Bonneagar Iompair Éireann
Transport Infrastructure Ireland

NTA
Údarás Náisiúnta Iompair
National Transport Authority

Luas Finglas

Environmental Impact Assessment Report 2024

Chapter 4: Alternatives Considered

BARRY TRANSPORTATION
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Project Ireland 2040
Building Ireland's Future

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GLOSSARY OF FREQUENTLY USED TERMS

Acronym	Term
AGS	An Garda Síochána
BCR	Benefit Cost Ratio
BRT	Bus rapid Transit
CAF	Common Appraisal Framework
CAT	City Access Transit
CBA	Cost Benefit Analysis
CPO	Compulsory Purchase Order
DCC	Dublin City Council
DTTAS	Department of Transport Tourism and Sport
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EPR	Emerging Preferred Route
ERM	East Regional Model
GDA	Greater Dublin Area
GHG	Greenhouse gas
ICW	Integrated Constructed Wetland
KTA	Key Trip Attractors
LCA	Landscape Character Area
LCC	Luas Cross City
LVIA	Landscape and Visual Assessment
MCA	Multi-Criteria Analysis
NTA	National Transport Authority
NSPC	Non-Statutory Public Consultation
NSR	Noise Sensitive Receptor
OPW	Office of Public Works
RO	Railway Order
SPA	Special Protection Area
SWOT	Strengths, Weaknesses, Opportunities and Threats
TII	Transport Infrastructure Ireland
UITP	L'Union Internationale des Transports Publics

SECTION 4: ALTERNATIVES CONSIDERED

4.1 Introduction

This chapter describes how Luas Finglas (hereafter referred to as "proposed Scheme") was planned and designed through a staged process, as applied to all major transport projects. This chapter presents an overview of the reasonable alternatives studied during the development of the proposed Scheme which have been informed by relevant policy / plans, previous studies and how it has been developed and refined as part of the ongoing design development and Environmental Impact Assessment (EIA) process.

The alternatives examined encompassed rail-based, bus-based and road-based solutions and combinations of these modal options. Apart from exploring some new options in the course of this analysis, several relevant previous studies were re-examined. Some of these prior studies required necessary modification due to salient changes which occurred in the intervening periods since they were first conducted.

This consideration of alternatives has been informed also by the relevant national, regional and local policy contexts and the need for the proposed Scheme as described in Chapters 2 (Planning & Policy Context) and 3 (Need for the Proposed Development), respectively. This assessment has been undertaken in accordance with inter alia, EU Directive 2011/92/EU as amended by Directive 2014/52/EU (European Union, 2014) on the assessment of the effects of certain public and private projects on the environment (hereafter referred to as "the EIA Directive") and the Transport (Railway Infrastructure) Act 2001 (as amended).

4.2 Environmental Impact Assessment Requirements

Article 5(1)(d) of Directive 2011/92/EU, as amended by Directive 2014/52/EU (European Union 2014) requires an Environmental Impact Assessment Report (EIAR) to include *'a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment'*.

The Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA 2022) notes the following in respect of alternatives:

'The objective is for the developer to present a representative range of the practicable alternatives considered. The alternatives should be described with 'an indication of the main reasons for selecting the chosen option'. It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required. (EPA 2022, p.33).'

Annex IV point 2 of the EIA Directive requires an EIAR to include:

'A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.'

The requirements of Directive 2014/52/EU were transposed into Irish law with the adoption of the S.I. No. 743/2021 - European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations 2021 (hereafter referred to as the EIA Regulations), which amend the Transport (Railway Infrastructure) Act 2001 to bring it in line with Directive 2014/52/EU.

The EIA Directive requires that Ireland and other Member States must decide which *'underground railways, suspended lines or similar lines of a particular type, used exclusively or mainly for passenger transport'* require EIA through a case-by-case examination or the use of thresholds or both.

In Ireland's case, the applicant for a Railway Order (RO) must submit an EIAR with the application for an RO to the Board as required by the Section 37(3)(e) of the Transport (Railway Infrastructure) Act, 2001 (as amended). This EIAR complies with the requirements of Section 37(3)(e) and 39 of the Transport (Railway Infrastructure) Act 2001 (as amended) and Annex IV to the EIA Directive.

New railway works are governed by the Transport (Railway Infrastructure) Act, 2001 (as amended), hereafter referred to as the '2001 Act'. The 2001 Act provides for an RO application to be made by TII to the Board.

Sections 37 to 47F of the 2001 Act (as amended by the Planning and Development (Strategic Infrastructure) Act 2006, the Dublin Transport Authority Act, 2008 and the European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations, 2021 (S.I. No. 743/2021)) set out the process required for making an application for an RO. Section 37(3) states that:

'An application under Subsection (1) shall be made in writing in such form as the Minister may specify and shall be accompanied by:

(a) a draft of the proposed order,

(b) a plan of the proposed railway works,

(c) in the case of an application by the Agency (now TII) or a person with the consent of the Agency (now TII), a plan of any proposed commercial development of land adjacent to the proposed railway works,

(d) a book of reference to a plan required under this subsection (indicating the identity of the owners and of the occupiers of the lands described in the plan), and

(e) a report on the likely effects on the environment (referred to subsequently in this Part as an 'environmental impact assessment report') of the proposed railway works, and a draft plan and book of reference shall be in such for as the Minister may specify or in a form to the like effect.'

Section 39 of the 2001 Act (as amended by the Planning and Development (Strategic Infrastructure) Act, 2006 and the European Union (Railway Orders) (Environmental Impact Assessment) (Amendment) Regulations, 2021 (S.I. No. 743/2021)) specifies the information that must be provided in the EIAR that accompanies an RO application. Sections 39(1) and 39(2) outline the following requirements:

'(1) The applicant shall ensure that an environmental impact assessment report:

(a) is prepared by competent experts,

(b) subject to subsection (3), contains:

> *(i) a description of the proposed railway works comprising information on the site, design, size and other relevant features of the proposed works,*
>
> *(ii) a description of the likely significant effects of the proposed railway works on the environment,*
>
> *(iii) the data required to identify and assess the main effects which the proposed railway works are likely to have on the environment,*
>
> *(iv) a description of any features of the proposed railway works, and of any measures envisaged, to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment,*
>
> *(v) a description of the reasonable alternatives studied by the applicant which are relevant to the proposed railway works and their specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the railway works on the environment, and*

(vi) a summary in non-technical language of the above information.

and

(c) takes into account the available results of other relevant assessments under European Union or national legislation with a view to avoiding duplication of assessments.

(2) The applicant shall further ensure that an environmental impact assessment report, in addition to and by way of explanation or amplification of the specified information referred to in subsection (1), contains any additional information specified in Annex IV to the EIA Directive relevant to the specific characteristics of the particular railway works, or type of railway works proposed and to the environmental features likely to be affected.'

Section 37(4) of the 2001 Act (as amended) sets out that 'The construction of railway works, the subject of an application for a railway order under this Part, shall not be undertaken unless the Board has granted an order under Section 43'.

Accordingly, this chapter of the EIAR describes the reasonable alternatives considered at all stages of the proposed Scheme in order to clearly outline:

- The robust decision-making process that has led to the proposed Scheme;
- How environmental analysis was integrated into the proposed Scheme development from the earliest stages;
- The main reasons, environmental and otherwise, for choosing the proposed Scheme or the specific element of the proposed Scheme from the reasonable alternatives; and
- The likely evolution of the current state of the environment without implementation of the proposed Scheme (do-nothing scenario)

The reasonable alternatives studied which are relevant to the proposed Scheme and its specific characteristics are outlined in Table 4-1 and described in the subsequent sections of this chapter.

Table 4-1: Outline of Alternatives Considered during the Development of the proposed Scheme

Alternatives Considered	Description	Section of this Chapter
Previous Studies		
Luas Line D1 – Broombridge to Metro West via Finglas	Route Corridor Identification and Feasibility Report	Section 4.4
Luas Line D	Analysis of Route Options	Section 4.4
Strategy / Policy where Alternatives to Luas considered		
Fingal North Dublin Transport Study / North West Corridor Study / Transport Strategy for the Greater Dublin Area	Outline of the consideration of alternatives having regard to environmental effects as referred to in the Fingal North Dublin Transport Study 2015, North West Corridor Study 2015 as it informed the Transport Strategy for the Greater Dublin Area 2016 – 2035 and the updated Transport Strategy for the Greater Dublin Area 2022 – 2042.	Section 4.5
Do-Nothing Alternative		
'Do-Nothing' Scenario	This is a general description of the key environmental effects that would be expected for the Do-Nothing scenario should the proposed Scheme not proceed.	Section 4.6

Alternatives Considered	Description	Section of this Chapter
Identification of the Emerging Preferred Route (January 2020)		
Alternative options for the proposed Scheme (Stage 1 and Stage 2)	This section summarises the proposed Scheme alternatives considered leading to the Emerging Preferred Route having consideration of the potential environmental effects.	Section 4.8
Identification of the Preferred Route (October 2021) and further design changes		
Further assessment of alternative options for the proposed Scheme	This section summarises further alternatives assessments undertaken to determine the preferred route having regard to public consultation feedback.	Section 4.9
Alternative Scheme Level Design	This section summarises the proposed Scheme alternatives considered, having regard to environmental effects leading to decisions made on the proposed Scheme design fundamentals including: ▪ Stabling Site Location ▪ McKee Avenue / St. Margaret's Road Junction Design ▪ ESBN Substation location	Sections 4.9.1, 4.9.9, and 4.9.15
Alternatives Technologies	Discussion of alternative technologies considered having regard to environmental effects leading to decisions made on the proposed Scheme covering: ▪ Alternative track proposals (grass track, embedded track, etc)	Section 4.11.1
Alternative Bridge Designs	▪ Broombridge tie-in; ▪ Broome bridge; and ▪ Tolka Valley Bridge	Sections 4.9.12, 4.9.13 and 4.9.14
Alternative Alignments	Alternative alignment options which were assessed having regard to environmental effects to determine the preferred Scheme alignment: ▪ Broombridge Road realignment; ▪ Tolka Valley Park minor re-alignments ▪ Farnham Crescent Park alignment; ▪ Casement Road & Patrickswell Place; ▪ Mellowes Alignment; ▪ Ravens Court Alternative Access; and ▪ St Margaret's Court.	Sections 4.9.2, 4.9.3, 4.9.5, 4.9.6, 4.9.7, 4.10.1 and 4.9.10
Stop locations and layouts	Discussion on how the specific stop locations and layouts emerged, based on the proposed Scheme design decisions at EPR and PR stage having regard to constraints of each site and potential environmental effects: ▪ St Helena's Stop; and ▪ Mellowes Park Stop	Sections 4.9.4 and 4.9.8
Park & Ride location and layout	Discussion on how the specific P&R locations and layouts emerged, based on the proposed Scheme design decisions at EPR and PR stage having regard to constraints of each site and potential environmental effects.	Section 4.9.11
Alternatives for the Construction Phase		
Construction Compounds	This section examines the considered alternatives assessed having regard to environmental effects as they relate to the Construction Phase of the proposed Scheme: ▪ Location of Construction Compounds	Section 4.12.1

4.3 Methodology

A clearly defined appraisal methodology has been used in the selection of the Preferred Option for the proposed Scheme. Consistent with other TII projects, the appraisal methodology applied is based on 'Guidelines on a Common Appraisal Framework for Transport Projects and Programmes' (CAF)[1] published by the Department of Transport Tourism and Sport (DTTAS), March 2016 (updated October 2021), and TII's Project Management Guidelines (TII PMG, 2019). The process comprises a two-stage approach, as appropriate:

- Stage 1 – Preliminary Appraisal (sifting) of a long list of options; and
- Stage 2 – Multi-Criteria Analysis (MCA) of a shorter list of feasible options.

In keeping with principles of the CAF Stage 1 Preliminary Appraisal approach, the purpose of the sifting is to subject a range of options to a preliminary appraisal, before subjecting a smaller number of options to a more detailed MCA. The option selection methodology is summarised in Figure 4-1.

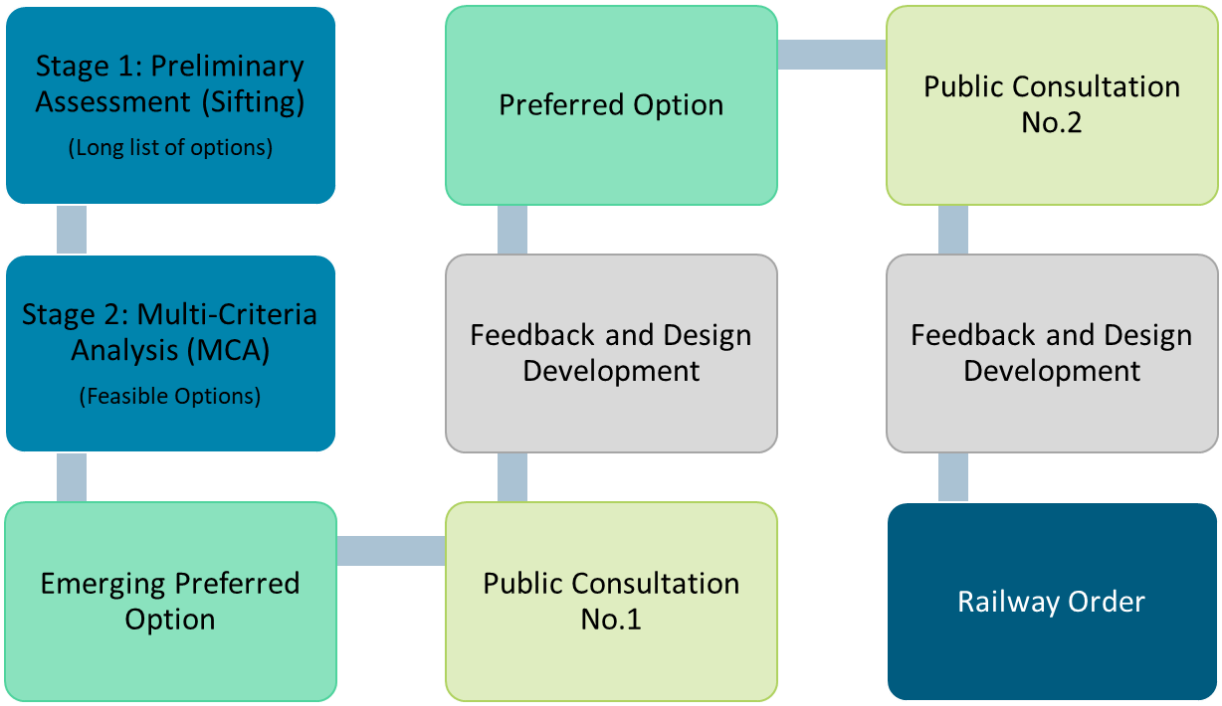


Figure 4-1: Option Selection Process (Emerging Preferred Option and Preferred Option Stages)
Stage 1: Preliminary Appraisal (Sifting)

[1] The Transport Appraisal Framework (TAF) replaced the Common Appraisal Guidelines in June 2023.

Stage 1: Preliminary Appraisal (Sifting) commenced with the identification of a long list of high-level options in order to verify their suitability against the high-level objectives set for Luas Finglas and its requirements.

Consistent with CAF, the headline criteria which the options were assessed against were the criteria of Engineering, Environment and Economy. Of these, the key 'pass' or 'fail' criterion was Economy in terms of whether an option was considered feasible and met the proposed Scheme objectives and requirements or not in terms of potential catchment, route length and level of segregation. Also, the alignment and more precisely, the degree of curvature of the route was a 'pass/fail' criterion in terms of Engineering. A pass/fail approach was not applied for Environment at the Preliminary Appraisal stage given that there were no environmental topics that warranted routes to be sifted at this stage.

4.3.1 Stage 2: MCA Methodology

During Stage 2, the optioneering process comprised a detailed multi-disciplinary comparative analysis of those feasible options that passed through Stage 1. The options were assessed against a common set of six CAF criteria, as described in Table 4-2 below and included qualitative and / or quantitative assessment of the options developed. The criteria were the measures of performance by which the options were assessed. These were tailored to have commonality with the CAF and specificity for the Luas Finglas scheme. The adopted methodology is comparative, in-line with CAF expectations, and undertaken on a similar basis as other appraisals for major transport infrastructure.

Table 4-2: CAF Project Appraisal Criteria for MCA

Criteria	Criteria description
Economy	The impacts of a transport investment on economic growth and competitiveness are assessed under the economic impact and economic efficiency criteria.
Integration	Integration considers the extent to which the proposed Scheme being evaluated promotes integration of transport networks and is compatible with Government policies, including national spatial and planning policy.
Accessibility & Social Inclusion	Accessibility and social inclusion embrace the notion that some priority should be given to benefits that accrue to those suffering from social deprivation, geographic isolation and mobility and sensory deprivation
Environment	Environment embraces a range of impacts, such as emissions to air, noise & vibration, population and human health, water, land and soils, material assets, climate, landscape & visual biodiversity and cultural heritage impacts.
Safety	Safety is concerned with the impact of the investment on the number of transport related accidents.
Physical Activity	This relates to the health benefits derived from using different transport modes

The assessment undertaken was of a comparative nature (i.e. options compared against each other), comparing the options, identifying and summarising the comparative advantages and disadvantages of each alternative under all applicable criteria and sub-criteria leading to an Emerging Preferred Option. This was based on professional judgement in respect of the items to be qualitatively evaluated and comprehensively assessed against the key relevant criteria in accordance with CAF Guidelines and good industry practice.

This basis of comparison is consistent with the CAF Guidelines which use the following five-point ranking scale when comparing options against each other for comparative analysis. Table 4-3 provides an overview of the comparative colour-coded scale for assessing the criteria and sub-criteria. For illustrative purposes, this scale is colour coded with significant advantages over other routes graded "dark green", significant disadvantages over other routes graded "red", orange and light green being adopted for "some" advantages/disadvantages and yellow being used for options which deliver comparable results to all other options.

Table 4-3: MCA Typical Scoring System

Colour Coding and Description
Significant advantages over other options
Some advantages over other options
Comparable to other options
Some disadvantages over other options
Significant disadvantages over other options

Criteria were then considered and aggregated to give a summary finding for each CAF criterion. The summary findings for all six CAF parameters were then considered and aggregated to determine the Preferred Option.

4.4 Previous Studies

Two separate studies on a Luas extension from Broombridge to the area surrounding Finglas were undertaken in 2010 and 2013 by the Railway Procurement Agency (RPA).

The **2010 study "Luas Line D1 – Broombridge to Metro West via Finglas – Route Corridor Identification and Feasibility Report"** commenced with an in-depth analysis of the area (largely informed via a 'spiderweb' approach; and resulted in a set of eight preferred options. Within the spiderweb assessment, every single possible section within the area was analysed independently and assessed in relation to its suitability for a Luas corridor. Refer to Figure 4-2.

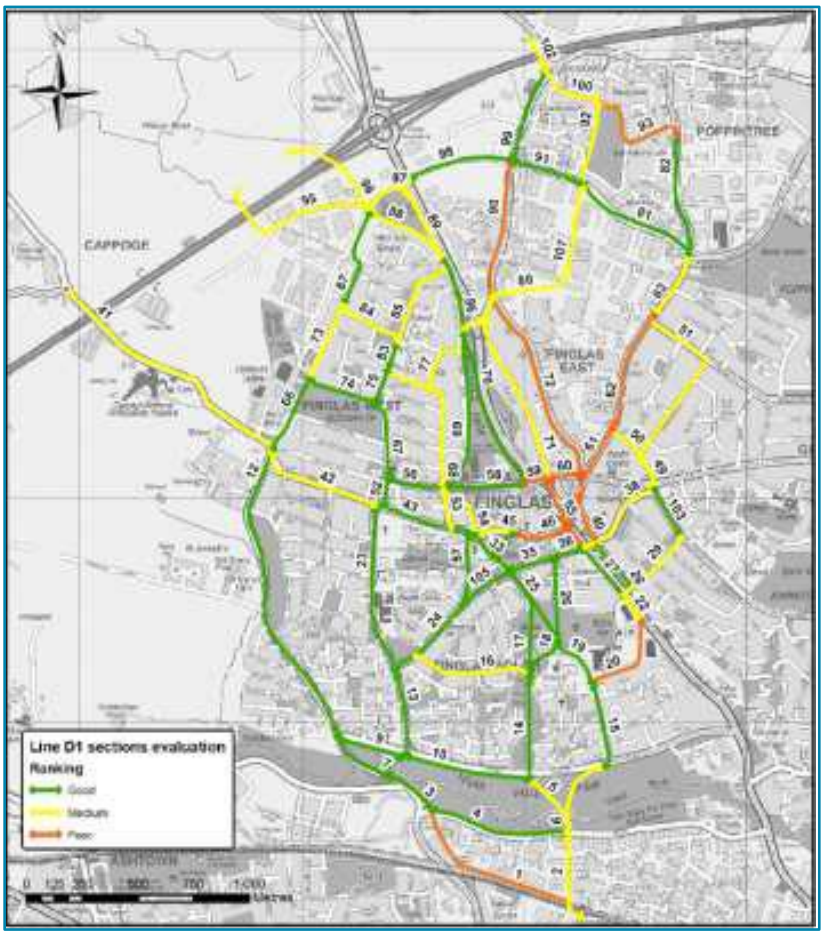


Figure 4-2: Spiderweb Analysis (Source: 2010 RPA Study)

That study was based, as the title refers, on connecting the unconstructed Luas green line (Luas BXD at the time) with Metro West, another light rail scheme under consideration at that time. Metro West was envisaged as an orbital Luas-based system running parallel to the M50 and between the outer suburban areas, linking Tallaght to Metro North (now MetroLink) at Dardistown (north of Ballymun). Since the Metro West project is no longer part of transport strategies and plans for Dublin, several of the conclusions were no longer valid. Nonetheless, the spiderweb analysis undertaken within that study remained valid, in particular its considerations regarding the suitability of the existing road network in accommodating the proposed Scheme, given that there were no major road layout changes nor new rail corridors since then. Thus, it has been used for the identification of the Emerging Preferred Route (EPR) Stage 1 Option Selection Report, and in particular, its considerations regarding the suitability of the existing roads network in accommodating a Luas corridor.

The **2013 study "Luas Line D – Analysis of Route Options"** drew upon the conclusions of the previous study and analysed in technical detail some of the emerging corridor of the 2010 study. However, this study did not create any new options and / or investigate transport planning or environmental considerations such as demand, catchment and cost versus benefits.

4.5 Strategic Alternatives

4.5.1 Fingal North Dublin Transport Study

In 2014, the NTA commissioned the Fingal / North Dublin Transport Study (NTA, 2015) to identify the optimum long-term public transport solution to connect three core areas, namely Dublin City Centre, Dublin Airport and Swords, running north / south through the Fingal and Dublin City local authority areas. The study, carried out by AECOM, considered alternative transport solutions for the provision of transport infrastructure for the year 2035. A summary of the main conclusions is presented below.

The strategic context for the proposed public transport infrastructure was based on the assumption that the travel demand within the study area would grow by approximately 40% by 2040 as determined by transport modelling for a Do Minimum Scenario undertaken for the Fingal / North Dublin Transport Study (NTA, 2015).

The study was undertaken in two distinct stages:

- Stage 1 was concerned with identifying the strategic context for future development within the study area. In response to this demand, a list of 25 potential public transport schemes was identified for the area. Each of these was developed to a conceptual level and appraised under Economy, Integration and Environment (Cultural Heritage, Natural Heritage, Planning, Natural Development), with a shortlist of six potential schemes for future development recommended;
- Stage 2 provided an opportunity for further development of the analysis of each of the six shortlisted schemes to enable a more detailed appraisal. The technical and operational feasibility, environmental impact and cost of each scheme was developed, and detailed transport modelling was undertaken to understand how each scheme might respond to future travel demand within the study area. The environmental assessments included air quality, noise & vibration, landscape & visual quality, biodiversity, cultural heritage, land use, soils & geology and water resources. The outcome of Stage 2 is the identification of one preferred public transport scheme for future development within the study area.

As part of Stage 2, all technically feasible options were subject to detailed appraisal in accordance with the Department of Transport's Guidelines on a Common Appraisal Framework (CAF) for Transport Projects and Programmes (DTTAS, 2016).

The assessment resulted in the identification of one preferred public transport scheme for future development within the study area.

4.5.1.1. Alternatives Considered within the Fingal / North Dublin Transport Study

The 25 alternative transport options to serve the Fingal / North Dublin Corridor in Stage 1 are listed in Table 4-4. The options assessed included for heavy rail, light rail and Bus Rapid Transit (BRT) options, in addition to combination options.

Table 4-4: Summary of Stage 1 Analysis in Fingal / North Dublin Transport Study

Option Ref	Stage 1 Option	Stage 1 Analysis
Heavy Rail		
HR1	Clongriffin to Airport	HR1 does not meet the basic project objective to serve Swords and was therefore eliminated from further consideration.
HR2	Extension of HR1 to Swords	HR2 performs well against economic criteria and serves a reasonably good level of population per extra kilometre of track and integrates reasonably well with policy and existing public transport. As a result, it was included for further consideration.
HR3	Malahide to Airport via Swords	HR3 performs poorly against the economic criteria and serves fewer passenger numbers per kilometre than HR2 and as a result was therefore eliminated from further consideration.
HR4	North Malahide Estuary to Airport via Swords West	HR4 performs similarly to HR3 and as a result was eliminated from further consideration.
HR5	Combination HR1 + HR3	HR5 performs similarly to HR3 but with lower passenger numbers and as a result was eliminated from further consideration.
HR6	Combination HR1 + Spur Malahide to Swords	HR6 performs poorly on the economic criterion as it involves constructing a relatively large length of track to serve a small population. Furthermore, it does not align with land use policy and as a result it was eliminated from further consideration.
HR7	Maynooth Line (Broombridge) to Swords via Airport	HR7 was ruled out from further consideration as it is a long route with high journey times. As a result, it was eliminated from further consideration.
HR8	Maynooth Line (Drumcondra) to Airport-Swords, under Glasnevin	HR8 serves a highly populated catchment, is very well integrated with existing land use policy and existing public transport. As a result, it was included for further consideration.
HR9	Heuston to Swords via Phoenix Park Tunnel, under Glasnevin	HR9 was significantly constrained by the Phoenix Park tunnel. As a result, it was eliminated from further consideration.
HR10	Metro Dublin (scheme as proposed from St James's Hospital to Malahide)	HR10 was eliminated due to constraints in connecting St James's hospital to Heuston Station and constraints using the Phoenix Park tunnel. As a result, it was eliminated from further consideration.
Light Rail		
LR1	Broombridge to Finglas (Luas D1)	LR1 eliminated from further consideration as it did not meet key project objectives of providing connectivity to Swords.

Option Ref	Stage 1 Option	Stage 1 Analysis
LR2	Broombridge to Swords via Airport and Finglas	The estimated journey time for this option was very long when compared to other options and as a result, it was eliminated from further consideration.
LR3	Luas Cross City (LCC) to Swords via Airport, under Glasnevin (Luas D2)	It was considered that LR3 merited further assessment and as a result it was included for further consideration.
LR4	LCC to Swords via Airport, via Phibsborough (Luas D2)	It was considered that LR4 merited further assessment and as a result it was included for further consideration.
LR5	LCC to Swords via Airport, via Drumcondra (Luas D2)	It was considered that LR5 merited further assessment and as a result it was included for further consideration.
LR6	Metro North	This option scores well in terms of potential benefits, but it scores poorly on cost. As a result, option LR7 was developed to provide a lower cost alternative to (Old) Metro North. LR6 was eliminated from further consideration.
LR7	Optimised Metro North	LR7 provides a similar service to “Metro North” but at reduced costs. LR7 was included for further consideration.
LR8	Dublin City Access Transit (CAT)	LR8 had significant journey time to the airport and would cause significant traffic disruption as it operates at street level. As a result, LR8 was eliminated from further consideration.
Bus Rapid Transit		
BRT1	Clongriffin to Airport via Malahide	BRT5 was included for further consideration which included BRT 2,3 & 4.
BRT2	Clongriffin to Airport	
BRT3	City Centre to Airport via Ballymun	
BRT4	Docklands to Swords via Tunnel	
BRT5	Combination of BRT2, BRT3, BRT4	
Combined Options		
C1	Combination of HR1 and LR3	C1 was brought forward for further consideration as it provides high capacity and low journey times.
C2	Combination of HR1 and high-capacity BRT Swords-Airport	C2 was eliminated from future consideration as it failed to provide a fixed rail commuting service to Swords and had limited ability to cater for the future long-term corridor needs.

The Stage 1 analysis reduced these options to six reasonable options based on an assessment of the feasibility of each option and on the consideration of whether the scheme meets the fundamental project objectives by serving Swords, Dublin Airport and the city centre. As described in Table 4-4, the extension of the Green Line from Broombridge to Finglas (LRT1) was eliminated from further consideration for this reason.

The Stage 2 assessment identified an Optimised Metro North (LR7) as the best medium- and long-term transport project for the Greater Dublin Area. However, one of the main reasons given for its choice, was that this option retained the opportunity to extend Luas Cross City to Finglas, which would not be feasible otherwise.

Further detail on each of these options and the findings of the full assessment undertaken can be found in the Fingal / North Dublin Transport Study (NTA, 2015).

4.5.2 North West Corridor Study

In addition to the Fingal North Dublin Transport Study carried out in 2015, a separate study 'The North West Corridor Study (NWCS) (NTA, 2015)' analysed the demand for transport in the northwest of Dublin. It concluded that Light Rail Transit (LRT) was required in addition to the bus network to support the sustainable growth of the area. The subsequent Transport Strategy for the Greater Dublin Area (GDA) 2016 – 2035 (and its recent successor for 2022-2042) identified an extension to the Luas from Broombridge into Finglas as a key measure to improve public transport connections in the area. The Luas CrossCity project which brought the Luas from St Stephen's Green to Broombridge was planned as a phase in the development of Dublin's light rail network and it was constructed to facilitate a northern extension through Finglas at a future date.

In advance of the preparation of the Transport Strategy for the Greater Dublin Area 2016-2035, the National Transport Authority defined several study areas, including the northwest corridor, in order to understand the forecasted 2035 transport demand and service requirements. The NWCS Area, shown in Figure 4-3, encompassed the areas of Finglas, Cabra, Glasnevin and Phibsborough south of the M50 and Ashbourne, Tyrrelstown and Ballycoolin, to the north of the M50. The NWCS was published by the NTA as background information alongside the Transport Strategy for the Greater Dublin Area 2016-2035.

A particular aim of the study was to identify public transport options that could meet the forecasted growth in transport demand to the year 2035 between the North West Study Area and Dublin city centre. Demand for transport within and through the corridor was also analysed in reviewing both demand and potential public transport schemes. The study was undertaken in four stages:

- **Stage 1:** Establish Transport Demand in 2035 - the demand was identified using the Greater Dublin Area Regional Model (GDARM), a forerunner to the NTA's East Regional Model (ERM);
- **Stage 2:** Identify Public Transport Options – consideration of alternative public transport modes (e.g. rail, light rail, BRT and bus) based on capacity thresholds;
- **Stage 3:** Assessment of Most Appropriate Public Transport Options – sifting of options based on functionality (journey time and availability to meet demand) and cost (capital cost as related to service level); and
- **Stage 4:** Testing of Preferred Options – modelling of preferred option within the GDARM to confirm its viability.

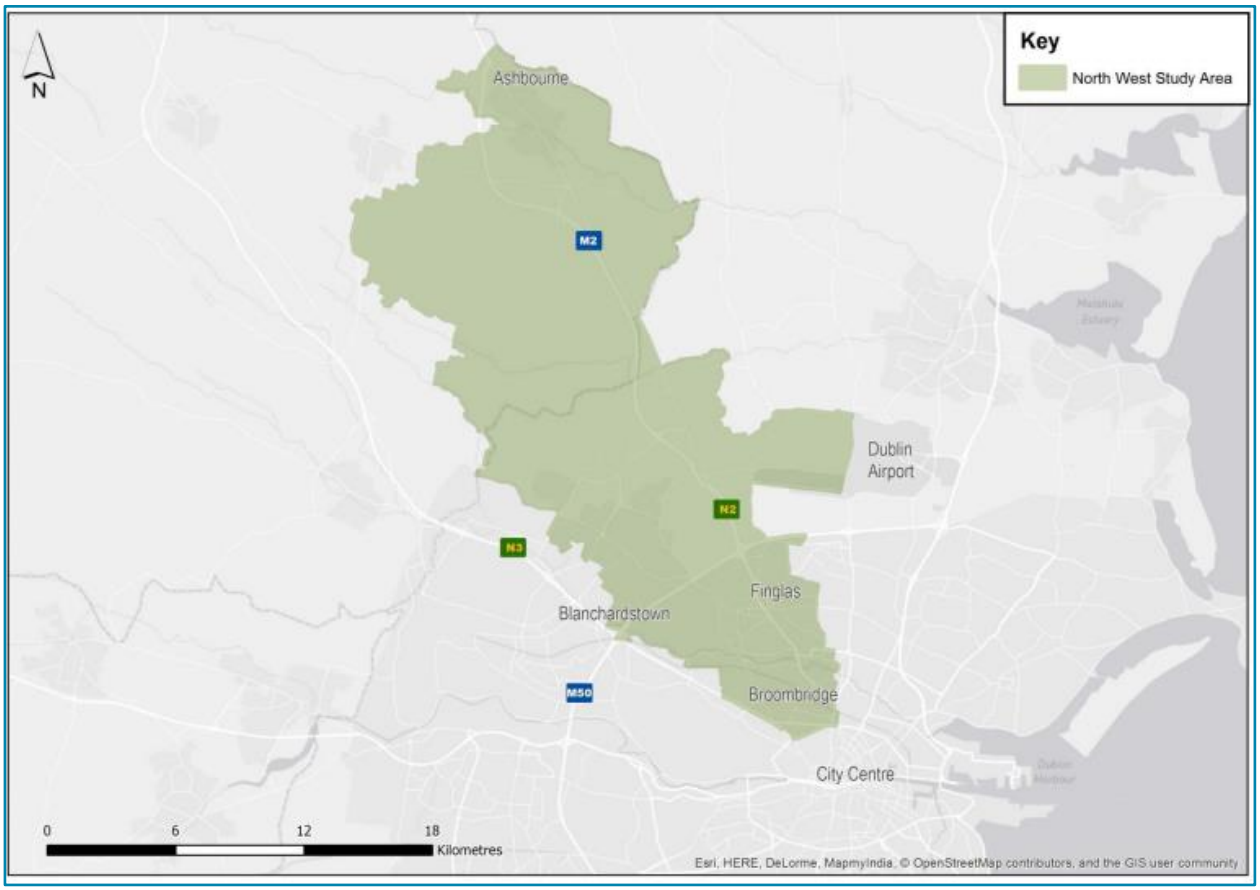


Figure 4-3: Northwest Corridor Study Area (Source: National Transport Authority, 2015)

Five alternative public transport modes were considered within the study:

- Option 1: Light Rail and Feeder Bus Services;
- Option 2: BRT and Feeder Bus Services;
- Option 3: New Rail Link with Feeder Bus Services;
- Option 4: New Metro Line with Feeder Bus Services; and
- Option 5: Enhanced Quality Bus Corridor with Express Bus Services and Feeder Bus Services.

The five options were considered in relation to the level of overall demand. Options 3 and 4 were discounted as the capacity provided was not proportionate to the demand requirements which would result in an over-supply of transport infrastructure and capacity, and there was no clear geographical alignment for new rail or metro lines. The remaining options were assessed against the criteria of demand, journey time and cost. The light rail option scored highest within the assessment. The public transport recommendations set out in the NWCS included the following:

- An extension of the Luas Green line from Broombridge to a terminus close to the N2 / M50 junction;
- Park & Ride provision to be catered for at this terminus; and
- Proportionate deployment of bus services to support access to the corridor.

It was noted in the study that the full impact of Demand Management Measures was not modelled, nor the Park & Ride facilities and bus network redesign (developed later under BusConnects Dublin). Therefore, the study provided a conservative view of demand levels for public transport.

4.5.3 Transport Strategy of the Greater Dublin Area 2016 - 2035

While the current strategy is the Transport Strategy for the Greater Dublin Area 2022-2042 which is discussed in section 4.5.4 below, it is important to initially consider the previous strategy, i.e. the Transport

Strategy for the Greater Dublin Area 2016-2035 (NTA, 2016) (hereafter referred to as the "former GDA Transport Strategy").

The former GDA Transport Strategy provided a framework for the planning and delivery of transport infrastructure and services in the GDA over the following two decades. The purpose of the Strategy was 'to contribute to the economic, social and cultural progress of the Greater Dublin Area by providing for the efficient, effective and sustainable movement of people and goods.'

This strategy set out the necessary transport provision, for the period up to 2035, to achieve the above objective for the region, and to deliver the objectives of existing national transport policy, set out in Chapter 2 (Planning and Policy Context), including in particular the mode share target of a maximum of 45% of car-based work commuting established under in "Smarter Travel – A Sustainable Transport Future". Various studies and reports were undertaken in the development of the former GDA Transport Strategy, including:

- Area-based studies covering the GDA area;
- Demand Management Study;
- Core Bus Network Study;
- Park & Ride Study;
- Transport Modelling Analysis; and
- Environmental reports.

Specifically, a Strategic Environmental Assessment (SEA) was undertaken on the former GDA Transport Strategy (NTA, 2016). As set out in the Environmental Report, in respect of which the SEA of the former GDA Transport Strategy was undertaken, a number of reasonable alternative strategies were devised and assessed, taking into account the objectives and the geographical scope of the strategy. The provisions of the former GDA Transport Strategy, were evaluated for potential significant effects, and measures were integrated into the Strategy on foot of SEA recommendations in order to ensure that potential adverse effects were mitigated.

In addition to direct studies and analyses undertaken as part of the preparation work, the former GDA Transport Strategy also took into account prior reports and plans in relation to transport provision. These prior studies included, inter alia, the following:

- GDA Cycle Network Plan (2013);
- Bus Rapid Transit – Core Network Report (2012);
- Fingal / North Dublin Transport Study (2015);
- Review of the DART Expansion Programme (2015);
- Various prior Luas studies (including Line B2 (Bray), Line D1 (Finglas), Line F1, and F2 (Lucan and Liberties), and Line E (2008); and
- Analysis completed for a 2011 Draft Transport Strategy.

The development of the former GDA Transport Strategy took into account the data and analyses provided through the supporting studies and background information and it formulated an overall integrated transport system to serve the needs of the GDA up to 2035. In relation to public transport, the former GDA Transport Strategy set out a network of heavy rail, metro, light rail and bus proposals, with those networks combining to serve the overall public transport needs of the region.

To facilitate an appraisal of existing and future land use and travel patterns, including trends and issues, the GDA was divided into a number of corridors based on the national and regional transport networks. These corridors are shown in Figure 4-4 and named using letters A to H. These corridors were also divided into Outer Hinterland, Outer Metropolitan and Inner Metropolitan areas in terms of character.

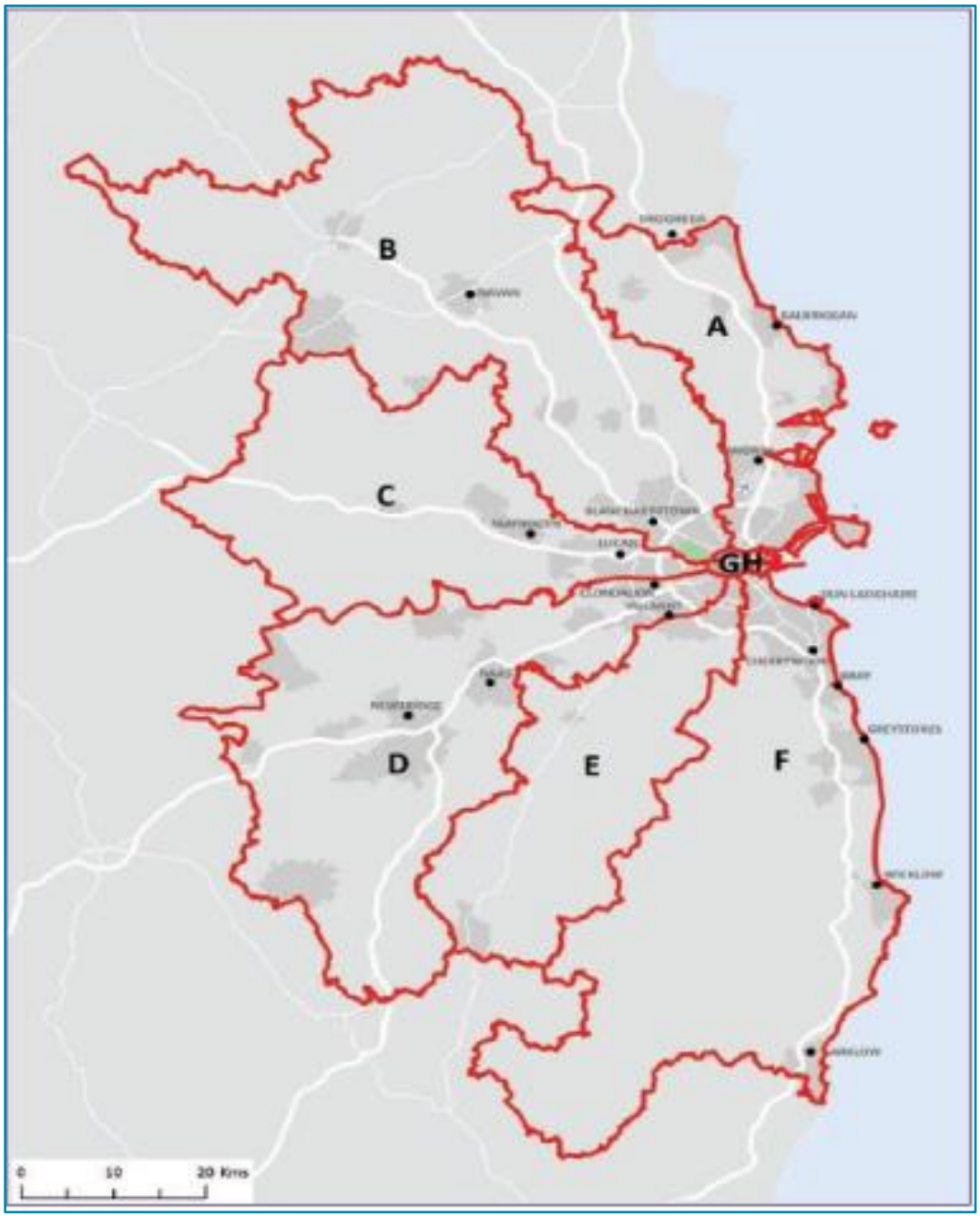


Figure 4-4: Corridors within the Greater Dublin Area (Source: former GDA Transport Strategy)

The proposed Scheme is located in Corridor B (Navan – Dunboyne – Blanchardstown – to Dublin City Centre) of the former GDA Transport Strategy which extends from the core City Centre area through to Blanchardstown and Dunboyne, and on towards Navan. The proposed Scheme is within the Inner Metropolitan segment traversing through largely low to medium density suburban areas.

Within this corridor, a significant proportion of the population is located outside of the larger urban settlements, and as such, it would be difficult to effectively serve on the basis of conventional public transport solutions. The car mode share for all trip purposes within this corridor is over 70 per cent, with a public transport mode share at only 8 percent. This corridor contains two major Inter-Urban roads, the N2/M2 and the N3/M3. Given the limited role of rail in meeting the demand for radially-based trips within this corridor, the management of transport demand across a range of modes on these inter-urban roads is of critical importance in catering efficiently for future demand.

4.5.3.1. Alternatives Considered within the former GDA Transport Strategy

The appropriate type of public transport provision in any particular case is determined predominately by the likely quantum of passenger demand along the particular public transport route.

For urban transport systems, bus-based transport is the appropriate public transport mode for passenger demand levels of up to 4,000 passengers per hour per direction (UITP, 2009). Light rail provision would generally be appropriate to cater for passenger demand of between 3,500 and about 7,000 passengers per hour per direction. Passenger demand levels above 7,000 passengers per hour per direction would generally be catered for by heavy rail or metro modes, which would usually be expected to serve a number of major origins or destinations along a particular corridor. In the case of both the bus and light rail modes, higher levels of passenger demand than the above stated figures can be accommodated under specific conditions.

The development of the former GDA Transport Strategy considered the likely public transport passenger demand levels across the region using the NTA's transport model and took into account the other studies referenced above, in addition to studies that had been carried out to investigate a potential light rail scheme within the area of this corridor.

Table 4-5 below sets out the outcome of the transport assessment for Corridor B in the former GDA Transport Strategy, along with the reasoning (including the environmental sensitivities) behind the choice of transport solutions to meet the demand in this corridor.

Table 4-5: Summary of alternatives considered and Environmental Assessment for Corridor B of the former GDA Transport Strategy (Source: SEA Environmental Report for the former GDA Transport Strategy)

Mode	Potential Measures	Transport Assessment	Environmental Assessment Comments	
			Key Sensitivities (may be impacted upon)	Specific Comments
Rail-Based	DART – Electrification of the Maynooth Rail Line, and capacity improvements.	Will serve future demand along part of the Corridor. Maximises the use of existing infrastructure and integrates with other parts of the network	<u>Ecological</u> ▪ Robust in many areas ▪ River sensitivities (e.g. the designated River Boyne in particular) <u>Water</u> ▪ River sensitivities ▪ Groundwater vulnerability in the northern areas of this corridor and at area surrounding Duleek <u>Landcover</u> ▪ Robust in general, apart from Phoenix Park <u>Cultural Heritage</u> ▪ Various designations, clusters in urban areas	Rail-based projects could contribute towards the achievement of Ireland's greenhouse gas emission targets in terms of emissions per passenger per kilometre. The tracks and route are present here already – this would reduce need for new development and associated impacts. Electrification and expansion of capacity could potentially present effects on ecological connectivity, habitats and species e.g. a collision risk for bird species. Electrification could displace or remove air emissions, water pollution and noise from existing diesel trains along corridors. Achievable mitigation measures have been integrated into the Strategy and would facilitate appropriate treatment of this risk. Lower-level plans and projects arising through the implementation of the Strategy will themselves be subject to lower tier assessments as relevant.
	Heavy Rail – extension of the commuter rail line to Navan	The level of forecast demand is insufficient to justify the development of a new high-capacity rail link		Rail-based projects could contribute towards the achievement of Ireland's greenhouse gas emission targets in terms of emissions per passenger per kilometre. The extension of this line would have the potential to affect a range of environmental sensitivities, including ecological sensitivities such as connectivity, habitats and species. Mitigation measures integrated into the Strategy would facilitate appropriate treatment of this risk. Lower-level plans and projects arising through the implementation of the Strategy will themselves be subject to lower tier assessments as relevant.
	Luas – new Luas extension from	Will meet the demand along parts of Corridor B not served by Heavy Rail.		Rail-based projects could contribute towards the achievement of Ireland's greenhouse gas emission targets in terms of emissions per passenger per kilometre.

Mode	Potential Measures	Transport Assessment	Environmental Assessment Comments	
			Key Sensitivities (may be impacted upon)	Specific Comments
	Broombridge to Finglas	Integrates with existing services and Luas Cross City.		This area is generally robust in environmental terms. There would be a need to implement mitigation measures for any crossings of the Royal Canal and River Tolka.
	Metro	The level of demand is insufficient to justify the development of a new high-capacity rail link		Rail-based projects could contribute towards the achievement of Ireland's greenhouse gas emission targets. Effects arising from constructing and operating Metro can include land take / impacts upon certain open spaces, loss of habitat during construction, disturbance to a range of common fauna species during construction and areas of permanent habitat loss to accommodate above ground structures such as air vents and emergency accesses.
Bus-Based	BRT - N3 corridor linking Blanchardstown, the Navan Road and City Centre; Broombridge to Finglas	BRT on the N3 Will meet the demand along the N3 where it is not directly served by the rail network. Potential to integrate well with the existing bus network. BRT from Broombridge to Finglas will not sufficiently meet future demand due to a constrained road network and passengers travelling to the city would require an interchange.	<u>Ecological</u> ▪ Robust in many areas ▪ River sensitivities (e.g. the designated River Boyne in particular) <u>Water</u> ▪ River sensitivities ▪ Groundwater vulnerability in the northern areas of this corridor and at area surrounding Duleek <u>Landcover</u> ▪ Robust in general, apart from Phoenix Park <u>Cultural Heritage</u> ▪ Various designations, clusters in urban areas	Bus-based projects could contribute towards the achievement of Ireland's greenhouse gas emission targets in terms of emissions per passenger per kilometre. This area is generally robust in environmental terms.
	Core Bus Network – Infrastructure and operational improvements	Will not sufficiently meet radial demand from the corridor into the City Centre. Could be justified as a complementary measure to DART, light		Bus-based projects could contribute towards the achievement of Ireland's greenhouse gas emission targets in terms of emissions per passenger per kilometre. Infrastructural and operational improvements to the Core Bus Network would be unlikely to produce potential effects other than those foreseen by the evaluation of alternatives for the Strategy.

Mode	Potential Measures	Transport Assessment	Environmental Assessment Comments	
			Key Sensitivities (may be impacted upon)	**Specific Comments**
		rail and BRT, particularly along the N2 corridor where upgrades could benefit regional and intercity bus services as well as city services. An effective and feasible option to meet demand for orbital movement.		
Road-Based	Strategic Road - upgrade of the N3, N2/M2, Slane bypass; Orbital Routes with links to Navan, upgrade connectivity outside the M50 between the N3, the N4 and N7	Improvements will allow for safe, consistent performance and connectivity of the strategic road network. Will also provide journey time reliability on a congested corridor.	<u>Ecological</u> ▪ Robust in many areas ▪ River sensitivities (e.g. the designated River Boyne in particular) <u>Water</u> ▪ River sensitivities ▪ Groundwater vulnerability in the northern areas of this corridor and at area surrounding Duleek <u>Landcover</u> ▪ Robust in general, apart from Phoenix Park <u>Cultural Heritage</u> ▪ Various designations, clusters in urban areas	Road-based projects facilitate journeys by motorised transport which contribute towards Ireland's greenhouse gas emission levels – particularly if there is a low or slow progress towards uptake of electric vehicles. If an integrated approach for the Strategy was not followed and the Strategy only provided for road-based projects, it is unlikely that the Strategy would help to facilitate the achievement of Ireland's greenhouse gas emission targets. Arising both directly from the construction and operation and indirectly from facilitating non-transport related development, road projects would have the potential to give rise to a range of adverse impacts upon environmental aspects such as energy usage, ecology, archaeological and architectural heritage and the status of water bodies. Potential conflicts would be mitigated by the achievable measures which have been integrated into the Draft Strategy. Road projects could also facilitate public transport, improving sustainable mobility and associated interactions, and facilitate the reuse and regeneration of brownfield sites.
	Road Expansion	Limited scope for increases in radial road capacity along this corridor. Will not meet the demand from the corridor into the City Centre. Road development will be required for orbital movement, safety reasons and as a means of facilitating land use development.		

Arising from the foregoing assessment, the former GDA Transport Strategy recommended that most of the growth in radial trips would be provided for by two rail lines, namely through the extension of the DART to Maynooth and the extension of Luas Cross City to Finglas, taking into consideration the need to implement mitigation measures for any crossings of the Royal Canal and River Tolka. These services would be complemented by a BRT corridor from Blanchardstown along the N3 corridor to the City Centre. Further transport demand would be supported by radial and orbital enhancements to the core bus network with the development of a core radial bus route along the N2 corridor and a core orbital bus route between Tallaght and Blanchardstown.

The former GDA Transport Strategy provided an efficient and effective transport system across the region and to accommodate future travel growth in a managed and balanced way. Increased public transport provision, coupled with enhanced cycling and walking facilities in the urban areas, provided the means to cater for much of the increased travel demand. However, it recognised that without complementary demand management measures the full benefits of the Strategy would not be achieved. As such, a range of Demand Management measures were proposed as part of the Strategy including setting maximum parking standards for new developments, reducing availability of workspace parking in urban areas, implementing demand management measures on the M50 and introduction or expansion of on-street parking controls.

4.5.4 Transport Strategy of the Greater Dublin Area 2022 – 2042

The January 2023 published Transport Strategy for the Greater Dublin Area 2022-2042 (hereafter referred to as the transport Strategy for the GDA) replaces the previous framework, entitled the Transport Strategy for the Greater Dublin Area 2016- 2035 (as detailed above in Section 4.7).

The transport Strategy for the GDA supports the findings of the previous GDA Transport Strategy 2016 – 2035 and commits to existing transformative projects in development, including BusConnects, DART+ and MetroLink, as well as Luas Finglas.

The transport Strategy for the GDA identifies Luas Finglas as one of the forthcoming schemes and states that a Railway Order application for Luas Finglas is expected to be submitted in 2023 / 2024. The proposed Scheme is supported by the following specific measures:

'Measure LRT3 – Luas Finglas: It is intended to extend the Luas Green Line northwards to Finglas, inclusive of a potential park and ride facility at or close to its terminal Stop.';

'Measure LRT12 – Additional Depot Facilities: It is intended to provide additional depot facilities as required to cater for an expanded light rail network.' The extension of the Green Line to Finglas requires an extension to the depot facilities at Broombridge.

The time span of the Transport Strategy encompasses three time periods – the first up to 2030, aligning with the current National Development Plan; the second from 2031 to 2036; and the third up the end of the strategy period in 2042. The Luas Finglas scheme is included in the Medium Term 2031-2036 period.

4.6 'Do Nothing' Scenario

The Do-Nothing scenario outlines what is likely to happen to the environment should the proposed Scheme not be implemented, taking account of the continuation or change of current management regimes as well as the continuation or change of trends currently evident in the environment, with no improvements being made to current systems.

The overarching objectives of the proposed Scheme, informed by policy (refer to Chapter 2 (Planning and Policy Context) of this EIAR, as established in the Preliminary Business Case, are as follows:

- *"Serve existing and future transport demand;*
- *Provide a safe, frequent, reliable, efficient and sustainable public transport connection from Charlestown and St Margaret's Road (where it also serves a strategic Park & Ride) to the city centre, via Finglas;*

- *Reduce public transport journey times between Charlestown, Finglas and the city centre compared to private car trips;*
- *Contribute to the Climate Action Plan targets for the decarbonisation of transport; and*
- *Promote economic growth for the residents and businesses of Charlestown, Finglas and the surrounding areas."*

The Do-Nothing option would not deliver the proposed Scheme objectives. With no improvements made to the current transport systems, transport travel demand will continue to increase, and the current transport system will not increase its capacity sufficiently to meet the future predicted demand as identified in the Transport Strategy for the GDA (NTA, 2023) and as discussed further in Chapter 3 (Need for the proposed Scheme). With the predicted increases in transport demand due to predicted population increases, use of the private car will also increase, leading to an increase in traffic congestion levels causing detrimental environmental impacts. As a result, the Do-Nothing Scenario would result in environmental impacts as summarised below:

Traffic and Transport: With no improvements made to the current transport systems, transport travel demand will continue to increase, but the current transport system will not increase its capacity to accommodate this.

In terms of public transport provision, the bulk of the study area has bus services only with relatively small catchment areas served by the heavy rail line. The existing and committed public transport provision does not serve the existing or future demand in the key nodes of Charlestown, Finglas and the surrounding areas. This high-quality public transport option is not currently available in the Finglas area and facilities supporting walking and cycling are limited. As a result, a high number of trips taken in Finglas are by private car.

According to Census 2022 data, around 50% of work trips and 42% of school / college trips from Finglas are made using private vehicles. Just 7% of trips for work or education in the Finglas area are made by rail-based modes with the nearest station located at Broombridge.

When compared to the wider Dublin City and suburbs, Finglas has a high proportion of car users for travel to work, and low proportions of walking and cycling. Access to Dublin city centre from the north-western corridor is constrained to a small number of bridge crossings over the Royal Canal at Phibsborough, Broombridge and Ratoath Road. These areas are currently over capacity.

Transport modelling analysis forecasts an additional 400 person trips crossing the Royal Canal from the north-west in the 2035 Do Minimum scenario AM peak (i.e. without the delivery of Luas Finglas) compared to a 2020 base scenario. This is including the proposed upgrades to the bus network and infrastructure to be delivered by BusConnects. This represents a relatively low growth in trips to the city centre given the estimated population increase of around 10,500 persons within the same time period reflecting the transport capacity constraints. Therefore, the analysis from the transport modelling indicates the need for a high-capacity public transport solution that can act independently of the existing road network to support the development of the Finglas area. Without this, congestion and journey times are likely to continue to grow into the future. Further details can be found in Chapter 18 (Material Assets: Traffic and Transport)

Population: Whilst population and employment continue to grow, the absence of the proposed Scheme is likely to be a constraint on the economic and physical growth of the region and at the local level. Connectivity and accessibility would be likely to deteriorate within the Study Area and wider Dublin region in the absence of the proposed Scheme given the anticipated population growth within the study area and capacity constraints on the existing transport infrastructure network. Restrictions could therefore be placed on residential, commercial and industrial development in the absence of the proposed Scheme.

Human Health: Human Health impacts will arise due to increases in emissions to air and noise levels associated with increased traffic congestion.

Noise and Vibration: In the Do-Nothing scenario there will be no increases in noise due to the Construction Phase. However increased traffic congestion during the Operational Phase of the proposed Scheme would

result in increases of noise levels in the absence of Luas Finglas. Noise monitoring undertaken for the proposed Scheme has identified that existing noise levels in the area are dominated by traffic noise, both local and distant. Exceedances of the noise criteria used in this assessment have been recorded all along the alignment of the proposed Scheme (Refer to Table 15-20 and 15.21 in Chapter 15 (Noise and Vibration) for further details of the criteria) and these exceedances are primarily related to traffic noise. In the absence of the proposed Scheme and other public transport enhancement projects, elevated noise levels associated with traffic will continue.

Air Quality: In the Do-Nothing scenario there will be no predicted increase in dust and air pollutant emissions to air due to Construction Phase and this assumes no changes in the level of dust and air pollutant emissions from the existing environment. However, the predicted future traffic volumes in the study area and the resultant increased traffic congestion in the absence of the proposed Scheme, has the potential to result in higher NO_2, PM_{10} and $PM_{2.5}$ emissions in the future. The predicted pollutant emissions from the Do Minimum traffic flows and from the Do Something traffic flows have been compared. The prediction modelling presented in Chapter 13 (Air Quality) indicates that NO_2, PM_{10} and $PM_{2.5}$ emissions will be higher for the Do Minimum scenario when compared to the Do Something scenario for the opening year and the design year.

Climate: In the Do-Nothing scenario there will be no increase in GHG emissions to air due to Construction Phase and this assumes no changes in the level of GHG emissions from the existing environment. However, the predicted future traffic volumes in the study area and the resultant increased traffic congestion in the absence of the proposed Scheme, has the potential to result in higher GHG emissions in the future. The predicted pollutant emissions from the Do Minimum traffic flows and from the Do Something traffic flows have been compared. The prediction modelling presented in Chapter 14 (Climate) indicates that GHG emissions will be higher for the Do Minimum scenario when compared to the Do Something scenario for the opening year and the design year. Therefore, the climate impact would be adverse under the Do-Nothing scenario as the proposed Scheme would not provide the sustainable public transport that will reduce reliance on private transport. In terms of the vulnerability of the existing environment to climate change, this will remain largely unchanged from the existing environment, but the proposed Scheme will result in an overall reduction in GHG emissions.

Hydrology/Hydrogeology: In the event of the proposed Scheme not being constructed, there would be no potential impacts on surface water resources along the alignment of the proposed Scheme during the Construction Phase as identified in Chapter 10 (Water) and Chapter 11 (Land And Soils: Soils, Geology, and Hydrogeology). However, in the absence of the proposed Scheme, continued low density development would result in increased potential impacts on the watercourses and groundwater within the study area.

Soils and Geology: In the Do-Nothing scenario there would be no direct impact on the soils and geology baseline. However, future development along the proposed Scheme corridor would be of less density, resulting in impacts on a greater area of soils (and underlying geology), due to a larger area being required to accommodate the future population requirements.

Land Take: The proposed Scheme will require land take in order to provide sufficient land for the construction of the proposed Scheme and for the infrastructure to be provided by the proposed Scheme. In the Do-Nothing scenario, the land take needed as identified in Chapter 12 (Land take) will not be required. However, in the absence of the proposed Scheme, it would be much more difficult to provide compact, higher density growth required to meet the future population projections. This would mean that future development would progress at a lower density, requiring a comparatively larger land take.

Infrastructure and Utilities: The proposed Scheme will impact on existing Infrastructure and Utilities and will require realignment and diversions of this infrastructure, as outlined in Chapter 17 (Material Assets: Infrastructure and Utilities). In the Do-Nothing scenario, there will be no impact on existing infrastructure and utilities.

Materials and Waste Management: In the Do-Nothing scenario the material and resource requirements identified in Chapter 19 (Material Assets: Resource & Waste Management) will not be required. Furthermore, the material and waste generation predicted in the chapter will not be generated.

Archaeology, Cultural Heritage and Architectural Heritage: In the Do-Nothing scenario there will be no impacts on sites of archaeological heritage or areas of archaeological heritage potential, as identified in Chapter 20 (Cultural Heritage). However, the less compact development predicted in the absence of the proposed Scheme would result in increased impacts on sites of archaeological value.

Landscape & Visual: In the Do-Nothing scenario, there will be no landscape and visual impacts associated with the proposed Scheme (positive or negative).

4.7 Assessment of Alternative Route Options

The former GDA Transport Strategy included for an extension of the Luas Green Line from its terminus at Broombridge to the north of Finglas, providing a strategic Park & Ride at or close to its terminal Stop. The former GDA Transport Strategy gave a general indication of the route for Luas Finglas. Accordingly, the proposed Scheme is in line with that strategy, which the transport Strategy for the GDA supports.

The assessment of alternatives to identify a preferred route for the proposed Scheme has been undertaken based on an assessment of several route options and stop locations. In July 2020, following a comprehensive assessment of the route options along the corridor, TII published the Options Selection Report, which identified the Emerging Preferred Route (EPR) for the proposed Scheme. The EPR was subject to a non-statutory public consultation in 2020 and the key observations and submissions are referred to in section 1.9.3 of Chapter 1 (Introduction) of this EIAR. A review of these submissions and further design development led to the establishment of a Preferred Route (PR) for the Scheme. This was subject to a further non-statutory public consultation in December 2021. The key observations and findings from that consultation are also referred to in section 1.9.4 of Chapter 1 (Introduction).

The assessment of alternatives leading to the preferred alignment is discussed in this chapter (refer to sections 4.8 and 4.9) having regard to decisions made in the development of the EPR and the PR.

4.8 Identification of the Emerging Preferred Route

4.8.1 Luas Finglas Option Selection Report – Stage 1

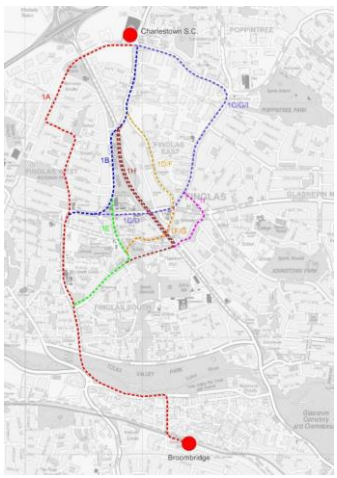
Following the former GDA Transport Strategy, Transport Infrastructure Ireland (TII) was instructed by the NTA to undertake a “Stage 1 Option Selection Report for Luas Finglas” in order to develop further the light rail network in Dublin.

This report was completed in August 2019, setting out the initial route options and concluding with the identification of three shortlisted options to be further optimised within a Luas Finglas Options Selection Report Stage 2. The Option Selection Report Stage 1 summarised below is included in Volume 5 - Appendix A4.1 of this EIAR.

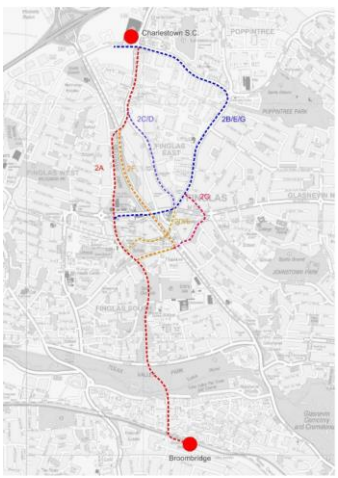
This Stage 1 Options Selection report considered an initial high-level route options assessment, or ‘sifting’ process, which appraised routes in terms of ability to achieve the scheme objectives and whether they could be practically delivered. The overarching objectives used in Stage 1 and Stage 2 assessments have been reconfirmed and remain applicable as set out in Chapter 1 (Introduction) of this EIAR.

Starting with the spiderweb analysis developed for the Luas Line D1 feasibility study from 2010, 29 potential end-to-end route options were created, as detailed in Figure 4-5. These 29 route options were then assessed following a two-step process in which a broad assessment of the suitability of all options against high level objectives (screening) was undertaken (as summarised in Section 4.8.1.1) and a more detailed multi-criteria analysis (MCA1) carried out with respect to the remaining options which passed through the screening step (as summarised in Section 4.8.1.2).

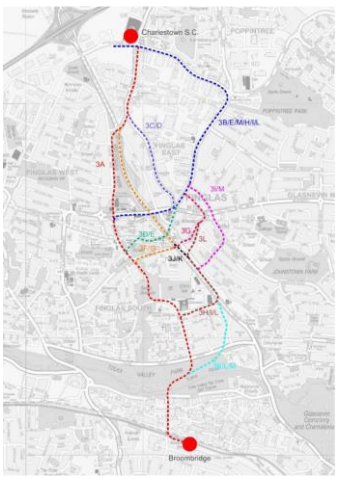
Details on the assessment methodology and the rationale for using selected environmental sub-criteria as differentiators is summarised below and can also be reviewed in full in the Option Selection Report Stage 1 contained in Volume 5 - Appendix A4.1.



Options 1s (1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I)



Options 2s (2A, 2B, 2C, 2D, 2E, 2F, 2G)



Options 3s (3A, 3B, 3C, 3D, 3E, 3F, 3G, 3H, 3I, 3J, 3K, 3L, 3M)

Figure 4-5: Feasible end-to-end routes for the proposed Scheme (Source: Luas Finglas Options Selection Report Stage 1, 2019)

4.8.1.1. Screening Analysis

This screening stage generally considered the options across three broad categories: Engineering, Economy and Environment, in the context of the overarching objectives for the proposed Scheme. Based on an initial screening of environmental constraints, there were no environmental topics that warranted routes to be sifted at this stage e.g. Special Areas of Conservation, Protected Habitats, etc. In total, each option was assessed against four criteria:

- Demand, Serving Finglas Village;
- Directness of the line (route length);
- Road interaction and number of junctions crossed At grade;
- Alignment and curvature degree.

Table 4-6 shows the Options assessment for the pass / fail screening process in the context of the high-level objectives for the proposed Scheme. The colour system for Table 4-6 uses green to represent a positive feature whereas red signifies a negative feature.

Table 4-6: Options assessment for pass/fail screening process (Source: Luas Finglas Options Selection Report Stage 1)

Option Ref	Serving Finglas Village	Directness	Interaction with road / junctions	Alignment
1A	The line is too far from the core of the Village with a distance of 900 to 1,000m.	The line is direct but long, 4.5km approximately. This is mainly due to its route running all along the eastern edges of the Study Area. This length is still considered acceptable	High number of road junctions, several of the local roads will have to be signal- controlled. Low level of segregation is possible on the upper part of the route.	Good alignment with few curves (2 clustered in the north section, prior to crossing the Finglas Road).

Option Ref	Serving Finglas Village	Directness	Interaction with road / junctions	Alignment
1B	The line does not properly serve the Village with a distance in excess of 600m.	The line is quite direct with just over 4km length.	Some interaction with roads in the lower part of alignment only, with an overall limited number of road junctions.	The alignment is good overall with very few curves, one of them potentially below 50m.
1C	The line passes through the middle of the Village with great potential for proximity service.	The line is very long with over 5.5km due to its corridor running perpendicular to the main north-south axis for a long stretch in order to pass from Finglas West to Finglas East.	Average to high road interaction also due to its length but not a showstopper.	Good alignment with few sharp curves.
1D	The line passes through the middle of the Village with great potential for proximity service.	The line is not direct, with a length of over 4.8km.	High road interaction with several At grade junctions particularly along McKee Avenue and Finglas Village.	Good alignment with few curves.
1E	The line runs some 400m from the core of the Village, which is considered acceptable in terms of level of service at this early stage.	The line is quite direct with a length of just over 4km. Its alignment is mostly north-south.	Some level of road interaction along Wellmount Road and St Margaret's Road, but this is deemed manageable at design stage.	An acceptable alignment overall despite the presence of 3 sharp curves (2 of which in and out of Wellmount Road).
1F	Good level of service for the Village, with the line running through the Five Arms junction, large potential for a proximity stop location.	The line is long (just over 4.4km) but still quite direct.	High number of road junctions and severe impact on the road network in Church Street, where the new bridge would take most of the cross-sectional width. Same significant impact is expected on the east side of the Finglas Road as well.	A significant number of sharp curves (5) and a convoluted alignment in the Church Street area makes the option less attractive at this early stage.
1G	Good level of service for the Village, with the line running through the Five Arms junction, large potential for a proximity stop location.	The route is well over 5km in length as it links the opposite extremities of the Study Area, transversally to the main north-south direction. This corridor is not direct.	Some level of road interaction (in terms of road junctions), in addition to a severe impact on Church Street and Finglas Village.	A significant number of sharp curves (5) and a convoluted alignment in the Church Street area.

Option Ref	Serving Finglas Village	Directness	Interaction with road / junctions	Alignment
1H	Good level of service for the Village, with the line running below the Mellowes Road bridge over the Finglas Road. Great potential for serving both sides of the Road and interchange with bus routes.	The line is just over 4.5km in length and while this is not the most direct route, it is considered acceptable at this early stage.	Some level of road interaction along Wellmount Road and St Margaret's Road.	Good alignment with few curves (3) at a significant distance.
1I	The lines passes peripherally to the south side of the core of the Village, but a Stop could be located in close proximity.	The route is well over 5.3km in length as it links the opposite extremities of the Study Area, transversally to the main north-south direction.	The corridor passes through a high number of road junctions.	Good alignment with few curves at a significant distance, with the exception of the Village, where speed is limited by other operational constraints.
2A	Acceptable services for the Village, with the line running some 400m west of its centre.	The line is one of the most direct, with only 3.5km length.	Very low road interaction, mostly along St Margaret's Road.	Very good alignment with no sharp curves.
2B	Finglas Village is very well served with the possibility for a Stop within the core of the Village or over a new adjacent bridge spanning the Finglas Road with easy access from both sides.	The route is long, but still within an acceptable value (4.7km) at this early sifting stage, considering its service of the East side of the Study Area.	Some level or road interaction with quite a high number of road junctions, but the corridor still allows a good level of segregation particularly along the southern section.	Good alignment overall with one tight curve only.
2C	Finglas Village is very well served with the possibility for a Stop within the core of the Village or over a new adjacent bridge spanning over the Finglas Road with easy access from both sides.	The route is direct, with a length of approx. 4km.	Higher level of road interaction than previous Option 2B with quite a high number of road junctions and shared sections north of the Village, but the corridor still allows a good level of segregation particularly along the southern section.	Good alignment overall with two tight curves only.
2D	Very good service for the Village, with the line	The line is one the most direct, with only 3.8km length.	High number of road junctions plus a severe impact on the road	Although the alignment is convoluted around the Church Street

Option Ref	Serving Finglas Village	Directness	Interaction with road / junctions	Alignment
	running through its core.		network in Church Street, where the new bridge would take most of the cross-sectional width. Same significant impact is expected on the east side of the Finglas Road as well.	sections, this is clustered around one section only and still acceptable.
2E				
	Very good services for the Village, with the line running through its core.	This line is long (4.5km), but this is still considered an acceptable length at this early stage.	With the exception of the severe impact on Church Street, where the new bridge would take most of the cross-section width, lower level of road interaction is expected along the rest of the route. This is deemed acceptable for this stage.	Although the alignment is convoluted around the Church Street section, this is clustered around one section only and still acceptable.
2F				
	Good level of service for the Village, with the line running below the Mellowes Road bridge over the Finglas Road. Great potential for serving both sides of the Road and interchange with bus routes.	The line is one of the most direct, with only 3.8km length.	Very low road interaction, mostly along St, Margaret's Road. The alignment along the Finglas Road can be either share with bus lanes or set back into a widened section of the road north of the overpass.	Good alignment with two sharp curves clustered together and in correspondence of a main road junction, where the speed will be limited by operation constraints.
2G				
	Reasonable level of service for the Village, with the line running some 400m to the south of its core.	Acceptable service for the Village, with the line running some 400m west of its centre.	Medium to high level of road interaction, mostly around Finglas Village, but still considered acceptable and manageable at this stage.	Acceptable alignment with three sharp curves, but quite clustered together in areas of low speed, will not pose a significant limitation to the operation of the corridor.
3A				
	Acceptable service for the Village, with the line running some 400m west of its centre.	The line is one of the most direct, with only 3.7km length.	Acceptable level of road interaction, mostly along St Helena's and St Margaret's Roads.	Very good alignment with one sharp curve.
3B				
	Finglas Village is very well served with the possibility for a Stop within the core of the Village or over a new adjacent bridge spanning over the	The route is too long, over 5km. Other routes serve similar areas with shorter alignments.	High level of road interaction with quite a high number of road junctions particularly along St Helena's Road and the Jamestown Road / Five Arms	Acceptable alignment overall with two tight curves only.

Option Ref	Serving Finglas Village	Directness	Interaction with road / junctions	Alignment
	Finglas Road with easy access from both sides.		junction in Finglas Village.	
3C				
	Finglas Village is very well served with the possibility for a Stop within the core of the Village or over a new adjacent bridge spanning the Finglas Road with easy access from both sides.	The route is of reasonable length, in around 4.2km.	Very high level or road interaction with quite a high number of road junctions and shared sections within the Village and north of it.	Acceptable alignment overall.
3D				
	Good service for the Village, with the line running through its core and potential for a Stop just south of it.	The line is quite short and direct, despite the convoluted alignment through Church Street.	High number of road junctions together with a severe impact on the road network in Church Street, where the new bridge would take most of the cross-sectional width.	Although the alignment is convoluted around the Church Street section, this is clustered around one section only and still acceptable.
3E				
	Good service for the Village, with the line running through its core and potential for a Stop just south of it.	The line is very long (approx. 4.8km), even in consideration of its services to the north-east quadrant within the Study Area.	High number of road junctions in addition to the severe impact on the road network in Church Street, where the new bridge would take most of the cross-sectional width.	Although the alignment is convoluted around the Church Street section, this is clustered around one section only and still acceptable.
3F				
	Good level of service for the Village, with the line running below the Mellowes Road bridge over the Finglas Road. Great potential for serving both sides of the Road and interchange with bus routes.	The line is 4km long, making this quite a direct corridor. This is mainly due to it running along the Finglas Road, north of Wellmount Road.	Reasonably low road interaction, mostly along St Margaret's Road. The alignment along the Finglas Road can be either shared with bus lanes or set back into a widened section for the road north of the overpass.	Acceptable alignment with three sharp curves, two of which clustered together and in correspondence of a main road junction, where the speed will be limited by operational constraints.
3G				
	Reasonable level of service for the Village, with the line running some 400m to the south of its core.	The line is too long (over 4.8km). Other corridors serve similar areas with shorter routes.	Medium to high level of road interaction, mostly around Finglas Village, but still considered acceptable and manageable at this stage.	The alignment is too convoluted with a high number of non-clustered sharp curves over a long central section of the route.
3H				
	Reasonable level of service for the Village,	The line is very long (over 4.6km) but this is	Low to medium number of road junctions and a	The alignment is too convoluted, counting

Option Ref	Serving Finglas Village	Directness	Interaction with road / junctions	Alignment
	with the line running some 300m to the south of its core.	not considered an absolute parameter, in consideration of the overall straightness (south-north) direction of the corridor.	reasonably good level of interaction with the road network. The new bridge over the Finglas Road is also a plus.	five long curves within the central section of the route. This, in combination with the relatively long route has potential to highly detrimental for noise, operation (speed) and maintenance at this early stage.
3I				
	Reasonable level of service for the Village, with the line running some 400m to the south of its core.	The line is very long (over 4.6km) but this is not considered an absolute parameter, in consideration of the overall straightness (south-north) direction of the corridor.	Low to medium number of road junctions and a reasonably good level of interaction with the road network. The new bridge over the Finglas Road is also a plus.	The alignment is too convoluted, counting five long curves within the central section of the route. This, in combination with the relatively long route has potential to highly detrimental for noise, operation (speed) and maintenance at this early stage.
3J				
	Good level of services for the Village, with the line running below the Mellowes Road bridge over the Finglas Road. Great potential for serving both sides of the Road and interchange with bus routes.	The line is 3.9km long, which means it is very direct. This is mainly due to it running along the Finglas Road north of the Clearwater shopping centre.	Reasonably low road interaction, mostly along St Margaret's Road. The alignment along the Finglas Road can be either shared with bus lanes or set back into a widened section of the road north of the overpass.	Very good alignment with two clustered sharp curves.
3K				
	Good level of services for the Village, with the line running below the Mellowes Road bridge over the Finglas Road. Great potential for serving both sides of the Road and interchange with bus routes.	The line is very direct (less than 3.9km long). This is mainly due to it running along the Finglas Road north of the Clearwater shopping centre.	Low road interaction, mostly along St Margaret's Road. The alignment along the Finglas Road can be either shared with bus lanes, or set back into a widened section of the road north of the overpass.	Very good alignment with virtually no sharp curves.
3L				
	Acceptable level of service for the Village, with the line running some 200m from the Five Arms junction.	The line is long as it runs over 4.5km reaching the east of Finglas Village, but it is acceptable for this stage of the sifting process.	Medium level of interaction with the road network and junctions, mostly along Jamestown Road and the east of Finglas Village. The alignment south of the Village has	Acceptable alignment with three sharp curves, two of which clustered together and in correspondence of a potential stop location (Finglas Village), where the speed will be limited

Option Ref	Serving Finglas Village	Directness	Interaction with road / junctions	Alignment
			a good level of protection and segregation.	by operational constraints.
3M				
	Acceptable level of service for the Village, with the line running some 200m from the Five Arms junction.	The line is very long (4.6km), but still acceptable from a directness point of view, even in consideration of the areas served.	Medium to high level of interaction with the road network and junctions, mostly along Jamestown Road and the east of Finglas Village/Clune Road where the level of segregation will be low. The alignment south of the Village has a good level of protection and segregation.	Acceptable alignment with two sharp curves.

Fifteen route options were eliminated in the screening analysis as they did not meet the pass/fail test based on the four criteria as explained above, and the following 14 routes options were brought forward to the next stage (MCA1): 1E, 1H, 2A, 2B, 2C, 2E, 2F, 2G, 3A, 3F, 3J, 3K, 3L and 3M.

4.8.1.2. Multi-Criteria Analysis (MCA1)

The MCA approach provides a valuable tool in prioritising schemes for investment and supporting decision making. In this Stage 1 of the proposed Scheme options assessment, the MCA was called MCA1 and it was developed to facilitate a ranking of each option against a set of defined criteria in accordance with the Common Appraisal Framework (CAF) guidelines (published in March 2016 and updated subsequently).

The MCA1 process considered each option against scheme objectives set out under the CAF appraisal criteria: Economy, Safety, Environment, Accessibility and Social Inclusion and Integration. Each of the options were assessed against sub-criteria objectives under these main criteria.

Within this MCA1, whilst all 14 environmental aspects as listed on Annex IV of the Directive 2011/92/EU as amended by Directive 2014/52/EU (European Union, 2014) were considered for each of the 14 route options and scored across the five-point scale, not all aspects were deemed to be differentiators at MCA1 stage. Only those environmental aspects (as summarised inTable 4-7) which were identified as directly influencing the development of route options at this stage were considered in greater detail within this MCA.

Table 4-7: Summary of Environmental Considerations (Source: Luas Finglas Options Selection Report Stage 1)

Aspect	Analysis of Environmental MCA1 Route Options	Differentiator?
Biodiversity	The provision of Luas Finglas infrastructure has the potential to impact on flora and fauna by potentially impinging on protected areas designated for their ecological features or land with ecological benefit. Impacts will differ between the route options and thus Biodiversity was considered to be a differentiator in this MCA1.	Yes
Land	The main constraints associated with land are related to land take, property and severance. The route options were primarily located on existing road infrastructure passing through a variety of land uses including, residential, green open space, community, industrial.	No

Aspect	Analysis of Environmental MCA1 Route Options	Differentiator?
	Whilst all route options will result in some degree of both temporary and permanent land take, land was not considered therefore to be a significant differentiator in determining preferred routes and thus did not require further evaluation in this MCA1. All options are expected to have a slight impact on constraints.	
Soils	The main constraints associated with soil are related to sealing, compaction, erosion and organic matter. All route options pass through the following soil types: Made Ground (Made), Alluvial (AlluvMIN), Deep well-drained mineral (BminDW) and Mineral poorly drained (BminPD). The dominant soil type for all route options is Made Ground. **Soil sealing** refers to the covering of the ground by an impermeable material. The European Commission considers soil sealing to be one of the main causes of soil degradation in the EU. Soil sealing often affects fertile agricultural land, puts biodiversity at risk and increases the risk of flooding. All proposed options will traverse Tolka Valley Park and directly impact the existing permeable surface permanently. However, all route options primarily traverse existing sealed surfaces i.e. roads. Whilst it was recognised that many of the route options will have direct impacts on other current impermeable surfaces at, for example, Kildonan Park and other green areas, it was determined that soil sealing was not a differentiator in this MCA1. **Soil compaction** is a form of physical degradation due to the reorganisation of soil micro and macro aggregates. Soil compaction reduces the capacity of soil to store and conduct water and makes it less permeable for plant roots. The construction of route options may cause soil compaction permanently at Tolka Valley Park (and in other green areas) and on existing roads. However, it was determined that soil compaction was not a differentiator in this MCA1. **Soil erosion** is a naturally occurring process that affects all landforms. Soil erosion can be caused by wind, water or tillage. During the Construction Phase, there is the possibility that soil erosion will occur if mitigation measures are not implemented. However, impacts would be likely to occur along all route options. Therefore, it was determined that soil erosion was not a differentiator in this MCA1. **Soil organic matter** has physical (e.g. improves water holding capacity), chemical (e.g. improves soils ability to resist pH change) and biological (provides food for living organisms in the soil) benefits. Impacts on soil organic matter from the construction and operation of the proposed scheme would be imperceptible. Therefore, it was determined that soil erosion was not a differentiator in this MCA1. In conclusion, soil was not considered to be a significant differentiator therefore in determining preferred routes and thus did not require further evaluation in this MCA1. All options are expected to have a slight impact on constraints.	No
Waste	The main constraints associated with waste relate to the presence of potentially contaminated sites and the generation of waste and the management of same associated with scheme construction. Tolka Valley Park is situated over a former city landfill. All route options will directly impact this historic landfill. Subsurface pollutants encountered by the proposed scheme would require appropriate handling, treatment, transfer and disposal. If appropriate mitigation measures are not implemented there may be impacts on the River Tolka. Other potential historic contamination sites identified include a smithy, paper mill and pumping station on Finglas Road, a quarry on Ballyboggan Road and a dairy on North Road. Historical pits and quarries are identified as a potential source of ground contamination as the backfill materials can be highly variable in nature and unregulated. However, with the exception of Tolka Valley Park,	No

Aspect	Analysis of Environmental MCA1 Route Options	Differentiator?
	no route option will have a direct impact on identified potentially contaminated historic sites. Waste generation and waste management was an environmental constraint for this MCA1. However, as the volumes and costs for disposal of all soil and contaminated ground were considered under economic criteria for MCA1, it was not considered to be a significant differentiator in determining preferred routes and thus did not require further environmental evaluation in this MCA1. The potential waste-related constraints within the scheme study area have been identified through the identification and assessment of potentially contaminated historic sites. In conclusion, waste was not considered therefore to be a significant differentiator in determining preferred routes and thus did not require further evaluation in this MCA1. All options are expected to have a slight impact on constraints.	
Water	<u>Groundwater</u> The main constraints associated with groundwater (hydrogeology) are aquifer type and classification, groundwater vulnerability and karst landforms. The Geological Survey of Ireland classify aquifers according to hydrogeological characteristics, size and productivity of the groundwater resource. The three main classifications are Regionally Important Aquifers (RI), Locally Important Aquifers (LI) and Poor Aquifers (P). All route options in this MCA1 pass through Locally Important Aquifers. Options 2B, 2E, 2G and Options 3L and 3M also pass through a Poor Aquifer. Groundwater Vulnerability is a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. The vulnerability is determined by the permeability and thickness of the overlying deposits. All route options pass through areas of Moderate, High and Extreme vulnerabilities. Options 3L and 3M also pass through areas of Low vulnerability. Options 1E and 1H, Options 2A, 2E, 2F and Option 3A pass through areas of either (i) rock at or near the surface, or (ii) karst. The potential hydrogeological constraints within the scheme study area were identified through the assessment of the aquifer classification, groundwater vulnerability and karst landforms. In conclusion, groundwater was not considered therefore to be an environmental constraint and was not considered therefore to be a significant differentiator in determining preferred routes and thus did not require further evaluation in this MCA1. <u>Surface water</u> The main constraints associated with surface water (hydrology) considered in this MCA1 are surface water bodies, flood plains and flood risks. There are a number of water bodies within the study area including River Tolka, the Finglaswood Stream and The Royal Canal. The River Tolka rises near Culmullin Cross Roads and with a network of small tributaries flows through Batterstown, Black Bull, Duboyne, Clonee, Mulhuddart, Blanchardstown, Finglas Bridge, Glasnevin, north Strand and east Wall before discharging into the Tolka Estuary in County Dublin. The Tolka River Estuary is a Special Protection Area. The EPA classifies the water quality status of existing watercourses in Ireland, such as the River Tolka, based on monitoring collated information. This collated information relating to water quality and macro-invertebrate community composition is condensed to a numerical scale of Q-values or Biotic Indices. The River Tolka is considered to be Moderately Polluted (Q-Value 2-3). The status of the River Tolka at the crossing points of all route options is affected by being located at the downstream end of its catchments, and the main pressures are generally upstream pollution, combined sewer overflows, misconnections of wastewater and urban run-off.	No

Aspect	Analysis of Environmental MCA1 Route Options	Differentiator?
	The Finglaswood stream is a small stream that originates in the village of Finglas on the northern outskirts of Dublin City. It flows in a southerly direction for 5km and outfalls to the river Tolka some 200 metres west of and upstream of Finglaswood Bridge in the Tolka Valley Park. The Finglaswood Stream was once an open stream but it is now culverted entirely and drains such areas as the large housing estates of Gortmore, Barnmore, Wellmount and Kippure all of which have been designed on the basis of a completely separate drainage system. The Royal Canal is an artificial water body and is classified based on its ecological potential rather than ecological status. The Royal Canal achieved good ecological potential in the 2013-2015 period. Other surface water bodies include the Tolka Valley Park Ponds, reservoirs and drains. All route options cross both the Royal Canal and the River Tolka and directly impact both water bodies. No other surface water bodies are crossed by the route options. In November 2002, a flooding event occurred along the River Tolka within the current study area. In 2004, flood relief works were undertaken on behalf of Dublin City Council. All options will impact directly on this historic flood plain. All options will also be within 10m of the Office of Public Works (OPW) flood point at Broombridge railway Station (October 2011). No options will have a direct impact on OPW flood points. The potential hydrological constraints within the scheme study area were identified through the assessment surface water bodies, flood plains and flood risks. In conclusion, surface water was not considered to be an environmental constraint and was not considered therefore to be a significant differentiator in determining preferred routes and thus did not require further evaluation in this MCA1. All options are expected to have a slight impact on constraints.	
Air	The main constraints associated with air quality are the number of sensitive locations in the scheme study area and the baseline air quality relative to regulatory limit values. Sensitive receptors include dwellings, health care facilities, places of worship, schools and sports centres. Following a review of the constraints mapping, it was determined that there was no significant difference between the number of sensitive receptors along each route option. Under the Clean Air for Europe Directive, EU member states must designate "Zones" for the purpose of managing air quality. For Ireland, four zones were defined in the Air Quality Standards Regulations (S.I. No. 180 of 2011). Zone A is defined under the Regulations as Agglomeration A — Dublin Conurbation. The EPA operate a particulate monitoring station on Sean Ennis Road within the study area. The air quality recorded at this location is shown to be well within air quality standards for PM10 and PM2.5. Furthermore, air quality recorded at other locations in Zone A for other pollutants including NO2, benzene and carbon monoxide are compliant with the air quality standards. Air quality was not considered to be an environmental constraint and was not considered therefore to be a significant differentiator in determining preferred routes and thus did not require further evaluation in this MCA1. It is expected that the main air quality impacts due to the proposed Scheme will occur during the Construction Phase. The proposed Scheme is expected to have a positive impact on air quality during the operational phase by encouraging a modal shift away from private car. All options are expected to have a positive impact on constraints.	No
Climate	The generation of greenhouse gas emissions associated with the construction and operational stages of the proposed Scheme are considered in this Climate assessment.	No

Aspect	Analysis of Environmental MCA1 Route Options	Differentiator?
	There is the potential for climate impacts due to the proposed Scheme to occur during the construction phase due to greenhouse gas emissions from the manufacture of construction materials, the transportation of materials and use of plant and equipment. During the Operational Phase, the proposed Scheme would be expected to have a positive impact on climate by encouraging a modal shift away from the private car. However, it is envisaged that Luas Finglas LRVs would be powered by electricity as per the remainder of the Luas network. The generation of electricity will result in carbon emissions associated with Luas Finglas. Whilst the length of the route options may result in different levels of greenhouse gas emissions, during both Construction and Operational Phases, they were not considered to be significant differentiators in this MCA1. All options are expected to have a slight impact on constraints.	
Noise and Vibration	<u>Noise</u> Noise impacts on constraints associated with the provision of Luas Finglas infrastructure were considered to be a differentiator in this MCA1. <u>Vibration</u> The main constraints associated with vibration are the number of sensitive locations. Vibration sensitive receptors include human beings and buildings. It is expected that the main impacts associated with vibration due to the proposed scheme will occur during the Construction Phase. Vibration effects associated with operations are not considered to be significant and are unlikely to cause building damage to structures or nuisance. Vibration was not considered to be an environmental constraint and was not considered therefore to be a significant differentiator in determining preferred routes. Thus, it did not require further evaluation in this MCA1. All options are expected to have a slight impact on constraints.	Yes
Electromagnetic Radiation and Stray Current	The main constraints associated with Electromagnetic Radiation are the number of sensitive locations in the scheme study area. Sensitive receptors include facilities that have highly sensitive equipment, health care facilities, signalling on rail networks, and telecommunications infrastructure. Following a review of the constraints mapping, it was determined that there was no significant difference between the number of sensitive receptors along each route option. The main constraints associated with Stray Current are the number of sensitive locations in the Scheme study area. Sensitive receptors include underground utilities, chemical industry installations and signalling on rail networks. Following a review of the constraints mapping, it was determined that there was no significant difference between the number of sensitive receptors along each route option. Radiation and Stray Current were not considered to be an environmental constraint and were not considered therefore to be a significant differentiator in determining preferred routes and thus did not require further evaluation in this MCA1. Options are expected to have no negative impact on constraints.	No

Aspect	Analysis of Environmental MCA1 Route Options	Differentiator?
Material Assets: Property and Agronomy	Material Assets-Property This aspect was considered separately as part of the Economy criterion in the overall multi-criteria analysis commensurate with the information available at the route option assessment stage. Material Assets-Agronomy Given the urban / suburban nature of the proposed Scheme and the assumption that Luas Finglas will run on predominantly existing road infrastructure this aspect was not considered to be relevant to the assessment. Material Assets were not considered to be an environmental constraint and were not considered therefore to be a significant differentiator in determining preferred routes and thus did not require further evaluation in this MCA1. Options are expected to have no negative impact on constraints.	No
Landscape	The main constraints associated with landscape and visual environmental aspect are associated with protected views / prospects and protected trees in the study area. Protected views and prospects DCC recognises the importance of views and prospects. Policy GI8 of the Dublin City Council Development Plan (DCCDP) 2016-2022 commits to protect and enhance views and prospects which contribute to the appreciation of landscape and natural heritage. In addition, Objective SC04 of the DCCDP 2016-2022 commits to undertake a 'Views and Prospects' study, with the aim of compiling a list of views and prospects for protection and / or enhancement which will be integrated with, and complement the urban form and structure of the city. Objective GI08 of the DCCDP 2016-2022 commits to undertake a 'Views and Prospects' study to identify and protect the key views and prospects of the city. Additional views and prospects may be identified through the development management process and local area plans. The DCCDP 2016-2022 identified 16 indicative 'Key Views and Prospects'. However, all 16 indicative 'Key Views and Prospects' are located outside the study area for Luas Finglas. Therefore, there will be no impact from the 14 route options on these indicative 'Key Views and Prospects'. Protected Trees There are three existing Tree Preservation Orders identified within the DCCDP 2016-2022. These three TPOs are located outside the study area for Luas Finglas. Therefore, there will be no impact from the 14 route options on existing TPOs. Options are expected to have no negative impact on constraints considered within this MCA1.	No
Population and Human Health	Elements of socioeconomics such as journey times, catchment analysis, transport integration, planned development in the area, quality of service for cyclists etc. were assessed under other non-environmental criteria and will be considered as part of the multi-criteria analysis. Other aspects of 'Population' including Electoral Division population, employment and lifestyle statistics, presence of employment centres, community facilities were not considered to be differentiators in this MCA1. Constraints and impacts in relation to Human Health from the proposed scheme were considered in the following environmental aspect (i) Air, (ii) Noise and Vibration and (iii) Climate. They were not considered further in this section and thus, it was determined that 'Human' Health was not a differentiator in this MCA1. All options are expected to have a slight impact on constraints.	No
Vulnerability of the proposed	The amended EIA Directive 2014/52/EU states the need to assess *'the expected significant adverse effects of the project on the environment deriving*	No

Aspect	Analysis of Environmental MCA1 Route Options	Differentiator?
Scheme to risks of major accidents and / or disasters	*from the vulnerability of the project to risks of major accidents and / or natural disasters which are relevant to the project concerned". Recital 15 of the Directive identifies that the underlying objective of the assessment is to ensure that appropriate precautionary actions are to be taken for those projects which "because of their vulnerability to major accidents and / or natural disasters (such as flooding, sea level rise or earthquakes), are likely to have significant adverse effects on the environment'.* Irrespective of the option eventually selected as the Emerging Preferred Route, the proposed Scheme will be designed, constructed and operated in line with best international current practice and, as such, major accidents will be very unlikely. Constraints and impacts in relation to flooding were considered within the 'Water' aspect of this assessment. Natural disasters such as sea level rise and earthquakes were not considered relevant to the proposed Scheme. Therefore, it was determined that 'Vulnerability of the proposed Scheme to risks of major accidents and / or disasters' was not a differentiator in this MCA1. Options are expected to have no negative impact on constraints.	
Cultural Heritage	The provision of Luas Finglas infrastructure has the potential to impact on cultural heritage within the study area. Impacts will differ between the route options and thus Cultural heritage was considered to be a differentiator in this MCA1.	Yes

As shown in Table 4-7, all 14 environmental aspects as listed on Annex IV of the Directive 2011/92/EU as amended by the Directive 2014/52/EU (European Union, 2014) were considered for each of the 14 route options and, following that consideration, only Biodiversity, Noise and Cultural Heritage were identified as directly influencing the development of route options at this stage and are thus considered in greater detail.

A summary of the overall results as part of the MCA1 is shown in Table 4-8 below.

Table 4-8: Overall MCA1 Options Assessment Results (Source: Luas Finglas Options Selection Report Stage 1)

Criterion	Parameter	Options 1		Options 2						Options 3					
		1E	1H	2A	2B	2C	2E	2F	2G	3A	3F	3J	3K	3L	3M
Economy	Cost														
	Catchment														
	Journey Time														
Integration	Compatibility with Development Plan (Land Use)														
	Integration with GDA Transport Policy and Networks														
Environment	Material and Cultural Assets*														

Criterion	Parameter	Options 1		Options 2						Options 3					
		1E	1H	2A	2B	2C	2E	2F	2G	3A	3F	3J	3K	3L	3M
	Natural Aspects**														
Accessibility and Social Inclusion	Social Inclusion														
	Key Attractors served														
Safety	Public / Road Interfaces / RSA Collisions Map														

*Material and Cultural Assets refer to archaeological, architectural and cultural heritage sites.

**Natural Aspects: included all 14 environmental aspects as listed on Annex IV of the Directive 2011/92/EU as amended by the Directive 2014/52/EU but Cultural Heritage (assessed separately). Biodiversity and Noise are included as part of this assessment.

Legend – Colour coded ranking scale:

- *Significant comparative advantage over other options*
- *Some comparative advantage over other options*
- *Comparable to other options*
- *Some comparative disadvantage over other options*
- *Significant comparative disadvantage over other options*

Table 4-9 summarises the narrative for the scoring given in Table 4-8 both from an overall and environmental impact viewpoint.

Table 4-9: Overall MCA1 Options Assessment Results (Source: Luas Finglas Options Selection Report Stage 1)

Option Assessed	Overall Analysis	Environmental Analysis
Five of the 14 options show an overall low score on several sub-criteria:		
1H	This option scores significantly lower than other options on cost, journey time and safety, lower than other options on integration with Transport Policies and compatibility with Development Plans, while not delivering significantly better results on catchment. Despite being a good option from environmental and social inclusion viewpoints, it does not deliver on significant criteria compared to other options.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on the wing wall of Broombridge Bridge which is a Protected Structure (RPS 909); a direct impact on the Zones of Notification relating to the ecclesiastical complex of St Canice, incorporating a church and graveyard (DU014-066009 / DU017-066017). This zone is impacted on both Wellmount Road and the R135. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. Noise This proposed route passes within 100m of approximately 400 sensitive receptors. Option 1H traverses roads with predicted noise levels ranging from 55-70dBA (Lden). Noise impacts associated with the operation of a light rail scheme along this route option may have a slight impact on a sensitive receptor.
2E	This option scores significantly lower than other options on cost, journey time and impact on Material and Cultural Assets, lower than other options on Natural aspects, Serving the Key Trip Attractors and Compatibility with Development Plans, while not delivering significantly better results on catchment.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on three Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909), the parapet wall of Finglas Wood Bridge (RPS 906) and the boundary wall and entrance of "The Elms" (RPS 1553). It will have a direct impact on the Zones of Notification relating to four RMPs comprising DU014-076001 (Castle – towerhouse), DU014-066005 (House – 16th / 17th century) and DU014-066008 (Town Defences / King William's Ramparts) at Patrickswell Place and the ecclesiastical complex of St Canice, incorporating a church and graveyard 9DU014-066009 / DU017-066017) on Church Street. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. There will be a direct impact on the DCC Integrated Constructed Wetlands in Tolka Valley Park. This may result in indirect impacts on the bird population, invertebrates and plant life present in Tolka Valley Park due to loss of habitat. In addition, impacts on the ICW may result in a direct impact on the River Tolka due to increased pollutant loadings.

Option Assessed	Overall Analysis	Environmental Analysis
		Noise This proposed route passes within 100m of approximately 520 sensitive receptors. Option 2E passes through an area between Tolka Valley Road and Wellmount Road with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
3K	This option scores significantly lower than other options on Social Inclusion, Safety, and Compatibility with Development Plans lower than other options on Integration with Transport Policies and Impact on Material and Cultural Assets, but it delivers some or significant advantages over other options on Journey Time (very fast option), Catchment, and Key Trip Attractors.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-079--- (Rose Hill House); a direct Impact on three Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909), the complete extent of Finglas Wood Bridge (RPS 906) and the curtilage of Rose Hill House (RPS 4850). It will also have a direct impact on three Conservation Areas comprising the Royal Canal (CA38), the Tolka River (CA37) and Rose Hill House (CA07). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. This Option will have a slight impact on ecological constraints. Noise This proposed route passes within 100m of approximately 390 sensitive receptors. Option 3K passes through an area between Tolka Valley Road and R132 with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
3L	This option scores significantly lower or lower than other options on all criteria, except Safety and Key Trip Attractors.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the complete extent of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zone of Notification relating to the ecclesiastical complex of St Canice incorporating a church and graveyard (DU014-066009 / DU017-066017) on the R135. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37).

Option Assessed	Overall Analysis	Environmental Analysis
		Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. This Option will have a slight impact on ecological constraints. Noise This proposed route passes within 100m of approximately 640 sensitive receptors. Option 3L passes through an area between Tolka Valley Road and R132 with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
3M	This option scores significantly lower or lower than other options on all criteria.	Material and Cultural Assets This option will have a direct Impact on two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the complete extent of Finglas Wood Bridge (RPS 906). It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the Tolka River (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. This Option will have a slight impact on ecological constraints. Noise This proposed route passes within 100m of approximately 730 sensitive receptors. Option 3M passes through an area between Tolka Valley Road and R132 with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
Six of the 14 Options show a mixed outcome.		
2B	This option scores significantly lower than other options on Cost and Journey Time and lower than other options on Key Trip Attractors and Natural aspects, but it	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the parapet wall of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zones of Notification relating to four RMPs comprising DU014-076001 (Castle – towerhouse); DU014-066003 (House -17th century), DU014-066005

Option Assessed	Overall Analysis	Environmental Analysis
	delivers some advantages over other options on all other criteria.	(House – 16th/17th century) and DU014-066008 (Town Defences / King William's Ramparts) at two locations on Patrickswell Place. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the Tolka River (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. There will be a direct impact on the DCC Integrated Constructed Wetlands in Tolka Valley Park. This may result in indirect impacts on the bird population, invertebrates and plant life present in Tolka Valley Park due to loss of habitat. In addition, impacts on the ICW may result in a direct impact on the River Tolka due to increased pollutant loadings. Noise This proposed route passes within 100m of approximately 520 sensitive receptors. Option 2B passes through an area between Tolka Valley Road and Wellmount Road with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
2C	This option delivers some advantages over other options on the majority of all criteria, with the significant exception of Journey Time (Red). It also scores lower than other options on Safety, Key Trip Attractors and Natural Aspects (this last as the majority of options).	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the parapet wall of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zones of Notification relating to four RMPs comprising DU014-076001 (Castle – towerhouse); DU014-066003 (House -17th century), DU014-066005 (House – 16th/17th century) and DU014-066008 (Town Defences / King William's Ramparts) at two locations on Patrickswell Place. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. There will be a direct impact on the DCC Integrated Constructed Wetlands in Tolka Valley Park. This may result in indirect impacts on the bird population, invertebrates and plant life present in Tolka Valley Park due to loss of habitat. In addition, impacts on the ICW may result in a direct impact on the Tolka River due to increased pollutant loadings.

Option Assessed	Overall Analysis	Environmental Analysis
		Noise This proposed route passes within 100m of approximately 380 sensitive receptors. Option 2C passes through an area between Tolka Valley Road and Wellmount Road with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
2F	This option delivers some advantages over other options on half of the criteria and has only one red scoring over the Compatibility with Development Plans.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the parapet wall of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zones of Notification relating to four RMPs comprising DU014-076001 (Castle – towerhouse) and the ecclesiastical complex of St Canice, incorporating a church and graveyard (DU014-066009 / DU017-066017). This zone is impacted on Wellmount Road and the R135. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. There will be a direct impact on the DCC Integrated Constructed Wetlands in Tolka Valley Park. This may result in indirect impacts on the bird population, invertebrates and plant life present in Tolka Valley Park due to loss of habitat. In addition, impacts on the ICW may result in a direct impact on the Tolka River due to increased pollutant loadings. Noise This proposed route passes within 100m of approximately 260 sensitive receptors. Option 2B passes through an area between Tolka Valley Road and Wellmount Road with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
2G	This option scores significantly lower than other options on journey time and Key Trip Attractors, and lower than other options on Cost, Catchment and Social Inclusion.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the parapet wall of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zones of Notification relating to two RMPs comprising DU014-076001 (Castle – towerhouse) and the ecclesiastical complex of St Canice, incorporating a

Option Assessed	Overall Analysis	Environmental Analysis
		church and graveyard (DU014-066009 / DU017-066017) on Wellmount Road. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. There will be a direct impact on the DCC Integrated Constructed Wetlands in Tolka Valley Park. This may result in indirect impacts on the bird population, invertebrates and plant life present in Tolka Valley Park due to loss of habitat. In addition, impacts on the ICW may result in a direct impact on the River Tolka due to increased pollutant loadings. Noise This proposed route passes within 100m of approximately 500 sensitive receptors. Option 2B passes through an area between Tolka Valley Road and Wellmount Road with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
3F	This option scores high on Catchment, Journey Time and Key Trip Attractors and shows no criteria in which it delivers significant disadvantages than other options.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the complete extent of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zone of Notification relating to the ecclesiastical complex of St Canice incorporating a church and graveyard (DU014-066009 / DU017-066017) on both Wellmount Road and the R135. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. This Option will have a slight impact on ecological constraints. Noise This proposed route passes within 100m of approximately 320 sensitive receptors. Option 3F passes through an area between Tolka Valley Road and Wellmount Road with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III).

Option Assessed	Overall Analysis	Environmental Analysis
		However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
3J	This option scores high on Catchment, Journey Time and Key Trip Attractors, but significantly lower than other options on Safety, partially because of its extensive running along the R135.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the complete extent of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zones of Notification relating to the ecclesiastical complex of St Canice, incorporating a church and graveyard (DU014-066009 / DU017-066017) on the R135. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. This Option will have a slight impact on ecological constraints. Noise This proposed route passes within 100m of approximately 350 sensitive receptors. Option 3J passes through an area between Tolka Valley Road and R132 with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
Three of the 14 options show an overall good to high score on several criteria and are therefore recommended for further assessment. They are:		
1E	This is one of the best options, scoring better or significantly better than other options on almost all criteria, with the exception of Journey Time and Compatibility with Development Plans where it delivers some disadvantages. It is also one of the few options scoring better than others on Natural aspects.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on the wing wall of Broombridge Bridge which is a Protected Structure (RPS 909); a direct impact on the Zones of Notification relating to three RMPs comprising DU014-066003 (House - 17th century), DU014-066005 (House – 16th / 17th century) and DU014-066008 (Town Defences / King William's Ramparts). The latter will be impacted at two locations on Patrickswell Place. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka.

Option Assessed	Overall Analysis	Environmental Analysis
		Noise This proposed route passes within 100m of approximately 400 sensitive receptors. Option 1E traverses roads with predicted noise levels ranging from 55-70dBA (Lden). Noise impacts associated with the operation of a light rail scheme along this route option may have a slight impact on sensitive receptor.
2A	This is one of the best options, scoring better or significantly better than other options on almost all criteria, with the significant exception of Key Trip Attractors and Natural aspects. This option scores highest in terms of Cost and directness (Journey Time), as with Option 3A.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the parapet wall of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zones of Notification relating to four RMPs comprising DU014-076001 (Castle – towerhouse); DU014-066003 (House - 17th century), DU014-066005 (House – 16th / 17th century) and DU014-066008 (Town Defences / King William's Ramparts) at two locations on Patrickswell Place. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. There will be a direct impact on the DCC Integrated Constructed Wetlands in Tolka Valley Park. This may result in indirect impacts on the bird population, invertebrates and plant life present in Tolka Valley Park due to loss of habitat. In addition, impacts on the ICW may result in a direct impact on the River Tolka due to increased pollutant loadings. Noise This proposed route passes within 100m of approximately 260 sensitive receptors. Option 2A passes through an area between Tolka Valley Road and Wellmount Road with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).
3A	Very similar to 2A, with very similar outcomes.	Material and Cultural Assets This option will have a direct impact on one RMP DU014-066000 (the Historic Town of Finglas); a direct Impact on two Protected Structures comprising the wing wall of Broombridge Bridge (RPS 909) and the complete extent of Finglas Wood Bridge (RPS 906). It will have a direct impact on the Zones of Notification relating to three RMPs comprising DU014-076001 (Castle – towerhouse); DU014-066003 (House - 17th century), DU014-066005 (House – 16th / 17th century) and DU014-066008 (Town Defences / King William's Ramparts) at two

Option Assessed	Overall Analysis	Environmental Analysis
		locations on Patrickswell Place. It will also have a direct impact on two Conservation Areas comprising the Royal Canal (CA38) and the River Tolka (CA37). Biodiversity There will be no direct impacts on internationally important designated sites. There will be a direct impact on the Royal Canal pNHA and the Tolka Valley Park. There will be a direct impact on the DCC Strategic Green Networks at the Royal Canal and the River Tolka. This Option will have a slight impact on ecological constraints. Noise This proposed route passes within 100m of approximately 320 sensitive receptors. Option 3A passes through an area between Tolka Valley Road and Wellmount Road with noise levels <55dBA (Lden) (according to DCC strategic noise mapping Phase III). However, the remainder of this route option traverses areas with predicted noise levels ranging from 55-70dBA (Lden).

4.8.1.3. Conclusions

Five of the 14 options showed an overall low score on several sub-criteria and were not brought forward. Six of the 14 Options showed a mixed outcome. Of the six options delivering mixed results:

- Options 3J and 3F were very similar in alignment, and Option 3J was brought forward over Option 3F because of its slightly better performances on Accessibility and Social Inclusion, despite its slightly lower performances on Safety;
- Option 2C was thoroughly considered because, while it did not excel on any criteria, it showed positive outcome on Integration and had no red scores. Despite this, and following a thorough analysis, Option 2C was not considered further because of the additional challenges associated with the passage through the core of the Village and the traffic, runtime and reliability implications. At this stage, it was assumed that all other criteria being similar, other options would deliver similar outcomes and stop locations with less interaction with traffic and specifically with the Five Arms junction;
- Of the other of these six options, none appear to deserve to be brought forward (2B,2F and 2G).
  - Option 2B scored significantly lower or lower than other options on Cost and Journey Time, Key Trip Attractors and Natural aspects.
  - Option 2F delivered a red scoring in terms of Compatibility with Development Plans.
  - Option 2G scored significantly lower or lower than other options on journey time and Key Trip Attractors, Cost, Catchment and Social Inclusion.

Three of the 14 options show an overall good to high score on several criteria and were therefore recommended for further assessment. They were:

- Options 2A and 3A - brought forward, potentially as a single corridor, subject to a more detailed alignment / catchment analysis of the lower section of the route to be carried out as part of the Stage 2. It was suggested that within Stage 2, the sub-option across Mellowes Road that did not cross through the Garda Station car park was to be assessed also.
- Option 1E, despite scoring high on the majority of the criteria, was not brought forward following the consideration of the most recent information at the time about the new Iarnród Éireann Station to be built between Broombridge and Ashtown. This station would be built adjacent to the Ashington Park, opposite Royal Canal Avenue. A new pedestrian / cyclist overbridge would also be built to link the station to the Pelletstown area, providing direct access to urban and suburban railway services and to the Luas via Broombridge interchange. Having considered this new information and following a meeting with the NTA in March 2019 during the drafting of Option Selection Report Stage 1, it was agreed not to progress this option further, in consideration of other shortlisted options that provided a better and more direct service to Finglas and Charlestown. It was noted that only the Options 1 served the Pelletstown area and therefore would have benefitted by this within the Key Trip Attractors criteria, but of these, only Options 1E and 1H passed the initial screening. Option 1H subsequently failed on the Economy and Safety criteria. Therefore, this comparatively late decision was deemed not to impact in any way on the robustness of Stage 1 of the options selection process since the elimination of Pelletstown from the Key Trip Attractors (KTA) criteria would not have changed the relative scoring of all other options.

The result of this process was a collection of feasible route options (Options 2A, 3A and 3J) which were to be taken to a more detailed Multi-Criteria Analysis (MCA2), including Cost Benefit Analysis (CBA).

The options to be brought forward to the MCA2 process are shown graphically in Figure 4-6. These three options were representative of the whole study area as they span from Finglas West (2A-3A), to East (3J).

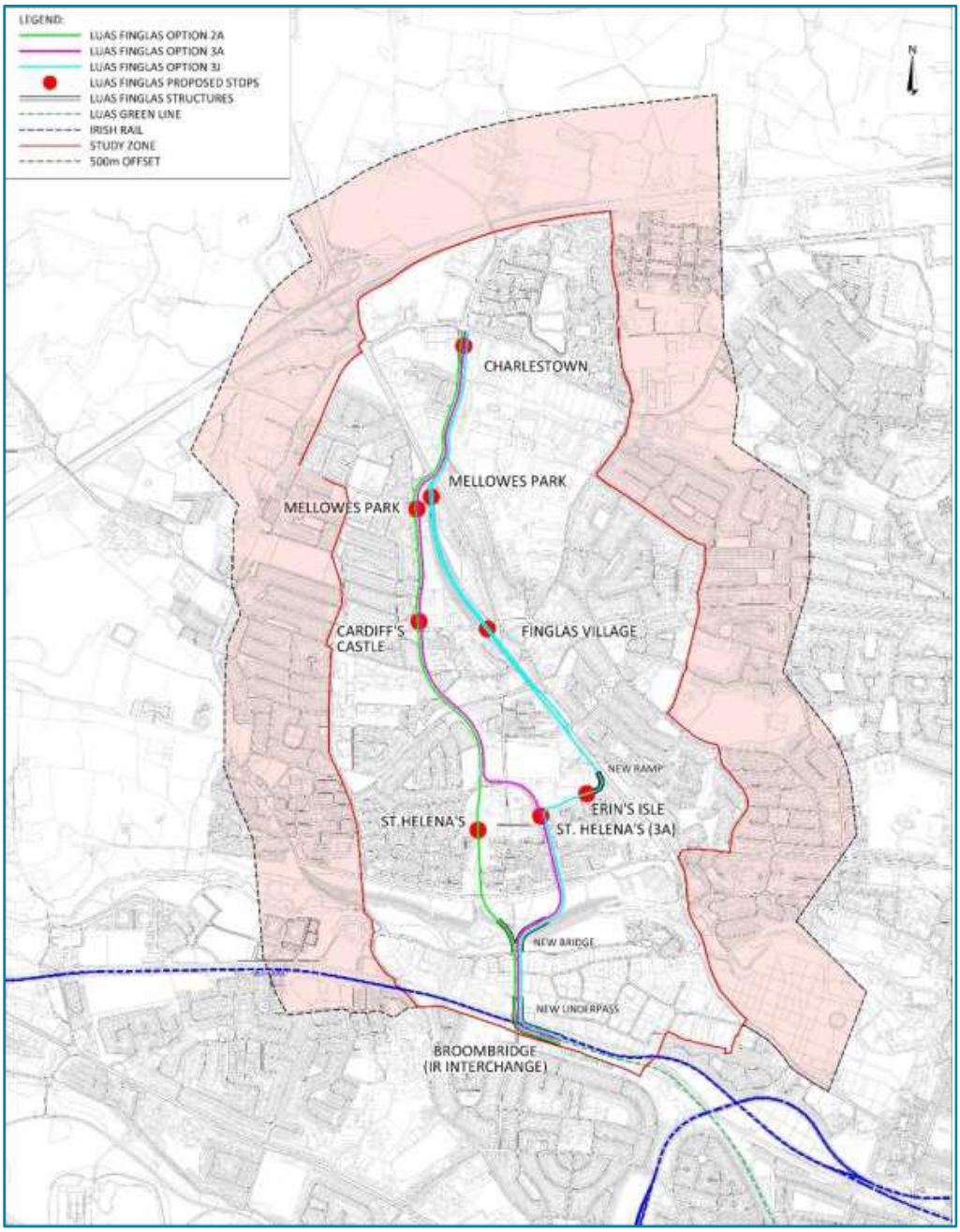


Figure 4-6: Luas Finglas Route Options for further analysis (MCA2) (Source: Luas Finglas Options Selection Report Stage 1)

4.8.2 Luas Finglas Option Selection Report – Stage 2

Following the Stage 1 assessment for the proposed Scheme, a "Luas Finglas Options Selection Report Stage 2" was prepared and included a technical assessment, a preliminary Cost Benefit Analysis (CBA), an environmental and multi-criteria analysis.

The aim of this report, completed in January 2020, was to assess the overall viability of the proposed Scheme and to determine the Emerging Preferred Route (EPR) starting from the three shortlisted options of the Luas Finglas Options Selection Report Stage 1. The Option Selection Report Stage 2 summarised below is included in Volume 5 – Appendix A4.2 of this EIAR.

Between the completion of the Stage 1 assessment and commencement of Stage 2, a number of optimisations were identified and developed by TII in conjunction with stakeholders, including the NTA, DCC

and the public. These improvements came in the light of new analysis and design details being available at the time. The following optimisations were proposed:

- **Mellowes Park route optimisation for Routes 2A and 3A** - Further assessment of route Options 2A and 3A highlighted the need for an improvement in the localised alignment for Mellowes Park whereby the route is to be shifted to the east of the park's open space. This places the line adjacent to the R135 and avoids severance of the park from nearby residential areas. The alignment will also avoid crossing the Garda Station car park, and thus avoids severing it from the Garda Station building. Secondary benefits include: the potential to align the proposed Scheme closer to Finglas Village, without overly compromising or competing with the potential BusConnects corridor on the R135. Moving the line eastwards has few implications for the northern section of the line (adjacent to the proposed Mellowes Park Luas Stop) but does introduce a number of low-radius curves in the vicinity of Cardiff Castle Road and Mellowes Road (R103);
- **Cycle lanes and facilities inclusion** - In discussion with stakeholders, it was proposed that a cycle lane be included along much of the proposed Scheme, particularly where it run through green areas. This will allow for the pragmatic use of the corridor for active modes and LRT-cycle trips which, in turn, will lead to increased public transport usage as behaviours and perception change. The cycle facilities proposed alongside the proposed Scheme are dedicated off-road cycle lanes. These high-quality facilities are to be provided where space reasonably permits their construction. Providing a cycle route in parallel with, and ideally adjacent to the proposed Scheme, allows an increase in active mode travel between the Broombridge, Finglas and Charlestown areas. The Stage 1 shortlisted corridors will be able to accommodate varying levels of cycle lane provision along their lengths, although the availability of land surrounding Route 2A particularly would facilitate the provision of high-quality cycle infrastructure. Each of the Luas Stops along the route corridors seeks to accommodate appropriate cyclist encouraging facilities, such as cycle parking and cycle racks. These would be particularly beneficial for those seeking to interchange as part of LRT-cycle trips;
- **Development of Route 3J sub-options** - With a more in-depth analysis of Route 3J, it emerged that Luas Finglas tracks would be required to cross the slip lanes of the R135 at signal-controlled junctions. These will be required across each of the four slip-lane crossing points (in and out of the northbound and southbound lanes), which could have detrimental effects on the current free flow traffic arrangement. There is a risk that this might be less appropriate in terms of road traffic capacity. Additionally, providing Luas tracks in the bus lanes would create potential safety hazards for cyclists at the shallow crossing angles, due to the presence of grooved rails. With the previous considerations, and the requirement to address the majority of the shortcomings, the option was further refined and optimised. As a result, Route 3J was sub-divided into Route 3Ja and Route 3Jb, respectively splitting the two directions of Luas travel to both sides of the R135 and maintaining both directions of Luas travel on the western side of the R135. Both sub-options run from Broombridge to Erin's Isle Stop, and along the St Margaret's Road, while they differ in the central section of Finglas Road, for approximately 1.4km. Route 3Ja was assessed as the original 3J configuration, whereas 3Jb instead was assessed as a single dual-track configuration on the west of the R135 only. The Stage 2 options assessment process therefore independently assessed Route 3Ja and Route 3Jb separately;
- **Luas Fleet and Stabling**: The Stage 1 Luas fleet assessment was based on the initial alignment of each route option. In the Stage 2 assessment, Routes 2A and 3A are presented with a change to their alignments, thus the initial fleet estimation required an update. Additional LRV will be necessary for the efficient operation of the new Luas line, so additional space for stabling the increased fleet will be required. The main factor determining the fleet size is the length of the route, but the difference in length across the four route options is minimal. Thus, the fleet parameter is not considered a determining factor for the final selection of the optimal route.

An overview of the final shortlisted four route options brought forward to the Stage 2 option selection process is provided in Figure 4-7 and Table 4-10 below.

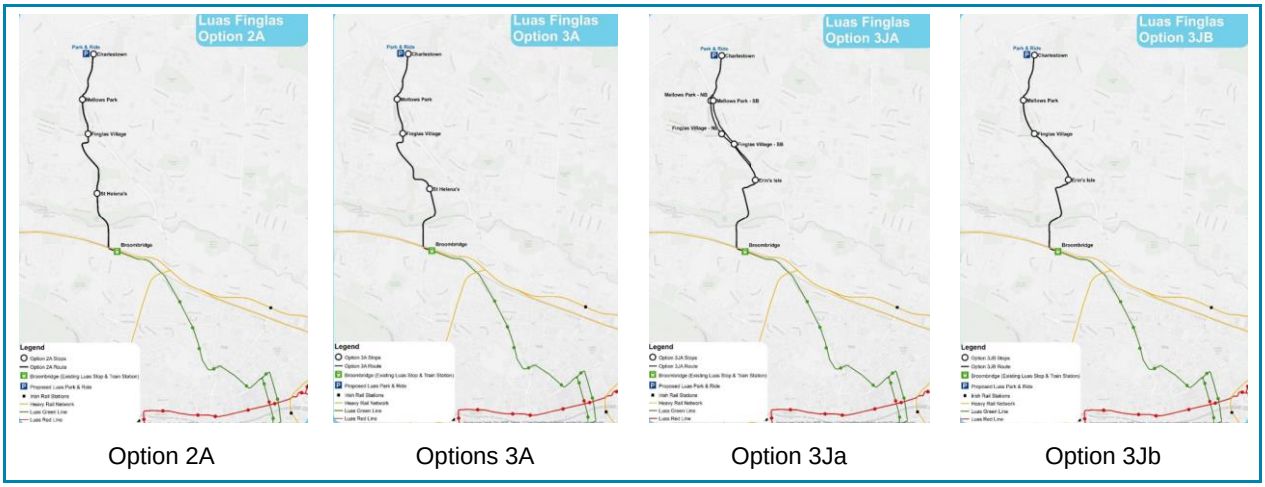


Figure 4-7: Route options brought forward to Stage 2 (Source: Luas Finglas Options Selection Report Stage 2)

Table 4-10: Summary of shortlisted four route options brought forward to the Stage 2

Option	Length	End to End runtime (estimate)	Key Features
2A	3.9km	13 minutes	▪ Located approximately 300m from Finglas Village; ▪ High connectivity for increasingly deprived areas west of Finglas; ▪ Significant sections of grass track to reduce environmental impacts; and ▪ Good access to Erin's Isle GAA club and surrounding recreational facilities.
3A	4.2km	14 minutes	▪ Improved access to the Tesco Clearwater and surrounding retail; ▪ Located approximately 300m from Finglas Village (similar to 2A); ▪ High connectivity for areas west of Finglas; and ▪ Improved access to the education and sports facilities of St Oliver Plunkett's National School and Rivermount Boys Football Club.
3Ja	4.2km	14 minutes	▪ Split track arrangement where some existing infrastructure may be able to be shared amongst several public transport options; and ▪ Closer line to Finglas Village, particularly its southbound Stop that would be anticipated to serve AM commuters to the city centre well.
3Jb	4.2km	13 minutes	▪ The most eastern, dual-track arrangement operating near Finglas Village; ▪ Likely to be easier to design, construct and operate than its split-track counterpart (Route Option 3Ja); and ▪ Provides good connectivity to several key trip attractors, including several retail, recreational and educational facilities around Erin's Isle.

4.8.2.1. Multi-Criteria Analysis (MCA2)

As mentioned above, four shortlisted route options were brought forward to the Stage 2 multi-criteria assessment (MCA2), which built on the Stage 1 MCA (MCA1). The Stage 2 multi-criteria assessment (MCA2) criteria, under which each route option was assessed, included Economy, Integration, Accessibility and Social Inclusion, Safety, Environment and Physical Activity.

A summary of the analysis of the four individual end-to-end route options is presented in Table 4-11.

Table 4-11: Summary of Stage 2 Multi-Criteria Analysis Outputs (Source: Options Selection Report Stage 2, 2020)

MCA2 Route Option	Analysis of MCA2 Route Options
Option 2A	**Economy:** The Benefit Cost Ratio (BCR), Plausible Catchment (predicted passenger Number) and Runtime estimates are highly favourable for this route option. Therefore, the total cost is highly favourable for Option 2A, compared to other options. The journey time is the fastest of all four options and therefore represents a time saving for passengers on this end-to-end option. **Integration:** Overall, Option 2A is considered to have some disadvantages over other route options in terms of Integration due to a weaker connection with the public transport network and greater distance of the Primary network (route 3B) of the GDA Cycle Network. However, route 2A (similarly to route 3A) scored relatively better on compatibility with BusConnects than the 3J alignments which maintain a higher percentage of overlap. **Environment:** Population and Human Health: the scoring across the option 2A is deemed to be comparable to all other options. There were no Seveso sites located within 700m of any of the route options. Therefore, the location of Seveso sites is not considered to be a differentiator across the different route options. Electromagnetic radiation and stray current have the potential to interfere with electronic equipment. This will be particularly important in proximity to the Finglas Garda station, which includes electricity masts. There are also offices and industrial locations in the area such as the Dublin Industrial Estate, which may have sensitive electronic equipment and may be heavily dependent upon telecommunications for its operation. As all route options travel through these areas, this is not considered a differentiation across the different route options. Biodiversity: the scoring across the option 2A is favourable in comparison with the other routes. Option 2A presents some disadvantages in terms of potential effects on populations of protected bird species, particularly Brent Geese, which are listed as of the special conservation interest of five SPAs in the area, with records of their presence in Tolka Valley Park and Farnham Drive, as it crosses a greater area of habitat potentially suitable for foraging geese. Soils and Geology The MCA2 for Soils and Geology determined highly negative impacts for all routes considered. A key consideration is associated with the generation and management of waste related to the presence of contaminated sites, namely at the Tolka Valley Park, a historical landfill. There is potential to release contaminants and emissions to the environment which could affect water quality and human health during the construction stage. All route options will directly impact the former landfill and therefore are comparable to each other under this criterion. Option 2A (similar to Option 3A) has associated reports of potential contaminated land in the open space / grassed area north and south of St Helena's Road, resulting in comparative advantage for Option 3Ja and Option 3Jb. Water Option 2A is considered favourable over other route options in terms of water due to a lesser extent of the route running over 'Extreme' vulnerability zones. There is also less likelihood but still some potential of flooding events, based on a lesser area of the route travelling along the R135, in close proximity to the Bachelors Stream floodplain. Air Quality and Climate All options are considered to be positive or neutral in terms of air quality and climate.

MCA2 Route Option	Analysis of MCA2 Route Options
	In terms of receptor sensitivity including residential areas, health care facilities, places of worship, schools and sports centres, the study area is characterised as having mostly high sensitivity receptors (residential) with a small number of medium sensitivity receptors (commercial) within 100m of the proposed Scheme for all route options. There is potential for dust soiling at sensitive residential receptors and in Finglas village during construction. In terms of Operational Phase impact, the nature of the development of a light rail vehicle system itself is not likely to directly result in significant air quality impacts. However, indirect emissions are likely due to induced traffic demand in the areas and due to the proposed 600 to 1,000 space Park & Ride facility. All route options will result in similar effects and therefore are comparable. The proposed Scheme has the potential to reduce congestion and associated greenhouse gas (GHG) emissions in urban areas. For the purposes of the MCA2, all route options will require similar construction works and therefore, GHGs emissions will be comparable across all route options. Similarly, the operational climate impacts will be comparable across all options. <u>Noise and Vibration</u> Option 2A is deemed to have significant advantages in terms of noise as it has the shortest length, has the fewest number of sharp bends and has the lowest number of proposed junctions / intersections with existing roads. In addition, it has the least number of noise sensitive receptors (NSRs) within 100m of the proposed Scheme. However, it presents significant disadvantages in terms of vibration as there are more cultural heritage resources located in proximity to Option 2A and therefore, there is the potential for greater vibration impacts associated with the construction phase along this route option. <u>Landscape</u> Option 2A is considered to have some comparable disadvantages in terms of landscape compared to the other route options as it travels through St Helena's Road with several 'very high (Category IV) sensitive residential receptors, with direct views of the Luas and the proposed St Helena's Stop, located within 20m of the proposed Scheme. <u>Material Assets</u> Option 2A (similar to Option 3A) has some comparative advantages over the other route options in terms of Material Asset due to the absence of major planning applications within 50m of the proposed route option. In addition, even though all of the route options encroach on existing properties, Option 2A will directly impact the least number of properties (21). However, it will affect eight car parking areas of the apartment blocks used by landowners of Mellowes Crescent Estate and the car parking areas of two community facilities located along the Mellowes Road. <u>Cultural Heritage</u> Option 2A is unfavourable in terms of Cultural Heritage compared to the other route options due to the number of impacts on archaeological, architectural, and cultural heritage constraints. All four Route Options will have equal direct impacts on a number of significant constraints, namely the CAs for the Royal Canal and the Tolka Valley. Respectively these CAs incorporate Broome Bridge and Finglas Wood Bridge which are Protected Structures (RPSs 909 and 906); all four Route Options will have a significant indirect visual impact on each of these constraints through the introduction of new bridge structures. All four Route Options will also have a direct impact on one RMP comprising the Historic Town of Finglas (DU014-066----). In addition to the aforementioned impacts common to all options, it will also have a direct impact on the Zone of Notification for four RMPs and three sites of archaeological potential along the proposed Scheme will be directly impacted. In summary, in relation to Soil, Vibration, Landscape and Cultural Heritage perspectives, Option 2A has some disadvantages over other options. However, it presents some advantages in terms of Biodiversity, Water and Material Assets, and has significant advantages in terms of Noise. Therefore, overall Option 2A is considered comparable to other options.

MCA2 Route Option	Analysis of MCA2 Route Options
	Accessibility and Social Inclusion: Option 2A is considered favourable from an Accessibility and Social Inclusion perspective. Route 2A have some advantages on improved provision of opportunities to deprived areas. The location of its more westward Luas Stops was advantageous in serving a higher number of 'disadvantaged' and 'very disadvantaged' people particularly. **Safety:** Option 2A is considered to have some advantages over other route options in terms of Safety due to being more favourable with regard to: road safety with a lower number of recorded collisions and a shorter length (one quarter) of shared track with the road network; cycling safety with its greater space availability and the avoidance of a significant interface with the comparatively higher speed R135; and personal safety as parklands and open spaces would be highly visible from a distance in most cases. **Physical Activity:** Option 2A is considered to present significant advantages in terms of physical activity when compared to other route options due to: its ability to accommodate the development of significant cycle parking in the future (Charlestown, Mellowes Park, St Helena's and Broombridge); the space available for cycle lanes parallel to the proposed Scheme, since it mostly travels along green areas; and its shorter average distance from the Luas Stops to recreational facilities (320m) and green spaces (433m).
Option 3A	**Economy:** The estimated total cost is favourable for Option 3A when compared to other route options. The Benefit Cost Ratio (BCR) and Plausible Catchment (predicted passenger Number) estimates are favourable for this route option. However, the journey time is the second lowest of all four options and therefore does not offer as significant a time saving for passengers on this route option. **Integration:** Overall Option 3A is considered to have some disadvantages over other route options in terms of Integration due to a weaker connection with public transport network and greater distance of the Primary network (route 3B) of the GDA Cycle Network. However, route 3A (similarly to route 2A) scored relatively better on compatibility with BusConnects than the route 3J alignments which maintain a higher percentage of overlap. **Environment:** Population and Human Health: the scoring across the option 3A is deemed to be comparable to all other options. There were no Seveso sites were located within 700m of any of the route options. Therefore, the location of Seveso sites is not considered to be a differentiator across the different route options. Electromagnetic radiation and stray current have the potential to interfere with electronic equipment. This will be particularly important in proximity to the Finglas Garda station, which includes electricity masts. There are also offices and industrial locations in the area such as the Dublin Industrial Estate which may have sensitive electronic equipment and may be heavily dependent upon telecommunications for its operations. As all route options travel through these areas, this is not considered a differentiation across the different route options. Biodiversity: Option 3A is significantly favourable in comparison with the other routes. It presents some disadvantages in terms of the total area of suitable foraging habitat that will likely be lost (although this loss is unlikely to give rise to significant effects on the SPAs concerned), the fragmentation to existing green corridors around the St Helena's open spaces and the loss of area of parks. However, it will result in the least impact on biodiversity overall.

MCA2 Route Option	Analysis of MCA2 Route Options
	Soils and Geology The MCA2 for Soils and Geology determined highly negative impacts for all routes considered. A key consideration is associated with the generation and management of waste related to the presence of contaminated sites, namely at the Tolka Valley Park, a historical landfill. There is potential to release contaminants and emissions to the environment which could affect water quality and human health during the construction stage. All route options will directly impact the former landfill and therefore are comparable to each other under this criterion. Option 3A (similarly to Option 2A) have reports of potential contaminated land in the open space / grassed area north and south of St Helena's Road, which results in some disadvantage over the other options. This results in some comparative advantage associated with Options 3Ja and Option 3Jb. Water Option 3A is considered favourable over other route options in terms of water due to a lesser extent of the route running over 'Extreme' vulnerability zones and there is less likelihood, though still some potential of flooding events, based on a lesser area of the route travelling along the R135, in close proximity to the Bachelors Stream floodplain. Air Quality and Climate All options are considered to be positive or neutral in terms of air quality and climate. In terms of receptor sensitivity including residential areas, health care facilities, places of worship, schools and sports centres, the study area is characterised as having mostly high sensitivity receptors (residential) with a small number of medium sensitivity receptors (commercial) within 100m of the proposed Scheme for all route options. There is potential for dust soiling at sensitive residential receptors and in Finglas village during construction. In terms of Operational Phase impact, the nature of the development of a light rail vehicle system itself is not likely to directly result in significant air quality impacts. However, indirect emissions are likely due to induced traffic demand in the areas and due to the proposed 600 to 1000-space Park & Ride facility. All route options will result in similar effects and therefore are comparable across all route options. The proposed Scheme has the potential to reduce congestion and associated greenhouse gas (GHG) emissions in urban areas. For the purposes of the MCA2, all route options will require similar construction works and therefore GHGs emissions will be comparable across all route options. The operational climate impacts will be comparable across all options. Noise and Vibration Option 3A presents some comparable disadvantages over the other options in terms of noise and vibration. This is mainly due to its length, the number of sharp bends and junctions/intersections with existing roads and also the number of NSRs within 100m of the proposed Scheme. Landscape Option 3A is considered to have significant advantage over the other route options in terms of landscape due to travel through the least landscape sensitivity areas. Material Assets Option 3A (similar to Option 2A) have some comparative advantages over the other route options in terms of Material Assets due to the absence of major planning applications within 50m of the proposed route option. Notwithstanding that,all of the route options encroach on existing properties, Option 3A will directly impact the second least number of properties (23). However, it will affect eight car parking areas of the apartment blocks used by landowners of Mellowes Crescent Estate and the car parking areas of two community facilities located along the Mellowes Road.

MCA2 Route Option	Analysis of MCA2 Route Options
	Cultural Heritage Option 3A is considered to have some comparative disadvantages in terms of Cultural Heritage compared to the other route options due to the number of impacts on archaeological, architectural, and cultural heritage constraints. All four Route Options will have equal direct impacts on a number of significant constraints, namely the CAs for the Royal Canal and the Tolka Valley. These CAs incorporate Broome Bridge and Finglas Wood Bridge respectively, and which are Protected Structures (RPSs 909 and 906); all four Route Options will have a significant indirect visual impact on each of these constraints through the introduction of new bridge structures. All four Route Options will also have a direct impact on one RMP comprising the Historic Town of Finglas (DU014-066----). Option 3A will have a direct impact for the Zone of Notification for three RMPs comprising the town defences (at two locations; RMP DU014- 066008-), and two 16th-17th century house sites (RMPs DU014-066005- and DU014-066003-). Two sites of archaeological potential along the alignment will be directly impacted; within Tolka Valley Park (St Helena's House; NIAH Garden 5506) and Mellows Park (relating to RMP DU014- 066017-). In summary, in relation to Soil, Noise, Vibration and Cultural Heritage perspectives, Option 3A has some disadvantages over other options. However, it presents significant advantages in terms of Biodiversity and Landscape and some advantages on Water and Material Assets. Therefore, overall Option 3A is considered favourable over other options. **Accessibility and Social Inclusion:** Option 3A is considered favourable from an Accessibility and Social Inclusion perspective. Route 3A have some advantages in improved provision of opportunities to deprived areas. The location of its more westward Luas Stops was advantageous in serving a higher number of 'disadvantaged' and 'very disadvantaged' people particularly. **Safety:** Option 3A is considered to have some advantages over other route options in terms of Safety due to being more favourable with regard to: road safety with a lower number of recorded collisions and a shorter length (one quarter) of shared track with the road network; cycling safety with its greater space availability and the avoidance of a significant interface with the comparatively higher speed R135; and personal safety as parklands and open spaces would be highly visible from a distance in most cases. **Physical Activity:** Option 3A is considered to have some advantages in terms of physical activity when compared to other route options. Option 3A scored second with three Luas Stops expected to have available space for installing a cycling facility (at Charlestown, Mellowes Park and Broombridge Stops) and cycle lanes running in parallel to the proposed Scheme, since it operates in several green areas, but to a lesser degree than Route 2A. Along with option 2A, option 3A had a high score with 315m and 567m distance respectively from recreational facilities and the green spaces.
Option 3Ja	**Economy:** The Benefit Cost Ratio (BCR) and Plausible Catchment (predicted passenger Number) estimates are the lowest on this route with 1.5 and 7,310 people catch, respectively. The runtime is the slowest of all four route options and therefore does not offer as significant a time saving for passengers on this end-to-end option when compared to others. The estimated total cost is considered unfavourable for this route option. Option 3Ja is considered to have significant disadvantages over other options in the economic assessment.

	Integration: Overall, Option 3Ja is considered neutral over other route options in terms of Integration. Route 3Ja would be expected to attain the best level of connection with public transport, compared to the other alignments with an average of 9.5 Stops in a proximity of 500m. The integration with Active Mode scored the best of the four, since connectivity with the Primary network (route 3B) of the GDA Cycle Network was half the distance compared to other routes. However, option 3Ja compatibility with BusConnects is unfavourable due to a higher percentage of alignment overlaps with the BusConnects route when compared with other routes. **Environment:** Option 3Ja is considered unfavourable. Population and Human Health: the scoring across the option 3Ja is deemed to be comparable to all other options. There were no Seveso sites were located within 700m of any of the route options. Therefore, the location of Seveso sites is not considered a differentiator across the different route options. Electromagnetic radiation and stray current have the potential to interfere with electronic equipment. This will be particularly important in proximity to the Finglas Garda station, which includes electricity masts. There are also offices and industrial locations in the area such as the Dublin Industrial Estate which may have sensitive electronic equipment and may be heavily dependent upon telecommunications for its operations. As all route options travel through these areas, this is not considered a differentiator across the different route options. Biodiversity Option 3Ja was considered unfavourable in terms of biodiversity due to loss of treelines and woodland / scrub across both sides of the R135 Finglas Road, which will lead to loss of non-volant mammals breeding and resting places, bat roosts, foraging habitat and fragmentation. Soils and Geology The MCA2 for Soils and Geology determined highly negative impacts for all routes considered. A key consideration is associated with the generation and management of waste related to the presence of contaminated sites namely at the Tolka Valley Park, a historical landfill. There is potential to release contaminants and emissions to the environment which could affect water quality and human health during the construction stage. All route options will directly impact the former landfill and therefore are comparable to each other under this criterion. Option 3Ja (similar to Option 3Jb) has some comparative advantage over Options 2A and 3A, as there are reports of potential contaminated land in the open space / grassed area north and south of St Helena's Road. Water Option 3Ja was considered unfavourable in terms of water due the likely impacts: flooding (close proximity to the Bachelors Stream floodplain); the adverse impacts on water quality that can arise from increased links between contaminants and receiving water bodies such as by increasing hardstanding areas, which are located predominantly within this route option; and the impacts on groundwater vulnerability over the other options based on a greater area of the route travelling along the R135. Air Quality and Climate All options are considered to be positive or neutral in terms of air quality and climate. In terms of receptor sensitivity including residential areas, health care facilities, places of worship, schools and sports centres, the study area is characterised as having mostly high sensitivity receptors (residential) with a small number of medium sensitivity receptors (commercial) within 100m of the proposed Scheme for all route options. There is potential for dust soiling at sensitive residential receptors and in Finglas village during construction. In terms of Operational Phase impact, the nature of the development of a light rail vehicle system itself is not likely to directly result in significant air quality impacts. However, indirect emissions are likely due to induced traffic demand in the areas and due to the proposed 600 to 1000-space Park & Ride facility. All route options will result in similar effects and therefore are comparable across all route options.

MCA2 Route Option	Analysis of MCA2 Route Options
	The proposed Scheme has the potential to reduce congestion and associated greenhouse gas (GHG) emissions in urban areas. For the purposes of the MCA2, all route options will require similar construction works and therefore GHGs emissions will be comparable across all route options. The operational climate impacts will be, similarly, comparable across all options. Noise and Vibration Option 3Ja was considered unfavourable in terms of noise as it has the greatest NSRs within 100m of the proposed Scheme. It also presents some comparable disadvantages in terms of vibration due to a sensitive land use identified within 100m of the proposed Scheme (Luas Finglas Surgery) and impact on archaeological / heritage sites. Landscape Option 3Ja had some disadvantages compared to other route options. The two-track option running along either side of the R135 would result in fragmentation and more urbanised landscape (particularly along the rear of An Bóthar Thuaidh, (the North Road). In addition, there will be direct impact on a number of properties (The Lawn – approx. 11 properties) at Finglas Road, due to some land take in rear gardens. Material Assets Option 3Ja is considered to be unfavourable in comparison with the other route options in terms of Material Assets due to existing planning applications and potential impact on existing properties. Option 3Ja (similar to Option 3Jb) has significant disadvantages compared to the other route options due to an active planning application for a Strategic Housing Development comprising the construction of 222 apartments, a childcare facility and associated site works at a brownfield site along Finglas Road Dublin 11, approximately 95m west of routes 3Ja and 3Jb. Notwithstanding that all the route options encroach on existing properties, Option 3Ja will directly impact the second greatest number of properties (48) including the second highest number of residential properties, commercial properties within the Clearwater Shopping Centre, the lands of two community / institutional properties and the lands of the commercial facility located along the eastern side of the Finglas Road. Cultural Heritage Option 3Ja is considered to have some comparative disadvantages in terms of Cultural Heritage compared to the other route options due to the number of impacts on archaeological, architectural, and cultural heritage constraints. All four Route Options will have equal direct impacts on a number of significant constraints, namely the CAs for the Royal Canal and the Tolka Valley. These CAs incorporate respectively Broome Bridge and Finglas Wood Bridge which are Protected Structures (RPSs 909 and 906); all four Route Options will have a significant indirect visual impact on each of these constraints through the introduction of new bridge structures. All four Route Options will also have a direct impact on one RMP comprising the Historic Town of Finglas (DU014-066----).Option 3Ja will impact directly on the curtilage of RPS 4849 Woodlands Lodge (Towson's Cottage) and on the Zone of Notification for the ecclesiastical complex of St Canice (RMP DU014-066009- / DU017-066017-), both located on the R135. As with Option 3A, it will have a direct impact on a site of archaeological potential at Mellowes Park (relating to RMP DU014-066017-) and it will also directly impact a site of archaeological potential west of the R135, located in proximity to the town defences (RMP DU014- 066008-). This option also has the potential for an indirect visual impact on St Canice's (though mitigated to a degree by the height difference and enclosing wall) and on RPS 4849 Woodlands Lodge (Towson's Cottage) In summary, Option 3Ja has significant disadvantages from Environmental, Biodiversity and Noise perspectives. It also presents some disadvantages in terms of Water, Vibration, Landscape, Material Assets and Cultural Heritage. Therefore, overall Option 3Ja is considered to be unfavourable vis-á-vis other options.

MCA2 Route Option	Analysis of MCA2 Route Options
	Accessibility and Social Inclusion: Option 3Ja is considered favourable from an Accessibility and Social Inclusion perspective due to serving more key facilities and presenting a shorter average distance from Finglas Village, compared to the other route options. **Safety:** Option 3Ja is considered to have some disadvantages over other route options in terms of Safety in terms of road safety and personal safety. Route 3Ja scored poorly due to the comparatively higher number of recorded collisions, including serious collision and more material damage collisions along its path. Secondly, routes 3Ja has over half its length adjacent to the road network. Furthermore, route 3Ja is proposed with mid-sections running alongside the R135. Though there may be increased visibility by road vehicles, visibility from further afield may be restricted. Connecting paths to and from the Stops (Finglas Village and Erin's Isle) may be in lesser accessible areas, due to the segregation effect of the R135. Route 3Ja particularly, would have fewer other travellers in the vicinity of Stops due to its split northbound and southbound track configuration, possibly heightening personal safety concerns. **Physical Activity:** Option 3Ja is considered to have some disadvantages over other route options in terms of physical activity. Option 3Ja presents the lowest score for cycle facilities with only two Stops expected to have comparable space availabilities to cater for Luas Cycle (Charlestown and Broombridge Stops). The Stops located in the vicinity of the R135 and Erin's Isle are anticipated to be increasingly constrained for space. Option 3Ja (like option 3Jb) scored poorly in local connectivity with stop locations, on average, with distances further than 700m and 550m from the recreational and green spaces.
Option 3Jb	**Economy:** The Benefit Cost Ratio (BCR) is favourable for Option 3Jb. However, the Plausible Catchment (predicted passenger Number) estimates are the lowest on this route with 7,310 people catch. The runtime is the second fastest of all four route options and therefore represents a moderate time saving for passengers on this end-to-end option. Overall, the total cost is considered neutral when compared to other options. **Integration:** Overall Option 3Jb is considered have some disadvantages over other route options in terms of Integration due to a weaker connection with public transport network and its overlap with BusConnects. However, the integration with Active Mode scored the best of the four, since its connectivity with the Primary network (route 3B) of the GDA Cycle Network was half the distance compared to other routes. **Environment:** <u>Population and Human Health:</u> the scoring across option 3Jb is deemed to be comparable to all other options. There were no Seveso sites located within 700m of any of the route options. Therefore, the location of Seveso sites is not considered a differentiator across the different route options. Electromagnetic radiation and stray current have the potential to interfere with electronic equipment. This will be particularly important in proximity to the Finglas Garda station, which includes electricity masts. There are also offices and industrial locations in the area such as the Dublin Industrial Estate which may have sensitive electronic equipment and may be heavily dependent upon telecommunications for its operations. As all route options travel through these areas, this is not considered a differentiator across the different route options. <u>Biodiversity:</u> Option 3Jb presents some disadvantages in comparison with the other routes in terms of biodiversity due to loss of treelines and woodland / scrub on one side the R135 Finglas Road, which will lead to loss of non-volant mammals breeding and resting places, bat roosts, foraging habitat and fragmentation.

MCA2 Route Option	Analysis of MCA2 Route Options
	Soils and Geology The MCA2 for Soils and Geology determined highly negative impacts for all routes considered. A key consideration is associated with the generation and management of waste related to the presence of contaminated sites, namely at the Tolka Valley Park, a historical landfill. There is potential to release contaminants and emissions to the environment which could affect water quality and human health during the construction stage. All route options will directly impact the former landfill and therefore are comparable to each other under this criterion. Option 3Jb (similar to Option 3Ja) has some comparative advantage with respect to Options 2A and 3A, as there are reports of potential contaminated land in the open space / grassed area north and south of St Helena's Road. Water Option 3Jb was considered unfavourable in terms of water due to the likely impacts: flooding (close proximity to the Bachelors Stream floodplain); adverse impacts on water quality that can arise from increased links between contaminants and receiving water bodies such as by increasing hardstanding areas, which are located predominantly within this route option; and the impacts on groundwater vulnerability over the other options based on a greater area of the route travelling along the R135. Air Quality and Climate All options are considered to be positive or neutral in terms of air quality and climate. In terms of receptor sensitivity including residential areas, health care facilities, places of worship, schools and sports centres, the study area is characterised as having mostly high sensitivity receptors (residential) with a small number of medium sensitivity receptors (commercial) within 100m from the proposed Scheme for all route options. There is potential for dust soiling at sensitive residential receptors and in Finglas village during construction. In terms of Operational Phase impact, the nature of the development of a light rail vehicle system itself is not likely to directly result in significant air quality impacts. However, indirect emissions are likely due to induced traffic demand in the areas and due to the proposed 600 to 1000-space Park & Ride facility. All route options will result in similar effects and therefore are comparable across all route options. The proposed Scheme has the potential to reduce congestion and associated greenhouse gas (GHG) emissions in urban areas. For the purposes of the MCA2, all route options will require similar construction works and therefore GHGs emissions will be comparable across all route options. The operational climate impacts will be comparable across all options. Noise and Vibration Option 3Jb presents some disadvantages in terms of noise as it has the second highest numbers of NSRs within 100m that will potentially be affected. It also presents the highest number of tight curves (similar to Options 3A, 3Ja and 3Jb). However, it has significant advantages over the other options in terms of vibrations as it has the potential to affect fewer cultural heritage resources. Landscape Option 3Jb was considered to have a significant disadvantage over the other route options as it would have more direct impacts on sensitive residential visual receptors due to land take required compared with other options. Material Assets Option 3Jb is considered to be unfavourable in comparison with the other route options in terms of Material Assets due to existing planning applications and potential impact on existing properties. Option 3Jb (similar to Option 3Ja) has significant disadvantages compared to the other route options due to an active planning application for a Strategic Housing Development comprising the construction of 222 apartments, a childcare facility and associated site works at a brownfield site along Finglas Road Dublin 11, approximately 95m west of routes 3Ja and 3Jb.

MCA2 Route Option	Analysis of MCA2 Route Options
	Notwithstanding that all the route options encroach on existing properties, Option 3Jb will directly impact the greatest number of properties (55) including the highest number of residential properties, commercial properties within the Clearwater Shopping Centre and the lands of two community / institutional properties. Cultural Heritage Option 3Jb is considered to be favourable in terms of Cultural Heritage compared to the other route options due to the least number of impacts on archaeological, architectural, and cultural heritage constraints. All four Route Options will have equal direct impacts on a number of significant constraints, namely the CAs for the Royal Canal and the Tolka Valley. These CAs incorporate Broome Bridge and Finglas Wood Bridge respectively, and which are Protected Structures (RPSs 909 and 906); all four Route Options will have a significant indirect visual impact on each of these constraints through the introduction of new bridge structures. All four Route Options will also have a direct impact on one RMP comprising the Historic Town of Finglas (DU014-066----). However, it will have a direct impact on the Zone of Notification for the ecclesiastical complex of St Canice (RMP DU014- 066009- / DU017-066017-) and on two sites of archaeological potential one at Mellowes Park (relating to RMP DU014-066017-) and one west of the R135 (relating to RMP DU014-066008-). This option also has the potential for an indirect visual impact on St Canice's, though this is mitigated to a degree by the height difference and enclosing wall. In summary, for Option 3Jb from an Environmental perspective, Biodiversity, Water, Noise, Landscape and Material Assets has some disadvantages over other options. However, it presents significant advantages in terms of Cultural Heritage and some advantages on Soil and Vibration. Therefore, overall Option 3Jb is considered comparable to other options. **Accessibility and Social Inclusion:** Option 3Jb is considered to have some disadvantages from an Accessibility and Social Inclusion perspective. Route 3Jb scored comparatively poorly on improved provision of opportunities to deprived areas compared to the rest of the routes, since more of its catchment might be considered to cover increasingly affluent areas where public transport is more widely accessible. **Safety:** Option 3Jb is considered to have some disadvantages over other route options in terms of Safety. Route 3Jb scored poorly due to the comparatively higher number of recorded collisions, including serious collision and more material damage collisions along its path. Secondly, route 3Jb has over half its length being adjacent to the road network. In addition, route 3Jb is proposed with mid-sections running alongside the R135 with cyclist and pedestrian interacting with higher traffic volumes on average. **Physical Activity:** Option 3Jb is considered to have some disadvantages over other route options in terms of physical activity. Option 3Jb presents the lowest score for cycle facilities with only two Stops expected to have comparable space availabilities to cater for Luas Cycle (Charlestown and Broombridge Stops). The Stops located in the vicinity of the R135 and Erin's Isle are anticipated to be increasingly constrained for space. Option 3Jb (like option 3Ja) scored poorly in local connectivity with stop locations, on average, with distances further than 700m and 550m from the recreational and green spaces.

A summary of the assessment is presented in Table 4-12.

Table 4-12: Summary of Luas Finglas Assessment of Alternative Route Options for Stage 2 (Reproduction of Table 74 of the Option Selection Report Stage 2)

Criteria	Sub-Criteria	Analysis			
		Option 2A	Option 3A	Option 3Ja	Option 3Jb
Economy	BCR				
	Plausible catchment				
	Runtime				
Integration	Local, national policies & guidance				
	BusConnects compatibility				
	Integration with the road network				
	Public Transport				
	Active modes (cyclists & pedestrians)				
Environment	Population and Human Health				
	Biodiversity				
	Soil				
	Water				
	Air quality and Climate				
	Noise				
	Vibration				
	Landscape				
	Material Assets				
	Cultural Heritage				
Accessibility and Social Inclusion	Access to key facilities				
	Improved provision of travel opportunities to deprived Areas				
Safety	Road Safety				
	Cycling Safety				
	Personal Safety				
Physical Activity	Cycle facilities at Stops				
	Space availability for cycle lanes				
	Permeability and local connectivity				

Legend – Colour coded ranking scale:

- *Significant comparative advantage over other options*
- *Some comparative advantage over other options*
- *Comparable to other options*
- *Some comparative disadvantage over other options*
- *Significant comparative disadvantage over other options*

The following were the main conclusions emerging from the MCA2 process:

Table 4-13: Summary scoring of six CAF Criteria (Reproduction of Table 75 of the Option Selection Report Stage 2)

MCA2 Criteria	Option 2A	Option 3A	Option 3Ja	Option 3Jb
Economy				
Integration				
Environment				
Accessibility and Social Inclusion				
Safety				
Physical Activity				

- Route 2A was determined as the most strongly positive corridor for Luas Finglas, where it attained the greatest overall assessment score across the six CAF criteria. The route delivers particularly well against the criteria of Economy and Physical Activity, but also well in Accessibility and Social Inclusion and Safety. Areas where the route requires particular consideration at the next stage of development are Integration and Environment. Both these areas may be subject to appropriate mitigation measures through design refinement, construction and operation phases.
- Route 3A was the second-best performing route, achieving good performance in many criteria, but not as well as Route 2A. Often Route 3A scored well in the same criteria as Route 2A.
- Both Routes 3Ja and 3Jb scored comparatively poorly, compared to Route 2A and 3A. Route 3Ja particularly performed poorly on Economy, Environment and Safety criteria – in many ways due to the cost and the complications of its split northbound and southbound track design. Route 3Ja's only positive score compared to Route 2A was for integration, where it passed slightly closer to the population of Finglas Village itself – however, this had a distinct disadvantage of serving an area of the city which already has good public transport links (somewhat duplicating and potentially undermining public transport services), and where it failed to improve access and development potential for some particularly disadvantaged areas of west Finglas.

The outcome of the MCA analysis of Luas Finglas Stage 2 route selection, taking into account environmental effects of different Options, led to the selection of Route 2A for the EPR.

4.8.3 Emerging Preferred Route

Informed by the appraisal of options as set out in the section 4.8.2, Option 2A was identified as the Emerging Preferred Route (EPR) in January 2020 for the proposed Scheme for the following reasons:

- The most direct end-to-end route options are the cheapest options to construct as they are the shortest in length, and would have a comparatively high Benefit Cost Ratio (BCR). Furthermore, the EPR was identified with the highest catchment per km;
- Options which have more westward Stops that serve the disadvantaged areas of west of Finglas are considered to be a great opportunity for social cohesion;
- Options which serve the areas of west of Finglas are considered to integrate with the existing and planned public transport network better than options which serve other alignments; and
- Options with shorter lengths of shared track with the road network, less interface with the comparatively high speed road R135 and running through parklands and open spaces (Mellowes Park and Barnamore Grove linear park) are considered to be the safest options for road user, cyclists and pedestrians.

On a comparative basis, Route 2A scored highest (or equal highest) in the four out of the six CAF criteria including Economy, Accessibility and Social Inclusion, Safety and Physical Activity. It was reasonable conclusion therefore that Route 2A be put forward as the Luas Finglas EPR. In terms of Environment, while there are some impacts in terms of Landscape and Visual, Vibration, Soils and Cultural Heritage, these impacts can largely be mitigated.

The EPR is shown in Figure 4-8 and is summarised below, as extracted from the 2020 EPR report:

'Option 2A is 3.9km in length with an estimated end-to-end runtime of under 13 minutes. The Luas Finglas Route 2A corridor starts at Broombridge (as an extension from the existing Luas Green Line) and travels north via an overpass of the Royal Canal and Maynooth railway line. It then passes along Broombridge Road, through the Dublin Industrial Estate towards Tolka Valley Park and through a new signal-controlled junction with Ballyboggan Road.

The corridor then travels towards Tolka Valley Park avoiding any interaction with the Finglas Wood Bridge, a protected structure. It will pass over a proposed new Tolka Valley Park bridge and join Tolka Valley Road at another new signal-controlled junction.

Continuing north via Barnamore Grove linear park, it emerges at St Helena's Road where the St Helena's Stop is located. The corridor continues north to a slight 'z-curve' via Mellowes Crescent where the Finglas Village Stop is located. This curve has the effect of bringing the line eastward towards Finglas Village, importantly avoiding the segregation of Mellowes Park and Garda Station car park and allowing for more space at the Finglas Village Stop for improved facilities. Another Stop is located at Mellowes Park[2]. Passing on the east of Mellowes Park at elevated tram speeds, the corridor then crosses the R135 at a signalised junction (replacing an existing roundabout), onto St Margaret's Road until reaching the Terminus Stop at Charlestown. There will be a 500-700 space Park & Ride facility adjacent to the Charlestown Stop[3] with potential to expand to 1000 spaces as demand increases. The southbound direction follows a similar reverse alignment.'

[2] This is a quotation from a 2020 report when there was a Stop located at Mellowes Park. Refer to section 4.9.8 for Mellowes realignment and change in the Stop location.

3 The location of the P&R has changed since then to St Margaret's Stop.

Figure 4-8: Emerging Preferred Route (NSPC on the EPR report, 2020)

A non-statutory public consultation (NSPC) of the EPR was undertaken from 28 July 2020 to 17 September 2020. This provided feedback which was then meaningfully taken into account in the further development of the proposed Scheme proposal as detailed in section 4.9. Refer to Chapter 1 of this EIAR for further details on the consultation process undertaken.

4.9 Identification of the Preferred Route

Submissions made by stakeholders and the public during the Public Consultation in 2020 on the EPR were carefully analysed and are outlined in Chapter 1 (Introduction). Taken together with other proposed route alignment and design improvements, design responses to consultation submissions have resulted in a number of changes to the EPR leading to a Preferred Route (PR). These amendments were incorporated into the designs and informed the PR.

The adoption of all significant changes was based on a multi-disciplinary analysis (including environmental assessment) undertaken comparing alternative design options to the EPR option.

All the changes undertaken (minor alterations and / or wider in scope and scale alterations) are summarised in Table 4-14 and described in the next sub-sections for completeness.

Table 4-14: Summary of key improvement from EPR to PR

Description	Key Improvements	Chapter Reference
Depot Stabling Site (2)	Design optimisation and improved site layout to better fit with DCC owned land and avoid impact on third parties.	Section 4.9.1
Broombridge Road Re-alignment (4)	New Broombridge road configuration with footpaths on both sides, segregated cycle lane off road to the west and Luas Road alignment shifted west, reduced impact on properties to the East and new impact on properties to the West	Section 4.9.2
Tolka Valley Park minor realignments (5)	Minor realignment of the Luas tracks and cycle lane for design optimisation.	Section 4.9.3
St Helena's Stop assessment (6)	Minor Luas track realignment, Stop moved to the north, local pedestrian accesses from the east no longer form part of the proposal.	Section 4.9.4
Farnham Crescent Park Alignment (7)	Alignment moved to the east of the park, now running adjacent to Farnham Drive. The two playing pitches are also shifted to the west to facilitate this.	Section 4.9.5
Casement Road and Patrickswell Place Alignment (8)	Road and Luas track realigned. The Luas corridor now runs within the road footprint and the road is shifted westwards. A segregated cycle lane in no longer proposed along this section.	Section 4.9.6
Mellowes Alignment (9)	Track alignment and Luas Finglas Stop changed. The new track alignment passes through the Garda Station carpark and PEM building with some property taken in Ravens Court estate and the new Stop is now located north of Mellowes Road, parallel to the Road.	Section 4.9.7
Mellowes Park Stop and N2 Junction (10)	"Mellowes Park" Stop moved to the east of the North Road junction, now named "St Margaret's Road" Stop. Minor alignment changes to facilitate the Stop and McKee Road junction.	Section 4.9.8
McKee Avenue (11)	Minor Track and Road alignment changes.	Section 4.9.9
St Margaret's Court (12)	Acquiring land from the adjacent Industrial Estate entrance road to widen the road (three lanes plus cycle lanes) and provide replacement cark park for the four houses impacted by the proposed Scheme.	Section 4.9.10
P&R Alternatives (13)	New P&R likely to be located at Lidl (North Road-St Margaret's Road Junction), in a new combined multi-storey structure housing 350 car parking spaces for the Luas P&R and Lidl car parking, instead of the 600-1,000 spaces proposed in the EPR. Accesses and egress to be provided from the North Road and McKee Road junction.	Section 4.9.11

Figure 4-9 shows the location of improvements from the EPR to form the PR.

Figure 4-9: Luas Finglas EPR and location of the changes to form the PR

4.9.1 Location of the proposed Scheme Stabling Site at Broombridge Depot

Refer to Figure 4-9, item number 2, for exact location.

The identification of a preferred site for the depot for the proposed Scheme was undertaken in three principal stages which are as follows:

- Assessment of an additional separate stabling yard;
- Assessment of capacity enhancement of existing depots at Sandyford and Broombridge; and
- Assessment of sub-options within Broombridge following discussions with DCC.

The initial assessment i.e. building a separate stabling yard on the same Luas Green Line was not recommended due to increased capital costs, increased operating costs and operational issues.

Similarly, following the extension works in Sandyford Depot at the time, it was not feasible to increase further its stabling capacity. Instead, at Broombridge, it is possible to increase the stabling capacity, acquiring additional land in the vicinity.

4.9.1.1. Broombridge Depot Local Options Assessment

Once a decision had been made that Broombridge was the only feasible location for the proposed depot, it was necessary to determine the most appropriate location for the depot site within the Broombridge area. A multi-criteria analysis was undertaken to review a number of possible locations either side of the proposed Scheme alignment, with different rail access arrangements into them.

The following four options were examined (with reference to Figure 4-10):

- **Option 1** considered the land currently occupied by two industrial units and DCC Cabra Water Services and Drainage Division, adjacent to the Broombridge depot, along its southern boundaries, directly accessible from Bannow Road. The land is bordered by the current Luas depot to the north, Bannow Road to the south, the new ET National School to the east and a new complex of apartment buildings to the west.
- **Option 2** considered the currently vacant land bordered to the north by the Broombridge depot stabling tracks, to the south by Bannow Road and to the east by the Batchelors factory (Valeo Foods). Consideration was given also to the option of constructing an underground structure on this site for stabling the LRVs, in order to facilitate future development at surface level by a third party and maximise the land-use. Due to engineering constraints though, the vertical track alignment required to link to the existing depot could not allow for this type of solution.
- **Option 3** considered a narrower strip of the same vacant land of Option 2 and a narrow strip of the Batchelors factory land (not impacting any building or shed).
- **Option 4** considered the green land between Shandon Gardens and St Attracta Road, bordered by the Luas main line tracks to the west, the canal to the north and Mount Bernard Park to the south. Road access to the land would be through Shandon Gardens, and given the distance from the main depot, this stabling area would require additional staff parking and facilities. This location would not allow direct link (vehicular or pedestrian) with the internal service roads of the existing depot. In this case, this would be a satellite-stabling depot of Broombridge which result in a number of significant disadvantages over other options as detailed below in Table 4-15.

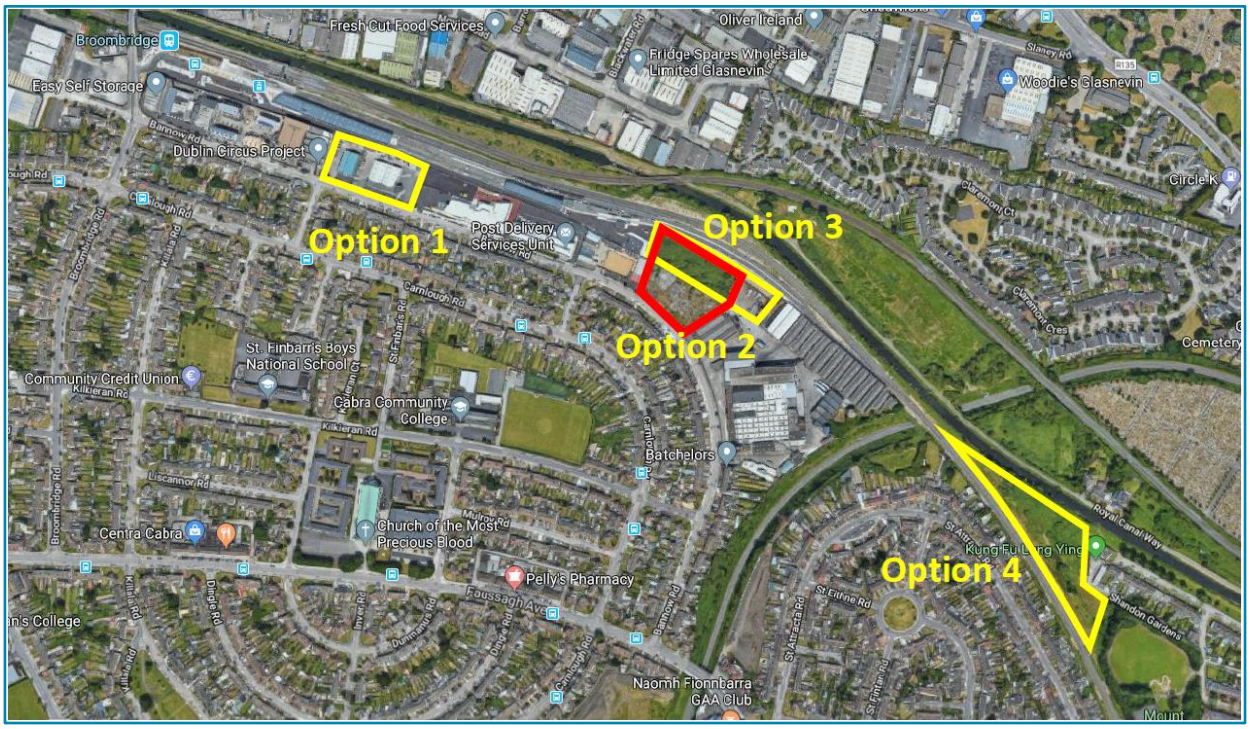


Figure 4-10: Overview of the four possible sites for Broombridge Depot extension

A simplified MCA was undertaken to consolidate all impacts of each option using criteria under the headings of the proposed Scheme Objectives, Environment and Planning, Engineering, Economy and Integration as outlined in Table 4-15.

Table 4-15: Depot options MCA (Source: Stabling Decision Document, January 2023)

Criteria		Option 1	Option 2	Option 3	Option 4
Scheme Objectives	**Additional stabling (over 10 spaces)**				
Environmental / Planning	**Population / Impact on surrounding properties**				
	Biodiversity / Water				
	Land risk				
Engineering	**Operation**				
	Security provision				
	Extending Maintenance building				
Economy	**Running costs**				
	Land take and construction cost				
Integration	**Internal road access and proximity to existing staff building.**				
	Impact on existing depot				
	Legend – Colour coded ranking scale: *Significant comparative advantage over other options* *Some comparative advantage over other options* *Comparable to other options* *Some comparative disadvantage over other options* *Significant comparative disadvantage over other options*				

Following the MCA, Option 3 was brought forward as the preferred option for the expansion of Broombridge stabling yard, with some risks associated with the land availability in the medium term and the land cost. Option 2, very similar to Option 3 was the second-best option, with additional drawbacks of not permitting additional stabling spaces in the future and having a slightly more challenging security provision.

Option 4 was not considered feasible because extending the additional stabling within this land would not be a viable option from operational, economic, environmental and safety viewpoint. Furthermore, road access and connectivity would prove very challenging. Option 1 was the least preferred option with significant disadvantages over others including Land cost (currently occupied by two industrial units and DCC Cabra Water Services and Drainage Division) and operations (which would require a high number of turnouts and the LRV access would be through a reversing movement from the circulation track back onto the first maintenance track). Both in and out movements would be reversing, which is not optimal from an operational viewpoint.

4.9.1.2. Environmental Analysis

This assessment considered environmental disciplines, but the following were the key environmental considerations with regard to the choice of the preferred depot site when compared to alternatives assessed:

- Population / Impact on surrounding properties: Option 1: has significant disadvantages over other options as the land is adjacent to a primary school (Broombridge ETNS) and a newly-built residential development. While both Options 2 and 3 are located between a boxing club car park and the production building of the Batchelor Factory, Option 3 is preferred in part due to its smaller footprint and greater offset from receptors on Bannow Road. Option 4 has some disadvantage as the area is surrounded by the Royal Canal, Mount Bernard Park and the end of terrace of Shandon Gardens.
- No key biodiversity differentiating factors were identified between Options 2 or 3. Invasive species were recorded comprising Butterfly-bush, a medium impact species which is not listed on the third schedule of the EC (Birds and Natural Habitats) Regulations 2011 S.I. No. 477/2011. Option 1 was preferable given its current industrial use and lack of existing green space. Option 4 is deemed least preferable from a biodiversity perspective as the site includes a boundary to the Royal Canal pNHA and the associated diversity of species it supports along this linear habitat (not applicable to the other options). A similar rationale was adopted for the assessment of impact on Water.
- Land risks. This considers the planning risks associated with securing the necessary plot of land for a given option, particularly in consideration of the timeline for Railway Order application envisaged for Luas Finglas. Option 1 is High risk for future development in the area, plus the area is currently occupied by several owners. Similarly, Option 3 is deemed High risk for future development in the area, plus the area is currently part of a productive industrial unit (Batchelors). Option 2 is also considered High risk for future development in the area. Option 4 is currently in TII ownership and has comparative advantage over other options.

4.9.1.3. Overall Conclusion

Following the NSPC of the EPR in July 2020, new information was gathered in relation to the lands identified for the preferred Depot Stabling Extension Site. These lands had been recently acquired by DCC, with the intention of developing rapid-build housing. Following discussions with DCC, Option 2 was no longer considered a viable option as it required the entire site.

Option 4 was re-assessed before taking a final decision on its future use and all considerations originally listed have been found to be still valid. Extending the additional stabling within this land would not be a viable option from operational, economic, environmental and safety viewpoints. Furthermore, road access and connectivity would prove very challenging. DCC now have plans to use these lands to expand Mount Bernard Park and as such, the impacts of the acquisition of those lands were greater than previously thought given DCC's plans for them.

Two additional sub-options local to the preferred site (Option 3) were then considered, as follows:

Development above stabling site: The option of residential development above the stabling area was considered by the Luas Team, and discounted for the following reasons:

- Significant additional costs associated with the construction of a transfer slab, which would be needed as the structural grid for an overhead development would not suit the LRT stabling area beneath. The cost would be significant due to the thickness of the transfer slab, the number of columns supporting it, and their foundations;
- Additional space would be needed at ground floor level for the stabling area to accommodate the columns supporting the transfer slab. Columns would have to be located at every second stabling track, in the inter-track space - where no pedestrian walkway is provided requiring a widening of the inter-axis of between 1 and 1.5m (column width plus clearances either side). This would result in a wider strip of land take, of some 3 to 5 metres;
- Interface issues in relation to fire safety and noise;
- Lack of precedent in Ireland for such a complex arrangement, even more challenging to justify from an economic viewpoint in a suburban area;
- Increased construction cost risk in the event that the development by DCC precedes Luas Finglas prior to Luas Finglas securing planning and funding; and
- Increased planning process risk and co-dependencies of the two schemes.

Adjacent to the Cabra Boxing Club Site: This option was discounted as the site could only accommodate stabling for an additional 4 LRVs.

Therefore, following additional consultation with both DCC Housing and DCC Planning, Option 3 was agreed as the preferred solution and the following changes were agreed in principle and incorporated into the PR (Refer to Figure 4-11):

- Access road to Bannow Road removed, in order to minimise, insofar as possible, the impact on the site;
- Improved road internal circulation from the existing depot;
- Curved stabling track layout to minimise land impact;
- Shortened track configuration (still allowing two LRVs per lane) to avoid impact on third parties land (Batchelors); and
- First bottom track is embedded (paved) to combine track and emergency road access, with a view to provide additional stabling capacity and flexibility while maintaining emergency access and reducing land impact.

Figure 4-11: Depot Stabling: proposed layout as part of the PR

4.9.2 Broombridge Road Minor Realignment

Refer to Figure 4-9, item number 4, for the exact location.

Consultation undertaken with key stakeholders including Fashionflo Ltd and Colorman identified the importance of the proposed works along Broombridge Road. Both companies identified that the proposed works and consequent loss of access and land meant that it would affect the daily operational capacity of their sites making it no longer viable or less viable, respectively, than its current location.

In addition, feedback received from DCC and the Dublin Cycling Campaign emphasised a strong demand to provide suitable walking and cycling facilities along Broombridge Road (and throughout the proposed Scheme) with good linkages to the Royal Canal Greenway and Tolka Valley Park. The EPR alignment proposed along Broombridge Road had not been space-proofed for the provision of such facilities.

In order to minimise the potential impacts on Broombridge Road and having regard to the constraints listed above, two feasible options were developed and assessed in order to reduce potential impacts in this area. Refer to Table 4-12 below with lands to be taken shown in red.

- Option A: the EPR alignment with additional cycling and pedestrian facilities; and
- Option B: which includes realigning Broombridge Road and the track further west.

Figure 4-12: Broombridge Road Luas track and road layout: EPR vs proposed realignment.

4.9.2.1. Environmental Analysis

This assessment considered environmental disciplines in order to inform which alternative option for the alignment was optimal, but the following were the key environmental considerations when comparing the alternatives assessed:

- Landscape & Visual: When compared with each other, Option A has lesser (minimal) space for the provision of landscaping along Broombridge Road or 'green link' from Royal Canal to Tolka Valley Park;
- Property and Land take: Option B has less of an impact on existing commercial properties on the eastern side of Broombridge Road with some impact on the properties on the western side of Broombridge Road, which will require mitigation; and
- Traffic & Transport: There will be potential traffic impacts to Broombridge Road arising from each option during the Construction Phase. Option B frees up more lands to the west of Broombridge Road in comparison with Option A. This will greatly assist in temporary traffic management and allow more space for construction in the area, meaning less disruption to local businesses and to traffic. If these lands are not made available (temporarily or permanently), there is a high likelihood that the works site would be extremely constrained, resulting in major disruption to local businesses and traffic in the area throughout the construction period.

4.9.2.2. Overall Conclusions

Following a thorough assessment of both options, including the additional costs associated with realigning the carriageway as well as assessing the impacted properties on both sides of Broombridge Road, it was recommended that Option B was progressed to the next stage of design development.

Option B has potential for some smaller impact on the properties on the western side of Broombridge Road (with new impacts not disturbing the access and/or operativity of the affected industrial units) if not fully mitigated. However, this option is preferred to the other option as it has potential to avoid the significant environmental impacts discussed above.

4.9.3 Tolka Valley Park Minor Realignment

Figure 4-13: EPR (orange) and PR (green) alignment at St Helena's

Refer to Figure 4-9, item number 5, for exact location.

No feedback was received for this section of the EPR at the NSPC. However, in an effort to minimise the amount of cut and digging in the landfill municipal area and reduce the environmental impact on the green areas from a soils and geology point of view, a minor re-alignment was brought forward with the aim of straightening the alignment and contributing to fulfilment of the sustainability objectives of the proposed Scheme by minimising waste and promoting the circular economy. The proposed re-alignment is indicated in green in Figure 4-13 above.

4.9.4 St Helena's Stop Location

Refer to Figure 4-9, item number 6, for exact location.

As part of the EPR, a Luas Stop was proposed within the Barnamore Grove Linear Park to the west of the general residential area, referred to as the Lakeglen Estate / St Helena's area. To a certain extent, the success of this Stop is linked to the level of permeability that can be achieved between the stop location and the nearby residential areas. Within the EPR, a number of pedestrian linkages were proposed linking the Lakeglen Estate / St Helena's area to this Stop. These pedestrian linkages required the creation of several gates / gaps in the boundary fences to the east of St Helena's Stop.

Within the NSPC for the EPR, residents in the areas of Lakeglen Estate / St Helena's indicated an opposition to the removal and / creation of entrances within the boundary fencing. Specifically, submissions from residents in Carrigallen Drive, Carrigallen Park, Carrigallen Road, Gortmore Avenue, Gortmore Road and Gortmore Drive) raised objections to the opening up of the cul-de-sacs in their area.

Further analysis was then undertaken to identify the preferred location of the Stop in this area taking into consideration the potential for impacts on the nearby residential areas. The existing (EPR) stop location was compared to a number of alternative options as shown in Figure 4-14. In general, the potential stop locations between the Tolka Valley Park and the Finglas Village Stop were set out and tested at roughly 200m-300m increments along the Luas alignment. Furthermore, a Double Stop provision alternative was also considered in place of St Helena's Stop (including Locations 1&2).

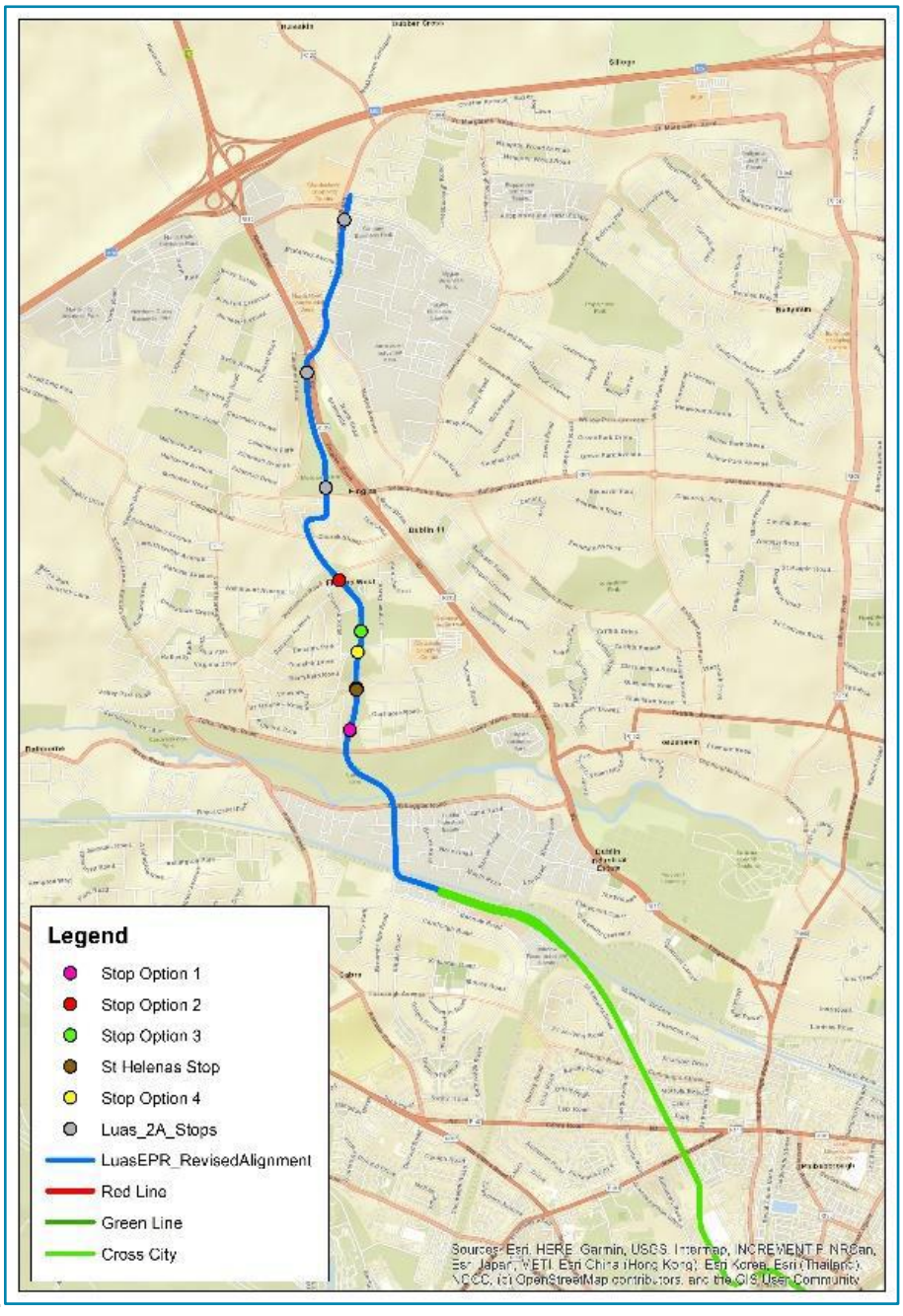


Figure 4-14: Alternative Stop Locations tested (Source: Luas Finglas – St. Helena's Stop Location – Options Working Paper Stage 2, Post NSPC)

The stop locations were examined against the following criteria:

- Catchment Analysis;
- Catchment Coverage;
- Impact on Run times;
- Environment;
- Safety and Security;

- Accessibility and Social Inclusion; and
- Integration.
  - Land use integration (compatibility with Development Plans);
  - Transport Integration (Bus Connects); and
  - Land use integration (Key trip attractors).

4.9.4.1. Environmental Analysis

An environmental assessment was undertaken on the proposed alternative locations of the St Helena's Stop to identify any potential significant environmental constraints and opportunities when compared to the EPR. The environmental assessment was undertaken, but as the proposed alternative stop location would be constructed along the EPR alignment, with very minor changes to the curvature, no additional environmental impacts were expected, subject to a thorough design of the stop facilities and their integration in the existing urban environment.

However, the linear open space at Stop 1 is poorly developed with low amenity and biodiversity value, and the Stop could be said to provide an opportunity for a well-designed linkage to the Tolka Valley Park and local public realm improvements, including provision for improved pedestrian linkages and traffic calming. Stop 2 is located in an area of local passive open space and the impact of the stop could be said to have a similar impact to the current EPR. Stop 3 is located in an established area of open space with active sports pitches which would be impacted by the stop footprint. Therefore, the impact on the current function of this open space needs to be considered. Stop location 4 is in an area of local passive open space and the impact of the Stop was considered similar to that of the EPR.

In 2023, an environmental analysis was undertaken considering all the information available during the development of this EIAR. The conclusions of this analysis show that there are no additional key environmental differentiators in terms of environmental impacts apart from Cultural Heritage. It is considered that while the Stop (with larger construction footprint) is now located closer to the St Helena's House [4](Protected Structure 7575, NIAH Reg. No. 50130011), it is within an open green space that contains no surface traces of any garden features associated with the house. The location has also been extensively disturbed by previous ground works evident on Ordnance Survey of Ireland aerial imagery (MapGenie 1999-2003 series) which are likely to have removed sub-surface remains of any garden features at this location.

St Helena's House is set within a landscape character area (LCA) which is low in sensitivity; there are no trees designated as having a Tree Preservation Order within this LCA and there are no Key Views and Prospects noted in the City Development Plan. As such, Landscape and Visual considerations are not an environmental differentiator at this location. The wider public realm improvements that the proposed Scheme will bring to this area's character, including removal of the metal palisade security fencing around St Helena's House and car park together with integration of the surrounds with the proposed Luas Stop Plaza, will improve the setting of the protected structure and will enhance the overall townscape setting.

Noise and vibration were considered and deemed not to be a major differentiator due to slight differences in distance between each of the proposed Stops and nearest dwellings.

4.9.4.2. Overall Conclusions

On that basis, it was recommended that the St Helena's Stop be moved approximately 150m-200m north of the current location along the EPR corridor, to a position just south of St Helena's Road. This would allow not only a greater accessibility from St Helena's Road, but also a better passive safety / security and urban / transport integration.

[4] St Helena's House is currently used as a Family Resource Centre.

Minor alignment changes to the EPR corridor have been made to suit the optimal stop location and the alignment further north, through Farnham Crescent Park.

4.9.5 Farnham Crescent Park Alignment

Refer to Figure 4-9, item number 7, for exact location

The proposed EPR alignment for proposed Scheme runs through Farnham Crescent Park, in a north / south direction. It was proposed to maintain the current layout of the park and the playing pitches, with the proposed track alignment running in between.

Farnham Crescent Park is an active local space situated in South Finglas. The park is surrounded mostly by residential housing estates, as well as some educational and commercial facilities to the southwest and southeast. The park mainly provides a recreational function in the form of sport as the majority of the park is given over to two playing pitches.

During the NSPC, feedback was received from local residents and other stakeholders, where concerns were expressed in relation to the impact that the proposed alignment would have on existing green space, proximity to playing pitches, and "tarnishing" of the existing park as well as impact to wildlife.

A further and more detailed analysis of the alignment through Farnham Crescent Park was undertaken. The following options were considered (with reference to Figure 4-15):

- Option A: the EPR alignment; and
- Option B: which included repositioning the proposed track alignment close to the eastern boundary of the park and relocating the existing playing pitches further west within Farnham Crescent Park as outlined in Figure 4-15.

Figure 4-15: EPR alignment (on the left) versus PR alignment (on the right)

4.9.5.1. Environmental Analysis

This assessment considered environmental disciplines in order to inform which alternative option for the alignment was optimum, but the following were the key environmental considerations when comparing the alternatives assessed:

- Biodiversity: Farnham Crescent Park was considered an area not deemed important for Brent Geese foraging when assessing the EPR. However, Light-bellied Brent Geese have been reported as present in the park. Repositioning the proposed track alignment close to the eastern boundary of the park, as proposed in Option B, minimises the impact on the existing layout of the park and the open space is maintained, without segregation. Similarly, the proposed Option A (EPR option) has potential for an impact on biodiversity as it impacts directly on a significant number trees (31 trees to be removed and replanted). Option B instead avoids a larger number of trees in this area;

- Landscape & Visual: As with Biodiversity, Option A has the greatest potential for effect due to the loss of trees when compared with Option B;
- Population: Option B has a lesser impact for residents on Dunsink Road and Casement Road as the alignment is moved further away from their houses. In addition, avoiding segregation within the park as proposed in Option B is likely to be a more favourable option with local residents and park users when compared to Option A (the EPR). This is because the park appearance, functionality and user experience is maintained; and
- Utilities and Infrastructure: It was deemed that the track realignment, as proposed in Option B, may have a reduced impact on Finglaswood Stream Culvert than the EPR, subject to additional investigations.

In 2023, an environmental analysis was undertaken, taking into account all the information available during the development of this EIAR. This analysis considered wintering bird surveys conducted by the Luas Team during the optimal survey months (December, January and February) for the 2021-2022 and 2022-2023 winter periods.

During the 2021-2022 winter period, Light-bellied Brent Geese flocks were most frequently recorded at the Erin's Isle GAA pitches, with the western side of Farnham Pitches being used only for foraging purposes by smaller flocks (41 - 171 individuals) of Light-bellied Brent Geese during the month of February 2022.

Similarly, during the 2022-2023 winter period, Light-bellied Brent Geese flocks were once again most frequently recorded at the Erin's Isle GAA pitches. The other less frequently utilised green amenity area - the playing pitches west of Farnham Drive - was utilised by smaller flocks between 92 and 186 in number. As the proposed Scheme is located within or immediately adjacent to existing roadways (Farnham area) and vehicular access routes (Tolka Valley Park), increases to operational disturbance from the light-rail activity will be negligible, given that the QI bird species, which periodically utilise these areas are already habituated to the presence of vehicles within these artificial corridors, as observed during the winter survey periods. The survey results support the repositioning of the proposed track alignment close to the eastern boundary of the park as proposed in Option B to minimise the impact on the existing layout of the park while maintaining the existing foraging areas at the western Farnham pitch / amenity grassland (West Farnham area).

4.9.5.2. Overall Conclusions

Following feedback received from local residents and stakeholders and in consultation with DCC, Erins Isle GAA Club and Rivermount FC, the alignment was moved to the east of the park, now running adjacent to Farnham Drive. The two playing pitches were shifted to the west with the main objective of providing a park layout that is adequately space-proofed for the proposed Luas track alignment, pedestrian and cyclist facilities and the relocated playing pitches. Dedicated pedestrian and cyclist facilities will be provided to the western side of the alignment. This change has a reduced impact on existing trees, and it contributes to maintaining the current park layout and appearance for park users. The change is also less likely to affect residents on Dunsink Road and Casement Road as the alignment is moved further away from their houses.

Option B option has potential for environmental effects if not fully mitigated. However, this option is preferred to the other option as it has potential to avoid significant environmental impacts as discussed above. Playing pitches will be closed for a period during construction and their relocation will result in additional work to be undertaken in relation to drainage. Refer to Chapter 10 (Water) and Chapter 6 (Construction Activities) for further details.

4.9.6 Casement Road and Patrickswell Place Minor Realignment

Refer to Figure 4-9, item number 8, for exact location

Local residents along Casement / Dunsink roads raised concerns in relation to the EPR running too close to Casement Road and potentially impacting on mature trees in the green area.

Similarly, local residents to the west of Patrickswell Road (Wellmount Parade and Patrickswell Court cul-de-sac) raised concerns in relation to the EPR running too close to the houses and in relation to the

relocation of Wellmount Parade and Patrickswell Court access (as part of the EPR, road accesses were relocated to the west to reduce conflict points with the proposed Scheme).

Following the feedback received during the NSPC and in order to minimise the impact on the existing boundaries and the loss of mature trees, a review of the proposed EPR alignment and the assessment of an alternative track, road and cycle lane alignment was undertaken.

The following key changes were implemented:

- The track alignment has been shifted eastwards by approximately 10 to 20m adjacent to Casement Road increasing the distance from the dwellings along Casement Road and also reducing impact on trees; and
- Patrickswell Place Road has been shifted west by approximately 10m with the track alignment now following the existing Patrickswell Place Road. This allows direct access from the realigned Patrickswell Place to Wellmount Parade and Patrickswell Court.

4.9.6.1. Environmental Analysis

The environmental analysis was a key consideration along with all the other topics taken into account at that time. The main aspects arising from the analysis are as follows:

- Biodiversity: The PR has lesser Biodiversity impact in particular in relation to a reduction in the loss of mature trees. Local level impacts include habitat loss and increased levels of disturbance (i.e., lighting, noise) to bats and bird species that use the area;
- Landscape & Visual: The PR has lesser Landscape & Visual impact for local residents to the west of Patrickswell Road (Wellmount Parade and Patrickswell Court cul-de-sac), in particular a reduction relating to impact on the existing boundaries and loss of mature trees; and
- Population: The PR has lesser impact for local residents to the west of Patrickswell Road (Wellmount Parade and Patrickswell Court cul-de-sac).

4.9.6.2. Overall Conclusions

The proposed changes / updates to the EPR are indicated in Figure 4-15 below (orange being the EPR), these changes positively address the following:

- Local resident concerns in relation to proximity of the LRT;
- Minimising pedestrian / cycle / traffic crossing points with the LRT;
- Retaining existing accesses to Wellmount Parade and Patrickswell Court; and
- Minimising impact on existing trees adjacent to Casement Road.

Figure 4-15: Casement Road and Patrickswell Place new proposed Luas track and road alignment, and "shared cycle streets" approach with off-road cycle links.

4.9.7 Mellowes Alignment

Refer to Figure 4-9, item number 9, for exact location

As part of the EPR, and approximately in the midpoint of the corridor, the proposed Scheme passed through the Mellowes Crescent and Court estates with a sharp "S" combination of horizontal curves before crossing Mellowes Road at a point some 40m west of the Finglas Fire Station.

Figure 4-16: Micro-Option 1 (the EPR)

Throughout the NSPC for the proposed Scheme, which ran from July to September 2020, residents of Mellowes Crescent and Court estates raised concerns that the current plans would divide their community in two. With the aim of responding to these concerns, the EPR was further assessed and compared to a number of alternatives routes between Cappagh Road and Mellowes Road as follows:

- The EPR alignment (called “Micro-Option 1”, refer to Figure 4-16 above) was still considered a viable and beneficial option; and
- Micro Options 3 and 5 were developed following the feedback from the EPR.

  - Micro-Option 3 (refer to Figure 4-17 below): routing the alignment through a possible redevelopment of Mellowes Court and Mellowes Crescent, with a different configuration and road access arrangement to the EPR, thereby delivering a better operational alignment than the EPR through Mellowes Court and Crescent and building on the opportunity afforded by DCC’s intention to redevelop the Court apartments complex;
  - Micro-Option 5 (refer to Figure 4-18 below): routing the alignment through the Finglas Garda Station car park, past Ravens Court Estate to the DCC municipal parking area.

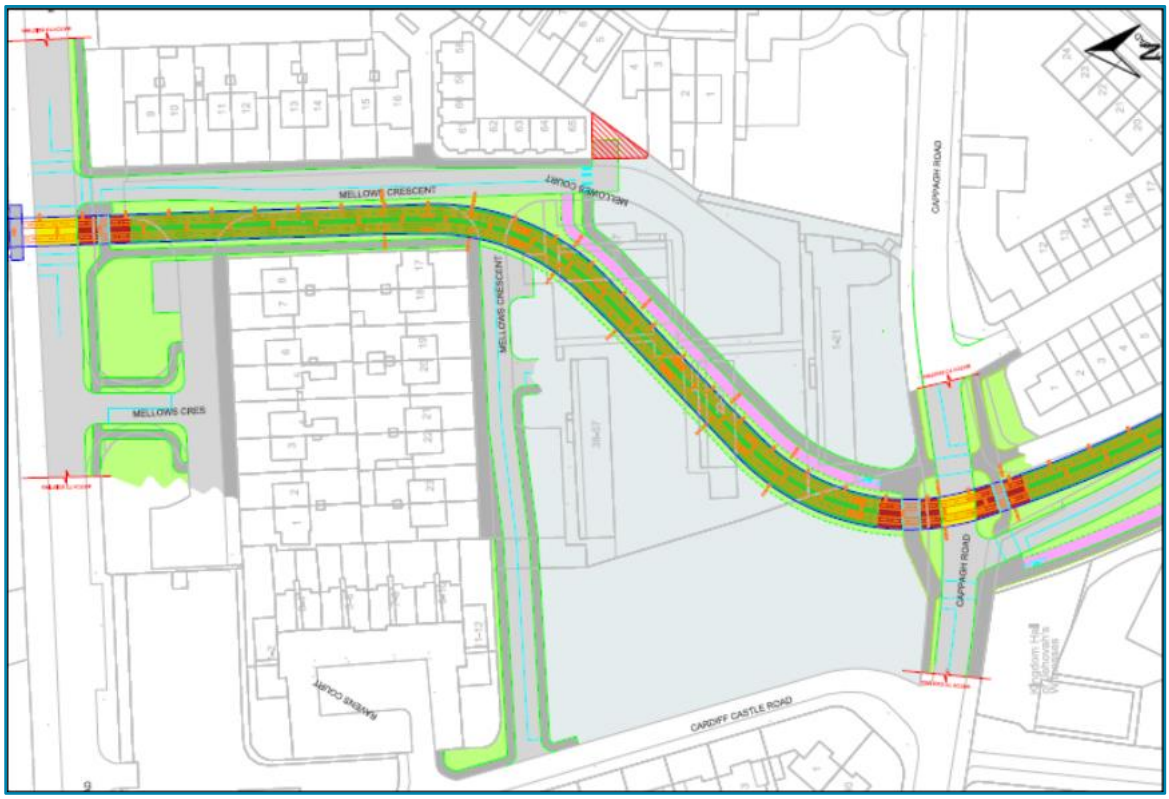


Figure 4-17: Micro-Option 3 (via DCC redeveloped Mellowes Court)

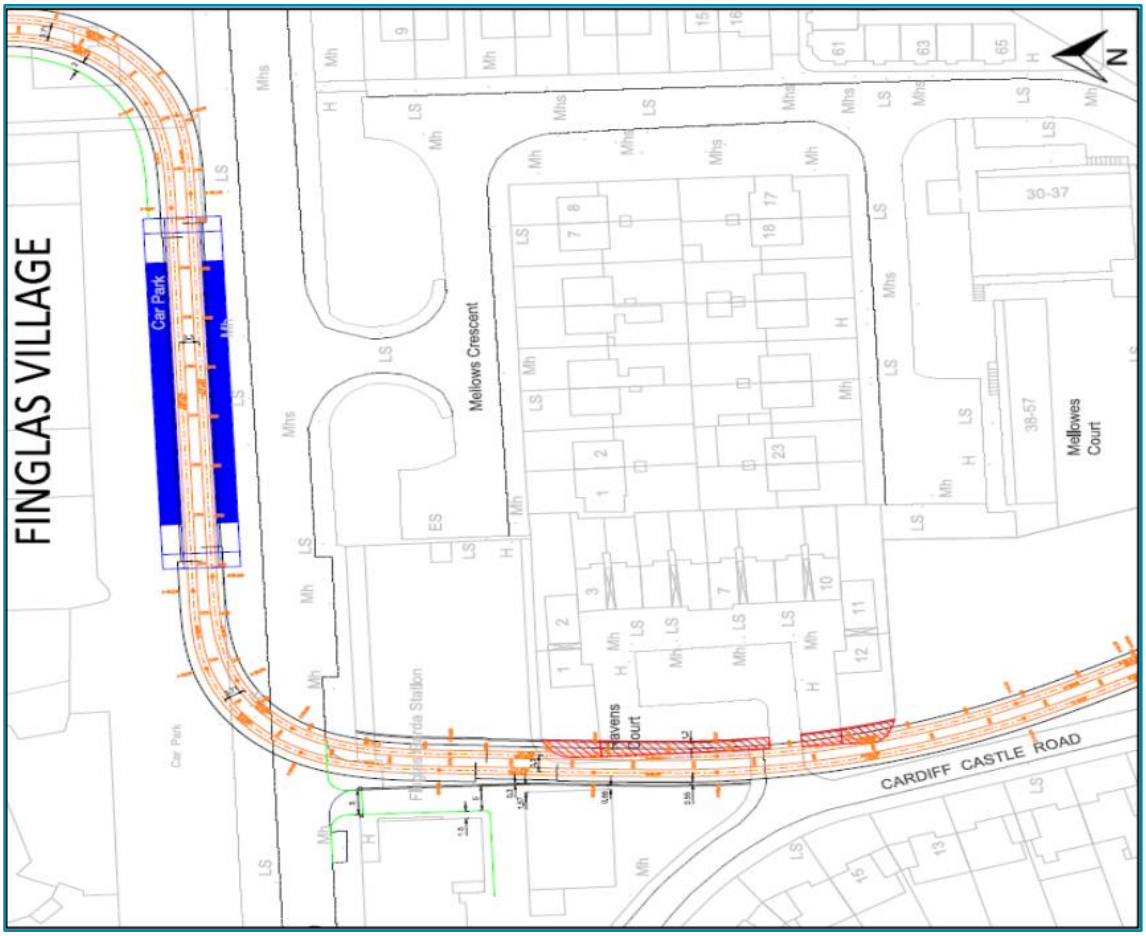


Figure 4-18: Micro-Option 5 (via Finglas Garda Station)

A summary of this assessment is depicted in Table 4-16 below which is now provided as a visual representation of the detail contained in the Luas Finglas Mellowes Micro-Options Working Paper – Additional Information Note 2 Report. Refer to Volume 5 - Appendix A4.3 of this EIAR for details of the full assessment.

Table 4-16: Assessment of Route Alternatives considered at Mellowes

	Strengths	Weaknesses	Opportunities	Threats
Micro-Option 1 (the EPR)				
Micro-Option 3 (via DCC redeveloped Mellowes Court)				
Micro-Option 5 (via Finglas Garda Station)				

4.9.7.1. Environmental Analysis

An environmental assessment was undertaken to identify the preferred alignment at Mellowes. A select number of environmental topics were assessed and explored which were directly influencing the development of proposed Scheme are discussed below.

- Noise and Vibration: The three proposed alignment options would have potential to impact on local sensitive receptors during the Construction Phase and Operational Phase due to the generation of noise and vibration, if not sufficiently mitigated. However, Micro-Option 5 has some comparative advantages over the other options as fewer sensitive receptors / residential properties are impacted by the alignment (12 houses, a majority of which at approximately 25m distance from the proposed Scheme, and separated from it by a boundary wall, fence and landscape versus 18 houses plus DCC apartment blocks (for the elderly) within 15-20m distance both in the EPR and Micro-Option 3). In addition, there will be no interaction with internal residential roads and playing / green areas once the boundary line is relocated.

In 2023, an environmental analysis was undertaken considering all the information available during the development of this EIAR. The conclusions of this analysis reinforce the decision made at the time to progress Micro-Option 5 based on the following:

- Landscape and Visual: Micro-Option 1, the emerging preferred route, involves minimal tree removal in Cardiff Castle Road but significant removal in Mellowes Crescent, leading to a permanent change in character and significant visual impacts on nearby properties. This option offers no opportunity for streetscape enhancement on Mellowes Road. Micro-Option 4, which follows a new alignment through Mellowes Court and Crescent, also involves minimal tree removal in Cardiff Castle Road but significant removal in Mellowes Crescent, with similar visual and residential impacts and no streetscape enhancement opportunities on Mellowes Road. Micro-Option 5, via the Garda Station and Ravens Court, involves removing the PEM building, creating more space for the Luas corridor, and providing tree planting opportunities. While it has significant visual and residential impacts on Ravens Court, these can be mitigated with a high wall and screen planting. This option allows for substantial public realm improvements on Mellowes Road and affects the fewest visually sensitive receivers, resulting in the least permanent change to landscape character and residential amenity. It is preferred for its landscape and public realm benefits.
- Biodiversity: The ecological features in this area are particularly minimal / lower quality so the loss of trees really is the deciding factor. All three proposed alignment options will result in permanent habitat loss, with amenity grassland and a number of immature and semi-mature trees being impact / removed. Of these three alignment options, Micro-Option 5 will result in the least amount of habitat loss in regard to the immature and semi-mature trees, (i.e., the higher value ecological features), present within this section. Therefore, Micro-Option 5 has been deemed to be the most preferred alignment option in respect of biodiversity impacts (construction and operational).

- Cultural Heritage: The three proposed alignment options extend into the west end of the Zone of Archaeological Potential (ZAP) around Finglas village (settlement cluster DU014-066----) and all extend into a section of a green area located approximately 60m to the east of an archaeological constraint that comprises the recorded location of a 17th century house (DU014-066003-), and which is now occupied by modern housing. However, Micro-Option 5 has comparative advantages over the other options as the majority of this alignment extends outside the ZAP boundary (DU014-066----), whereas the majority of the other two options are located within its boundary. In addition, Micro-Option 1 and Micro-Option 3 extend approximately 30m to the west of the location of an archaeological constraint (Holy Well DU014-066002-), while the nearest section of Micro-Option 5 is located approximately 90m to the north of this constraint.
- Population / Human Health: Micro-Option 1 would create significant severance between two parts of the estate, causing psychological separation despite pedestrian crossings and environmental measures. It would also impact the residential amenity of 19 properties on Mellowes Crescent and Mellowes Court due to noise and visual intrusion, particularly affecting older residents. These impacts would be temporary but heightened during construction. Micro-Option 3, is the least preferred option, as it would have similar effects on Mellowes Crescent and also require redeveloping Mellowes Court, affecting around 38 properties. Demolitions would have a significant negative impact, with the lasting effect depending on alternative housing arrangements, especially for older residents if not rehoused together. Micro-Option 5 would introduce significant new severance for Ravens Court residents due to tracks crossing the estate entrance, causing physical and psychological impacts and affecting 12 properties (least number of properties impacted) with noise-related issues. Temporary construction impacts would be heightened, but access to community facilities on Mellowes Road would improve during the operational phase. Additionally, there would be a profound negative impact on one building of the Garda Station and potentially a slight operational impact due to car park separation.
- Air Quality: The three proposed alignment options have the potential to impact on sensitive receptors due to construction dust emissions during the Construction Phase. Micro-option 1 and Micro-option 3 are in quite close proximity to the houses in Mellowes Crescent. There is the potential for excavation and construction dust impacts in quite close proximity, <10m to residential properties. Micro-option 3 has potentially more significant dust impacts due to the proposed demolition works at the Mellowes Crescent apartment blocks, compared to Micro-option 1 and Micro-option 5. Micro-Option 5 has a potentially slightly less construction dust impact than the other options as there are fewer sensitive receptors in close proximity to the alignment (Approx. 12 houses are located approx. 25m from the proposed alignment). In terms of the Operational Phase, there is no significant difference in terms of air quality between the three options.
- Climate: In terms of the Construction and Operational Phase, there is no significant difference in terms of climate impacts among the three options. Micro-option 3 has potentially slightly more significant climate impacts during the Construction Phase, due to the proposed demolition works at the Mellowes Crescent apartment blocks, compared to Micro-option 1 and Micro-option 5.
- Land Take: Micro-Option 1 has minimal private property land take, primarily parking areas in Mellowes Court and a small portion of a front garden at the corner of 17 Mellowes Crescent, as it is mainly primarily affecting public parklands and roadways. Micro-Option 3 has the highest impact, requiring the demolition and rebuilding of a housing development, crossing multiple housing blocks, and acquiring private garden space to 65 Mellows Crescent. Micro-Option 5 mainly affects public land, including parklands, Dublin City council owner property and Garda Station property, with some private land acquisition in Ravenscourt. Overall, Option 1 is the least impactful in terms of land take, followed by Option 5, with Option 3 being the most impactful.
- Water: The Finglaswood Stream is the closest surface waterbody in proximity to the above micro-options, commencing along Patrickswell Place. As the alignment is not altered until the scheme is north of the Cappagh Road, the above micro-options would not pose any additional environmental impacts. All micro-options feature some overlap with existing surface water sewers, which could act as an indirect pathway for construction related debris to reach downstream surface waterbodies (in the absence of mitigation). None of the above options offer any distinct advantages / disadvantages over other options with respect to the surrounding water environment.
- Soils: After assessment of the three proposed alignment options, it has been determined that each option presents a similar profile in terms of impact on soils and geology. All three routes traverse areas with

comparable soil types, characterised by a mix made ground overlying natural soils underlain by bedrock. Consequently, there is no clear advantage or disadvantage among the three options based solely on their impact on soils and geology.

- Traffic and Transport: The three proposed alignment options would have similar impacts on the wider strategic transport network. However, at a local level, Micro-Option 5 has some comparative advantages over the other options as:

  - The other options require additional residential vehicular accesses from Mellowes Road and Cardiff Castle impacting on the existing road network in these areas.
  - Micro-Option 5 requires no interaction with internal residential roads once the boundary lines are relocated. Whereas the other two options cut through existing residential areas which is an additional operational risk in terms of public safety.
  - The Luas runtime in Micro-Option 5 is likely to be slightly improved when compared to the other options as there is less interaction with residential areas, and the sharp curves are located in close proximity to junctions and the Finglas stop where operational speed is reduced anyway.
  - Micro-Option 5 includes an improved setting of the Finglas Village stop running parallel to Mellowes Road in a more prominent location providing for more seamless integration with bus services and cycle facilities supporting sustainable travel.

- MA Utilities: The three proposed alignment options would have potential to impact on infrastructure during the Construction Phase and Operational Phase, if not sufficiently mitigated. However, Micro-Option 5 has some comparative advantages over the other options as fewer utilities are impacted by the alignment and mitigations will primarily be on public roads instead of in estates.
- Waste: The volumes of waste expected to be generated from Micro-Option 3 will not be significantly different from waste volumes proposed from the assessment of the emerging preferred route. The majority of waste generated will be re-used in or around the scheme as part of the circular economy objectives of the proposed Scheme. For Micro Option 5, generation of additional waste (rubble, etc.) is considered a disadvantage over other options, which would not incur the same volume of waste.

Table 4-17: Environmental Assessment of Mellowes Alignment Alternatives

Option / Criteria	Micro-Option 1 (the EPR)	Micro-Option 3, via a new alignment through Mellowes Court and Crescent	Micro-Option 5, via the Garda Station and Ravens Court
Noise and Vibration			
Landscape & Visual Impact			
Biodiversity			
Cultural Heritage			
Human Health			
Population			
Air Quality			
Climate			
Land Take			
Water			
Soils			
MA: Traffic			
MA: Utilities			
MA: Waste			
Electromagnetic Compatibility			

4.9.7.2. Overall Conclusion

Overall, the results of the multi-disciplinary analysis undertaken has identified Micro-Option 5, via the Garda Station, as the proposed alignment at Mellowes for the following reasons:

- Mellowes Crescent and Court estates are no longer impacted;
- Impacts on local residents (Ravens Court) are limited and can be significantly mitigated;
- Impacts on the Garda station operation have been minimised, essentially maintaining an equal number of parking spaces and maintaining an entrance onto Mellowes Road;
- Continuation of the cycle lane can be achieved, with a suitable cycle-friendly shared surface;
- Micro-Option 5 is a more direct route than the EPR and the operational efficiency (combining curves with road junction and Stops) is improved;
- The overall noise impact is reduced, as residential receptors are far from the tight curves;
- There is less impact on and interfaces with the local road network; and
- The Luas Stop is in a more prominent location on Mellowes Road, allowing for more integrated strategies for land-use, transportation and urban design.

The design for the Garda station and the area in the vicinity of Luas Finglas Village Stop on Mellowes Road has been refined taking into consideration a new track alignment, road layout, public realm, active travel and future DCC developments.

The track alignment and Luas Finglas Village Stop have been significantly modified to avoid passing through Mellowes Crescent and to re-arrange the Stop layout. The new track alignment passes through the Garda Station carpark that will be reconfigured with some property take in Ravens Court estate (both communal green area and part of the side gardens of two houses). The new Stop is now located north of Mellowes Road, parallel to the Road, within DCC land.

4.9.8 Mellowes Park Stop and N2 Junction

Refer to Figure 4-9, item number 10, for exact location.

The EPR included a Stop in Mellowes Park. During the NSPC and in line with DCC's masterplan of the rezoned Jamestown Industrial Estate, DCC suggested moving the Stop located in Mellowes Park, as per the EPR, to a location, approximately 160m north on the proposed Scheme, on St Margaret's Road. This would result in the alternative stop location being adjacent to the southern part of the new rezoned DCC residential development (the northern part being served by Charlestown Stop).

In addition, feedback provided by general stakeholders relating specifically to the Mellowes Park Stop referred to potential anti-social behaviour around the Stop and questioned what security measures would be implemented. Stakeholders noted that the Stop was not easily accessible, that dangerous activities currently take place in the park and some requested that the Stop should be relocated away from this location.

In line with DCC's master planning vision for the Jamestown Estate development and addressing concerns raised in the NSPC, the relocation of the Stop was assessed (refer to Figure 4-19 below).

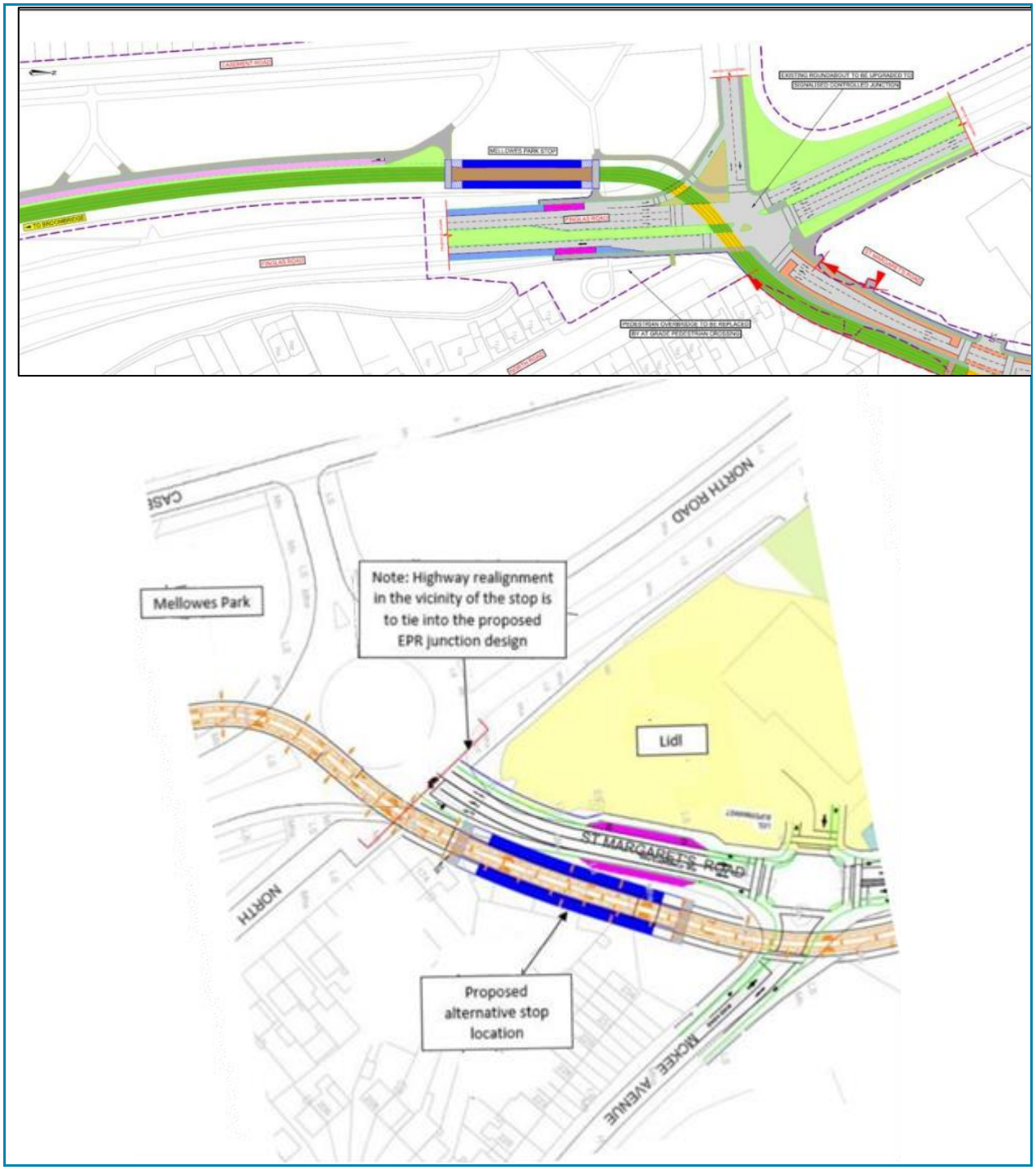


Figure 4-19: N2 / St Margaret's Road Junction (EPR top, PR developments bottom)

4.9.8.1. Environmental Analysis

This assessment considered environmental disciplines, but the following were the key environmental considerations with regard to the assessment of the alignment options on St Margaret's Road:

- Property and land take: There is a potential requirement for a wider strip of land compared to the EPR and closer proximity to private properties. Any property and land take impacts can be mitigated through the implementation of a high-quality design to minimise land take while providing compensation for properties impacted.
- Population: The revised stop location facilitates much improved permeability and pedestrian and road connectivity while reducing interference between pedestrians and cyclists, due to cycle lanes being on-street along St Margaret's Road, as opposed to running adjacent (to the back of) one platform. It also

improves linkages with residential areas to the west of Finglas Road via the new pedestrian crossing proposed as part of the junction redesign and the new residential development on St Margaret's Road. Also, the alternative Stop on St Margaret's Road provides a higher-quality urban design that will enhance the area with opportunities for additional future transport interchanges relating to Park and Ride and bus connections, as this route has been identified as a BusConnects corridor.

4.9.8.2. Overall Conclusions

Following the conclusions above, it was agreed to undertake an additional assessment to update the catchment analysis that had been based on preliminary information received from DCC, and which showed that the relocated Stop would exceed the original catchment estimates of the EPR Stop. This analysis took into consideration the impact of a potential redevelopment of the Jamestown Industrial Estate.

Following the review of DCC's Planning objectives, the track alignment, urban integration analysis and the Luas passenger impacts from relocation of the Stop, it was removed from Mellowes Park and relocated to the south of St Margaret's Road - the "Mellowes Park" Stop has then been named "St Margaret's Road" Stop.

4.9.9 McKee Avenue / St Margaret's Road Junction

Refer to Figure 4-9, item number 11, for exact location.

The current site layout consists of a roundabout junction connecting St Margaret's Road and McKee Avenue. St Margaret's Road is a two-way single lane arterial link between Finglas Road / North Road to the south and Charlestown and the M50 Motorway to the north (refer to Figure 4-20 and Figure 4-21 below). McKee Avenue is a local road providing access to Finglas Village, an industrial estate, and residential areas. Both St Margaret's Road and McKee Avenue form part of Dublin Bus service routes. The junction also includes an access arm to a Lidl supermarket.

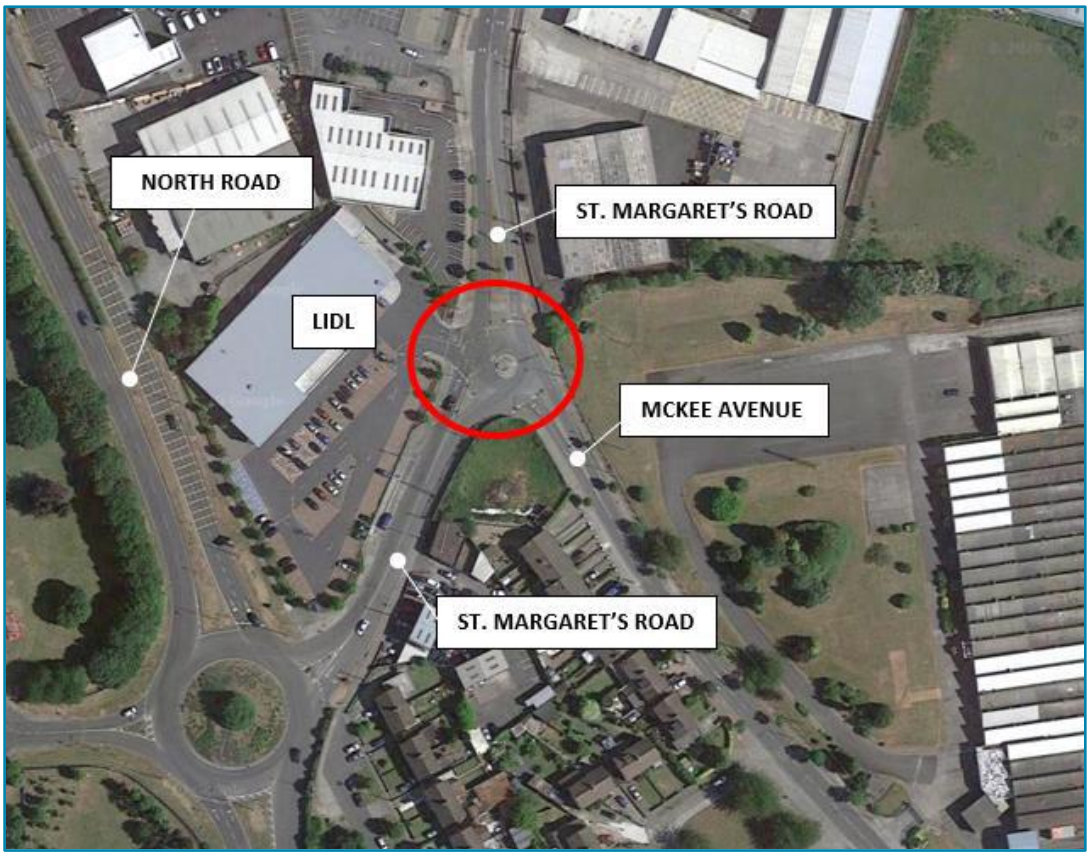


Figure 4-20: St Margaret's Road / McKee Avenue existing layout (Source: Google)

As part of the NSPC of the EPR, feedback was received from DCC in relation to an ongoing scheme to upgrade the mini-roundabout to a four-arm signal-controlled junction, which will require the redesign of the St Margaret's Road / McKee Avenue junction as proposed in the EPR.

Figure 4-21: St. Margaret's Road / McKee Avenue Proposed Junction Layout (Luas Finglas EPR)

Following the NSPC for the proposed Scheme, TII and DCC had several meetings to discuss proposals, jointly developing a coordinated scheme design, which would accommodate the proposed Scheme without the need to modify the position of kerb lines or road alignments during its construction. An integrated design approach was agreed, with the construction of the junction proposed to be delivered in two phases:

- Phase 1 (to be undertaken by DCC): Upgrade the junction to a four-arm traffic signal-controlled junction with cycle lanes and cycle protection on all approaches and exits; and
- Phase 2 (to be undertaken by TII): Enabling utility diversions and main infrastructural works for Luas Finglas, including the construction of the Luas alignment and associated infrastructure, additional signalised pedestrian crossing across McKee Avenue (east of the alignment) and uncontrolled pedestrian crossings of the Luas alignment.

The final junction design has been included in the design for the proposed Scheme and has been assessed as part of this EIAR including traffic impacts. Should Phase 1 not be delivered by DCC, then it will be delivered as part of the Luas Finglas works.

The junction included in the proposed Scheme is presented in Figure 4-22.

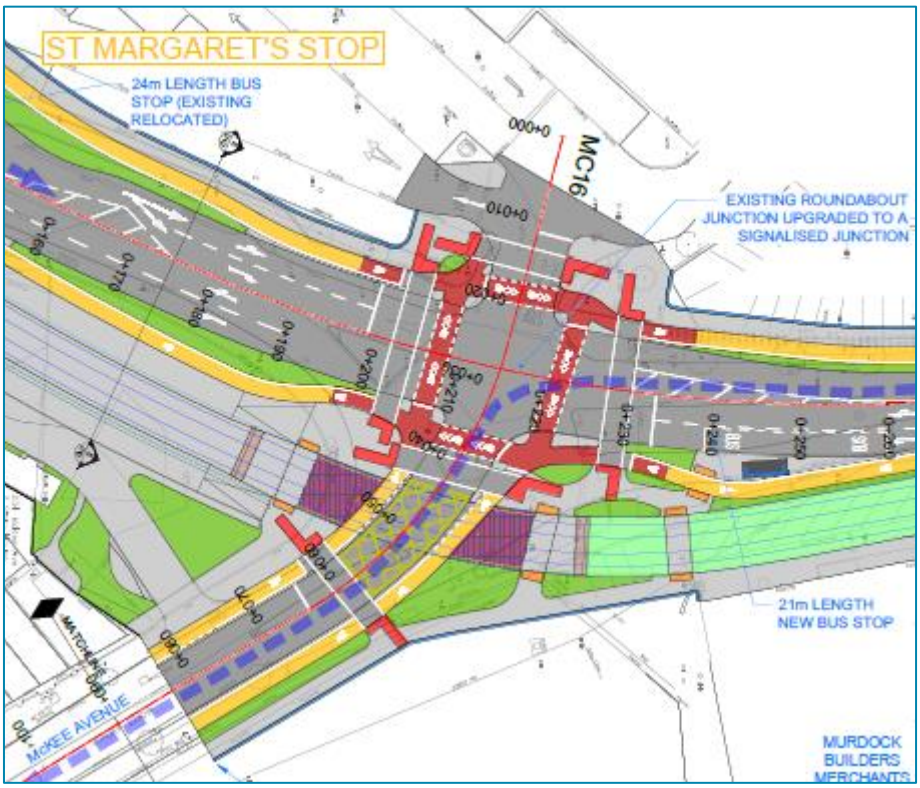


Figure 4-22: Proposed St Margarets Road / McKee Avenue Junction Design

4.9.10 St Margaret's Court

Refer to Figure 4-9, item number 12, for exact location.

As part of the EPR, in the northern section of the corridor, the proposed Scheme passes adjacent to the St Margaret's Court properties fronting onto St Margaret's Road.

The EPR alignment of Luas interfaced with the existing entrance to St Margaret's Court, that currently provides access to the properties at the back of the estate. The alignment also required a portion of private land in front of the properties 1-4, resulting in the loss of parking frontage onto St Margaret's Road. Design Option 1, in Figure 4-23, shows the scheme that is proposed as part of the EPR to provide alternative access and parking for the residents of St Margaret's Court.

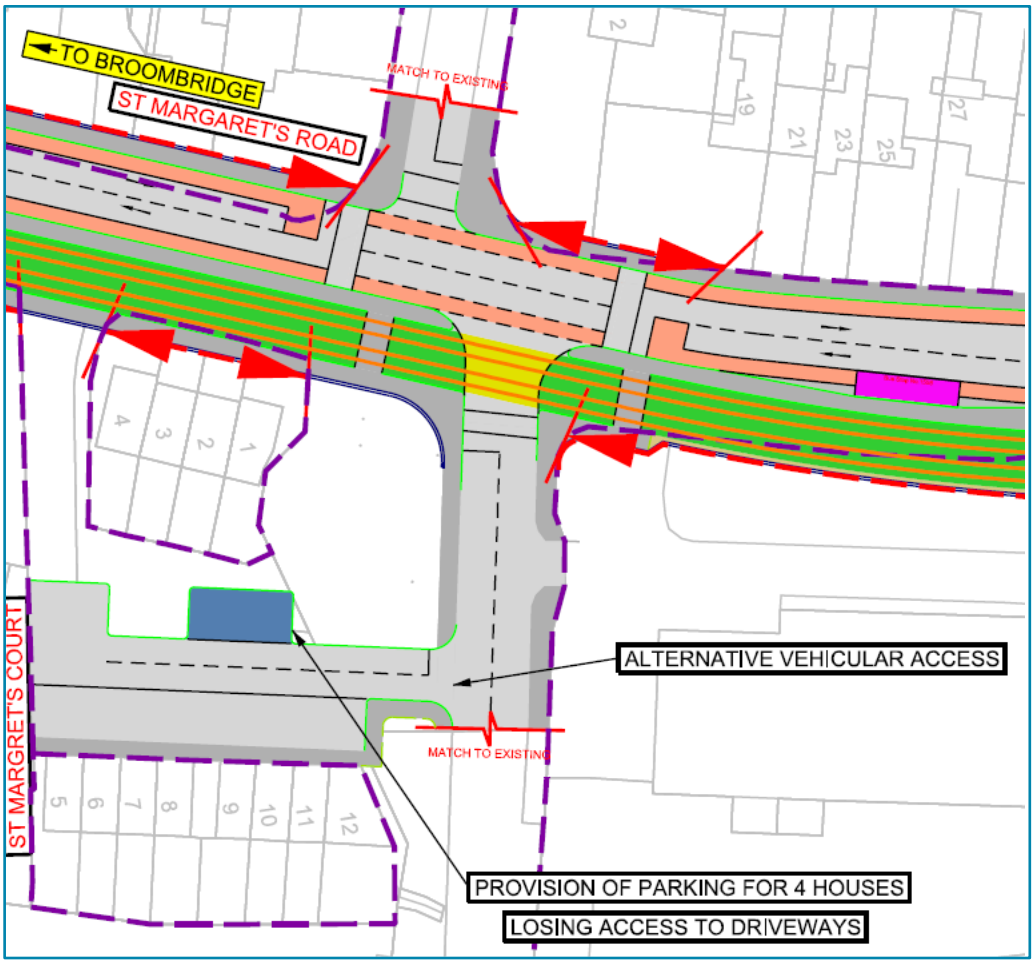


Figure 4-23: EPR at St Margaret's Court

Throughout the NSPC for the proposed Scheme, the EPR was challenged by residents of St Margaret's Court estate. During this process, TII engaged with the residents of St. Margaret's Court. A Microsoft Teams meeting was held on the 13th August 2020 where TII and the residents discussed the proposed scheme. On the 9th September, a site meeting was organised by the residents and was attended by the TII project team, 25 residents and four public representatives.

The residents raised concerns on the proposed alternative access and parking arrangement and noted that the proposed plan would not provide an arrangement as convenient as the current layout. Issues reported by residents were in relation to accessibility, safety, security, recreation, social inclusion and noise. Refer to Table 4-18.

Table 4-18: NSPC Feedback from St Margaret's Court residents

Resident Group	Summary of Resident Concerns
St. Margaret's Court residents (from the properties at the back of the estate)	▪ Residents would prefer that an alternative route to St. Margaret's Road is found, such as North Road which should be reconsidered as an option. ▪ The loss of green space in front of the houses. ▪ The change in access and the need for the existing entrance to be walled or fenced off to discourage anti-social behaviour. ▪ Suggestion to include extended green area and planting at the closed entrance. ▪ Impact of people parking on the cul-de-sac to access nearby stops. ▪ Accessibility for emergency services and refuse vehicles. ▪ Impact of new entrance on safety due to high volume of traffic using industrial estate conflicting with resident vehicles and pedestrians.

Resident Group	Summary of Resident Concerns
	▪ Noise disruption from Luas and additional traffic on St. Margaret's Road.
St. Margaret's Court residents (from the properties fronting onto St. Margaret's Road)	▪ Loss of existing secure off-street parking outside of front doors. ▪ Do not reduce back garden sizes to accommodate parking solution. ▪ Houses will require rear access in order to accommodate relocation of household bins.

4.9.10.1. St Margaret's Court Options Assessment

In order to minimise the concerns raised by residents of St Margaret's Court estate, further design development was undertaken, and two new alternative arrangements were identified and assessed to improve accessibility, secure parking and enhance the green space and landscaping in the estate.

Design Option 2 for St Margaret's Court

It is proposed that the entrance to St Margaret's Court will be via the new traffic signal-controlled junction, as per the EPR. Using the green space to the north of the estate, dedicated parking will be provided for properties 1-4. To enhance the amenity and security of the premises, a boundary wall will be provided to close off the existing entrance from St Margaret's Road and it will follow the front perimeter of the estate around to the new entrance, with the provision of gated entrances to properties 1-4. A private pedestrian gated access will also be provided frontage onto St Margaret's Road to allow front access for residents from the parking area. To the south of Number 4, the existing footway will be removed and instead, an access to back gardens will be provided, addressing concerns raised by residents relating to the storage of household bins. A dedicated area for household bin collection for properties 1-4 has also been provided.

It is proposed that the gated entrance to the industrial estate to the east of St Margaret's Court be set back by approximately 6.5m to accommodate the new access to the residential estate. While the road is currently used to access an industrial estate, this access will likely be retained to access the rezoned residential area replacing the industrial estate in the future. Refer to Figure 4-24.

Figure 4-24: Design Option 2 for St Margaret's Court

Design Option 3 for St Margaret's Court

Design Option 3 is similar to Design Option 2 except for providing a variation to the parking arrangement for properties 1-4. Refer to Figure 4-25.

Figure 4-25: Design Option 3 for St Margaret's Court

Design Option 4 for St Margaret's Court

Design Option 4 is the result of later consultations with residents, a further on-site meeting with residents took place on 19th June 2024, and incorporates assigned two parking spaces each for properties 1-4 to the rear of their homes, 16 marked out parking bays outside properties 5-12, eight additional marked out parking bays, and no pedestrian access via the green space to the north. Refer to Figure 4-26.

Figure 4-26: Design Option 4 for St Margaret's Court

4.9.10.2. Environmental Analysis

An environmental assessment was undertaken to identify the preferred alignment at St Margaret's Court. The environmental assessment was undertaken having regard to environmental topics, but only those environmental aspects which were identified as differentiators between the options considered and directly influencing the development of proposed Scheme are discussed below.

- Landscape & Visual: In comparison to the EPR (Design Option 1), Options 2, 3 and 4 retain the green area in front of the rear properties and also allow for the green area to be extended to the closed existing entrance, with landscaping provided, if preferred. A grouping of trees located in the green space to the north of the St Margaret's Court estate will have to be removed. However, the intention would be to retain the grouping of trees further to the west. The design will be developed to incorporate the tree as part of the landscape design, adding to the amenity of the estate. The alternative parking for properties 1-4 is now located so that it does not compromise the existing green space in front of the houses 5-12. The green area is extended due to the closing of the existing access and the opening of the area to the north to accommodate the parking, offering the opportunity for enhanced landscaping.

4.9.10.3. Overall Conclusion

Arising from the overall analysis undertaken the recommendation was that Option 4 was brought forward as the Preferred Option. The principal reasons for the choice of the Preferred Route are as follows:

- Improve accessibility to secure parking; and
- Enhance the green space and landscaping the estate over the EPR option and is similar to options 2 and 3.

It should be noted that the Luas EPR alignment was not affected by this change. Purchasing land from the adjacent Industrial Estate entrance road is needed to widen the road (three lanes plus cycle lanes) and provide replacement car park for the four front houses impacted by the proposed Scheme.

4.9.11 Park & Ride

The selection process for the Luas Finglas Park & Ride was developed in tandem with both Stage 1 Route Options Assessment and Stage 2 Route Options Assessment.

In those initial studies, five possible locations were selected for the Luas Finglas P&R (see Figure 4-27) and Options 1-2 (separately or combined) were recommended to be brought forward as Preferred Options. Options 1-2 were preferred from a Luas and strategic road connections viewpoint (within current road network scenario), while Option 4 emerged as more suitable in terms of land use and unconstrained development. At the time, the P&R was conceived to provide 600 car spaces at the opening year and up to approximately 1,000 car spaces by Year 10.

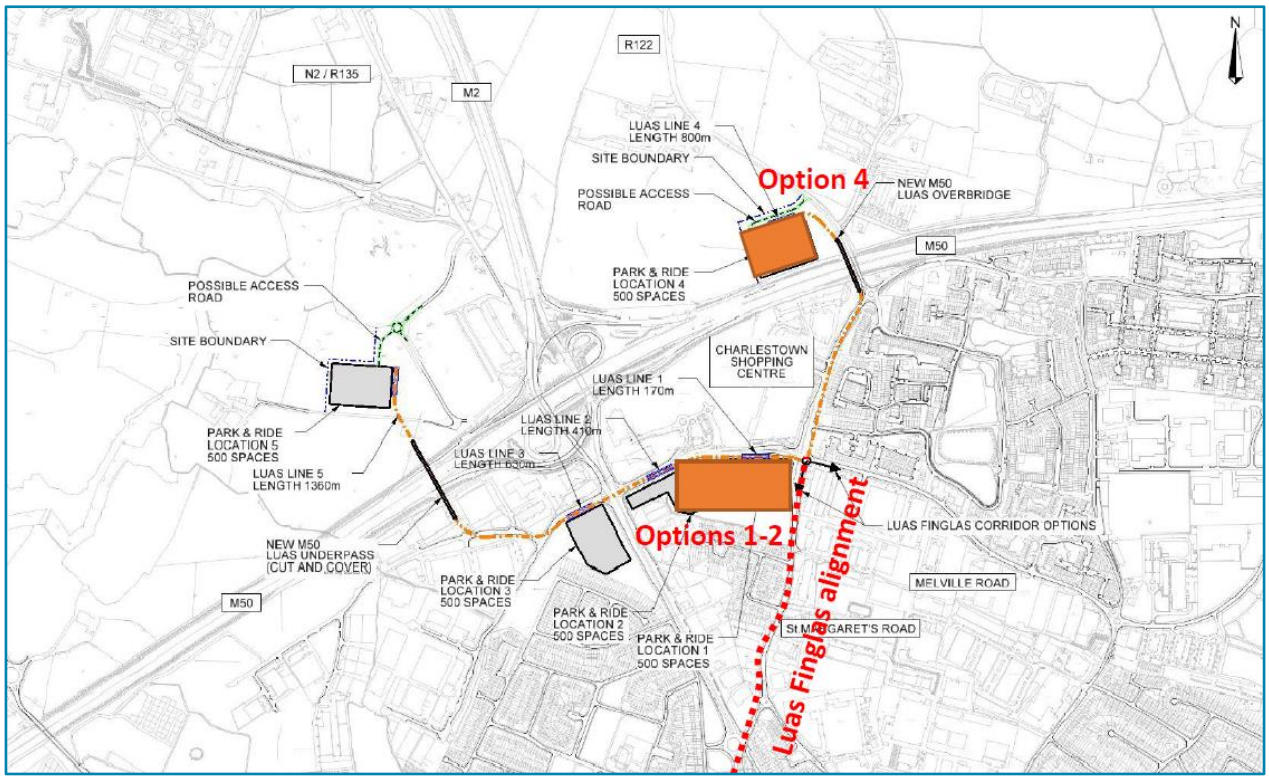


Figure 4-27: Luas Finglas P&R initial location options with EPR options 1-2 and 4

In the assessment of alternatives, an essential prerequisite of Park & Ride provision is that such facilities improve public transport accessibility without unduly worsening road congestion, or increasing the total distance travelled by car. A key objective is to develop a network of strategic rail-based Park & Ride facilities at appropriate points where rail services intersect with the national road network, adjacent to, or outside of, the M50 (including Finglas) with the capacity of the onward public transport service.

During the NSPC of the EPR, which ran from July to September 2020, TII was made aware of a proposal from the landowner / developer of the site for Options 1-2 to apply to ABP in the following months after the NSPC for a Strategic Housing Development (SHD), the so-called “Charlestown Phase 3”, comprising a series of apartment blocks up to ten storeys height, delivering up to (indicatively) 580 apartments and one basement car park for the residents.

This subsequent feedback and additional information gained led to three viable scenarios for the location of the new P&R. Refer to Figure 4-28 for option locations and names.

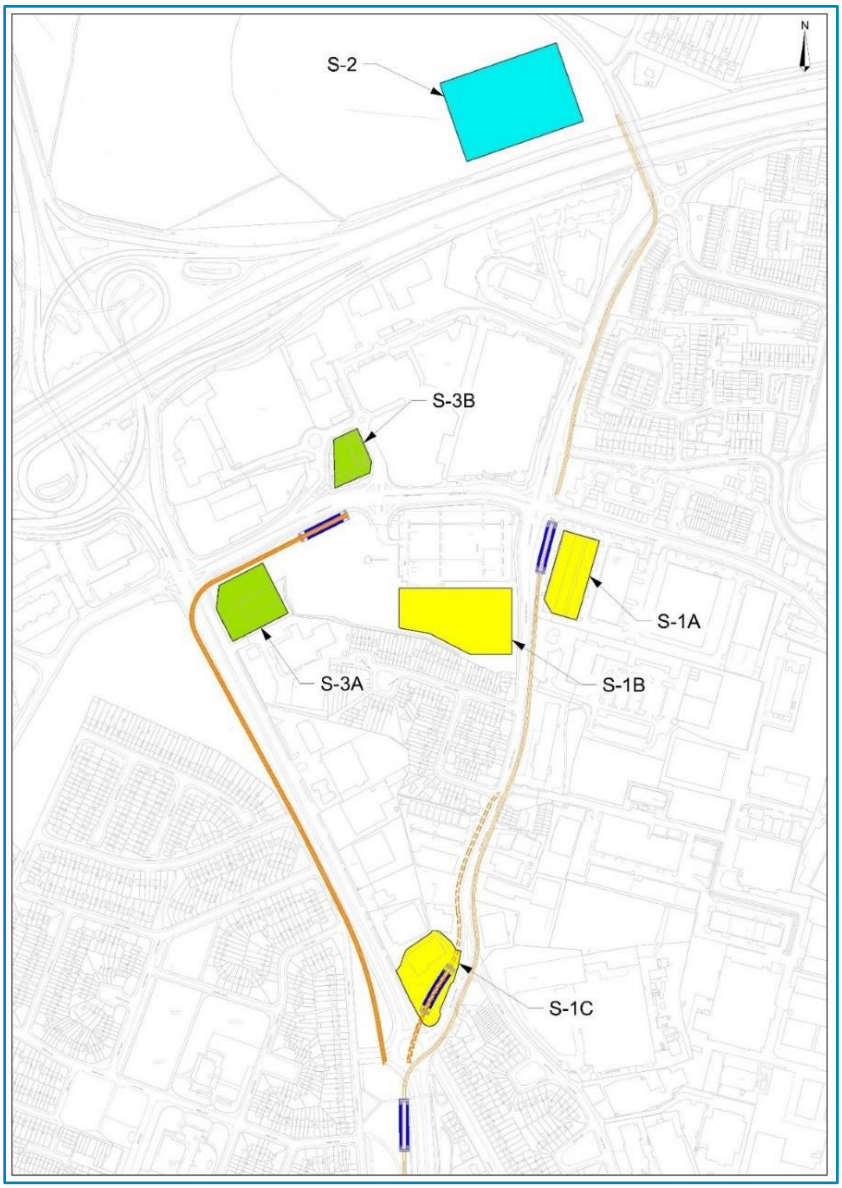


Figure 4-28: P&R Site Options

- **Scenario 1** - explores all options for providing a multi-storey P&R of adequate capacity in the vicinity of the last Stop, or along the EPR. This scenario assumes the EPR alignment is maintained, or alternative alignments are used on St Margaret Rd. It includes options based on acquiring a block of commercial properties and returning the ground floor to retail use after completion.

  - Option A in the upper corner of the Jamestown Industrial Estate, taking one or two single-storey sheds;
  - Option B in the Mc Kelvey Celtic A.F.C. playing pitch, just south of the proposed Charlestown Phase 3 development;
  - Option C, approx. 550m south from Charlestown, in the Margaret's Road Lidl supermarket site, adjacent to the McKee / St Margaret's Road junction. This option would not be served by Charlestown terminus Stop, but by the previous Stop (St Margaret's Road, formerly Mellowes Park), which should be moved to the west side of the North Road as part of this option.

- **Scenario 2** - explores site options and alignments for locating a P&R across the M50. This scenario includes accurate information on access from M50 and N2. The north-eastern quadrant of the M50-N2 junction was shortlisted in the previous studies and this remains the only feasible option across the M50. A significant portion of this area consists of currently unoccupied lands, generally zoned for industrial

use and employment creation. Based on the land value in this area and relative pro-rata construction cost, it initially appeared that a surface P&R would be more suitable than a multi-storey facility at this site and this is still considered the case.

- **Scenario 3** - explores alignments along the North Road. This scenario assumes that a block of commercial premises can be acquired and maybe part of the new building can be dedicated to retail. It is worth noting that an alignment along the North Road was examined in the Options Selection Stage 1 for Luas Finglas, and that it was discarded, but due to the requirement to re-examine an alternative P&R location a thorough reconsideration of this option was warranted. Reconsidering this option did not undermine the Options selection process as all the shortlisted options of the Stage 1 could be routed via St Margaret's Road or the North Road and therefore this section is common to all.

  - Option A - Upper corner of the North Road-Charlestown Place as this would be in close proximity to where the Luas corridor could cross the North Road, delivering the opportunity for a Luas Stop adjacent to the P&R without the need for P&R users to cross the North Road. It would also shorten the entry journey in the am peak from the M50-N2 interchange, which is the most critical. In this case, the Luas interchange Stop could be either located over the structure, at approx. +5m over ground level if adjacent to the P&R, or at ground level, if located further east;
  - Option B - In the "restaurant corner" of the Charlestown area (KFC and McDonald's).

A SWOT analysis was undertaken to consolidate all impacts of each option using criteria under the headings of Luas Alignment, Economy (cost and runtime), Property, Connectivity, Integration and Other Costs/Risks.

Following this assessment of the possible sites, two locations (S1-A and S1-C) were brought forward as the feasible alternative options for further consideration and engagement with the landowners and the Local Authorities. Both options scored well in terms of potential for future increase of serviceable catchment, passenger connectivity, environmental (archaeological) constraints and compatibility with development plans and integration with the GDA strategy. There were, however, some risks associated with road connectivity and land property that needed further consideration.

Option S1-B, approximately 50m south of the proposed Luas Stop, did not compare well in comparison with other options due to safety and passenger connectivity issues between the P&R and the Luas Stop as passengers would be required to cross St. Margaret's Road. In addition, it does not align with FCC's zoning objectives of Green Space. Therefore, this option was discarded.

Option S2 would incur a very high cost, more than double of other options assessed, with significant new road infrastructure to be provided including a new bridge over the N2, a new junction off the N2 with higher planning risks and a possible new Luas bridge needed over the M50 with uncertainty about the potential for future increase of serviceable catchment in this location. In addition, this area presents poor connectivity for cyclists and pedestrians, and it was also considered a high-risk area for archaeology.

Both options within Scenario S3 were discarded as they require a different Luas corridor (along the North Road) than the EPR, which was deemed to be less attractive than the EPR at the options selection stage. This scenario would be less compatible with the zoning of the green area, while the provision of a Luas overbridge, with associated structures and ramps either side of the North Road, could be challenging from an environmental / aesthetic viewpoint, particularly to the west of the North Road. The option where the Luas runs at grade through the junction would still impact the green area (to a larger extent) and would have a detrimental effect on the junction capacity, which is key to delivering M50-N2 interchange capacity. In addition to this, the potential for future increase of serviceable catchment in this location is somewhat limited. The opportunity for development of future employment and high-density residential facilities in the area resulting from the zoning by the Local Authority (re-zoning of the Jamestown Industrial estate) would be poorly served by the proposed alignment and stop location.

However, Option S3-A presented some strengths including excellent connectivity for road users, potential for future increase of serviceable catchment and limited archaeological risks (limited impacts in general).

Following the findings presented above, in December 2020, it was recommended also considering Scenario 3 Option A (S-3A) with proposed site being served by an extension of the EPR alignment rather than the North Road alignment. This option, called S3-A1, which included approximately 400m of alignment and an additional Stop, as illustrated by Figure 4-29 was incorporated into the SWOT analysis.

Figure 4-29: S-3A-1, served by EPR Extension

The outcome of the SWOT analysis indicate that once again Options S1-A and S1-C were deemed the most viable options for the P&R facility, with Option S1-A scoring slightly better overall.

Option S3-A with an alignment along St. Margaret's Road and Charlestown Place also scores very highly, with the exception of the cost associated with the longer Luas alignment, the additional Stop and the technical challenge associated with future line extensions northwards and eastwards, all of which made it a less attractive option.

The NTA subsequently requested TII to postpone the P&R location analysis pending the results of its Dublin-wide strategic P&R assessment study. The P&R Strategy set out objectives for Park & Ride which seeks to intercept private vehicle traffic at the earliest point on the network that would support the provision of higher frequency public transport. In developing the strategy in the GDA and applying these principles a key focus was ensuring that the demand generated along a corridor was served by P&R facilities on that corridor and in that regard provision of facilities within the M50 corridor should be limited. This approach is detailed in the GDA Park & Ride Strategy that was published as a background paper to the GDA Transport Strategy 2022-2042.

A travel demand analysis was undertaken along the M2 corridor between the M50 and Ashbourne. Select links from the ERM were taken at various locations along the corridor for both the current and future year (2043), to determine the destinations of cars passing each location based on the model. The recorded data included the number of car trips passing each of the selected links, heading southbound during the AM peak and northbound during the PM peak. Two separate destination zones within Dublin City were chosen i.e. the Canal Cordon and Docklands Zone, and the Suburban Zone, defined as a 2 to 3km wide corridor between the M50 and the Canal Cordon Zone. Different capture rates for both base and future years were applied, and the results determined the optimal location and daily usage of the P&R facilities along the M2 corridor.

For the M2 corridor a 350-bus based Park & Ride in the environs of Ashbourne complemented by a 350-space Luas P&R at Finglas was defined as the appropriate provision to meet demand in line with the objectives for Park & Ride. It should be noted that the northern bus-based P&R facility is currently at option selection stage and a planning application is expected to be lodged by the end of 2024.

The results of this NTA study were communicated at the May 2021 Project Board meeting, allowing the Options Selection study for Luas Finglas P&R to be further progressed.

Following that, the Luas Team confirmed the two shortlisted options for the P&R location, namely S-1A (adjacent to Charlestown) and S-1C (at the Lidl site, adjacent to the relocated "St Margaret's Road" Stop) as illustrated in Figure 4-30, and then developed some high level designs for both options.

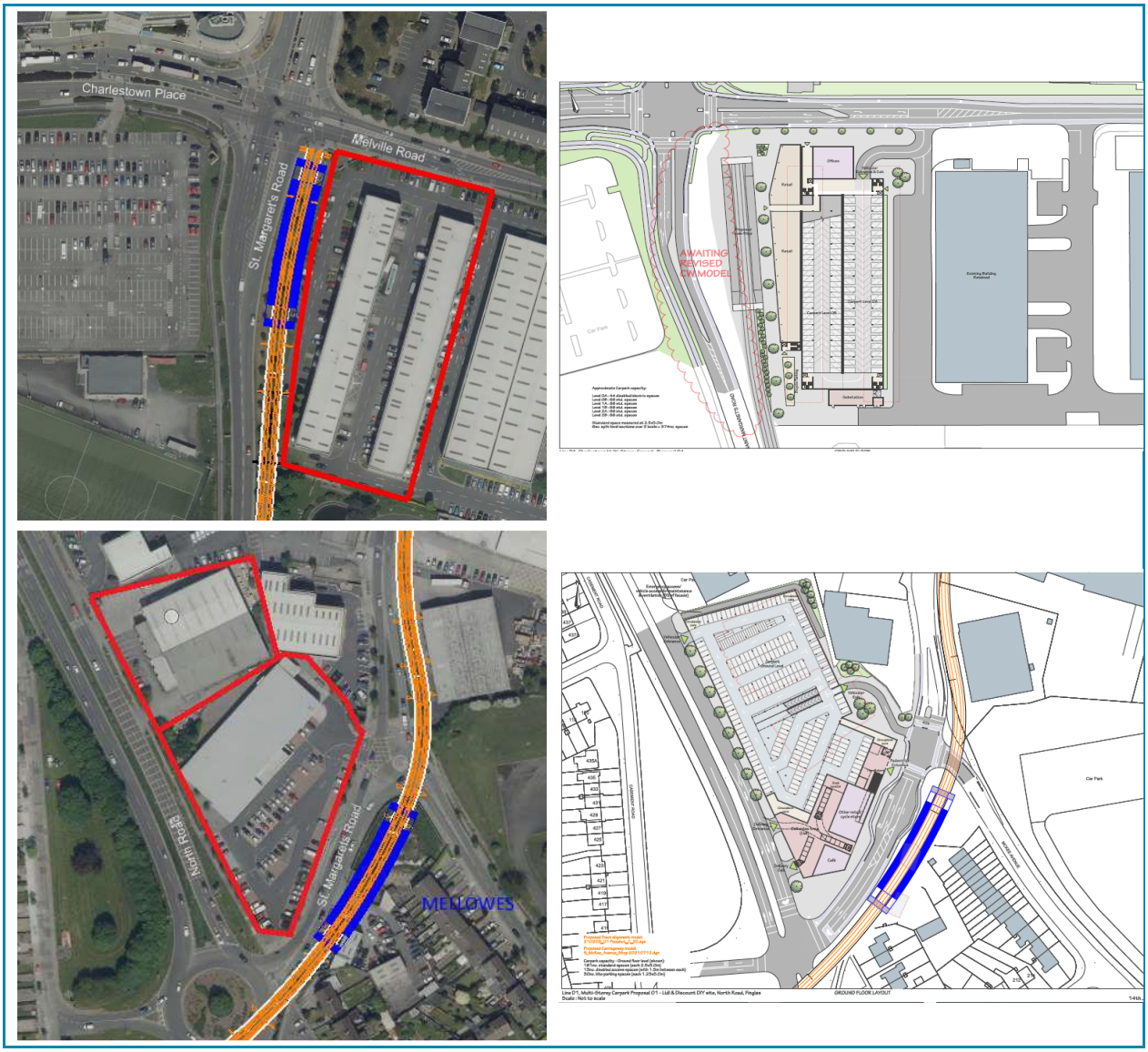


Figure 4-30: P&R Site Options (Charlestown (S1A) site at the top, Lidl (S1C) site at the bottom)

Consequently, property owners were engaged formally to gain feedback on the feasibility of a multi-storey car park within the respective sites before a final decision was taken. Similarly, DCC and FCC were formally engaged to gain a better understanding on the requirements of a P&R facility for integration purposes whilst also aligning with development plan policies.

Following formal engagement with the landowners of both properties, a more in-depth analysis of both options was carried out. Option S1-A presented clearly foreseeable challenges inter alia access / egress and issues posed by the number and nature of property stakeholders involved (multiple existing business occupiers and multiple owners together with common areas to a larger established business park), including the HSE mental health day care facility amongst several other operators. In summary, Option S1-C (Lidl option) worked better from a property, traffic and cost viewpoint and it was recommended as preferred option.

4.9.11.1. Preferred P&R Site Analysis

Once S1-C was identified as the preferred P&R site in November 2021, a number of micro-options for the site and adjacent lands were explored with a view to maximising the P&R benefits. Moreover, following engagement with Lidl, the proposed P&R allows for any future/potential re-development of the lands by Lidl to accommodate their forthcoming requirements.

Micro-Options	Description
Option 1 	Option 1 is a combined development proposed by Lidl, which is based on Lidl's potential future development plans. It includes a section of the parking spaces on the ground floor, a multistorey P&R at the rear, and the first floor between the Lidl premises and residential apartments. It also includes an external vertical core with pedestrian bridges.
Option 2 	Option 2 includes only a portion of the Lidl site, which provides access from St Margaret's Road.
Option 3 	Option 3 proposes a separate multi-storey P&R structure on the Discount DIY (owned by Lidl) site that has no interactions with third parties. It also includes pedestrian connectivity from the P&R to the Luas Stop via enhanced North Road footpath, avoiding any interaction with the current Lidl supermarket layout and their parking.

Micro-Options	Description
Option 4 	Option 4 is similar to Option 3, but it includes a safe pedestrian access and egress across a portion of the Lidl site from St Margaret's Road instead of using the North Road footpath. This impacts on current Lidl lay-out and parking, which will have to be redeveloped, but provides a better pedestrian linkage for the P&R to the Luas Stop.
Option 5 	Option 5 is also similar to option 3, which locates the P&R on the Discount DIY site. In this case, after the construction of the P&R, part of the ground floor could be returned to Lidl for its future use as car parking as part of any proposed redevelopment, subject to Lidl obtaining planning permission for that use and subject to certain restrictive covenants in relation to the use of the area that are required to protect the P&R facility.
Option 6 	Option 6 also includes the Discount DIY site. In this case, after the construction of the P&R, part of the ground floor could be returned to Lidl for its future use as car parking as part of any proposed redevelopment, subject to Lidl obtaining planning permission for that use and subject to certain restrictive covenants in relation to the use of the area that are required to protect the P&R facility and a portion of the Lidl site for pedestrian access from St Margaret's Road. It provided better pedestrian connectivity for the Luas while potentially providing Lidl with future additional under croft parking spaces. However, it requires full redevelopment of the Lidl supermarket as certain demolitions are required to facilitate the pedestrian walkway, alternatively a pedestrian bridge would be required.
Option 7 	Option 7 includes the Atlas Tyre site and a portion of the Discount DIY site to provide road access from North Road, as well as pedestrian access from St Margaret's Road.

A SWOT analysis was developed to assess each micro-option against the following key factors: Integration and Urban Planning, P&R Customer Experience, Construction and Phasing, Property Considerations and Legal/Planning Risks. The outcome of this analysis is summarised in Table 4-19.

Table 4-19: Micro-Options Assessment for the preferred P&R Site

Options	Strengths	Weaknesses	Opportunities	Threats
Option 1				
Option 2				
Option 3				
Option 4				
Option 5				
Option 6				
Option 7				

In parallel to the Luas Team design development/refinement, several meetings were held with the Lidl landowner. From end of 2021 to middle of 2023, the Luas Team engaged extensively with planning and legal consultants and it became clear, from a planning and legal perspective, that the initial proposed options with a combined development (including the development of the P&R together with the redevelopment of the Lidl store and possible other mixed use/residential use) presented many interface risks and challenges to the Luas Finglas P&R. The design was then developed with the P&R located fully within the Discount DIY site (owned by Lidl), which minimises interfaces with both Lidl's existing and future planned redeveloped store.

Taking into account all of the above, Option 6 (Discount DIY-Lidl) was initially determined as the preferred option and taken forward to the next stage of design development.

4.9.11.2. Discount DIY vs Discount DIY & Atlas

Following extensive consultation with the landowner and the legal and planning teams/consultants in TII, a pedestrian bridge was included, which spanned the existing loading bay. This pedestrian bridge, while offering some advantages, also increased costs, interfaces with Lidl operations, and did not provide an intuitive or efficient pedestrian link from the P&R to the platform. For that reason, options 5, 6 and 7 were further assessed based of their relative advantages or disadvantages in relation to: Pedestrian Connectivity and Passenger Experience, Architectural Design and Integration / Compatibility with development plans, Environmental, Property Acquisition and Construction Cost, Stakeholder / Landowner Impacts and Road Connectivity and Cycle Integration. See Figure 4-31 below.

- Option 1 (formerly option 6) - Current Design "Lidl-Discount DIY" with pedestrian bridge (Refer to Figure 4-32);
- Option 2 (formerly option 5) - "Lidl-Discount DIY" without pedestrian bridge (Refer to Figure 4-33); and
- Option 3 (formerly option 7) - "Lidl-Discount DIY & Atlas" (Refer to Figure 4-34).

Figure 4-31: "Lidl-Discount DIY" option in Red and new "Lidl-Discount DIY & Atlas" option in yellow, with pedestrian connectivity indicated in dashed lines.

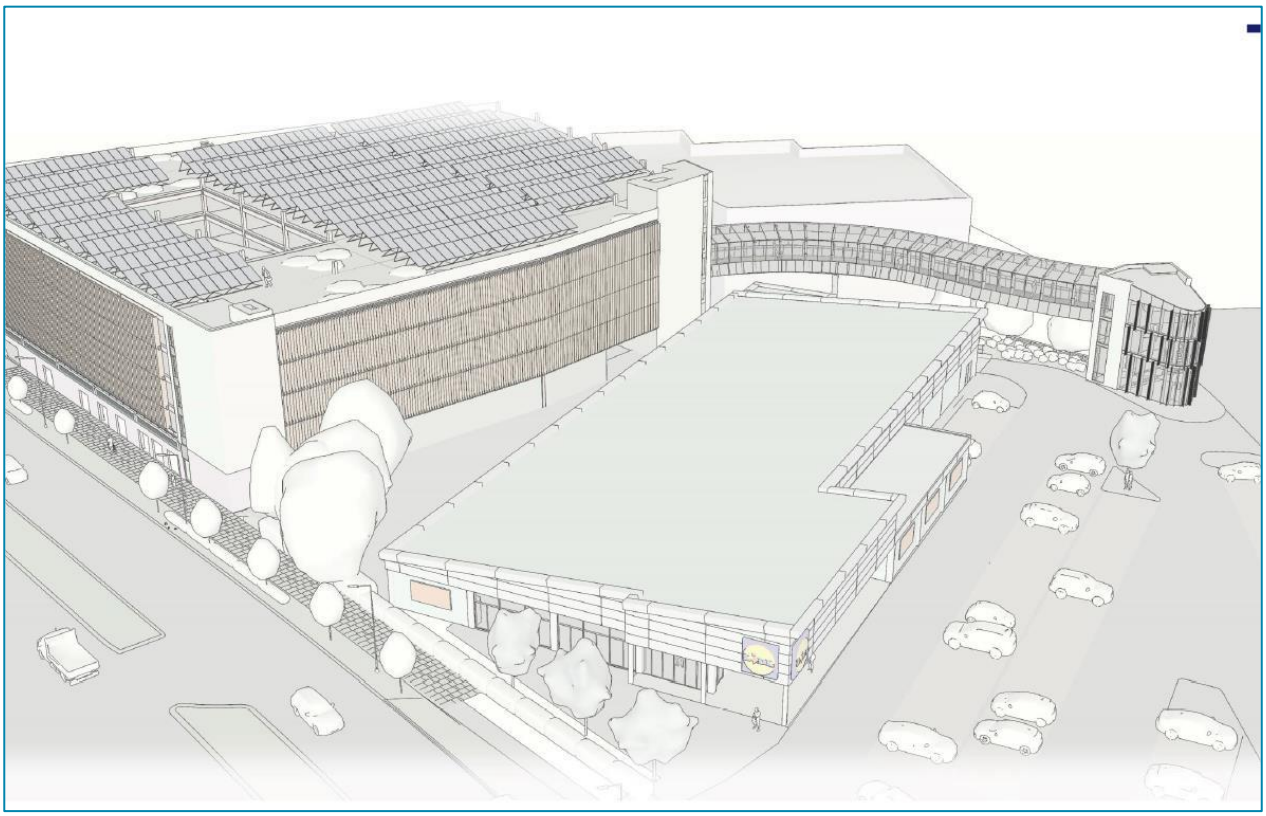


Figure 4-32: Lidl-Discount DIY with pedestrian bridge (Option 1)

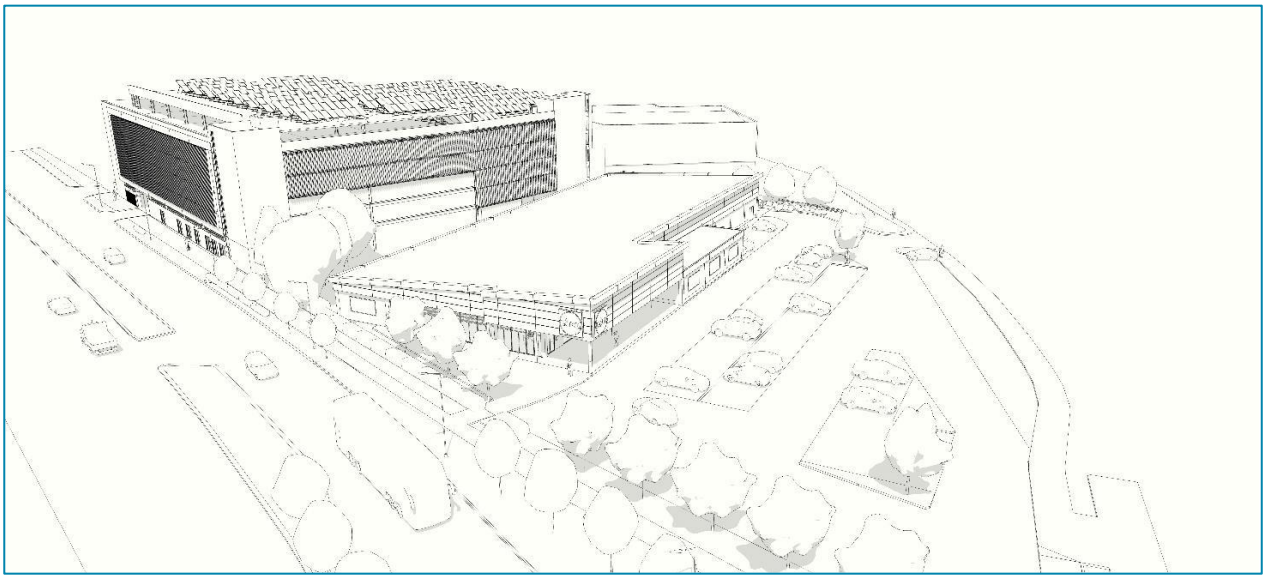


Figure 4-33: Lidl-Discount DIY without pedestrian bridge (Option 2)

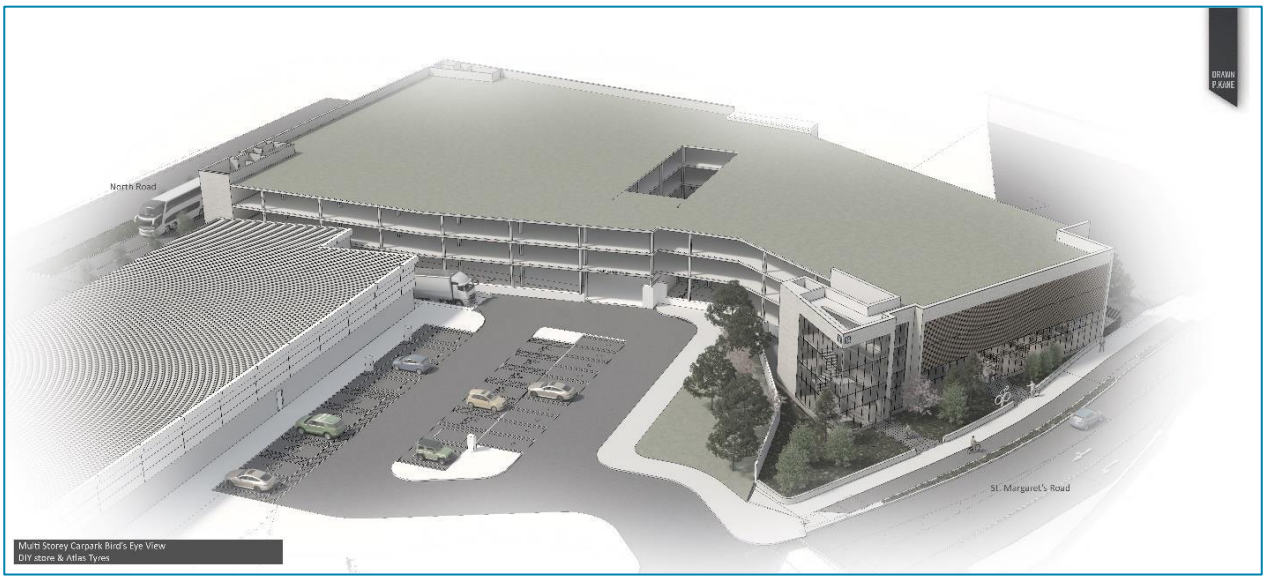


Figure 4-34: Lidl-Discount DIY & Atlas (Option 3)

The conclusions of this assessment are summarised in Table 4-20 below.

Table 4-20: Summary of MCA undertaken on P&R options

Option / Criteria	Option 1 – Current Design "Lidl-Discount DIY" with pedestrian bridge	Option 2 – "Lidl-Discount DIY" without pedestrian bridge	Option 3 – "Lidl-Discount DIY–Atlas"
Pedestrian Connectivity and passenger experience			
Architectural Design and Integration / Compatibility with development plans			
Environmental			
Property Acquisition & Construction Cost			
Stakeholder / Landowner Impact			
Road Connectivity and Cycle Integration			

4.9.11.3. Environmental Analysis

Whilst all the environmental aspects as listed on Annex IV of the Directive 2011/92/EU as amended by Directive 2014/52/EU (European Union, 2014) were considered for each of the P&R options, not all aspects were deemed to be differentiators. Only those environmental aspects (as summarised in Table 4-21) which were identified as directly influencing the development of route options at this stage were considered in greater detail within this assessment.

Table 4-21: Environmental Considerations for the three P&R options

Criteria	Analysis of Environmental P&R Options	Differentiator?
Population and Human Health	No key differentiators although Option 1 will provide direct pedestrian bridge link.	No
Biodiversity	No key differentiators for all 3 Options with respect to Biodiversity. The area is largely urbanised with most of the area comprising either artificial surfaces or ornamental planting with no ecological value.	No
Land and Soils	Conditions are anticipated to be broadly consistent with surrounding area and as all three Options comprise urban brownfield sites, and there is no material differentiation in terms of impact on Land and Soils.	No
Air Quality and Climate	It is not expected that the Park & Ride facility will have any significant air emissions other than vehicle tail pipe emissions. The Construction Phase air quality impacts will be related to construction dust that will be undertaken in accordance with the relevant IAQM construction dust assessment guidance. A similar construction dust impact is expected for each option, in terms of demolition, earthworks, construction and trackout. Appropriate construction dust mitigation measures will be contained in the CEMP for the proposed demolition, earthworks, construction and trackout works in this area. The Construction Phase climate impact assessment will be based on the outputs from the detailed TII carbon tool. This will be mainly populated with information from the design engineers. A similar Construction and Operational Phase climate impact is expected for each option. Overall, it is not expected that there will be any significant difference in the 3 Options with respect to operational and construction air quality and climate impacts.	No
Noise and Vibration	The 3 Options considered will have similar noise & vibration impacts. During construction there will be slight differences in the duration and location of works with Options 1 & 3 requiring additional construction activity compared to Option 2. The major noise source during operation is traffic to and from the P&R with the possibility of some mechanical and electrical plant to serve the development. Given that each option is nominally equivalent and use the same access point for traffic, no significant differentiators are noted. During the Operational Phase, all three options are considered equivalent in terms of noise and vibration impacts	No
Water	During the Construction Phase of all three options there is the possibility that construction related silt, gravel and fines could be washed into public sewers. This material can then potentially make its way to watercourses within the region. This impact will be proportional to the scale of construction, meaning Option 1 will have the largest impact, Option 2, the second largest impact, and Option 3, the third largest impact. Measures to mitigate this impact will be as detailed in the EIAR and the Surface Water Management Plan. However, these are relatively insignificant impacts, and it is considered there is no material differentiation in terms of Water. During the Operational Phase, where pedestrian bridges are provided, there will be additional hardstand area which will require a surface water collection system, but it is considered there is no material differentiation of all three options in terms of water at the operational stage.	No
Material Assets (Traffic and Transport)	There is no change in the general access arrangements for traffic across the 3 P&R options. Therefore, there is no difference from a traffic perspective across the 3 Options.	No
Cultural Heritage	No key differentiators among the 3 options. There are no recorded archaeological sites or protected structures located within c.800m of the	No

Criteria	Analysis of Environmental P&R Options	Differentiator?
	P&R Options and there are no NIAH-listed constraints within c.300m of the location. In addition, the P&R location is not within a Zone of Archaeological Potential or an Architectural Conservation Area. The only cultural heritage constraints identified within the environs of the P&R location comprise levelled townland boundaries which are now occupied by modern developments. The variation in design of the three options will result in no differentiation in terms of the assessment of impacts on cultural heritage.	
Landscape and Visual	All three options are within a local Landscape Character Area which is of low quality and low sensitivity i.e. the area exhibits a high capacity for change and has very few or no designated landscapes or open space areas. Intermittent roadside trees on North Road, Finglas Road and St Margaret's Road are the tallest elements within these road corridors, and they help to assimilate the existing industrial, commercial and residential buildings into the urban landscape. The introduction of a six-storey Park & Ride structure (Options 1 and 2) will dominate both the local landscape character and the skyline in this location. The building will be taller than existing trees and it will obstruct westerly views from visual receptors on Casement Road (R129 and R130 Ref chapter 21, LVIA) and has the potential to be visually overbearing. To mitigate any visual impacts, an option which allows for planting of tall trees to partially screen a new tall building is preferred. Option 1 with the pedestrian footbridge, results in further visual obstruction of views from the raised footbridge structure and is least preferred, if a six-storey building is required. Option 2 without pedestrian bridge, allows for maximum space at ground level for footpaths and trees planting, and presents the greatest opportunity for mitigation. This is preferred if a six-storey building is required. Option 3, the Lidl Discount DIY Altas design has greater surface area, so the building could be lower in height resulting in less visual obstruction of views. It would be less dominant within the low-rise urban environment and has potential to accommodate tree planting at the interface with the existing streetscape. Overall, Option 3 is preferred from a Landscape Character and Visual Impact assessment perspective.	No

4.9.11.4. Overall Conclusions

This analysis identified, as summarised in Table 4-20, a preferred site option (Option 2 – "Lidl-Discount DIY" without pedestrian bridge(formerly Option 5)) for the location of the P&R to the north-eastern corner of the existing North Road, Finglas Road, St Margaret's Road roundabout. The site currently contains operational businesses in the form of a DIY store.

The preferred solution will locate the P&R at the Discount DIY site, in a new multi-storey structure housing a 350-car parking spaces. Accesses and egress to be provided from the North Road.

This proposed location for the P&R has a number of advantages over alternative site locations including the following:

- Limiting impacts on landowners;
- Reducing the overall cost;
- Avoiding a P&R structure fronting St Margaret's Road;
- Reducing overall stakeholder delivery risks; and
- Allowing for potential future redevelopment.

4.9.12 Broombridge Tie-In Options

In March 2020, a comprehensive series of potential options were developed with various tie-in configurations at Broombridge, all grade-separated crossing the canal and the railway either under or over to establish the most appropriate form of connection to the existing Luas Green Line Terminus at Broombridge. The connection configuration is constrained by the existing road, existing historic bridge and the current terminus station as well as a nearby electrical substation. Clearances to both the canal and the railway line (which is due to be electrified under a separate project) had to be considered.

The majority of the options follows Broombridge Road and enters Tolka Valley Park at the junction of Broombridge Road and Ballyboggan Road; this is shown as corridor 1 in Figure 4-35. Other options with the alignment crossing the railway and the canal further west have also been examined and are shown as corridor 2 in Figure 4-35.

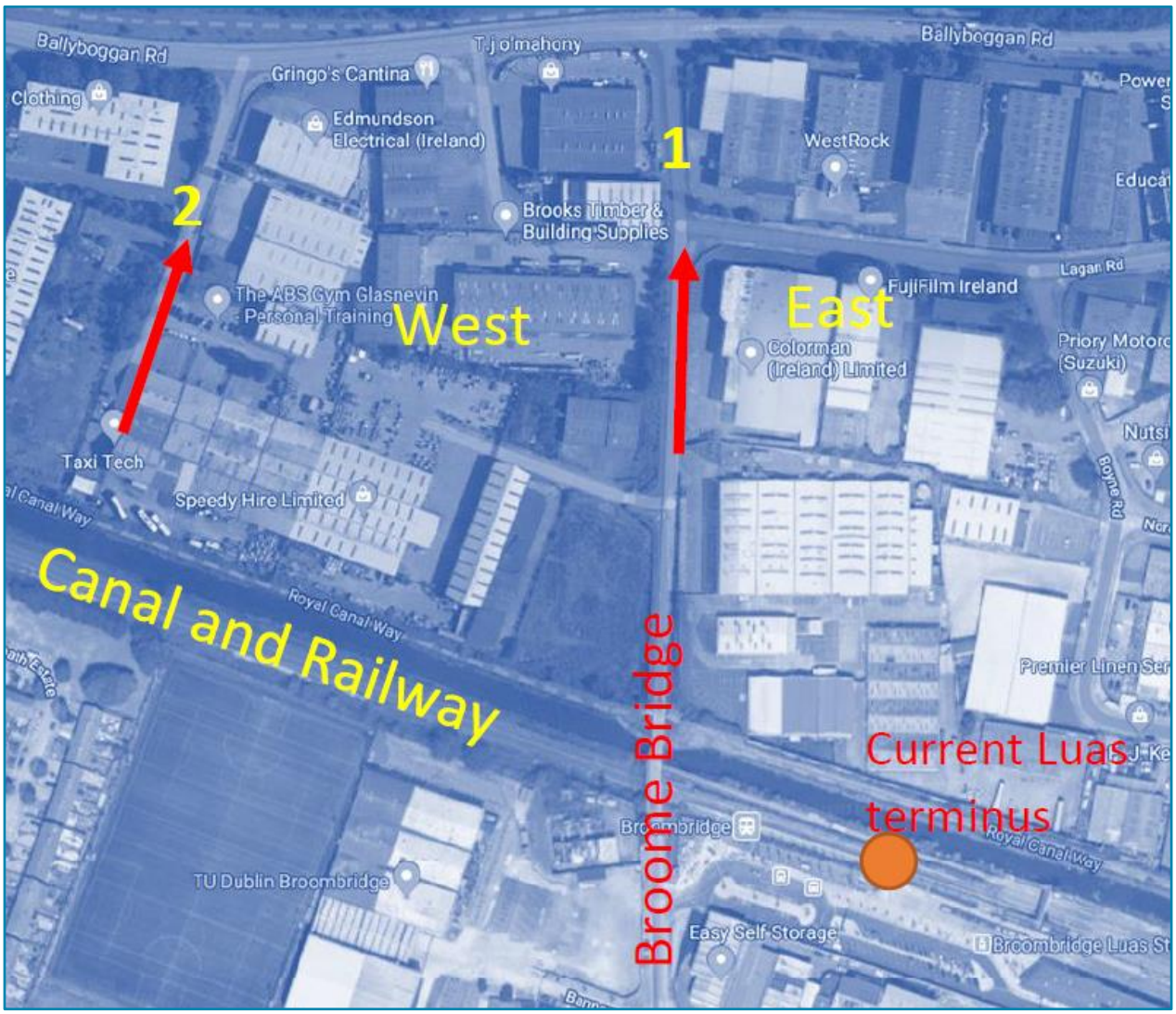


Figure 4-35: Key features of the Broombridge tie-in area

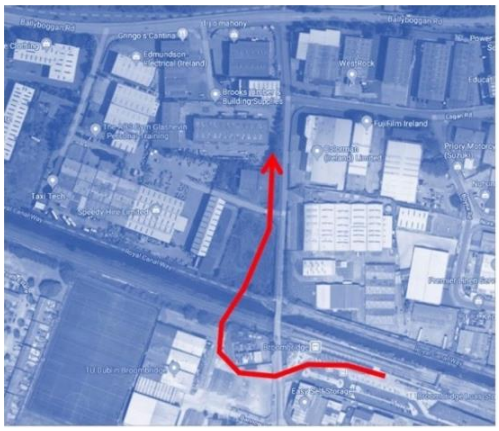
A detailed assessment was undertaken assessing up to 14 different options for connecting the line at Broombridge including alternative alignments and bridge locations as well as several tunnelled options. All options considered are illustrated in Figure 4-36.

Option 1 & 2: Overpass / Underpass East

Option 3: Underpass West

Option 4 & 5: Overpass / Underpass

Option 6: Overpass West



Options 7, 8, 9, & 10

Options 11,12, & 13

Figure 4-36: Tie-in Options Considered

The underpass solution crossing the canal and the railway to the east side of the Broome Bridge requires repositioning of the existing Luas terminus further east requiring demolition and re-construction. Options crossing the canal and the railway west of the Broome Bridge do not require repositioning of the current Luas terminus but do impact on the electrical substation (ESS) and electrical and telecommunications masts. Options were developed to avoid this particular impact, including a looped alignment to the south of the electrical substation, but these present their own geometric problems and additional land take. These options would also limit the potential future planned expansion of the electrical substation.

In order not to omit any potential options, including running the Luas corridor over the existing Broome Bridge structure, all possible options were analysed at high level from a technical and environmental point of view. Some of these were either technically not feasible for various reasons or did not bring additional

benefits against the shorter alignment options and therefore were ruled out at the very early stage as explained below. Note that there were no environmental showstoppers at this stage.

For example, options running the Luas corridor over the existing bridge had significant physical impact, did not offer adequate width for a double track and proved vertically and horizontally unsuitable.

- Option 4 was not technically feasible due to the relative levels and the limiting Luas gradients. It is not possible to pass under Broombridge Road and over the railway and the canal in a short distance;
- Option 5 was not technically feasible due to the relative levels and the limiting Luas gradients;
- Option 8 route passed under Broombridge Road and formed a loop around the electrical substation while ramping up to overpass the railway and canal. However, this option was not technically feasible due to the relative levels and the limiting Luas gradients. It is not possible to pass under Broombridge Road and over the railway and the canal over a 120m distance;
- Option 9 saw the alignment crossing Broombridge Road at grade, the alignment then dived downwards while making a loop around the ESS to pass under both railway and canal. This option was not technically feasible due to the relative levels and the limiting Luas gradients. It is not possible to pass Broombridge Road at grade and then under the railway and the canal over a 120m distance. In order to gain the necessary depth, the Luas corridor would have to be further extended towards the south in an even more convoluted loop with tighter horizontal radii and with more significant land impacts, thus making this option impractical;
- Option 11 route ran under Broombridge Road, and then it continued along the narrow corridor between the ESS and the railway to cross the railway and the canal further west. The combination of passing under Broombridge Road and the canal and the railway further west of Broome Bridge was ruled out on the basis that it would not deliver additional benefits over Option 3. This required a longer retained cut and a cut-and-cover section (over 450m) in the narrow strip of land parallel to IR tracks. This made the option less attractive than Option 3 and thus not worth being brought forward in the analysis;
- Option 12 route ran under Broombridge Road, and continued along the narrow corridor between the ESS and the railway lines while ramping up to cross the railway and the canal further west on a curved bridge structure. This option, due to the relative levels and the limiting Luas gradients, would not allow the Luas corridor to reach at grade crossing Ballyboggan Road. As a consequence, the Luas corridor would have to span Ballyboggan Road and the River Tolka making the overall crossing structures extremely long compared to other options (more than 700m in length with 500m of viaduct). Given these parameters this option was discounted;
- Option 13 route crossed Broombridge Road at grade and then it continued along the narrow corridor between the ESS and the railway while diving downwards into a retained cut and then a cut-and-cover to cross the railway and the canal further west. This option did not deliver additional benefits to other similar but shorter arrangements and was therefore ruled out; and
- Option 14 route crossed Broombridge Road at grade, and then it continued along the narrow corridor between the ESS and the railway while ramping up, in order to cross the railway and the canal further west over a bridge. Similar to Option 12, due to the relative levels and the limiting Luas gradients this corridor would not reach the grade at Ballyboggan Road so it did not make the shortlist.

Table 4-22 gives a graphical explanation of how options using the existing structure were discounted early on.

Table 4-22: Overview of options for Broombridge tie-in

Option	East / West	Broombridge Road crossing	Railway and Canal crossing	Corridor	Electrical Substation	Feasible?
1	E	n/a	Over	1	n/a	Y
2	E	n/a	Under	1	n/a	Y
3	W	Under	Under	1	Front	Y
4	W	Under	Over	1	Front	N

Option	East / West	Broombridge Road crossing	Railway and Canal crossing	Corridor	Electrical Substation	Feasible?
5	W	At grade	Under	1	Front	N
6	W	At grade	Over	1	Front	Y
7	W	Under	Under	1	Rear	Y
8	W	Under	Over	1	Rear	N
9	W	At grade	Under	1	Rear	N
10	W	At grade	Over	1	Rear	Y
11	W	Under	Under	2	Front	N
12	W	Under	Over	2	Front	N
13	W	At grade	Under	2	Front	N
14	W	At grade	over	2	Front	N

Options running to the rear of the electrical substation and along corridor 2 were not included as there were no additional benefits that would outweigh negative aspects associated with a less direct alignment.

This resulted in eight options excluded from the assessment as either unfeasible or noticeably less advantageous and a shortlist of six options (Options 1, 2, 3, 6, 7, and 10) developed for further assessment.

4.9.12.1. Environmental Assessment

The following were the key environmental considerations with regard to the choice of the preferred tie-in option site when compared to alternatives assessed:

Population, socio-economic and integration

Option 1 is the preferred alternative given the selection of IR access Options 3 or 4, as the only other impact of a socio-economic nature associated with this option is a minor one to a business's car parking area. Option 2 has significant negative impacts in terms of construction and also moderate impacts on pedestrian access and amenity. Option 3 introduces a severance barrier to the outbound IR platform, requiring access from the Luas platform, but is acceptable. Option 7 also introduces a severance barrier, but additionally impacts on an industrial unit. Option 6 and 10 result in significant impacts to traffic flow on Broombridge Road and the loss of an industrial unit.

Table 4-23: Tie-in Population, socio-economic and integration Assessment and ranking options

Option	Construction	Pedestrian access	Business Impact	Traffic flow	Ranking
1	Minor	Minor*	Minor	Imperceptible	
2	Significant	Moderate	Minor	Imperceptible	
3	Minor	Minor	Moderate	Imperceptible	
6	Minor	Minor	Significant	Significant	
7	Moderate	Minor	Significant	Imperceptible	
10	Moderate	Minor	Significant	Significant	

*subject to non-selection of Option 1 for passenger access to Iarnród Éireann in-bound.

Land use

In terms of the impact on local businesses and Land Use:

- Option 1: it is described as presenting some access issues for adjacent businesses;
- Options 2, 3 and 6: it is stated that the western entrance to the industrial estate will close for options 3 and 6. There may be access problems to existing industrial units due to the retained cut for the northern ramp for option 2. Also, the impact of the Option 2 on the lands west of Broombridge road would significantly hinder future development potential on that site as the long, curved portal would sterilise a larger area; and
- Options 7 and 10: it is stated that western entrance to the industrial estate will close and have an impact on Easy Self Store.

In this instance, Option 1 is preferred. Options 2, 3, and 6 are intermediate with some disadvantages. Options 7 and 10 are least preferred, although with minor disadvantages rather than significant disadvantages. This is due to the fact that the businesses in the building threatened with demolition are not major employers and may be compensated / relocated to alternative premises. These rankings vary from those in the MCA, but there are other criteria for the assessment of Compatibility with Development Plan and Land Use than current business impact alone i.e. the impact of the underpass on the lands west of Broombridge road would not just affect the access but also would significantly hinder future development potential on that site as the long, curved portal would sterilise a larger area.

Safety from anti-social behaviour/ anxiety

The risk of anti-social behaviour would be greater where there is an underpass.

- Option 1: has no underpass.
- Option 2: has an underpass, but this is of short length and so presents the least risk.
- Option 3: has an underpass which is longer and curved in relation to Option 2.
- Option 6: is described as safe in terms of anti-social activity.
- Option 7: has a longer and curving cut-and-cover section and so presents a greater risk of anti-social behaviour.
- Option 10: anti-social behaviour risks are not presented for this option, but the bridge structure suggests that these risks are low.

Options 1, 6 and 10 would perform equally in the MCA. Option 2 has a fourth-place ranking with some disadvantages. Option 3 has fifth place ranking with some disadvantages and Option 7 has a sixth ranking with significant disadvantages.

Cultural Heritage

From a cultural heritage perspective there are a number of factors which differentiate the Broombridge Tie-In Options. These include the potential for direct and indirect impacts on the Royal Canal (including its banks and towpaths) which is a feature of notable industrial heritage significance, the Royal Canal Conservation Area (DCC ref. CA 38), Broome Bridge which is a Protected Structure (RPS 909) also listed on the NIAH (50060126) and the MGWR. Table 4-24 provides a ranking of Options which includes a summary of the scope of direct and indirect impacts on cultural heritage assets.

Table 4-24: Tie-in Cultural Assessment and ranking options

Option	Potential Impacts identified	Ranking
1	Direct significant permanent impact on the retaining wall of the Midland Great Western Railway (MGWR) and on the banks of the Royal Canal and its associated towpath. Direct permanent impact on Royal Canal Conservation Area (CA 38). Indirect profound permanent visual impact on Broome Bridge (RPS 909) resulting in the significant obstruction of the views from east.	

Option	Potential Impacts identified	Ranking
	Indirect significant permanent visual impact on the Royal Canal and the MGWR.	
2	Direct permanent impact on the north-eastern wing wall of Broome Bridge which is a Protected Structure (RPS 909) resulting in a loss of original fabric. Direct significant permanent impact on the banks of the Royal Canal and its associated towpath as well as the Royal Canal conservation Area (CA 38). Indirect significant permanent visual impact on the northeast aspect of Broome Bridge (RPS 909) and the Royal Canal both due to loss of original fabric and due to the presence of Luas infrastructure. Permanent visual impact on the MGWR from east.	
3	Direct significant permanent impact on Royal Canal Conservation Area (CA 38). Vibrations arising from the associated construction works will have a likely indirect significant impact on the fabric of Broome Bridge (RPS 909). Indirect moderate permanent visual impact on the views of Broome Bridge (RPS 909), the Royal Canal and the MGWR from east.	
6	Direct significant permanent impact on the southern wing wall of Broome Bridge which is a Protected Structure (RPS 909) resulting in a loss of fabric. Direct significant permanent impact on the banks of the Royal Canal and its associated towpath as well as on Royal Canal Conservation Area (CA 38). Indirect significant permanent visual impact on the views of Broome Bridge (RPS 909) and the Royal Canal from west both due to loss of original fabric and due to the presence of an elevated Luas infrastructure. Moderate permanent indirect visual impact on the views of Broome Bridge (RPS 909) and the MGWR from east.	
7	Indirect moderate permanent visual impact on the views of Broome Bridge (RPS 909), the Royal Canal and the MGWR from east.	
10	Direct significant permanent impact on Royal Canal Conservation Area (CA 38) and on the banks of the Royal Canal and its associated towpath. Indirect significant permanent visual impact on the views of Broome Bridge (RPS 909) and the Royal Canal from west, Indirect moderate permanent visual impact on the views of Broome Bridge (RPS 909) and the MGWR from east.	

Air Quality and dust

This review on the potential air quality and dust impacts relating to the Broombridge Tie-In Options is based upon the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, 2011. The nearest sensitive residential properties to the tie-in options are located on the Bannow Road to the south. Industrial and commercial receivers are located in closer proximity immediately to the south and north of the Royal Canal, but these are less sensitive to local air quality and construction dust impacts than residential receivers.

In terms of future operational impacts on local air quality, there is little to differentiate between the options.

During the construction phase, there is the potential for short-term increased local air quality and dust impacts at the nearest sensitive residential properties located on Bannow Road.

Table 4-25: Tie-in Air quality and dust Assessment and ranking options

Option	Potential Impacts identified	Ranking
1	Shortest option. Likely to have the shortest construction period. Least potential excavation and haul truck movements required. Furthest from nearest dwellings at Bannow Road to the south of the works.	

Option	Potential Impacts identified	Ranking
2	Shortest option. Will have a longer construction period than Option 1 due to underpass excavation required. Greater extent of excavation works and a significantly greater number of haul movements required compared to overpass options. Furthest from nearest dwellings at Bannow Road to the south of the works.	
3	Longer option than underpass Option 2. Will have a longer construction period than Option 2 due to the length of at grade works. Greater extent of excavation works and a significantly greater number of haul movements required compared to overpass options.	
6	Construction Phase will have potential for greater dust impact than overpass Option 1 due to the length of the at grade works for the option and the building demolition that is required. However, it is located away from the nearest sensitive residential properties located on Bannow Road.	
7	Construction Phase will have potential for greatest dust impact than underpass Options 2 & 3 due to the length of the option. The underpass excavation required and the longer at grade length will potentially result in a greater dust impact. A greater extent of excavation works and a significantly greater number of haul movements required compared to overpass options. The at grade works to the south of the canal are approx. 30m closer to the nearest sensitive residential properties located on Bannow Road and Broombridge Road than Options 1, 2, 3 and 6.	
10	Construction Phase will have potential for greater dust impact than overpass Options 1 & 6 due to the length of the option. The at grade works to the south of the canal are approx. 30m closer to the nearest sensitive residential properties located on Bannow Road and Broombridge Road than Options 1, 2, 3 & 6.	

Landscape and visual

From a landscape and visual perspective there was a clear preference for the underground design options. They would have less long-term impact on the landscape character around the Royal Canal at Broombridge for recreational users of the canal towpath and less visual impact for the residents of Bannow Road. The options that are to the east of Broome Bridge were also preferred to those on the western side as they would have a reduced effect on the scenic views from the west approaching Broome Bridge. Additionally, the options that are east of Broome Bridge had a greater potential to improve the visual amenity of the Broombridge Road corridor linking to the Tolka Valley Park. The least preferred options were the overground options that obstruct direct views from west of Broome Bridge from the towpath and were also close to the visually sensitive receivers on Bannow Road. In addition, options that lie east of Broome Bridge had the potential of further allowing for visual amenity along Broombridge Road. towards Tolka Valley.

In considering the design options for the overpass, there was a preference for the steel-concrete bridge design rather than the tied-arch design. The steel and concrete design can accommodate a finish that would complement Broome Bridge and have minimal and momentary visual impacts for LRT users, rather than the tied-arch design which would alter the current landscape setting by introduce a new modern feature which would intrude and compete with the existing relatively traditional and peaceful views towards Broome Bridge.

During construction, the visual impact and disruption of the amenity were considered be of similar levels for all options.

A summary of the landscape and visual assessment is included in Table 4-26.

Table 4-26: Tie-in Landscape and visual assessment and ranking options

Option	Potential Impacts identified	Ranking
1	Overground option with potential for adverse permanent visual impact on sensitive receptors.	
2	Underground option with limited potential for adverse visual impact on the area and with potential to improve visual amenity along Broombridge Rd.	
3	Underground option with limited potential for adverse visual impact on the area	
6	Overground option with potential for adverse permanent visual impact on sensitive receptors.	
7	Underground option with potential for adverse visual impact on sensitive receptors.	
10	Overground option with potential for adverse permanent visual impact on a wider group of sensitive receptors.	

Biodiversity

From a biodiversity point of view the underground design options are preferable. The Royal Canal is a proposed Natural Heritage Area (pNHA). The ecological value of the Royal Canal lies more in the diversity of species it supports along its linear habitats than in the presence of rare species. Otter, an Annex II species, is one of the protected species occurring along its length.

Though none of the options would directly impact on this species and potentially occurring protected birds such as Kingfisher (under the Wildlife Acts 1976-2020), the underpass options would be preferable for least disturbance from noise and visual impact. All of the routes have the potential for a temporary impact on nesting / breeding birds in trees and scrub vegetation through vegetation removal during the construction phase. The preference is for the underground option to the east of Broom Bridge.

The disturbance caused by the underground option with canal sections cut was seen as having temporary / reversible impact on terrestrial and aquatic habitat. Overground options would have longer term impacts on flight paths of species such as Swan and commuting / foraging bats. However, of the overground options, Option 1 East overpass was preferred as it is adjacent to the old bridge and keeps the bridge linkage as one corridor, thereby reducing the impact somewhat. The other western overpasses introduced a greater span of disturbance, with two structures to navigate. Refer to Table 4-27 below.

Table 4-27: Tie-in biodiversity assessment and ranking options

Option	Potential Impacts identified	Ranking
1	Overground option with potential impact on Royal Canal pNHA- impact on Swan and commuting/foraging bats. However, having the new bridge adjacent to the old keeps the bridge linkage as one corridor.	
2	Underground option with limited potential for impact on Grand Canal pNHA, least impact on, swans, bats, trees and nesting habitat for birds.	
3	Underground option with limited potential for impact on Grand Canal pNHA, swans, bats.	
6	Overground option with potential for impact on Royal Canal pNHA, impact on Swan and commuting/foraging bats.	
7	Underground option with limited potential for impact on Grand Canal pNHA, swans, bats.	
10	Overground option with potential for impact on Royal Canal pNHA, impact on Swan and commuting/foraging bats.	

Noise and Vibration

From a noise and vibration perspective, there is little to differentiate the Broombridge Tie-In Options. During construction there will be some short-term impacts on nearby sensitive locations. Options 7 and 10 require works closer to the nearby dwellings at Bannow Road to the south and therefore have a greater potential for impacts during this phase.

During the Operational Phase, the overbridge options have the potential to generate long-term noise impacts which may impact on the surrounding environment, in particular the potential for future residential development on adjacent lands that are currently commercial or industrial developments. However, this risk is not significant and future developments may be designed to avoid placing the most sensitive types of development directly adjacent to the Luas track and over bridge. The following scoring and ranking would be considered appropriate for the various options in terms of noise and vibration. Refer to Table 4-28 below.

Table 4-28: Tie-in noise and vibration assessment and ranking options

Option	Potential Impacts identified	Ranking
1	As a shorter option it will have a shorter construction period and is located away from existing sensitive properties; 80-90m from nearest properties on Bannow Road and Broombridge Road, and 150m from properties on Carnlough Road.	
2	Construction Phase will be more disruptive than Option 1 due to the depth of excavation and need for retaining walls, however it is located away from existing sensitive properties; 80-90m from nearest properties on Bannow Road and Broombridge Road, and 150m from properties on Carnlough Road.	
3	Comparable to other options - Construction Phase will be more disruptive than Options 1 and 2 due to the length of the option, however it is located away from existing sensitive properties; 80-90m from nearest properties on Bannow Road and Broombridge Road, and 150m from properties on Carnlough Road.	
6	At Grade Broome Bridge (BB) Overpass West – Construction Phase will be more disruptive than Options 1 and 2 due to the length of the option, however it is located away from existing sensitive properties; 80-90m from nearest properties on Bannow Road and Broombridge Road, and 150m from properties on Carnlough Road	
7	Less preferred to other options due to the closer proximity of this option to existing sensitive receptors; approximately 50-60m to properties on Bannow Road and Broombridge Road, and 90m to properties on Carnlough Road.	
10	Less preferred to other options due to the closer proximity of this option to existing sensitive receptors; approximately 50-60m to properties on Bannow Road and Broombridge Road, and 90m to properties on Carnlough Road.	

Hydrogeology and Hydrology

From a hydrogeological perspective there is a clear preference for the overpass design options (1, 6 and 10). All construction activity would be above the water table and will not interact with the groundwater regime. All the overpass options are equally preferable and will have no perceptible impacts on the hydrogeological environment. Surface water environment / flooding is deemed equivalent across all options.

The underpass options (2 & 3) are not preferred with underpass Option 7 least preferred due to longer at grade length. Where the excavation extends below the water table there are potential impacts on the groundwater flow regime due to dewatering. The lowering of the water table during dewatering has the potential to cause settlement and risks compromising the integrity of the canal.

The restriction in the groundwater flow path caused by the tunnel has the potential to result in a backing up of the groundwater table during the operational phase. The risk of contamination of the groundwater will be greater. The options with longest lengths of underpass would therefore be the least preferable. Refer to Table 4-29 below.

Table 4-29: Tie-in hydrogeology and hydrology assessment and ranking options

Option	Potential Impacts identified	Ranking
1	Overground option. Imperceptible impacts on groundwater flow regime and groundwater quality.	
2	Underground option. Potential for adverse impacts on groundwater flow regime and groundwater quality.	
3	Underground option. Potential for adverse impacts on groundwater flow regime and groundwater quality.	
6	Overground option. Imperceptible impacts on groundwater flow regime and groundwater quality.	
7	Underground option. Potential for adverse impacts on groundwater flow regime and groundwater quality.	
10	Overground option. Imperceptible impacts on groundwater flow regime and groundwater quality.	

Geotechnical, land and soils

Based on the currently available data, the geotechnical conditions are believed to be generally consistent across each of the proposed Tie-In options (GSI mapping and historical borehole data indicate Dublin boulder clay overlying limestone rock). As such, the east / west option variable does not make a significant difference in terms of ground conditions. The key option variable is whether it includes an underpass or an overpass solution. While an underpass and overpass solution are both technically valid approaches, from a geotechnical perspective, the overpass options offer a significantly reduced level of geotechnical risk compared to underpass solutions.

The overpass option will require geotechnical input for foundation design and retained approach ramps. Adopting an underpass option will require substantially more geotechnical engineering input compared to an overpass option.

An underpass solution will involve significant excavation adjacent to existing assets (protected structures, Iarnród Éireann line, Royal Canal, ESS, etc) which will require temporary and permanent supports; condition assessments and monitoring prior to, during and after excavation works. The underpass options will generate spoil that will need to be re-used or disposed of in accordance with the waste regulations. The disposal of the spoil will have an indirect impact on construction traffic.

Rock may be encountered within the required excavation depths depending on exact design vertical alignment. Excavation in competent rock is generally slow without the use of drill and blast (explosives). Ground treatment such as compensation grouting may be required depending on volume loss during box jacking, although shallow ground cover may limit its viability.

Relatively shallow groundwater (less than 5m) and potential hydraulic connectivity with the adjacent Royal Canal, will likely result in the need for construction dewatering and long-term groundwater control measures to manage uplift pressures and groundwater ingress into any underpass structures. Any of the overpass options (1,6,10) are geotechnically preferable to the underpass options (2,3,7). Option 1 is assessed to be the most preferred as it has shortest span. Refer to Table 4-30 below.

Table 4-30: Tie-in geotechnical, land and soils assessment and ranking options

Option	Potential Impacts identified	Ranking
1	Overground option with a relatively lower level of geotechnical risk. This is the shortest overall length.	

Option	Potential Impacts identified	Ranking
2	Underground option with significant geotechnical risk. Significant excavations adjacent to existing key assets (BB / IR / RC). Shortest length of Cut & Cover; Skewed approach for box jacking.	
3	Underground option with significant geotechnical risk. Significant excavations adjacent to existing key assets (ESS / BB / IR / RC). Longer section of Cut & Cover compared to Option 2; Indirect impact of subsurface utilities at ESS; Skewed approach for box jacking.	
6	Overground option with a relatively lower level of geotechnical risk. Longer over length compared to Option 1; limited space along northern boundary of ESS as embankment drops towards IR tracks (may need to be bridged?).	
7	Underground option with significant geotechnical risks. Best underpass option due to better approach angle for box jacking.	
10	Overground option with a relatively lower level of geotechnical risk. Longer over length compared to Option 1; retained cut at rear of ESS.	

4.9.12.2. Overall Conclusion

An exhaustive assessment of all the options considered against the following criteria was undertaken.

- Economy;
- Integration;
- Environment;
- Accessibility; and
- Safety.

The results of this analysis indicate a strong preference for the Option 1 Overpass East (refer to Table 4-31 below). This option is delivering positive results on constructability, integration, transport interchange and safety. Option 1 is the best option in terms of reducing the risk of physical impact on the protected Broome Bridge structure and the visual impacts from the west. In terms of possible mitigation measures, the visual impact from the east could be partly addressed at design stage with the design of a 'signature' and slender bridge, less intrusive parapets, glass or similar. Low level derailment containments could be used to avoid any type of heavy containment barriers. A highly attractive architectural modern structure with a slender deck thickness could be facilitated with relatively short spans. To a certain extent all other overpass options, 6 and 10, would have a visual impact on the Broome Bridge from the west, which currently enjoys the most natural and unobstructed view. The Broome Bridge views from south and east are partially obscured by the railway infrastructures, both Luas and IR, fences; sheds; the Luas depot building and by the pedestrian overpass and steel ramp of the IR platform.

Table 4-31: MCA results for Broombridge tie-in options

Criteria	Parameter	Option 1	Option 2	Option 3	Option 6	Option 7	Option 10
Economy	Constructability						
	Operation and maintenance (including runtime)						
Integration	Compatibility with Development plans and Land use						
	Public Transport						

Criteria	Parameter	Option 1	Option 2	Option 3	Option 6	Option 7	Option 10
	Integration and accessibility						
Environment	Material and cultural assets						
	Natural aspects						
Safety	Construction and Operational safety						

4.9.13 Royal Canal and Rail Bridge

The proposed bridge crosses over the Dublin to Sligo heavy railway line, owned and operated by Iarnród Éireann, and the Royal Canal, owned and managed by Waterways Ireland, both running parallel and closely to each other. Since the vertical alignment of the proposed Luas line north of the Canal is more than 3 m higher than the existing Broombridge Road and adjacent lands, it is also proposed to provide a second bridge structure serving as an approach ramp for the main bridge crossing. The combined length of both bridges is approximately 180 m, of which the main bridge is 90m and the approach bridge 90m. There are also reinforced earth approach embankments at each end of the bridge, 30m and 25m long (south / north).

As discussed, the proposed bridge is crossing over the Royal Canal, which forms a natural bio-corridor, and therefore it needs to meet relevant environmental criteria. Refer to Table 4-32.

Figure 4-37: Bridge Location

Three bridge options were developed with due consideration of the constraints such as span, structural form alternatives and various details. The three distinct options proposed for the main bridge crossing are:

- Option 1 – Tied Arch Bridge;

- Option 2 – Steel Box Girder Bridge; and
- Option 3 – Concrete Four-Span Bridge.

4.9.13.1. Environmental Analysis

The assessment of alternatives and the likely significant impacts on environmental factors were assessed with regard to Article 3(1) of the EIA Directive 2011/92/EU as amended by Directive 2014/52/EU and are summarised in the Table 4-32 below.

Table 4-32: Environmental assessment of Rail overbridge options

Environmental Criteria	Option 1	Option 2	Option 3
Population and Human Health	▪ Population and human health impacts are deemed equivalent across all options. ▪ Option 1 is considered to be neutral compared with other options.	▪ Population and human health impacts are deemed equivalent across all options. ▪ Option 2 is considered to be neutral compared with other options.	▪ Population and human health impacts are deemed equivalent across all options. ▪ Option 3 is considered to be neutral compared with other options.
Biodiversity	▪ The physical footprint (with consequent habitat loss) of the bridge structure keeps ground-based works away from the Royal Canal and the more biodiverse habitats adjacent to it. ▪ Increased likelihood of bird strikes due to over-arching suspension structure. ▪ Approximately 6m^2 of the physical footprint (north abutment) of the bridge lies within the Royal Canal pNHA. ▪ Option 1 is considered to be moderate positive to other options,	▪ The addition of two supporting piers increases the physical footprint of the bridge, with the northern pier within relatively close proximity to the canal (circa 5m). However, the pier locations fall within low biodiversity areas, significantly reducing any biodiversity net loss. ▪ Significantly reduced likelihood of bird strikes as there is no over-arching suspension structure to this design option. ▪ Approximately 34m^2 of the physical footprint (pier) of the bridge lies within the Royal Canal pNHA. ▪ Option 2 is considered to be moderate negative to other options.	▪ With three supporting piers, this design has the largest physical footprint of the three design options. While the southern and northern piers are located in low value biodiversity areas, the central pier is in close proximity to the canal (circa 10m). ▪ Significantly reduced likelihood of bird strikes as there is no over-arching suspension structure to this design option. ▪ Approximately 56m^2 of the physical footprint (pier) of the bridge lies within the Royal Canal pNHA. ▪ Option 3 considered to be major negative to other options.
Land and Soils	▪ All options are underlain by dark limestone and shale (calp) from the Lucan Formation with quaternary sediment deposits of Till derived from Limestones (TLs). ▪ Land and soil impacts are deemed equivalent across all options. ▪ Option 1 is considered to be neutral compared to other options.	▪ All options are underlain by dark limestone and shale (calp) from the Lucan Formation with quaternary sediment deposits of Till derived from Limestones (TLs). ▪ Land and soil impacts are deemed equivalent across all options. ▪ Option 2 is considered to be neutral compared to other options.	▪ All options are underlain by dark limestone and shale (calp) from the Lucan Formation with quaternary sediment deposits of Till derived from Limestones (TLs). ▪ Land and soil impacts are deemed equivalent across all options. ▪ Option 3 is considered to be neutral compared to other options.
Water	▪ There is a reduced potential for construction stage pollution events within the Royal Canal	▪ The northern pier is in close proximity to the Royal Canal resulting in increased potential for	▪ The central pier is in close proximity to the Royal Canal resulting in increased potential for

Environmental Criteria	Option 1	Option 2	Option 3
	pNHA, due to reduced physical footprint closer to the canal. ▪ Flooding impacts are deemed equivalent across all options. ▪ Option 1 is considered to be moderate positive to other options.	construction stage pollution events within the Royal Canal pNHA. ▪ Flooding impacts are deemed equivalent across all options. ▪ Option 2 is considered to be moderate negative to other options.	construction stage pollution events within the Royal Canal pNHA. ▪ Flooding impacts are deemed equivalent across all options. ▪ Option 3 is considered to be moderate negative to other options.
Air and Climate	▪ Air and climate impacts are deemed equivalent across all options. ▪ Option 1 is considered to be neutral compared to other options.	▪ Air and climate impacts are deemed equivalent across all options. ▪ Option 2 is considered to be neutral compared to other options.	▪ Air and climate impacts are deemed equivalent across all options. ▪ Option 3 is considered to be neutral compared to other options.
Material Assets	▪ All impacts on built services are deemed equivalent across all options. ▪ Option 1 is considered to be neutral compared to other options.	▪ All impacts on built services are deemed equivalent across all options. ▪ Option 2 is considered to be neutral compared to other options.	▪ All impacts on built services are deemed equivalent across all options. ▪ Option 3 is considered to be neutral compared to other options.
Cultural Heritage	▪ The option crosses over the Royal Canal Conservation Area with no direct impacts on the canal or Broome Bridge (Protected Structure 909) as all new abutment structures will be outside the functional area of the Canal including access to the towpath. ▪ Option 1 is not expected to have any direct impacts on cultural heritage sites but there may be indirect impacts on views of the historic Broome Bridge from the Canal to the east and west. The lack of piers in front of views of the historic bridge elevations and high position of the soffit of the suspended new bridge above the arches and part of the parapet to the protected bridge minimise the impact of the proposed bridge on views of the stone structure. The large and complex superstructure and bridge deck will present significant visual impact and distraction to the setting and views of both east and west	▪ The option crosses over the Royal Canal Conservation Area although the western S2 pier will be located close to the historic masonry wingwall separating the upper footpath and the canal-side towpath and consideration will be necessary during construction of this to prevent or mitigate a potential direct impact on protected historic stonework. ▪ Indirect impacts of Option 2 on cultural heritage sites are limited, with only one pier proposed in front of views of the eastern elevation of the protected Broome Bridge and most of the existing curved string course being visible beneath the soffit of the new arched span. Views of the existing bridge parapet masonry will be partially blocked from the east and the new bridge deck will interfere with views of the parapet wall-line from both east and west. ▪ All three options provide for removal of existing clutter from the east elevation of	▪ The option crosses over the Royal Canal Conservation Area and will see a large concrete pier placed directly on the existing access to the road from the towpath. This will create a direct impact on the associated infrastructure of the protected bridge. ▪ In addition to the pier proposed on the existing access to the towpath on the north bank of the Canal, a further wide pier on the area between the Canal and existing rail line presents an indirect visual impact on views of the east elevation of the protected stone bridge with Option 3. The proposed bridge deck will be generally higher and will interfere unevenly with the lines of the existing stone bridge confusing views towards it from the east and west. ▪ All three options provide for removal of existing clutter from the east elevation of the protected stone bridge and can facilitate consolidation and conservation of existing masonry where required.

Environmental Criteria	Option 1	Option 2	Option 3
	elevations of the historic bridge. ▪ All three options provide for removal of existing clutter from the east elevation of the protected stone bridge and can facilitate consolidation and conservation of existing masonry where required. ▪ Option 1 is considered to be moderate negative to other options.	the protected stone bridge and can facilitate consolidation and conservation of existing masonry where required. ▪ Option 2 is considered to be moderate positive to other options.	▪ Option 3 is considered to be major negative to other options.
Landscape	▪ Considered in the context of the adjacent historic Broome Bridge and surrounding buildings, this option would have the most significant visual impact, primarily because of the arch height. ▪ Another aspect of this option which needs consideration is the fact that the main visibility or a viewing angle of the structure will be from the ground, especially underneath and the deck grillage with the main tension tie running asymmetrically across the soffit will not be as aesthetically pleasing as a smooth soffit of a slab or box girder option. ▪ Option 1 is considered to be major negative to other options.	▪ The main visual aspect of the bridge represents its bespoke parapet with horizontal and vertical curvatures complementing the bridge deck alignment. The overall visual impact is much more sensitive when compared with Option 1. ▪ Option 2 is considered to be moderate positive to other options.	▪ Concrete colour and texture bring a new, fresh element into the visual mix. However, the overall impact is affected by the additional pier between the railway and canal and when viewed from the east, the whole structure looks heavier. ▪ Option 3 is considered to be moderate negative to other options.

As part of the environmental assessment, the carbon footprint of the main bridge construction materials was also assessed in order to reduce the carbon footprint and improve overall sustainability of finished structures. These preliminary calculations indicate that Option 3 has the lowest amount of embodied carbon (560 tCO_2e), Option 1 approx. 20 % higher (680 tCO2e) and Option 2 significantly higher (1200 tCO2e). The sustainability scoring in Table 4-33 below reflects these relative differences.

The combined environmental and sustainability assessment lead to the conclusion that Option 1 and Option 2 are neutral, Option 3 has a moderate disadvantage (refer to Table 4-33).

Table 4-33: Environmental & Sustainability Comparison

Option	Final Scoring
1	
2	
3	

4.9.13.2. Overall Conclusions

Table 4-34: Multi Criteria Assessment Matrix

Assessment Criteria	Option 1	Option 2	Option 3
Technical			
Cost			
Aesthetics			
Durability and Maintenance			
Environmental			
Health & Safety			
Constructability			

Based on these evaluations, Option 2, the Steel Box Girder Bridge, was taken forward for design development.

4.9.14 Tolka River Bridge

The proposed bridge is set approximately 20m west of an existing masonry arch bridge providing pedestrian and cycle facility over the River Tolka. This structure, the “Finglas Wood Bridge”, appears to date from the late medieval period and is a protected structure. Refer to Figure 4-38.

Figure 4-38: Proposed Tolka River Bridge Location in Context

Three bridge options were developed to resolve the main constraints (River Tolka and the artificial wetlands area along the left (northern) river bank), which determined the bridge spans:

- Option 1 – Single Span, Concrete Girder Bridge;

- Option 2 – Two-Span, Steel Girder Bridge; and
- Option 3 – Two-Span, Precast Segmental Arch Bridge.

The three bridge options were evaluated using seven main criteria: Technical, cost, aesthetics, durability & maintenance, environmental, health & safety and constructability.

4.9.14.1. Environmental Analysis

The assessment of alternatives and the likely significant impacts on environmental factors were assessed with regard to Article 3(1) of the EIA Directive 2011/92/EU as amended by Directive 2014/52/EU. The principal environmental considerations arising from the analysis are as follows:

Table 4-35: Environmental Assessment

Environmental Criteria	Option 1	Option 2	Option 3
Population and Human Health	▪ Population and human health impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 1 is considered to be neutral compared with other options.	▪ Population and human health impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 2 is considered to be neutral compared with other options.	▪ Population and human health impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 3 is considered to be neutral compared with other options.
Biodiversity	▪ This single span concrete girder option minimises the overall physical footprint / habitat loss of the bridge. However, the northern section, specifically the pedestrian / cycle lane section, appears to be partially located within the existing reed marsh / wetland area (bottom of the steep contours), resulting in notable biodiversity loss and increasing the potential for construction phase impacts on surface waters and the inhabiting flora and fauna. ▪ The bridge span over the wetland habitat would obstruct sunlight and result in reduced benefits from that section of the wetland. ▪ It would be ideal if the northern section could be extended so that none of its base falls within the wetland area. ▪ Option 1 is considered to be moderate positive to other options.	▪ The steel box girder with a midway support, has a larger physical footprint / habitat loss than Option 1. The addition of the support structure midway through the bridge increases the habitat loss within the reed marsh / wetland area, further increasing potential pollution events within the wetland. ▪ Furthermore, the northernmost section has a slightly increased presence within the reed marsh / wetland area, which would in turn reduce biodiversity net value. ▪ The bridge span over the wetland habitat would obstruct sunlight and result in reduced benefits from that section of the wetland. ▪ Option 2 is considered to be moderate negative to other options.	▪ While the precast concrete arches would help minimise certain negative aspects of the Construction Phase, their physical footprint is quite negative. The southern section is located close to the southern bank of the River Tolka, negatively impacting existing riparian vegetation and potentially reducing overall biodiversity net value in the area. ▪ The midway point / meeting of the two arches is almost entirely located within the reed marsh / wetland area, this is a significant impact on this high value habitat. ▪ As with the other options the footpath / cycle lane section has a physical footprint within the northern boundary of the wetland area. ▪ The bridge span over the wetland habitat would obstruct sunlight and result in reduced benefits from that section of the wetland.

Environmental Criteria	Option 1	Option 2	Option 3
			▪ Option 3 is considered to be major negative to other options.
Land and Soils	▪ All options are underlain by dark limestone and shale (calp) from the Lucan Formation with quaternary sediment deposits of Gravels derived from Limestones north of River Tolka and Alluvium deposits south of the river. ▪ Land and soil impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 1 is considered to be neutral compared to other options.	▪ All options are underlain by dark limestone and shale (calp) from the Lucan Formation with quaternary sediment deposits of Gravels derived from Limestones north of River Tolka and Alluvium deposits south of the river. ▪ Land and soil impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 2 is considered to be neutral compared to other options.	▪ All options are underlain by dark limestone and shale (calp) from the Lucan Formation with quaternary sediment deposits of Gravels derived from Limestones north of River Tolka and Alluvium deposits south of the river. ▪ Land and soil impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 3 is considered to be neutral compared to other options.
Water	▪ The Tolka Valley Integrated Constructed Wetland (ICW) is located north of River Tolka. The area of ICW with physical footprint of the bridge is approximately 29m^2 and the area underlying the bridge is 158m^2. ▪ There is an increased potential for construction impacts on the River Tolka and the inhabiting flora and fauna. ▪ Option 1 is considered to be moderate positive to other options.	▪ The area of ICW with physical footprint of the bridge is approximately 32m^2 and the area underlying the bridge is 155m^2. ▪ The addition of the support structure midway through the bridge increases potential pollution events within the River Tolka. ▪ Option 2 is considered to be moderate negative to other options.	▪ The area of ICW with physical footprint of the bridge is approximately 9m^2 and the area underlying the bridge is 181m^2. ▪ The location of southern section in close proximity to the river increases the potential for construction impacts on the River Tolka. ▪ Option 3 is considered to be major negative to other options.
Air and Climate	▪ Air and climate impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 1 is considered to be neutral compared to other options.	▪ Air and climate impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 2 is considered to be neutral compared to other options.	▪ Air and climate impacts are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 3 is considered to be neutral compared to other options.
Material Assets	▪ The impacts on ICW are addressed under 'Biodiversity' and 'Water'. ▪ All impacts on built services are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 1 is considered to be neutral compared to other options.	▪ Impacts on ICW are addressed under 'Biodiversity' and 'Water'. ▪ All impacts on built services are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 2 is considered to be neutral compared to other options.	▪ Impacts on ICW are addressed under 'Biodiversity' and 'Water'. ▪ All impacts on built services are deemed equivalent across all options. Difference insufficient to merit a clear preference. ▪ Option 3 is considered to be neutral compared to other options.

Environmental Criteria	Option 1	Option 2	Option 3
Cultural Heritage	▪ All options cross the Tolka Conservation Area and have similar potential for direct impacts on unknown sites and proximity to the south-western wing wall of protected structure - Finglas Wood bridge (RPS 906). ▪ With few existing clear views of the western elevation of the protected structure, the deeper section of the proposed structure will create an indirect impact through obstruction of views of this elevation from ground-level, more so than the slender deck of option 2 ▪ All bridge options introduce a positive opportunity to appreciate the west elevation of the existing Finglas Wood Bridge from the LUAS tracks. ▪ Option 1 is considered to be moderate negative to other options.	▪ All options cross the Tolka Conservation Area and have similar potential for direct impacts on unknown sites and proximity to the south-western wing wall of protected structure - Finglas Wood bridge (RPS 906). ▪ The greater span of the overall bridge structure and the more slender profile facilitated by the central pier will make this option less visually obtrusive to views of the east and west elevations of the protected stone bridge. This will reduce potential indirect impacts. ▪ All bridge options introduce a positive opportunity to appreciate the west elevation of the existing Finglas Wood Bridge from the LUAS tracks. ▪ Option 2 is considered to be moderate positive to other options.	▪ All options cross the Tolka Conservation Area and have similar potential for direct impacts on unknown sites and proximity to south-western wing wall of protected structure - Finglas Wood bridge (RPS 906). ▪ The proposed form of the new bridge in option 3 will cause the greatest indirect impact on the historic Finglas Wood Bridge by presenting the most solid obstruction to existing or potential views towards the western elevation of the protected stone bridge. ▪ The use of stone-facing and traditional arch forms to complement the existing historic bridge is likely to have a pastiche appearance that will be inappropriate for the context of the protected structure and will have an indirect, negative impact on its historic setting. ▪ All bridge options introduce a positive opportunity to appreciate the west elevation of the existing Finglas Wood Bridge from the LUAS tracks. ▪ Option 3 is considered to be major negative to other options.
Landscape	▪ Option 1 presents a simple form which in the context of the park environment is very unobtrusive, especially with the use of grass track across the bridge deck. ▪ The main viewing angle of the structure will be from the deck level or above (if viewed from the area behind the north abutment). ▪ Therefore, the bridge plan, separation between the Luas track and cycle / footpath as well as parapet lines, are the most	▪ Option 2 with its central pier achieves a very slender deck. The abutments are set further away from the river and the visual impression is as if the bridge deck continued straight into the sides of the river berm. ▪ The grass track and styling of the adjacent foot/cycle path still provide the necessary visual continuity when viewed from different angles in the park. ▪ The bridge pier adds an intrusive element with a	▪ Option 3 follows design cues from the adjacent masonry arch bridge. Though the traditional arch form may be elegant, functional, and efficient in many cases, here it forces a direct comparison of the two structures and the modern, rather utilitarian twin arch may not look appropriate. ▪ The proportion of arch span to rise is very different and large areas of spandrel walls, even with a stone cladding to mimic the historical

Environmental Criteria	Option 1	Option 2	Option 3
	prominent architectural features of this bridge. And this is reflected in the design. ▪ Option 1 is considered to be moderate positive to other options.	higher environmental impact, and the resulting impression is less positive. ▪ Option 2 is considered to be moderate negative to other options.	stonework, look heavy and obtrusive. ▪ Option 3 is considered to be major negative to other options.

As part of the environmental assessment, the carbon footprint of the main bridge construction materials was also assessed in order to reduce the carbon footprint and improve overall sustainability of finished structures. Preliminary calculations of the estimated amount of embodied carbon (CO2e) indicate that Option 1 and Option 3 are comparable (approx. 530 tCO2e over the life cycle), Option 2 has significantly higher amount of embodied carbon (approx. 760 tCO2e over the life cycle). This is reflected in the sustainability scoring in Table 4-36 below.

The combined environmental and sustainability assessment lead to the conclusion that Option 1 has a moderate advantage compared to Options 2 and 3 (refer to Table 4-36).

Table 4-36: Environmental & Sustainability Comparison

Option	Final Scoring
1	
2	
3	

4.9.14.2. Overall Conclusions

Table 4-37: Multi-criteria assessment matrix

Assessment Criteria	Option 1	Option 2	Option 3
Technical			
Cost			
Aesthetics			
Durability and Maintenance			
Environmental			
Health & Safety			
Constructability			

As can be seen from Table 4-37, the option which performed best in the seven criteria assessed is Option 1. It has several major / minor positives over other options, such as technical, aesthetics and environmental, and it is also neutral in other aspects. The second preferred is Option 2 which has moderate disadvantages in durability & maintenance as well as in environmental criteria. Option 3 is lagging, especially in its aesthetics and environmental impact.

Based on these evaluations, Option 1, the Single Span Concrete Girder Bridge, was taken forward for design development.

4.9.15 ESBN Substation location

There is an existing substation at Broombridge. Based upon the line characteristics, fleet type and size and the proposed operation plan, a traction power simulation exercise determined the need for two substations as part of the proposed Scheme. The optimum location for these is approximately at the mid-point of the

line for the first substation and towards the end of the line for the second substation. There is also a requirement for a substation for the Park & Ride.

During the Operational Phase, the proposed Scheme will be powered by a 10kV MV power supply from ESB Networks (ESBN). For resilience reasons, the ESBN 10kV MV power supply will be presented to two different Luas Finglas HV substations. This means that if one power supply fails, there will be a backup connection that will ensure that the system will continue to operate.

Substation 1

The proposal is for one Luas Finglas MV substation located at the mid-point of the line on the assumption that the second would be located close to the terminus. As a result, suitable locations for the first substation, in consultation with DCC, were identified north of St Helena's and south of Mellowes Park. Locations considered included: the former Parks Superintendent's house located next to the Fire Station on Mellowes Road; locations within Mellowes Park itself, adjacent to the St Helena's Stop; and the final preferred location adjacent to the existing Uisce Éireann pumping station, just north of the proposed Luas Finglas Village Stop. The locations within the existing parklands on St Helena's and Mellowes Park were rejected due to impacts on the amenity space and thus the option at the former Superintendent's house was developed further.

Substation 2

The second substation 2 was initially proposed to be located at the terminus of the proposed Scheme immediately adjacent to the Charlestown Stop.

However, following the non-statutory public consultation and in response to DCC re-zoning of the Jamestown Industrial estate lands under Variation 33 of the Development Plan, there was a change of location of the formerly known Mellowes Park Stop to St Margaret's Road (opposite Lidl) on the site of the North Road Motor company. This change created a landlocked site at the rear of the Stop which offered an opportunity to locate the substation there. This site is bordered by long rear gardens of the surrounding residential houses. The site is of an appropriate size to accommodate the substation and could be provided with independent access through adjacent lands which are being acquired in any case. The location was considered carefully from the point of view of technical feasibility, visual intrusion and noise and vibration plus other environmental impacts. However, subsequent design development and discussion with DCC led to a reassessment of this site and an expressed preference by DCC to make use of the residual lands for residential use such as a sheltered housing scheme, this being considered a more compatible use with the existing residential nature of the context and complementary to the proposed Luas Stop. It is also less likely to give rise to concerns from the adjacent householders / residents.

As a result, further analysis was undertaken to identify a preferred location for the second 10kV substation. An alternative substation location was identified alongside the N2 adjacent to the current roundabout where there is an existing pedestrian overbridge, which requires demolition to allow the alignment in Mellowes Park to pass through nearby, and this location was analysed to identify if it was a feasible alternative.

Park & Ride Substation

A dedicated substation is proposed to be located at the Park & Ride facility in order to provide an electrical supply for the electric vehicle charging points which are to be provided as part of the project.

The proposed substation is located at the ground floor level fronting North Road.

4.9.15.1. Environmental Analysis

An environmental assessment was undertaken to identify the preferred location for the two 10kV substations. The principal environmental considerations were as follows:

Substation 1

- Cultural Heritage and Water: There are no protected sites or heritage features in proximity of the proposed substation. The Royal Canal pNHA (Proposed Natural Heritage Area) is the nearest NPWS protected site approximately 1.7km south of the substation plot. The closest features of cultural heritage

significance are a Record of Monuments and Places (DU014-066008-) and a Record of Protected Structures (RPS 8734), approximately 95m from the substation plot area. The nearest waterbody is Bachelors stream, approximately 75m east of the substation plot.

- Biodiversity: The footprint of the proposed substation is in close proximity to five trees (Ailanthus Altissima) which are in good condition and categorised as B2 (Baseline Tree Survey Report, 2021). These trees, along with mature trees to the south of the substation footprint, are identified as sensitive bat activity areas. The proposed substation can be constructed with no impact to these trees and associated biodiversity.
- Population, Noise and EMC: The location for proposed substation is not overlooked by any adjacent residential development and is in a location which will cause very few issues with regard to environmental considerations such as noise, stray current and EMC. However, this would also require consideration of the future DCC housing development.
- Landscape and Visual: The architectural and landscape integration will require careful consideration in relation to the urban design of the future residential buildings to ensure both its functional compatibility e.g., maintenance access, and visual integration.

Substation 2

- Cultural Heritage and Water: There are no protected sites or heritage features in proximity of the proposed substation. The Royal Canal pNHA (Proposed Natural Heritage Area) is the nearest NPWS protected site approximately, 2.3km from the substation plot. The closest feature of cultural heritage significance is an architectural site listed in the National Inventory of Architectural Heritage (ID 50130023) approximately 170m from the substation plot area. The nearest waterbody is Bachelors stream, which runs adjacent to the proposed substation.
- Biodiversity: There are sixteen trees (Lombardy Poplar; Cherry) at the location of the proposed substation. These are in good condition and categorised as C2 (Baseline Tree Survey Report, 2021). These mature trees are also identified as sensitive bat activity areas.
- Population, Noise and Vibration, EMC: The majority of the mature planting can be maintained to provide good visual screening. There are some residential properties close to the substation so careful consideration is needed as the design develops to ensure there are no adverse impacts from the point of view of visual impact, noise, vibration, and emissions on the immediate adjacent residences. It is anticipated that there will be no appreciable increase in ambient noise taking cognisance of the adjacent highway but in any event, this will be minimised. Noise mitigation, if deemed necessary during the detailed noise assessment, will be provided to minimise noise impacts. Careful enhancement of the current planting and sensitive treatment of the aesthetic aspects of the substation will help to minimise impacts and enhance the visual environment.
- Landscape and Visual: It is proposed that the existing tree planting (primarily Lombardy Poplar; Cherry) will be reinforced with dense high shrub and tree planting together with a timber clad facade, similar to the architectural treatment to be developed for the covered bike stores, which will help to minimise visual impact and enhance the environment quality of the site. Timber perimeter fencing will be designed to complement the substation timber facade, with discreet security lighting to avoid excessive light pollution.

4.9.15.2. Overall Conclusion

Substation 1

The proposed location of substation 1 meets all the technical requirements for a Luas traction substation, it is on publicly-owned lands in a discreet but accessible location. The site is already developed and built upon and minimises any disturbance to the adjacent park and can be integrated into a future development compatible with its use. The location is not overlooked by any adjacent residential development and is in a location which will cause very few issues regarding environmental considerations such as noise and EMC. The location is close to the track alignment and main road, thereby avoiding long cable runs for both the incoming and outgoing supply.

Substation 2

There are opportunities for reusing the residual lands left after demolition and clearance of the pedestrian overbridge spiral ramp. Demolition will offer a site that can accommodate substation 2, leaving the lands

immediately adjacent to the St Margaret's Stop free for other uses. The location already has some mature planting, the majority of which can be maintained to provide good visual screening. The site, whilst not offering an excess of curtilage space, is accessible from the adjacent service road for installation or removal of transformers and other heavy equipment and for normal servicing of the substation. There are some residential properties close to the substation so careful consideration is needed as the design develops to ensure there are no adverse impacts from the point of view of visual impacts, noise, vibration, and emissions on the immediate adjacent residences. It is anticipated that there will be no appreciable increase in ambient noise taking cognisance of the adjacent highway but in any event, this will be minimised. Careful enhancement of the current planting and sensitive treatment of the aesthetic aspects of the substation will help to minimise impacts and enhance the visual environment.

4.10 Preferred Route following Consultation and further design changes

Following feedback received on the NSPC for the PR and dialogue with stakeholders, a minor number of design developments were made. Some of the changes made to the Preferred Route were relatively small scale and no further option assessment were required. These include:

- Development of design elements such as landscaping and drainage;
- Development of roads and active travel designs;
- Access to properties along St Margaret's Road impacted by the proposed Scheme;
- Provision of access into Colorman property from realigned Broombridge Road;
- Provision of cul-de-sac to McKelvey Road; and
- Revised access and parking for St Helena's Resource Centre.

However, some of the major changes for the proposed Scheme implemented in the design of the updated Preferred Route include further environmental assessment as discussed in the next sections.

- Ravens Court Alternative Access
- Pedestrian Bridge over the Royal Canal

4.10.1 Ravens Court Alternative Access

Based on the assessment of the proposed alignment at Mellowes Road (refer to section 4.9.7), the Luas Team, in consultation with Ravens Court Residents and Local Representatives, reviewed the corridor adjacent to Ravenscourt Estate to determine if alterations to the boundary treatment and access points to the estate could be optimised insofar as possible.

In addition to the original design proposal, two other options (refer toFigure 4-39, Figure 4-40 and Figure 4-41) were considered and assessed having regard to the following five elements:

- Ravens Court Resident Impacts;
- Luas Traffic Segregation;
- Luas Operation;
- Environmental; and
- Adjacent Residents.

Figure 4-39: Original design

Figure 4-40: Alternative Option 1: Ravens Court Access via Mellowes Crescent

Figure 4-41: Alternative Option 2: Ravens Court Access further south

4.10.1.1. Environmental Analysis

This assessment considered environmental disciplines, but the following were the principal environmental considerations with regard to whether to progress with the original design as part of the proposed Scheme:

- Landscape and Visual: The original design option has the least impact on the existing public green space. The loss of public green space is an imperceptible to slight negative effect for residents on Cardiff Castle Road, noting that the full extent of this green space is little used. In addition, Options 1 and 2 not only have a visual impact on Ravens Court, which impact is assessed and discussed in greater detailed in Chapter 21 (Landscape and Visual Impacts) of this EIAR, but also have a greater visual impact on adjacent properties on Cardiff Castle Road;
- Cultural Heritage: There are no recorded cultural heritage constraints at this location. However, the original design option is moderately preferable from a cultural heritage perspective as it has least impact on public green space, which has the potential to contain subsurface archaeological remains;
- Water: Surface water from the road alignment related to the Ravens Court access will be collected and transferred to the closest surface water sewer in the vicinity. The alterations to flow rates and times of concentrations will be insignificant. However, as Options 1 and 2 incorporate additional open space, there is a slightly positive impact with the potential to incorporate a SuDS feature, which would provide treatment to the paved surfaces within and adjacent to Ravens Court;

- Air Quality: The operational traffic flow changes in this area are not expected to be significant in terms of local air quality and specific operational air quality mitigation measures are not envisaged to be required at Ravens Court. The original design option appears to have the least impact on the existing open space, while the car parking provision in the area appears similar for all options. Hence, this option has the lowest potential for construction dust impact, albeit to a very small extent in comparison to the other options. Appropriate construction dust mitigation measures are outlined for the proposed demolition, excavation and construction works in this area in chapter 13 (Air Quality) of this EIAR. In terms of construction air quality / dust impact, additional public green space is needed in Options 1 and 2 in comparison to the original design, but the car parking provision in the area appears similar for all options. Hence, Options 1 and 2 have a slightly higher but insignificant potential for additional construction dust impact in comparison to the current design, albeit of a very marginal scale in terms of the proposed demolition, excavation, haulage and construction works; and
- Biodiversity: The range of semi-mature trees within and adjacent to the green space are the only high valued ecological features within the Ravens Court area. Despite the need for additional screen planting to reduce visibility of the track into the courtyard in all options considered, the track and road alignment of the original design results in the least amount of these trees being removed within the green space area in order to accommodate the new access road. This would be the most preferred design option in respect to local ecology.

4.10.1.2. Overall Conclusion

In summary, and following the assessment undertaken above, the alternative design options considered were not deemed to offer benefits over the original design. A summary of the MCA is depicted in Table 4-38.

The driven key rationale for this decision, in addition to the environmental assessment, is as follows:

- Ravens Court Resident Impacts: Option 2 offers a slightly positive impact as it provides additional communal green spaces within the estate. However, there is a slight negative effect for Number 12 Raven's Court, given that it would be adjacent to the access road, while noting that it is provided with relocated garden space;
- Luas Traffic Segregation: in both the original design and Option 2, the entry and exist movements to the estate must cross the Luas tracks. This vehicle and pedestrian crossing point is removed with Option 1;
- Luas Operation: A speed restriction of 10kph for the LRT will be in place local to the junction, due to the line geometry (close proximity to a Radius 25m). The original design and Option 1 will have a marginal difference in speed restriction. However, in Option 2, the speed restriction will have to be extended further south to cater for the relocated crossing point; and
- Adjacent Residents: the original design has no new impacts on adjacent residents. However, Option 1 places slight additional traffic on Mellowes Road and this new connectivity was not desirable to the residents of either estate. Option 2 introduces additional impacts on residents in Cardiff Castle Road, due to the boundary modifications and removal of public space.

Table 4-38: MCA Summary

Option / Criteria	Original Design	Option 1: Ravens Court access via Mellowes Crescent	Option 2: Ravens Court Access further south
Ravens Court Residents impact			
Luas traffic segregation			
Luas Operation			
Environmental			
Adjacent Residents			

4.10.2 Pedestrian Bridge over the Royal Canal

As part of the development of the proposed Scheme, design considerations in the selection of the best option to provide accessible access to Iarnród Éireann's inbound platform at Broombridge is required. The current access is incompatible with the proposed new Luas alignment and bridge structure over the railway and canal at Broombridge. Due to spatial and track parameters there is insufficient headroom for the current ramped access to remain. In addition, Iarnród Éireann plan to modify the old canal bridge to facilitate electrification of the line which will require the road level and thus the access point of the ramp to be raised, further reducing the available headroom.

The following four options were developed and assessed for pedestrian access to the inbound Iarnród Éireann platform. Consultation with Iarnród Éireann, Waterways Ireland and DCC during the design development phase took place.

The following criteria were considered as part of the comparative analysis:

- Architecture;
- Structure;
- Environment; and
- Operations, Maintenance and Safety.

4.10.2.1. Option 1- Do minimum scenario.

This option proposes directing all users through the interchange plaza and using the existing lift and stair structure, installed as part of Luas Green Line, to access inbound Iarnród Éireann services. This is on the assumption that numbers using the existing ramp will decrease once the proposed Scheme is built, due to the parallel nature of service offering by Iarnród Éireann and Luas to carry passengers to and from the city centre, including to Connolly and the Docklands by light rail via transfer at Abbey Street. In addition, there is proposed bike parking to be provided as part of Luas Finglas adjacent to the proposed Luas Stop which will reduce the pedal cyclist usage on the ramp.

This option is entirely contingent on the full operational use of the lifts, to a high standard of service. There have been limited reports of anti-social behaviour at the lifts, which are maintained by the Luas Operator. TII and the Luas Operator will continue to maintain these lifts to a high standard of service to ensure the lifts provide the linkage needed. Other suggested interventions as part of all options include improved footpath access from the Finglas direction to the interchange, good vehicular set-down and disabled parking within the interchange for mobility impaired passengers and the design of a high quality, safe and legible environment for pedestrians moving through the interchange site.

4.10.2.2. Option 2 New access structure off Hamilton Bridge

Option 2 proposes a new lift and stairs (or lift only) access from the Hamilton Bridge to the inbound Irish Rail platform, positioned between the existing Hamilton Bridge and the proposed new Luas Finglas bridge structure, taking passengers from Broombridge Road to the Irish Rail inbound platform.

Figure 4-42: Option 2 New access structure off Hamilton Bridge

An alternative access from the Hamilton Bridge area incorporating a new bridge/ramp structure from the north abutment of the Hamilton bridge to the inbound Irish Rail platform, positioned between the existing Hamilton bridge and the new Luas Finglas bridge was also investigated. The launch point of the structure would be located at the higher level of the canal towpath, to allow pedestrian and canal clearance as it crosses the lower towpath and the waterway, which would then ramp down under the new Luas bridge structure to the platform. Clearance over the canal is required to be 3.5m over the high-water mark. However, this option has limited feasibility because of several factors: firstly, the level difference at the proposed north end of the footbridge and the greenway is >1m with no space available to accommodate a ramp; secondly, construction of a new footbridge with associated stairs/ramps in such a close proximity to the protected structure and proposed Luas rail bridge would be difficult. This alternative option was ruled out and not assessed further.

Figure 4-43: Alternative Option 2 - New bridge/ramp from the north abutment of Hamilton bridge

4.10.2.3. Option 3 Extension of existing bridge and lift structure to the towpath

This option proposes an extension of the existing overbridge, constructed as part of Luas Green Line, to connect the Royal Canal towpath with the inbound Iarnród Éireann platform, thus accommodating those pedestrians coming from the Finglas direction wishing to access inbound Iarnród Éireann Services.

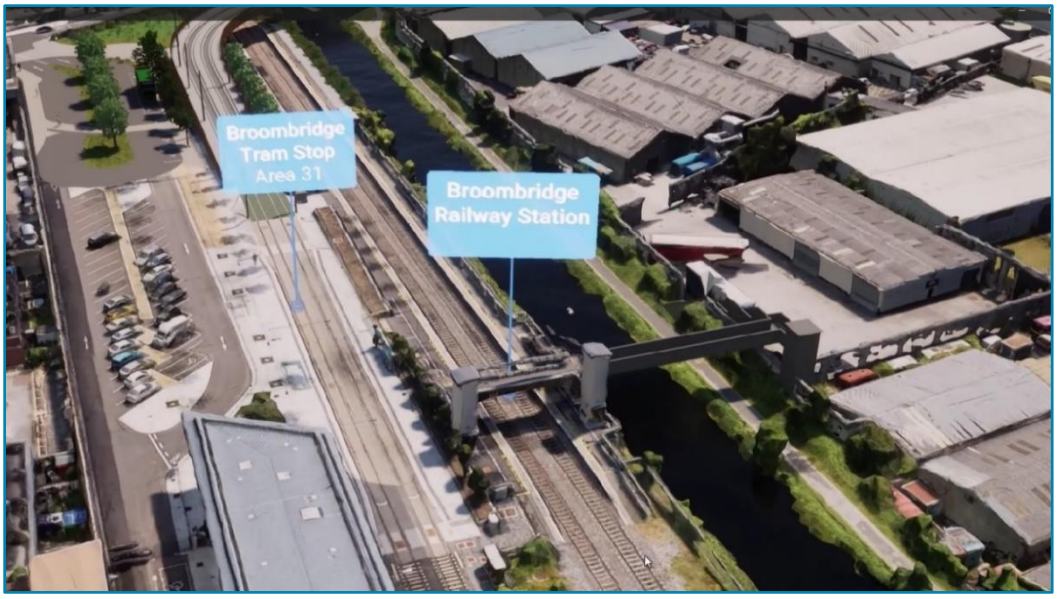


Figure 4-44: Pedestrian Bridge over the Royal Canal Option 3

4.10.2.4. Option 4 – New canal bridge with integrated towpaths

This option proposes a footbridge over the canal - between the Luas lift and stair structure constructed as part of Luas Green Line and the new Luas Finglas bridge structure adjacent to Hamilton Bridge - linking the canal towpath to the Iarnród Éireann platform. A navigable channel of 3.5m over high water level is required over the canal, meaning that a ramp of approximately 160m (ramps of approximately 80m each side of the bridge) would be needed along the canal towpath and a ramp of approximately 40m would be required on the Iarnród Éireann platform. It is proposed to gently ramp the towpath from both the city side and the Broombridge side at gradients of 1:25, and to integrate the bridge into the canal setting and allow for a restoration of the canal landscape. This option requires a retaining along the private boundary to the North of the Canal tow path.

Figure 4-45: Pedestrian Bridge over the Royal Canal Option 4

4.10.2.5. Environmental Analysis

An environmental assessment was undertaken on all the options proposed for the pedestrian bridge over the Royal Canal. A summary of this assessment is shown in Table 4-39.

Table 4-39: Environmental Assessment of the Pedestrian Bridge over the Royal Canal

Option / Criteria	Option 1 – Do Minimum Scenario	Option 2a and 2b- New access structure off Hamilton Bridge	Option 3 Extension of existing bridge	Option 4 – New Canal Bridge
Visual Impact				
Biodiversity				
Cultural Heritage				
Human Health				
Population				
Air Quality				
Noise and Vibration				
Land Take				
Water				
Soils				

Option 1 is the least environmentally intrusive since it makes use of infrastructure already in place. There would be no increase in lighting – a threat to bat species - and no increased risk of water pollution, arising from construction works and so forth. The sensitive areas of the canal such as the banks and verges will not be impacted in this option. Ideally the landscape and ecology of these banks and verges would be restored, following the removal of the access ramp, as part of the works. However, Option 1 brings all passengers to the same entrance point, although people with disabilities would need to use a lift to access the Iarnród Éireann service. The lifts are within the main concourse with a better prospect of regular maintenance. There is good surveillance. The option is simple and inexpensive. However, the walk length for people coming from Finglas is longer by 160m.

Option 2 is highly impactful on an environmentally sensitive location. The position of the new structure to the rear of the Iarnród Éireann Stop would impinge on the littoral zone of the canal, a known habitat for otters. It would require substantial clearance of canal vegetation – as opposed to restoration in other options. The requisite lighting of the bridge and ramp structure for safety and accessibility reason would be intrusive to bat species and notwithstanding the impact of the larger Luas Finglas bridge, the visual impact of an additional structure so close to the historic structure would be significant.

Option 3 The lift structure would be located off-path, away from canal habitats. It would still require some clearance to hedgerows on the northern edge of the towpath. Care would be required regarding constructing over the canal including with regard to lighting and linear bat and foraging habitats. It is not intended to construct foundations in the canal verges or riparian zones; however, access ramp and stairs structures are likely to encroach and require extensive clearance.

Option 4 could be visually impactful on the historic bridge if handled poorly and impactful on the sensitive littoral zones of the canal and on otter habitats, if over-structured. Option 4 will require de-watering of the canal to facilitate construction. A pier within the canal may also be required to facilitate a slim structure.

4.10.2.6. Overall Conclusion

Any proposed access solution at this location, as part of the proposed Scheme, must be compatible with the DART+. Consequently, any structure crossing over or adjacent to the newly electrified line will need to comply with all relevant safety and clearance standards, as well as to take account of increased and more frequent patronage. Similarly, the Royal Canal Greenway scheme must also be taken into account and consideration must be made in relation to clear widths, access, maintenance and active travel objectives.

Table 4-40: Summary of the MCA undertaken for the Pedestrian bridge over the Royal Canal

Option / Criteria	Option 1 – Do Minimum Scenario	Option 2a and 2b- New access structure off Hamilton Bridge	Option 3 Extension of existing bridge	Option 4 – New Canal Bridge
Architectural design				
Structural				
Environmental				
Operations, Maintenance and Safety				

Based on the MCA shown in Table 4-40, Option 1 scored best and, therefore, it was brought forward as the preferred option.

Option One is, on balance, the most practical solution, with smaller and simpler interventions. Notwithstanding the potential inconvenience to a small number of users, it does provide a viable alternative for those with a mobility impairment and provided mitigation measures are put in place, will allow for an interchange environment which is safe and intuitive to use. Cost hasn't been factored into the assessment. However, it is noted that Option 1 is the most cost-effective solution utilising the existing infrastructure. All the other options involve new infrastructure which will add significant cost to the project.

In terms of future transport demand, all the intermodal transfers and desired transport patterns can be achieved either at Broombridge Interchange. It is anticipated that the number of users wishing to make the transfer from Broombridge to the city centre, via Irish rail, will decrease once Luas Finglas is in place, since passengers who currently walk to or get dropped to Broombridge will board the Luas sooner, stay on board to the city centre and transfer, if necessary, at Abbey Street for services to the Docklands or to Connolly. Adequate set-down and disabled parking spaces should be provided at the interchange, as part of the Luas Finglas scheme, to accommodate those with mobility issues who may struggle with a longer walk. A new drop-off/access point within the interchange for those with mobility issues has the added benefit of the interchange plaza being the recognisable, go-to location for all modes of transport for Broombridge.

The visual and environmental impacts of Options 2 and 3 and 4 are significant, in an environmentally sensitive area. Option 2 is not only structurally and architecturally awkward, but it may also struggle to manage safety and anti-social issues, given the cramped and over-shadowed nature of its setting.

4.10.3 Finglas Garda Station

The proposed Scheme, is passing through Finglas Garda Station, following earlier studies on alternative options. The corridor adjacent to Ravens Court Estate was optimised insofar as possible. Refer to sections 4.9.7 and 4.10.1 for further information.

The entrance to the Garda Station, as per the PR, is in close proximity to the Luas alignment. While AGS and Luas traffic interfaces could be managed by traffic signalling priorities for AGS, this was not considered an ideal arrangement by AGS.

Following extensive consultation with An Garda Síochána (AGS) and the Office of Public Works (OPW) from September 2023, an alternative design option, with an alternative vehicle access for the Garda station onto Finglaswood Rd (western AGS site boundary) and refinement of the Luas alignment was developed.

- Preferred Route Option (2022) (refer to Figure 4-46 and Figure 4-47); and
- Railway Order Design Option (2024) (refer to Figure 4-48 and Figure 4-49).

Both options were assessed against the following criteria:

- Luas and AGS Traffic Segregation;
- Ravens Court Resident Impacts;
- Luas Pedestrian Interfaces;
- Environmental; and
- Adjacent Residences on Cardiff Castle Road.

Figure 4-46: PR Option adjacent to Finglas Garda Station (2022)

Figure 4-47: Visualisation of PR and modified boundary adjacent to Finglas Garda Station (2022)

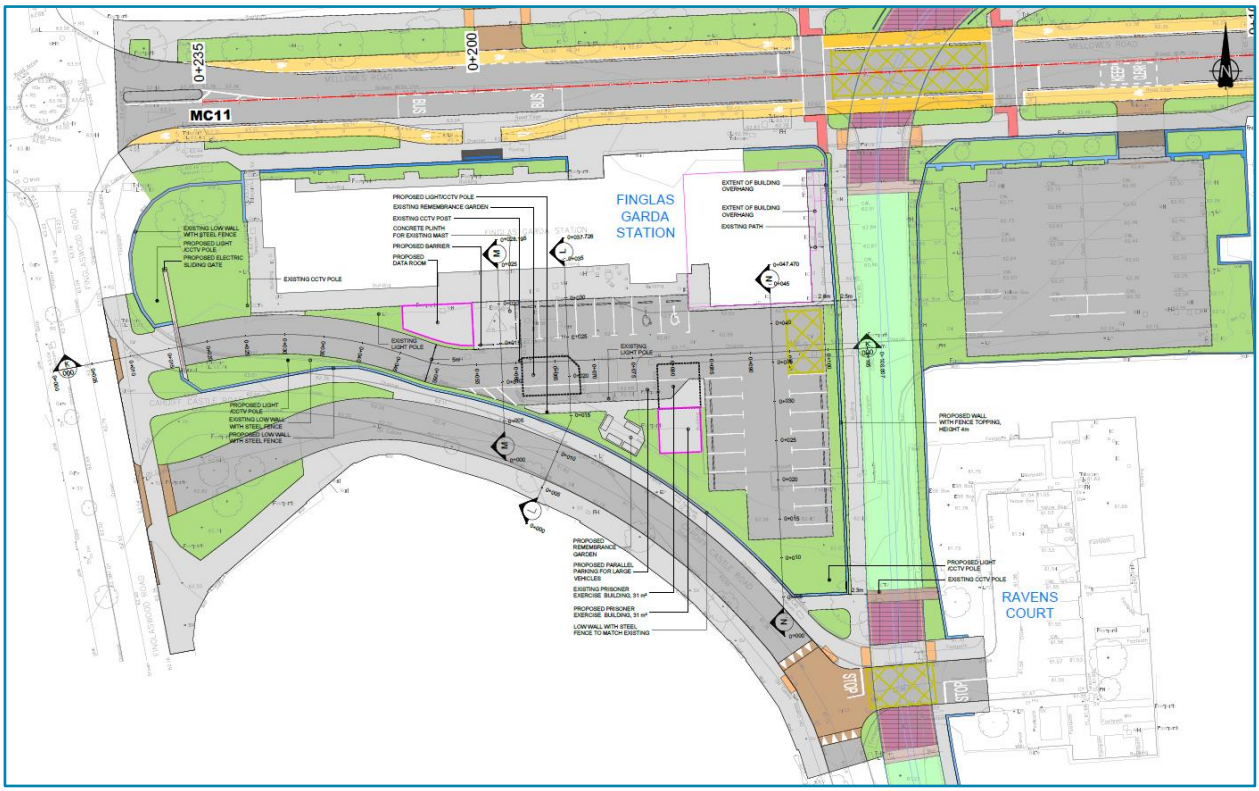


Figure 4-48: Railway Order Design Option adjacent to Finglas Garda Station (2024)

Figure 4-49: Visualisation of Railway Order Design adjacent to Finglas Garda Station (2024)

4.10.3.1. Environmental Analysis

An environmental assessment was undertaken to identify the preferred alignment and boundary adjacent to the Finglas Garda Station.

The majority of environmental criteria (described further in the summary Table 4-41 below) are considered to be neutral. The main differentiators between both options are the removal of public green space and visual impacts on adjacent properties on Cardiff Castle Road as part of the Railway Order design option, which has a moderate negative impact in comparison to the Preferred Route Design (2022).

Table 4-41: Environmental Assessment for Finglas Garda Station options

Option / Criteria	Preferred Route Design (2022)	Railway Order Design (2024)
Removal of Public Green Space		
Noise and Vibration		
Visual Impacts on adjacent properties		
Cultural Heritage		
Water		
Air Quality		
Biodiversity		
Climate		

4.10.3.2. Overall Conclusions

Arising from the overall analysis undertaken the recommendation was that the Railway Order Design (2024) option was recommended for the following reasons:

- relocates vehicle access for the Garda station onto Finglaswood Road (instead of Mellowes Road), thereby minimising potential traffic issues with Luas;

- moves the proposed Scheme alignment further west, which has a moderate improvement on impacts to Ravens Court estate; and
- removes a pedestrian crossing point in the mid-point of the Luas alignment (between Ravens Court estate and Mellowes Road).

Table 4-42: MCA results for Finglas Garda Station options

Option / Criteria	Preferred Route Design (2022)	Railway Order Design (2024)
Luas and AGS Traffic Segregation		
Ravens Court Resident impacts		
Luas Pedestrian Interfaces		
Environmental		
Adjacent Residents on Cardiff Castle Road		

The moderate negative impact on the environment caused by the modifications to the AGS boundary and re-allocation of green spaces, will be slightly mitigated with planted trees and landscape within the AGS site.

4.11 Technological Alternatives

Technological alternatives were considered throughout the preliminary design process. However, the proposed Scheme forms part of a wider Luas network in Dublin and alternatives had to be able to accomplish the objectives of the proposed Scheme in a satisfactory manner and should also be feasible including in terms of technology and other relevant criteria.

Therefore, only technologies compatible with the existing network and systems were considered. Incompatible systems and non-proven technology were discounted from the start.

A summary of the alternatives considered is presented in the following sections.

4.11.1 Trackform Options

There is no universally recognised norm nor international standards for LRT trackform construction. As such, there are a great number of existing track systems. Moreover, local adaptations to standard systems have been carried out in most LRT networks worldwide and this is also the case of the existing lines of the Dublin Luas network.

Therefore, only those trackform solutions, compatible with the existing network and meeting the specific requirements for the proposed Scheme, as follows, were assessed.

- Flat-bottomed *Vignole* rail (49E1 profile with 1:40 inclination) is preferred outside of embedded track;
- Grooved rail profile 59R2 (also named Ri59N) in embedded track;
- Number of transitions between *Vignole* rail and grooved rail to be minimized;
- Rail-to-earth resistance of 10 ohm/km per track minimum; and
- Concrete volume to be minimized.

A grooved rail is most commonly used with a high-level vegetation layer because a grooved rail inherently provides a protective flange way in grass or any other finish. Off-the-shelf embedded solutions exist with *Vignole* rail; however, they do not all achieve high rail-to-earth resistance figures. Therefore, there is a need for innovation or out-of-the-box thinking to develop a grass track solution that will achieve all requirements.

Furthermore, a grass track cross-section with grooved rail might be required as well as one with *Vignole* rail for short or isolated sections of grass track in order to reduce the number of transition rails or if transition rails cannot be used where they would be required, for instance in a tight curve.

4.11.1.1. Existing Dublin Track

Embedded and Street Running: The trackform on existing lines A, B and C mainly comprises a rail encapsulated in a factory environment with a two-component polyurethane coating, known as ALH Series 6. A cork filler is added to the mix to provide resilience and minimise costs. The encapsulated rail is then embedded in a concrete slab.

Grass Track: The existing grass trackform in Dublin includes a rail encapsulated with ALH Series 6 coating and is embedded in a concrete slab. The track slab includes deep recesses between the rail concrete shoulders in order to provide enough thickness to the vegetation base layer.

4.11.1.2. Embedded Track

Five embedded track options were considered and assessed for the proposed Scheme. A summary of those options along with their advantages and disadvantages is presented in Table 4-43.

Table 4-43: Proposed Embedded Track Options with Advantages and Disadvantages

Track Options	Advantages	Limitations
Option 1 - *Rheda City* with RCS Encapsulation Profile	The sleeper system is proven in terms of installation efficiency and maintainability Already in use on the network Steel reinforcement can be removed depending on the design approach	The clamp fastening system offers limited rail support in curves Requires shoulders only in road crossings Rail renewal requires demolition of the shoulder and part of the surface finish
Option 2 - *Sateba* Sleeper with *Trelleborg*	The sleeper system is proven in terms of installation efficiency and maintainability The fastening system (*Pandrol Nabla*) is very robust in curves Steel reinforcement can be removed depending on the design approach	New moulds need to be developed for 59R2 rail profile with additional costs Requires shoulders only in road crossings Rail renewal requires demolition of the shoulder and part of the surface finish
Option 3 – *Frateur - De Pourcq* Hybrid System	The sleeper system is proven in terms of installation efficiency and maintainability The system can be pre-assembled off-site in skeleton track panels or assembled in-situ The surface finish does not have to be demolished during rail renewals Does not require shoulders Steel reinforcement can be removed depending on the design approach	A steel plate is provided at the interface between road and encapsulation Uses monoblock sleepers
Option 4 - *Voestalpine* Flat Steel Sleeper	Weight of the flat steel sleeper is less than a concrete sleeper Already in use on the network	The installation is more difficult than with a concrete sleeper because the steel sleeper bends Requires concrete shoulders throughout Requires steel reinforcement Rail renewal requires track slab replacement and interruption of LRT service during the daytime
Option 5 - *Pandrol* Continuous Rubber Jacket	Initial cost is attractive Includes recycle tyres in the encapsulation rubber jacket	The installation requires temporary jigs and is more difficult than other systems Requires steel reinforcement Rail renewal requires track slab replacement and interruption of LRT service during the daytime

The Multi-Criteria analysis undertaken is summarised in Table 4-44 below.

Table 4-44: Comparison of Embedded Trackform Solutions

Criteria	Option 1	Option 2	Option 3	Option 4	Option 5
Availability and Development					
Constructability					
Whole Life Cost and Maintainability					
Initial Cost					
Surface Finish Quality					
Electrical Insulation					
Sustainability					

The multicriteria analysis shows that the three systems on sleepers are clearly more adapted for the proposed Scheme than the other two systems. Option 3 (the *Frateur - De Pourcq* Hybrid System) is recommended for the proposed Scheme mainly due to its reduced impact on surface finish during rail renewals.

Grass Track

Four grass track options were considered and assessed for the proposed Scheme. A summary of those options along with their advantages and disadvantages is presented in Table 4-45.

Table 4-45: Proposed Grass Track Options with Advantages and Disadvantages

Track Options	Advantages	Limitations
Option 1 - *Rheda City* Green with *StrailBerlin* Fillers	Easiness of installation and maintenance Relies on mechanical fastening system Can be built using fibre concrete without steel reinforcement	Vegetation depth is limited offering less water retention capabilities Rail-to-earth resistance will decrease over time and with heavy rainfalls Uses more concrete volume than slab track systems on permeable ground
Option 2 - *Rheda City* Green with RCS Encapsulation for *Vignole* Rail	Higher rail-to-earth resistance than filler block encapsulation Easiness of installation and maintenance Relies on mechanical fastening system Can be built using fibre concrete without steel reinforcement	Vegetation depth is limited offering less water retention capabilities Uses more concrete volume than slab track systems on permeable ground Use additional filler blocks to keep grass away from rail
Option 3 - *Sateba* Ladder Track with *Trelleborg* Boot	High electrical insulation Cost competitive solution compared to poured encapsulation Combined with precast Ladder Track Deep vegetation layer offering better water retention capabilities Relies on mechanical fastening system Uses less concrete volume compared to conventional slab track systems	Product is not developed Requires steel reinforcement in the precast slab panel The boot thickness

Track Options	Advantages	Limitations
Option 4 - Embedded Rail System (ERS)	Excellent electrical insulation Can be easily combined with *Edilon Sedra* precast slab track (Chemnitz) Deep vegetation layer offering better water retention capabilities Uses less concrete volume compared to conventional slab track systems	The encapsulation material is costly If built in-situ, construction of is demanding Requires steel reinforcement in the precast slab panel

The Multi-Criteria analysis undertaken is summarised in Table 4-46 below.

Table 4-46: Comparison of the proposed Grass Track Options

Criteria	Option 1	Option 2	Option 3	Option 4
Availability and Development				
Constructability				
Whole Life Cost and Maintainability				
Initial Cost				
Vegetation Layer Thickness				
Electrical Insulation				
Drainage Attenuation				
Sustainability				

Based on the above evaluation, the Embedded Rail System is the best trackform meeting all the proposed Scheme requirements. It could be built in-situ or precast.

The *Rheda City Green* is a strong alternative, however the rail-to-earth insulation value will decrease over time and eventually reach figures below the proposed Scheme requirement, given the rubber filler blocks.

The Ladder Track is available off-the-shelf with filler blocks as well, however the solution with integrated Trelleborg boot needs to be developed entirely, which would present risk and development costs to be spread among the number of units supplied for the proposed Scheme.

Shallow Track on Structures

Four shallow track options on structures were considered and assessed for the proposed Scheme. A summary of those options along with their advantages and disadvantages is presented in Table 4-47.

Table 4-47: Proposed Shallow Track Options with Advantages and Disadvantages

Track Options	Advantages	Limitations
Option 1 – Embedded Sleepers	The sleeper system is proven in terms of installation efficiency and maintainability Steel reinforcement can be removed depending on the design approach	Requires a separate track slab over bridge deck The trackform is too thick for the Canal/Railway Bridge (Broombridge).
Option 2 – Direct-Fixed Base Plates	Shallow track that does not require a separate track slab Relies on a mechanical fastening system	The bridge deck installation tolerance needs to be compensated with the rail

Track Options	Advantages	Limitations
		support system to achieve the rail alignment ase plate anchors to be coordinated with bridge deck design Bridge deck waterproofing interface with anchors Rail installation may require jigs and be more difficult to achieve line, level and gauge
Option 3 – Plinth Track	Plinth track can either be precast or cast in-situ Relies on a mechanical fastening system Plinth track accommodates bridge deck construction tolerance Can accommodate grass track Plinth track achieves the 350mm required for Canal/Railway Bridge (Broombridge)	Requires separate longitudinal concrete beams over bridge deck Includes steel reinforcement Rail installation may require jigs and be more difficult to achieve line, level and gauge Bridge deck waterproofing interface with plinth dowels
Option 4 - Embedded Rail System (ERS)	Shallow track that does not require a separate track slab Can accommodate grass track	The bridge deck installation tolerance needs to be compensated with the rail support system to achieve the rail alignment Rail renewal requires cutting the embedment material and reinstating new material Pre-formed channels to be provided in bridge check design

The Multi-Criteria analysis undertaken is summarised in Table 4-48 below.

Table 4-48: Comparison of the proposed Shallow Track Options

Criteria	Option 1	Option 2	Option 3	Option 4
Availability and Development				
Constructability				
Whole Life Cost and Maintainability				
Initial Cost				
Bridge-Track Interface				
Grass Finish on Tolka Valley Bridge				
Track Depth (Dead Load)				
Sustainability				

Based on the above evaluation, the plinth track achieves the proposed Scheme objectives and is, therefore, recommended as preferred option. This system is indeed able to achieve the required track depth (i.e. maximum of 350mm) for the Canal / Railway Bridge (Broombridge) as well as accommodating a grass finish on Tolka Valley Bridge.

4.12 Consideration of Alternatives for the Construction Phase

The construction of the proposed Scheme has potential to have short-term effects when not mitigated sufficiently. In the development of the Construction Phase design for the proposed Scheme, alternative options have been developed and assessed to identify preferred options having regard to the potential environmental effects under the following headings:

4.12.1 Location of Construction Compounds

As described in Chapter 5 of this EIAR there are a number of construction compounds required to allow for the construction of the proposed Scheme. Construction compounds have been located in proximity to the required working areas to ensure the maximum efficiency of the Construction Phase works and to minimise potential environmental effects. In the majority of cases, it was not possible to consider an alternative site for a construction compound as the sites are required to be at or adjacent to the construction works locations. The assessment of alternative construction compounds is presented in Table 4-49.

Table 4-49: Consideration of Alternative Construction Compounds

Compound Name	Alternatives Assessed	Rationale	Environmental Assessment
C-31A	Immediately east of Broome Bridge	The triangle within existing Broombridge depot is also proposed for construction purposes to provide storage space for plant and materials and additional working room to construct the proposed Broome Bridge.	No environmental assessment of alternatives as this was the only feasible option
C-31B	-	-	No environmental assessment of alternatives as this was the only feasible option
C-31C	-	-	No environmental assessment of alternatives as this was the only feasible option
C-31D	Other areas in Tolka Valley Park immediately adjacent to the proposed alignment	To utilise the existing DCC Parks compound to provide storage space for offices, plant and materials and additional working room including to construct the proposed Tolka Valley Park Bridge.	Alternatives within the Tolka Valley Park are ruled out to minimize disturbance to parkland and associated biodiversity by utilising existing hardstanding areas.
C-32A	Other areas north of St Helena's Rd (Farnham Pitches) immediately adjacent to the proposed alignment	-	Alternative areas north of St Helena's Rd (Farnham Pitches) are ruled out to minimize disturbance to playing pitches and also to minimise disturbance to Wintering Birds.
C-32B	-	-	No environmental assessment of alternatives as this was the only feasible option
C-33A	-	-	No environmental assessment of alternatives as this was the only feasible option

Compound Name	Alternatives Assessed	Rationale	Environmental Assessment
C-33B	Other areas in Mellowes Park immediately adjacent to the proposed alignment	-	The chosen location was determined on assessment of the tree survey report and to minimise the fragmentation to the main Mellowes Park [Proposed location is north of the existing pedestrian bridge]
C-33C	-	-	No environmental assessment of alternatives as this was the only feasible option

4.13 Conclusion

The Proposed Scheme, described in full in Chapter 5 (Description of Proposed Scheme), has been the subject of a systematic and comprehensive assessment of reasonable alternatives during the course of its development, informed by extensive engagement with residents, businesses, the local authority and other interested stakeholders, public representatives and the general public.

As described in this Chapter, a significant range of alternatives has been considered. At all stages of the process, the assessment of alternatives took account of environmental impacts, together with other relevant factors including the economy, safety and accessibility.

It is considered that the examination of alternatives presented in this Chapter meets and exceeds the requirements of the EIA Directive; which states that an EIAR must contain '*"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."*

4.14 References

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