DART+ Coastal North

ANNEX 3.6

Technical Optioneering Report: Works around Howth Junction & Donaghmede Station

ARUP

Contents

Tables

Figures

Appendices

Abbreviations

Abbreviation	Definition
ABP	An Bord Pleanála
APIS	Authorisation for Placing in Service
ATP	Automatic Train Protection
BRT	Bus Rapid Transit
BGL	Below Ground Level
CAPEX	Capital expenditure
CAWS	Continuous Audible Warning System
CCE	Chief civil engineer's department
CCTV	Closed Circuit Television
CET	Controlled Emission Toilets
CFRAM	Catchment Flood Risk Assessment and Management
CTC	Central Traffic Control
D&D	Dublin and Drogheda
DART	Dublin Area Rapid Transit
DCIHR	Dublin City Industrial Heritage Record
DMUs	Diesel Multiple Units
DOO	Driver Only Operation
EMUs	Electric Multiple Units
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
FLU	Full Length Unit
GAA	Gaelic Athletic Association
GI	Ground Investigation
GNR(I)	Great Northern Railway of Ireland
GSI	Geological Survey Ireland
HLU	Half Length Unit
HTHJ	Howth – Howth Junction
IÉ	Iarnród Éireann/Irish Rail
ITM	Irish Transverse Mercator
LAP	Local Area Plan
LV	Low Voltage
MCA	Multi-Criteria Analysis
MIC	Maximum Import Capacity
MV	Medium Voltage
MVA	Megavolt Amperes
NIAH	National Inventory of Architectural Heritage
NTA	National Transport Authority
OHLE	Overhead Line Equipment
OPEX	Operational expenditure

Abbreviation	Definition
OPW	Office of Public Works
OSI	Ordnance Survey Ireland
pNHA	Proposed Natural Heritage Area
P&C	Points and Crossings
PTS	Points
QBC	Quality Bus Corridor
RPS	Record of Protected Structures
RSC	Railway Safety Commission
SAC	Special Area of Conservation
SCADA	Supervisory Control and Data Acquisition
SDH	Synchronous Digital Hierarchy
SDZ	Strategic Development Zone
SEB	Signalling Equipment Building
SET	Signalling Electrification and Telecoms
SPA	Special Protected Area
SSI	Solid State Interlocking
TER	Telecoms Equipment Rooms
TII	Transport Infrastructure Ireland
TPH	Trains Per Hour
TSS	Train Services Specification
WFD	Water Framework Directive

1 Introduction

The purpose of the report is to provide the technical input to the Preliminary Option Selection Report. This report provides the technical assessment at Howth Junction & Donaghmede Station from option selection through to the emerging preferred option, including the options considered and how an emerging preferred option was chosen.

The report includes:

- An introduction and description of the study;
- A summary of the option assessment approach undertaken;
- A description of the existing situation;
- The relevant requirements;
- The relevant constraints;
- The option assessment containing:
    - Longlist of options;
    - Sifting of longlist of options;
    - Summary and details of the shortlisted options;
    - Multi-criteria analysis (MCA);
    - The emerging preferred option.

1.1 Packages of Work

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

This report refers to the optioneering assessment for the works at Howth Junction & Donaghmede Station. The scope is to consider Howth Junction & Donaghmede Station for suitability as a turnback to achieve the TSS and maximise capacity, and to and design any associated re-configuration works. This report considers all feasible long list options with a view to reducing the list via reasoned sifting, including the likes of cost, impact, and the TSS requirements.

1.2 References

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

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

Annex	Title	Description
N/A	DART+ Coastal North Preliminary Option Selection Report	This is the main report which summarises the optioneering process and the different packages of proposed works on the DART+ Coastal North project.
N/A	DART+ Coastal North Preliminary Option Selection Report – Executive Summary	This report summarises the main Preliminary Option Selection Report.
1	Emerging Preferred Option Maps	Includes drawings for each Emerging Preferred Option, to support the Preliminary Option Selection Report.
2.1	Policy Context	This presents a detailed review of the European, National, Regional and Local policy context for the DART+ Programme and the DART+ Coastal North Project
2.2	Useful Links	Useful links to documents/websites relating to the DART+ Coastal North project.
3.1	Constraints Report	This report reviews the DART+ Coastal North constraints.
3.2	Technical Optioneering Report: Electrification of the Northern Line between Malahide and Drogheda.	The Technical Optioneering Report for the Electrification of the Northern Line between Malahide and Drogheda. The report is divided into a series of sections.
3.3	Technical Optioneering Report: Works around Drogheda MacBride Station	The Technical Optioneering Report for Works around Drogheda MacBride Station. The report addresses track and station modifications to allow for the increased number of DART services.

Annex	Title	Description
3.4	Technical Optioneering Report: Works around Malahide Station	The Technical Optioneering Report for Works around Malahide Station. The report addresses track modifications required to allow trains to be turned back clear of through running services.
3.5	Technical Optioneering Report: Works around Clongriffin Station	The Technical Optioneering Report for Works around Clongriffin Station. The report addresses track modifications required to allow trains to be turned back clear of through running services.
3.6	Technical Optioneering Report: Works around Howth Junction & Donaghmede Station	The Technical Optioneering Report for Works around Howth Junction & Donaghmede Station. The report addresses the addition of tracks to allow a higher frequency shuttle service.
3.7	Technical Optioneering Report: Howth Branch Level Crossings	The Technical Optioneering Report for the Howth Branch Level Crossings. The report addresses the impacts of all proposed increases in train frequency on existing level crossings on the Howth Branch.

1.3 Option Assessment Approach

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

2 Existing Situation

2.1 Overview

Howth Junction & Donaghmede Station is located at the bifurcation of the Northern Line and the Howth Branch. The station is located approximately at grid reference 728100.763E, 739387.653 N based in the ITM Grid.

Howth Junction & Donaghmede Station comprises four platforms: Platforms 1 and 2 are located on the Howth Branch, and Platforms 3 and 4 are located on the Up and Down Belfast lines. The current platform lengths for Platforms 1 through to 4 are 174m, 174m, 188m and 211m for each respective platform.

Access to Platforms 2 and 3 is provided by the existing station pedestrian footbridge (OBQ0).

An aerial view of the site is shown in Figure 2-1.

Figure 2-1: Aerial view on Howth Junction & Donaghmede Station (source: OSI aerial mapping)

2.2 Structures

There are six existing structures associated with Howth Junction & Donaghmede Station as shown on Figure 2-1, Figure 2-2 and Figure 2-4, in Annex 1.5 (Emerging Preferred Option Map 5 of 38), and as listed here:

- Underbridge UBB17 (17 Killbarrack Rd / Public Road R104);
- Overbridge OBB17A – Mainline footbridge;
- Overbridge OBQ0 - Station footbridge;
- Culvert OBQ0A;
- Culvert OBQ0B;
- Culvert UBB17F.

Figure 2-2: Underbridge UBB17 Aerial View (source: OSI aerial mapping)

Figure 2-3: Underbridge UBB17 Street View (source: Irish Rail)

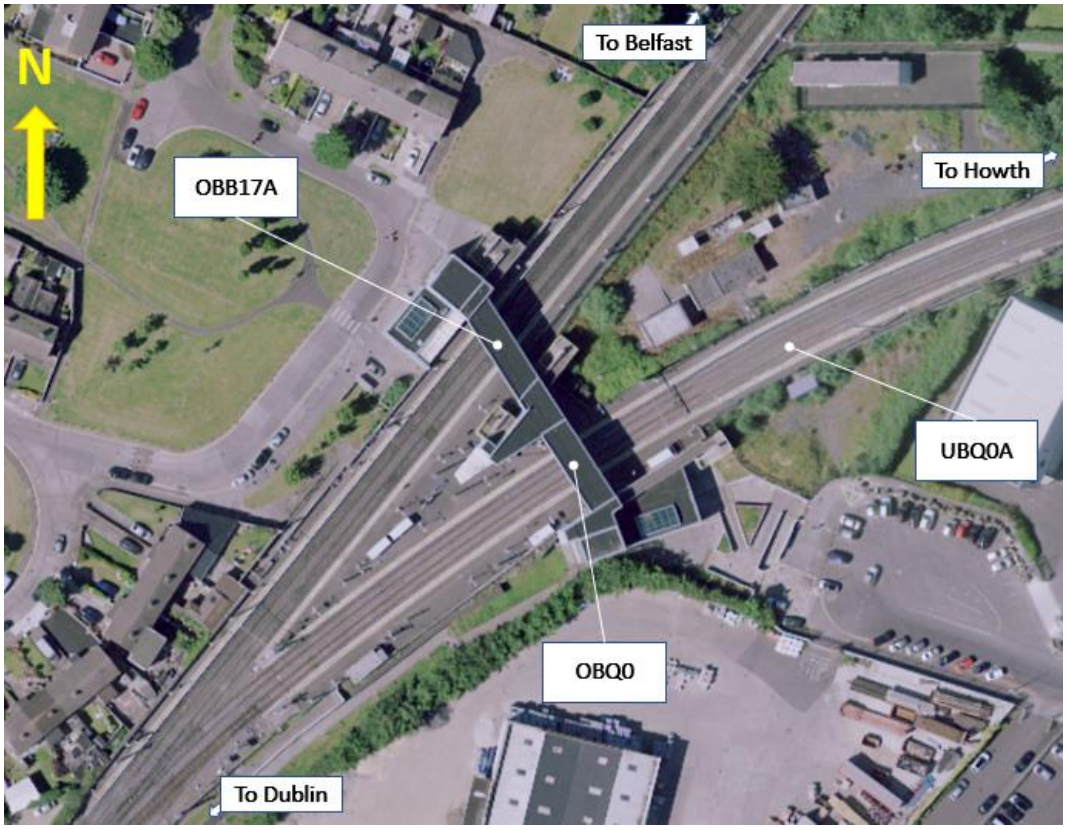

Figure 2-4: Aerial view of existing structures located within the vicinity of Howth Junction & Donaghmede Station (source: OSI aerial mapping)

Figure 2-5: View looking towards Overbridge OBB17A (source: Irish Rail)

2.3 Permanent Ways and Tracks

Howth Junction & Donaghmede Station is located at the bifurcation of the Main Belfast Lines and the Howth Branch. The current line speeds are 70mph for the Mainlines and 30 mph through the double junction and platform areas on the Howth Branch line.

On the approach to the station traveling in a northerly direction, the Howth Branch is accessed via a double junction and PTS 610B and 609A connecting to the Up and Down Belfast lines respectively.

Main line protection is currently provided on the Up Howth Branch only, via trap points 609B. This leads to a short siding and friction buffer stop.

Within the immediate vicinity of the platform areas no other points and crossings exist at present.

2.4 Other Railway Facilities

2.4.1 Signalling

The signalling in the Howth area is controlled from Central Traffic Control (CTC) and is operated by the HTHJ SSI (Solid State Interlocking) which was commissioned in 2012/2013. Consequently, the condition of the signalling equipment and accommodation buildings is good. It is expected that changes to the signalling involving the addition of a number of new lineside signals and point machines can be accommodated in the existing signalling equipment building (SEB) and some additional new location cases situated along the tracks. However, this will be dependent on the agreed signalling solution.

Figure 2-6: Sutton SEB (similar in design to the existing Howth Junction & Donaghmede Station SEB

Howth Junction & Donaghmede Station is controlled from Centralised Traffic Control (CTC) using the Solid State Interlocking (SSI) interlocking covering Dublin North HTHJ (the light green lines in Figure 2-7 below) that was first commissioned in 2012/2013. The installations are therefore new and in very good condition. The area is controlled locally from the signalling equipment building located adjacent to the station.

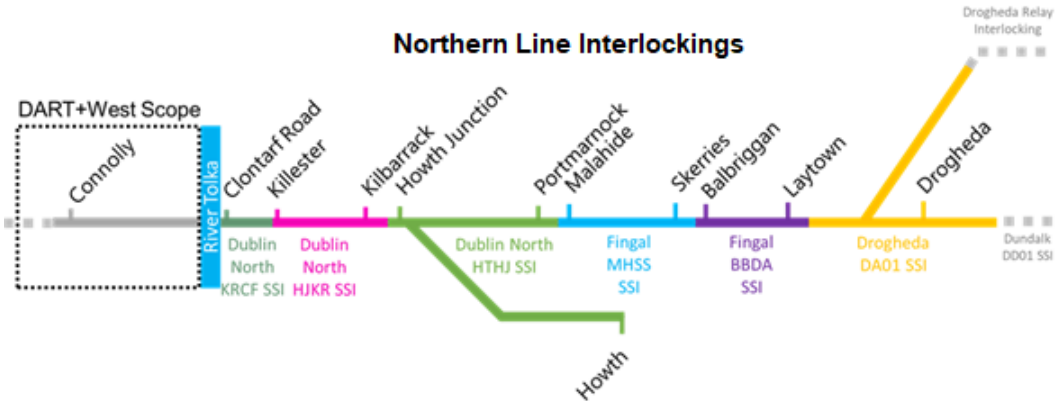

Figure 2-7: Interlocking control areas

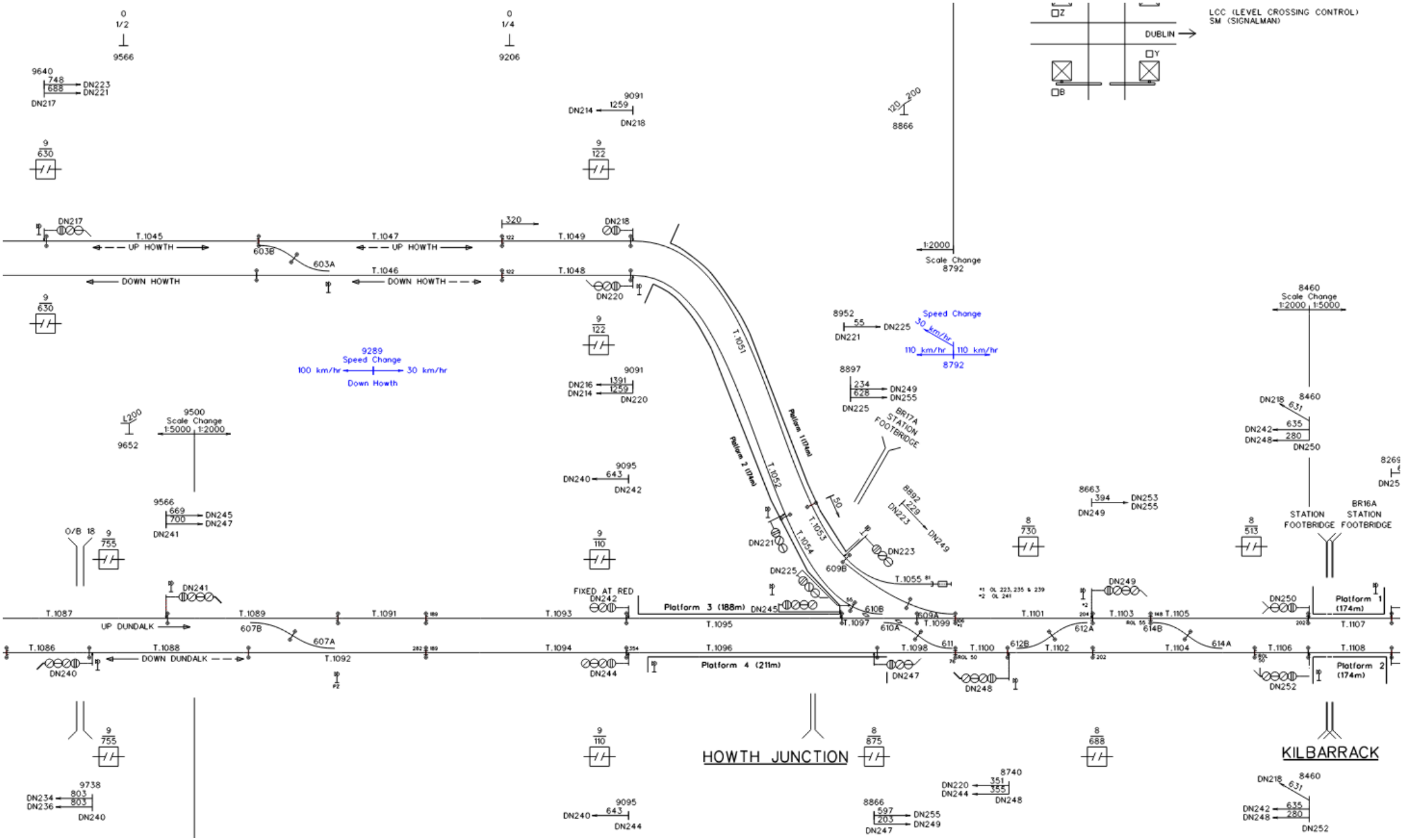

Figure 2-8: Signalling Plan for Howth area

2.4.2 Telecoms

The Telecoms Operational network is a legacy Synchronous Digital Hierarchy (SDH) which is in the process of being fully replaced by Irish Rail (IÉ). Existing cables which have a low number of available fibres will be fully replaced as part of the DART+ Coastal North and DART+ Coastal South projects.

On the supportive network side, the Gigabit network supports station communications equipment such as LED (Light Emitting Diode) platform indicators, Public Address Systems, CCTV (Closed-circuit television) and help points. GSM-R (Global System for Mobile Communications-Railway) coverage is provided from the cell mast located adjacent to the TER and SEB buildings at Howth Junction & Donaghmede Station.

2.4.3 OHLE

Changes to the overhead line equipment (OHLE) and additional support structures may be needed to provide the revised OHLE configuration for the revised track and platforms. Additional cantilevers from the existing masts may be used in locations where these are suitable. New masts may be required in some locations where the existing masts are not suitably located. The OHLE can be designed to accommodate any of the proposals within the longlist of options, whether it be adding additional crossovers, extending of existing platforms or adding new platforms.

2.4.4 High Voltage supply

The traction current for the Howth Junction & Donaghmede Station area is primarily provided by the substations located in the surrounding areas: Bayside, Raheny and Portmarnock. These substations are currently operating well below their originally designed capacity of between 4 and 4.5MVA.

2.4.5 Ancillary Electrical Systems

There are other minor systems that support the train operation including SCADA (Supervisory Control and Data Acquisition) responsible for the remote operation of the traction power supply to the OHLE and the Earthing and Bonding cable system that is required to ensure the safe management of traction return current and prevention of unsafe voltages on adjacent structures.

2.5 Ground Conditions

Historic mapping and aerial photography show that the site was initially agricultural land and remained undeveloped in the period 1757-1850. The site was bounded by green fields. The railway line to Howth was constructed in the period 1860-1870. Recent developments consisting of a series of light industrial units to the south-east of the station and residential developments to the west are noted.

The Rivers of Dublin map by (Sweeney, 2017) indicates that two historic rivers/streams cross at Howth Junction & Donaghmede Station. At present, it is not

known whether these waterbodies were culverted or infilled and there exists the possibility of soft ground within this region. A culvert (UBQ0A) is present within the station crossing the Howth branch line and may relate to the northern river/stream feature; no details of a culvert to the south of the station are known or available.

Geological Survey Ireland (GSI) Quaternary sediment mapping indicates the presence of till derived from limestone at the station. An alluvium channel is noted running west-east through the station. Immediately to the north of the station, a mega scale lineation is noted along with small areas of hummocky sand and gravel material.

GSI bedrock mapping shows that the site overlays the boundary of the Tober Colleen formation (calcareous shale, limestone conglomerate) and of the Lucan Formation (dark limestone and shale (calp)). GSI depth to bedrock (Dublin County) mapping indicates bedrock depths of 5 to 10m.

Available historic ground investigation (GI) information within in the station indicates the presence of up to 1.5m of made ground overlying firm to hard fine-grained glacial deposits however one borehole located between the Belfast Line and the Howth Branch identified made ground to a depth of 5.5m below ground level (BGL). The depths of the glacial deposits have not been proven, with boreholes terminating at 5 to 10.5m BGL. Historic ground investigation to the north of the site records the presence of soft silt/clay materials up to 2m BGL.

Rock levels have not been proven on the site. No groundwater monitoring information is available at the location.

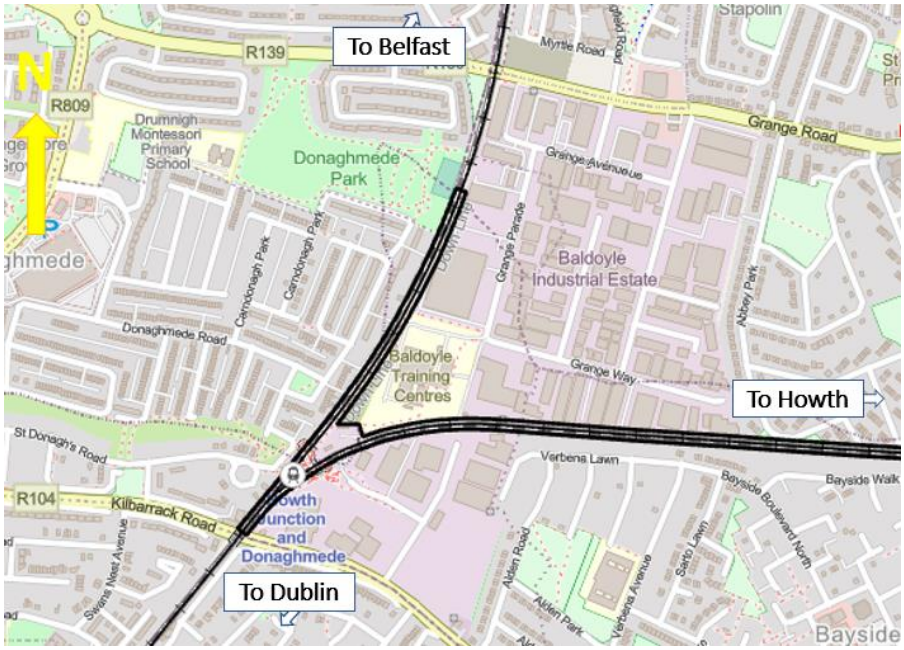

Figure 2-9: Aerial view showing the extent of the site over which ground conditions have been considered. (Map data © OpenStreetMap contributors, Map layer by Esri)

2.6 Environmental

The study area around Howth Junction & Donaghmede Station is well developed, located to the northeast of Dublin City, straddling the administrative areas of Dublin City Council (to the east and south) and Fingal County Council (most of the study area, to the north and east). The station and Howth Branch line are wholly within the Fingal County administrative area.

The area around the railway line in the vicinity of the proposed works is well developed, with Howth Junction Business Park to the south of the railway, Baldoyle Industrial Estate to the north, and residential development to the northwest, south and east.

The R104 Tonglegee – Kilbarrack Road crosses the railway to the south (on the mainline) with Naomh Barrog GAA (Gaelic Athletic Association) club and Bayside National School located to the south/southeast of the Howth Branch line.

There are no European sites in the immediate vicinity, with Baldoyle Bay Special Area of Conservation (SAC), Special Protected Area (SPA) and Proposed Natural Heritage Area (pNHA) sites located to the northeast and North Dublin Bay SAC and pNHA and North Bull Island SPA located to the southeast, respectively. Further to the east and south, there are a number of European sites, including Ireland's Eye SAC, SPA and pNHA, Rockabill to Dalkey Island SAC, Howth Head SAC and pNHA, as well as South Dublin Bay and River Tolka Estuary SPA and South Dublin Bay SAC and pNHA.

A brief overview of the baseline environment, under key environmental criteria, is provided in the following sections.

2.6.1 Traffic and Transportation

The site is accessible by a local road currently providing access to a commercial area. The road is approximately 8m wide and includes cycle lanes. The nearest road link of regional importance is the R104 Kilbarrack Road, which links, through an urban area, with the R107 Malahide Road to the west and the M1/M50 further to the west.

2.6.2 Landscape and visual impact

The works area is located along the existing railway lines at Howth Junction & Donaghmede Station which lies between Donaghmede to the west and north and Kilbarrack to the east and south. The business, industrial and warehousing areas of Baldoyle Industrial Estate and Howth Junction Business Centre are immediately east of the rail junction with established residential areas at Carndonagh, Donaghmede, St. Donagh's Road, etc. west of the railway lines and at Verbena Lawn south of the rail lines. The boundary of the corridor of the rail lines is a mix of walls and / or fences with some limited boundary plantings and mature trees. Properties at Verbena Lawn back on to the rail line corridor and have established gardens and plantings.

Areas east of the rail lines and north of Kilbarrack Road lie within the Fingal County area. The area around Howth Rail Junction is zoned General Employment. A former signalman's cottage off Kilbarrack Road is identified as a protected structure (Fingal County Council Record of Protected Structures No. 0788).

Areas west of the railway lines and south of Kilbarrack Road are within the Dublin City area. These are generally a mix of existing residential and open space zoned lands. The open space between St. Donagh's Road and Holywell Road / Donaghmede / Carndonagh is identified as a Conservation Area.

There are otherwise no landscape or visual sensitivities.

2.6.3 Archaeological and cultural heritage

There are no monuments, finds or features of a cultural heritage interest within the proposed railway works area. The Dublin and Drogheda Railway began operating in 1844 and the branch line to Howth opened in 1846. Prior to the opening of the railway, this area is shown on first edition six-inch Ordnance Survey map (1837) as fields located within Kilbarrack Upper townland. The railway now passes through an area that presents as a built up suburban and industrial streetscape with housing estates to the west and business parks to the north and south of the proposed works at Howth Junction & Donaghmede Station.

2.6.4 Architectural Heritage

The site of Howth Junction & Donaghmede Station was at the boundary of Donaghmede demesne prior to the construction of the Dublin and Drogheda (D&D) Railway in 1840-4. A demesne was a parcel of land retained by a landlord farmer, for the use of the house. They provided a natural parkland setting for the house. The landscapes vary greatly in size, and often possessed features, such as long driveways, gate lodges, stately entrances, walled gardens, bodies of water and belts, avenues and clumps of deciduous and specimen trees. The boundaries tended to be planted and sometimes walled to screen the internal landscapes. The Donaghmede demesne is included in the National Inventory of Architectural Heritage's (NIAH) Garden Survey (NIAH 2516).

As represented on Griffith's Valuation maps, surveyed c.1850, the landscape comprised of a house set in a large parkland with outbuildings, walled gardens, a summer house and gate lodge. The eastern part of the demesne was more formally laid out, with the western boundary already impacted by the railway as shown on the map. The historic landscape associated with Donaghmede House was much reduced by 1907, as indicated on the Ordnance Survey maps from this date. The house was in ruins c.1930 as indicated on the Casini six-inch maps and has been demolished. The NIAH Garden Survey notes that the historic landscape is completely covered in residential development.

The Howth Branch of the D&D Railway was completed by May 1847, with Howth Junction & Donaghmede Station opened on 30 October 1848. The D&D Railway would eventually extend to link Dublin to Belfast with the completion of the Boyne crossing in 1855, merging to form the Great Northern Railway of Ireland (GNR(I)) in 1876, and operated by Iarnród Éireann since 1987.

The original station building at Howth Junction & Donaghmede Station has been replaced with modern structures, though some historic walls remain along the train line on the west side at Carndonagh Lawns. There was a brick signal box, to the south of the station building which has been removed. A former station master's house survives further to the south, in poor or derelict condition. The building is of interest for architectural, artistic and social reasons, though it is not included in the NIAH or the Record of Protected Structures (RPS).

No other features of built-heritage interest have been identified as part of the preliminary desk-based baseline review of the study area at Howth Junction & Donaghmede Station.

2.6.5 Noise and vibration

The existing noise and vibration environment at Howth Junction & Donaghmede Station includes noise and vibration from trains travelling through and stopping at Howth Junction. Sensitive receptors in the area include residents to the south and west, and commercial premises to the north and east.

Trains running through Howth Junction & Donaghmede Station are currently electric and diesel trains. The electrification process will have a positive effect on the noise environment at the station.

2.6.6 Air quality and climate

The nearest Environmental Protection Agency (EPA) air quality monitoring station to the Howth station is located in Swords. The quality of air in Swords in 2019 was very good with measured concentrations of pollutants well within air quality standards.

The Climate Action and Low Carbon Development (Amendment) Act 2015, as amended, supports Ireland's transition to Net Zero and achieve a climate neutral economy by no later than 2050. It commits to a reduction of 51% in the total amount of greenhouse gas emissions by 31 December 2030, relative to 2018 emissions.

2.6.7 Agricultural and Non-Agricultural

Agricultural Land

Farms in County Dublin are larger than the national average. There are fewer dairy and other livestock farms and more tillage farms. Howth Junction & Donaghmede Station is entirely surrounded by urban development and there is no agricultural land.

Table 2-1: Agriculture in County Dublin (2010[1] Agricultural Census, CSO)

Farm enterprise type (Table 2, 2010 Ag Census, CSO)	Co Dublin	Nationally
Mainly dairy	3.5	11
Non - dairy grazing livestock (beef cattle) and mixed field	65	72.5
Mainly tillage	25.5	3.5
Mixed crops & livestock	3	2
Other	1	1
Total	100	100
Average size (ha)	47.6	32.7

[1] The proposed 2020 Agri Census was postponed due to Covid-19 and therefore the 2010 Census is the most recent enterprise type data for County Dublin.

Non-Agricultural land/population assessment

Howth Junction & Donaghmede Station is located in the Baldoyle suburb of Dublin. The station is located to the south-west of Baldoyle Industrial Estate, immediately north of a commercial estate off Kilbarrack Parade, and east from across the mainline tracks from residential housing on Carndonagh Lawn and St Donagh's Road. Eight properties in St. Donagh's Road face onto the mainline tracks from the rear.

2.6.8 Geology and Soils

The expected ground conditions at Howth Junction & Donaghmede Station are detailed in Section 2.5. Additionally, two historic rivers/streams cross the site and it is currently unknown whether these waterbodies were culverted or infilled. Therefore, there is a risk of soft ground within this area.

The site is underlain by made ground over till derived from Carboniferous Limestones.

The Corine Land Cover 2018 categorises the land use in the area as artificial surfaces with industrial, commercial and transport units as well as discontinuous urban fabric.

2.6.9 Water resources

Surface water bodies

The study area lies in the Santry_020 river sub-basin which is in the Mayne_010 river sub-catchment. The Mayne Estuary transitional waterbody (IE_EA_080_0100) is located 1.5km northeast of the site and discharges to the Irish Sea Dublin (HA09) coastal waterbody. The estuary is part of the Baldoyle Bay SAC, SPA and pNHA. One of the objectives of the Baldoyle Bay SAC and North Dublin Bay SAC relates to the flooding regime, and specifically the natural tidal regime. The pioneer saltmarsh community at the SAC requires regular tidal inundation.

The Bull Island Bay transitional waterbody (IE_EA_090_0100) is located approximately 1km southeast of the site and discharges to Dublin Bay coastal

waterbody. The area is part of the North Bull Island SPA and North Dublin Bay SAC and pNHA.

Under the Water Framework Directive (WFD, 2000/60/EC) the 'Ecological Status' of the Mayne Estuary and North Bull Island transitional bodies are unassigned, indication that their quality is not monitored, whereas the Irish Sea Dublin (HA09) and Dublin Bay coastal waterbodies are classified as Good status. Under the WFD, the minimum objectives for a water body are to achieve at least Good status (or Good potential for artificial/ highly modified water bodies), and no deterioration of existing status. The Irish Sea Dublin and Dublin Bay are not at risk of losing their good status.

Groundwater

There are no significant karst features identified near the study area.

The site is underlain by Dinantian Upper Impure Limestone which is part of the Tober Colleen Formation or classified as Calp. The Tober Colleen formation is classified as a Poor (PI) Aquifer which is Generally Unproductive except in Local Zones. The Calp limestone is a Locally Important (Ll) Aquifer which is Moderately Productive only in Local Zones. The groundwater vulnerability at the site is low.

The study area lies within the Dublin groundwater body (IE_EA_G_008). The Dublin groundwater body is currently at Good WFD Status for the 2013-2018 monitoring cycle and currently Not at Risk with regard to achieving its WFD objectives.

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

Flooding

Historical flooding has been assessed by examining reports and maps from the OPW's (Office of Public Works) National Flood Hazard mapping. There are no records of flood events within the site area. The closest recorded flood event to the site occurred on Grange Road in Donaghmede in November 1982 from surface water runoff.

Risk of flooding from the rivers and the sea has been assessed and mapped by OPW as part of the Eastern Catchment Floor Risk Assessment and Management (CFRAM) study. According to OPW predictive flood maps (floodinfo.ie), the site is not shown to be at areas at risk of fluvial or tidal flooding. There is some coastal flooding adjacent to the railway line circa 1.5km east of the proposed works. There is a localised risk of pluvial flooding along the railway line, east of the proposed works, potentially caused by ponding or poor drainage.

2.6.10 Biodiversity

The works location is within the urban environment of Donaghmede/Baldoyle/Kilbarrack with the Howth Junction & Donaghmede

Station immediately adjacent and surrounded by industrial and residential developments.

2.7 Utilities

There are extensive utility networks in the area, typical of an urban environment such as that surrounding Howth Junction & Donaghmede Station. Service providers with network assets in the area, from whom records have been obtained, include:

- Gas Networks Ireland;
- Irish Water (Water Supply);
- Irish Water (Foul Water Sewers);
- Dublin City Council (Storm Water Sewers);
- Fingal County Council (Storm Water Sewers);
- ESB Networks (Low and Medium Voltage Networks)
- Eir;
- BT Ireland;
- Lineside cables running along the length of the railway line.

All utility records should be considered indicative only and must be verified prior to any intrusive works occurring. It is envisaged that utility surveys will be undertaken at a later stage, once the preferred option is selected, to inform design. Most of the utilities within the area cross the railway track at or near existing bridges.

Utility service records have been obtained from all providers in the area. Most services are located within the existing street network surrounding the railway. All records should be considered indicative only and must be verified prior to any intrusive works occurring.

The records indicate that there are services at track level or within the railway corridor. These include possible data cables/fibre running parallel to the mainline railway and are indicated as crossing the railway into the area between Platforms 2 and 3.

There is an existing 1350mm diameter surface water sewer running under the station. This goes from St Donagh's Road to the west of the station through to Kilbarrack Way to the east.

There is a medium voltage (MV) electrical connection to the station building from St Donagh's Road. There is a low voltage (LV) electrical cable running under the Howth Branch Railway from Kilbarrack Way to the existing equipment located between Platforms 2 and 3.

There is an existing telecommunications mast located in the area between platforms 2 and 3. From review of the Comreg Site Viewer this mast hosts equipment for the Vodafone, Three and Eir networks

3 Requirements

3.1 Specific Requirements

In addition to the general feasibility requirements of constructability and safety, this section describes the specific requirements for this area to achieve the project Train Service Specification – referred to as TSS 1C. To meet TSS 1C, Howth Junction & Donaghmede Station must, as a minimum, be able to handle the following quantum and pattern of train services:

- 6 trains per hour (TPH) DART shuttle terminating/departing services from Howth;
- 9 TPH DART through services;
- 2 TPH Diesel Multiple Unit (DMU) through services;
- 1 TPH Enterprise non-stop through services

The 6 TPH turnaround trains to Howth can be handled on a single platform, although it increases operational flexibility to have two platforms available. Whilst the TSS does not require through running of services from Howth south in the direction of Connolly, there is a requirement to maintain the possibility for future services.

3.2 Systems Infrastructure and Integration

Overall Signalling, Electrification and Telecoms (SET) requirements are defined in the functional requirements specifications for the DART+ Programme. These documents support IÉ SET standards covering the requirements for the signalling, electrification and telecommunications (telecoms) may need some adaptation to the conditions that are specific to the Howth Junction & Donaghmede Station development.

Changes and additions to the existing signalling, telecoms and OHLE will be required to support operation with the revised operating pattern. Signalling will be adapted to enable the safe and efficient use of new or revised routes to support the operation according to the new track configuration selected.

Similarly, additional OHLE will be installed and/or adapted to ensure that Electric Multiple Units (EMUs) are able to fully utilise the revised track layout using components that are similar or identical to the existing installation, comprising galvanised masts and suspension equipment providing a nominal contact wire height of approximately 4.7m and possibly additional feeder wires in some locations.

Additionally, changes to the traction power supplies will be required to ensure that the increased numbers of trains will have sufficient power. Changes to key parameters of the traction substations will be required including the Maximum Import Capacity (MIC).

Telecoms changes will be required to support the communication between any additional/new equipment or relocated equipment providing passengers with

enhanced information and considering new operating patterns as a result of the altered layout.

3.3 Design Standards

Table 3-1 contains some of the key applicable standards that will be used to develop the design. This list of standards is not exhaustive and other IÉ Standards may be used.

Prior to completing the detailed design Arup will undertake a fully detailed risk assessment in accordance with The Commission of Railway Regulation (CRR) mandatory requirements as set out within the documents listed below:

- CRR-G-009-G: Guideline for the Process of Authorisation for Placing in Service of Railway Sub Systems;
- CRR-G-009-G Sections 2.2.3 – 2.2.4: Guideline providing List of Parameters and Requirements for Authorisation for Placing in Service (APIS) of Heavy Rail INF & related OPE/MAI Parameters.

Table 3-1: Design Standards

Source	Description	Comments
European Commission Regulation	EU/1299/2014	Technical Specification for Interoperability for the 'Infrastructure' subsystem
European Commission Regulation	EU/1302/2014	Technical Specification for Interoperability for the "rolling stock subsystem - Locomotives and passenger rolling stock"
Irish Rail	I-PWY-1101	Requirements for Track and Structures Clearances
Irish Rail	I-PWY-1136	Requirements for Design, Installation and Maintenance of Lineside Drainage
Irish Rail	CCE-TMS-300	Track Construction Requirements and Tolerances
Irish Rail	CCE-TMS-340	Horizontal Curvature Design
Irish Rail	CCE-TMS-341	Vertical Curvature Design

Source	Description	Comments
Irish Rail	CCE-TMS-344	Requirements for Undertrack Crossings and Pressure Pipelines
Irish Rail	CCE-TMS-345	Engineering Requirements for Passenger Platforms and Barrow Paths
Irish Rail	CCE-TMS-410	Civil Engineering Structures Design Standard
Irish Rail	CCE-TRK-SPN-007	Specification for Track Ballast
Irish Rail	CCE-TRK-SPN-021	Specification for Permanent Way Signs
Irish Rail	CCE-TRK-SPN-037	Fencing Specification
Irish Rail	MAY-MDC-ELE-DART-SP-E-0002	Electricity Functional Specifications System-Wide
Irish Rail	MAY-MDC-TEL-DART-SP-Y-0001	Telecommunications Generic Functional Requirement Specification DART Wide
Irish Rail	MAY-MDC-SIG-DART-SP-E-0001	Signalling Functional Requirements Specifications System-Wide
Irish Rail	MAY-MDC-LVP-DART-SP-E-0001	SET Electricity Functional Specifications System-Wide for LV Power

4 Constraints

This section describes the constraints that are relevant to this package of work.

4.1 Technical

The technical constraints are described in the following sub-sections.

4.1.1 Permanent Way and Track

No constraints have been identified. The area uses standard track units.

4.1.2 Geotechnical

Limited ground investigation is available for the site. One historic GI has been completed within the station and does not appear to indicate the presence of onerous ground conditions. However, it is worth noting the notable depth of made ground identified between the Belfast Line and the Howth Branch and the risk of soft ground related to a potential alluvium channel running west to east through the station.

Furthermore, there is the risk of contamination due to the presence of made ground and with respect to the historic and industrial use of the site as a railway. As such, material excavated during the works may not be suitable for reuse on site and may require disposal or recovery to a suitably licenced facility.

Due to the limited information on stratigraphy, groundwater and geo-environmental from existing ground investigations, a site-specific ground investigation is a prerequisite at the location of the proposed works to investigate the stratigraphy present.

4.1.3 Structures

This area currently accommodates a two-track railway along both the mainline and the Howth branch. Any reconfiguration of the horizontal track alignment or introduction of new platform may require alternation to the structures in the area as described in Table 4-1.

Table 4-1: Structure constraints along the site

Name	ID	Function	Constraint
17 Killbarrack Rd / Public Road R104	UBB17	Underbridge	Any alteration to the tracks at this location may require a modification to the bridge, should additional width be required here.

Name	ID	Function	Constraint
Howth Junction & Donaghmede Station – mainline footbridge	UBB17A	Overbridge	The bridge spans the tracks, with piers located on the platforms. The position of the piers form a constraint to any significant modification of the track or platforms through the station.
UB17F-H2JDA	UBB17F	Culvert	It is anticipated that any significant modifications to the horizontal alignment or number of tracks will require modification to this culvert.
Howth Junction & Donaghmede Station – Branch footbridge	OBQ0	Overbridge	The bridge spans the tracks, with piers located on the platforms. The position of the piers form a constraint to any significant modification of the track or platforms through the station.
Culvert	UBQ0A	Culvert	It is anticipated that any significant modifications to the horizontal alignment or number of tracks will require modification to this culvert.
Culvert	UBQ0B	Culvert	It is anticipated that any significant modifications to the horizontal alignment or number of tracks will require modification to this culvert.

4.1.4 Utilities

Utility locations are a consideration when designing and implementing new railway infrastructure (whether at a station or elsewhere along the railway line), as this usually requires all the existing utilities in that location to be diverted – either temporarily or permanently. Underground services can impact on the placement of OHLE masts, as they must be placed on either side of the utilities and may not be placed on top of them. Above ground utilities that cross the railway line overhead can impact on the minimum clearance required by the OHLE.

As outlined in section 2.7, there are several utilities traversing and alongside the existing rail corridor, within the study area for the works at Howth Junction & Donaghmede Station. Most services are located within the existing street network surrounding the railway. Underground utilities present are medium and low voltage electrical cables, low pressure gasmains, telecommunications, watermains, wastewater sewers and surface water drainage networks. There is also an existing telecommunications mast and other infrastructure located in the area between platforms 2 and 3.

There are lineside telecommunications running parallel to the railway in this area, including possible data cables/fibre running parallel to the mainline railway, and are indicated as crossing the railway into the area between platforms 2 and 3. There is an existing 1350mm diameter surface water sewer running under the station. This goes from St Donagh's Road to the west of the station through to Kilbarrack Way to the east. There is an MV Electrical connection to the station building from St Donagh's Road. There is an LV Electrical cable running under the Howth Branch Railway from Kilbarrack Way to the existing equipment located between platforms 2 and 3. There is an existing telecommunications mast located in the area between platforms 2 and 3 that hosts equipment for the Vodafone, Three and Eir networks

Options that involve adding an additional platform to the north of platform 2 could cause disruption to the existing stormwater pipe running under the station and would likely cause significant impact to the electrical and telecommunications equipment located in the area between platforms 2 and 3. It will be necessary to liaise with the relevant utility companies prior to construction to ensure that existing services are protected during construction, and that any diversions or outages are minimised.

The existing utilities in the vicinity of Howth Junction & Donaghmede Station are shown in Figure 4-1 below.

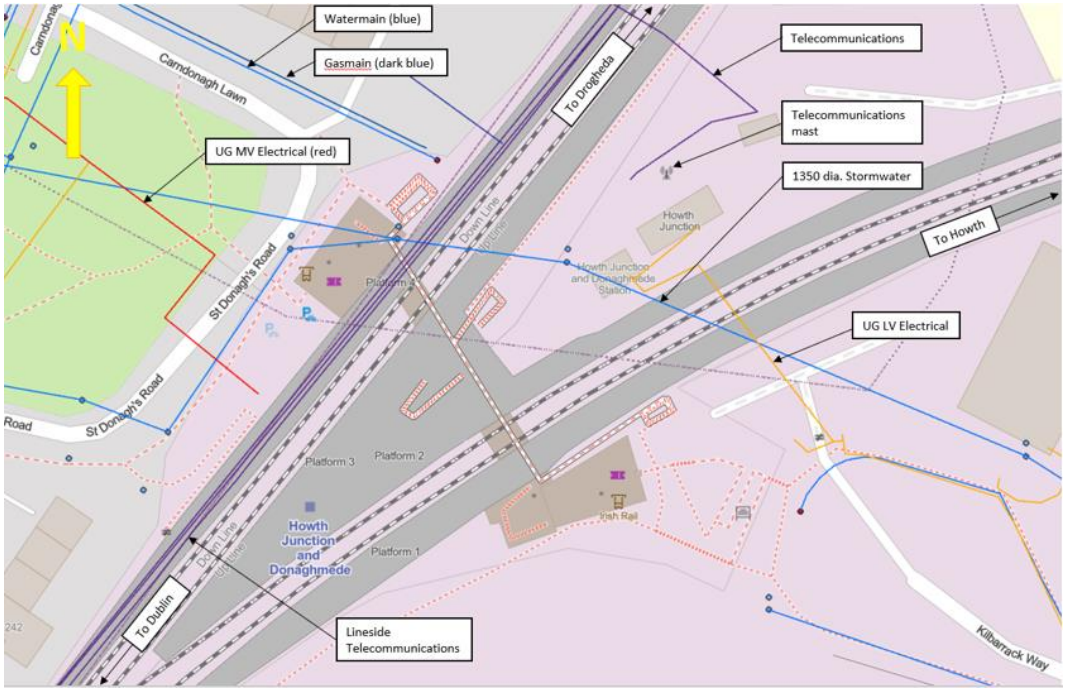

Figure 4-1: Existing Utilities at Howth Junction & Donaghmede Station

4.1.5 Other Railway Facilities

Signalling

The current signalling SSI interlocking is constrained to be only able to take 63 Trackside Functional Modules. This might be an insufficient number depending on the outcome of the chosen solution.

There will be a number of additional signals and point machines to be controlled. Additional signalling trackside locations will be needed to connect these signals, axle counter blocks and point machines to the interlocking via the Howth Junction & Donaghmede SEB.

The TSS is constrained by the 3-aspect unidirectional Signalling.

The current Train Protection System CAWS/ATP is obsolete and is difficult to source. The existing TPS will be replaced with a new TPS based on the preferred solution identified by IÉ.

Telecoms

The main Telecoms constraint is that the Telecoms Operational network is constrained to the low number of available fibres. Currently IÉ only has 12 fibres along the Coastal Line.

Telecoms is limited by the amount of space available in the TER (Telecoms Equipment Room). At this stage it is not envisaged that a new TER is required as new equipment can be accommodated within the existing building. This will be confirmed at the next design stage.

OHLE

The OHLE is constrained to the available capacity from the substation. Where this needs to be increased due to the additional trains, changes to the feeder configuration may introduce minor changes to the wire arrangement on the masts. Mast pole placements need to take utilities into account and be placed in such a way to allow access to the utility infrastructure in the future.

4.1.6 Roads

Access to the site will be provided via Howth Junction & Donaghmede Station. A number of car parking areas and pedestrian facilities associated with the existing station need to be considered and accommodated by the proposed scheme's construction and operation. Access to the railway station by all modes of transport (including cycle lane) need to be maintained safely throughout the construction period and during operation.

The low speed and low traffic character of the surrounding streets will also need to be considered in the context of construction traffic.

4.2 Environmental

For an overview of the existing environmental constraints for DART+ Coastal North refer to Annex 3.1 Constraints Report.

Section 2.6 above describes the baseline environment for the various options being considered under this study pack. Building on this information, the key constraints associated with the options being considered, under the various environmental criteria, are summarised below.

Archaeological and cultural heritage

The are no recorded monuments or features of a cultural heritage interest in proximity to the proposed works and it is likely that disturbance from recent development and works within the railway lands have reduced the archaeological potential. As such no constraints have been identified from an archaeological or cultural heritage perspective.

Noise and Vibration

Constraints for the site will largely be during the construction phase, when noise and vibration levels will be higher than during the operational phase.

Noise and vibration levels at the surrounding sensitive receptors will have to be limited, which may change proposed construction techniques and mean that noise barriers will have to be built around the construction site.

Although noise and vibration levels at surrounding sensitive receptors will be less during the operational phase than the construction phase, they must still be limited. Additional points and crossings will increase the noise and vibration levels, as will increased speed and frequency of trains. These increases will, however, be offset by electrification of the rail line, which will decrease noise levels to surrounding sensitive receptors.

Air quality and climate

The main air quality constraint to development relates to the proximity of sensitive receptors (dwellings, amenity areas, ecological sensitive sites, etc.) to the works during construction. The Verbena housing estate is located to the south of the railway line. No sensitive receptors are located on the northern side - only commercial developments.

Mitigation measures will be required during the construction phase to minimise dust impacts at sensitive locations.

In general, the modernisation and improvement of rail services will expand train capacity, thereby increasing the attractiveness of rail travel. This will reduce reliance on private car travel and contribute to reductions in carbon emissions.

Landscape and visual impact

The key landscape and visual constraints are:

- Residential communities / properties to east and south of rail lines;

- Some existing trees / plantings within and along the corridor of the rail lines;
- Former signalman's house at Kilbarrick Road (Protected Structure No.0788);
- Conservation area at St. Donagh's / Holywell west of rail lines; and

  Adjoining institutional, warehousing, industrial areas.

Architectural Heritage

There are no protected structures, buildings or features included in the National Inventory of Architectural Heritage (NIAH) Building Survey. The area is not included in an Architectural Conservation Area or a Conservation Area.

The lands on which Howth Junction & Donaghmede Station is built, were part of a designed landscape associated with Donaghmede House. The landscape is included in the NIAH Garden Survey. Donaghmede House was demolished in the mid-twentieth century. Its landscape has been built upon in recent times. While it remains of some architectural and social interest, due to the condition of the site, the interest is Record-Only.

The railway line is included in the Dublin City Industrial Heritage Record (DCIHR) and is of industrial heritage interest. Historic masonry walls and embankments, such as the walls to the west of the station at Carndonagh Lawns, contribute to the industrial heritage value of the site.

There are the remains of the station master's house, to the south of the station, on the east side of the tracks. The building is in poor condition but retains features of interest including a decorative brick gable onto Kilbarrack Road. Despite its current condition, it is of regional importance for reasons of architectural, artistic and social interest.

Agricultural

Howth Junction & Donaghmede Station is entirely surrounded by urban development, there is no agricultural land and therefore no agricultural constraints.

Non-Agricultural/Population assessment

Given the distance from residential properties, construction impacts are not likely to be impact on the built environment and relate mainly to Noise or Lighting for which it would be necessary to refer to these assessments.

Where options require passengers to cross platforms, people with disabilities will need to be catered for with appropriate facilities.

Geology and Soils

Based on the historic and industrial use of the site as a railway, there are likely to be some sources of contamination within the made ground throughout the study area.

There are no Geological Heritage Areas identified in the study area around the station.

Water resources

The constraints to the development in terms of water resources include the Mayne Estuary and North Bull Island transitional water bodies and the protected Baldoyle Bay SAC/SPA/pNHA and North Dublin Bay SAC. There are no watercourses downgradient of the site and therefore the Santry_020 is not considered likely to be impacted by any proposed development. The underlying Poor and Locally Important aquifers are also considered to be constraints. The constraints identified may be impacted by changes to the hydrogeological and hydrological regime or as a result of changes in water quality.

Biodiversity

There are no significant ecological constraints in this area. The areas which would be affected by works are either existing track and other railway infrastructure, buildings and built ground, or small amounts of vegetation (most likely shrubs and/or scrub with little or no trees or mature vegetation).

The closest designated sites are North Dublin Bay SAC, North Bull Island SPA and North Dublin Bay pNHA which are approximately 1km to the south as indicated in the subsequent maps.

Figure 4-2: Location of SACs close to Howth Junction & Donaghmede Station

Figure 4-3: Location of SPAs close to Howth Junction & Donaghmede Station

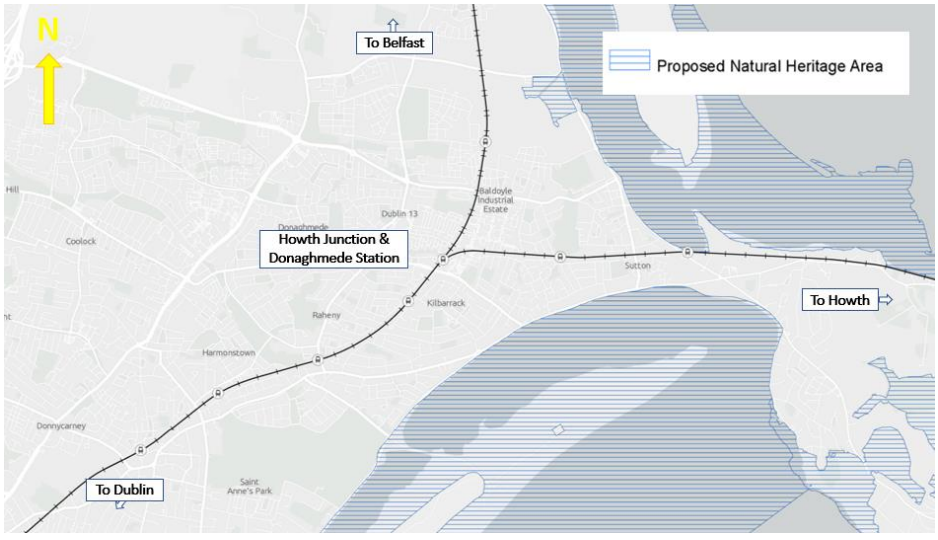

Figure 4-4: Location of pNHAs close to Howth Junction & Donaghmede Station

Other potential ecological constraints include:

- Potential for roosting bats in the two flat roofed buildings, although this is deemed very unlikely given their modern construction;
- Vegetation (scrub, hedgerows or treelines) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals);
- Potential for the railway to support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature,
- Potential for invasive species to occur along the railway line.

4.3 Planning

Howth Junction & Donaghmede Station is located partly within Dublin City Council and partly within Fingal County Council.

The Dublin City Development Plan (2016-2022) sets out policies and objectives to guide how and where development will take place in the city over the lifetime of the Plan.

The Development Plan contains a number of principles to guide the future development of the city, including "Movement":

"Helping to build an integrated transport network and encouraging the provision of greater choice of public transport active travel."

The following policies and objectives are relevant:

"MTO1: To encourage intensification and mixed-use development along existing and planned public transport corridors and at transport nodes where sufficient public transport capacity and accessibility exists to meet the sustainable transport requirements of the development, having regard to conservation policies set out elsewhere in this plan and the need to make best use of urban land. Dublin City Council will seek to prepare SDZs, LAPs or other plans for areas surrounding key transport nodes, where appropriate, in order to guide future sustainable development."

MT3: To support and facilitate the development of an integrated public transport network with efficient interchange between transport modes, serving the existing and future needs of the city in association with relevant transport providers, agencies and stakeholders.

MT4: To promote and facilitate the provision of Metro, all heavy elements of the DART Expansion Programme including DART Underground (rail interconnector), the electrification of existing lines, the expansion of Luas, and improvements to the bus network in order to achieve strategic transport objectives.

MT6: (i) To work with Iarnród Eireann, the NTA, Transport Infrastructure Ireland (TII) and other operators to progress a coordinated approach to improving the rail

network, integrated with other public transport modes to ensure maximum public benefit and promoting sustainable transport and improved connectivity.

MTO5: (i) To facilitate and support measures proposed by transport agencies to enhance capacity on existing public transport lines and services, to provide/ improve interchange facilities and provide new infrastructure."

Howth Junction & Donaghmede Station is located adjoining lands zoned residential. There is also an area of land zoned Open Space, north of the Kilbarrack Road. This is also a designated Conservation Area.

The DART + Coastal Project aligns with the policies and objectives of the Dublin City Council Development Plan. It is considered that the adjoining zoning and conservation designation will not act as a constraint.

The area east of the railway line and station is location with the located within the function area of Fingal County Council. The Fingal Development Plan 2017-2023 sets out the Council's proposed policies and objectives for the development of the County over the Plan period.

The Strategic Vision intends to deliver on the Main Aims of the Plan by, inter alia:

"Seek the development of a high-quality public transport system throughout the County and linking to adjoining counties, including the development of the indicative route for New Metro North and Light Rail Corridor, improvements to railway infrastructure including the DART Expansion Programme, Quality Bus Corridors (QBCs) and Bus Rapid Transit (BRT) systems, together with enhanced facilities for walking and cycling."

The following objectives in relation to transportation are also relevant:

"Objective MT01

Support National and Regional transport policies as they apply to Fingal. In particular, the Council supports the Government's commitment to the proposed new Metro North and DART expansion included in Building on Recovery: Infrastructure and Capital Investment 2016-2021. The Council also supports the implementation of sustainable transport solutions.

Objective MT30

Support Iarnród Éireann and the National Transport Authority (NTA) in implementing the DART Expansion Programme, including the extension of the DART line to Balbriggan, the design and planning for the expansion of DART services to Maynooth, and the redesign of the DART Underground."

The lands adjoining the station of railway line are zoned GE - General Employment.

There are no policies, objectives or designated areas that would be directly impacted by The DART + Coastal Project at Howth Junction & Donaghmede Station.

5 Options

The following section runs through the optioneering process from the longlist of options to the selection of the emerging preferred option. The option selection process is described in the Preliminary Option Selection Report.

5.1 Longlist of options

This section describes the options which have been considered at Howth Junction and Donaghmede. The discussion is limited to items which will have a bearing on the development or selection of an option. A more detailed technical description of the works is included for the shortlisted options. It should be noted that, for track modifications that are essential to facilitate the increase in train services (i.e. the subject of this report), no 'Do-Minimum' option exists as some intervention is required in order to meet the project objectives and requirements.

The options which have been considered are summarised in Table 5-1.

Table 5-1: Longlist of options considered

Option	Description
Option 0	Do-Nothing
Option 1	Platform 1 via new crossover on straight
Option 2	Platform 1 via new crossover on curve
Option 3	Platform 2 using crossover and platform 1 trap
Option 4	Stopping up of Platform 2
Option 5	Signalling overlap on Platform 2
Option 6	New platform behind to Platform 2 on a curve
Option 7	New platform behind to Platform 2 on a straight alignment
Option 7a	New platform behind to Platform 2 with reduced curve alignment
Option 8	Option 5 but only using half-length units (HLU) in majority of services of services on branch

All of the options identified can be supported by revisions to the existing signalling and OHLE equipment to provide safe and efficient use of the new track layout. Solutions to each will be fundamentally similar in terms of the extent of additional equipment to be installed and the type of equipment to be utilised. Signalling will be designed to ensure that speeds are controlled according to the design of the track and turnouts.

5.1.1 Option 0 - Do Nothing Option

The 'Do-Nothing' represents a scenario where infrastructure works and interventions to meet the Project Objectives and Requirements are absent. For this option there will be no change to the current layout and terminating trains will use Platform 2 as the only viable platform to turn back.

On approach to the platform, signalling arrangements will result in red aspects being shown on the mainline.

5.1.2 Option 1 – Platform 1 via new crossover on straight

Figure 5-1: Aerial view of Option 1 (green indicates existing track and red indicates new track)

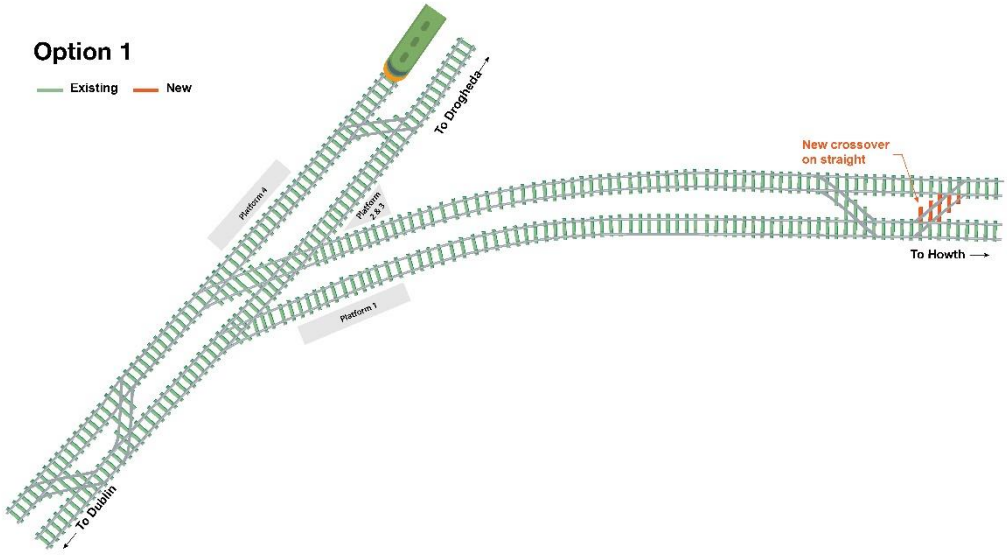

Figure 5-2: Schematic view of Option 1

In Option 1, a new crossover from Up Howth to the Down Line is introduced to allow terminating trains to use Platform 1 on the straight section of track. The terminating trains on Platform 1 are set to the trap points which removes any interface with the mainline signalling. The location of the crossover on the straight allows for standard components to be used but has an impact on operations with its increased distance from the station with the distance of wrong road running required. If operational requirements are more important, then the location of the crossover could be brought closer to the station at the expense of requiring bespoke components and the associated impact to maintenance times.

Platform 2 remains an option for terminating trains, if required. However, it is worth noting that on approach to the platform, signalling arrangements will result in red aspects being shown on the mainline.

5.1.3 Option 2 - Platform 1 via new crossover on curve

Figure 5-3: Aerial view of Option 2 (green indicates existing track and red indicates new track)

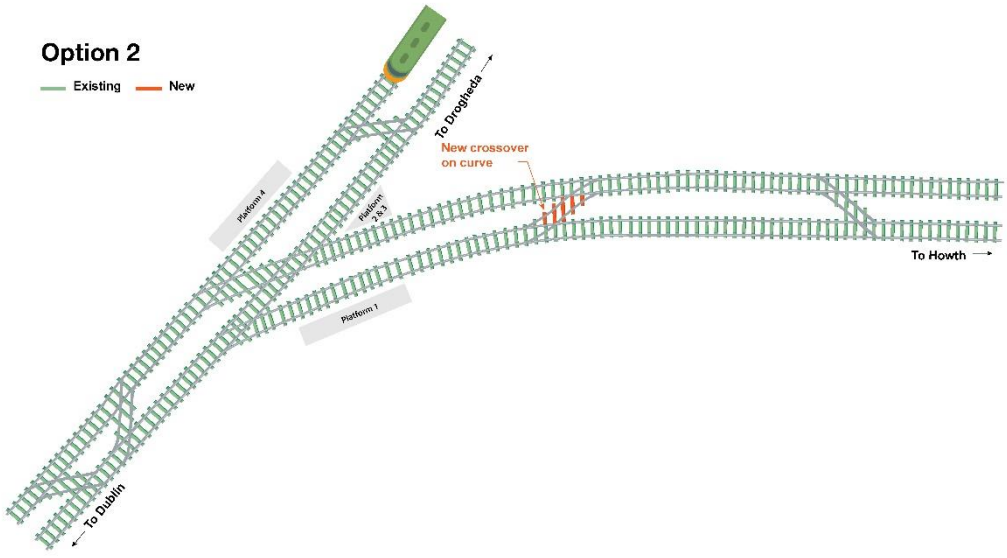

Figure 5-4: Schematic view of Option 2

Like Option 1, this option introduces a new crossover from Up Howth to the Down Line to allow terminating trains to use Platform 1. Option 2, however, has the crossover located on the curve. The crossover on the curve would require bespoke components, however, being closer to the station is better for operations The

terminating trains on Platform 1 are set to the trap points which removes any interface with the mainline signalling.

Platform 2 remains an option for terminating trains, if required. However, it is worth noting that on approach to the platform, signalling arrangements will result in red aspects being shown on the mainline.

5.1.4 Option 3 - Platform 2 using new crossover and platform 1 trap

Figure 5-5: Aerial view of Option 3 (green indicates existing track and red indicates new track)

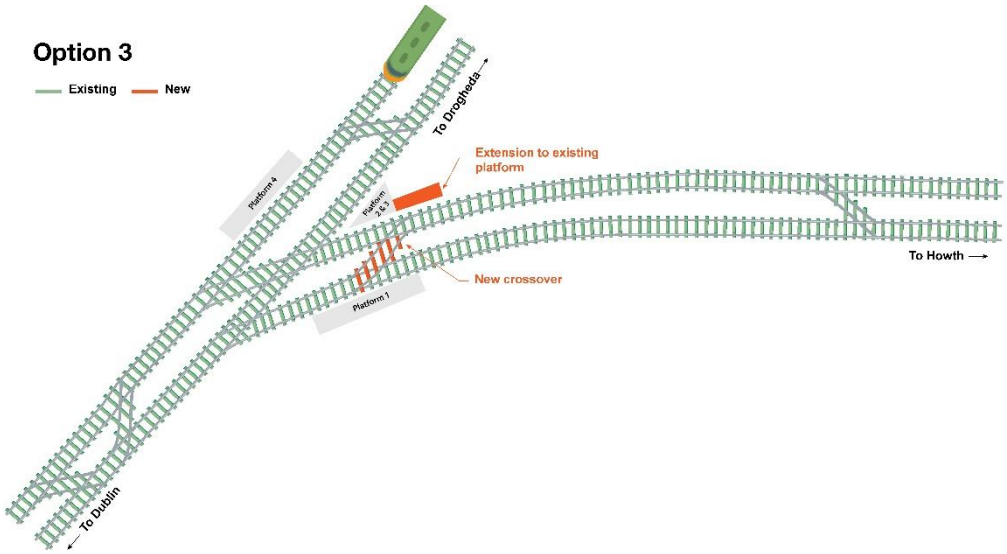

Figure 5-6: Schematic view of Option 3

In Option 3, a new crossover from the Up Howth to the Down Line is introduced to allow terminating trains to use the trap on Platform 1 on the straight section of

track. The terminating trains are set to the trap points which removes any interface with the mainline signalling.

This option requires a platform extension to the east to offset the required stopping position in advance of the crossover.

5.1.5 Option 4 – Stopping up of Platform 2

Figure 5-7: Aerial view of Option 4 (green indicates existing track and red indicates new track)

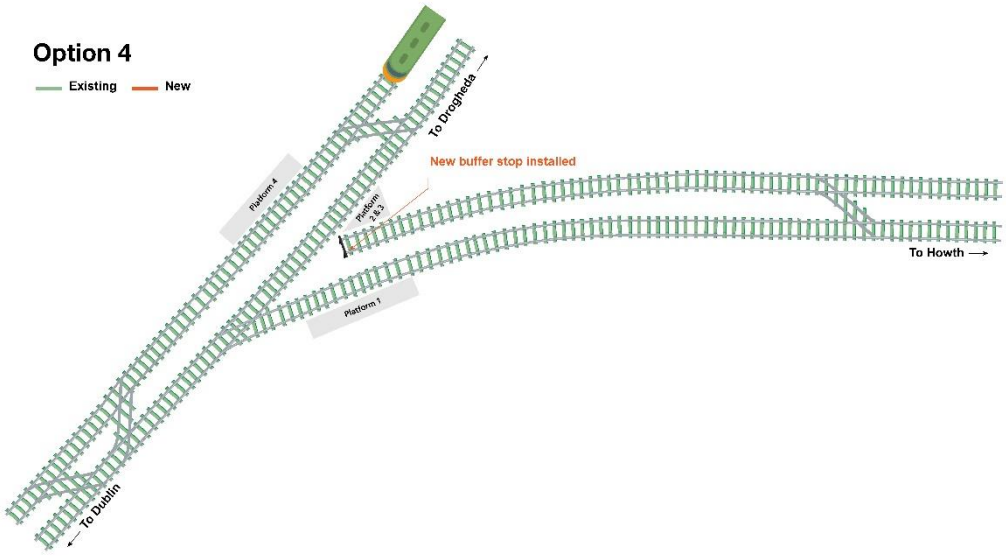

Figure 5-8: Schematic view of Option 4

In Option 4 trains stop at Platform 2 with buffers at the western end. This option may involve a minor platform extension to the east.

5.1.6 Option 5 – Signalling Overlap on Platform 2

Figure 5-9: Aerial view of Option 5 (green indicates existing track and red indicates new track)

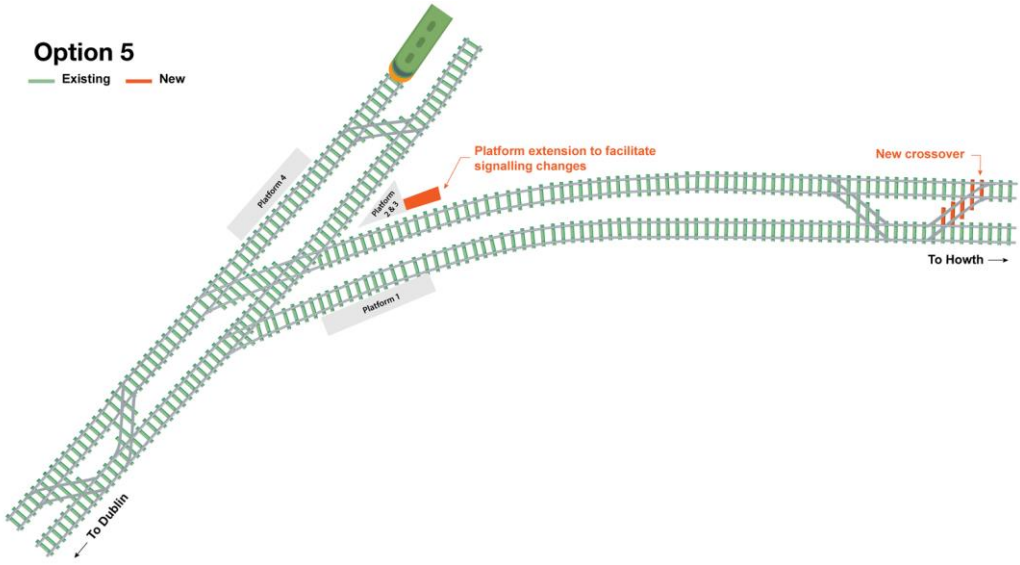

Figure 5-10: Schematic view of Option 5

Option 5 involves the installation of new signalling to allow circa 90m of overrun protection between itself and the mainline. It requires a platform extension to the east to offset the required stopping position in advance of the signal. A new facing crossover shall be provided.

5.1.7 Option 6 – New Platform behind to Platform 2 on a curve

Figure 5-11: Aerial view of Option 6 (green indicates existing track and red indicates new track)

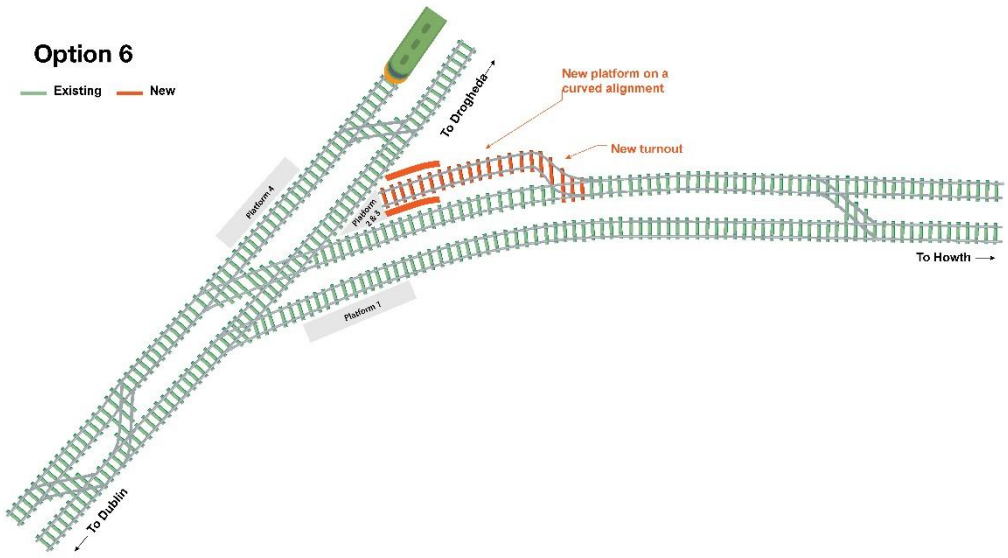

Figure 5-12: Schematic view of Option 6

In Option 6 a new platform is constructed behind the existing Platform 2 on a similar alignment for terminating services. Note the new platform is constructed on a curve. Due to the location of the existing SEB and adjacent technical rooms, this new platform will have some impact if not of the structures themselves, then on the cable routes associated with the buildings.

5.1.8 Option 7 – New Platform behind to Platform 2 on a straight alignment

Figure 5-13: Aerial view of Option 7 (green indicates existing track and red indicates new track)

Figure 5-14: Schematic view of Option 7

In Option 7 a new platform is constructed behind the existing Platform 2 on a similar alignment for terminating services. Note that the new platform is constructed on the straight. Due to the location of the existing SEB and adjacent technical rooms, this new platform will have some impact if not of the structures themselves, then on the cable routes associated with the buildings.

5.1.9 Option 7a – Combination of Option 6 & 7

Figure 5-15: Aerial view of Option 7a (blue indicates existing track and red indicates new track)

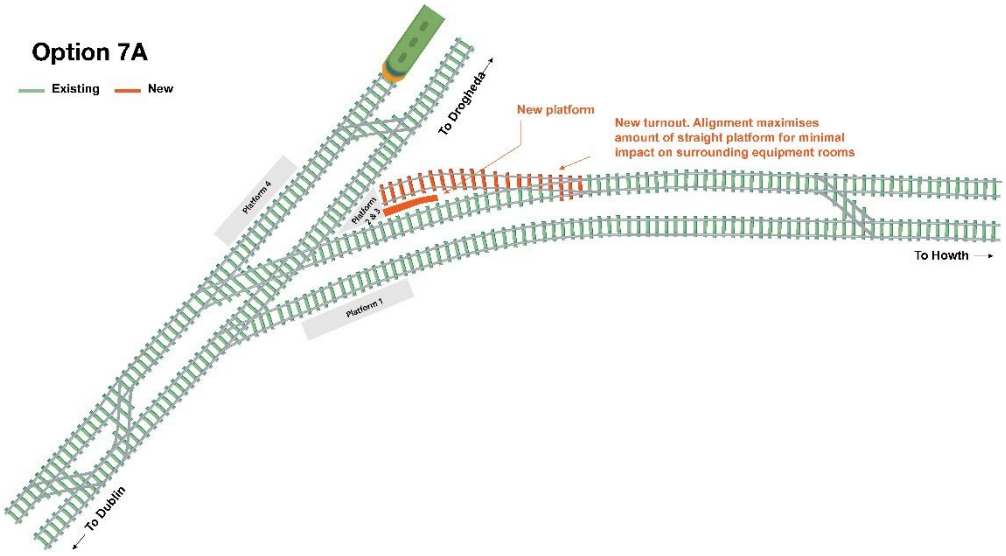

Figure 5-16: Schematic view of Option 7a

Due to the location of the existing SEB and adjacent technical rooms, this new platform will have some impact if not of the structures themselves, then on the cable routes associated with the buildings. This option combines Option 6 and 7 to maximise the amount of straight platform but minimise the impact on the surrounding equipment rooms.

5.1.10 Option 8 – Option 5 but only using HLU in majority of services on branch

Option 8 involves the installation of new signalling to allow circa 90m of overrun protection between itself and the mainline.

This option differs from Option 5 by only using Half Length Units (HLUs) on the branch. Full Length Units (FLUs) can be used on occasion, but this will introduce signalling interfaces with the mainline.

5.2 Sifting of Longlist of Options

This sifting process considers the project objectives and project requirements. Each option presented in section 5.1 will be assessed on its ability to meet the project objectives and requirements

The results of this screening process are presented in Table 5-2: and Table 5-3: .

Table 5-2: Assessment of long list of options against project objectives and requirements (Options 0 to 4)

Project objectives and requirements	Description	Option 0 - Do Nothing		Option 1 – Platform 1 via new crossover on straight		Option 2 - Platform 1 via new crossover on curve		Option 3 - Platform 2 using new crossover and platform 1 trap		Option 4 – Stopping up of Platform 2	
		Pass/ fail	Rationale	Pass/ Fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable an increased DART service frequency between Drogheda and Central Dublin.	**Fail**	• Utilisation of Platform 2 only (ability to meet 6TPH with only single platform) • On approach to the platform, signalling arrangements will result in red aspects being shown on the mainline • This constraint will make the TSS unachievable especially in times of perturbation	**Pass**	• Option of using both platforms, however Platform 2 will occur some disruptions – detailed assessment is required to check performance issues.	**Pass**	• Option of using both platforms, however Platform 2 will occur some disruptions – detailed assessment is required to check performance issues • Note there is a slight operational improvement from Option 1	**Pass**	• Utilising Platform 2 only- • No ability to use both platforms at the same time (restricted use).	**Pass**	• Utilising Platform 2 only- • No ability to use both platforms at the same time (restricted use).
Project objective	To deliver solutions which improve the passenger experience where passenger infrastructure interventions are required to meet the Train Service Specification.	**Pass**	• No requirement to cross the bridge during the morning peak hours to catch connecting train	**Pass**	• Negative passenger experience as passengers continue to cross the bridge for the majority of the time for connecting trains • Note no options allow any significant improvements	**Pass**	• Negative passenger experience as passengers continue to cross the bridge for the majority of the time for connecting trains • Note no options allow any significant improvements	**Pass**	• No requirement to cross the bridge in morning peak times to catch connecting trains • Note no options allow any significant improvements	**Pass**	• No requirement to cross the bridge in morning peak times to catch connecting trains • Note no options allow any significant improvements

Project objectives and requirements	Description	Option 0 - Do Nothing		Option 1 – Platform 1 via new crossover on straight		Option 2 - Platform 1 via new crossover on curve		Option 3 - Platform 2 using new crossover and platform 1 trap		Option 4 – Stopping up of Platform 2	
		Pass/ fail	Rationale	Pass/ Fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	**Pass**	• No works	**Pass**	• Making use of the existing infrastructure	**Pass**	• Making use of the existing infrastructure	**Pass**	• Largely making use of the existing infrastructure but new infrastructure through platform extension	**Pass**	• Making use of the existing infrastructure
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	**Pass**	• No cost	**Pass**	• Use of standard P&C units	**Pass**	• On a curve therefore non-standard. • Cost of spares will be significantly higher than standard units	**Pass**	• Additional platform extension cost • Additional signalling cost	**Pass**	• Maintenance costs reduced due to the removal of main-line infrastructure
Project objective	To minimise adverse impacts on the natural and built environment associated with construction, operation and maintenance of the project	**Pass**	• No works	**Pass**	• Minimal works	**Pass**	• Minimal works	**Pass**	• Minimal track works • Minimal impact from platform extension	**Pass**	• Minimal works

Project objectives and requirements	Description	Option 0 - Do Nothing		Option 1 – Platform 1 via new crossover on straight		Option 2 - Platform 1 via new crossover on curve		Option 3 - Platform 2 using new crossover and platform 1 trap		Option 4 – Stopping up of Platform 2	
		Pass/ fail	Rationale	Pass/ Fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To minimise adverse impacts on existing rail services, road users and landowners associated with the construction, operation and maintenance of the project.	**Pass**	• No works	**Pass**	• Minimal impacts • Works can mainly be planned around short blockades	**Pass**	• Minimal impacts • Works can mainly be planned around short blockades	**Pass**	• Minimal impacts • New platform construction will impact (more than Options 1 and 2)	**Pass**	• Minimal impacts • Works can mainly be planned around short blockades
Project objective	To provide efficient and cost-effective integration of systems with the other DART+ projects.	**Pass**	• No new systems required	**Pass**	• No integration issues identified at this stage	**Pass**	• No integration issues identified at this stage	**Pass**	• No integration issues identified at this stage	**Pass**	• No integration issues identified at this stage
Project requirement	To design in accordance with IÉ Standards and relevant national and EU standards and guidelines.	**Pass**	• Compliant • Note use of existing curved platform	**Pass**	• Compliant • Note use of existing curved platform	**Pass**	• P&C compliant but is not preferred	**Fail**	• Introduction of a new curved platform extension: requirement to design new platforms straight unless there is no alternative. Further discussion with IÉ needed to confirm acceptance • Failed on the basis this has disadvantages when compared to option 5 and no benefits when compared to Option 5	**Pass**	• Compliant

Project objectives and requirements	Description	Option 0 - Do Nothing		Option 1 – Platform 1 via new crossover on straight		Option 2 - Platform 1 via new crossover on curve		Option 3 - Platform 2 using new crossover and platform 1 trap		Option 4 – Stopping up of Platform 2	
		Pass/ fail	Rationale	Pass/ Fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project requirement	Designs shall comply with the Minimum Employer's Functional Requirements and meet the Train Service Specification	**Pass**	• Compliant • Note use of existing curved platform	**Pass**	• Compliant • Note use of existing curved platform	**Pass**	• P&C compliant but is not preferred	**Fail**	• Introduction of a new curved platform extension: requirement to design new platforms straight unless there is no alternative. Further discussion with IÉ needed to confirm acceptance • Failed on the basis this has disadvantages when compared to option 5 and no benefits when compared to Option 5	**Pass**	• Compliant
Project requirement	Provision of new turnback infrastructure at Howth Junction which will meet the Train Service Specification.	**Fail**	• Utilisation of Platform 2 only • On approach to the platform, signalling arrangements will result in red aspects being shown on the mainline • This constraint will make the TSS unachievable especially in times of perturbation	**Pass**	• Option of using both platforms, however Platform 2 will occur some disruptions – detailed assessment is required to check performance issues.	**Pass**	• Option of using both platforms, however Platform 2 will occur some disruptions – detailed assessment is required to check performance issues.	**Pass**	• Utilising Platform 2 only- No ability to use both platforms at the same time (restricted use).	**Pass**	• Utilising Platform 2 only- • No ability to use both platforms at the same time (restricted use).
Project requirement	Maintain provision for through running from Connolly to the Howth Branch Lines.	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines	**Fail**	• Option of Through Running from the Northern Line to the Howth Branch Lines is NOT maintained on both lines.

Table 5-3: Assessment of long list of options against project objectives and requirements (Options 5 to 8)

Project objectives and requirements	Description	Option 5 – Signalling Overlap on Platform 2		Option 6 – New Platform behind to Platform 2 on a curve		Option 7 – New Platform behind to Platform 2 on a straight alignment		Option 7a – New platform behind to Platform 2 which maximises the amount of straight platform but minimise the impact on the surrounding equipment rooms.		Option 8 – Option 5 but only using HLU in majority of services on branch	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To deliver a higher frequency, higher capacity, reliable, electrified route to enable increased DART service frequency between Drogheda and Central Dublin.	**Pass**	• Provides the option of using 2 platforms to carry out the service: Platform 1 and Platform 2	**Pass**	• Provides the option of using 2 platforms to carry out the service: Platform 2 and a new platform	**Pass**	• Provides the option of using 2 platforms to carry out the service: Platform 2 and a new platform	**Pass**	• Provides the option of using 2 platforms to carry out the service: Platform 2 and a new platform	**Fail**	• TSS note the use of FLU car trains. • Requirement to use FLUs on Howth branch provided by IÉ at workshop on 12/05/21
Project objective	To deliver solutions which improve the passenger experience where passenger infrastructure interventions are required to meet the Train Service Specification.	**Pass**	• No requirement to cross the bridge in morning peak times to catch connecting trains • Note no options allow any significant improvements	**Pass**	• No requirement to cross the bridge in morning peak times to catch connecting trains • Note no options allow any significant improvements	**Pass**	• No requirement to cross the bridge in morning peak times to catch connecting trains • Note no options allow any significant improvements	**Pass**	• No requirement to cross the bridge in morning peak times to catch connecting trains • Note no options allow any significant improvements	**Pass**	• No requirement to cross the bridge during the morning peak hours to catch connecting train • Note no options allow any significant improvements
Project objective	To deliver a sustainable, low carbon and climate resilient design solution including making use of existing infrastructure where possible with targeted improvement works.	**Pass**	• Increased new infrastructure (platform extension) • Redundant infrastructure: no use of Platform 1	**Pass**	• New platform to be constructed.	**Pass**	• New platform to be constructed.	**Pass**	• New platform to be constructed.	**Pass**	• Minimal works

Project objectives and requirements	Description	Option 5 – Signalling Overlap on Platform 2		Option 6 – New Platform behind to Platform 2 on a curve		Option 7 – New Platform behind to Platform 2 on a straight alignment		Option 7a – New platform behind to Platform 2 which maximises the amount of straight platform but minimise the impact on the surrounding equipment rooms.		Option 8 – Option 5 but only using HLU in majority of services on branch	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project objective	To identify cost-effective solutions from a capital, operations, and maintenance perspective.	**Pass**	• Additional platform extension cost • Use of standard P&C units	**Pass**	• Significant infrastructure • Modification of signalling rooms	**Pass**	• Significant infrastructure • Significant modification of signalling & telecoms rooms/equipment	**Pass**	• Significant infrastructure • Reduced modification of signalling and telecoms rooms/equipment – compared to Option 7	**Pass**	• Complexity to diagram and combo of HLU and FLU car on the service would add cost and complexity to the running
Project objective	To minimise adverse impacts on the natural and built environment associated with construction, operation and maintenance of the project	**Pass**	• Minimal track works • New platform construction will impact the built environment	**Pass**	• Moderate construction work but impacts will not significantly affect the built environment	**Pass**	• Moderate construction work but impacts will not significantly affect the built environment. • Would impact on the access track to the station and equipment buildings	**Pass**	• Moderate construction work but impacts will not significantly affect the built environment. • Would impact on the access track to the station and equipment buildings	**Pass**	• Minimal works
Project objective	To minimise adverse impacts on existing rail services, road users and landowners associated with the construction, operation and maintenance of the project.	**Pass**	• Minimal impacts • New platform construction will have an impact	**Pass**	• Impact due to signalling rooms possession	**Pass**	• Impact due to signalling rooms possession	**Pass**	• Impact due to signalling rooms possession	**Pass**	• Minimal works
Project objective	To provide efficient and cost-effective integration of systems with the other DART+ projects.	**Pass**	• No integration issues identified at this stage	**Pass**	• No integration issues identified at this stage	**Pass**	• No integration issues identified at this stage	**Pass**	• No integration issues identified at this stage	**Pass**	• No integration issues identified at this stage

Project objectives and requirements	Description	Option 5 – Signalling Overlap on Platform 2		Option 6 – New Platform behind to Platform 2 on a curve		Option 7 – New Platform behind to Platform 2 on a straight alignment		Option 7a – New platform behind to Platform 2 which maximises the amount of straight platform but minimise the impact on the surrounding equipment rooms.		Option 8 – Option 5 but only using HLU in majority of services on branch	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project requirement	To design in accordance with IÉ Standards and relevant national and EU standards and guidelines.	**Pass**	• Introduction of a new curved platform extension: requirement to design new platforms straight. Further discussion with IÉ needed to confirm acceptance	**Fail**	• Introduction of a new curved platform extension: requirement to design new platforms straight. Further discussion with IÉ needed to confirm acceptance • Failed on the basis this has disadvantages compared to Option 7a and no benefits when compared to option 7a	**Fail**	• Failed on the basis this has disadvantages compared to Option 7a and no benefits when compared to Option 7a	**Pass**	• Introduction of a new curved platform extension: requirement to design new platforms straight. Further discussion with IÉ needed to confirm acceptance	**Pass**	• Compliant
Project requirement	Designs shall comply with the Minimum Employer's Functional Requirements and meet the Train Service Specification	**Pass**	• Introduction of a new curved platform extension: requirement to design new platforms straight. Further discussion with IÉ needed to confirm acceptance	**Fail**	• Introduction of a new curved platform extension: requirement to design new platforms straight. Further discussion with IÉ needed to confirm acceptance • Failed on the basis this has disadvantages compared to Option 7a and no benefits when compared to option 7a	**Fail**	• Failed on the basis this has disadvantages compared to Option 7a and no benefits when compared to Option 7a	**Pass**	• Introduction of a new curved platform extension: requirement to design new platforms straight. Further discussion with IÉ needed to confirm acceptance	**Pass**	• Compliant

Project objectives and requirements	Description	Option 5 – Signalling Overlap on Platform 2		Option 6 – New Platform behind to Platform 2 on a curve		Option 7 – New Platform behind to Platform 2 on a straight alignment		Option 7a – New platform behind to Platform 2 which maximises the amount of straight platform but minimise the impact on the surrounding equipment rooms.		Option 8 – Option 5 but only using HLU in majority of services on branch	
		Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale	Pass/ fail	Rationale
Project requirement	Provision of new turnback infrastructure at Howth Junction which will meet the Train Service Specification.	**Pass**	• Utilising Platform 2 only- • No ability to use both platforms at the same time (restricted use).	**Pass**	• Provides the option of using 2 platforms to carry out the service: Platform 2 and a new platform	**Pass**	• Provides the option of using 2 platforms to carry out the service: Platform 2 and a new platform	**Pass**	• Provides the option of using 2 platforms to carry out the service: Platform 2 and a new platform	**Fail**	• TSS note the use of FLU everywhere.
Project requirement	Maintain provision for through running from Connolly to the Howth Branch Lines.	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines	**Pass**	• Option of Through Running from the Northern Line to the Howth Branch Lines is maintained on both lines

5.3 Summary of Longlist Sifting

Table 5-4: Summary of Longlist Sifting

Option	Description	Screening Result	Summary
'Do-Nothing'	No interventions made to meet the Project Objectives and Requirements	**FAIL**	The constraint on operations will make the TSS unachievable especially in times of perturbation
Option 1	Platform 1 via new crossover on straight	**PASS**	Met project objectives and requirements
Option 2	Platform 1 via new crossover on curve	**PASS**	Met project objectives and requirements
Option 3	Platform 2 using new crossover and platform 1 trap	**FAIL**	Failed on the basis this has disadvantages when compared to option 5 and no benefits when compared to option 5
Option 4	Stopping up of Platform 2	**FAIL**	Fails as the option of through running from the Northern Line to the Howth Branch Lines is NOT maintained on both lines.
Option 5	Signalling Overlap on Platform 2	**PASS**	Met project objectives and requirements
Option 6	New Platform behind to Platform 2 on a curve	**FAIL**	Failed on the basis this has disadvantages compared to option 7a and no benefits
Option 7	New Platform behind to Platform 2 on a straight alignment	**FAIL**	Failed on the basis this has disadvantages compared to option 7a and no benefits
Option 7a	Install new platform behind existing platform 2 on a similar alignment for terminating services	**PASS**	Met project objectives and requirements
Option 8	Option 5 but only using HLU in majority of services on branch	**FAIL**	Fails to meet the TSS requirement to use FLU

5.4 Shortlisted Options

The following sections describe the shortlisted options in further detail.

5.4.1 Option 1 description

Refer to section 5.1.2 for an overview of the option. Detail is provided below under the following disciplines: Track, OHLE, Signalling, Telecoms and Civils/Structures. The drawing for this option can be found in Appendix B under reference D+WP56-ARP-ZZ-NL-DR-PW-SK0005.

Track

This option maintains all existing connections to the Main Lines and the spare via the existing double junction. Installation of a new standard crossover from the Up Howth to the Down Howth Branch is required after PTS 603A/B to minimise the distance for a reserve movement.

OHLE

OHLE masts and a variety of support structures will be needed to provide the revised OHLE configuration to equip the new crossover. Additional headspans or portal frames will be used to span the new crossover to support feeders, catenary and contact wires. Cantilevers from the existing masts may be used in locations where these are suitable.

This option impacts on a few existing OHLE masts on the Up and Down tracks of Howth Junction & Donaghmede Station which will need to be relocated according to the new crossover proposed. New OHLE wires for the crossover will be also required.

Signalling

There will be a small number of additional signals and point machines to be controlled. Additional signalling trackside location cases will be needed to connect these signals, balises, axle counter heads and point machines to the interlocking via the SEB.

Using Platform 2 for terminating trains, if required, is not ideal from a Signalling perspective as the Up mainline will be blocked out for the duration that the train is at Platform 2.

Telecoms

This option has no impact on Telecoms.

Civils/Structures

This option has no impact on nearby structures.

5.4.2 Option 2 description

Refer to section 5.1.3 for an overview of the option. Detail is provided below under the following disciplines: Track, OHLE, Signalling, Telecoms and

Civils/Structures. The drawing for this option can be found in Appendix B under reference D+WP56-ARP-ZZ-NL-DR-PW-SK0006.

Track

This option maintains all existing connections to the Main Lines and the spare via the existing double junction. Installation of a bespoke crossover from the Up Howth to the Down Howth Line is prior to PTS 603A/B to minimise the distance for a reserve movement.

OHLE

OHLE masts and a variety of support structures will be needed to provide the revised OHLE configuration to equip the new crossover. Additional headspans or portal frames will be used to span the new crossover to support feeders, catenary and contact wires. Cantilevers from the existing masts may be used in locations where these are suitable.

There is no drastic change or impact from an OHLE perspective when weighing up Option 1 with Option 2.

As in Option 1, this option also impacts a few existing OHLE structures on the Up and Down tracks of Howth Junction & Donaghmede Station and new OHLE wires for the new proposed crossover will be required.

Signalling

There will be a small number of additional signals and point machines to be controlled. Additional signalling trackside location cases will be needed to connect these signals, balises, axle counter heads and points machines to the interlocking via the SEB.

This option is not ideal from a signalling perspective as trains on Platform 1 will be fouling the points, removing the ability to use the crossover for the duration that trains are stationed at Platform 1.

Using Platform 2 for terminating trains, if required, is not ideal from a signalling perspective as the Up mainline will be blocked out for the duration that the train is at Platform 2.

Telecoms

This option has no impact on Telecoms.

Civils/Structures

This option has no impact on nearby structures.

5.4.3 Option 5 description

Refer to section 5.1.6 for an overview of the option. Detail is provided below under the following disciplines: Track, OHLE, Signalling, Telecoms and Civils/Structures. The drawing for this option can be found in Appendix B under reference D+WP56-ARP-ZZ-NL-DR-PW-SK0007.

Track

This option maintains all existing connections to the Main Lines and the spare via the existing double junction. It requires a platform extension to the east to offset the required stopping position in advance of the signal and a new facing crossover shall be provided.

OHLE

Option 5 has a limited impact on the OHLE**.**

This option impacts on two existing OHLE structures on the Down track of the Howth Branch, which will need to be replaced because they interfere with the proposed platform. Alternative support structures will be required along the extended platform. Modifications will be required to facilitate the new facing crossover.

Signalling

This option will require changes to the existing signalling. Signals, axle counters, ATP/CAWS and trackside location cases will need to be moved. Existing cabling will need to be replaced. Signalling scheme plans and other documentation will need to be updated. Modifications will be required to facilitate the new facing crossover.

Telecoms

Changing the platform length will require new lighting surveys to be carried out and possibly new lighting to be installed. This will also impact the existing placement of Driver Only Operation (DOO) CCTV (Closed-circuit television) which will be need to be re-assessed and altered as required.

Civils/Structures

This option may require the construction of a new retaining structure (<1m retained height) along the back of the new platform extension. Some modifications may also be required to the existing culvert UBQ0A, although at this stage details of the culvert are unknown.

The existing platform will be widened to the rear to allow passengers to access the new platform extension without compromising the circulation space for the existing platform. The platform widening should match the construction type of the existing platform where possible.

A new platform extension will be constructed. This may take the form of a traditional front wall platform which is infilled with engineering fill material or a crosswall platform with platform slabs spanning between crosswalls.

Provision of ducting through the platform will be required for lineside services, such as telecoms and signalling, as well as provision of station services ducting for lighting columns, CCTV, public address systems etc.

Drainage will be required to capture rainfall and convey this away from the platform. Fencing will also be required to the rear of the platform.

5.4.4 Option 7a description

Refer to section 5.1.9 for an overview of the option. Detail is provided below under the following disciplines: Track, OHLE, Signalling, Telecoms and Civils/Structures. The drawing for this option can be found in Appendix B under reference D+WP56-ARP-ZZ-NL-DR-PW-SK0008.

Track

Options 6 and 7 as per previous options, maintain the current layout of the existing permanent way. However, Platform 2 will be extended - both in terms of length and width - to allow for a conversion from a side platform arrangement to an island platform. A new turn back and siding will be provided to the west of Platform 2 with access gained via a single slip from the Down Howth Branch to the buffers.

OHLE

OHLE masts and a variety of support structures will be needed to provide the revised OHLE configuration to equip the new slip and siding. Additional headspans or portal frames will be used to span the new crossover to support feeders, catenary and contact wires. Cantilevers from the existing masts may be used in locations where these are suitable. Additional mast poles will need to be installed.

This option will impact in a few existing OHLE structures located on the Down Line needing to be replaced because of the installation of the new siding track and the new platform. Additionally, new OHLE structures and wires will be required for the new siding track.

Signalling

There will be a number of additional signals and point machines to be controlled. Additional signalling trackside location cases will be needed to connect these signals, balises, axle counter heads and points machine to the interlocking via the SEB.

Using the new platform for terminating trains, if required, would be ideal from a signalling perspective as it would have no impact on the running of trains on the mainline.

Telecoms

Adding a new platform will require new lighting surveys to be carried out and new lighting to be installed. A new DOO CCTV installation will also be required at the new platform. Customer Information Services will also have to be updated to reflect the change, and possibly new systems installed.

Civils/Structures

This option may require the construction of a new retaining structure along the back of the new platform. Some modifications may also be required to the existing culvert UBQ0A, although at this stage details of the culvert are unknown. Depending on the exact location and details of existing culvert UBQ0B, this may also require some modifications.

A new platform extension will be constructed. This may take the form of a traditional front wall platform which is infilled with material, or a crosswall platform with platform slabs spanning between crosswalls.

Provision of ducting through platforms for lineside services such as telecoms and signalling will be required, as well as provision of station services ducting for lighting columns, CCTV, public address systems etc.

Drainage will be required to capture rainfall and convey it away from the platform. As this will be an island platform, fire evacuation routes will need to be assessed.

5.5 Multi-criteria analysis

5.5.1 Methodology

For each shortlisted option, an assessment against the MCA criteria has been carried out. Each option has been relatively compared against each other based on the five-point colour coded ranking scale shown in Table 5-7.

5.5.2 MCA summary table

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

The scoring has been reviewed and moderated with IÉ during an optioneering workshop.

A more detailed table is provided in a separate appendix with the full detailed rationale behind the scoring of each criteria and option.

Table 5-5: MCA sub-criteria summary table

Criteria	Sub-Criteria	Option 1	Option 2	Option 5	Option 7a
		Platform 1 via new crossover on straight	Platform 1 via new crossover on curve	Signalling overlap on Platform 2	New platform behind Platform 2
Economy	CAPEX				
	OPEX				
	Train operations functionality/economic benefit				
	Traffic functionality and associated economic activities and opportunities				
Safety	Employer's Safety				
	Public safety				
Environment	Landscape and Visual Quality				
	Biodiversity				
	Noise and Vibration				
	Water resources				
	Archaeology, Architectural and Cultural Heritage				
	Geology and Soils (includes waste)				
	Agricultural and non-agricultural				
	Air Quality & Climate Change				
Accessibility & Social Inclusion	Accessibility				
	Social Inclusion				
Integration	Adaptability in the future				
	With other transport systems				
	Land Use Integration				
	Government policy integration				
	Geographical integration				
Physical Activity	Walking/cycling opportunities				

Table 5-6: Overall criteria MCA summary table

Criteria Summary	Option 1	Option 2	Option 5	Option 7a
	Platform 1 via new crossover on straight	Platform 1 via new crossover on curve	Signalling overlap on Platform 2	New platform behind Platform 2
Economy				
Safety				
Environment				
Accessibility & Social Inclusion				
Integration				
Physical Activity				

Table 5-7: Legend for MCA Summary Tables

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

5.5.3 Economy

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

CAPEX

There is no proposed impact on key existing bridge or civil structures for any of the options presented. The works in Options 1 and 2 are relatively simple. They require some possession time to install the new crossovers. Option 5 requires more construction work to be undertaken during possessions, however most of the works can be done outside of possessions. The scope of work is significantly greater for Option 7a, especially the relocation of the SEB and construction of new retaining structures.

Regarding trackwork, Option 1 involves installation of a single low speed crossover whereas Option 2 requires a bespoke crossover with longer lead times, therefore a spare will need to be kept in stores which increases the capital expenditure. Option 5 will require a new crossover. Option 7a will require a single set of points and additional plain line to be installed with buffers.

The OHLE interventions in Options 1 and 2 are comparable with a few existing OHLE masts on the Up and Down Lines being relocated to accommodate the new crossover. Two OHLE masts on the Down Line need to be replaced in Option 5 as they interfere with the proposed platform. Option 7a has the greatest comparative disadvantage as a few OHLE masts on the Down Line will need to be replaced as they clash with the new siding and new platform, and additionally new OHLE structures and wires will be required for the new siding.

From the perspective of stations, Options 1 and 2 require no change to the existing station and no new platforms are required. They therefore have a significant advantage over Option 7a which requires a new platform. Option 5 requires a shorter and narrower length of new platform compared to Option 7a however it does require a new crossover.

In conclusion, Options 1 has significant advantages over all other options with Option 2 having some comparable advantages. Options 5 have some disadvantages over options 1 and 2, however Option 7a has significant disadvantages compared to all options.

OPEX

All options would require the same level of staffing and rolling stock provision so are comparable from this perspective.

All options are considered comparable from the perspective of track maintenance and platform lighting costs. There will, however, be some variation between the options but this is not considered significant enough to be a deciding factor.

Train operations functionality/economic benefits

Options 1 and 2 are inferior to Option 7a and Option 5, since the train service will only utilise 1 platform, namely Platform 1, thus, limiting robustness and timetable recovery, or also use Platform 2, which will block the main Up Line, greatly decreasing timetable robustness, reliability and flexibility. Using Platform 2 will

result in red aspects being shown on the mainline. As such, using Platform 2 negates some of the benefit of segregating the Howth Branch operations by allowing the branch to affect the more numerous Drogheda to Dublin services.

Option 2 has some comparable advantage over Option 1 in that the crossover enabling access to Platform 1 is closer to the platform, slightly decreasing journey time on the bi-directional track, therefore slightly increasing timetable performance.

Option 5 has advantage over Options 1 and 2 as it prevents delays being imported to the more numerous Drogheda to Dublin services. It has disadvantage when compared to Option 7a as it has one less platform face for flexibility and robustness in periods of perturbed or non-standard operations (e.g., exit from service).

Option 7a has advantages over all the other options, with two platforms providing substantial redundancy that enable increased timetable robustness in periods of perturbed operations and overall increased timetable flexibility. This is accomplished whilst maintaining service segregation between the Howth Branch and the more numerous Drogheda to Dublin services.

Traffic functionality and associated economic activities and opportunities

The proposed upgrades are part of a scheme that will increase the capacity of the rail system and consequently the attractiveness for trips to be undertaken by public transport in the Greater Dublin Area. As such, it brings about positive benefits to sustainable transportation.

Options 1 and 2 will have minimal construction impact as they are mainly focussed on the use of existing infrastructure. Option 5 will require some construction work and mitigation measures as it will involve the extension of an existing platform. Option 7a will also require some construction work and mitigation measures as it will require the construction of a new platform and construction activity related to the relocation of at least some of the signalling and telecoms rooms adjacent to the existing platform 2.

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

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

5.5.4 Safety

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

Employer's Safety

All options are considered comparable from the perspective Employer's safety. There will, however, be some variation between the options but this is not considered significant enough to be a deciding factor.

Public safety

Option 7a has significant advantage over the other options as it provides significant additional platform space to accommodate additional passengers and reduce crowding. Option 5 provides less additional platform space than Option 7a and the platform is also curved which marginally increases the risk of falling. However, similar to Option 7a, it does present significant comparative advantages over Options 1 and 2 given they do not provide for any increase in the platform size.

5.5.5 Environment

Section 2.6 sets out a description of the existing environment, under key environmental criteria, whilst Section 4.2 considers the key environmental constraints associated with this study area. Below is a summary of the key findings of the MCA under the various environmental criteria, with an emphasis on differentiating aspects for the options considered.

Landscape and Visual

With proposed works located entirely or largely within the existing corridor of the rail lines there are no comparative landscape and visual differences between Options 1, 2, 5 all of which have little or limited likelihood for landscape and visual impacts. Option 7a will impact on the existing boundary with the institutional lands to north of the rail line and potentially on existing trees / plantings within / along the corridor of the rail lines. Although there are impact they are seen as to be minor and do not affect the overall scoring.

Biodiversity

There is little to differentiate the options from each other in terms of ecological constraints. No options are likely to involve impacts on designated sites or have any other significant ecological impacts. Options 1 and 2 involve minor works all within the existing railway track and will not require any vegetation removal. Options 6 and 7 involve a higher level of work including new or extended platform, new retaining structures and additional lighting. However, none of the habitats within these works areas are likely to be of any significant ecological value or represent significant constraints. Option 7 will involve the removal of existing buildings, however these appear to have extremely low potential to support bats or breeding birds and their removal is unlikely to pose a significant ecological constraint.

There are a number of potential minor ecological constraints which will be similar across all options and do not differentiate the preference between options. These include:

- Vegetation removal with potential for removal of habitat (i.e. shrub and/or scrub) which may provide foraging, nesting, and commuting corridors for fauna species (e.g. birds, bats, small mammals);
- Some level of works on the existing tracks. Railway lines can often support interesting flora species and habitats due to the calcareous nature of the ballast and their often relatively undisturbed nature. If any such habitat is present the level of impact is likely to be similar across all options and is unlikely to be a significant differentiator between options;
- It is not known whether invasive species may occur along the railway line. If present, then there would be risk of spreading these to adjacent areas. Even if it were the case that invasive species are present in this area, the level of impact is likely to be similar across all options and is unlikely to be a significant differentiator between options.

It is unlikely that any significant ecological enhancement opportunites exist for any of the options. If there are any opportunites for planting then this could be designed to be of some benefit for biodiversity (e.g. nesting/roosting opportunities for birds or bats or pollinator friendly planting). Some of the lands surrounding Howth Junction & Donaghmede Station are unmanaged scrub/rough grassland. If any of these are within Irish Rail's ownership, then consideration could be given to management and/or improvement of these lands for biodiversity.

Noise and Vibration

All options will have a minimal impact on the surrounding sensitive receptors, however Options 1 and 2 will have higher operational noise and vibration levels because of the new points and crossings.

In terms of construction noise and vibration, Options 5 and 7a will have higher noise levels than Options 1 and 2 because more work is involved in constructing these options. Noise and vibration mitigation such as noise barriers and low vibration construction plant may be necessary to mitigate noise and vibration levels to the surrounding receptors.

Water resources

There are no comparative differences between Options 1, 2 and 5 as the works associated with the new crossovers and signalling overlap are minor. There is a marginal difference between these options in comparison with Option 7a, where the construction of a new platform is proposed behind Platform 2. Construction of the platform may require excavation of foundations which may present a potential impact to groundwater flow regime as well as groundwater and surface water quality, however the difference is negligible when compared to the other options.

Archaeological, Architectural & Cultural Heritage

From an archaeological, architectural and cultural heritage perspective there are no significant comparative differences between the options.

No sites or features of an archaeological or cultural heritage interest have been identified within the lands proposed for the railway works and as such there is no significant difference between the identified options. All options are comparable.

Geology and Soils

The comparative differences across the four options relate mainly to construction-related activities and the expected interaction with the underlying geology and soils as opposed to the operational considerations where there are no discernible differences.

With respect to the potential installation of Options 1 and 2 minimal invasive works will be required in order to install the proposed cross over since on the basis the proposed crossover will be contained within the existing right of way, with track form and suitable formation design already present.

Option 5 requires a platform extension which will result in localised earthworks and the potential for handling contaminated land during construction. This may result in the potential generation of earthworks material requiring recovery or disposal on or off the site. Additionally, the proposed works also comprise the construction of a new retaining structure along the back of the new platform extension.

Option 7a requires the construction and extension of new and existing platforms which will generate significant earthworks. Therefore, there is a risk for made ground/contaminated land to require excavation, as well as land/topsoil/growing soil. Moreover, the proposed works also consist of the construction of a new retaining wall structure along the back of the new platform extension.

However, none of the excavation works are significant therefore differences between the options are negligible.

Agricultural

There are no comparative differences between the options in respect of agriculture.

Air quality and climate

As sensitive receptors are primarily positioned on the southern side of the railway line only, options where works occur on the northern side are preferable. As all options will generate a more efficient rail service, there are no comparative differences with respect to climate.

5.5.6 Accessibility and Social Inclusion

Option 7a has some comparative advantage over all the other options. For Options 1, 2 and 5 there is a greater number of passengers on the platform with no additional platform space. Passengers are also required to cross the footbridge for connecting services in the morning. This has a greater impact on mobility, e.g. people with pushchairs who have to use the lift etc. Option 5 which also has increased travel

distance between the platforms and the exit due to the increased platform length. In Option 7a, however, the majority of services can use Platform 2, avoiding the footbridge in the morning peak. Wider space on the platform allows improved flow and movement between platforms and the shorter length of platform requires shorter travel distance.

5.5.7 Integration

Integration is assessed using the five sub-criteria described below.

Adaptability in the future

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

Transport integration

There is a potential temporary impact on existing access roads to the station in Options 5 and 7a, however these are not considered significant enough to be disadvantageous when compared to Options 1 and 2.

Land use integration

In all options the proposal complies with regional and local policies to improve public transport services including DART services, encouraging modal shift and allowing for increased density of development in certain areas. The development is contained within the existing 'envelope' of the railway line. There is no impact on existing land uses.

Government policy integration

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

Geographical integration

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

5.5.8 Physical Activity

Options 5 and 7a have a potential temporary impact on existing pedestrian walkways and cycle access to the station as more construction activities are expected compared to Option 1 and 2. However the difference is not considered to be significant and so the options are comparable.

5.6 Construction Considerations

Constructability considerations for the shortlisted options at Howth Junction & Donaghmede Station are as follows:

- Option 1: Works are relatively simple, with a small amount of track possession time required. Disruptive possessions of the railway are anticipated, along with isolation of the OHLE. No highway access or disruption is envisaged.
- Option 2: Very similar in scope and construction complexity to Option 1. Disruptive possessions of the railway are anticipated, along with isolation of the OHLE. No highway access or disruption is envisaged.
- Option 5: The scope of works is greater than Options 1 and 2 but would still be relatively simple, assuming amenable construction access arrangements could be agreed with neighbouring industrial/commercial organisations. Some possession work is needed but much could be done in normal working hours. Disruptive possessions of the railway are anticipated, along with isolation of the OHLE.
- Option 7a: The scope of works, involving a new platform, is significantly greater than other options. Other requirements involve relocating some of the signalling and telecoms buildings and constructing a new retaining structure. More track possessions will be needed as a result. Disruptive possessions of the railway are anticipated, along with isolation of the OHLE. Highway disruption should be minimal, assuming amenable construction access arrangements could be agreed with neighbouring industrial/commercial organisations.

Construction access for contractors' road/rail plant could be arranged from an access point already positioned at Howth station. There would also be a local worksite compound near to the works to support the construction.

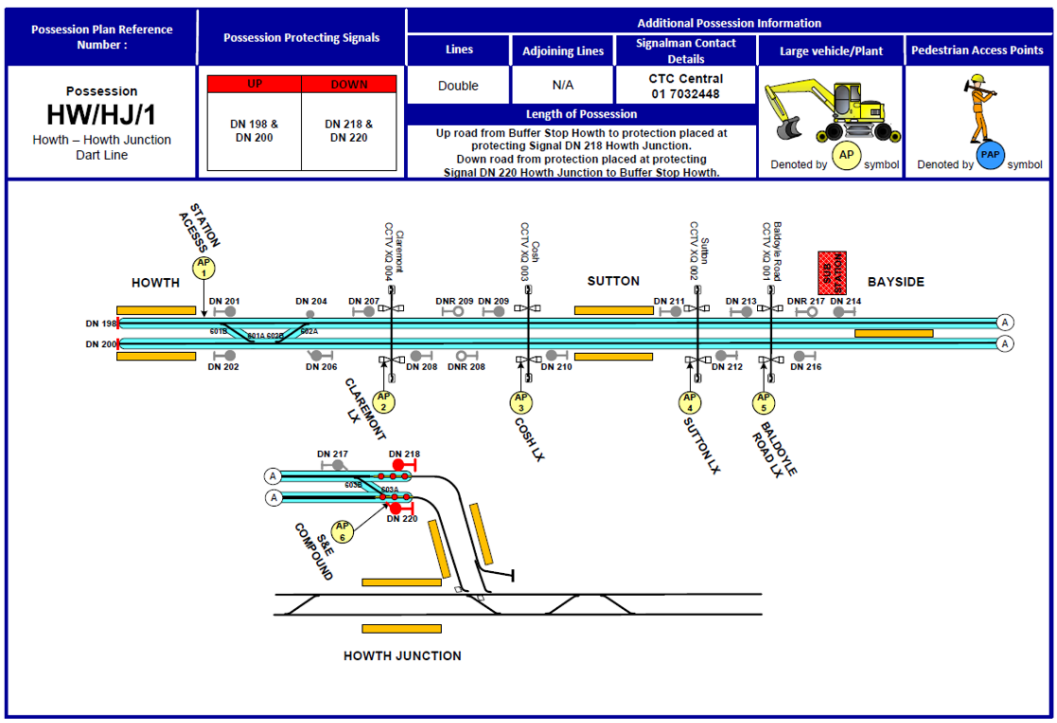

Figure 5-17: Existing access points

6 Summary and conclusions

6.1.1 Non-preferred options

Option 1 is not preferred due to:

- Its poor comparative operational performance and ability to allow the flexibility of using Platform 2 as a turnback without impacting on mainline signalling.
- The majority of services needing to use Platform 1, which in a morning peak would require passengers to use the footbridge to use a connecting train.

Option 2 is not preferred due to:

- Its poor comparative operational performance and ability to allow the flexibility of using Platform 2 as a turnback without impacting on mainline signalling.
- The majority of services needing to use Platform 1, which in a morning peak would require passengers to use the footbridge to use a connecting train.

Option 7a is not preferred due to:

- The additional ongoing maintenance and operational cost of introducing an additional platform
- The impact and cost risk of installing a new platform and relocating existing SET assets

6.1.2 Emerging preferred option

Option 5 has been identified as the emerging preferred option as:

- It allows for Platform 2 to be used to turn back trains without impacting on the mainline signalling.
- By using Platform 2 for the majority of services, passengers will not have to travel over a footbridge to get a connecting train into Dublin.

6.1.3 Key Risks/Next Steps

The following risks have been identified:

- The platform extension is required to be installed on a curved alignment which will require a derogation.
- Platform widening of the existing platform may be required in order to make it all a compliant width.

- Investigation is required into the necessary changes in passenger facilities to reflect that the station is to become used commonly as an interchange such that it will provide a satisfactory customer experience