact may occur due to construction of new access road. Current landowners will be affected	Pass	Majority of works can be carried out away from the railway line. Some road impact may occur due to construction of new access road. Current landowners will be affected
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No impact due to 'do-nothing' approach.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	No infrastructure intervention considered as part of 'do-nothing' approach.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged from 'do-nothing' approach.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Fail	Insufficient location and number of substations for delivery of an electrified route.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	No clearance issues associated with 'do-nothing' approach.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Safety not impacted by 'do-nothing' approach. Protection of substation infrastructure not required.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

5.3.1 Summary of longlist sifting

Table 5-2: Summary of Longlist Sifting

Option	Screening Result	Summary
"Do-Nothing"	**FAIL**	• Fails to provide electrified railway between Malahide and Drogheda • Fails to provide adequate number and location of substations
Option 1	**PASS**	Meets project objectives and requirements
Option 2	**PASS**	Meets project objectives and requirements
Option 3	**PASS**	Meets project objectives and requirements

5.4 Shortlisted options

The following options have been taken forward to the shortlist and to the MCA process:

- Option 1;
- Option 2; and
- Option 3.

For further detailed drawings of the shortlisted options please refer to drawing D+WP56-ARP-ZZ-NL-DR-HV-000030 to D+WP56-ARP-ZZ-NL-DR-HV-000037 in Appendix B.

5.5 Multi-criteria analysis

5.5.1 Methodology

For each individual entity an assessment has been made against the MCA criteria. Each option has been relatively compared against the others based on the five-point colour coded ranking scale in Table 5-5.

5.5.2 MCA summary table

A multi-criteria analysis table is presented in this section. This has been developed to reflect the relative rankings for all sub-criteria for each of the options assessed and is presented as a summary of the key issues considered.

A more detailed table is provided in Appendix A to this report with the full detailed rationale behind the scoring of each criterion and option.

Table 5-3 MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 2	Option 3
Economy	CAPEX			
	OPEX			
	Train Operations Functionality/Economic Benefit			
	Traffic functionality and associated economic activities and opportunities			
Safety	Employer's Safety			
	Public safety			
Environment	Landscape and Visual Quality			
	Biodiversity			
	Noise and Vibration			
	Water resources			
	Archaeology, Architectural and Cultural Heritage			
	Geology and Soils (includes waste)			
	Agricultural and non-agricultural			
	Air Quality & Climate Change			
Accessibility & Social Inclusion	Accessibility			
	Social Inclusion			
Integration	Adaptability in the future			
	Transport Integration			
	Land Use Integration			
	Government policy integration			
	Geographical integration			
Physical Activity	Walking/cycling opportunities			

Table 5-4 Overall criteria MCA summary table

Criteria Summary	Option 1	Option 2	Option 3
Economy			
Safety			
Environment			
Accessibility & Social Inclusion			
Integration			
Physical Activity			

Table 5-5: Legend for MCA Summary Tables

Significant comparative advantage over other options
Some comparative advantage over other options
Comparable to other options / neutral
Some comparative disadvantage over other options
Significant comparative disadvantage over other options

5.5.3 Economy

Economy has been divided into four sub-criteria which are considered below.

CAPEX

Option 1 and 2 have some comparative advantages over option 3 as it is located on land which requires minimal excavation with no large civil infrastructure. Option 3 will require large excavations with the construction of retaining walls.

OPEX

Although there are minor differences, for example length of access road could affect maintenance costs, these are not perceived as having any comparable differences and therefore the options are comparable/neutral to each other.

Train operations functionality/economic benefits

All options are considered comparable from the perspective of train operations. All options provide a substation which will allow the electrification of the Northern Line.

Traffic functionality and associated economic activities and opportunities

When operational, the scheme will have no visible impacts on the prevailing traffic conditions in the surrounding road networks.

None of the options are expected to have a comparably more significant impact than any of the other.

Construction activities on all options considered, are expected to generate a relatively low number of additional vehicular journey, and therefore will, at most, have a minor temporary impact on the traffic conditions of the local road network.

5.5.4 Safety

Safety has been divided into two sub-criteria which are considered below. It should be noted that all options are safe, but some will have the potential for greater residual risks to remain. This criterion considers relative advantages of each option on the criteria of safety.

Employer's Safety

There are no material differences between the options when comparing the employer's safety. All substation options have the same designs to ensure employer's safety is considered and maintained.

Public Safety

Similar to employer's safety, there is no material difference between the substation option designs.

5.5.5 Environment

5.5.5.1 Landscape and visual quality

Option 1 is located in a remote open agricultural location east of the railway. It requires a relatively long access road.

Option 2 is located east of the railway close to Golf Links Road. The area is directly east of the clubhouse at Skerries Golf Club and west of residential property. The location is well screened from Golf Links Road – but an access is required.

Option 3 is located in the southeast corner of an agricultural field north of Golf Links Road. The location is remote from residential property and well screened from Golf Links Road – but an access is required.

Despite its visually open remote location, Option 1 has some comparative advantages over other options. Given its proximity to the clubhouse and residential property, Option 2 is least preferred and has significant comparative disadvantages over other options. Given its secluded well-screened location, Option 3 is preferred with significant comparative advantages over other options.

5.5.5.2 Biodiversity

There is little to differentiate the options from each other in terms of ecological constraints. No options are likely to involve impacts on designated sites or have any other significant ecological impacts. All of the options require some sort of vegetation removal for either the TSS itself, or for access roads. Vegetation removal with potential for removal of habitat (i.e. shrub and/or scrub, treelines, hedgerow) may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals). Options 2 and 3 would likely require the least amount of vegetation removal, however

the vegetation removal in all the works' areas are unlikely to be of any significant ecological value or constraints.

Options 2 and 3 will be in very close proximity to a bridge with low potential for roosting bats. Whilst there could be disturbance impacts from lighting and/or noise during construction and operation, this is unlikely to pose a significant ecological constraint.

Option 1 includes an access road that crosses through agricultural fields. There is potential for this field to be used by overwintering bird species for foraging inland. However due to the size of the fields and the habitat present, they are unlikely to be used by large flocks of overwintering bird species.

It is not known whether invasive species may occur along or near the railway line. If present, then there would be risk of spreading to adjacent areas. Even if it were the case that invasive species are present in this area, the level of impact is likely to be similar across all options and might not be a significant differentiator between options.

All works are very close to the existing tracks. Railway lines can often support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature. If any such habitat is present the level of impact is likely to be similar across all options and is unlikely to be a significant differentiator between options.

5.5.5.3 Noise and Vibration

Option 1 is the furthest substation location from residential receivers and has the lowest potential for noise intrusion. It is close to the Skerries Golf Clubhouse.

Option 2 and 3 are the closest substation locations to a residential receptor and therefore have some comparable disadvantages to Option 1.

5.5.5.4 Water Resources

From a water resources perspective, Options 1, 2 and 3 are similarly comparable with each other.

5.5.5.5 Archaeology, architectural and cultural heritage

Option 2 is considered to be of some comparative advantage over Options 1 and 3. There are no recorded monuments in the vicinity of this proposed substation option. At this location there is, however, the potential to reveal subsurface archaeological finds and deposits during any earth moving works associated with the construction of the substation in this agricultural field in Hacketstown.

As Option 3 is located in Milverton townland and is considered to have a greater potential to reveal human remains based on past findings. Aerial photography shows a darkened spread of material (135m x 48m) within the ploughed field at the south end of Option 1 and this also is considered to have a greater archaeological potential and requires to be investigated to ascertain it nature. Therefore, these options are considered to have disadvantages over the other options.

From an Architectural Heritage perspective all options are considered to be equal.

Option 1 is on lands that were part of the Hacketstown Demesne, to the west of the site of Hacketstown House. A historic underpass is indicated at this location and further investigation is required to establish the architectural heritage value of this structure.

It is anticipated that the magnitude of impact on the designed landscape would be Medium resulting in a Negative, Moderate impact on the architectural heritage value of the site.

Option 2 is to the southeast of the Golf Links Road bridge. It is on the site of the former gate lodge of Hacketstown House. There are possible remains of this structure indicated on the current OS maps for the site, and on aerial photographs. A sub-station in this location would negatively impact on the former designed landscape of Hacketstown House. Due to the proposed location, which corresponds to an historic entrance to the demesne, it is anticipated that the magnitude of impact would be low. Overall, this option would have a Negative, Slight impact on the architectural heritage value of the site.

Option 3 is to the northwest of the Golf Links Road bridge. A sub-station in this location would negatively impact on the setting of the bridge. It is anticipated that the magnitude of impact would be low.

This option would also negatively impact on the complex of early nineteenth century farm buildings to the east of Golf Links Road bridge. The farm buildings would be screened by the railway line and existing mature trees. It is anticipated that the magnitude of impact would be Low. Overall, this option would have a Negative, Slight impact on the architectural heritage value of the site.

Overall Option 2 is the favoured option as it has comparative advantages over Options 1 and 3.

5.5.5.6 Geology and Soils

Option 1 is comparatively disadvantageous over Options 2 and 3 respectively.

While for all proposed options, there is potential for loss of top/growing soil and the requirement for the construction of an access road, Option 1 will generate more earthworks due to the longer access road required.

5.5.5.7 Agricultural and non-agricultural

Option 1 has some comparative disadvantages compared to options 2 and 3 because access to option 1 will require a longer access road through agricultural land.

5.5.5.8 Air quality and climate

Option 1 is preferred due to the greatest separation from sensitive receptors. However, no significant impacts on air quality are likely during the construction phase due to the scale of the proposals. The development of a substation is required to electrify the railway between Malahide and Drogheda. This conversion will result in positive impacts on air quality and climate. Irish Rail is committed to the use of 80% renewables for DART+ which will result in even greater benefits.

5.5.6 Accessibility and Social Inclusion

All options are comparable as the operation and construction of the substation in all options has no impact on accessibility or social inclusion

5.5.7 Integration

Integration has been assessed using the five sub-criteria described below.

Adaptability in the future

All options are comparable as the operation and construction of the substation in all options has no impact on future internal transport links.

Transport integration

All options are comparable as the operation and construction of the substation in all options has no impact on transport integration.

Land use integration

Options 1 and 2 are zoned G3/Green Belt. Option 3 is zoned P1/Rural. A substation on either zoning would be acceptable.

Government policy integration

All international, national, regional and local policies encourage improvements in relation to the efficiency of public transport. All the proposed options will facilitate the achievement of greater efficiency in public transportation long part of the east coast of the country and therefore comply with government policy.

Geographical integration

All of the options are infrastructural buildings adjoining a railway line and are considered neutral in comparison to each other.

5.5.8 Physical Activity

The options are considered to be comparable with each other with regards to physical activity.

5.6 Construction Considerations

- Construction of any substation needs to consider at least the following factors:
- Access arrangements off the public highway;
- Type and proximity of neighbouring activities (and their sensitivity to construction aspects such as noise, dust, vehicle movements and vibration);
- Type and proximity of nearby ecology (especially vegetation and animals);
- Space availability for worksite compound, i.e. beyond permanent substation footprint; and
- Ground conditions, with regard to operation of construction plant;

With these factors in mind, views on the constructability of substation options at Skerries South can be summarised accordingly:

- Option 1 - the main relative disadvantage is that an additional access route would need to be constructed, which would impede the agricultural activity in the field the substation would be

built in. There would be relatively more ecological damage during construction as a result, but there are no nearby residential properties which is positive.
- Option 2 has two residential properties within 50 metres of the proposed site, countering the lack of need to build a long access road.
- Option 3 has no nearby residential properties, access off the public highway is good and damage to ecology is mitigated by having only a short new access road.

5.7 Summary and conclusions

5.7.1 Non-preferred options

Option 1 is not preferred due to:

- Longer access road compared to the other options therefore greater land area to be purchased.
- A number of environmental disadvantages, such as agricultural and geology.

Option 3 is not preferred due to:

- Large area of vegetation requires removing when compared to the other options.
- Relocation of services required and requirement of a retaining wall
- The above points link to a greater CAPEX cost when compared to other options.

5.7.2 Preferred option

Option 2 has been identified as the preferred option. It has advantages over predominately all assessment criteria compared to the other options:

- Minimal removal of vegetation/excavation and no requirements for retaining structures
- A shorter access road required when compared to option 1.
- No requirement for retaining structures
- Minimal impact on agricultural land, soils and heritage issues.

For further details of the preferred option refer to drawing D+WP56-ARP-P3-NL-DR-CX-000501 in Appendix C.

5.7.3 Key Risks/Next Steps

The key next steps are:

- Survey and design of highway alignment for access road.
- Seek feedback from stakeholders on the preferred option.

6. SKERRIES NORTH SUBSTATION OPTION SELECTION

6.1 Existing Situation and Constraints

The requirements described in Section 2 have dictated the need for a substation in the vicinity of North Skerries. The area under consideration extends from agricultural land 250m southeast of Barnageeragh Bay Steps to woodland on the south-eastern tip of Ardgillan Castle land.

6.1.1 Utilities

Substations shall be supplied from the ESBN 38kV network and each substation will include ESBN infrastructure to manage the incoming supply and necessary protection. ESBN will require unfettered access to their protection equipment accommodated in a secure dedicated building.

Substations are expected to be equipped with welfare facilities for maintenance staff and will require a fresh water supply and foul water drainage.

Existing utilities are a constraining factor to the project when considering the various design options for the construction of substations. It is often cheaper, easier, and quicker for a project to change the design than to divert a utility. Existing utilities should be taken into consideration from an early stage in the project, and where possible worked around and only diverted where necessary. Appropriate arrangements must be made with the various utility providers long before construction of the substation commences.

Utility records have been gathered from the utility providers in the area. The following utility companies have infrastructure within the area of interest:

- Eir;
- Gas Networks Ireland;
- ESB;
- Irish Water; and
- Irish Rail.

The figure below shows the utility records that Arup has for the proposed substation sites.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring.

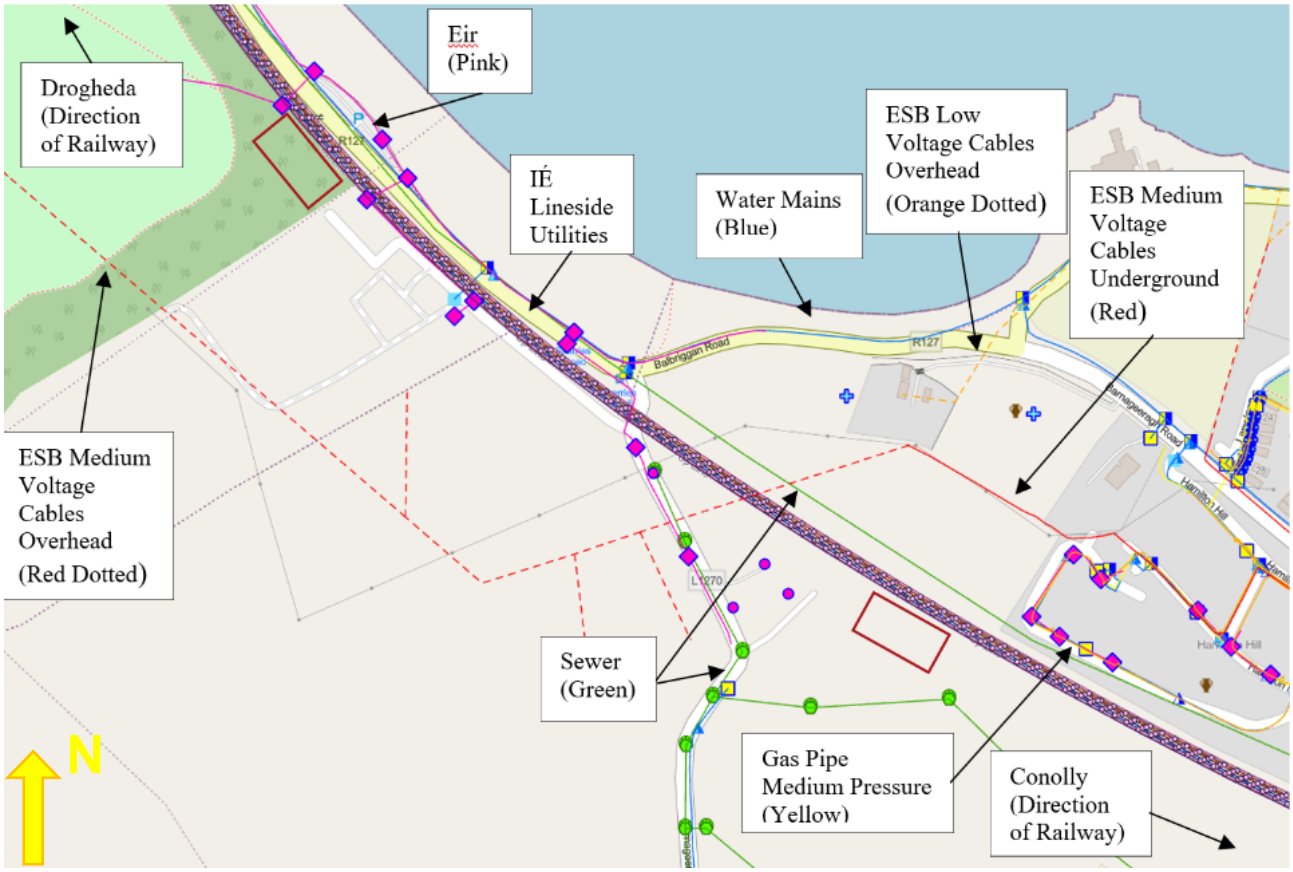

Figure 6-1 Existing Utilities to the north of Skerries

6.1.2 Environmental

6.1.2.1 Traffic and Transportation

The nearest road link of strategic importance in this area is the R127 which links through the village of Balbriggan and connects with the M1 in the north-west via the R132 and R122. The road is 6m wide and should be suitable to serve construction traffic.

The nearby overbridge across the rail line has a clearance of 3.12m which needs to be considered in terms of construction vehicle access. Due to the low volume of operational traffic to be generated by the substation and the temporary nature of the construction period no constraints are envisioned.

6.1.2.2 Landscape and visual quality

Lands are generally zoned HA – High Amenity with an area of OS – Open Space between the railway and R127 Coast Road and north of Hamilton Hill residential development. Other residential properties are also located along and off Barnageeragh Road. The area is close to the coast which lies east of the R127. Access and steps lead off the R127 to Barnageeragh Beach. There is an objective to preserve views along the east (coast side) of the R127 north of its junction with the Barnageeragh Road and moving north coastal views are available for users of the railway. Ardgillan Demesne is located northwest of the area. The area north of Barnageeragh Road is a Historic Landscape Character (HLC) area. All of the landscape is described as being Highly Sensitive.

Key constraints are the sensitive coastal landscape lands, protected views, residential amenity, and field and property boundaries.

6.1.2.3 Archaeology and cultural heritage

The options for a substation at North Skerries are located outside and to the south of the historic demesne lands. Ardgillan Demesne (RPS 94) is situated on eighty hectares of elevated rolling mature parkland, mixed woodland and gardens. The demesne consists of the ancient townlands of Kilmainham, Ardgillan and Baltray and parts of Ballymad, Laytown and Barnageera Little (Murphy 1984). On Rocque's (1760), Duncan's (1821) map it was named 'Prospect'. It is a castellated thirteen-bay three-storey over basement house, built 1738 by Dean Robert Taylor. It comprises a central three-bay block with breakfront tower and is flanked by advanced three-bay wings which are terminated by towers. The house overlooks a restored walled garden. It was remodelled c.1815 and opened to the public as a Regional Park in June 1985.

The proposed substation options 1 and 2 are both located in Barnageeragh townland where subsurface archaeological features and finds have been revealed through development projects in the past.

6.1.2.4 Architectural Heritage

The railway bridge over Barnageeragh Road is included in Fingal County Council's Record of Protected Structures (FCC RPS 878). It is described as a mid-nineteenth century single-arch limestone railway bridge over the road. There are rubble faced retaining walls on approach to the bridge which are also of architectural heritage interest.

To the east of the bridge there is a vernacular farm complex, which is included in Fingal County Council's Record of Protected Structures (FCC RPS 882). It is described as a late-18th or early-19th century traditional farmhouse and courtyard farm complex (date stone of 1790).

There is a mound to the east of the farm, which is both a Protected Structure and a Recorded Monument. These structures are screened from the railway by the steep topography.

There is a clustered settlement to the southeast of Barnageeragh Bridge, which now includes a number of buildings in use as a garden centre (Flower Power). The settlement cluster appears on the first edition OS and is likely to date from c.1800. The buildings are not included in the Record of Protected Structures, or the NIAH but there appear to be surviving houses, cottages, farm buildings, boundary walls and gates which are of architectural and social interest. A site investigation is required to inform the assessment of their architectural heritage value. For the purpose of this assessment, they are assumed to be of regional importance.

Ardgillan Demesne is a historic designed landscape which is designated as an Architectural Conservation Area. It is included in the NIAH Garden Survey (NIAH 2194). It is located to the east of the proposed locations, 250meters away at the closest point. It is screened from the railway line by dense and mature planting.

6.1.2.5 Noise and Vibration

The substation locations for Skerries North are in a rural setting, near the beach and the historic castle land. The acoustic environment in this location will include noise from train pass bys, that will

decrease with electrification, as well as natural sounds such as birds, wind in vegetation, and the ocean.

Construction noise and vibration have the potential to impact nearby sensitive receptors more than operational noise, although low frequency tonal noise should be considered during the operational phase.

6.1.2.6 Air quality and climate

The development of a substation will have no operational air quality impacts. There is the potential for air quality impacts during the construction phase where works take place in proximity to sensitive receptors. However, the construction works will be of a small scale.

6.1.2.7 Agricultural and non-agricultural

To the west of the railway the land is agricultural. This land is medium sensitivity due to tillage enterprise. East of the railway line is not agricultural.

6.1.2.8 Geology & Soils

A review of historic mapping (OSi Historic 6" and 25" Maps) show that the site was undeveloped until 1888, where the construction works for the railway line as well as a level crossing were then completed. Minor developments to the south-east and a well with 250m from the railway line were identified. Aerial photography shows significant residential and industrial developments to the north-west from 1995 onwards.

The Corine Land Cover 2018 mapping categorises the land use for most of the site as agricultural areas with non-irrigated arable land with some regions to the north-west categorised as agricultural areas with pastures and to the south east, as artificial surfaces with discontinuous urban fabric. No historic pits, quarries or IPPC, IPC and IEL facilities were identified within 250m from both sides of the railway line at the site.

The EPA waterbodies map (2021) shows that no stream/river crosses the site or is located within the vicinity. No soft deposits are therefore expected across the site.

The GSI Quaternary sediment mapping shows the presence of Irish Sea till and gravels derived from Lower Palaeozoic sandstones and shales at the site. Alluvial deposits to the south-east of the site and less than 100m away from the railway line were noted.

GSI bedrock mapping show that the site is mostly underlain by laminated blue-grey siltstone and sandstone of the Skerries formation and, a small proportion with pale grey limestone of the Mullaghfin formation. A bedrock fault crossing the site was noted.

6.1.2.9 Water resources

Surface water bodies

There are no watercourses in the vicinity of the study area and drainage in the study area is directly into the Northwestern Irish Sea (HA08), northeast of the site. The Northwestern Irish Sea (HA08) waterbody is at 'High' status for the 2013-2018 monitoring cycle and classified as 'Not at Risk'. The

minimum objectives for a water body under the WFD are to achieve at least 'Good' status (or 'Good potential' for artificial/ highly modified water bodies), and no deterioration of existing status.

Groundwater

The study area is mostly underlain by Silurian Metasediments and Volcanics which are part of the Skerries Formation. The aquifer is classified as a 'Poor aquifer (Pl)' where the bedrock is 'Generally Unproductive except for Local Zones'. The groundwater vulnerability in the study area is classified as 'High'.

There are no significant karst features identified near the site. There are also no high yielding water supply springs and wells i.e. public water supplies or group water scheme supplies within the site. No Source Protection Zones associated with public or group groundwater supply schemes are located with the site.

The study area lies within the Balrothery groundwater body (IE_EA_G_043). The groundwater body is at 'Good' WFD Status for the 2013-2018 monitoring cycle and currently under review with regard to achieving their WFD objectives.

Flooding

Historical flooding has been assessed by examining reports and maps from the OPW's National Flood Hazard mapping. There are no records of flood events. There is risk of coastal flooding and erosion 50m northwest of option 1. The study area is not identified to be at risk of coastal flooding.

6.1.2.10 Biodiversity

The works location are set within Ardgillan, north west of Skerries town and adjacent/close to Barnageera Bay Beach to the north, and Ardgillan Castle and Demesne to the north west. For all options, the works are adjacent to the existing railway line.

There are no significant ecological constraints in this area. The areas which would be affected by works would require small amounts of vegetation removal (shrub, agricultural grassland, hedgerow, trees). The closest designated sites are Skerries Island SPA and NHA, located c. 3.5km offshore east of the proposed works area. Rockabill to Dalkey Island SAC and Rockabill SPA are located further east to these sites, also offshore. Knock Lake pNHA is the closest onshore designated site (c. 3.4km west).

Other potential ecological constraints include:

- Vegetation (scrub, hedgerows, agricultural grassland) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals)
- Potential for roosting bats in bridges adjacent to works areas
- Potential for invasive species to occur adjacent to or along the railway line
- Potential for the railway and adjacent land to support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature

6.1.3 Planning

The lands on which the various options are located, have similar zonings in both the current Fingal Development Plan 2107-2022 and the Draft Fingal Development Plan 2023-2029:

- G3/High Amenity: Protect and enhance high amenity areas.
- G4/Open Space: Preserve and provide for open space and recreational amenities.

There are preserved views along the coastline directly to the east of options 2 and 3.

There are no pending planning applications or undeveloped planning permissions that are affected by the various options.

6.2 Longlist Options

The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. Locations considered are shown in Figure 6-2.

Figure 6-2: Skerries North substation options

6.2.1 Option 0 – Do nothing

No substation provided.

6.2.2 Option 1

Option 1 comprises construction of a substation on grassed scrubland opposite the top of Barnageeragh Bay Steps, east of the railway. An access road would be required from the Hamilton Hill residential development as direct access to the R127 is precluded by the surrounding topography.

6.2.3 Option 2

Option 2 comprises construction of a substation on agricultural land opposite the top of Barnageeragh Bay Steps, west of the railway. An access road would be required from the agricultural gate on Barnageeragh Rd.

6.2.4 Option 3

Option 3 comprises construction of a substation within the wooded area on the south-eastern tip of Ardgillan Castle land, west of the railway. An access road would be required from the private driveway currently serving the properties directly south.

6.2.5 Option 4

Option 4 comprises construction of a substation on agricultural land 250m southeast of Barnageeragh Bay Steps, west of the railway. The substation is positioned close to the railway corridor, blocking the current access road to the farmland directly south of the proposed substation. An access road would be required from Barnageeragh Rd either across and will continue to allow access to the farmland south to be maintained.

6.3 Sifting of longlist of options

Assessment is provided in Table 6-1.

Table 6-1 Assessment of longlist of options against project objectives and requirements (options "do-nothing" to 4)

Project objectives and requirements	Description	Option "do-nothing"		Option 1 description		Option 2 description		Option 3 description		Option 4 description	
		Pass/ fail	Rationale	Pass/fail	Rationale	Pass/fail	Rationale	Pass/fail	Rationale	Pass/fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	No impact due to 'do-nothing' approach.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Fail	Lack of substation does not allow delivery of electrified route in accordance with standards. I.e., non-compliant	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards. I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards . I.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	No impact due to 'do-nothing' approach.	Pass	Potential greenfield site Construction close to embankment, could be made ground	Fail	Located set-back from railway, would require cables under road and private garden	Fail	Located in historic castle grounds Located in woodland area	Pass	Greenfield site Current farm access track would need rerouting
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	No impact due to 'do-nothing' approach.	Pass	Majority of works can be carried out away from the railway line.	Fail	Majority of works can be carried out away from the railway line. Located set-back from railway, would require cables under road and private garden	Fail	Majority of works can be carried out away from the railway line. Located in historic castle grounds	Pass	Majority of works can be carried out away from the railway line. Some road impact may occur due to construction of new access road. Current farm access track would need rerouting Construction on access road along rear of garden centre

Project objectives and requirements	Description	Option "do-nothing"		Option 1 description		Option 2 description		Option 3 description		Option 4 description	
		Pass/ fail	Rationale	Pass/fail	Rationale	Pass/fail	Rationale	Pass/fail	Rationale	Pass/fail	Rationale
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No impact due to 'do-nothing' approach.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Potential greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site Woodland	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	No infrastructure intervention considered as part of 'do-nothing' approach.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged from 'do-nothing' approach.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Fail	Insufficient location and number of substations for delivery of an electrified route.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	No clearance issues associated with 'do-nothing' approach.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Safety not impacted by 'do-nothing' approach. Protection of substation infrastructure not required.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

6.3.1 Summary of longlist sifting

Table 6-2: Summary of longlist sifting

Option	Screening Result	Summary
"Do-Nothing"	**FAIL**	• Fails to provide electrified railway between Malahide and Drogheda • Fails to provide adequate number and location of substations
Option 1	**PASS**	Meets project objectives and requirements
Option 2	**FAIL**	• Fails to consider built environment and landowners by requiring routing of substation power cables under road and private garden
Option 3	**FAIL**	• Fails to consider adverse impact on built environment and landowners by building within historic castle grounds
Option 4	**PASS**	Meets project objectives and requirements

6.4 Shortlisted options

The following options have been taken forward to the shortlist and to the MCA process:

Option 1; and

Option 4.

For further detailed drawings of the shortlisted options please refer to drawing D+WP56-ARP-ZZ-NL-DR-HV-000030 to D+WP56-ARP-ZZ-NL-DR-HV-000037 in Appendix B.

6.5 Multi-criteria analysis

6.5.1 Methodology

For each individual entity an assessment has been made against the MCA criteria. Each option has been relatively compared against the others based on the five-point colour coded ranking scale in Table 6-5.

6.5.2 MCA summary table

A multi-criteria analysis table is presented in this section. This has been developed to reflect the relative rankings for all sub-criteria for each of the options assessed and is presented as a summary of the key issues considered.

A more detailed table is provided in Appendix A to this report with the full detailed rationale behind the scoring of each criterion and option.

Table 6-3 MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 4
Economy	CAPEX		
	OPEX		
	Train Operations Functionality/Economic Benefit		
	Traffic functionality and associated economic activities and opportunities		
Safety	Employer's Safety		
	Public safety		
Environment	Landscape and Visual Quality		
	Biodiversity		
	Noise and Vibration		
	Water resources		
	Archaeology, Architectural and Cultural Heritage		
	Geology and Soils (includes waste)		
	Agricultural and non-agricultural		
	Air Quality & Climate Change		
Accessibility & Social Inclusion	Accessibility		
	Social Inclusion		
Integration	Adaptability in the future		
	Transport Integration		
	Land Use Integration		
	Government policy integration		
	Geographical integration		
Physical Activity	Walking/cycling opportunities		

Table 6-4 Overall criteria MCA summary table

Criteria Summary	Option 1	Option 4
Economy		
Safety		
Environment		
Accessibility & Social Inclusion		
Integration		
Physical Activity		

Table 6-5: Legend for MCA Summary Tables

Significant comparative advantage over other options
Some comparative advantage over other options
Comparable to other options / neutral
Some comparative disadvantage over other options
Significant comparative disadvantage over other options

6.5.3 Economy

Economy has been divided into four sub-criteria which are considered below.

CAPEX

Option 4 has some comparative advantages over Option 1 due to it being location on agricultural land with minor (if any) level changes. It is assumed at this stage no retaining structures are required. Option 1 is positioned on land which has changing levels and would require a number of retaining walls for the substation and along the new access road.

OPEX

Similarly, with OPEX Option 4 has some comparative advantages over Option 1 due to its minimal infrastructure needing maintenance. Option 1 however has a number of retaining walls which will need to be monitored/maintained – along with the long access road parallel to the railway corridor.

Train operations functionality/economic benefits

All options are considered comparable from the perspective of train operations. All options provide a substation which will allow the electrification of the Northern Line.

Traffic functionality and associated economic activities and opportunities

When operational, the scheme will have no visible impacts on the prevailing traffic conditions in the surrounding road networks.

None of the options are expected to have a comparatively more significant impact than any of the other. Option 1 would require construction access through a residential area. Option 4 would require large vehicles to access via the more rural and narrow roads to the west due to the height restricted bridge under the railway on Barnageerahg Road.

Construction activities on all options considered, are expected to generate a relatively low number of additional vehicular journey, and therefore will, at most, have a minor temporary impact on the traffic conditions of the local road network.

6.5.4 Safety

Safety has been divided into two sub-criteria which are considered below. It should be noted that all options are safe, but some will have the potential for greater residual risks to remain. This criterion considers relative advantages of each option on the criteria of safety.

Employer's Safety

There are no material differences between the options when comparing the employer's safety. All substation options have the same designs to ensure employer's safety is considered and maintained.

Public Safety

Similar to employer's safety, there is no material difference between the substation option designs.

6.5.5 Environment

6.5.5.1 Landscape and visual quality

Option 1 is located northeast of the railway in a previously disturbed area zoned for open space. The site is somewhat remote from residential properties and despite its proximity to the coast, has opportunity for screening.

Option 4 is located southwest of the railway close to residential property (and a garden centre).

Despite its more coastal location, Option 1 has some comparative advantages over Option 4 and is the preferred option. Being close to residential properties Option 4 has some comparative disadvantages over Option 1.

6.5.5.2 Biodiversity

There is little to differentiate the options from each other in terms of ecological constraints. No options are likely to involve impacts on designated sites or have any other significant ecological impacts. All of the options require some sort of vegetation removal for either the TSS itself, or for access roads. Vegetation removal with potential for removal of habitat (i.e. shrub and/or scrub, hedgerow, agricultural grassland) may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals).

Option 1 will require scrub and hedgerow removal, whilst option 4 will only require agricultural grassland removal. The habitats in both options are unlikely to be of any significant value. Based on the extent of works and regrading required for the access road to option 1, option 1 is considered to have a minor comparable disadvantage to option 4

Options 1 will be in very close proximity to a bridge with low potential for roosting bats (UBB53). Whilst there could be disturbance impacts from lighting and/or noise during construction and operation, this is unlikely to pose a significant ecological constraint.

Option 4 includes an access road that runs along the peripheries of an agricultural fields. There is potential for this field to be used by overwintering bird species for foraging inland. However due to

the size of the fields and the habitat present, they are unlikely to be used by large flocks of overwintering bird species.

Option 1 is close to Barnageera Bay Beach (c. 70m), which may be used as a foraging and/or roosting site for over wintering bird species. There is potential for disturbance to birds within this habitat as a result of the construction of the TSS and access road.

It is not known whether invasive species may occur along or near the railway line. If present, then there would be risk of spreading to adjacent areas. Even if it were the case that invasive species are present in this area, the level of impact is likely to be similar across all options and might not be a significant differentiator between options.

All works are very close to the existing tracks. Railway lines can often support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature. If any such habitat is present the level of impact is likely to be similar across all options and is unlikely to be a significant differentiator between options.

6.5.5.3 Noise and Vibration

The difference between the two locations is very small, as both are a similar distance from sensitive residential receptors, therefore both options are similarly comparable with each other.

6.5.5.4 Water Resources

From a water resources perspective both options are similarly comparable with each other.

6.5.5.5 Archaeology, architectural and cultural heritage

Options 1 and 4 are considered to have the potential to reveal sub-surface archaeological features and preconstruction investigation will be carried out to assess the potential. Both options are considered equal in preference.

Option 1 is located on steep topography between the railway line and the road. It is anticipated that the magnitude of impact on the setting of the adjacent bridge would be high. The proposed sub-station at this location would also impact on the setting of the vernacular farm complex to the east. The magnitude of impact would be low. It is anticipated that the proposed substation at location 1 would have a Negative, Significant impact on the architectural heritage value of the site.

It is anticipated that the magnitude of impact from option 4 on the setting of the historic structures would be Low. No other buildings or features of architectural heritage interest were identified which could be impacted by a proposed sub-station at this location. It is anticipated that the proposed location would have a Negative, Slight impact on the architectural heritage value of the site.

From and Architectural Heritage perspective Option 4 has some comparative advantage over option 1.

Option 1 is located beside the railway bridge (UBB 53) over Barnageeragh Road is included in Fingal County Council's Record of Protected Structures (FCC RPS 878). No direct negative impact anticipated. There is a potential indirect or visual impact the magnitude of which is low. It is

anticipated that the proposed location would have a Negative, Slight impact on the architectural heritage value of the site.

The proposed site for Option 4 is a greenfield site with no known architectural heritage features. It is anticipated that the magnitude of impact from option 4 on the setting of the historic structures would be negligible. No other buildings or features of architectural heritage interest were identified which could be impacted by a proposed sub-station at this location.

As such overall Option 4 has some comparative advantage over Option 1 for heritage.

6.5.5.6 Geology and Soils

Option 1 is comparatively disadvantageous over Option 4.

While for both options, there is potential for loss of topsoil/growing soil and the requirement for the construction of an access road, Option 1 also requires the construction of a retaining wall, thereby generating comparatively more earthworks.

In Option 4, there is the possibility of encountering alluvial deposits based on geological maps.

6.5.5.7 Agricultural and non-agricultural

Option 1 is comparatively advantageous over Option 4.

Option 1 is located on non- agricultural/scrubland and therefore this location is assessed as very low sensitivity from an agricultural perspective.

Option 4 will be located within a 3.5-hectare tillage field which is of medium sensitivity from an agricultural perspective. Access to Option 4 would also be through agricultural land, therefore Option 4 has some comparative disadvantages compared to Option 1.

6.5.5.8 Air quality and climate

No significant impacts on air quality are likely during the construction phase due to the scale of the proposals, therefore both options are considered comparable to each other. The development of a substation is required to electrify the railway between Malahide and Drogheda. This conversion will result in positive impacts on air quality and climate. Irish Rail is committed to the use of 80% renewables for DART+ which will result in even greater benefits.

6.5.6 Accessibility and Social Inclusion

All options are comparable as the operation and construction of the substation in all options has no impact on accessibility or social inclusion.

6.5.7 Integration

Integration has been assessed using the five sub-criteria described below.

Adaptability in the future

All options are comparable as the operation and construction of the substation in all options has no impact on future internal transport links.

Transport integration

All options are comparable as the operation and construction of the substation in all options has no impact on transport integration.

Land use integration

Option 4 is zoned G3/High Amenity. Option 1 is zoned G4/Open Space. A substation on an Open Space zoning has comparative advantage over a substation in High Amenity zone.

Option 1 has comparative advantages over Option 4 and is therefore the preferred option.

Government policy integration

All international, national, regional and local policies encourage improvements in relation to the efficiency of public transport. All the proposed options will facilitate the achievement of greater efficiency in public transportation long part of the east coast of the country and therefore comply with government policy.

Geographical integration

All of the options are infrastructural buildings adjoining a railway line and are considered neutral in comparison to each other.

6.5.8 Physical Activity

The options are considered to be comparable with each other with regards to physical activity.

6.6 Construction Considerations

- Construction of any substation needs to consider at least the following factors:
- Access arrangements off the public highway
- Type and proximity of neighbouring activities (and their sensitivity to construction aspects such as noise, dust, vehicle movements and vibration)
- Type and proximity of nearby ecology (especially vegetation and animals)
- Space availability for worksite compound, i.e. beyond permanent substation footprint
- Ground conditions, with regard to operation of construction plant

With these factors in mind, views on the constructability of substation options at Skerries North can be summarised accordingly:

- Option 1 - the principal negatives are the need to construct an access route with retaining walls on either side, and that construction access appears to need to come through a residential area. There would also be significant damage to ecology. The main positive is that the only residential property in the vicinity is about 100 metres away.
- Option 4 - the access road would be simpler to construct that for Option 1, and there appear to be no nearby residential properties. Access off the public highway is reasonable but would

have to be from the west for high vehicles via narrower roads, damage to ecology would be relatively slight.

6.7 Summary and conclusions

6.7.1 Non-preferred options

Option 1 is not preferred due to:

- A number of retaining walls surrounding the substation and access road are required.
- Large volumes of excavation works required when compared to Option 4.
- The points above lead to a greater CAPEX cost when compared with Option 4.
- The land is zoned Open space which is considered less preferable for development to that of high amenity.

6.7.2 Preferred option

Option 4 has been identified as the preferred option. It has advantages over a number assessment criteria compared to the other option:

- Minimal removal of vegetation/excavation and no requirement for a retaining wall. This leads to lower CAPEX and OPEX costs when compared with Option 1.
- Less impact on biodiversity, cultural heritage and soils.
- Less impact on open space and recreational land.

For further details of the preferred option refer to drawing D+WP56-ARP-P3-NL-DR-CX-000505 in Appendix C.

6.7.3 Key Risks/Next Steps

The following next steps are recommended:

- Detailed highway survey and access design
- Seek feedback from stakeholders on the preferred option.

7. BALBRIGGAN SUBSTATION OPTION SELECTION

7.1 Existing Situation and Constraints

The requirements described in Section 2 have dictated the need for a substation in the Balbriggan area. The area under consideration extends from grassland directly north of O'Dwyers GAA pitches to directly south of the overbridge (OBB62) serving agricultural land.

7.1.1 Utilities

Substations shall be supplied from the ESBN 38kV network and each substation will include ESBN infrastructure to manage the incoming supply and necessary protection. ESBN will require unfettered access to their protection equipment accommodated in a secure dedicated building.

Substations are expected to be equipped with welfare facilities for maintenance staff and will require a fresh water supply and foul water drainage.

Existing utilities are a constraining factor to the project when considering the various design options for the construction of substations. It is often cheaper, easier, and quicker for a project to change the design than to divert a utility. Existing utilities should be taken into consideration from an early stage in the project, and where possible worked around and only diverted where necessary. Appropriate arrangements must be made with the various utility providers long before construction of the substation commences.

Utility records have been gathered from the utility providers in the area. The following utility companies have infrastructure within the area of interest:

- Gas Networks Ireland;
- ESB;
- Irish Water; and
- Irish Rail.

The figure below shows the utility records that Arup has for the proposed substation sites.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring.

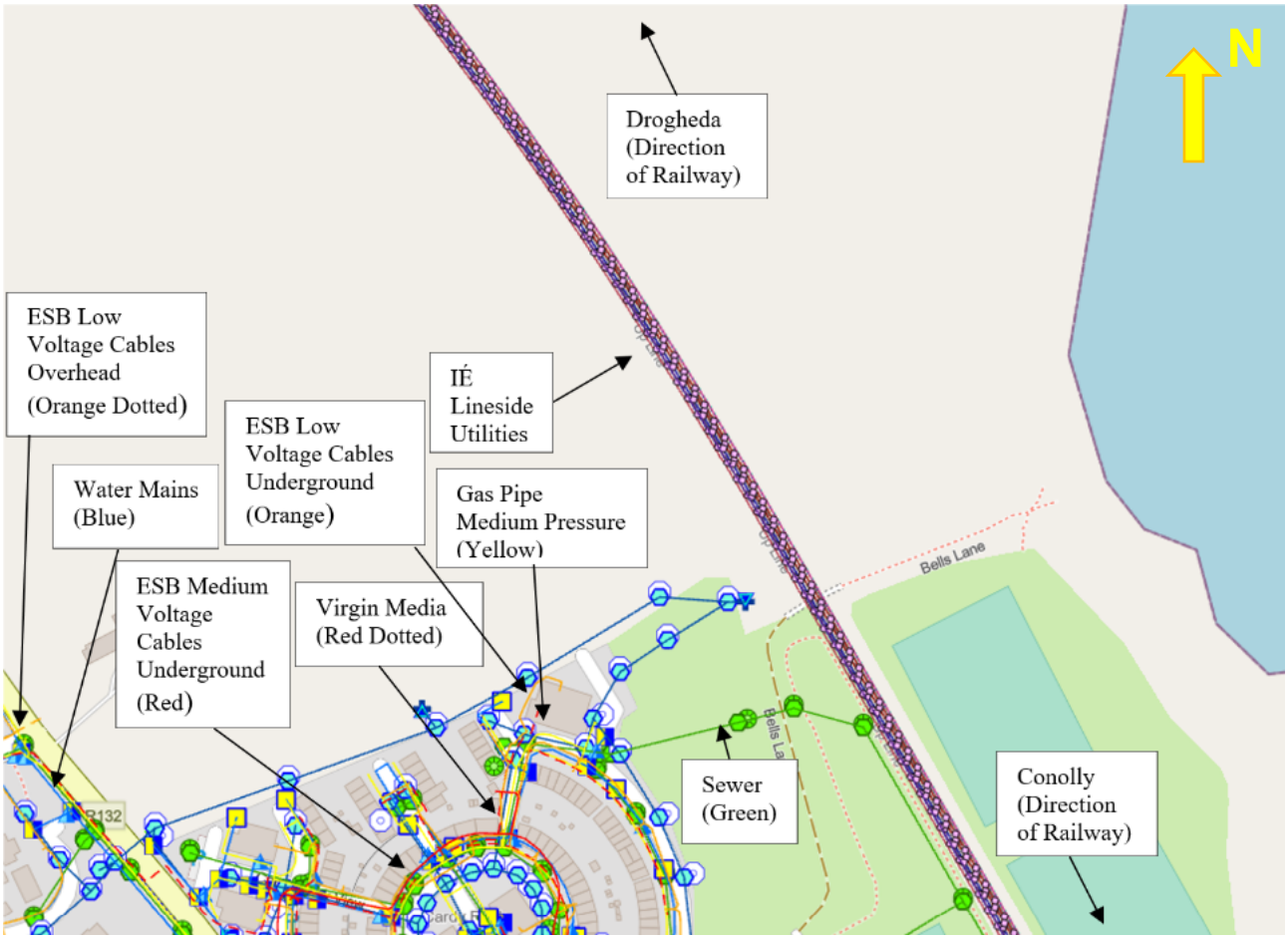

Figure 7-1 Existing Utilities to the north of Balbriggan

7.1.2 Environmental

7.1.2.1 Traffic and Transportation

The nearest road link of strategic importance in this area is the R132 which connects with the M1 in the north-west. The road is 6m wide and should be suitable to serve construction traffic.

Access roads in the area are narrow and adjacent to the GAA field is an existing pedestrian underpass. It is noted that the regional road R132 accommodates operational bus routes but there should not be any significant impact.

It should be noted that the underbridge serving Bremore Bay Beach is not sufficiently large to enable construction of a substation east of the railway and this is a driving factor as to why all options are on the west side of the line..

7.1.2.2 Landscape and visual quality

Lands along the railway in the vicinity of the proposed options are generally zoned OS – Open Space, with some areas south of the Bremore Castle / beach access road being used as active sports grounds (including O'Dwyer's GAA) and open space with footpaths / walkways. Active open space is also located east of the Cardy Rock residential development, and the general area is overlooked by residential properties at Cardy Rock.

While lands north of Cardy Road are zoned open space they are still in agricultural use. All lands not zoned open space or residential area zoned High Amenity and all are described as being in a Highly Sensitive landscape.

The lands are close to the coast and there is an objective to preserve views from the R132 north of Cardy Rock / Bremore Cottages. There are also open views of the coast from the railway. Bremore Castle, a protected structure, is a prominent heritage tower house structure which is undergoing restoration works. The castle grounds also host a regular food and craft village.

Key constraints are the coastal landscape, Bremore Castle, residential amenity, open space and sports grounds and preserved views.

7.1.2.3 Archaeology and cultural heritage

The proposed options are located in Bremore townland to the north of Balbriggan. This townland is of considerable archaeological significance with a passe tomb cemetery located on the headland which would have been a focus of funerary activity in this area. The church and graveyard in Bremore (RMP DU002-002002/3) is reputed to have been the Early Christian ecclesiastical site of Lann Beachaire, possibly founded by St. Molaga in the 7th century and traditionally associated with the transportation of bees from Wales by St. Modomnócc (Walsh 1888; Gwynn & Hadcock 1970). The medieval church which remains on the site was the manorial chapel for Bremore Castle (DU002-002001) - an important stronghold for the Barnewell family from the 14th century. Field systems (DU002-014 and DU002-019) have been revealed by archaeological investigation and aerial photography and demonstrate the potential to reveal archaeological remains even when there is no visible trace on the ground.

7.1.2.4 Architectural Heritage

Balbriggan Railway Bridge is included in Fingal County Council's Record of Protected Structures (FCC RPS 0012). It is described as a mid-nineteenth century single-arch stone railway bridge over laneway to the north of Bremore Castle. The bridge is also included in the NIAH where it is rated of regional importance for reasons of architectural and technical interest.

To the south of the railway bridge there are two further protected structures, both of which are also included in the RMP. They are St. Molaga's Church and graveyard (FCC RPS 0013) and Bremore Castle (FCC RPS 0014). These sites are not included in the NIAH. They are of regional importance for reasons of architectural, archaeological and social interest.

There is a road bridge to the north of Balbriggan Bridge in Bremore townland. It is not protected or included in the NIAH and a site investigation is required to inform the assessment of the architectural heritage value. The parapet walls are limestone with some modern and historic masonry. For the purpose of this assessment the bridge is assumed to be of regional importance.

7.1.2.5 Noise and Vibration

The Balbriggan substation will be located in semi-rural land, near to the town of Balbriggan. The acoustic environment in the area will include train pass bys (that will decrease in noise level with electrification) as well as noise from the nearby school.

Construction noise and vibration have the potential to impact nearby sensitive receptors more than operational noise, although low frequency tonal noise should be considered during the operational phase.

7.1.2.6 Air quality and climate

The development of a substation will have no operational air quality impacts. There is the potential for air quality impacts during the construction phase where works take place in proximity to sensitive receptors. However, the construction works will be of a small scale.

7.1.2.7 Agricultural and non-agricultural

There is agricultural land at both sides of the railway line on the north side of Balbriggan. The farm enterprise is tillage and hence the sensitivity is medium. The southern end of the study area is non-agricultural land owned by Dublin County Council and used for public amenity.

7.1.2.8 Geology & Soils

A review of historic mapping (OSi Historic 6" and 25" Maps) shows that the site was undeveloped until 1888, where the construction works for the railway line, culvert UBB60A and a level crossing were completed. A well 120m to the east of the railway line is identified. A review of aerial photography shows significant developments to the west in the period 2005-2012.

The Corine Land Cover 2018 categorises the land use for most of the site as agricultural areas with non-irrigated arable land with some regions to the east as artificial surfaces with discontinuous urban fabric. No historic pits, quarries or IPPC, IPC and IEL facilities were identified within the study area and its surrounding environs.

The EPA waterbodies map (2021) shows that no stream/river crosses the site or is located within the vicinity. No soft deposits are therefore expected across the site

The GSI Quaternary sediment mapping shows the presence of Irish Sea till and gravels derived from Lower Palaeozoic sandstones and shales at the site.

GSI bedrock mapping show that the site is underlain by andesite, pillow breccia, mudstone and tuff of the Belcamp formation.

7.1.2.9 Water Resources

Surface water bodies

There are no watercourses in the vicinity of the study area and drainage in the study area is directly into the Northwestern Irish Sea (HA08), east of the site. The Northwestern Irish Sea (HA08) waterbody is at 'High' status for the 2013-2018 monitoring cycle and classified as 'Not at Risk'. The minimum objectives for a water body under the WFD are to achieve at least 'Good' status (or 'Good potential' for artificial/ highly modified water bodies), and no deterioration of existing status.

Groundwater

The study area is mostly underlain by Ordovician Volcanics which are part of the Belcamp Formation. The aquifer is classified as a 'Locally Important Aquifer' where the bedrock is 'Generally Moderately Productive'. The groundwater vulnerability in the study area is classified as Low to Moderate.

There are no significant karst features identified near the site. There are also no high yielding water supply springs and wells i.e. public water supplies or group water scheme supplies within the site. No Source Protection Zones associated with public or group groundwater supply schemes are located with the site.

The study area lies within the Balbriggan groundwater body (IE_EA_G_039). The groundwater body is at 'Good' WFD Status for the 2013-2018 monitoring cycle and currently under review with regard to achieving its WFD objectives.

Flooding

Historical flooding has been assessed by examining reports and maps from the OPW's National Flood Hazard mapping. There are no records of flood events or potential for flooding in the study area.

7.1.2.10 Biodiversity

The works locations are set north of the outskirts of Balbriggan town, adjacent/close to Bremore Bay Beach to the east, residential environment to the south, and agricultural fields in the immediate vicinity. For all options, the works are adjacent to the existing railway line in grassland habitats.

There are no significant ecological constraints in this area. The areas which would be affected by works are would require small amounts of vegetation removal (shrub, agricultural grassland, hedgerow, trees). The closest designated sites are River Nanny Estuary and Shore SPA and Laytown Dunes/Nanny Estuary pNHA, located c. 4km north of the proposed works areas.

Other potential ecological constraints include:

- Vegetation (scrub, hedgerows, agricultural grassland) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals).
- Potential for roosting bats in bridges adjacent to works areas.
- Potential for invasive species to occur adjacent to or along the railway line.
- Potential for the railway and adjacent land to support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature.

7.1.3 Planning

The lands on which the various options are located, have similar zonings in both the current Fingal Development Plan 2107-2022 and the Draft Fingal Development Plan 2023-2029:

- G4/Open Space: Preserve and provide for open space and recreational amenities.
- G3/High Amenity: Protect and enhance high amenity areas.

A Part XI (ref. PARTXI/006/20) was approved by Fingal County Council in June 2021 for the Bremore Regional Park Development Project, including the Balbriggan Sports and Recreational Hub, Central Zone Open Spaces, new Coastal Park etc.

7.2 Longlist Options

The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. Locations considered are shown in Figure 7-2.

Figure 7-2: Balbriggan Substation Options

7.2.1 Option 0 – Do nothing

No substation provided.

7.2.2 Option 1

Option 1 comprises construction of a substation on scrubland directly north of the underbridge serving Bremore Bay Beach, west of the railway.

7.2.3 Option 2

Option 2 comprises construction of a substation on grassed parkland directly south of the underbridge serving Bremore Bay Beach, west of the railway.

7.2.4 Option 3

Option 3 comprises construction of a substation on agricultural land 350m north of the aforementioned underbridge, west of the railway. An access road would be required from the R132, running along the boundary of the existing fields.

7.3 Sifting of longlist of options

Assessment is provided in Table 7-1.

Table 7-1 Assessment of longlist of options against project objectives and requirements (options "do-nothing" to 3)

Project objectives and requirements	Description	Option "do-nothing"		Option 1 description		Option 2 description		Option 3 description	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	No impact due to 'do-nothing' approach.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of longer access road Cost of land
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Fail	Lack of substation does not allow delivery of electrified route in accordance with standards. I.e., non-compliant	Pass	Proposed option includes delivery of substation in accordance with all relevant standards i.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards i.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards i.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	No impact due to 'do-nothing' approach.	Pass	Greenfield site	Pass	Greenfield site in current park	Pass	Greenfield site
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	No impact due to 'do-nothing' approach.	Pass	Majority of works can be carried out away from the railway line.	Pass	Majority of works can be carried out away from the railway line.	Pass	Majority of works can be carried out away from the railway line. Potential for some disruption to road users during access road construction
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No impact due to 'do-nothing' approach.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site, currently park	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	No infrastructure intervention considered as part of 'do-nothing' approach.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged from 'do-nothing' approach.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.

Project objectives and requirements	Description	Option "do-nothing"		Option 1 description		Option 2 description		Option 3 description	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Fail	Insufficient location and number of substations for delivery of an electrified route.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	No clearance issues associated with 'do-nothing' approach.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Safety not impacted by 'do-nothing' approach. Protection of substation infrastructure not required.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

1.1.1 Summary of longlist sifting

Table 7-2: Summary of longlist sifting

Option	Screening Result	Summary
"Do-Nothing"	**FAIL**	• Fails to provide electrified railway between Malahide and Drogheda • Fails to provide adequate number and location of substations
Option 1	**PASS**	Meets project objectives and requirements
Option 2	**PASS**	Meets project objectives and requirements
Option 3	**PASS**	Meets project objectives and requirements

7.4 Shortlisted options

The following options have been taken forward to the shortlist and to the MCA process:

- Option 1;
- Option 2; and
- Option 3.

For further detailed drawings of the shortlisted options please refer to drawing D+WP56-ARP-ZZ-NL-DR-HV-000030 to D+WP56-ARP-ZZ-NL-DR-HV-000037 in Appendix B.

7.5 Multi-criteria analysis

7.5.1 Methodology

For each individual entity an assessment has been made against the MCA criteria. Each option has been relatively compared against the others based on the five-point colour coded ranking scale in Table 7-5.

7.5.2 MCA summary table

A multi-criteria analysis table is presented in this section. This has been developed to reflect the relative rankings for all sub-criteria for each of the options assessed and is presented as a summary of the key issues considered.

A more detailed table is provided in Appendix A to this report with the full detailed rationale behind the scoring of each criterion and option.

Table 7-3 MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 2	Option 3
Economy	CAPEX			
	OPEX			
	Train Operations Functionality/Economic Benefit			
	Traffic functionality and associated economic activities and opportunities			
Safety	Employer's Safety			
	Public safety			
Environment	Landscape and Visual Quality			
	Biodiversity			
	Noise and Vibration			
	Water resources			
	Archaeology, Architectural and Cultural Heritage			
	Geology and Soils (includes waste)			
	Agricultural and non-agricultural			
	Air Quality & Climate Change			
Accessibility & Social Inclusion	Accessibility			
	Social Inclusion			
Integration	Adaptability in the future			
	Transport Integration			
	Land Use Integration			
	Government policy integration			
	Geographical integration			
Physical Activity	Walking/cycling opportunities			

Table 7-4 Overall criteria MCA summary table

Criteria Summary	Option 1	Option 2	Option 3
Economy			
Safety			
Environment			
Accessibility & Social Inclusion			
Integration			
Physical Activity			

Table 7-5: Legend for MCA Summary Tables

Significant comparative advantage over other options
Some comparative advantage over other options
Comparable to other options / neutral
Some comparative disadvantage over other options
Significant comparative disadvantage over other options

7.5.3 Economy

Economy has been divided into four sub-criteria which are considered below.

CAPEX

Option 1 and 2 are considered comparable to each other. Option 3 has some comparable disadvantages over option 1 and 2 as the length of access road and the new highway connection involves a higher capital cost.

OPEX

Although there are minor differences, for example length of access road could affect maintenance costs, these are not perceived as having any comparable differences and therefore the options are comparable/neutral to each other.

Train operations functionality/economic benefits

All options are considered comparable from the perspective of train operations. All options provide a substation which will allow the electrification of the Northern Line.

Traffic functionality and associated economic activities and opportunities

When operational, the scheme will have no visible impacts on the prevailing traffic conditions in the surrounding road networks.

None of the options are expected to have a comparatively more significant impact than any of the other.

Construction activities on all options considered, are expected to generate a relatively low number of additional vehicular journey, and therefore will, at most, have a minor temporary impact on the traffic conditions of the local road network.

7.5.4 Safety

Safety has been divided into two sub-criteria which are considered below. It should be noted that all options are safe, but some will have the potential for greater residual risks to remain. This criterion considers relative advantages of each option on the criteria of safety.

Employer's Safety

There are no material differences between the options when comparing the employer's safety. All substation options have the same designs to ensure employer's safety is considered and maintained.

Public Safety

Option 3 has some comparable advantages over option 1 and 2 as maintenance access is segregated from public areas. Although maintenance access needs are limited with option 1 and 2 access would have to be via the access tracks within the proposed Bremore Regional Park. This would create an interaction between members of the public using the park access routes and the substation maintenance vehicles.

7.5.5 Environment

7.5.5.1 Landscape and visual quality

Option 1 is partly overlooked from residential development at Cardy Rock and is sited off the beach access lane. The lands are zoned open space but currently in agricultural use. Some screening could be provided; however, the option has some comparative disadvantages over other options.

Option 2 is located within existing open space along the beach access lane. The option adjoins and impacts on existing footpaths in the open space. Option 2 is also in close proximity to Bremore Castle and has significant comparative disadvantages over other options.

Option 3 is located is located north of open space lands and is remote and not openly visible. Appropriate screening can be provided. The location does not adversely impact on views to be preserved from the R132 and the option has significant comparative advantages over other options.

7.5.5.2 Biodiversity

There is little to differentiate the options from each other in terms of ecological constraints. No options are likely to involve impacts on designated sites or have any other significant ecological impacts. All of the options require some sort of vegetation removal for either the TSS itself, or for access roads. Vegetation removal with potential for removal of habitat (i.e. shrub and/or scrub, hedgerow, agricultural grassland) may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals). All options will require hedgerow removal of some sort (for TSS or access road), with option 3 likely requiring the most removal for the construction of an access road (c.370m). Option 1 and 3 will require some portion of agricultural grassland/arable crop removal, which in itself is not likely to be of any significant value. The dominant habitat in Option 2 appears to be amenity grassland (from satellite view), which is also not likely to be of any significant value.

Option 1 and 2 are close to (c. 40m) from UBB61, a high potential, protected, underbridge. Whilst there could be disturbance impacts from lighting and/or noise during construction and operation, this is unlikely to pose a significant ecological constraint due to the distance between the bridges and the proposed works areas.

All options are located in wintering bird habitat (amenity grassland, agricultural fields), and have the potential to be used as inland sites for foraging and/or roosting bird species from the nearby shoreline. However due to the size of the fields and the habitat present, and as the proposed works area will be located on the peripheries of these habitats, this is unlikely to cause a significant impact on wintering birds. Wintering bird surveys would advise the likelihood of this impact occurring; however, this impact would be greatest in option 3, due to the construction of the access road.

It is not known whether invasive species may occur along or near the railway line. If present, then there would be risk of spreading to adjacent areas. Even if it were the case that invasive species are present in this area, the level of impact is likely to be similar across all options and might not be a significant differentiator between options.

All works are very close to the existing tracks. Railway lines can often support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature.

If any such habitat is present the level of impact is likely to be similar across all options and is unlikely to be a significant differentiator between options.

7.5.5.3 Noise and Vibration

Option 3 is the substation location that is furthest from any residential receptors and is therefore the most favourable from a noise perspective.

Options 1 and 2 are closer to residential receptors, and therefore less favourable. Option 2 is slightly further from residential receptors, and therefore more favourable than Option 1.

7.5.5.4 Water Resources

From a water resources perspective, Options 1, 2 and 3 are similarly comparable with each other.

7.5.5.5 Archaeology, architectural and cultural heritage

All three options (Options 1, 2 and 3) are comparable for archaeology and cultural heritage. They are all located Bremore townland where there are the recorded monuments such as Bremore Castle, church and graveyard and the National Monument of Bremore Megalithic Tombs (DU002-001001-005). As such these options are considered to have the potential to reveal sub-surface archaeological features and preconstruction investigation will be carried out to assess this potential.

From an architectural heritage perspective Option 3 has a comparative advantage over option 1 and option 2.

For Option 1 the proposed site is a greenfield site with no known architectural heritage features. There is a potential visual impact on Balbriggan Railway Bridge (UBB61) located to the south east. It is anticipated that the magnitude of impact on the setting of the bridge would be low. No other buildings or features of architectural heritage interest were identified which could be impacted by a proposed substation at this location. It is anticipated that the proposed sub-station at location 1 would have a Negative, slight impact on the architectural heritage value of the site.

Option 2 may have a visual impact on impact on the on the setting of St. Molaga's Church and graveyard (FCC RPS 0013) and Bremore Castle (FCC RPS 0014). While these features are approximately 150m away from the proposed substation, due to the open nature of the coastal setting, the magnitude of impact on the setting of the historic structures is anticipated to be Medium. Due to the number of sites which would be impacted by a sub-station at this location, it is anticipated that the proposed sub-station at Location 2 would have a Negative, moderate impact on the architectural heritage value of the site.

For Option 3, no buildings or features of architectural heritage interest were identified which could be impacted by a proposed substation at this location which gives it a comparative advantage over the other two options.

Overall Option 3 is the favoured option as it has significant comparative advantages over Option 2 and some comparative advantages over Option 2.

7.5.5.6 Geology and Soils

Option 2 is comparatively advantageous to Options 1 and 3 since the proposed location is associated with the construction of an access road which will generate comparatively less earthworks.

Option 3 is significantly disadvantageous over Options 1 and 2 since the proposed location is associated with the potential for loss of top/growing soil and, the construction of a longer access road thereby generating more earthworks.

In Option 1, there is also potential for loss of top/growing soil.

7.5.5.7 Agricultural and non-agricultural

Option 2 has significant comparable advantages compared to Options 1 and 3 because it is not located in agricultural land. Both Options 1 and 3 are located on agricultural land (arable) which is medium sensitivity. Compared to Option 1, Option 3 has a significant comparative disadvantage due to the long access road.

7.5.5.8 Air quality and climate

No significant impacts on air quality are likely during the construction phase due to the scale of the proposals therefore all options are considered comparable to each other. The development of a substation is required to electrify the railway between Malahide and Drogheda. This conversion will result in positive impacts on air quality and climate. Irish Rail is committed to the use of 80% renewables for DART+ which will result in even greater benefits.

7.5.6 Accessibility and Social Inclusion

All options are comparable as the operation and construction of the substation in all options has no impact on accessibility or social inclusion.

7.5.7 Integration

Integration has been assessed using the five sub-criteria described below.

Adaptability in the future

All options are comparable as the operation and construction of the substation in all options has no impact on future internal transport links.

Transport integration

All options are comparable as the operation and construction of the substation in all options has no impact on transport integration.

Land use integration

Options 1 and 2 are zoned G4/Open Space. Options 3 is zoned G3/High Amenity.

A utility installation would be considered open for consideration in both zonings. However, as Options 1 and 2 are encompassed by the Part XI approval for a recreational park, it is unlikely that that Fingal County Council would support a substation on these lands. In this context, Option 3 has comparative advantage over other options and is considered more favourably in planning terms.

Government policy integration

All international, national, regional and local policies encourage improvements in relation to the efficiency of public transport. All the proposed options will facilitate the achievement of greater efficiency in public transportation long part of the east coast of the country and therefore comply with government policy.

Geographical integration

All of the options are infrastructural buildings adjoining a railway line and are considered neutral in comparison to each other.

7.5.8 Physical Activity

The options are considered to be comparable with each other with regards to physical activity.

7.6 Construction Considerations

Construction of any substation needs to consider at least the following factors:

- Access arrangements off the public highway
- Type and proximity of neighbouring activities (and their sensitivity to construction aspects such as noise, dust, vehicle movements and vibration)
- Type and proximity of nearby ecology (especially vegetation and animals)
- Space availability for worksite compound, i.e. beyond permanent substation footprint
- Ground conditions, with regard to operation of construction plant

With these factors in mind, views on the constructability of substation options at Balbriggan can be summarised accordingly:

- Option 1. Scores reasonably poorly, primarily due to poor road access. It appears that construction traffic would have to pass along either a private road leading to Bremore Castle or share roads through the circular residential complex just north of the castle. The nearest residential property in the vicinity is about 100 metres away. There would be minimal ecological damage.
- Option 2. Scores as Option 1 for the same reasons. There are additional slight negative impacts from being reasonably close to the tourist attraction of Bremore Castle and more intrusive on agricultural land.
- Option 3. Scores moderately well as few parties would be inconvenienced by construction noise or traffic other than the local farmer who would have a new access road built alongside the edge of one field. This extra construction would lead to a relative negative aspect from an ecological perspective.

7.7 Summary and conclusions

7.7.1 Non-preferred options

Options 1 and 2 are not preferred due to:

- Located within the proposed Bremore Park
- They have disadvantages for public safety, due to vehicles interaction (during construction and operation) with the public visiting the park.

7.7.2 Preferred option

Option 3 has been identified as the preferred option. It has advantages over predominately all assessment criteria compared to the other options:

- Outside of the Bremore Park development therefore scoring highly for land use integration and public safety.
- Scores well under a number of environmental parameters including landscape & visual quality and noise & vibration.

For further details of the preferred option refer to drawing D+WP56-ARP-P3-NL-DR-CX-000503 in Appendix C.

7.7.3 Key Risks/Next Steps

The following key next steps are recommended:

- Highway access survey and design
- Environmental surveys
- Seek feedback from stakeholders on the preferred option.

8. GORMANSTON SUBSTATION OPTION SELECTION

8.1 Existing Situation and Constraints

The requirements described in Section 2 have dictated the need for a substation in the Gormanston area. The area under consideration extends from 150m north of the disused runway to the overbridge to the north.

8.1.1 Utilities

Substations shall be supplied from the ESBN 38kV network and each substation will include ESBN infrastructure to manage the incoming supply and necessary protection. ESBN will require unfettered access to their protection equipment accommodated in a secure dedicated building.

Substations are expected to be equipped with welfare facilities for maintenance staff and will require a fresh water supply and foul water drainage.

Existing utilities are a constraining factor to the project when considering the various design options for the construction of substations. It is often cheaper, easier, and quicker for a project to change the design than to divert a utility. Existing utilities should be taken into consideration from an early stage in the project, and where possible worked around and only diverted where necessary. Appropriate arrangements must be made with the various utility providers long before construction of the substation commences.

Utility records have been gathered from the utility providers in the area. The following utility companies have infrastructure within the area of interest:

- ESB
- Irish Rail

The figure below shows the utility records that Arup has for the proposed substation sites.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring.

Figure 8-1 Existing Utilities to the north of Gormanston

8.1.2 Environmental

8.1.2.1 Traffic and Transportation

The nearest road link of strategic importance in this area is the R132 which connects with the M1 in the south-west. The road is 6m wide and should be suitable to serve construction traffic.

It is noted that the local access road is narrow but is not considered a significant constraint. Due to the low volume of operational traffic to be generated by the substation and the temporary nature of the construction period no constraints are envisioned.

8.1.2.2 Landscape and visual quality

The landscape is agricultural and rural in nature. The lands are also visually open, patricianly east of the railway, being influenced by its coastal location. Views of the coast are available from the railway. Two residential / farm properties, one with a range of farm outbuildings, are located north of the Irishtown Road and west of the railway. The properties include some mature trees and other plantings. Irishtown local road is elevated across the railway and leads down to the beach. There are wide generally open views across the landscape from the overbridge. A somewhat unusual block planting of evergreen trees is located in the field south of the local road and west of railway.

The key constraints are the open coastal landscape and residential amenity.

8.1.2.3 Archaeology and cultural heritage

The Gormanston substation options are located in Irishtown townland, on the historic Ordnance Survey maps, this area is shown as agricultural field along the coastline. To the northwest of the options, a number of archaeological sites appearing as cropmarks have been detected from aerial survey. These include a circular cropmark recorded as a ringfort (ME028-056), a subcircular enclosure with a possible souterrain in its interior (ME028-057/001) and a ring-ditch (ME028-058) identified from an aerial photograph (Ordnance Survey Aerial Photographs). Also identified is a circular enclosure with a ring ditch located in the northwest quadrant of this feature (ME028-091001 and 002). These features have been identified as recently as 2020 and demonstrate the below ground archaeological potential of this coastal environment.

The only upstanding archaeological remains in the area are those of a church and graveyard (ME028-017001 and 002). St Peter's chapel is located at the southern edge of a raised triangular grass-covered plateau in this low-lying level landscape. There is no evidence of burial now. These sites are located 860m to the northwest of the substation options.

8.1.2.4 Architectural Heritage

There are no protected structures or NIAH structures within the vicinity of the proposed sites. There is a road bridge over the tracks whose parapet walls are constructed in modern concrete and bocks. A site inspection is required to inform the assessment of the architectural heritage value of the bridge. For this assessment, it is assumed to be of local importance for reasons of architectural and technical interest.

There are two farm complexes noted to the west of the road bridge. At both locations there are buildings which appear on the first OS map, with further buildings added before the 1907 revision was surveyed. The complex to the south is marked Irishtown House on the 1907 OS map. There are surviving houses, farm buildings and historic boundary treatments at these locations. As above a site inspection is required to confirm their architectural heritage value. For the purpose of this assessment, they are assumed to be of regional importance for reasons of architectural and social interest.

8.1.2.5 Noise and Vibration

The location for the Gormanston substation is in a rural area, with one detached house to the north. The acoustic environment will include train pass bys (that will decrease in noise level with electrification), and natural sounds such as birds and wind in vegetation.

Construction noise and vibration have the potential to impact nearby sensitive receptors more than operational noise, although low frequency tonal noise should be considered during the operational phase.

8.1.2.6 Air quality and climate

The development of a substation will have no operational air quality impacts. There is the potential for air quality impacts during the construction phase where works take place in proximity to sensitive receptors. However, the construction works will be of a small scale.

8.1.2.7 Agricultural and non-agricultural

The land at both sides of the railway line is owned by the Department of Defence and is non-agricultural grassland. Therefore, the entire area is low sensitivity from an agricultural perspective.

8.1.2.8 Geology & Soils

A review of historic mapping (OSi Historic 6" and 25" Maps) shows that the site was undeveloped until 1888, where the construction of the railway line is noted. Minor developments notably the Irishtown House at approximately 150m to the east of the railway line were identified. Aerial photography shows significant residential and industrial developments to the east in the period 1995-2012.

The Corine Land Cover 2018 categorises the land use for most of the site as agricultural areas with pastures with some regions to the north as agricultural areas with non-irrigated arable land. No historic pits, quarries or IPPC, IPC and IEL facilities were identified within the study area and its surrounding.

The EPA waterbodies map (2021) shows that no stream/river crosses the site or is located within the vicinity. No soft deposits are therefore expected across the site.

The GSI Quaternary sediment mapping shows the presence of gravels derived from limestones at the site with marine beach sands at approximately 200m to the east of the railway line noted.

GSI bedrock mapping shows that the site is underlain by greywacke sandstone and siltstone of the Denhamstown formation and thinly bedded siltstone and sandstone of the Clatterstown formation respectively.

8.1.2.9 Water resources

Surface water bodies

There are no watercourses in the vicinity of the study area and drainage in the study is directly into the Northwestern Irish Sea (HA08), east of the site. The Northwestern Irish Sea (HA08) waterbody is at 'High' status for the 2013-2018 monitoring cycle and classified as 'Not at Risk'. The minimum objectives for a water body under the WFD are to achieve at least 'Good' status (or 'Good potential' for artificial/ highly modified water bodies), and no deterioration of existing status.

Groundwater

The study area is underlain by Silurian Metasediments and Volcanics of the Denhamstown Formation to the south and Clatterstown Formation to the north. The Clatterstown Formation is classified as a 'Poor Aquifer (Pl)' which is 'Generally Unproductive except for Local Zones'. The

Denhamstown Formation is classified as a 'Poor Aquifer (Pu)' which is 'Generally Unproductive'. The groundwater vulnerability in the study area is classified as 'High'.

There are no significant karst features identified near the site. There are also no high yielding water supply springs and wells i.e. public water supplies or group water scheme supplies within the site. No Source Protection Zones associated with public or group groundwater supply schemes are located with the site.

The study area lies within the Duleek groundwater body (IE_EA_G_012). The groundwater body is at 'Good' WFD Status for the 2013-2018 monitoring cycle and currently under review with regard to achieving its WFD objectives.

Flooding

Historical flooding has been assessed by examining reports and maps from the OPW's National Flood Hazard mapping. There are no records of flood events or potential for flooding in the study area.

8.1.2.10 Biodiversity

The works locations are set in the rural area of Gormanston/Irishtown, between Laytown and to the north, and Balbriggan to the south. The works locations are adjacent to Gormanston Camp, and west of the Gormanston beach shoreline.

For all options, the works are adjacent to the existing railway line in improved grassland habitats. The surrounding environs are predominantly agricultural lands. The shoreline east of the proposed works area, is designated as a Special Protection Area (SPA). This extends northwards along the coastline, where it is also designated as a proposed Natural Heritage Area (pNHA).

The key ecological constraints in this area are the River Nanny Estuary and Shore SPA, and Laytown Dunes/Nanny Estuary pNHA designation which are designated for marine habitats and overwintering birds. These designated areas are of international and national biodiversity importance.

The qualifying interests (reasons for designation) of the River Nanny Estuary and Shore SPA, are listed in Table 8-1 below.

Table 8-1: Table of Qualifying Interests for River Nanny Estuary and Shore SPA

River Nanny Estuary and Shore SPA
A130 Oystercatcher *Haematopus ostralegus*
A137 Ringed plover *Charadrius hiaticula*
A140 Golden Plover *Pluvialis apricaria*
A143 Knot *Calidris canutus*
A144 Sanderling *Calidris alba*
A184 Herring gull *Larus argentatus*
A999 Wetlands and Waterbirds

Other potential ecological constraints include:

- Vegetation (scrub, hedgerows, improved grassland) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals).
- Potential for roosting bats in bridges adjacent to works areas.
- Potential for invasive species to occur adjacent to or along the railway line.
- Potential for the railway and adjacent land to support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature.

8.1.3 Planning

None of the lands on which the proposed substations are located, are zoned.

There are no pending planning applications or undeveloped planning permissions that are affected by the various options.

8.2 Longlist Options

The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. Locations considered are shown in Figure 8-2 below.

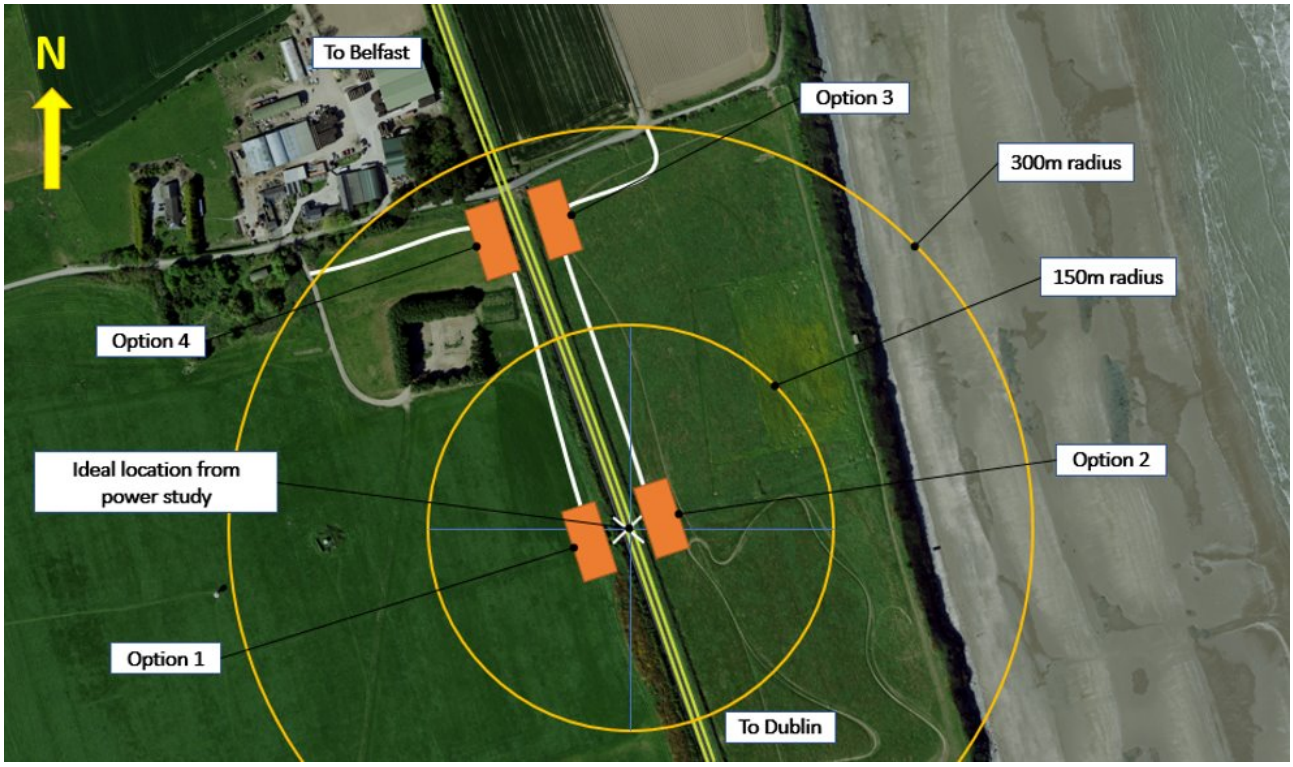

Figure 8-2: Gormanston Substation Options

8.2.1 Option 0 – Do nothing

No substation provided.

8.2.2 Option 1

Option 1 comprises construction of a substation on grassland within Gormanston Camp, 150m north of the disused runway, west of the railway. An access road would be required around the perimeter of the camp to the adjacent lane.

8.2.3 Option 2

Option 2 comprises construction of a substation on grassland, 150m north of the disused runway, east of the railway. An access road would be required parallel to the railway boundary and up to the adjacent lane.

8.2.4 Option 3

Option 3 comprises construction of a substation on grassland directly south of the aforementioned overbridge, east of the railway.

A short access road would be required perpendicular to the tracks due to topological constraints for the overbridge access ramps.

8.2.5 Option 4

Option 4 comprises construction of a substation on grassland directly south of the aforementioned overbridge, west of the railway.

A short access road would be required perpendicular to the tracks due to topological constraints for the overbridge access ramps.

8.3 Sifting of longlist of options

Assessment is provided in Table 8-2.

Table 8-2 Assessment of longlist of options against project objectives and requirements (options "do-nothing" to 4)

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3		Option 4	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	No impact due to 'do-nothing' approach.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Fail	Lack of substation does not allow delivery of electrified route in accordance with standards. I.e., non-compliant	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards as listed in Section I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	No impact due to 'do-nothing' approach.	Pass	Disused airfield now a camp/parkland	Pass	Greenfield site adjacent dirt-bike trails	Pass	Greenfield site adjacent dirt-bike trails	Pass	Disused airfield now a camp/parkland
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	No impact due to 'do-nothing' approach.	Pass	Majority of works can be carried out away from the railway line. Disruption to camp	Pass	Majority of works can be carried out away from the railway line. Disruption to dirt-bike trails	Pass	Majority of works can be carried out away from the railway line. Disruption to dirt-bike trails	Pass	Majority of works can be carried out away from the railway line. Disruption to camp
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No impact due to 'do-nothing' approach.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Potential greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Potential greenfield site

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3		Option 4	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	No infrastructure intervention considered as part of 'do-nothing' approach.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged from 'do-nothing' approach.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Fail	Insufficient location and number of substations for delivery of an electrified route.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	No clearance issues associated with 'do-nothing' approach.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Safety not impacted by do-nothing approach. Protection of substation infrastructure not required.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

8.3.1 Summary of long list sifting

Table 8-3 Summary of Longlist Sifting

Option	Screening Result	Summary
"Do-Nothing"	**FAIL**	• Fails to provide electrified railway between Malahide and Drogheda • Fails to provide adequate number and location of substations
Option 1	**PASS**	Meets project objectives and requirements
Option 2	**PASS**	Meets project objectives and requirements
Option 3	**PASS**	Meets project objectives and requirements
Option 4	**PASS**	Meets project objectives and requirements

8.4 Shortlisted options

The following options have been taken forward to the shortlist and to the MCA process:

- Option 1;
- Option 2;
- Option 3; and
- Option 4.

For further detailed drawings of the shortlisted options please refer to drawing D+WP56-ARP-ZZ-NL-DR-HV-000030 to D+WP56-ARP-ZZ-NL-DR-HV-000037 in Appendix B.

8.5 Multi-criteria analysis

8.5.1 Methodology

For each individual entity an assessment has been made against the MCA criteria. Each option has been relatively compared against the others based on the five-point colour coded ranking scale in Each option has been relatively compared against the others based on the five-point colour coded ranking scale in MCA summary Table 8-6.

A multi-criteria analysis table is presented in this section. This has been developed to reflect the relative rankings for all sub-criteria for each of the options assessed and is presented as a summary of the key issues considered.

A more detailed table is provided in Appendix A to this report with the full detailed rationale behind the scoring of each criterion and option.

Table 8-4 MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 2	Option 3	Option 4
Economy	CAPEX				
	OPEX				
	Train Operations Functionality/Economic Benefit				
	Traffic functionality and associated economic activities and opportunities				
Safety	Employer's Safety				
	Public safety				
Environment	Landscape and Visual Quality				
	Biodiversity				
	Noise and Vibration				
	Water resources				
	Archaeology, Architectural and Cultural Heritage				
	Geology and Soils (includes waste)				
	Agricultural and non-agricultural				
	Air Quality & Climate Change				
Accessibility & Social Inclusion	Accessibility				
	Social Inclusion				
Integration	Adaptability in the future				
	Transport Integration				
	Land Use Integration				
	Government policy integration				
	Geographical integration				
Physical Activity	Walking/cycling opportunities				

Table 8-5 Overall criteria MCA summary table

Criteria Summary	Option 1	Option 2	Option 3	Option 4
Economy				
Safety				
Environment				
Accessibility & Social Inclusion				
Integration				
Physical Activity				

Table 8-6: Legend for MCA Summary Tables

Significant comparative advantage over other options
Some comparative advantage over other options
Comparable to other options / neutral
Some comparative disadvantage over other options
Significant comparative disadvantage over other options

8.5.2 Economy

Economy has been divided into four sub-criteria which are considered below.

CAPEX

Although there are minor differences, for example length of access road, these are not perceived as having any comparable differences and therefore the options are comparable/neutral to each other.

OPEX

Although there are minor differences, for example length of access road could affect maintenance costs, these are not perceived as having any comparable differences and therefore the options are comparable/neutral to each other.

Train operations functionality/economic benefits

All options are considered comparable from the perspective of train operations. All options provide a substation which will allow the electrification of the Northern Line.

Traffic functionality and associated economic activities and opportunities

When operational, the scheme will have no visible impacts on the prevailing traffic conditions in the surrounding road networks.

None of the options are expected to have a comparatively more significant impact than any of the other.

Construction activities on all options considered, are expected to generate a relatively low number of additional vehicular journey, and therefore will, at most, have a minor temporary impact on the traffic conditions of the local road network.

8.5.3 Safety

Safety has been divided into two sub-criteria which are considered below. It should be noted that all options are safe, but some will have the potential for greater residual risks to remain. This criterion considers relative advantages of each option on the criteria of safety.

Employer's Safety

Following discussions with the Defence forces it has been identified that options 1 and 4 have the least risk associated with the nearby firing ranges and hence have a comparable advantage over options 2 and 3 with regards to safety of employees.

Public Safety

Similar to employer's safety, there is no material difference between the substation option designs.

8.5.4 Environment

8.5.4.1 Landscape and visual quality

Option 1 is located in an open and exposed location in farmland on the west side of the railway. The option has some comparative disadvantages over other options.

Options 2 and 3 are located in open and exposed locations on coastal side of railway. The locations would impact views from trains and screening would be difficult. These options have significant comparative disadvantages over other options.

Option 4 is located in a low setting on the west side of the railway close to Irishtown local road. The location is well-screened in views on approach but locally is visually open. Appropriate screening can be provided, and the option has significant comparative advantages over other options.

8.5.4.2 Biodiversity

All of the proposed options have potential to indirectly impact on the River Nanny Estuary and Shore SPA and Laytown Dunes/Nanny Estuary pNHA. Potential indirect impacts include construction related impacts (e.g. potential for water quality impacts or disturbance to birds) and new lighting which could impact on birds. The potential for this impact is greater in Options 1 and 2, and they would require the most amount of disturbance for the construction of the TSS and access roads. These options are located within improved grassland habitats which is suitable foraging habitat for overwintering bird species such as geese. Increased human presence, lighting, and noise could have significant impacts on qualifying interest species from the nearby SPA, and designated sites further afield.

All of the options require some sort of vegetation removal for either the TSS itself, or for access roads. Vegetation removal with potential for removal of habitat (i.e. shrub and/or scrub, hedgerow, improved grassland) may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals). Options 1 and 2 would require the most removal, primarily for the access roads, however vegetation removal would not be a significant constraint in any of the options due to the likely low value of the habitats in question.

Option 3 and 4 are in very close proximity to a bridge with low potential for roosting bats (OBB68). Whilst there could be disturbance impacts from lighting and/or noise during construction and operation, this is unlikely to pose a significant ecological constraint due to the distance between the bridges and the proposed works areas.

It is not known whether invasive species may occur along or near the railway line. If present, then there would be risk of spreading to adjacent areas. Even if it were the case that invasive species are present in this area, the level of impact is likely to be similar across all options and might not be a significant differentiator between options.

All works are very close to the existing tracks. Railway lines can often support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature. If any such habitat is present the level of impact is likely to be similar across all options and is unlikely to be a significant differentiator between options.

8.5.4.3 Noise and Vibration

Option 2 is the most preferable option as it is the furthest from the detached house to the north. Option 1 is very similar, although slightly closer to the house.

Option 4 is the least favourable, as it is closest to the house, with Option 3 being similar, but slightly further away.

8.5.4.4 Water Resources

From a water resources perspective, all options are similarly comparable with each other.

8.5.4.5 Archaeological, architectural and cultural heritage

The four substation Options (1-4) are considered equal in preference for archaeological and cultural heritage. There are no recorded monuments at the locations for the substations. A recent review of aerial photography identified subsurface archaeological enclosure sites in the agricultural fields to the northwest in Irishtown townland. The closest archaeological recorded monument is the site of a pit burial, located at the coastline, 210m east of the substation options. While there are no known or recorded archaeological constraints at this location, there is the potential to reveal subsurface archaeological features and finds at this greenfield location.

For architectural heritage Option 1 and Option 2 have comparative advantages over Options 3 and 4.

Option 4 would impact on the setting of the road bridge in Irishtown townland. The magnitude of impact is anticipated to be medium. A negative impact is also anticipated on the setting of the farm complexes to the west. The magnitude of impact is anticipated to be low due to the distance between the proposed building and the sites, and existing trees which would provide screening. Overall, this option would have a Negative, Slight impact on the architectural heritage value of the site.

Option 3 would impact on the setting of the road bridge in Irishtown townland. The magnitude of impact is anticipated to be medium. Overall, this option would have a Negative, Slight impact on the architectural heritage value of the site.

For Options 1 and 2, no buildings or features of architectural heritage interest were identified which could be impacted by proposals.

8.5.4.6 Geology and Soils

Options 1 and 2 are comparatively disadvantageous over Options 3 and 4 since there is the requirement for the construction of a longer access road thereby generating more earthworks.

8.5.4.7 Agricultural and non-agricultural

All options are located on non-agricultural grassland and have similar impacts.

8.5.4.8 Air quality and climate

No significant impacts on air quality are likely during the construction phase due to the scale of the proposals, hence all options are considered comparable. The development of a substation is required to electrify the railway between Malahide and Drogheda. This conversion will result in positive impacts on air quality and climate. Irish Rail is committed to the use of 80% renewables for DART+ which will result in even greater benefits.

8.5.5 Accessibility and Social Inclusion

All options are comparable as the operation and construction of the substation in all options has no impact on accessibility or social inclusion.

8.5.6 Integration

Integration has been assessed using the five sub-criteria described below.

Adaptability in the future

All options are comparable as the operation and construction of the substation in all options has no impact on future internal transport links.

Transport integration

All options are comparable as the operation and construction of the substation in all options has no impact on transport integration.

Land use integration

The lands on which the proposed substations are located, are not zoned.

Following discussions with the Defence forces it has been identified that option 4 has the least impact on military operations and assets and hence has comparative advantages over the other options.

Government policy integration

All international, national, regional and local policies encourage improvements in relation to the efficiency of public transport. All the proposed options will facilitate the achievement of greater efficiency in public transportation long part of the east coast of the country and therefore comply with government policy.

Geographical integration

All of the options are infrastructural buildings adjoining a railway line and are considered neutral in comparison to each other.

8.5.7 Physical Activity

The options are considered to be comparable with each other with regards to physical activity.

8.6 Construction Considerations

Construction of any substation needs to consider at least the following factors:

- Access arrangements off the public highway
- Type and proximity of neighbouring activities (and their sensitivity to construction aspects such as noise, dust, vehicle movements and vibration)
- Type and proximity of nearby ecology (especially vegetation and animals)
- Space availability for worksite compound, i.e. beyond permanent substation footprint
- Ground conditions, with regard to operation of construction plant

With these factors in mind, views on the constructability of substation options at Gormanston can be summarised accordingly:

- Option 1. Scores moderately, primarily due to needing to construct a relatively long access road, which in turn will negatively impact ecology. Other aspects are reasonable, there being no nearby residential receptors and the public highway being the same for all options (adequate but not good).
- Option 2. Scores similarly to Option 1 for the same reasons however it appears that a public footpath may be interrupted.
- Option 3. Scores moderately well as the required additional access road would be relatively short and few parties would be inconvenienced by construction noise or traffic.
- Option 4. Scores moderately well for the same reasons as Option 3 but a closer proximity to one residential property.

8.7 Summary and conclusions

8.7.1 Non-preferred options

Options **2** and **3** are not preferred due to:

- Options are located closer and interfacing with access to the practice firing area for the Military of Defence.

Option **1** is not preferred due to:

- Scores poorly for land use integration as could impact military operations.
- Scores poorly for a number of environmental factors (when compared with option 4), such as geology and biodiversity

8.7.2 Preferred option

Option 4 has been identified as the preferred option. It has advantages over predominately all assessment criteria compared to the other options:

- Shortest access road
- Scores highly for land use integration when compared to other options due to the land is not zoned and has the least impact on military operations

For further details of the preferred option refer to drawing D+WP56-ARP-P3-NL-DR-CX-000502 in Appendix C.

8.7.3 Key Risks/Next Steps

The following key next steps are recommended:

- Highway access survey and design
- Environmental surveys
- Seek feedback from stakeholders on the preferred option.

9. BETTYSTOWN SUBSTATION OPTION SELECTION

9.1 Existing Situation and Constraints

The requirements described in Section 2 have dictated the need for a substation in the Bettystown area. The area under consideration extends from agricultural land south of Ardmore Ave to woodland west of Ardmore Lane.

9.1.1 Utilities

Substations shall be supplied from the ESBN 38kV network and each substation will include ESBN infrastructure to manage the incoming supply and necessary protection. ESBN will require unfettered access to their protection equipment accommodated in a secure dedicated building.

Substations are expected to be equipped with welfare facilities for maintenance staff and will require a fresh water supply and foul water drainage.

Existing utilities are a constraining factor to the project when considering the various design options for the construction of substations. It is often cheaper, easier, and quicker for a project to change the design than to divert a utility. Existing utilities should be taken into consideration from an early stage in the project, and where possible worked around and only diverted where necessary. Appropriate arrangements must be made with the various utility providers long before construction of the substation commences.

Utility records have been gathered from the utility providers in the area. The following utility companies have infrastructure within the area of interest:

- Gas Networks Ireland;
- ESB;
- Irish Water;
- Irish Rail.

The figure below shows the utility records that Arup has for the proposed substation sites.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring.

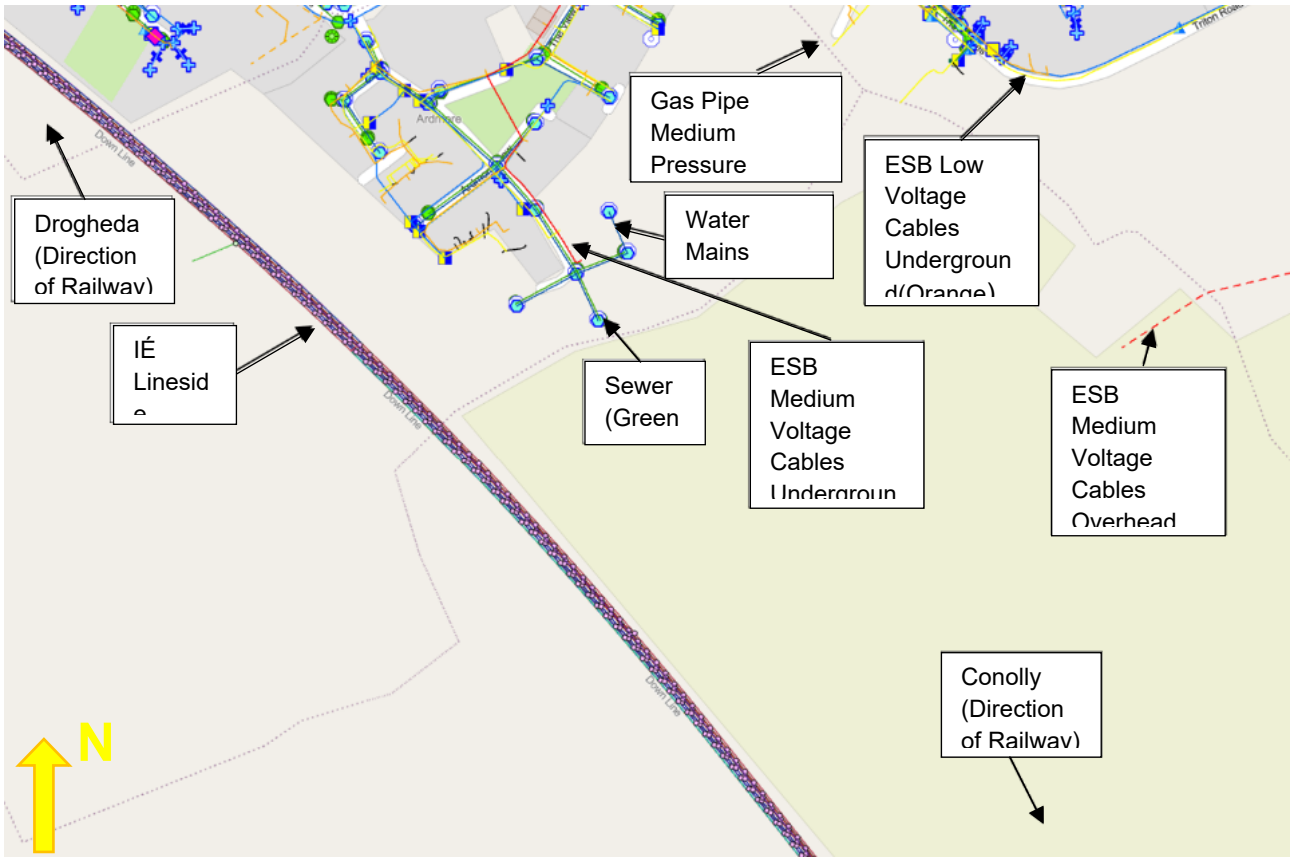

Figure 9-1 Existing Utilities to the west of Bettystown

9.1.2 Environmental

9.1.2.1 Traffic and Transportation

The nearest road link of strategic importance in this area is the R132 which connects with the M1 in the south. The road is 6m wide and should be suitable to serve construction traffic. Due to the low volume of operational traffic to be generated by the substation and the temporary nature of the construction period no constraints are envisioned.

9.1.2.2 Landscape and visual quality

East of the railway the relatively flat landscape is a mix of residential (at Eastbury and Ardmore), open space and agricultural land uses. West of the railway the relatively flat landscape is agricultural and rural in nature. Some small areas of woodland / dense planting exist to either side of the railway. There is an objective to provide for a future train station west of Ardmore.

The key constraints are the residential amenity and existing trees, hedgerows and other vegetation.

9.1.2.3 Archaeological and cultural heritage

The Bettystown substation area is located in Sevitsland and Ministown townlands. A holy well (ME021-013) was the only one recorded monument in the vicinity of the railway until recently when an examination of aerial photography after the drought of 2018 identified three enclosure sites (ME021-032, ME021-013001 and ME021-031) ranging from 25m in diameter to 45m. These newly identified cropmarks indicate the below ground archaeological potential of this area.

9.1.2.4 Architectural Heritage

There are no protected structures or NIAH structures within the vicinity of the proposed sites. No other features of architectural heritage interest were identified through the desk-based analysis of the site.

9.1.2.5 Noise and Vibration

The position for the Bettystown substation is at the edge of the suburbs of the town of Bettystown and has the potential to impact residents in the suburbs. Noise from train pass bys will decrease with electrification.

Construction noise and vibration have the potential to impact nearby sensitive receptors more than operational noise, although low frequency tonal noise should be considered during the operational phase

9.1.2.6 Air quality and climate

The development of a substation will have no operational air quality impacts. There is the potential for air quality impacts during the construction phase where works take place in proximity to sensitive receptors. However, the construction works will be of a small scale.

9.1.2.7 Agricultural and non-agricultural

Land use to the west of the railway line is agricultural – a mixture of arable and grassland. On the eastern side of the railway line there is agricultural land to the south and non-agricultural land to the north. The farm enterprises are medium sensitivity (tillage and grassland for beef or sheep or silage / hay).

9.1.2.8 Geology & Soils

A review of historic mapping (OSi Historic 6" and 25" Maps) shows that the site was undeveloped until 1888, where the construction of the railway line is noted. Aerial photography shows no development across the site in the period 1995-2012.

The Corine Land Cover 2018 categorises the land use of the site as agricultural areas with non-irrigated arable land and pastures as well as artificial surfaces with discontinuous urban fabric. No historic pits, quarries or IPPC, IPC and IEL facilities were identified within the study area and its surrounding.

The EPA waterbodies map (2021) shows that the Pilltown and Mornington streams/rivers cross the site. There is therefore potential for associated soft alluvial deposits.

The GSI Quaternary sediment mapping shows the presence of Irish sea till derived from Lower Palaeozoic sandstones and shales at the site. Moreover, gravels derived from limestones at approximately 300m to the east of the railway line were noted.

GSI bedrock mapping shows that the site is underlain by pale micritised grainstone-wackestone of the Tullyallen formation and dark limestone and calcareous shale of the Mornington formation respectively.

9.1.2.9 Water resources

Surface water bodies

The study area is adjacent to the Betaghstown_010 (IE_EA_08B330980) watercourse which drains into the Northwestern Irish Sea (HA08). Under the Water Framework Directive (WFD, 2000/60/EC) the status of the Betaghstown_010 is unassigned and the waterbody is classified as 'under review'. The Northwestern Irish Sea (HA08) waterbody is at 'High' status for the 2013-2018 monitoring cycle and classified as 'Not at Risk'.

The minimum objectives for a water body under the WFD are to achieve at least 'Good' status (or 'Good potential' for artificial/ highly modified water bodies), and no deterioration of existing status.

Groundwater

The northern part of the study area is underlain by Dinantian Upper Impure Limestones which is part of the Mornington Formation. The aquifer is classified as a 'Locally Important Aquifer (Lm)' which is 'Generally Moderately Productive'. The southern part of the study area is underlain by Dinantian Pure Bedded Limestones which are part of the Tullyallen Formation. The aquifer is classified as a 'Regionally Important Aquifer (Rk_d)' which is dominated by diffuse karsified flow. Groundwater vulnerability is low across the study area.

There are no significant karst features identified near the site. There are also no high yielding water supply springs and wells i.e. public water supplies or group water scheme supplies within the site. No Source Protection Zones associated with public or group groundwater supply schemes are located with the site.

The study area lies within the Bettystown groundwater body (IE_EA_G_016). The groundwater body is at 'Poor' WFD Status for the 2013-2018 monitoring cycle and currently 'At Risk' with regard to achieving its WFD objectives.

Flooding

Historical flooding has been assessed by examining reports and maps from the OPW's National Flood Hazard mapping. There are no records of flood events or potential for flooding in the study area.

9.1.2.10 Biodiversity

The works locations are set in the partially rural/residential outskirts of Laytown and Bettystown.

Most options are within agricultural fields adjacent to Betaghstown watercourse and the existing railway line, with one option located in a wooded area close to residential areas. The betaghstown watercourse flows downstream, through Bettystown, where it outfalls into the Irish Sea at Bettystown Beach. This outfall is south of the Boyne Coast and Estuary Special Area of Conservation, Special Protection Area and proposed Natural Heritage Area.

The key ecological constraint in this area is the Betaghstown River, which flows close to three of the options. This river flows downstream and outfalls into Bettystown Beach, c. 330m south of the Boyne Coast and Estuary SAC and pNHA, c. 1.1km north of the River Nanny Estuary and Shore SPA, and c. 2.4km south of the Boyne Estuary SPA, which are designated for marine habitats and overwintering birds. These designated areas are of international and national biodiversity importance.

The qualifying interests (reasons for designation) of the Boyne Coast and Estuary SAC, the Boyne Estuary SPA, and the River Nanny Estuary and Shore SPA, are listed in the table below:

Table 9-1: Table for Qualifying Interests for nearby SACs and SPAs

Boyne Coast and Estuary SAC	Boyne Estuary SPA	River Nanny Estuary and Shore SPA
1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1210 Annual vegetation of drift lines 1310 Salicornia and other annuals colonising mud and sand 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) 2110 Embryonic shifting dunes 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)	A048 Shelduck *Tadorna* A130 Oystercatcher (*Haematopus ostralegus*) A140 Golden Plover (*Pluvialis apricaria*) A141 Grey Plover (*Pluvialis squatarola*) A142 Lapwing (*Vanellus vanellus*) A143 Knot (*Calidris canutus*) A144 Sanderling (*Calidris alba*) A156 Black-tailed Godwit (*Limosa limosa*) A162 Redshank (*Tringa totanus*) A169 Turnstone (*Arenaria interpres*) A195 Little Tern (*Sterna albifrons*) A999 Wetland and Waterbirds	A130 Oystercatcher *Haematopus ostralegus* A137 Ringed plover *Charadrius hiaticula* A140 Golden Plover *Pluvialis apricaria* A143 Knot *Calidris canutus* A144 Sanderling *Calidris alba* A184 Herring gull *Larus argentatus* A999 Wetlands and Waterbirds

Other potential ecological constraints include:

- Vegetation (scrub, hedgerows, woodland, agricultural grassland, riparian habitat) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals, otter, fish)
- Potential for invasive species to occur adjacent to or along the railway line
- Potential for the railway and adjacent land to support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature

9.1.3 Planning

The lands on which the various options are located are zoned as “Rural Area” in the Meath County Council Development Plan 2021-2027, the objective of which is:

“To protect and promote in a balanced way, the development of agriculture, forestry and sustainable rural-related enterprise, community facilities, biodiversity, the rural landscape, and the built and cultural heritage.”

Specific Objective 1 in relation to Bettystown states:

"To facilitate the provision of a train station at Bettystown (in addition to the existing station at Laytown) as part of the DART expansion works to Drogheda through the planned electrification of the Northern Rail Line by Irish Rail."

There are no pending planning applications or undeveloped planning permissions that are affected by the various options.

9.2 Longlist options

The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. Locations considered are shown in Figure 9-2 below.

Figure 9-2: Bettystown Substation Options

9.2.1 Option 0 – Do nothing

No substation provided.

9.2.2 Option 1

Option 1 comprises construction of a substation on agricultural land south of Ardmore Avenue, east of the railway. An access road would be required from the corner of Ardmore Avenue and around the perimeter of the field. The access road crosses a drainage ditch/stream.

9.2.3 Option 2

Option 2 comprises construction of a substation on agricultural land southwest of Ardmore Avenue, west of the railway. An access road would be required from Minnistown Road, running along the perimeter of two fields, over approximately 600m.

9.2.4 Option 3

Option 3 comprises construction of a substation on scrubland adjacent to Ardmore Avenue. It is envisaged that it could be directly accessed from the existing road with a small section of access road.

9.2.5 Option 4

Option 4 comprises construction of a substation on agricultural land south of Ardmore Avenue, west of the railway. An access road would be required from Minnistown Road, running along the perimeter of two fields, over approximately 600m. The access road crosses a drainage ditch/stream.

9.2.6 Option 5

Option 5 comprises construction of a substation in Irish Rail owned land adjacent to the junction between Ardmore Lane and Narroways Road, east of the railway. An access road would be required from the substation to the junction.

9.3 Sifting of longlist of options

Assessment is provided in Table 9-2 and Table 9-3 below.

Table 9-2 Assessment of longlist of options against project objectives and requirements (options "do-nothing" to 4)

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3		Option 4	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	No impact due to 'do-nothing' approach.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of access road Cost of land
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Fail	Lack of substation does not allow delivery of electrified route in accordance with standards. I.e., non-compliant	Pass	Proposed option includes delivery of substation in accordance with all relevant standards i.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards i.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards i.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards i.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	No impact due to 'do-nothing' approach.	Pass	Greenfield site, agricultural land	Pass	Greenfield site, agricultural land	Pass	Greenfield site, grassland adjacent development	Pass	Greenfield site, agricultural land
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	No impact due to 'do-nothing' approach.	Pass	Majority of works can be carried out away from the railway line. Disruption to housing development during construction	Pass	Majority of works can be carried out away from the railway line. Disruption to road users during construction of access road	Pass	Majority of works can be carried out away from the railway line. Disruption to housing development during construction	Pass	Majority of works can be carried out away from the railway line. Disruption to road users during construction of access road
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No impact due to 'do-nothing' approach.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3		Option 4	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	No infrastructure intervention considered as part of 'do-nothing' approach.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged from 'do-nothing' approach.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Fail	Insufficient location and number of substations for delivery of an electrified route.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	No clearance issues associated with 'do-nothing' approach.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Safety not impacted by do-nothing approach. Protection of substation infrastructure not required.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

Table 9-3: Assessment of long list options against project objectives and requirements (option 5)

Project objectives and requirements	Description	Option 5	
		Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Pass	Enables delivery of an electrified route
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land Cost of access road
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards i.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	Greenfield site, woodland
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	Majority of works can be carried out away from the railway line. Construction of access road adjacent to rear of properties Disruption to road users during access road construction
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site, woodland
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Pass	Enables delivery of an electrified route.
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

Table 9-4: Summary of Longlist Sifting

Option	Screening Result	Summary
"Do-Nothing"	**FAIL**	• Fails to provide electrified railway between Malahide and Drogheda • Fails to provide adequate number and location of substations
Option 1	**PASS**	Meets project objectives and requirements
Option 2	**PASS**	Meets project objectives and requirements
Option 3	**PASS**	Meets project objectives and requirements
Option 4	**PASS**	Meets project objectives and requirements
Option 5	**PASS**	Meets project objectives and requirements

9.4 Shortlisted options

The following options have been taken forward to the shortlist and to the MCA process:

- Option 1;
- Option 2;
- Option 3;
- Option 4; and
- Option 5.

For further detailed drawings of the shortlisted options please refer to drawing D+WP56-ARP-ZZ-NL-DR-HV-000030 to D+WP56-ARP-ZZ-NL-DR-HV-000037 in Appendix B.

9.5 Multi-criteria analysis

9.5.1 Methodology

For each individual entity an assessment has been made against the MCA criteria. Each option has been relatively compared against the others based on the five-point colour coded ranking scale in Table 9-7.

9.5.2 MCA summary table

A multi-criteria analysis table is presented in this section. This has been developed to reflect the relative rankings for all sub-criteria for each of the options assessed and is presented as a summary of the key issues considered.

A more detailed table is provided in Appendix A to this report with the full detailed rationale behind the scoring of each criterion and option.

Table 9-5 MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 2	Option 3	Option 4	Option 5
Economy	CAPEX					
	OPEX					
	Train Operations Functionality/Economic Benefit					
	Traffic functionality and associated economic activities and opportunities					
Safety	Employer's Safety					
	Public safety					
Environment	Landscape and Visual Quality					
	Biodiversity					
	Noise and Vibration					
	Water resources					
	Archaeology, Architectural and Cultural Heritage					
	Geology and Soils (includes waste)					
	Agricultural and non-agricultural					
	Air Quality & Climate Change					
Accessibility & Social Inclusion	Accessibility					
	Social Inclusion					
Integration	Adaptability in the future					
	Transport Integration					
	Land Use Integration					
	Government policy integration					
	Geographical integration					
Physical Activity	Walking/cycling opportunities					

Table 9-6 Overall criteria MCA summary table

Criteria Summary	Option 1	Option 2	Option 3	Option 4	Option 5
Economy					
Safety					
Environment					
Accessibility & Social Inclusion					
Integration					
Physical Activity					

Table 9-7: Legend for MCA Summary Tables

Significant comparative advantage over other options
Some comparative advantage over other options
Comparable to other options / neutral
Some comparative disadvantage over other options
Significant comparative disadvantage over other options

9.5.3 Economy

Economy has been divided into four sub-criteria which are considered below.

CAPEX

The major difference between the options is the length of access road required. Options 2 and 5 have comparable disadvantages as the length of access road required is significantly greater than Options 1, 3 and 5.

OPEX

Although there are minor differences, for example length of access road could affect maintenance costs, these are not perceived as having any comparable differences and therefore the options are comparable/neutral to each other.

Train operations functionality/economic benefits

All options are considered comparable from the perspective of train operations. All options provide a substation which will allow the electrification of the Northern Line.

Traffic functionality and associated economic activities and opportunities

When operational, the scheme will have no visible impacts on the prevailing traffic conditions in the surrounding road networks.

None of the options are expected to have a comparatively more significant impact than any of the other.

Construction activities on all options considered, are expected to generate a relatively low number of additional vehicular journey, and therefore will, at most, have a minor temporary impact on the traffic conditions of the local road network.

9.5.4 Safety

Safety has been divided into two sub-criteria which are considered below. It should be noted that all options are safe, but some will have the potential for greater residual risks to remain. This criterion considers relative advantages of each option on the criteria of safety.

Employer's Safety

There are no material differences between the options when comparing the employer's safety. All substation options have the same designs to ensure employer's safety is considered and maintained.

Public Safety

Similar to employer's safety, there is no material difference between the substation option designs.

9.5.5 Environment

9.5.5.1 Landscape and visual quality

Options 1 and 2 are located in an open agricultural landscape east and west of the railway respectively. Screening could be provided; however, the options have some comparative disadvantages over other options.

Option 3 is located in farmland on the west side of the railway. It is remote from residential properties and good screening could be provided. The location is across the railway from the site of an objective for a potential future train station. The option has significant comparative advantages over other options.

Option 4 is located on former disturbed lands west of Ardmore residential estate. Despite the proximity to the residential development, good screening could be provided and the location is close to the site of an objective for a potential future train station. The option has some comparative advantages over other options.

Option 5 is located close to residential property in an area of existing dense planting which includes mature trees. The access road would further impact on existing plantings and the option has significant comparative disadvantages over other options.

9.5.5.2 Biodiversity

Three of the proposed options have potential to indirectly impact on downstream designated sites i.e. Boyne Coast and Estuary SAC and pNHA, the Boyne Estuary SPA, the River Nanny Estuary and Shore SPA. Potential indirect impacts include construction related impacts (e.g. potential for water quality impacts or disturbance to birds) and new lighting which could impact on birds. Downstream effects could alter the hydrological regime that supports designated sites, and therefore the birds that feed within. These options are located within improved agricultural grassland habitats which is suitable foraging habitat for overwintering bird species.

Increased human presence, lighting, and noise could have significant impacts on qualifying interest species from the nearby SPA, and designated sites further afield. Option 2 is also located in an agricultural field, and is not located near the Betaghstown River, however the access road does run close to the watercourse. Disturbance impacts is likely to be minimal in options 1, 2 3 and 4 within these habitats nonetheless, due to the small amount of habitat loss, and the suitable habitat within the wider environs.

All of the options require some sort of vegetation removal for either the TSS itself, or for access roads. Vegetation removal with potential for removal of habitat (i.e. shrub and/or scrub, hedgerow, woodland,, riparian habitat, improved grassland) may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals, otters, fish).

Option 5 would require removal of woodland, hedgerow and scrub, however it is unknown if this woodland is of high value. Options 1, 3 and 4 would potentially require alteration of the riparian habitat adjacent to the Betaghstown Stream.

This could have downstream, effects as well as direct habitat loss of potential otter, fish, and other freshwater faunal species. This effect has the potential to be significant.

It is not known whether invasive species may occur along or near the railway line. If present, then there would be risk of spreading to adjacent areas. Even if it were the case that invasive species are present in this area, the level of impact is likely to be similar across all options and might not be a significant differentiator between options.

All works are very close to the existing tracks. Railway lines can often support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature. If any such habitat is present the level of impact is likely to be similar across all options and is unlikely to be a significant differentiator between options.

For the above reasons option 2 has some comparative advantages over the other options.

9.5.5.3 Noise and Vibration

Option 1, 2 and 4 are the most favourable options, as they are furthest away from any residents.

Options 3 and 5 are less favourable as they are close or directly adjacent to a housing. Construction noise will have to be carefully considered.

9.5.5.4 Water Resources

From a water resources perspective, Options 2 and 5 are similarly comparable with each other. Options 1, 3, and 4, have some comparative disadvantages over the other options since they are located near or require an access road to be built over a watercourse.

9.5.5.5 Archaeological, architectural and cultural heritage

The five substation options are equal in preference. There are no recorded monuments at the locations of the substations. A recent review of aerial photography identified subsurface archaeological enclosure sites in the agricultural fields located over 300m to the east and south of the substation options.

While there are no known or recorded archaeological constraints at the substation option locations, there is the potential to reveal subsurface archaeological features and finds within the agricultural fields.

No buildings or features of architectural heritage interest were identified which could be impacted by a proposed sub-station at these locations.

9.5.5.6 Geology and Soils

For all five options, there is the potential to encounter soft ground deposits due to the proximity of streams/rivers and the required construction of an access road, thereby generating earthworks.

However, Options 2, 4 and 5 have significant comparative disadvantageous over Options 1 and 3 since the proposed locations require the construction of a relatively longer access road, resulting in the generation of more earthworks. Additionally, there is the potential for excavation of made ground or contaminated land associated with the proposed location for Option 5.

Options 1, 2, 4 and 5 are also associated with potential loss of topsoil/growing soil.

9.5.5.7 Agricultural and non-agricultural

Options 3 and 5 have significant comparable advantages compared to Options 1, 2 and 4. This is because Options 3 and 5 are not located in agricultural land.

Although the access route through agricultural land is shorter for Option 1 it shares a similar score to Options 2 and 4 because all three options are located in agricultural land and require access roads through agricultural land.

9.5.5.8 Air quality and climate

No significant impacts on air quality are likely during the construction phase due to the scale of the proposals hence all options are considered comparable. The development of a substation is required to electrify the railway between Malahide and Drogheda. This conversion will result in positive impacts on air quality and climate. Irish Rail is committed to the use of 80% renewables for DART+ which will result in even greater benefits.

9.5.6 Accessibility and Social Inclusion

All options are comparable as the operation and construction of the substation in all options has no impact on accessibility or social inclusion.

9.5.7 Integration

Integration has been assessed using the five sub-criteria described below.

Adaptability in the future

All options are comparable as the operation and construction of the substation in all options has no impact on future internal transport links.

Transport integration

All options are comparable as the operation and construction of the substation in all options has no impact on transport integration.

Land use integration

All of the options are located in areas zoned as “Rural Area”. Utility installations are permitted in principle in this zoning objective.

Given the relative remoteness of Options 1-3 from the existing housing in the area, these options have some comparative advantage over Options 4 and 5, therefore they would be the preferred options.

Government policy integration

All international, national, regional and local policies encourage improvements in relation to the efficiency of public transport. All the proposed options will facilitate the achievement of greater efficiency in public transportation long part of the east coast of the country and therefore comply with government policy.

For all options the ability to safeguard land for a future station remains possible.

Geographical integration

All of the options are infrastructural buildings adjoining a railway line and are considered neutral in comparison to each other.

9.5.8 Physical Activity

The options are considered to be comparable with each other with regards to physical activity.

9.6 Construction Considerations

Construction of any substation needs to consider at least the following factors:

- Access arrangements off the public highway
- Type and proximity of neighbouring activities (and their sensitivity to construction aspects such as noise, dust, vehicle movements and vibration)
- Type and proximity of nearby ecology (especially vegetation and animals)
- Space availability for worksite compound, i.e. beyond permanent substation footprint
- Ground conditions, with regard to operation of construction plant

With these factors in mind, views on the constructability of substation options at Bettystown can be summarised accordingly:

- Option 1. Scores moderately, with main negative aspects being that construction access would need to be via a residential area, and the new road needed to the site is reasonably long. Positive aspects are that the site is far from residential areas and little ecological damage would be incurred.

- Option 2. Scores quite poorly due primarily to the need to construct a very long access road to it which would damage ecology. A positive is being far from residential receptors.
- Option 3. Scores quite poorly due to being only about 50 metres from a number of residential units, though has only a short access road to it and therefore would damage ecology minimally.
- Option 4. Scores better than Option 2 as needs a shorter access road (but still quite long) and is still remote from residential units.
- Option 5. Scores poorly as within about 20 metres of residential property and would need to remove a significant number of trees. There is little positive to say for this plot from a construction perspective.

9.7 Summary and conclusions

9.7.1 Non-preferred options

Options **2** and **4** are not preferred due to:

- Long access roads to the locations (from Minnistown Rd)
- Scores poorly under a number of environmental parameters, including geology and agricultural

Option 1 is not preferred due to:

- Scores poorly from a water resources point of view due to the need for an access road to cross a water course.
- There are a number of other environmental parameters where this option has comparative disadvantages: biodiversity, geology, agricultural, landscape.

Option 5 is not preferred due to:

- The volume of excavation/removal of vegetation required for the access road. This is linked to scoring low for landscape and geology

9.7.2 Preferred option

Option 3 has been identified as the preferred option. It has advantages over a number of assessment criteria compared to the other options:

- Short access road with access from the residential estate to the east of the railway.
- Advantages from a landscape, water resource and agricultural aspect.
- Can be integrated with the future station and access road

For further details of the preferred option refer to drawing D+WP56-ARP-P3-NL-DR-CX-000506 in Appendix C.

9.7.3 Key Risks/Next Steps

- The following key next steps are recommended:
- Highway access survey and design
- Environmental surveys
- Seek feedback from stakeholders on the preferred option.
- Interface with proposed adjacent development
- Interface with long-term station proposals

10. DROGHEDA SUBSTATION OPTION SELECTION

10.1 Existing Situation and Constraints

The requirements described in Section 2 have dictated the need for a substation in the Drogheda area. The area under consideration extends from the end of McGrath's Lane to the Marsh Road Pay & Display car park.

10.1.1 Utilities

Substations shall be supplied from the ESBN 38kV network and each substation will include ESBN infrastructure to manage the incoming supply and necessary protection. ESBN will require unfettered access to their protection equipment accommodated in a secure dedicated building.

Substations are expected to be equipped with welfare facilities for maintenance staff and will require a fresh water supply and foul water drainage.

Existing utilities are a constraining factor to the project when considering the various design options for the construction of substations. It is often cheaper, easier, and quicker for a project to change the design than to divert a utility. Existing utilities should be taken into consideration from an early stage in the project, and where possible worked around and only diverted where necessary. Appropriate arrangements must be made with the various utility providers long before construction of the substation commences.

Utility records have been gathered from the utility providers in the area. The following utility companies have infrastructure within the area of interest:

- Eir;
- Gas Networks Ireland;
- ESB;
- Irish Water;
- Irish Rail.

The figure below shows the utility records that Arup has for the proposed substation sites.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring.

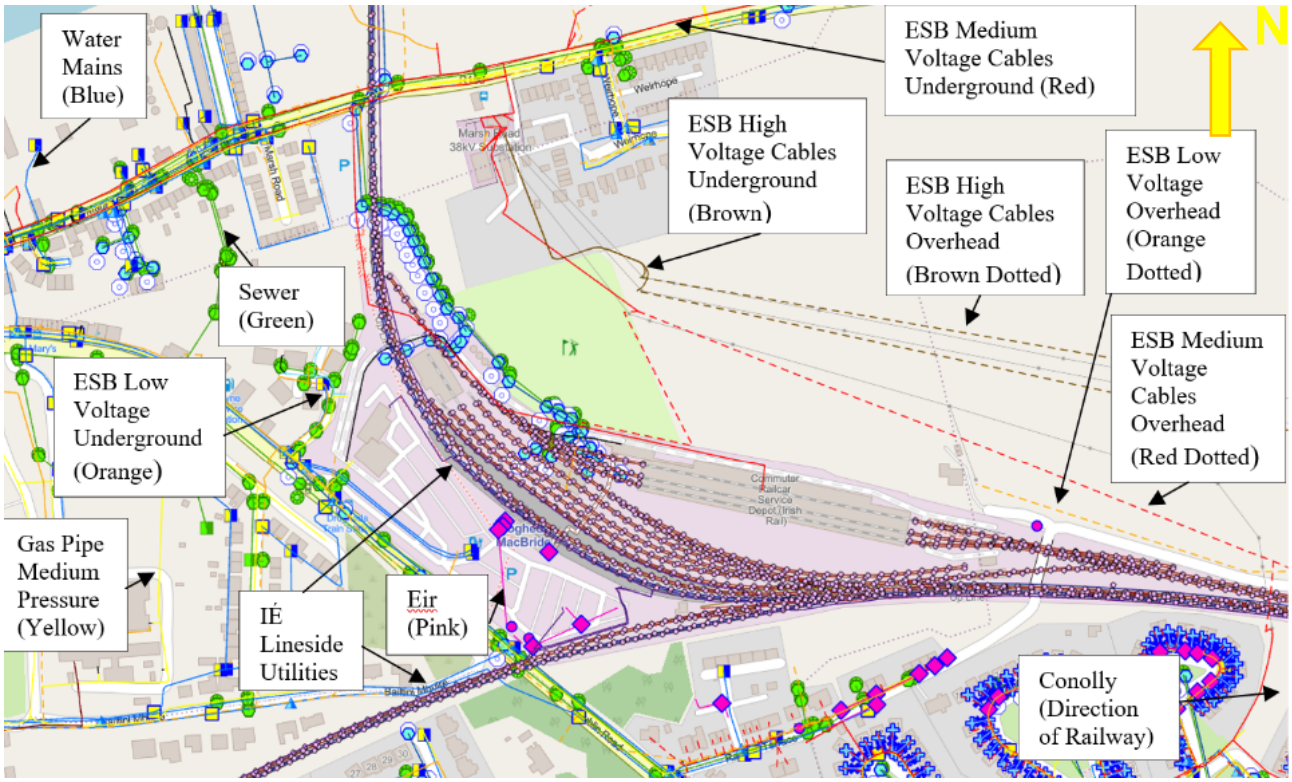

Figure 10-1 Existing Utilities around Drogheda Station

10.1.2 Environmental

10.1.2.1 Traffic and Transportation

The nearest road link of strategic importance in this area is the R152 which connects with the M1 in the south-west. The road is 6m wide and should be suitable to serve construction traffic. The existing parking, pedestrians and cyclists need to be accommodated at the Drogheda Station Car Park. Some local access tracks within the study area, particularly to the north, are narrow but this is not considered a significant constraint. Due to the low volume of operational traffic to be generated by the substation and the temporary nature of the construction period these are not considered to be constraints.

10.1.2.2 Landscape and visual quality

The lands are centred on the existing MacBride Railway Station in Drogheda with the railway leading to the prominent feature of the Boyne Viaduct (a protected structure) immediately north. Lands to the south and west of the station / railway are generally in residential use with development off Railway Terrance, along Dublin Road, at Pines Hamlet and Carmelite Cottages. Lands to the north and east of the station / railway are generally undeveloped and include MacBride Pitch and Putt course; however, two residential properties are accessed of McGrath's Lane and more residential properties are located at St. James's and Weirhope off Marsh Road.

Lands associated with the railway station and lands north / east thereof are zoned J1 Transportation Development Hub. Lands south and west are generally zoned A1 Existing Residential.

The existing station building and associated structures and the Boyne viaduct are protected structures. Trees west of Dublin Road (and west of the station) are identified as being of Special Amenity Value and protected Views and Prospects of the viaduct are identified from up and down the river.

Key constraints are residential amenity, protected structures, views and trees, existing pitch and the putt course / amenity.

10.1.2.3 Archaeological and cultural heritage

Drogheda is a twelfth century Anglo-Norman town (RMP LH024-041). The Irish name, Droichead Átha, which means “the bridge of the ford”, was the name given to the lowest bridging point of the River Boyne. The original fording site is located 2km west of Drogheda, but the town was established further downstream to provide a transport route inland and between north and south, with a harbour to accommodate seaborne trade. The proposed works are located outside and to the east of the historic town in the environs of Drogheda Railway Station and viaduct.

The arrival of the railway in the nineteenth century had a significant impact in Louth, due its pivotal location between Dublin and Belfast.

The Drogheda/Boyne viaduct is 30m (98 feet) high, consists of an eighteen-span limestone and iron railway over the river bridge and dates to 1855. It is considered to be of national importance due to the architectural, technical, artistic and historic aspects of the bridge design. It is recorded as ‘The Boyne Viaduct’ and is a protected structure (RPS 184) and a feature of architectural significance (NIAH 13620012).

Archaeological monitoring took place at the base of the viaduct during the construction of a carparking area (Licence 11E002). The excavation revealed the existing surface consisted of a modern deposit (late 20th century) of hardcore (crushed limestone c. 0.1m in diameter) mixed with modern rubbish up to 0.3m deep. This covered a variety of deposits excavated to a depth of 0.4m deep. The most extensive deposits were located along the Marsh Road frontage and were composed of fragments of black limestone including occasional red bricks. The deposit was contained within a matrix of fine, grey, silty dust and covered an area measuring 40m x 40m. This was interpreted as a deposit of waste stone chipping and dust derived from the working of the masonry on site for the construction of the viaduct. A large pond is located immediately to the east of the viaduct adjacent to the carpark. The pond was a quarry pit where some of the stone used in the construction of the bridge was derived.

Burnt deposits consisting of cinders, oyster shells, burnt limestone, slate and occasional fragments of red brick were identified c. 30-40m from the Marsh Road street frontage. This suggests that limestone was being burnt at the site to produce lime mixed with crushed oyster shell. Lime is essential to manufacture mortar. This is again interpreted as evidence for 19th century construction activity related to the construction of the viaduct.

The excavation for the carpark at the base of the large embankment at the southern end of the site illustrates the depth of the most recent dumped material (19th century). This revealed up to 8m and greater of deposits had been accumulated over the existing natural slope of the ridge the runs parallel to the River Boyne.

10.1.2.4 Architectural Heritage

The Dublin and Drogheda Railway, which was formed in 1835 and granted parliamentary permission in 1836, reached Drogheda in 1844. The original station was to the south of the existing (at Buckey's Sidings) and was in operation until the completion of the first Boyne Viaduct in 1855. Prior to this, passengers travelling north had to disembark, crossing the Boyne by carriage to Newfoundwell Platform on the north side of the estuary. The replacement viaduct is a protected structure which is rated of National importance by the NIAH for reasons of architectural, artistic, historical and social interest.

Drogheda Station is a Protected Structure (LCC RPS DB-055). The listing notes this railway station retains a great deal of its original fabric and is a well composed architectural set piece.

Five additional structures in the station complex are also included in the Record of Protected Structures. These are: Engine Shed LCC RPS DB-395, Water Tower LCC RPS DB-397, Parcel Office LCC RPS DB-396, Boiler House LCC RPS DB-398 and a toilet block LCC RPS DB-399. All of these structures are also included in the NIAH where they are rated of Regional Importance for reasons of architectural, technical and social interest. The NIAH notes that the high-quality workmanship in stone and brick detailing, developments in railway architecture as evidenced in the buildings and the sensitivity of modern interventions.

Historic map analysis suggests that the station layout has been altered on a number of occasions, resulting in a complex site, of multi-layered morphology.

Notably, the 1870 Drogheda Map series map shows two goods sheds (the larger of which is now demolished) to the south of and in front of the station building. A turntable held a prominent position in front of the engine shed, with more turntables noted at the entrance to the goods shed and inside. A number of signal posts and boxes are shown and there was a watch house on the east side of the station. There was a footbridge on the east side of the station building, and a long carriage house to the north of the down platform. There was also a platform on the Navan Line. Stone bridges are marked crossing the Dublin Road and Railway Terrace.

Several buildings and sites of interest are also noted around the station including the Union Workhouse and Fever Hospital to the west, Gardens marked St. James's and Weirhope to the north, and Railway Terrace to the South.

10.1.2.5 Noise and Vibration

The location options for the substation for Drogheda are located in and around the existing Drogheda Train Station. The acoustic environment will include noise from cars and trains arriving at the station. Noise from trains will decrease with electrification of the line.

Construction noise and vibration have the potential to impact nearby sensitive receptors more than operational noise, although low frequency tonal noise should be considered during the operational phase.

10.1.2.6 Air quality and climate

The development of a substation will have no operational air quality impacts. There is the potential for air quality impacts during the construction phase where works take place in proximity to sensitive receptors. However, the construction works will be of a small scale.

10.1.2.7 Agricultural and non-agricultural

The land north of the railway line is agricultural – a mixture of arable and grassland. The farm enterprises are medium sensitivity. The land south of the railway line is not agricultural.

10.1.2.8 Geology & Soils

A review of historic mapping (OSi Historic 6" and 25" Maps) and aerial photography show that the site was originally agricultural land up to 1842. The railway line was then constructed in the period 1888-1913 and the potential for Made Ground associated with construction was noted. Additionally, a number of historic pits or quarries were identified within a distance of 100-500m from the railway line at the site.

Significant developments comprising Drogheda Station as well as numerous residential, commercial, and industrial buildings occurred to the south of the site and a wastewater treatment plant was built to the north-east in the twentieth century.

The Corine Land Cover 2018 categorises the land use as artificial discontinuous urban fabric areas in the south and north-west, heterogeneous agricultural with complex cultivation patterns in the north and agricultural area with permanent crops as well as non-irrigated arable land in the north-east.

Two historic quarries and one quarry area were identified within 300m from the railway line at Drogheda station. Two IPPC facilities (one adjacent to Boyne viaduct and is currently closed and the other, approximately 300m to the south of Drogheda station) were identified.

The EPA waterbodies map (2021) does not indicate any historic or existing rivers crossing or near the site. However, River Boyne and Stagrennan stream were noted to the north and south-east of the site respectively. Historic mapping from 1837 indicates that the R150 Marsh Road marks the historic extent of the floodplain of the River Boyne prior to land reclamation.

The GSI Quaternary sediment mapping indicates the widespread presence of Made Ground associated with urbanised and developed areas, recent sediments such as lacustrine and alluvial deposits associated with past and existing water bodies and Irish Sea Till derived from Lower Palaeozoic sandstones and shales to the east (and potentially underlying the Made Ground).

GSI bedrock mapping shows that the site is underlain by dark Limestone & calcareous shale of the Carboniferous Mornington bedrock formation.

Based on the available ground investigation report at Drogheda Depot, the following considerations of the expected ground conditions were made:

- The stratigraphy consists of widespread made ground which comprises ballast/hardcore fill and a silty clay fill with inclusions of brick, pottery, glass and organics to depths of up to 9.0mbgl. The latter is underlain by a firm to stiff (very stiff with depth) very sandy, very gravelly clay with

occasional cobbles. It must be highlighted that bedrock was proven but refusal elevations in the cable percussion holes may represent rockhead.
- Groundwater monitoring was conducted with standpipes installed at two locations with standing water levels of 2.38 and 2.55 mbgl respectively.

Another ground investigation performed at approximately 200m to the east of McGrath's Bridge pointed out the following:

- The stratigraphy consists of topsoil of depth up to 0.3m followed by either made ground comprising of fragments of wood, wires, brick and domestic refuge not exceeding 1.0m or fill of rail ballast. The latter is underlain by firm to stiff brown clay followed by dense brown gravel and finally, very stiff brown clay with occasional cobbles and boulders. Moreover, rotary core drillholes revealed that bedrock at depths in the range 3.5-4.5m consists of a mid to dark grey, fine-grained, slightly weathered limestone with subordinate units of brown dolomitised limestone. It must be highlighted that at one specific location, topsoil is underlain by soft clay.
- Groundwater monitoring data indicates that sub-artesian conditions with the groundwater level in the standpipe at ground level at one specific borehole.

Historic ground investigation in 2009 for the Marsh Road carpark, with a Dando Terrier rig, identified the following:

- The stratigraphy consists of made ground comprising of pieces of glass and brick with low cobble and boulder content to depths of up to 2.5mbgl. The latter is underlain by soft to very soft clay at depths in the range 0.2-2.1m. At some locations, gravel was also encountered. It must be highlighted that bedrock was proven.
- Geo-environmental testing indicated the presence of hydrocarbons in both the embankment and made ground at the proposed the car park.

While there is no available geo-environmental information covering the study area entirely, there is a potential for contamination based on site history and usage.

10.1.2.9 Water resources

Surface water bodies

The Boyne Estuary transitional waterbody (IE_EA_010_0100) is located approximately 200m north of the study area. Under the Water Framework Directive (WFD, 2000/60/EC) the status of Boyne Estuary is 'Moderate' and is classified as 'At Risk', indicating that the waterbody may not maintain or achieve that status on the next WFD cycle. The minimum objectives for a water body under the WFD are to achieve at least 'Good' status (or 'Good potential' for artificial/ highly modified water bodies), and no deterioration of existing status. The Boyne Estuary is part of the River Boyne and River Blackwater SAC.

Groundwater

The study area is underlain by Dinantian Upper Impure Limestones which is part of the Mornington Formation. The aquifer is classified as a 'Locally Important Aquifer (Lm)' which is 'Generally Moderately Productive'. Groundwater vulnerability is low across the study area.

There are no significant karst features identified near the site. There is a public supply dug well recorded with a location accuracy of 1km located within the study area. It is assumed that this is no longer a public supply well. However, confirmation is required to identify the exact location and if this dug well is currently used for public supply.

The study area lies within the Drogheda groundwater body (IE_EA_G_025). The groundwater body is at 'Good' WFD Status for the 2013-2018 monitoring cycle and currently under review regarding achieving its WFD objectives.

Flooding

Historical flooding has been assessed by examining reports and maps from the OPW's National Flood Hazard mapping. There are records of flood events in the northern part of the study area on the Marsh Road. This area, which is covered in hard standing also has the potential for low to medium probability of coastal flooding and low probability of fluvial flooding.

10.1.2.10 Biodiversity

The works location is within the existing Drogheda train station, which is set in the urban centre of Drogheda, south of the River Boyne, and adjacent to residential holdings and the Dublin Road. The Boyne Viaduct crosses the Boyne River, north of the site, with the Boyne Estuary 800m east of the Viaduct. The area between the works area and the River Boyne is taken up by a pitch and put club, residential holdings, pockets of woodland, scrub, and bare ground/artificial surfaces.

The River Boyne (and River Blackwater) is designated as a Special Area of Conservation. It is also designated as a Special Protection Area and proposed Natural Heritage area c. 3.7km west of the works area. The Boyne Coast and Estuary is designated as a SAC and pNHA, c. 2km north east of the works, and also as a SPA c. 1km north east of the works. Although these designated sites are relatively close to the works area, none of the works are likely to cause any significant impacts on any designated site due to the small-scale nature of the works, and as there are no impact pathways to designated sites present. Therefore, they are not considered further.

There are no significant constraints within this area. The areas which would be affected by works are either within hard-standing and artificial land, agricultural land, or within hedgerow/scrub habitat.

Potential ecological constraints include:

- Vegetation (scrub, hedgerows or treelines) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals)
- Potential for the railway and habitats adjacent to support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature
- Potential for invasive species to occur along the railway line
- Potential for roosting bats in buildings adjacent to works areas

10.1.3 Planning

Options 1-4 and 6-9 are all zoned J1 - "Transportation Development Hub" in the Louth Development Plan 2021-2027. Option 5 is zoned residential.

There are no pending planning applications or undeveloped planning permissions that are affected by the various options. There is a planning application for a number of residential units adjacent to the sites under reference 21.1333.

10.2 Longlist Options

The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. Locations considered are shown in Figure 10-2 below.

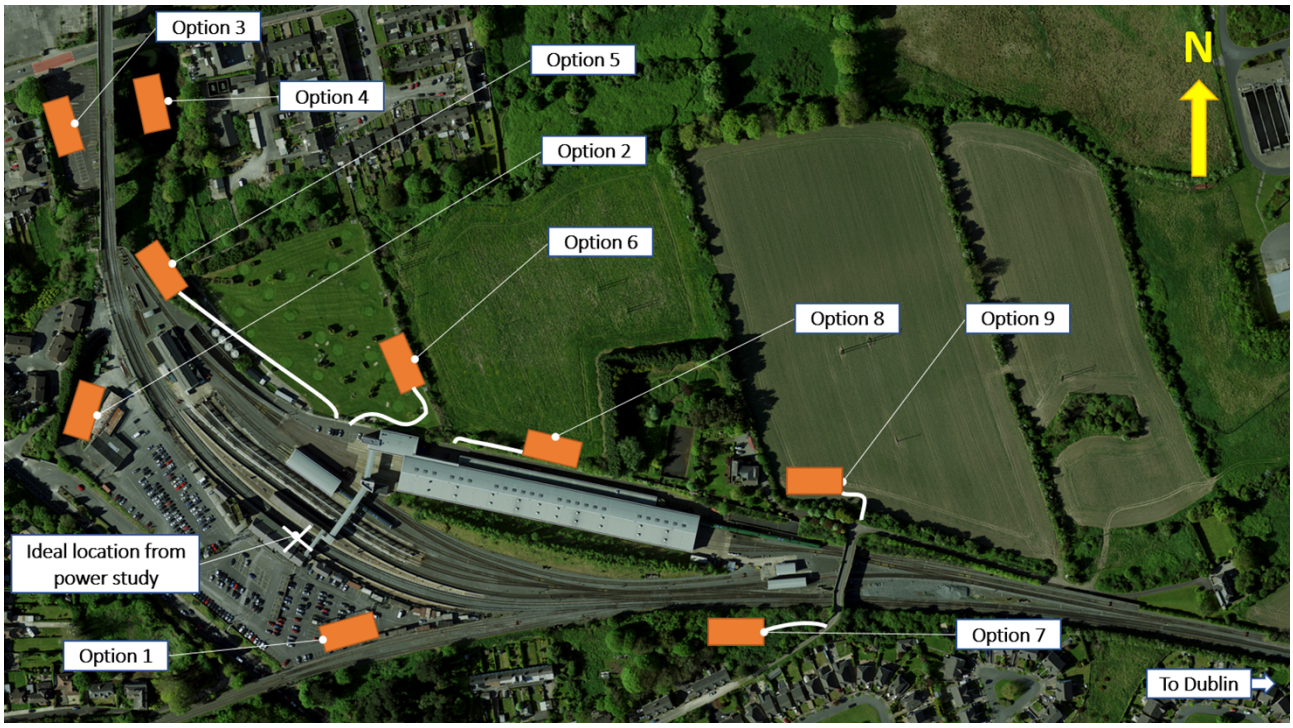

Figure 10-2: Drogheda Substation Options

10.2.1 Option 0 – Do nothing

No substation provided.

10.2.2 Option 1

Option 1 comprises construction of a substation on the southern boundary of the station car park.

10.2.3 Option 2

Option 2 comprises construction of a substation on hardstanding for a current construction storage area and ancillary buildings within the station car park. This would require demolition of the existing corrugated steel building.

10.2.4 Option 3

Option 3 comprises construction of a substation on the existing Marsh Road Pay & Display car park, west of the Boyne Viaduct.

10.2.5 Option 4

Option 4 is positioned on an old quarry which is currently filled with water. The quarry lake is approximately 40 x 75m with varying depth, from 3m to 7m in some locations. The lake would need to be drained and infilled to allow construction of a substation here.

10.2.6 Option 5

Option 5 comprises construction of a substation on a wooded area behind Weirhope garages and adjacent to the start of the Boyne Viaduct. It is envisaged access would be provided from the depot, along the boundary with the McBride Pitch and Putt Club. The site is situated on sloping ground.

10.2.7 Option 6

Option 6 comprises construction of a substation on grassland currently used by the McBride Pitch and Putt Club, north of the depot confines. A short access road would be required from the current depot boundary.

10.2.8 Option 7

Option 7 comprises construction of a substation on vegetated land located between the railway corridor and McGrath's Llane, just south of the railway bridge. This area is heavily vegetated and likely on a sloping gradient.

10.2.9 Option 8

Option 8 comprises construction of a substation on agricultural land, north of the depot train shed. A short access road would be required from the current depot boundary. Access would be created through the existing reinforced concrete wall, rather than through the gabion wall, with additional sections of RC wall constructed to the rear when in cutting.

10.2.10 Option 9

Option 9 comprises construction of a substation on agricultural land north of the end of McGrath's Lane, north of the railway. It is envisaged access would be provided from McGrath's Lane, directly opposite the railway bridge.

10.3 Sifting of longlist of options

Assessment of options is provided in Table 10-1 and

Table 10-2.

Table 10-1 Assessment of longlist of options against project objectives and requirements (options "do-nothing" to 4)

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3		Option 4	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	No impact due to 'do-nothing' approach.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land and access	Fail	Unsuitable impacts on maintenance operations – the option involves removing the maintenance buildings for the stations	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land and access	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of draining and infilling the quarry lake IÉ owned land and access
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Fail	Lack of substation does not allow delivery of electrified route in accordance with standards. I.e., non-compliant	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Pass	No impact due to 'do-nothing' approach.	Pass	Brownfield site	Pass	Brownfield site	Pass	Brownfield site	Fail	Unsuitable topography does not consider adverse impact on natural and built environment and disruption due to significant works required
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	No impact due to 'do-nothing' approach.	Pass	Majority of works can be carried out away from the railway line. Loss of some car parking	Fail	Majority of works can be carried out away from the railway line. Loss of maintenance compounds	Pass	Majority of works can be carried out away from the railway line. Loss of some car parking	Pass	Majority of works can be carried out away from the railway line.
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No impact due to 'do-nothing' approach.	Pass	No location-specific existing infrastructure available to be utilised.	Pass	No location-specific existing infrastructure available to be utilised.	Pass	No location-specific existing infrastructure available to be utilised.	Pass	No location-specific existing infrastructure available to be utilised.

Project objectives and requirements	Description	Option "do-nothing"		Option 1		Option 2		Option 3		Option 4	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
					Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Brownfield site		Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Brownfield site		Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Brownfield site		Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Brownfield site
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	No infrastructure intervention considered as part of 'do-nothing' approach.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged from 'do-nothing' approach.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Fail	Prevents delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Fail	Insufficient location and number of substations for delivery of an electrified route.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	No clearance issues associated with 'do-nothing' approach.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Safety not impacted by 'do-nothing' approach. Protection of substation infrastructure not required.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

Table 10-2 Assessment of longlist of options against project objectives and requirements (options 5 to 9)

Project objectives and requirements	Description	Option 5		Option 6		Option 7		Option 8		Option 9	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land and access Cost of construction on steep topography	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land and access	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound IÉ owned land and access	Pass	Location requires cabling under depot to main line. Deemed not technically feasible/achievable in a cost-effective manner Cost of land Cost of substation compound Cost of access road	Pass	Enables delivery of electrified route in cost effective manner, along with access for general operations and maintenance. Cost of substation compound Cost of land Cost of access road
Project objective	Designs should be in accordance with IÉ Standards and compliant with CRR Guidelines except where departures are granted. Designs shall comply with the Minimum Employer's Functional Requirements and the Train Service Specification.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.	Pass	Proposed option includes delivery of substation in accordance with all relevant standards I.e., compliant.
Project objective	To consider the adverse impacts on the natural and built environment during construction, operation and demolition.	Fail	Unsuitable, very steep topography requiring significant works impacting built and natural environment	Pass	Potential greenfield site	Pass	Potential greenfield site	Pass	Greenfield site	Pass	Greenfield site
Project objective	To consider the impacts on existing rail services, road users and landowners during construction and operation.	Pass	Majority of works can be carried out away from the railway line.	Pass	IÉ owned land is currently leased as a pitch and putt	Pass	IÉ owned land but zoned as residential	Pass	Majority of works can be carried out away from the railway line. Some disruption to road users during access road construction	Pass	Majority of works can be carried out away from the railway line.
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Woodland loss	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Potential greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Potential greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site	Pass	No location-specific existing infrastructure available to be utilised. Substation enables electrification of railway line, creating a climate resilient, low-carbon rail network. Greenfield site

Project objectives and requirements	Description	Option 5		Option 6		Option 7		Option 8		Option 9	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To consider; where infrastructure interventions are required, providing infrastructure for an improved passenger experience	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.	Pass	Electrification and service frequency increase will improve the passenger experience on the DART route.
Project objective	To provide efficient and cost-effective integration of systems with the other DART routes	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.	Pass	No negative impact on integration with other DART routes envisaged. Completes electrification of Northern Line enabling effective integration with the network.
Project requirement	Electrification of the line from the end of the current electrified section at Malahide to Drogheda with 1500V DC overhead.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.	Pass	Enables delivery of an electrified route.
Project requirement	Appropriate number and location of substations (in conjunction with ESB) to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.	Pass	Enables provision of appropriate number of substations in required locations to support electrification.
Project requirement	Undertake necessary infrastructure change to achieve the clearances required for electrification at bridges and structures.	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable	Pass	Away from line, not applicable
Project requirement	Undertake safety improvements resulting from the introduction of 1500V DC Overhead.	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards	Pass	Relevant anti-trespass and electrical safety measures can be undertaken in accordance with design standards

10.3.1 Summary of longlist sifting

Table 10-3: Summary of Longlist Sifting

Option	Screening Result	Summary
"Do-Nothing"	**FAIL**	• Fails to provide adequate number and location of substations • Fails to provide electrified railway between Malahide and Drogheda
Option 1	**PASS**	Meets project objectives and requirements
Option 2	**FAIL**	Unsuitable impacts on maintenance operations.
Option 3	**PASS**	Meets project objectives and requirements
Option 4	**FAIL**	Unsuitable topography does not consider adverse impact on natural and built environment and disruption due to significant works required
Option 5	**FAIL**	Unsuitable topography does not consider adverse impact on natural and built environment and disruption due to significant works required
Option 6	**PASS**	Meets project objectives and requirements
Option 7	**PASS**	Meets project objectives and requirements
Option 8	**PASS**	Meets project objectives and requirements
Option 9	**PASS**	Meets project objectives and requirements

10.4 Shortlisted options

The following options have been taken forward to the shortlist and to the MCA process:

- Option 1;
- Option 3;
- Option 6;
- Option 7;
- Option 8; and
- Option 9.

For further detailed drawings of the shortlisted options please refer to drawing D+WP56-ARP-ZZ-NL-DR-HV-000030 to D+WP56-ARP-ZZ-NL-DR-HV-000037 in Appendix B.

10.5 Multi-criteria analysis

10.5.1 Methodology

For each individual entity an assessment has been made against the MCA criteria. Each option has been relatively compared against the others based on the five-point colour coded ranking scale in Table 10-6.

MCA summary table

A multi-criteria analysis table is presented in this section. This has been developed to reflect the relative rankings for all sub-criteria for each of the options assessed and is presented as a summary of the key issues considered.

A more detailed table is provided in Appendix A of this report with the full detailed rationale behind the scoring of each criterion and option.

Table 10-4 MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 3	Option 6	Option 7	Option 8	Option 9
Economy	CAPEX						
	OPEX						
	Train Operations Functionality/Economic Benefit						
	Traffic functionality and associated economic activities and opportunities						
Safety	Employer's Safety						
	Public safety						
Environment	Landscape and Visual Quality						
	Biodiversity						
	Noise and Vibration						
	Water resources						
	Archaeology, Architectural and Cultural Heritage						
	Geology and Soils						
	Agricultural and non-agricultural						
	Air Quality & Climate Change						
Accessibility & Social Inclusion	Accessibility						
	Social Inclusion						
Integration	Adaptability in the future						
	Transport Integration						
	Land Use Integration						
	Government policy integration						
	Geographical integration						
Physical Activity	Walking/cycling opportunities						

Table 10-5 Overall criteria MCA summary table

Criteria Summary	Option 1	Option 3	Option 6	Option 7	Option 8	Option 9
Economy						
Safety						
Environment						
Accessibility & Social Inclusion						
Integration						
Physical Activity						

Table 10-6: Legend for MCA Summary Tables

Significant comparative advantage over other options
Some comparative advantage over other options
Comparable to other options / neutral
Some comparative disadvantage over other options
Significant comparative disadvantage over other options

10.5.2 Economy

Economy has been divided into four sub-criteria which are considered below.

CAPEX

All options are expected to be broadly comparable with regards to cost for the traction power substation. It has been identified that the cost of providing ESB supplies to option 7 could be significantly higher than other options due to the need to cross the line with new supplies. Option 7 has therefore been assessed as having comparative disadvantages when compared to other options

OPEX

Although there are minor differences, for example length of access road could affect maintenance costs, these are not perceived as having any comparable differences and therefore the options are comparable/neutral to each other.

Train operations functionality/economic benefits

Construction of a substation in the location of Option 3 would have impacts on the ability of the proposed BEMU substation maintaining functionality. There would be significant interface between the two substations which would be difficult to manage without impacting on the power supplies and BEMU services. Therefore Option 3 has a comparative disadvantages when compared to other options.

Traffic functionality and associated economic activities and opportunities

When operational, the scheme will have no visible impacts on the prevailing traffic conditions in the surrounding road networks.

Option 1 and 3 will have a minor impact on existing parking, pedestrians and cyclists at the Drogheda Station car park during construction and mitigation measures will be required.

Construction activities on all options considered, are expected to generate a relatively low number of additional vehicular journey, and therefore will, at most, have a minor temporary impact on the traffic conditions of the local road network.

10.5.3 Safety

Safety has been divided into two sub-criteria which are considered below. It should be noted that all options are safe, but some will have the potential for greater residual risks to remain. This criterion considers relative advantages of each option on the criteria of safety.

Employer's Safety

There are no material differences between the options when comparing the employer's safety. All substation options have the same designs to ensure employer's safety is considered and maintained.

Public Safety

Similar to employer's safety, there is no material difference between the substation option designs.

10.5.4 Environment

10.5.4.1 Landscape and visual quality

Option 1 is located in the existing station carpark where it would impact on the setting of existing railway station, including protected station structures. The option has some comparative disadvantages over other options.

Option 3 is located in the lower carpark off Marsh Road on the west side of the viaduct. In general, the location is visually enclosed; however, it is close to residential properties at Carmelite Cottages. The option has some comparative advantages over other options.

Option 6 is located within the grounds of MacBride Pitch and Putt grounds and would have a significant impact on the course. The option has significant comparative disadvantages over other options.

Option 7 is located in a densely planted area to the rear of existing residential properties off Railway Terrance. The area is zoned residential and this option would have a significant impact on adjoining residential amenity. The option has significant comparative disadvantages over other options.

Option 8 is located close to existing maintenance buildings at MacBride Station. Despite its proximity to a residential property, the location is well screened. The option has significant comparative advantages over other options.

Option 9 is located close to residential property with steep access through a strongly planted boundary at the end of McGrath's bridge The option has some comparative disadvantages over other options.

10.5.4.2 Biodiversity

There is little to differentiate the options from each other in terms of ecological constraints. No options are likely to involve impacts on designated sites or have any other significant ecological impacts.

Options 1 and 3 are most beneficial in terms of impacts on biodiversity/ecology, due to being located on areas of hard standing (i.e. carparks). Option 3 is located adjacent to the Boyne Viaduct, which has high potential for roosting bats. Any additional lighting required during construction/operation has the potential to impact bat species.

However, due to the size and scale of the development, this is not predicted to be a significant constraint. Option 9 also has some comparative advantage over other options. This substation is located in an agricultural field (low quality habitat) and would require very little/no removal of good quality habitat.

Option 7 is the least desirable option due to the amount of vegetation removal required, with potential for removal of habitat of value (scrub, hedgerows or treelines) and which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals). This location is also adjacent to Obb80/80A/80B, which have moderate potential for roosting bats. Construction works and any lighting required during operation has the potential to disturb bat species.

Options 6 and 8 would require some habitat removal (hedgerows/treelines). This is unlikely to be a significant constraint.

It is not known whether invasive species may occur along or near the railway line. If present, then there would be risk of spreading these to adjacent areas. This constraint would be most likely in options 6, 7 8, and 9.

10.5.4.3 Noise and Vibration

Option 8 is furthest from any residential receptors, with Option 6 a similar distance (although slightly closer to residential receptors to the north).

Option 3 is closest to the largest number of residential receptors, with Options 7 and 9 being similarly positioned with respect to residential receptors (i.e., less favourable than Options 1, 6, and 8).

Option 6 is more favourable than Options 1, 3, 7, and 9, but less favourable than Option 8.

10.5.4.4 Water resources

From a water resources perspective, options 1, 6, 7, 8 and 9 are considered comparable to each other. Option 3 is proposed in an area of low risk of fluvial flooding which could lead to increased flood risk and is therefore considered to have significant comparative disadvantage over other options.

10.5.4.5 Archaeology, architectural and cultural heritage

For archaeology and cultural heritage Options 6, 7, 8 and 9 have the potential to reveal below ground archaeological remains associated with agricultural land and a pitch and putt course in the case of Option 6 in a greenfield environment. Option 1 has the potential to find buried industrial heritage remains associated with the development of Drogheda Railway Station.

As such they are all considered to have some comparative disadvantage over Option 3. Option 3 is the preferred option as this area has already been subjected to archaeological monitoring from the development of a carpark. Option 3 has some comparative advantage over other options.

For architectural heritage, Option 1 is located south of Drogheda Station (LCC RPS DB-055) in an existing car park. No Direct heritage impact anticipated but there is a potential negative visual impact on Drogheda Station Buildings which are protected structures the magnitude of which is low. It is predicted that it will have a slight negative visual impact

Option 3 is located to the west of a Boyne Valley Viaduct (NIAH 13620012, UBB 81b). No Direct heritage impact anticipated but there is a potential negative visual impact on the bridge. It is located below the bridge Overall, this would have a Negative, Slight impact on the architectural heritage value of the site.

Option 6 is a greenfield site with no known heritage features. No significant impact is anticipated.

Under Option 7 there is a potential visual impact on UBB80a and UBB 80b, the historic structures within the Drogheda Station (LCC RPS DB-055) complex and Railway Terrace Architectural Conservation Area, the magnitude of which is low. It is predicted that it will have a slight negative visual impact

Option 8 is a greenfield site located outside of the station complex with no known heritage features. It is to the rear of the station building and will be visually screened or masked by it. No significant impact is anticipated.

Option 9 located on a is a greenfield to the north of UBB80a and UBB 80b. There is a potential negative visual impact, but this is negligible as the substation will be screens or masked by mature trees.

Overall Option 3 is the preferred option as it has some comparative advantages over other options.

10.5.4.6 Geology and soils

All options are comparable as the operation and construction of the substation in all options has no impact on geology and soils.

10.5.4.7 Agricultural and non-agricultural

Options 1, 3, 6 and 7 have some comparable advantages over the other Options as they are not located on agricultural land. There are no agricultural constraints at the location of Options 1, 3, 6 and 7, therefore these locations are assessed as very low sensitivity from an agricultural perspective. Options 8 and 9 will be located within an 8-hectare tillage plot which is of medium sensitivity from an agricultural perspective and therefore these options have some comparative disadvantages compared to the other options.

10.5.4.8 Air quality and climate

Options 1, 6 and 8 have some comparative advantages over Options 3, 7 and 9, therefore these are preferable from an air quality perspective due to their greater separation from sensitive receptors. This will reduce the potential for air quality impacts during the construction phase.

10.5.5 Accessibility and Social Inclusion

All options are comparable as the operation and construction of the substation in all options has no impact on accessibility or social inclusion.

10.5.6 Integration

Integration has been assessed using the five sub-criteria described below.

Adaptability in the future

All options are comparable as the operation and construction of the substation in all options has no impact on future internal transport links.

Transport integration

Options 1 and 3 will result in a loss of station car parking and are therefore considered to have some comparable disadvantages over other options.

Land use integration

Options 1, 3, 6, 8 and 9 are zoned Transportation Development Hub whereas Option 7 is zoned as existing residential. A substation on land zoned as residential is less desirable and therefore has some comparative disadvantages when compared to the other options located on land zoned as Transportation Development Hub.

Government policy integration

All international, national, regional and local policies encourage improvements in relation to the efficiency of public transport. All the proposed options will facilitate the achievement of greater efficiency in public transportation long part of the east coast of the country and therefore comply with government policy.

Geographical integration

All of the options are infrastructural buildings adjoining a railway line and are considered neutral in comparison to each other.

10.5.7 Physical Activity

The options are considered to be comparable with each other with regards to physical activity.

10.6 Construction Considerations

Construction of any substation needs to consider at least the following factors:

- Access arrangements off the public highway
- Type and proximity of neighbouring activities (and their sensitivity to construction aspects such as noise, dust, vehicle movements and vibration)
- Type and proximity of nearby ecology (especially vegetation and animals)
- Space availability for worksite compound, i.e. beyond permanent substation footprint

- Ground conditions, with regard to operation of construction plant

With these factors in mind, views on the constructability of substation options at Drogheda can be summarised accordingly:

- Option 1. Scores well, with no need for any new access route to it, no nearby residential receptors, no damage to ecology and excellent hardstanding area to work from. The main downside is it would be disruptive to car park users.
- Option 3. Scores poorly due primarily to several residential properties being within 50 metres of the site, and the loss of several parking spaces. Positive aspects are no need for a new access route, no damage to ecology and good hardstanding to construct from residential receptors.
- Option 6. Scores moderately. Access to it appears to be relatively poor (via the station) and it also takes land from a pitch and putt golf course (thus also damaging ecology). A positive aspect is lack of nearby residential property.
- Option 7. Scores poorly as it is close to residential property and would damage a significant amount of trees and ecology.
- Option 8. Scores well as no nearby residential property, has a reasonably short access road to it and space for construction is comfortable. It would damage some but not much ecology.
- Option 9. Scores poorly as it would rely on a small bridge which is due to be rebuilt and is close to a residential property. It is also relatively damaging to ecology. There is little positive to state about this plot from a constructability perspective.

10.7 Summary and conclusions

10.7.1 Non-preferred options

Option 1 is not preferred due to:

- Located on car parking spaces therefore scores poorly for traffic functionality/integration.

Option 3 is not preferred due to:

- Located on car parking spaces therefore scores poorly for traffic functionality/integration.
- Likely to impact the operation/maintenance of the BEMU substation.
- Located within a flood zone

Option 6 is not preferred due to:

- Scores poorly under a number of environmental parameters including biodiversity and landscape and impact on recreational facilities

Option 7 is not preferred due to:

- The volume of removal of vegetation required. This is linked to scoring low for landscape and biodiversity
- Construction constraints with feeding the cables to the substation along McGrath's Lane.
- Proximity to residential buildings

Option 9 is not preferred due to:

- Scores poorly under a number of environmental parameters including biodiversity, landscape, agricultural and air quality

10.7.2 Preferred option

Option 8 has been identified as the preferred option. It has advantages over predominately all assessment criteria compared to the other options:

- Has comparative environmental advantages under a number of environmental parameters including landscape, noise and water resources.

For further details of the preferred option refer to drawing D+WP56-ARP-P3-NL-DR-CX-000508 in Appendix C.

10.7.3 Key Risks/Next Steps

The following key next steps are recommended:

- Highway access survey and design
- Environmental surveys
- Seek feedback from stakeholders on the preferred option.

Appendix A - Detailed MCA table

Appendix B - Drawings showing shortlisted options

Appendix C - Drawings showing Preferred Option