Metro to Knocklyon Feasibility Study

Metro to Knocklyon Feasibility Study Report

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National Transport Authority

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Contents

Executive Summary

This study was undertaken to consider the feasibility and suitability of a Metro system for serving the transport demand along the corridor from the city centre to Knocklyon in the south-west of the county. As outlined in this report, this study has first identified potential stop locations through a Multi Criteria Analysis to form potential Metro Alignments and subsequently modelled a pair of potential Metro alignments which are considered broadly representative of the range of potential Metro options for serving the transport corridor fromCentral Dublin to Knocklyon via Rathmines and Terenure and carried out a high level Cost Benefit Analysis.

Both alignments share an origin point at Ballycullen in the south, run northbound through the southern suburbs of Terenure and Rathmines before continuing northbound towards the city centre, a higher employment area. The first (Charlemont alignment) then continues to back west to integrate with MetroLink at Charlemont. The second (St. Stephen's Green link) continues north from Rathmines to link up with the current Metrolink alignment at an interchange point.

Prior to the demand forecasting and economic appraisal, a comparative Multi Criteria Analysis to identify indicative stop locations was undertaken against the objectives. This analysis objectives are fully addressed for the beginning of the proposed alignment but for some categories (e.g. integration with transport) are only partially met as the alignment reaches the south-west of Knocklyon and Ballycullen. Although selected with the goal of serving the areas within this corridor with the greatest trip generating potential, the forecast usage of the proposed alignments is seen to be relatively low, both in relation to loadings on the core Metro alignment and the available capacity offered. While modelling results show peak periods experience high volumes of travel inbound in the AM and outbound in the PM, other travel time periods and directions during the peak, e.g. outbound in the AM experienced low usage. This can relate to low density housing in the suburbs and lack of attractors to these suburbs, such as office and retail attractors. It should also be noted however that there was a small uplift in public transport usage based on the difference of both scenarios of 2.36%.

Subsequent analysis of the benefits and costs of the proposals show that both have a benefit cost ratio of below 1.0. Whilst the options are considered broadly feasible, this provides an initial indication that a Metro option is unlikely to be a cost-effective approach to enhancing public transport in this area of Dublin.

More detailed review of the demand forecasts supporting the appraisal highlights some of the challenges in developing a feasible Metro option to serve this.

The relative performance of the options appraised makes a very strong case for options of this type being fully integrated with the existing Metro as a through running service, which appears to offer a more attractive service, for similar or lower cost.

More positively however is the relative success of the Charlemont alignment in enabling access to the southern suburbs of Rathmines, Terenure and Knocklyon from the north. Although still modest relative to station usage levels for the existing MetroLink proposals, demand levels may be sufficient to support higher quality public transport proposals of a more modest character.

1. Introduction

The National Transport Authority requested Jacobs to undertake a feasibility study for a possible Metro line along the city centre to Knocklyon corridor. This study is to include an assessment of an indicative route(s), including indicative station locations, and investigate its feasibility from a technical, environmental, transport planning, demand and economic point of view.

This study does not include identification of a preferred route for a possible Metro line on the corridor, nor the suggestion of the preferred design on any section of the alignment considered. Should the proposed Metro be considered feasible and worthy of advancement, a further route option selection and design process would be required to advance specific proposals.

This feasibility study will identify a workable option within the study corridor based on the proposal put forward during the public consultation on both MetroLink and BusConnects, which would serve Harold's Cross / Rathmines, Terenure, Rathfarnham, and Knocklyon.

The overall aim of MetroLink is 'to provide a safe, high frequency, high capacity, fast, efficient and sustainable public transport service connecting swords, Dublin Airport, Irish Rail, DART, Luas, Dublin Bus and the city centre'. The stated aims of the scheme are:

- Cater for the growing travel demand along the corridor;
- Reduction of urban congestion;
- Facilitate connection to attractor nodes;
- Provision of interchanges and 'Park and Ride' improving transport integration;
- Attractive and accessible to all users;
- Support environmental sustainability;
- Support economic development; and,
- Be segregated from other transport modes for optimal service.

During the course of public consultation on the full MetroLink proposal from Swords to Sandyford, an alternative alignment on the southside has been proposed for consideration, which would serve Harold's Cross/Rathmines, Terenure, Rathfarnham, and Knocklyon. The rational for this proposal put forward is that it would serve a sector of the Dublin Metropolitan Area which currently suffers from a significant public transport deficit; it would cause less disruption to transport services (Luas Green line) on the southside during construction; and, it would have less permanent adverse impacts on the urban environment and on accessibility for residents and businesses than the upgrade of the Luas Green Line.

1.1 Report Structure

This report contains the following chapters:

- Chapter 2: Definition / identification of the study area / corridor
- Chapter 3: Multi Criteria Analysis
- Chapter 4: Transport Modelling
- Chapter 5: Cost Estimate
- Chapter 6: Economic Appraisal
- Chapter 7: Summary
- Appendices

2. Definition / Identification of the study area / corridor

2.1 Overview of Proposed Route Options

In developing options for consideration, route options were put forward and subsequently developed further for a feasibility study. While both route alignment options have a common origin at Knocklyon, their linkage to the city centre differs. Option A provides through running at Charlemont and continuing on the MetroLink alignment. Option B provides for a linked option to St. Stephen's Green, bypassing Charlemont station.

A Station location Multi Criteria Analysis (MCA) was prepared to analyse different options for stopping locations along the proposed Metro to Knocklyon alignment.

Table 2-1: Details of options for each proposed Station location

Area	Stop Options	Location Details
Rathmines	Option A1 Harold's Cross	Harold's Cross Park
	Option A2 Rathmines	Grounds of St. Louis' Convent
Terenure	Option B1 Terenure	CYM Sports Club
	Option B2 Terenure	Rathgar Tennis and Bowling Club
Rathfarnham	Option C1 Rathfarnham	Grounds of Rathfarnham Castle, lands close to the northern entrance
	Option C2 Rathfarnham	Open lands to the north east of Woodview Cottages
Ballyboden	Option D Ballyboden	Coláiste Éanna Sports Grounds
Knocklyon	Option E Knocklyon	Open private lands to the north of Scholarstown Road zoned for development
Ballycullen	Option F Ballycullen	Lands zoned for development

The proposed options are shown in Figure 2-1, within a 600m buffer zone.

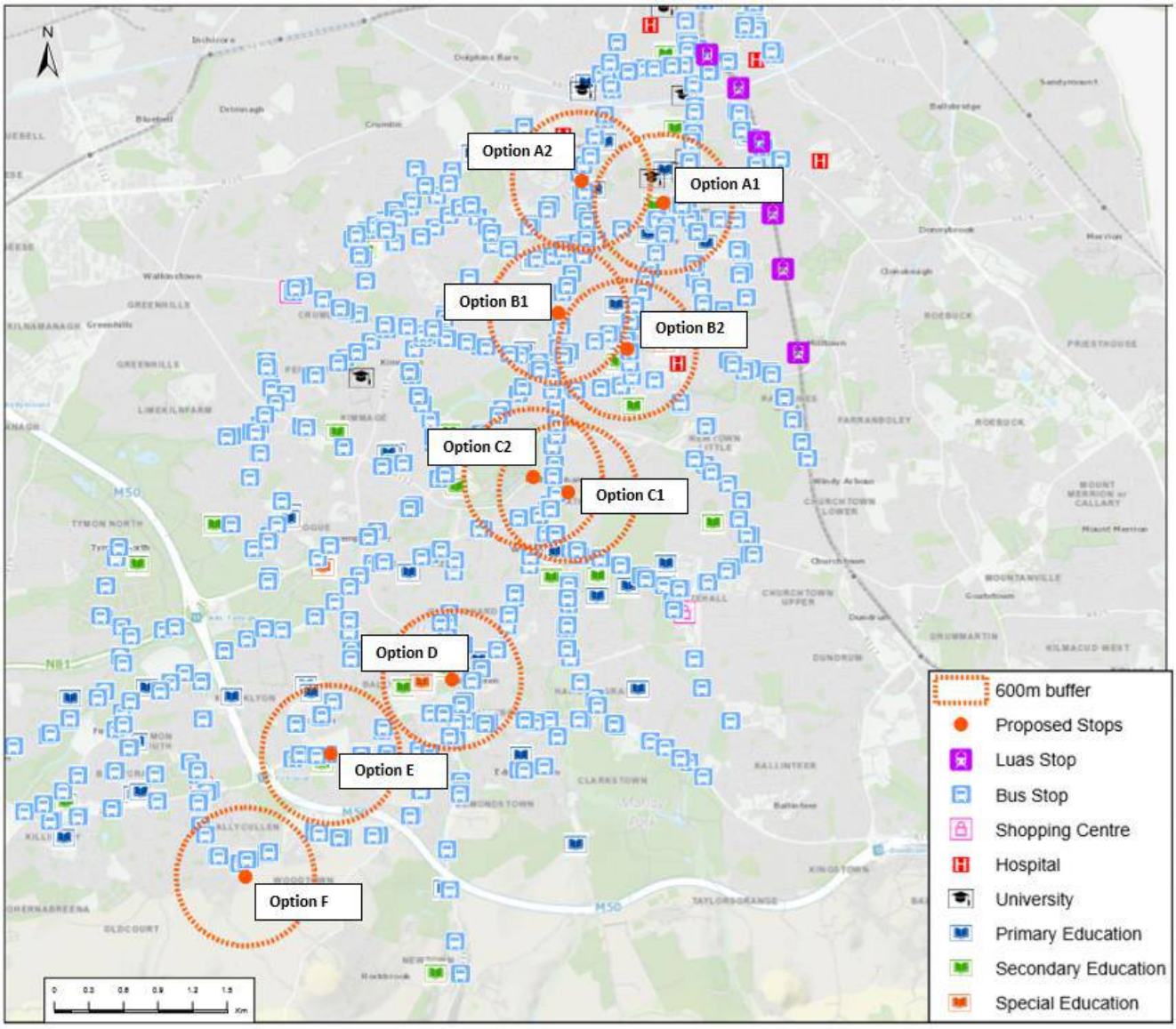


Figure 2-1: Identification of Potential stop locations for metro to Knocklyon Alignment within a 600m buffer zone

2.2 Analysis of Proposed Stations

Proposed station locations analysed in this section are based on the Assessment of Alternative Alignments that was undertaken for MetroLink, prepared by the National Transport Authority. This included undertaking a Multi Criteria Analysis for the alignment options, as well as each of the proposed station locations in order to be consistent with what was done previously for the MetroLink project. Each station location will be analysed within the context of development plan zoning, observations from site visits, the surrounding catchment including population figures and key attractors, and the possibility of interchange with other modes of public transport. As such, each station will be assessed on its ability to fulfil the objectives of the full MetroLink scheme.

2.3 Assessment of Station Options

Each proposed station location has been assessed on its ability to meet the objectives of the full MetroLink scheme, such as public transport interchange, connection to attractor nodes and accessibility.

Option A1 Harold's Cross is located in an area with lesser used centre than Rathmines, with a limited mix of land uses and minimal pedestrian footfall. As a result, the location may not be attractive and accessible for all users. However, Option A2 Rathmines is in close proximity to Rathmines local centre. As such, Rathmines is zoned as a

Key District Centre under the Dublin City Development Plan 2016-2022, with a core aim of developing a sustainable urban village, which would be supported through the provision of a MetroLink station. The proposed location would facilitate connection to a greater number of attractor nodes than Option A1 Harold's Cross and therefore would be attractive and accessible to more users in the area. Therefore, Option A2 Rathmines is the preferred stop.

Option B1 Terenure is located near a number of attractor nodes such as CYM Sports Club, Terenure local centre in the south, and a number of services to the north of the site. The area has high accessibility as there is a provision of bus lanes, cycle lanes and a taxi rank and shelter in close proximity to the proposed location, and as such provides interchanges with other modes of public transport, making it attractive and accessible for more users in the area. In comparison, Option B2 Terenure is also located in close proximity to a busy local centre, however there is a limited provision for interchange with other modes of public transport as no bus or cycle lanes are provided on Orwell Road, which predominantly serves the proposed station. As this station is only accessible via two small streets, it does not facilitate connection to attractor nodes as it is hidden from the main street. As a result, this location is not as accessible for all users. Therefore, Option B1 Terenure is the preferred stop in this area.

Option C1 Rathfarnham is located at Rathfarnham Castle and Playground which is a key trip generator in this area, as well as being close in proximity to Main Street, which includes a number of cafés, restaurants, shops and other services. As a result, economic development would be supported in this area if a MetroLink station was provided. The proposed station location also provides for interchange with other modes of public transport and whilst there is not a specific 'Park and Ride' designation there is a car park available close to the site, therefore making the station attractive and accessible to all users. Option C2 Rathfarnham is located within the Dodder Flood Zone, under the Dublin City Development Plan 2016-2022, and therefore new development in this area would be restricted without providing a detailed flood risk assessment. Additionally, there are limited attractor nodes surrounding this site, with a steep pedestrian path leading through a residential development to Main Street, therefore limiting the accessibility of the site. There is no bus lane present and there are no existing bus stops along the R112, thus providing no interchange with other modes of public transport. As a result, Option C1 Rathfarnham is the preferred stop in this area.

Option D Ballyboden is surrounded by a number of attractor nodes as there are several schools and colleges in the area, as well as local commerce. Further residential development has also taken place in the area in recent years and therefore the provision of a MetroLink station would cater for the growing travel demand in the area in an environmentally sustainable way. This location also provides for interchange with other modes of public transport due to the presence of existing bus stops, with the availability of cycle lanes and pedestrian footpaths making it attractive and accessible to all users. As such, Option D Ballyboden is the preferred location in this area, with no other options considered.

Option E Knocklyon is proposed to be in an area zoned for development under the Dublin City Development Plan 2016-2022, and therefore a station at this location would cater for the growing travel demand in the area. By locating in this area, interchanges with other modes of public transport are also provided which may reduce urban congestion, thus supporting environmental sustainability. Due to the station's proximity to several schools and Knocklyon Shopping and Community Centres, this location would also facilitate connection to attractor nodes, making the station attractive and accessible to all users. As a result, Option E Knocklyon is the preferred location in this area, with no other options considered.

Option F Ballycullen is proposed to be located in an area zoned for development under the Ballycullen-Oldcourt Local Area Plan, however it is situated in proximity to a limited number of trip attractors. Similarly, it is not served by sufficient public transport and therefore does not facilitate interchange, making it inaccessible for many users. Potentially a park and ride site can be used to facilitate interchange from private car users to Metro at this location. No other options have been considered for this location. Table 2-2 summarises the preferred stop for each area.

Table 2-2: Summary of Preferred Station at Each Location along MetroLink to Knocklyon Alignment

Station	Station Option	Preferred Station
Station A1 Harold's Cross	Station A2 Rathmines	**Station A2 Rathmines**
Station B1 Terenure	Station B2 Terenure	**Station B1 Terenure**
Station C1 Rathfarnham	Station C2 Rathfarnham	**Station C1 Rathfarnham**
Station D Ballyboden	-	**Station D Ballyboden**
Station E Knocklyon	-	**Station E Knocklyon**
Station F Ballycullen	-	**Station F Ballycullen**

3. Multi Criteria Analysis

3.1 Methodology

The Multi Criteria Analysis (MCA) evaluates the six stations options proposed for the alternative Metrolink alignment towards Knocklyon and Ballycullen. The preferred station options are those defined in Appendix C at the end of this report and comprise:

1) Station A2 Rathmines
2) Station B1 Terenure
3) Station C1 Rathfarnham
4) Station D Ballyboden
5) Station E Knocklyon
6) Station F Ballycullen

The options are evaluated based in the following criteria, which also align with the overall objectives of the Metrolink project, as shown in Table 3-1.

Table 3-1: Assessment Categories and Objectives

Category 1: Economy	**Impact on economic growth and competitiveness**
	- Population catchment - Reduction of urban congestion
Category 2: Integration with Government Policies	**Compatibility with government policies**
	- Existing / proposed zoning and plans - Approved planning applications - Local, regional and national transport objectives
Category 3: Integration of Transport Networks	**Integration of transport networks**
	- Station proximity to a park and ride facility - Station proximity to bus stop(s)
Category 4: Accessibility and Social Inclusion	**Social deprivation, geographic isolation and mobility / sensory deprivation**
	- Station proximity to an urban centre

	- Station proximity to key attractor(s) - Station proximity to a direct access from main road - Conditions of pedestrian and cycling infrastructure
Category 5: Environment	**Water, air, noise and architectural impacts**
	- Water and flooding - Air quality and noise sensitive receptors - Cultural heritage
Category 6: Safety	**Number of transport related accidents**
	- Reduction of number of cars

3.2 Multi Criteria Analysis Summary

From undertaking a detailed multi criteria analysis of the potential station locations, the findings show that for the majority, the objectives have been met, especially for Safety on the proposed alignment due to the potential reduction in car usage. Objectives have been partially met in terms of integration with policy and transport connections, as the majority of interchange will occur closer to the city centre, e.g. Rathmines and the opposite the further away from the city centre the alignment is, e.g. Knocklyon. Overall, the objectives have been met at different levels depending on location. As the level of how the objectives are being met change as the potential stations move outbound from the city centre, it may be worth future exploration of how to better address the objectives of the suburbs in the south-west. We acknowledge that a previous study, although not part of an option selection process, into the feasibility of a future LRT line in this part of the city was done in the past. This was ruled out due to space constraints along the route, however we must be cognisant of the fact that other options could be available to investigate in this part of the city. The preferred stop locations will form routes that will be brought forward to a more detailed transport demand and economic appraisal.

Table 3-2: MCA Summary of proposed stops

	Stop A2 Rathmines	Stop B1 Terenure	Stop C1 Rathfarnham	Stop D Ballyboden	Stop E Knocklyon	Stop F Ballycullen	Full Route
Category 1: Economy							
Category 2: Integration (policies)							
Category 3: Integration (transport)							
Category 4: Accessibility and social inclusion							
Category 5: Environment							
Category 6: Safety							
All Categories							

Colour Key	Description
	Fully addresses objectives
	Addresses objectives well
	Partially Addresses objectives
	Addresses objectives poorly
	Does not address objectives

4. Transport Modelling

4.1 Future Transport Context

The performance of the proposed options has the potential to be highly influenced by the wider transport context including public transport enhancements in the adjacent local area.

The potential interfaces and interactions with other schemes are discussed further in the context of the modelling scenario assumptions.

4.2 Do Minimum Public Transport Network

The following schemes are assumed in the 2030 Do-NDP based scenario.

4.2.1 MetroLink

The MetroLink scheme is included in full in the 2030 Do-NDP scenario, with the assumption of a 2-minute (30 tph) headway

4.2.2 BusConnects

- Radial Core Bus Corridors
- BusConnects Fares / Ticketing
- BusConnects Routes and Services

4.2.3 Park and Ride

- Rail and Bus based P&R provision (partial implementation by 2028)

4.2.4 Rail

- Interim DART Expansion (Pelletstown & Kishogue only)

4.2.5 Other

2030 assumptions regarding Cycling, National Roads, Regional and Local Roads and Demand Management remain as per the 2030 Do-NDP scenario.

4.3 Do Something (Metro Extensions)

Two metro schemes have been considered:

A – "Through running" (AAG): Metro Estuary – Ballycullen (Extension of Metrolink to the South)

B – "Linked St. Stephen's Green" (AAK): Metro St. Stephen's Green – Ballycullen (Separate Metro line connecting to MetroLink)

The alignments for both schemes are represented in **Figure 4-1** and **Figure 4-2**.

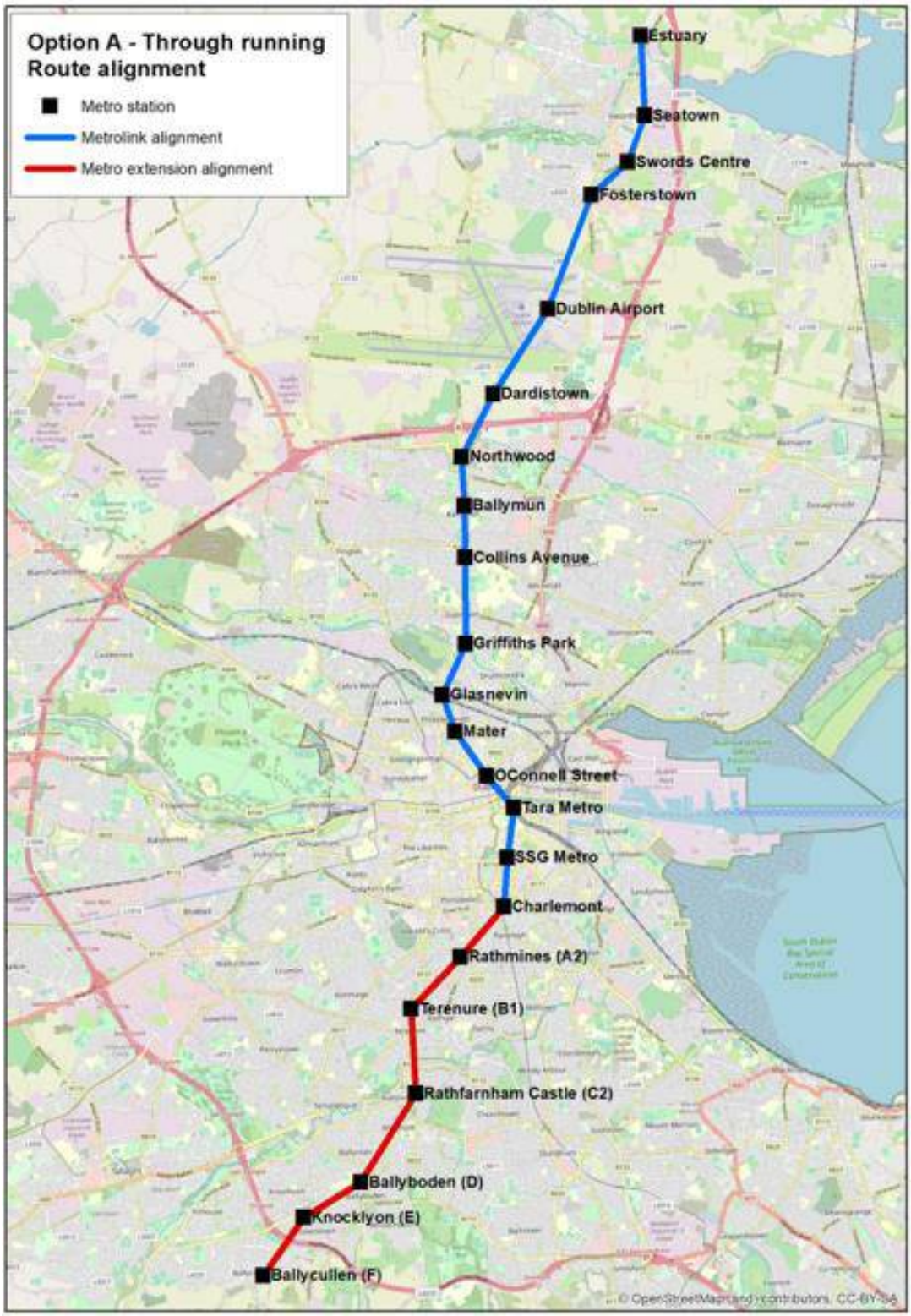


Figure 4-1: Option A through running alignment

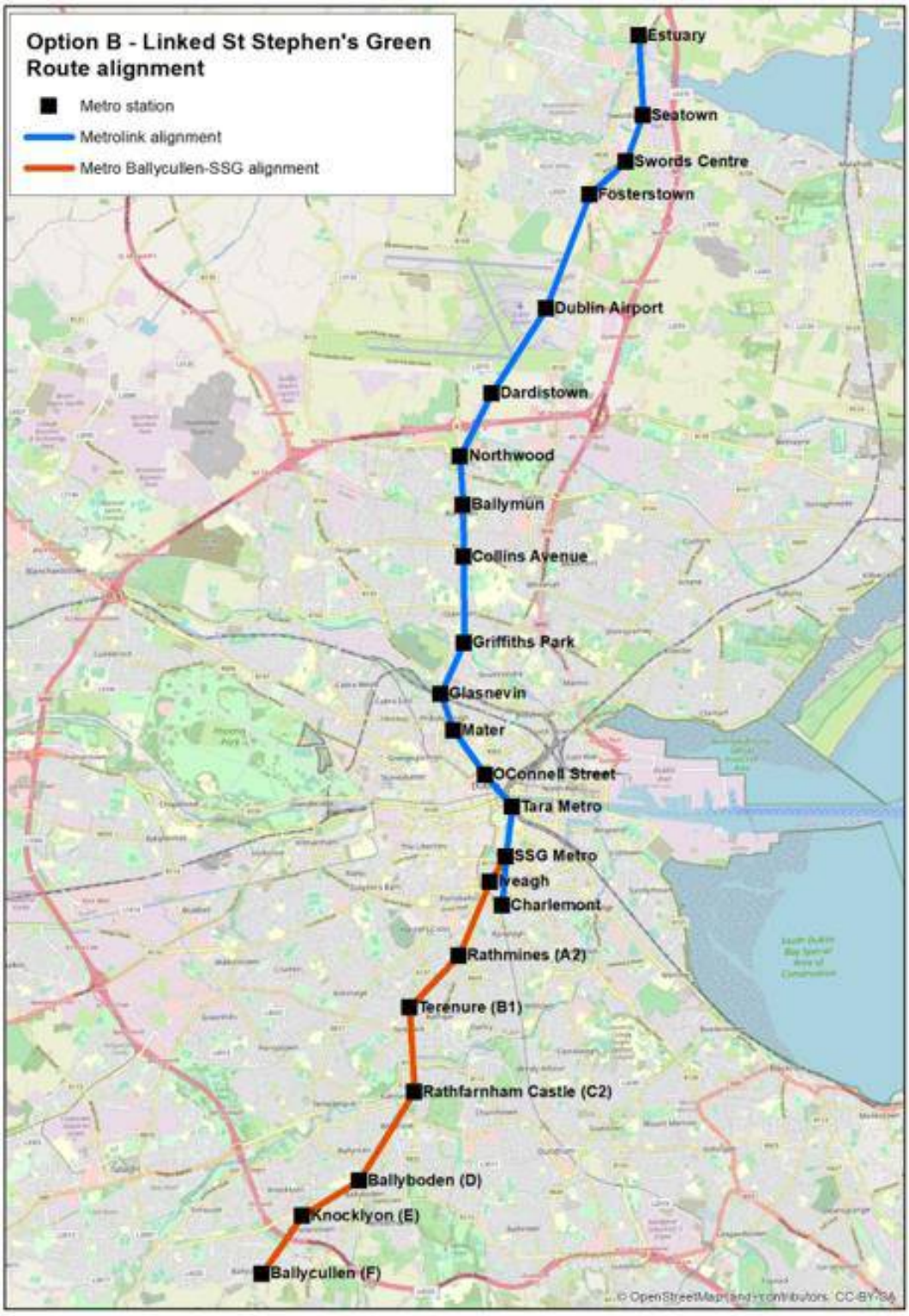


Figure 4-2: Option B linked SSG alignment

4.4 Model Runs

Below is a list of the model runs and their related scenarios, as well as the modelled year.

Table 4-1: Model Run ID's

Run ID	Scenario	Modelled Year	metro
AAF	Do Minimum	2030	Estuary - Charlemont
AAG	A – Through running	2030	Estuary - Ballycullen
AAK	B – Linked SSG	2030	Estuary – Charlemont + SSG - Ballycullen

4.5 Passenger Flow Comparisons

Metro line loadings for the AM, LT and PM peak in 2030 with Metro to Knocklyon in place using the through running alignment at Charlemont (AAG) and the linked alignment at St. Stephen's Green (AAK) for Northbound and Southbound are shown in Figures 4.3 – 4.8 below. Both the AAG and AAK scenarios are represented on the same chart to facilitate comparison.

From the results of the model runs using the Eastern Regional Model, the through running option Estuary to Ballycullen generates higher passenger flows than the linked option to St. Stephen's Green across all time periods and in both directions. The reason for the difference in flows is due to the need for passengers to interchange with the linked option at St. Stephen's Green, making longer journeys faster and therefore more attractive. Apart from the peak directions (AM inbound and PM outbound), passenger flows on the extended section from Charlemont to Ballycullen are below 2,000 passengers per hour.

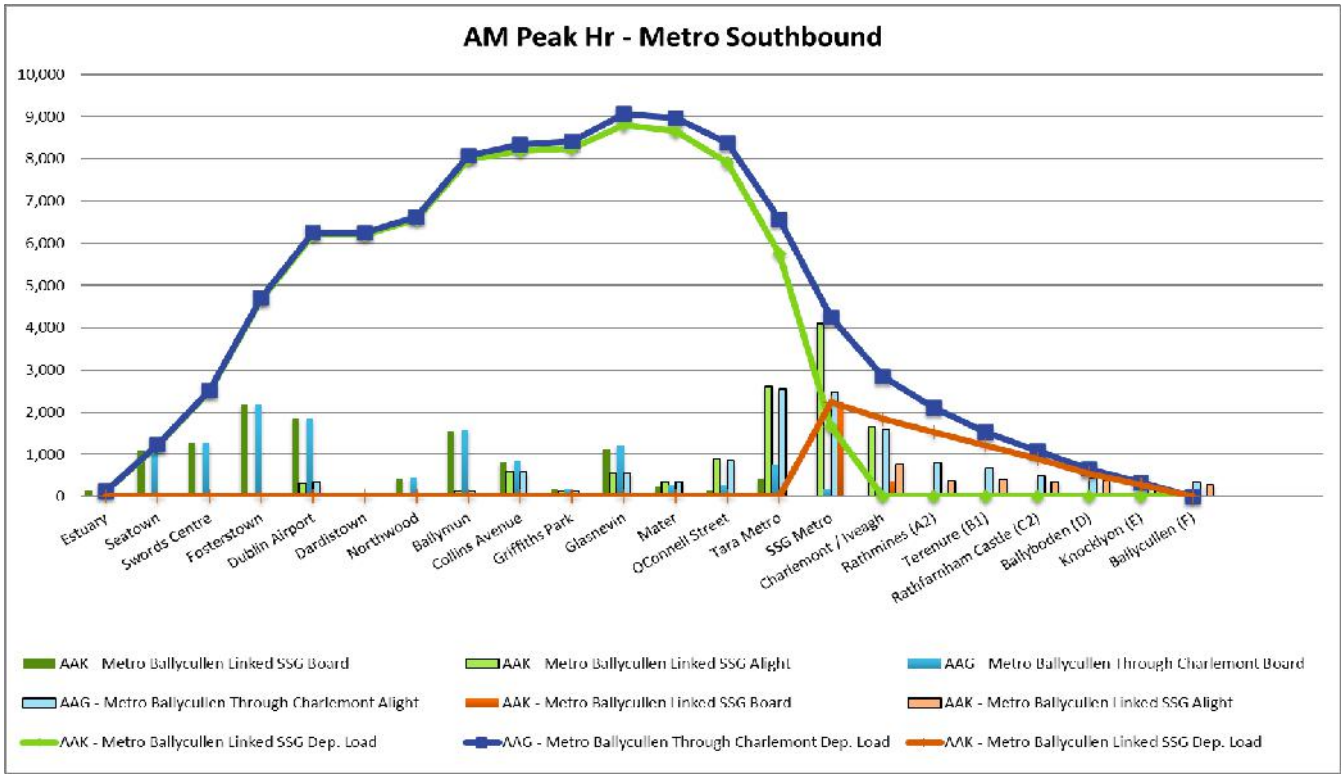


Figure 4-3: Passenger flows AM peak southbound

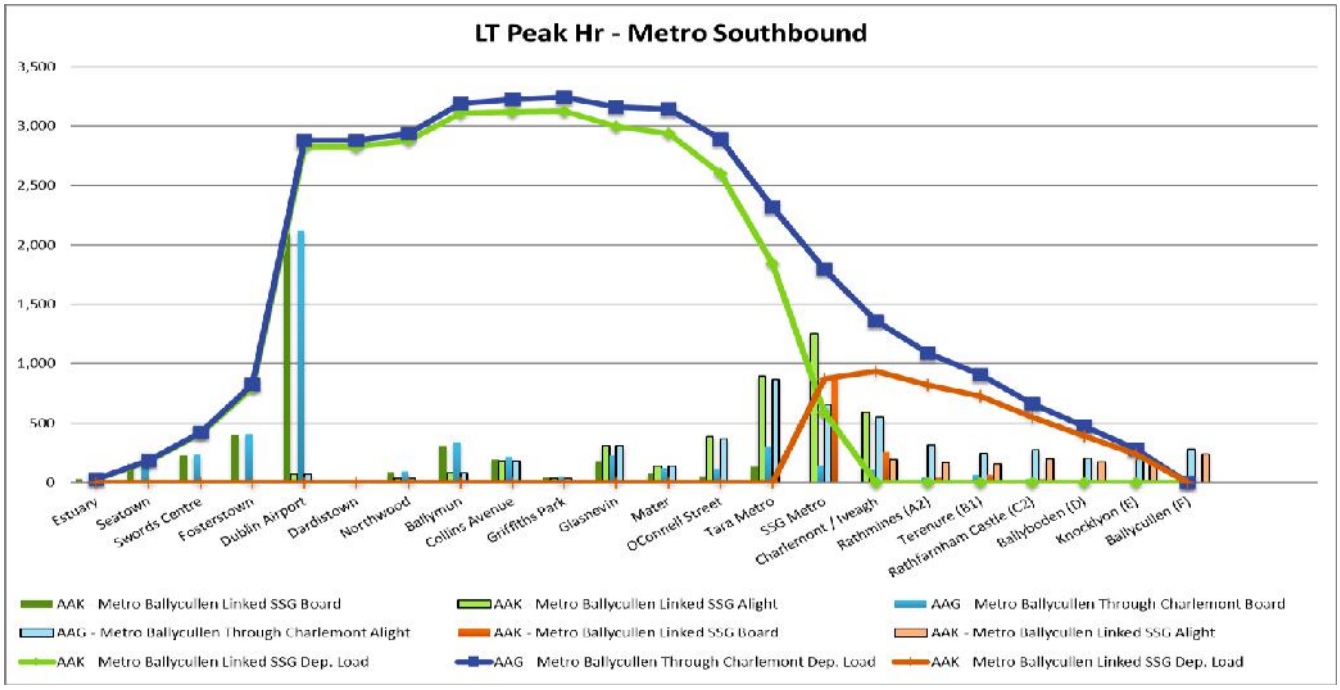


Figure 4-4: Passenger flows LT peak southbound

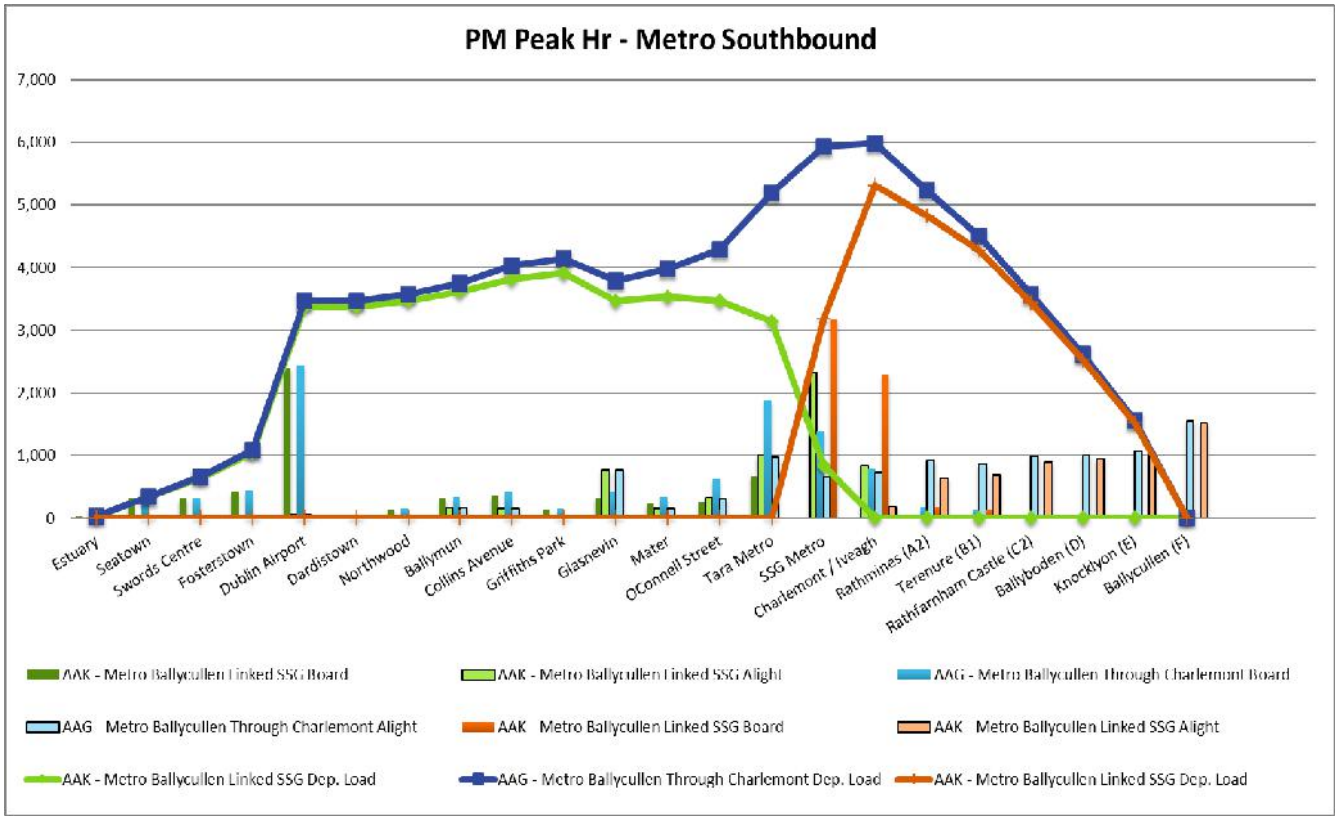


Figure 4-5: Passenger flows PM peak southbound

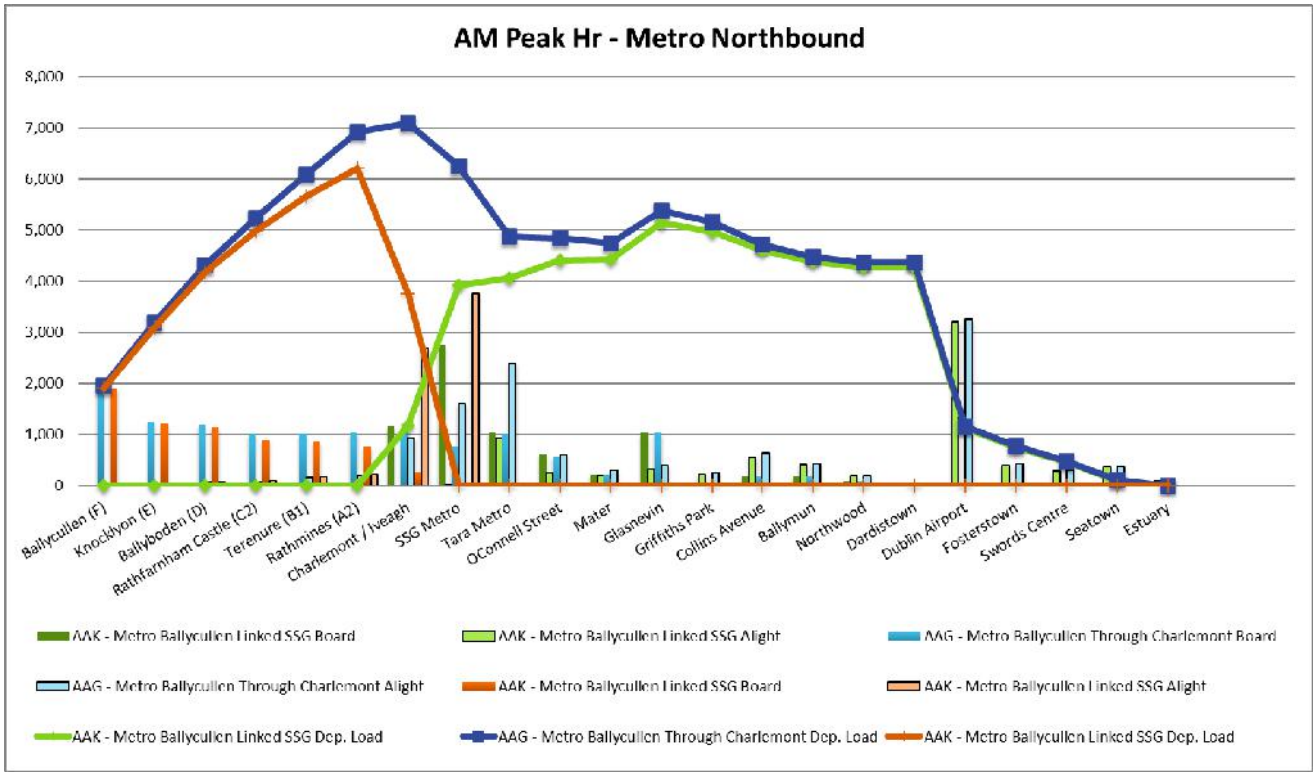


Figure 4-6: Passenger flows AM peak Northbound

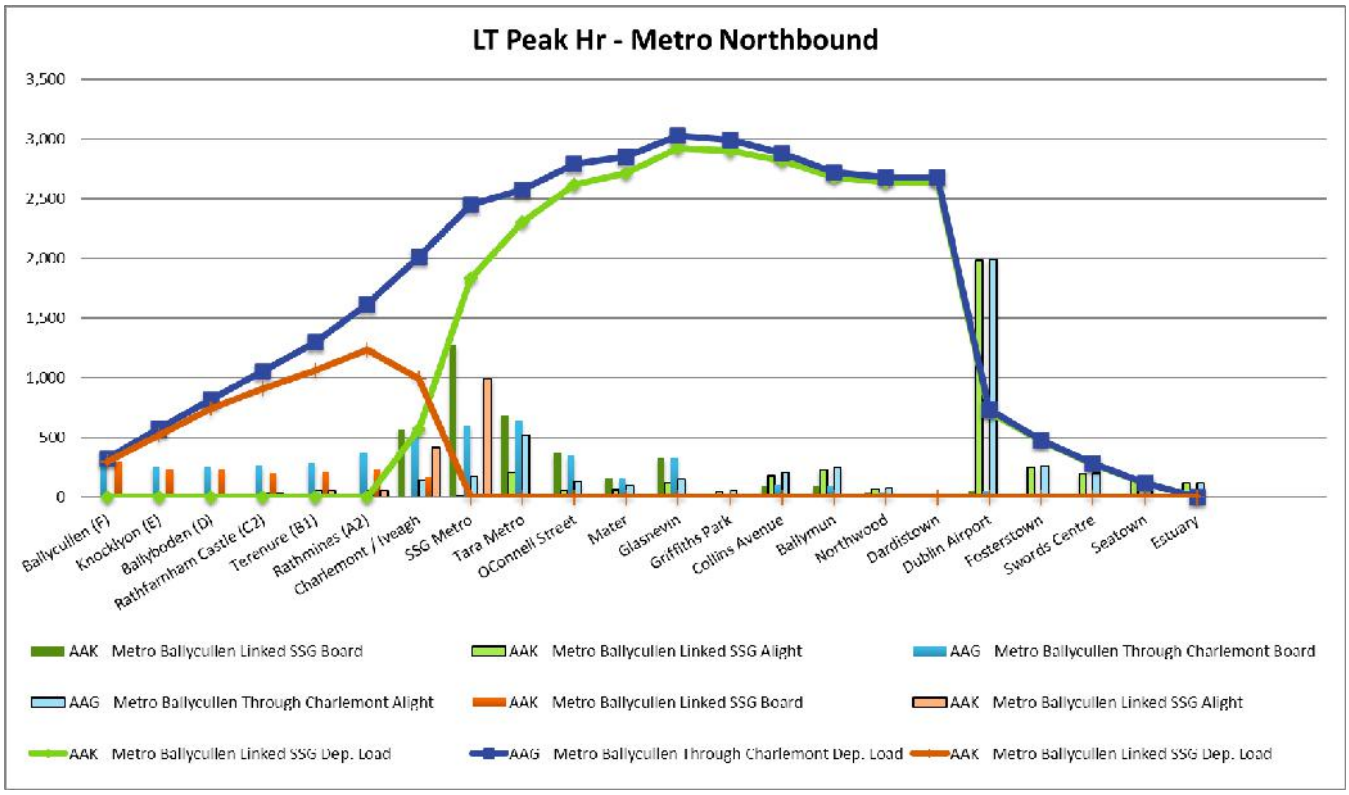


Figure 4-7: Passenger flows LT peak Northbound

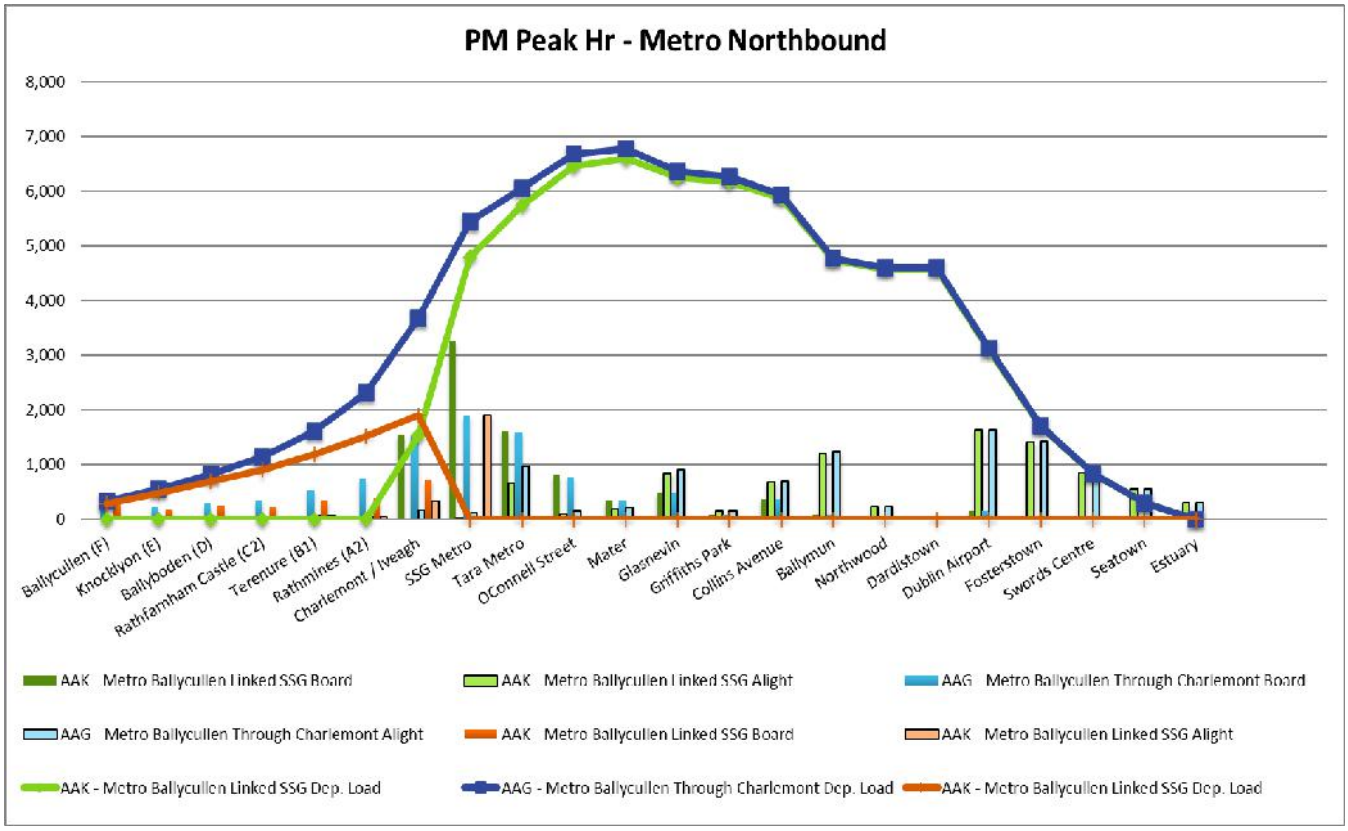


Figure 4-8: Passenger flows PM peak Northbound

4.6 Transport Demand and Mode share

Total modelled PT passengers per mode (boarding's) for the AM peak hour are summarised in Table 4-2.

Model run results show that the Metro extension to Ballycullen (AAG) increases the overall number of metro boarding's for the AM peak by circa 9,000 passengers compared to the Do Minimum. Half of that increase is coming from switching from the other PT modes:

- 3,000 from urban bus
- 1,300 from Luas

The separate metro line linked at St. Stephen's Green (AAK) generates more metro boarding's (12,000+) than the option from Ballycullen to Charlemont (AAG). This is mostly due to transfers at St. Stephen's Green between the two metro lines. Removing these intra-metro system transfers and the difference in terms of boarding's with the Do Minimum is similar to the option of Ballycullen to Charlemont.

Table 4-2: AM PT boarding's per mode

Mode	Do Minimum	Through Running (AAG)	Difference AAG/Do Minimum	Linked (AAK)	Difference AAK/Do Minimum
DART	27,803	27,727	-76 (-0.27%)	27,587	-217 (-0.78%)
HEAVY RAIL	18,344	18,356	11 (+0.06%)	18,299	-45 (-0.25%)
LUAS	23,456	22,193	-1,263 (-5.38%)	22,593	-863 (-3.68%)
URBAN BUS	88,805	85,820	-2,984 (-3.36%)	85,546	-3,259 (-3.67%)
OTHER BUS	15,860	15,840	-20 (-0.13%)	15,828	-32 (-0.2%)
METRO	16,728	25,565	8,837 (52.82%)	28,840	12,112 (+72.4%)
TOTAL	**190,996**	**195,501**	**4,504 (2.36%)**	**198,693**	**7,697 (+4.03%)**

To better understand the origin of the metro demand, the assigned Public Transport flow difference between the Do Minimum and the Do Something has been plotted. The purpose of these maps in Figures 4.9 – 4.12 below is to identify and quantify any transfer between PT modes (e.g. passengers switching from bus to metro).

The figures below show a similar pattern in both scenarios and for both time periods (AM & PM peak):

- Transfer of 300 passengers per hour form the Luas Green Line (AM inbound – PM outbound)
- Transfer of 300 passengers per hour from the Luas Red Line (AM inbound – PM outbound)
- Transfer of 800 – 1,00 passengers per hour from bus services along the corridor of Templeogue – Terenure – Rathmines

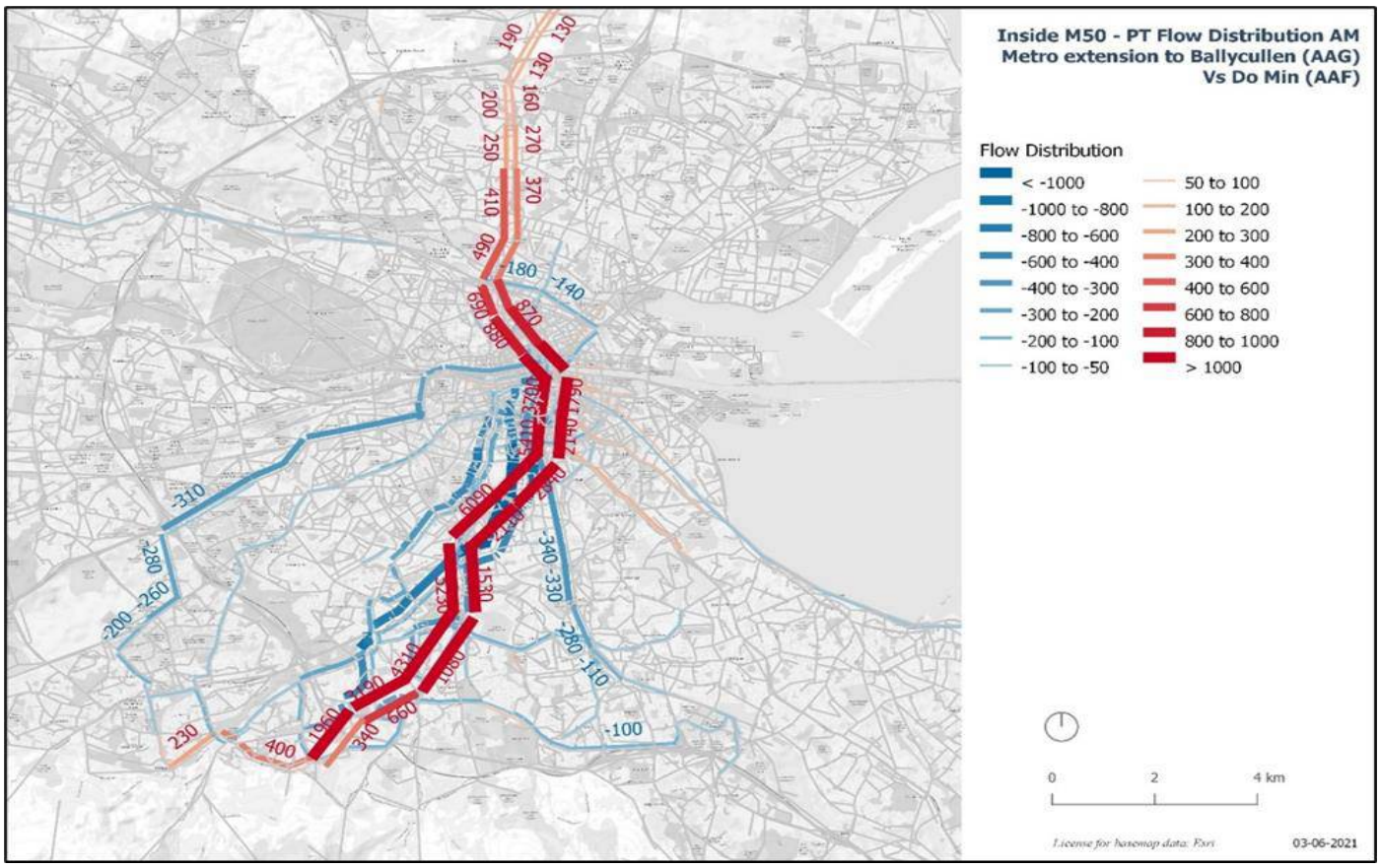


Figure 4-9: PT flow difference between through running option (AAG) and Do Min - 2030 AM

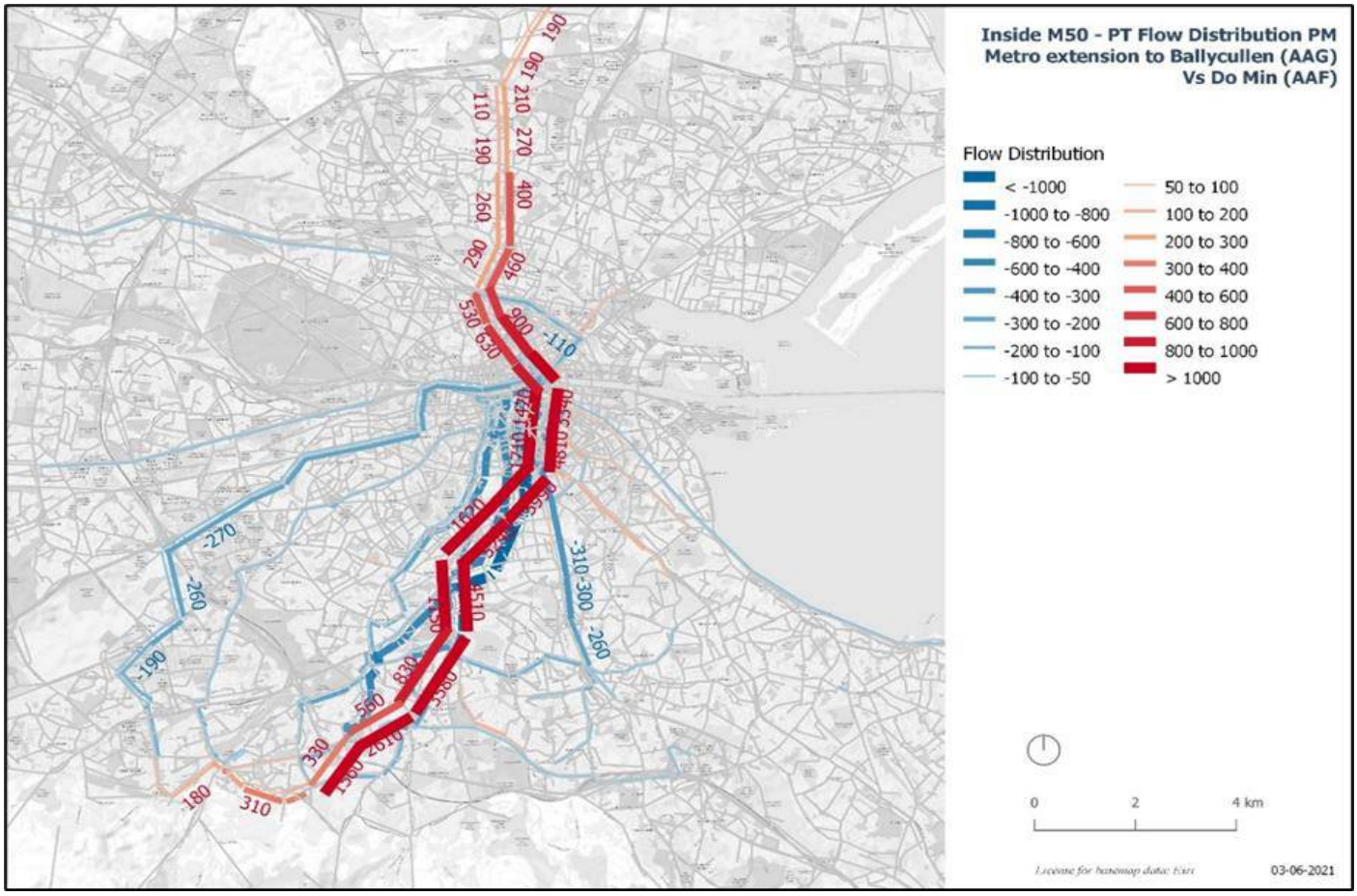


Figure 4-10: PT flow difference between through running option (AAG) and Do Min - 2030 PM

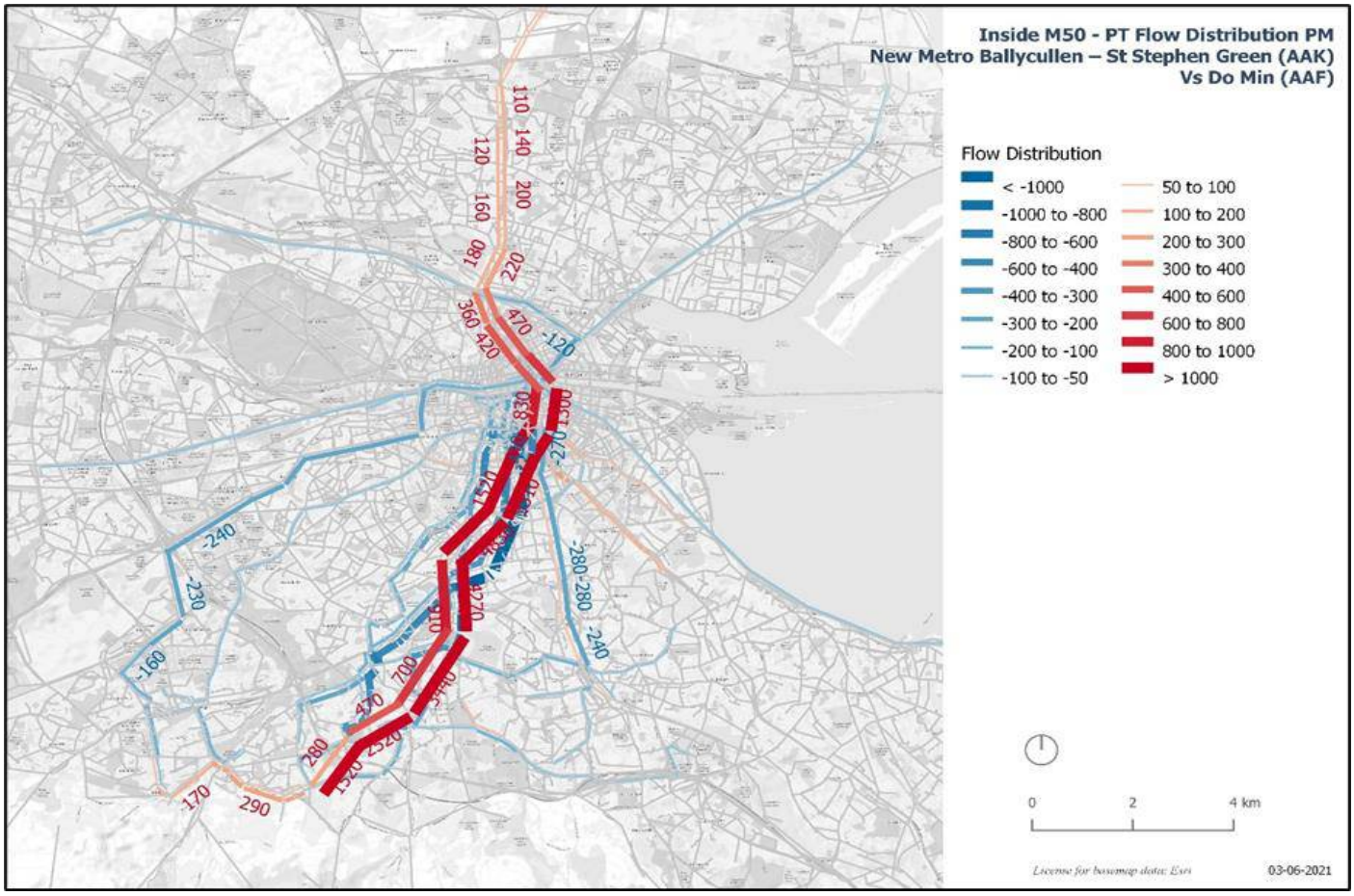


Figure 4-11: PT flow difference between linked option to St. Stephen's Green (AAK) and Do Min - 2030 AM

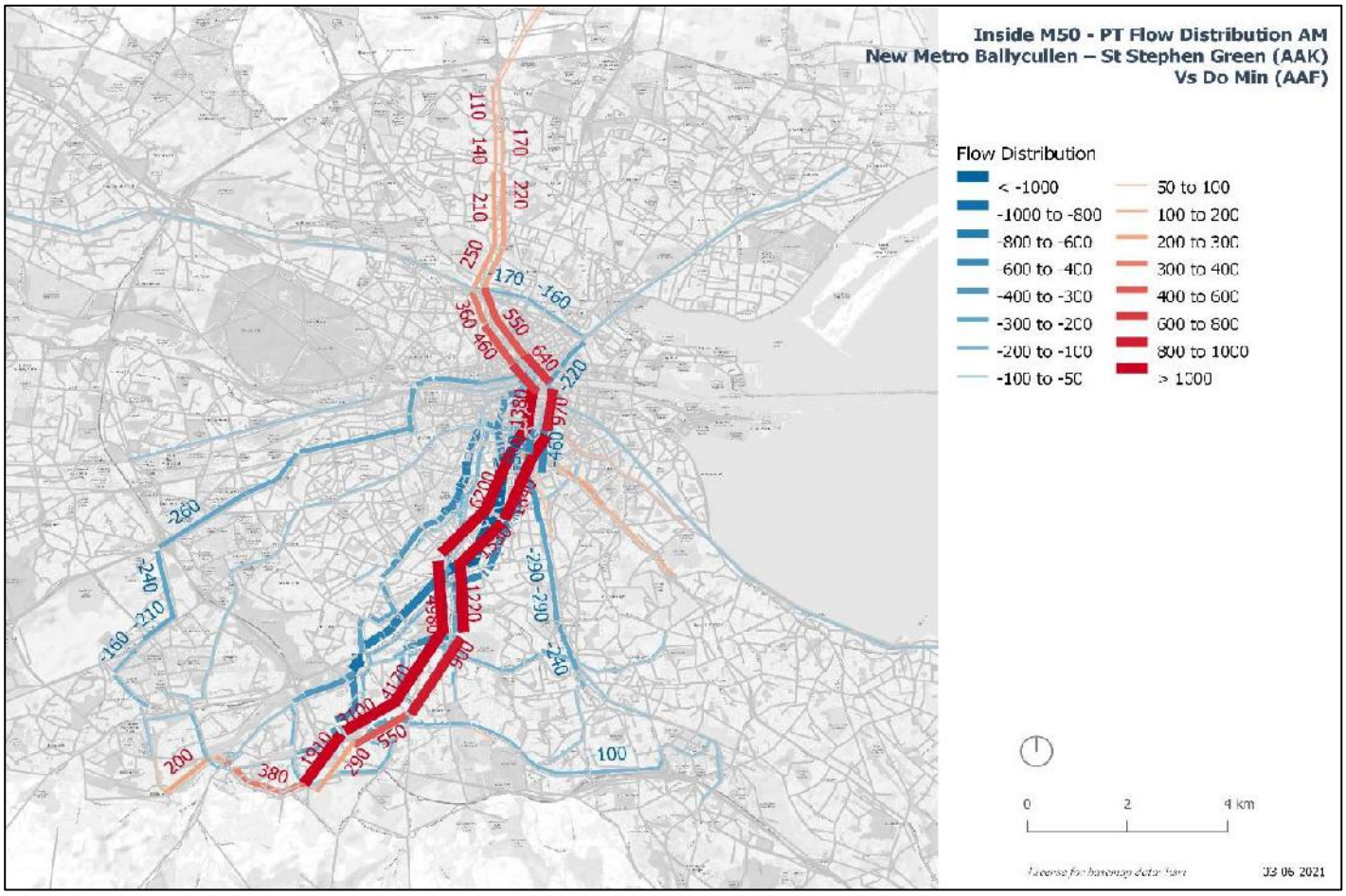


Figure 4-12: PT flow difference between linked option to St. Stephen's Green (AAK) and Do Min - 2030 PM

5. Cost Estimate

A joint costing exercise was undertaken to support a consistent value for money appraisal for the various Metro options being considered as part of the Metro to Knocklyon and the Metro UCD to Sandyford studies and costs were developed using a shared estimation approach for both sets of project options. As outlined below, these estimates capture the full range of key factors to allow for a comprehensive estimation of the Net Present Value of the costs, reflecting a specific understanding of the separate impacts of:

- Capital costs
  - Direct and indirect costs
  - Contractor overhead profit and insurance
  - Client costs
  - Land and property
  - Risk allowances
- Operations and maintenance costs
- Assumed expenditure profiles
- Interface with MetroLink construction

5.1 Capital costs

Following review of the route options with the estimation team, initial capital costs were estimated for each option on the basis of the quantities of basic units. These included:

- Station underground (open cut or mined)
- Station surface
- Vents/Escape shafts
- Metres of single bore twin track tunnel etc.
- Metres of track
- Numbers of trains
- Location of and access to the maintenance depot
- Location of operation control centre and alternative spare
- Park-and-ride facility
- System wide installations (track, fencing, power supply, comms, signalling, etc.)

Where appropriate item costs were adjusted to control for factors such as:

- Urban or suburban settings (stations)
- Station depth
- Adjacency to railway lines
- Likely utilities

5.2 Application of risk and optimism bias

Reflective of the very early stage of project development and the correspondingly low level of engineering detail available at this stage a Quantified Risk Assessment (QRA) has not been undertaken at this point. Reference Case Forecasting has instead been used to adjust for risk and optimism bias. As reported in the UK Government's Transport Appraisal Guidance, analysis by Oxford Global Projects recommends different optimism bias uplifts for different projects at different stages of the project lifecycle. These are summarised in Table 5-1 for the earliest stage of project development.

Table 5-1: Recommended optimism bias uplifts for different projects at different stages of the life of a transport

Category	Item	Stage 1 (Project Definition)
Roads	Motorway, trunk roads, local roads	46%
Rail	Metro, Light rail, Guided buses on tracks, line upgrades, high speed rail	56%
Fixed links	Bridges and Tunnels	55%
Building projects	Stations and Terminal buildings	70%
IT projects	IT system development	69%
Land and property	Property purchases	33%
Rolling stock (new procurement)	Powered and unpowered vehicles	61%

As a complex project blending elements of Rail, Fixed link, land and property and rolling stock a blended allowance of 65% was applied to the total cost estimate. Although cautious, this is considered reasonable at this stage in the process, given the proportion of costs attributed to station construction, signalling and Rolling stock.

An initial cost was then built up for each option through application of previously developed library rates. This was then uplifted on an item by item basis to account for preliminary costs and then using global factors for contractor overheads, profits and bonds and sureties. Further allowances for client costs (indirect costs and land and property) were estimated for each option through comparison with the MetroLink scheme. Reflective of the low level of engineering detail available at this stage in the project development process a risk allowance of 65% was applied to the total cost estimate. The NTA cost management guidelines around contingency and other benchmarking criteria were considered as part of this study and was reflective of the level of design available.

The cost build-up for the two route options is summarised in **Error! Reference source not found.** and **Error! Reference source not found.**. These costs are presented in Quarter four 2019 Euros, and are exclusive of VAT, which is addressed as part of the conversion to Net Present Costs. Regarding the difference in subtotal amounts between the two options, option presents a higher subtotal amount due to additional construction and infrastructure requirements in creating separate, longer tunnelling and also the construction of a large turnback facility at St. Stephen's Green to facilitate this option.

Table 5-2: Metro Knocklyon, Ballycullen to Charlemont (through running), capital costs (factor costs, Q4 2019 prices, nearest €100,000).

Category	Item	Total (EUR) (Q4 2019)
Capital costs	Tunnels & Intervention shafts	549,900,000
	Subsurface stations	904,200,000
	Rolling stock	149,800,000
	Other	384,600,000
	Total	1,988,500,000
Client costs	Indirects	285,400,000
	Land and property	189,900,000
Sub-total		2,463,800,000
Risk & Optimism Bias	65%	1,601,500,000
Total		4,065,300,000

Table 5-3: Metro Knocklyon, Ballycullen to St Stephen's Green (linked), capital costs (factor costs, Q4 2019 prices, nearest €100,000).

Category	Item	Total (EUR) (Q4 2019)
Capital costs	Tunnels & Intervention shafts	612,100,000
	Subsurface stations	1,266,500,000
	Rolling stock	217,600,000
	Other	647,700,000
	Total	2,743,900,000
Client costs	Indirects	393,700,000
	Land and property	269,000,000
Sub-total		3,406,600,000
Risk & Optimism Bias	65%	2,214,300,000
Total		5,620,900,000

5.3 Operations and maintenance

Independently to the capital cost estimation process, an allowance for operations and maintenance (O&M) costs of the proposed Metro Knocklyon route options was developed to capture the potential O&M costs over a 60-year operational time horizon. For both the Metro Knocklyon and Metro UCD to Sandyford route options a total allowance of €600m (in 2011 prices and values) across the 60-year period is proposed as approximately representative with reference to the equivalent MetroLink projections.

5.4 Expenditure profile

To allow estimation of the present value of the capital and O&M costs, expenditure profiles were developed support this.

5.4.1 Capital expenditure profile

For both proposed routes a four-year construction programme ending in 2030 was assumed with equal expenditure assumed in each year. At this stage, this assessment should be considered highly preliminary, and is proposed solely for the purpose of evaluating the present value of the costs.

5.4.2 O&M expenditure profile

Rather than following a pro-rata estimate of €10m per annum, O&M expenditure was assumed to increase over the 60 year operation period, as the age of the assets increases, from €6.6m in the 1st year to €13.8m in year 60.

5.5 Construction price inflation

The potential impacts of Covid-19 and construction of MetroLink on construction prices are considered an area of significant uncertainty and remain to be confirmed.

Whilst a project of a scale of the MetroLink construction might be expected to drive increases in construction costs, this has not been quantified, and any impact would also be influenced by the timing of these proposals. Conversely, the schemes proposed may be in a position to benefit from efficiencies and lessons learned during the delivery of MetroLink.

No specific allowance has been made for the separate impacts of these issues, which are considered to fall under the overall allowance for Risk and Optimism bias.

5.6 Present value of costs

For use in the value for money appraisal, the costs have been adjusted for presentation in a 2011 market price basis and value, this has been undertaken in line with Transport Infrastructure Ireland's Project Appraisal Guidelines (PE-PAG-02030).

The capital and O&M costs are provided on a factor cost basis, for conversion to market cost basis for comparison with the potential user benefits, an uplift of 1.183 has been applied.

As per TII guidance the present value year has been taken as 2011, the capital costs have been deflated to 2011 values based on the observed Consumer Price Index for the period 2011- 2019. O&M costs were originally estimated on a 2011 basis.

Future year capital and O&M costs are similarly discounted to 2011 values with discount rates as per TII guidance of 4% for years 1-30 and 3.5% for years 31-60.

Table 5-4: in Costs in (2011 Prices and Values, nearest €100,000).

Category	Option A Metro Knocklyon, Ballycullen to Charlemont (through running)	Option B Metro Knocklyon, Ballycullen to St Stephen's Green (linked)
Construction Cost	€2,257,000,000	€3,120,700,000
Operating Cost	€105,500,000	€105,500,000
Total Cost	€2,362,500,000	€3,226,200,000

6. Economic appraisal

6.1 Introduction

A Public Transport User Benefits appraisal of the Dublin MetroLink (Metro extension to Knocklyon), scheme has been completed as part of the feasibility study. This appraisal has been conducted to identify the user benefits expected from scheme implementation. The Public Transport appraisal has been split into two distinct sections, corresponding to the two options described in the Transport Modelling chapter of the report: Option A "Through Running" (Metro Estuary-Ballycullen) Extension to the South and Option B "Linked St Stephen's Green" (Metro St Stephen's Green-Ballycullen) as a separate metro line to Metrolink. While the appraisal will foremostly provide an indicative value of user benefits expected from scheme implementation, comparisons between the two options will aid option selection. The appraisal of each alignment option has followed the same defined process.

The transport modelling outputs which underpin the economic appraisal have been produced using the National Transport Authority's (NTA) Regional Modelling System, developed as part of the Modelling Services Framework in collaboration with SYSTRA and Jacobs Engineering Ireland. The National Transport Authority's Regional Modelling System comprises the National Demand Forecasting Model, five large-scale, technically complex, detailed and multi-modal regional transport models and a suite of Appraisal Modules covering the entire national transport network of Ireland. The five regional models are focussed on the travel-to-work areas of the major population centres in Ireland. The Eastern Regional Model (ERM) has been used for this appraisal as it focuses on the travel-to-work areas of the population centre of Dublin and nearby regions. The ERM captures all day travel demand, thus enabling more accurate modelling of mode choice behaviour and increasingly complex travel patterns.

The appraisal has been conducted using the TUBA v1.9.4.

As specified in the economics file, the ERM, and Irish guidance, impacts will be modelled in four distinct time periods: AM, LT, SR and PM. The annualization factors used for each of these time periods are presented in **Table 6-1** and are those provided by the NTA for scheme appraisal. The annualization factor in the LT period is higher than other periods due to its use in approximating off peak and weekend trips.

Table 6-1: Annualization factors used for appraisal

Time Period	Annualization factor
AM (07:00-10:00)	616
LT (10:00-13:00)	3,044
SR (13:00-16:00)	688
PM (16:00-19:00)	688

A sectoring file was used to aid analysis of the scheme impacts. The five sectors used for this analysis are shown in Figure 6-1 and in **Table 6-2**.

Table 6-2: Sectors

Sector Number	Description
1	Reference Metro
2	Metro Expansion
3	Rest of Dublin
4	Rest of GDA
5	External

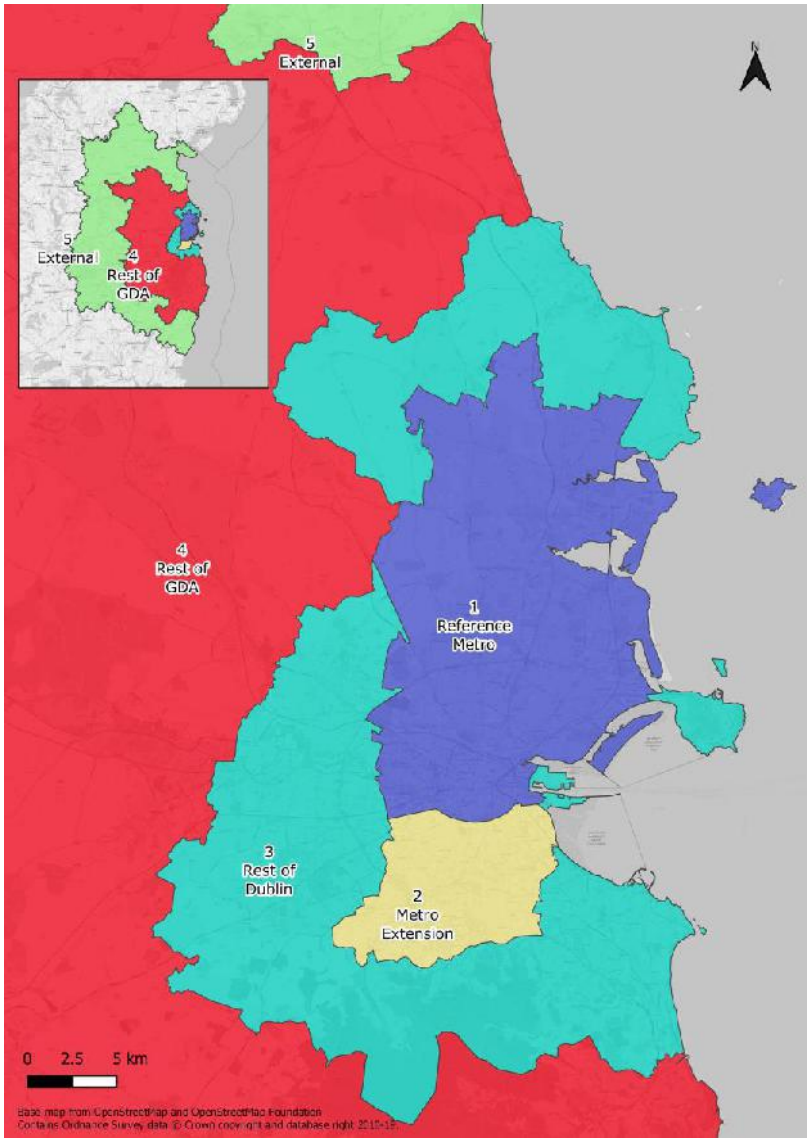


Figure 6-1: Sector Map

To align with the construction plan, the Public Transport User benefits appraisal has assumed a first year of 2030, with modelled years of 2030 and 2045. In line with PAG guidance, a 60-year appraisal period has been considered, meaning 2089 has been used as the horizon year. In line with the appraisal of the core MetroLink scheme, CUBE weighted generalised cost outputs were used for the appraisal of the public transport element of the scheme and standard outputs for the highway's element. The highways element is not affected by discrepancies in cost calculations in the CUBE / appraisal interface and so use of standard outputs is appropriate.

6.2 Option A Through Running – Metro Estuary – Ballycullen Extension to the South

6.2.1 Introduction

Section 6.2 discusses the user and provider impacts expected to occur as a result of the Metro Estuary to Ballycullen MetroLink development, Southern Extension. An overview of this route option is provided in the Transport Modelling chapter of this report.

Option A is expected to provide connectivity from Ballycullen to the city centre, via Charlemont as part of a through service from Estuary to Ballycullen. It is expected to provide a total of €1.99bn (2011 prices and values) benefits over the appraisal period. This includes benefits through improved accessibility to and from the city centre via public transport, and benefits for highways users from decreased congestion as a result of modal shift away from private road vehicles.

Figure 6-2 illustrates the total combined Public Transport and Highways impact of the proposed scheme for trip origins. Positive benefits can be seen in the two sectors covering the entire alignment (Reference Metro and Metro Extension). Residents along the alignment will now have access to MetroLink, improving city centre access.

The Rest of Dublin Area to the west of the main route corridor experiences origin benefits as a result of the proposed scheme in a similar scale compared to the two central sectors. Further, the Rest of GDA Area is expected to experience disbenefits as a result of the scheme.

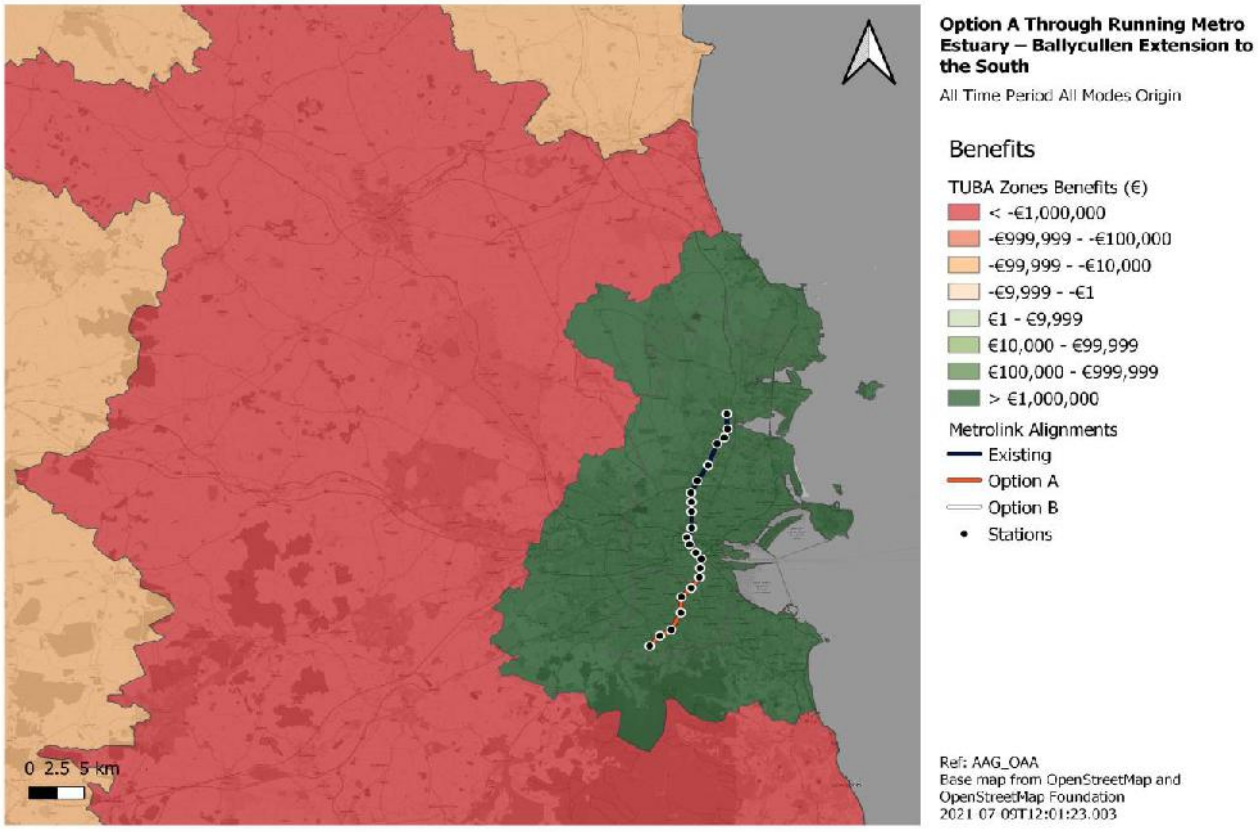


Figure 6-2: Total monetised user impact (€), all times periods, 2045, origin, 2011 prices and values.

Figure 6-3 illustrates the total combined Public Transport and Highways impact of the proposed scheme for trip destinations. It shows a similar distribution of impacts to Figure 6-2. Particularly, large benefits are expected to accrue for residents within the two central sectors. The majority of Dublin experiences net benefits as a result of

the proposed scheme. This is likely to be due to users benefitting from improved city centre access following the extension of the southern section of the MetroLink.

The Rest of GDA sector is expected to experience disbenefits as a result of the proposed scheme.

As outlined below these impacts are primarily driven by impacts on highway users. Congestion at a number of the junctions on the M50 is a known future issue with the modelling of these being potentially sensitive to relatively small demand changes – further exploration of the impacts here would be recommended as part of any further work on this option.

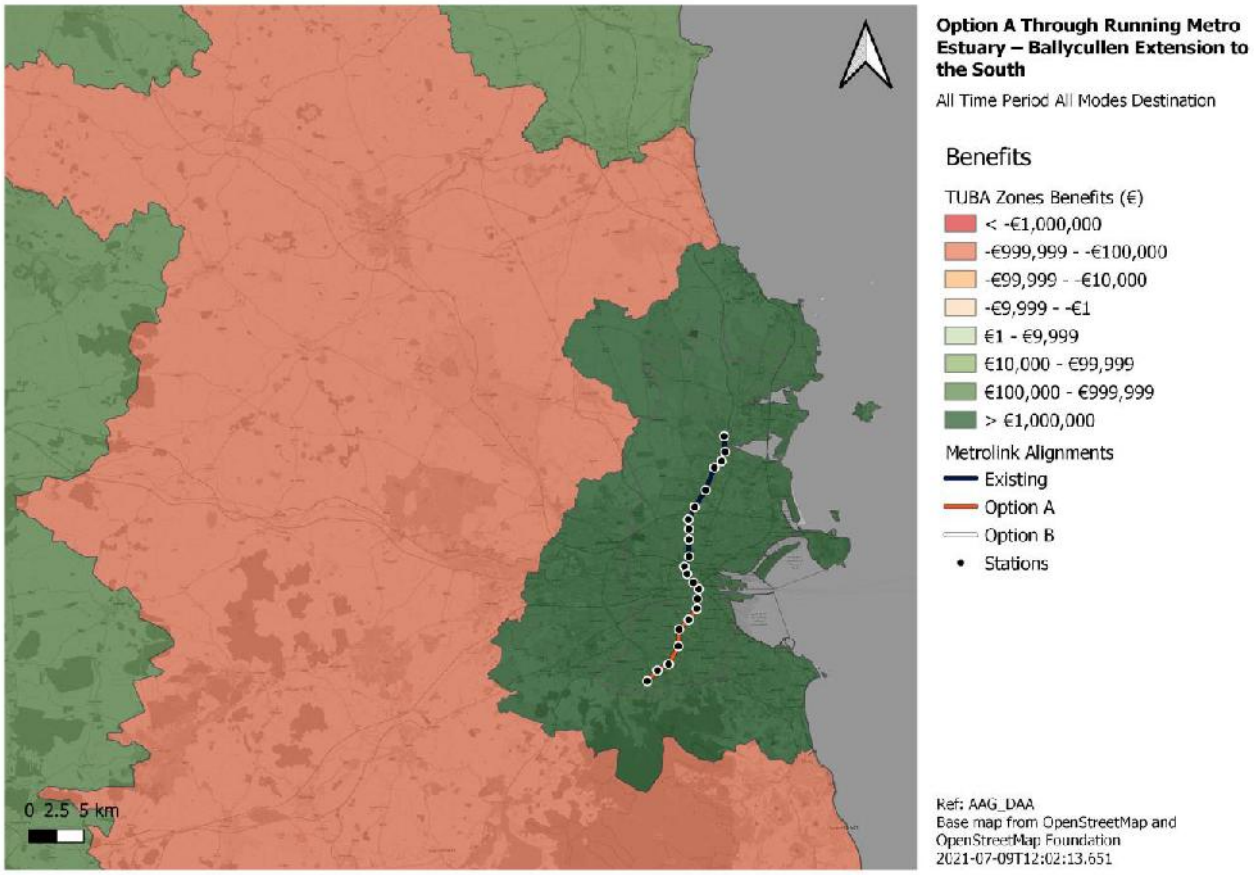


Figure 6-3: Total monetised user impact (€), all time periods, 2045, destination, 2011 prices and values.

Further detail, disaggregated by journey type, is provided in Table 6-6 of this report.

6.2.2 Public Transport

Figure 6-4 illustrates the Public Transport impact of the proposed scheme for AM trip origins. This primarily considers the benefits arising for commuters travelling to work, mapped by their origin.

Generally, there are widespread low-level benefits across Dublin. The central sectors experience benefits of greater than €1m. The areas to the west of the scheme corridor experience the lowest benefit. Residents of these areas must travel the furthest to reach the scheme.

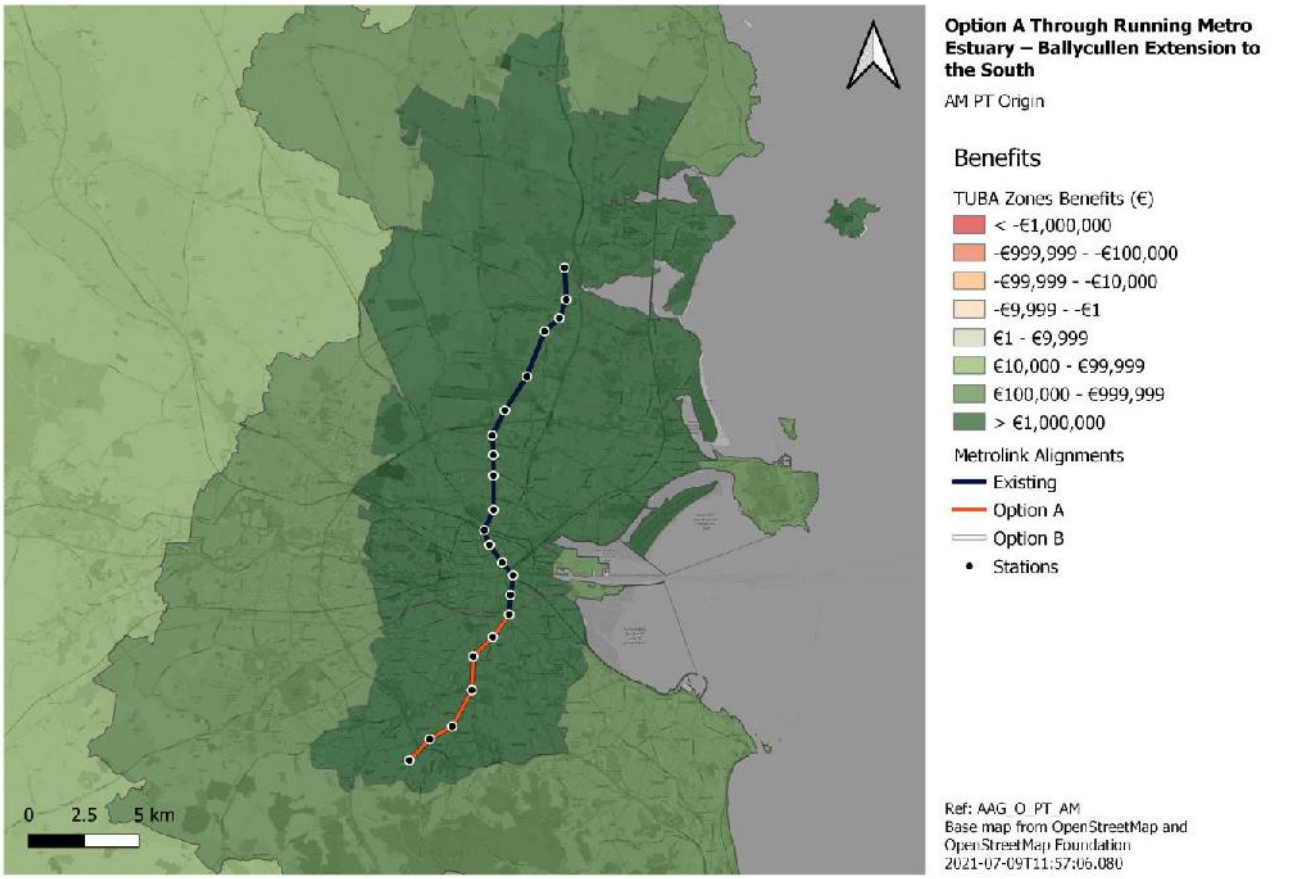


Figure 6-4: Total monetised user impact (€), AM, 2045, origins, 2011 prices and values.

Figure 6-5 illustrates the Public Transport impact of the proposed scheme for PM trip destinations. The general distribution of impacts is widespread, with benefits experienced in all sectors. The highest benefits are received in the two central sectors.

Both the Rest of Dublin and Rest of GDA Areas experience benefits but in a lower range compared to the central areas. Residents of these areas have to travel the furthest to reach the scheme.

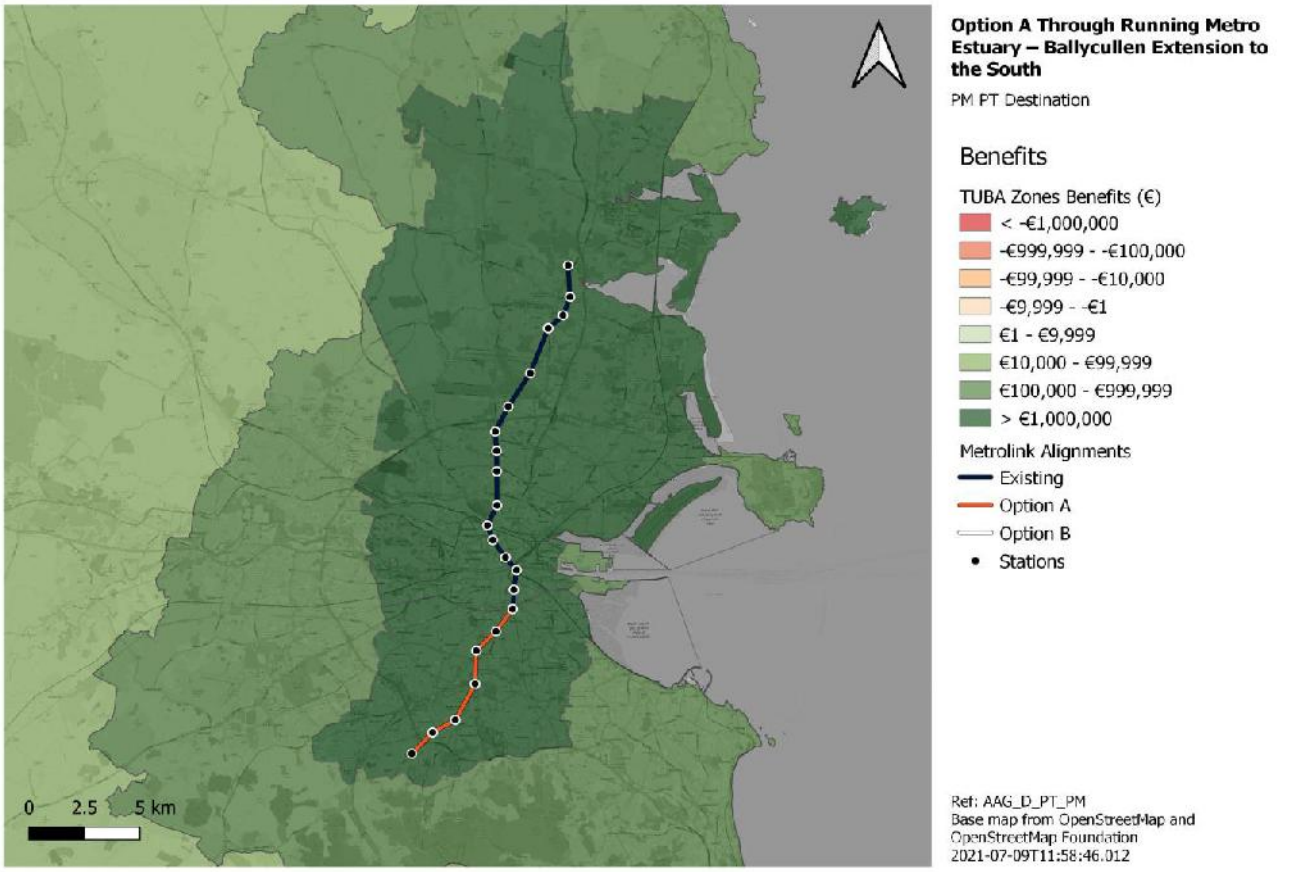


Figure 6-5: Total monetised user impact (€), PM, 2045, destinations, 2011 prices and values.

Table 6-3 shows the distribution of monetised public transport user time impacts by trip purpose. All five trip purposes receive a net monetised user time benefit as a result of the Option A Alignment. Leisure trips receive the greatest benefit with aggregate user benefits of €736,200,000 (2011 prices and values) across the 60-year appraisal period. Large benefits are also received by business and commuting users, while slightly smaller benefits are received by the educational and retired user groups.

The 'User Charges' column in **Table 6-3** indicates the welfare change for Public Transport users from the change in fare payments. A negative user charge value is expected for all trip purposes as a result of the Option A Alignment. The greatest disbenefit is expected for leisure trips, which sees disbenefits of over -1,500,000 (2011 prices and values).

As this is a public transport scheme there are no vehicle operating costs considered within this part of the appraisal because public transport users do not perceive them. Any costs associated with the additional Metro vehicles required to operate the scheme and their operations are captured within the costs estimates.

Table 6-3: Total monetised user impacts by trip purpose over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Trip Purpose	User Time impacts (€)	User Charges (€)
Business	426,200,000	-600,000
Commuting	311,800,000	-1,000,000
Leisure	736,200,000	-1,500,000
Education	-	-
Retired	-	-

Table 6-4 shows the total monetised public transport user impacts accrued across the 60-year appraisal period disaggregated by time period. All four time periods are expected to receive net benefits over the 2030-2089 appraisal period. The LT time period is expected to receive approximately €590,200,000 (2011 prices and values) of benefits – the most of any time period. This is partly due to the high number annualization factor associated with this period, which is used to approximate off peak and weekend trips. Benefits in the AM and PM time periods are of a similar magnitude (approximately €350,000,000) (2011 prices and values), while the SR time period receives the lowest value of benefits.

The 'User Charges' column in Table 6-4 indicates the welfare change for Public Transport users from the change in fare payments. A negative user charge value is expected for all time periods as a result of the Option A Alignment. The greatest disbenefit is expected for AM trips, with disbenefits of over -€1,900,000 (2011 prices and values).

Table 6-4: Total monetised user impacts by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	User Time impacts (€)	User Charges (€)
AM	392,200,000	-1,900,000
LT	590,200,000	-200,000
SR	156,300,000	-
PM	335,400,000	-1,000,000

Table 6-5 shows the change in operator revenue and indirect tax revenue as a result of the proposed scheme, disaggregated by time period. All four time periods are expected to see an increase in operator revenue as a result of the proposed scheme. This is because of an increase in MetroLink patronage for all time periods, with more people willing to use the scheme as a result of the proposed improvements. The greatest increase in operator revenue is experienced in the LT time period, with over €97,000,000 (2011 prices and values) increase in revenue. The increase in operator revenue in the AM and PM time periods is broadly similar.

A reduction in indirect tax revenue can be seen for all time periods, with the greatest reduction in the LT time period (over €11,000,000) (2011 prices and values). Indirect tax revenues are expected to fall as a result of the proposed scheme due to the increase in public transport patronage. Increased public transport usage is causes a re-allocation of expenditure towards public transport. As consumers spend a greater proportion of their income on public transport (which is not taxable) and less on alternative, taxable, consumption, indirect tax revenue falls.

Table 6-5: Total monetised provider impacts and changes in indirect tax revenues by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	Operator Revenue (PT fares) (€)	Indirect Taxes (€)
AM	54,200,000	-7,900,000
LT	97,400,000	-11,900,000
SR	21,500,000	-3,100,000
PM	49,900,000	-7,100,000

6.2.3 Highways

Figure 6-6 illustrates the Highways impact of the proposed scheme for AM trip origins. This primarily considers the benefits arising for commuters travelling to work, mapped by their origin. The two central sectors see benefits on a similar scale, with the Rest of Dublin Area expected to experience lower benefits. The Rest of GDA area is expected to experience disbenefits as a result of the scheme.

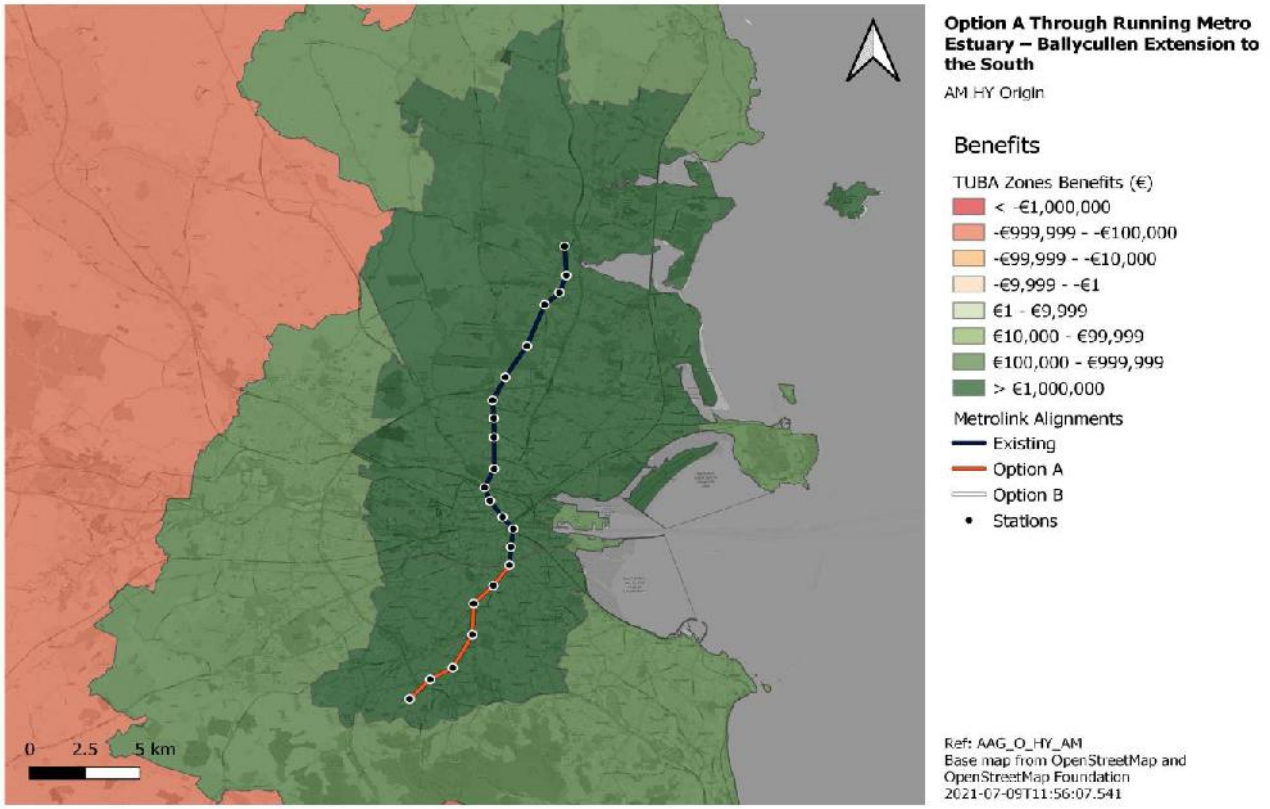


Figure 6-6: Total monetised user impact (€), AM, 2045, origins, 2011 Prices and Values.

Figure 6-7 illustrates the Public Transport impact of the proposed scheme for PM trip destinations. The distribution of impacts is similar to the AM Highway Origins map in Figure 6-6. However, the Metro Expansion Area south of the city centre is expected to experience lower benefits compared to AM trip origins.

Disbenefits are experienced by highways users in the Rest of GDA Area.

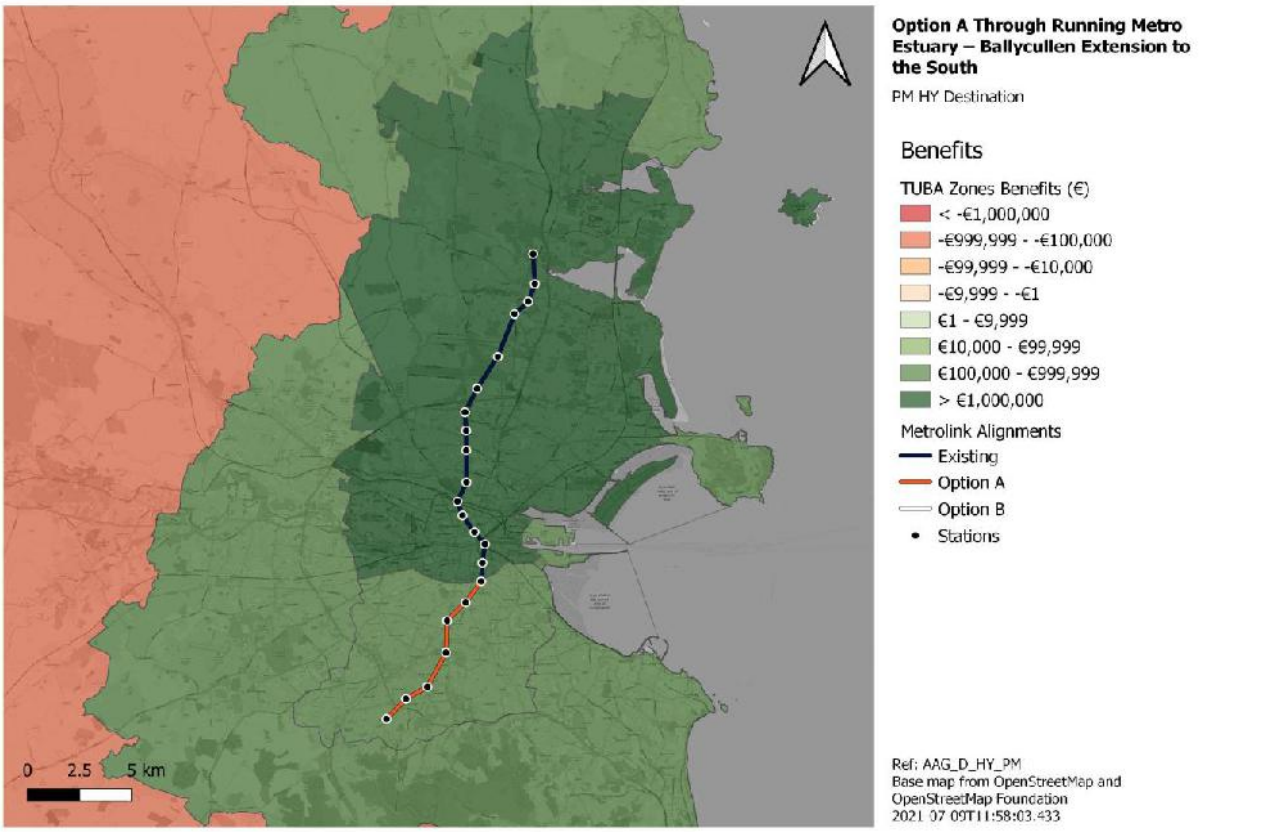


Figure 6-7: Total monetised user impact (€), PM, 2045, destination, 2011 prices and values.

Table 6-6 shows the distribution of monetised highways user time impacts by trip purpose. All five trip purposes experience a monetised user time benefit as a result of the Option A Alignment, with the greatest benefit being the €212,300,000 (2011 prices and values) received by business trips across the 60-year appraisal period.

A disbenefit as a result of user charge changes (national toll) can be seen for business trips, indicating this group sees the greatest increase in toll payments.

Table 6-6 also shows the change in welfare resulting from changes in vehicle operating costs for highways users as a result of the scheme. Positive welfare benefits can be seen for fuel and non-fuel vehicle operating costs across all five trip purposes, with the greatest benefit for business travel and commuting. Positive welfare benefits indicate highways users have to pay lower operating costs as a result of the MetroLink improvements. A large proportion of this benefit is likely to be due to a reduction in congestion.

Table 6-6: Total monetised user impacts and vehicle operating costs by trip purpose over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Trip Purpose	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
Business	212,300,000	-500,000	1,600,000	3,600,000
Commuting	78,200,000	100,000	1,600,000	5,300,000
Leisure	17,000,000	300,000	200,000	700,000
Education	9,100,000	300,000	100,000	200,000
Retired	8,600,000	300,000	100,000	200,000

Table 6-7 shows the distribution of monetised highways user time impacts, user charges and vehicle operating costs (fuel and non-fuel), disaggregated by time period. The greatest user time benefit is experienced in the AM time period, where benefits of €144,400,000 (2011 prices and values) accrue over the 60-year appraisal period. Time benefits are also experienced in the other time periods. These benefits are likely to accrue due to the reduction in highways congestion from the implementation of the MetroLink improvements allowing quicker road journeys.

Table 6-7 shows the benefit impact of changes in user charge payments (tolls) as a result of the proposed scheme, disaggregated by time period. Both the AM and LT time periods see a benefit from changes in user charge payments over the 60-year appraisal period. However, the benefit in the AM time period is smaller than €100,000. The benefits are likely to be the result of reduced travel on toll roads due to a decrease in congestion on non-toll roads. Disbenefits can be seen in the SR and PM time periods. This suggests highways users in these time periods are paying more toll charges than they were previously.

Table 6-7 also shows the change in welfare from changes in vehicle operating costs for highway users as a result of the scheme. A benefit can be seen as a result of changes in both fuel and non-fuel vehicle operating costs for all time periods. This suggests highways users are spending less on vehicle operating costs either due to shorter highway or less congested highway journeys.

Table 6-7: Total monetised user impacts by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
AM	144,400,000	-	1,300,000	2,800,000
LT	21,700,000	1,100,000	800,000	3,700,000
SR	61,200,000	-200,000	700,000	1,400,000
PM	97,800,000	-500,000	800,000	2,100,000

Table 6-8 shows the expected change in operator and indirect tax revenue as a result of the proposed scheme, disaggregated by time slice.

All time periods experience a reduction in indirect tax revenue over the 60-year appraisal period. This indicates a reduction in taxable expenditure on road travel by highways users travelling in these time periods.

Table 6-8: Total provider impacts and changes in indirect tax revenues by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	Operator Revenue National Toll (€)	Indirect Taxes (€)
AM	-600,000	-7,900,000
LT	-6,700,000	-11,900,000
SR	-800,000	-3,100,000
PM	-400,000	-7,100,000

Table 6-9 shows the distribution of monetised highways user time impacts, user charges and vehicle operating costs (fuel and non-fuel), disaggregated by vehicle type. The greatest user time benefits are experienced by car users, who received over 80% of all highway benefits generated by the proposed scheme. Positive benefits are experienced by all vehicle types. Car users also experience a benefit from the change in user charge payments, of approximately €400,000 (2011 prices and values).

Table 6-9 also shows the change in welfare from changes in vehicle operating costs for highway users as a result of the scheme. Benefits are seen for all vehicle types for both fuel and non-fuel operating costs, implying reductions in operating costs for all vehicle types. The greatest benefits are experienced by car users.

Table 6-9: User benefits and changes in revenues by submode/vehicle type over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Vehicle Type	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
Car	266,200,000	400,000	2,400,000	9,700,000
LGV	55,700,000	100,000	1,200,000	100,000
OGV1	3,300,000	-	-	200,000
OGV2	-	-	-	-
All	325,200,000	500,000	3,600,000	10,000,000

Table 6-10 shows the expected change in operator and indirect tax revenue as a result of the proposed scheme, disaggregated by vehicle type. A reduction in toll revenue of over €8,000,000 (2011 prices and values) is expected from car users. This is likely to be caused by car users switching to non-toll roads due to reductions in congestion as a result of the scheme. A decrease in indirect tax revenue is expected from all vehicle types as a result of the Option A Alignment over the 60-year appraisal period. This indicates a reduction in taxable expenditure on road travel by highways users travelling by these vehicle types.

Table 6-10: Total provider impacts and changes in indirect tax revenues by submode/vehicle type over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Vehicle Type	Operator Revenue National Toll (€)	Indirect Taxes (€)
Car	-8,400,000	-500,000
LGV	-100,000	-500,000
OGV1	-	-
OGV2	-	-
All	-8,500,000	-1,000,000

6.2.4 Summary

Figure 6-8 presents the combined Highways and Public Transport Economic Efficiency of the Transport System (TEE) Tables over a 60-year Appraisal Period (2011 prices and values).

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Highway**	**Public Transport**
Travel Time	€ 389,991	€ 78,218	€ 311,774
Vehicle operating costs	€ 6,904	€ 6,904	€ 0
User charges	-€ 827	€ 141	-€ 968
During Construction & Maintenance	€ 0	€ 0	€ 0
NET CONSUMER - COMMUTING BENEFITS	**€ 396,068**	**€ 85,262**	**€ 310,806**

Consumer - Other user benefits	**All Modes**	**Highway**	**Public Transport**
Travel Time	€ 770,831	€ 34,656	€ 736,176
Vehicle operating costs	€ 1,513	€ 1,513	€ 0
User charges	-€ 679	€ 819	-€ 1,498
During Construction & Maintenance	€ 0	€ 0	€ 0
NET CONSUMER - OTHER BENEFITS	**€ 771,665**	**€ 36,988**	**€ 734,677**

	All Modes	**Highway**		**Public Transport**	
Business		Road Personal	Road Freight	Bus Personal	Bus Freight
Travel Time	€ 638,491	€ 209,003	€ 3,309	€ 426,179	€ 0
Vehicle operating costs	€ 5,218	€ 4,996	€ 223	€ 0	€ 0
User charges	-€ 1,148	-€ 455	-€ 45	-€ 649	€ 0
During Construction & Maintenance	€ 0	€ 0	€ 0	€ 0	€ 0
Subtotal	**€ 642,561**	**€ 213,544**	**€ 3,487**	**€ 425,530**	**€ 0**

Private Sector Provider Impacts	**All Modes**	**Highway**	**Public Transport**
Revenue	€ 214,543	-€ 8,460	€ 223,003
Operating costs	€ 0	€ 0	€ 0
Investment costs	€ 0	€ 0	€ 0
Grant/subsidy	€ 0	€ 0	€ 0
Subtotal	**€ 214,543**	**-€ 8,460**	**€ 223,003**

Other business Impacts			
Developer contributions	€ 0	€ 0	€ 0

NET BUSINESS IMPACT	**€ 857,104**

TOTAL	
Present Value of Transport Economic Efficiency Benefits (TEE)	**€ 2,024,837**

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2011 prices and values

Figure 6-8: Combined Highways and Public Transport TEE Tables (2011 Prices and Values, €000's)

Figure 6-9 shows the combined Highways and Public Transport Public Accounts (PA) Table over a 60-year Appraisal Period (2011 prices and values).

Public Accounts			
Local Government Funding	**ALL MODES**	**Highway**	**Public**
Revenue	€ 0	€ 0	€ 0
Operating Costs	€ 0	€ 0	€ 0
Investment Costs	€ 0	€ 0	€ 0
Developer Contributions	€ 0	€ 0	€ 0
Grant/Subsidy Payments	€ 0	€ 0	€ 0
NET IMPACT	**€ 0**	**€ 0**	**€ 0**
Central Government Funding: Transport	**ALL MODES**	**Highway**	**Public**
Revenue	€ 0	€ 0	€ 0
Operating costs	€ 119,398	€ 0	€ 119,398
Investment costs	€ 2,423,313	€ 0	€ 2,423,313
Developer Contributions	€ 0	€ 0	€ 0
Grant/Subsidy Payments	€ 0	€ 0	€ 0
NET IMPACT	**€ 2,542,711**	**€ 0**	**€ 2,542,711**
Central Government Funding: Non-Transport			
Indirect Tax Revenues	**€ 30,042**	**€ 955**	**€ 29,087**
TOTALS			
Broad Transport Budget	**€ 2,542,711**	**€ 0**	**€ 2,542,711**
Wider Public Finances	**€ 30,042**	**€ 955**	**€ 29,087**

Note: Costs appear as positive numbers, while revenues and developer contributions appear as negative numbers.

Note: All entries are present values discounted to 2011, in 2011 prices

Figure 6-9: Combined Highways and Public Transport PA Table (2011 prices and values, €000's)

Figure 6-10 shows the combined Highways and Public Transport Analysis of Monetised Costs and Benefits (AMCB) Table over a 60-year Appraisal Period (2011 prices and values).

Error! Reference source not found. **Combined Highways AMCB Table (2011 prices and values, €000's)**

It should be noted that no accident valuation has been undertaken as part of this appraisal. However, the impact is expected to be small in comparison to overall scheme benefits and of similar value across schemes.

The BCR for the scheme is 0.8. This represents a return of €0.80 for every €1 spent for direct transport users. Without consideration of other wider benefits which may be associated with the scheme, the Option A alignment provides poor value for money.

6.3 Option B Linked St Stephen's Green – Metro St Stephen's Green-Ballycullen

6.3.1 Introduction

Section 6.3 of this report discusses the user and provider impacts expected to occur as a result of Option B, the Ballycullen to St Stephen's Green MetroLink development. An overview of Option B is provided in the Transport Modelling chapter of this report.

Option B is a standalone line which runs from Ballycullen to a separate terminus at St Stephen's Green station to the south of the city centre. It is designed to improve connectivity to and from the city centre for residents located to the south of Dublin. It is expected to provide a total of €1.82bn (2011 prices and values) benefits to Public Transport users over the appraisal period. This includes benefits through improved accessibility to and from the city centre via public transport.

Figure 6-11 illustrates the total combined Public Transport and Highways impact of the proposed scheme for trip origins. Positive benefits can be seen in the two sectors covering the entire alignment (Reference Metro and Metro Extension) as well as in the Rest of Dublin. Residents along the alignment will now have access to MetroLink, improving city centre access. The Rest of GDA Area is expected to experience slight disbenefits as a result of the scheme.

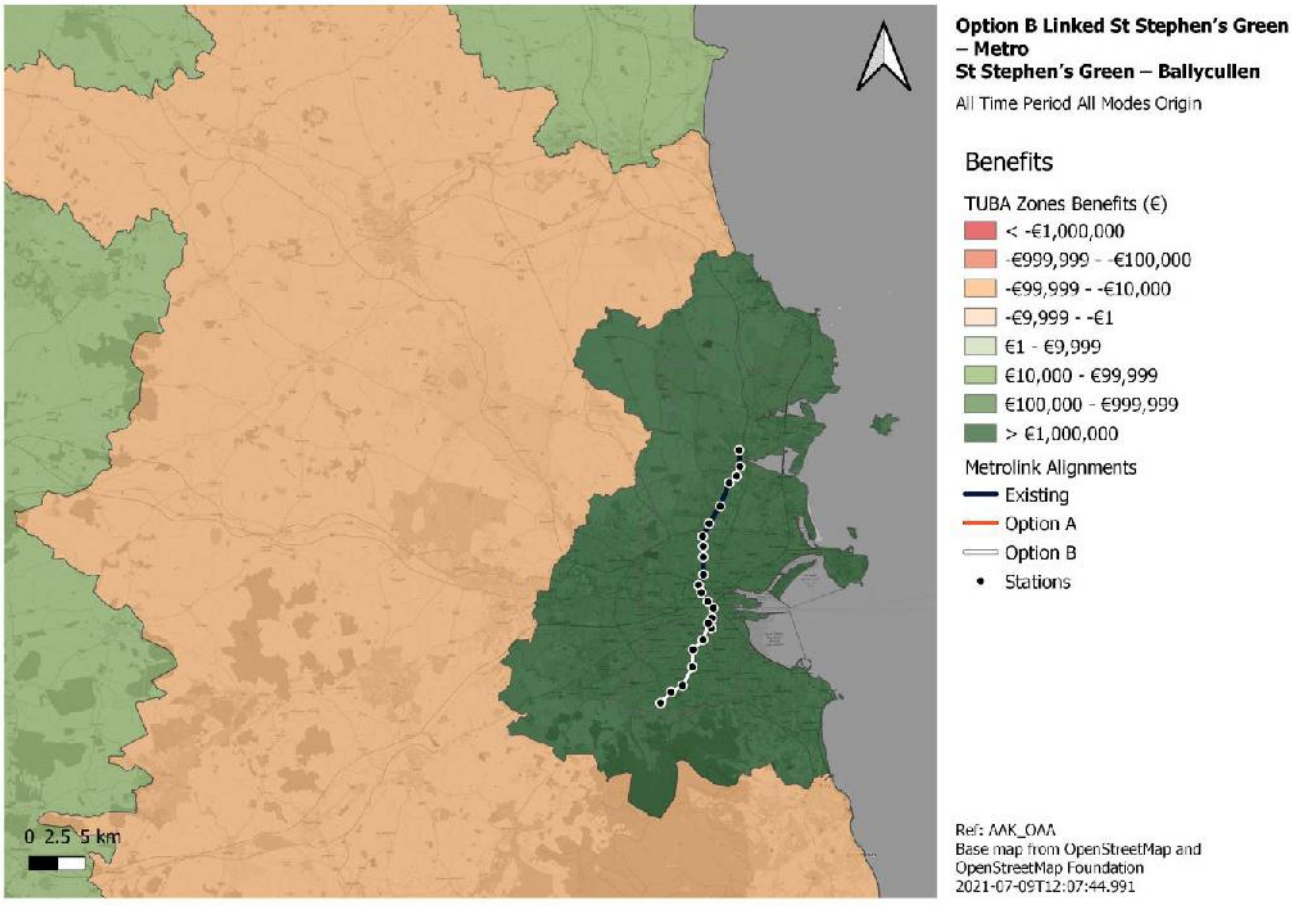


Figure 6-11: Total monetised user impact (€), all times periods, 2045, origin, 2011 prices and values.

Figure 6-12 illustrates the total combined Public Transport and Highways impact of the proposed scheme for trip destinations. It shows a similar distribution of impacts to Figure 6-11 with greater disbenefits as a result of the proposed scheme in the Rest of GDA Area.

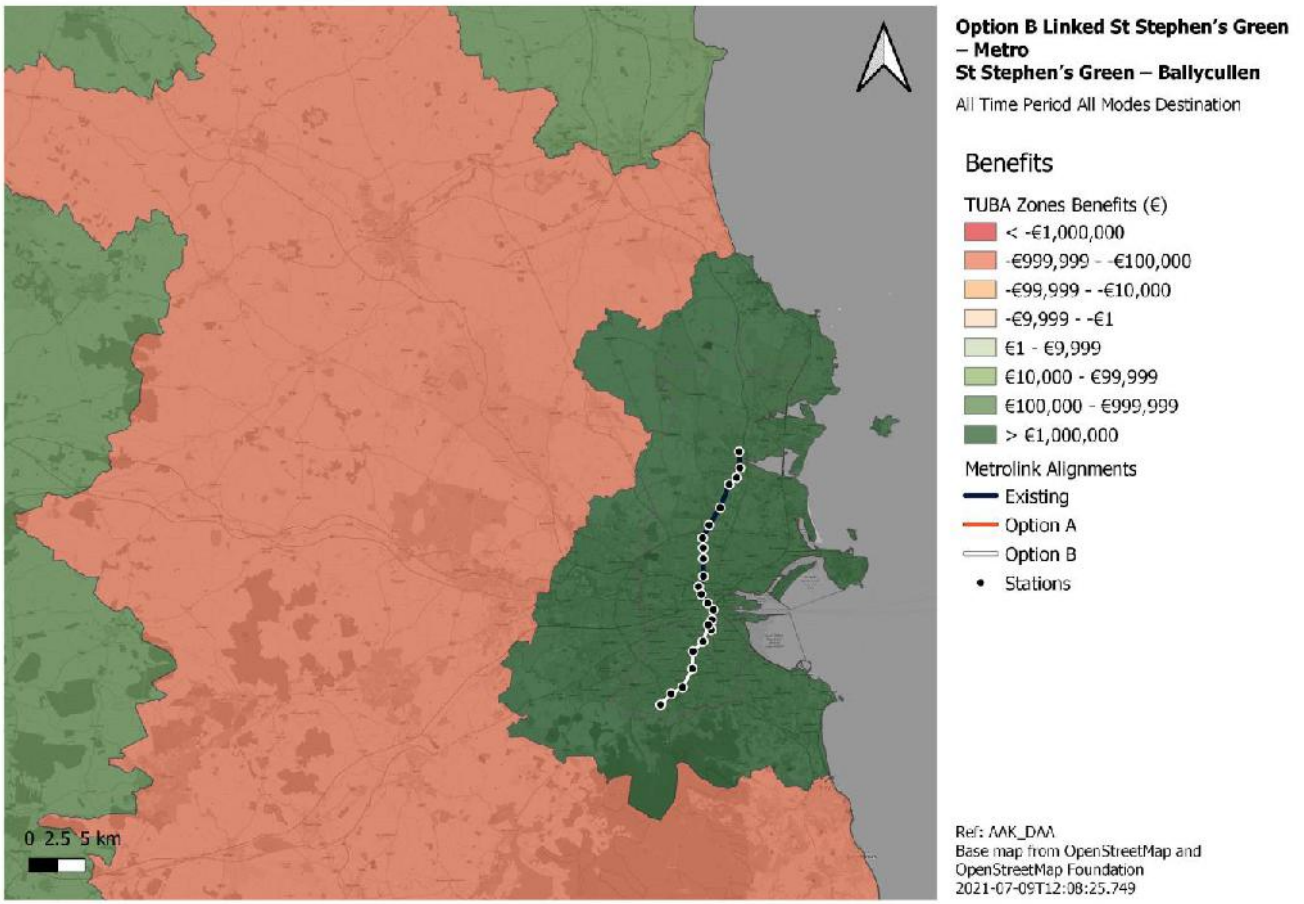


Figure 6-12 Total monetised user impact (€), all times periods, 2045, destination, 2011 prices and values.

6.3.2 Public Transport

Figure 6-13 illustrates the Public Transport impact of the proposed scheme for AM trip origins. This primarily considers the benefits arising for commuters travelling to work, mapped by their origin.

Generally, there are widespread benefits across Dublin. The highest benefits are received in the two central sectors with over €1m. The Rest of GDA Area will experience the lowest benefits as a result of the proposed scheme in the AM period.

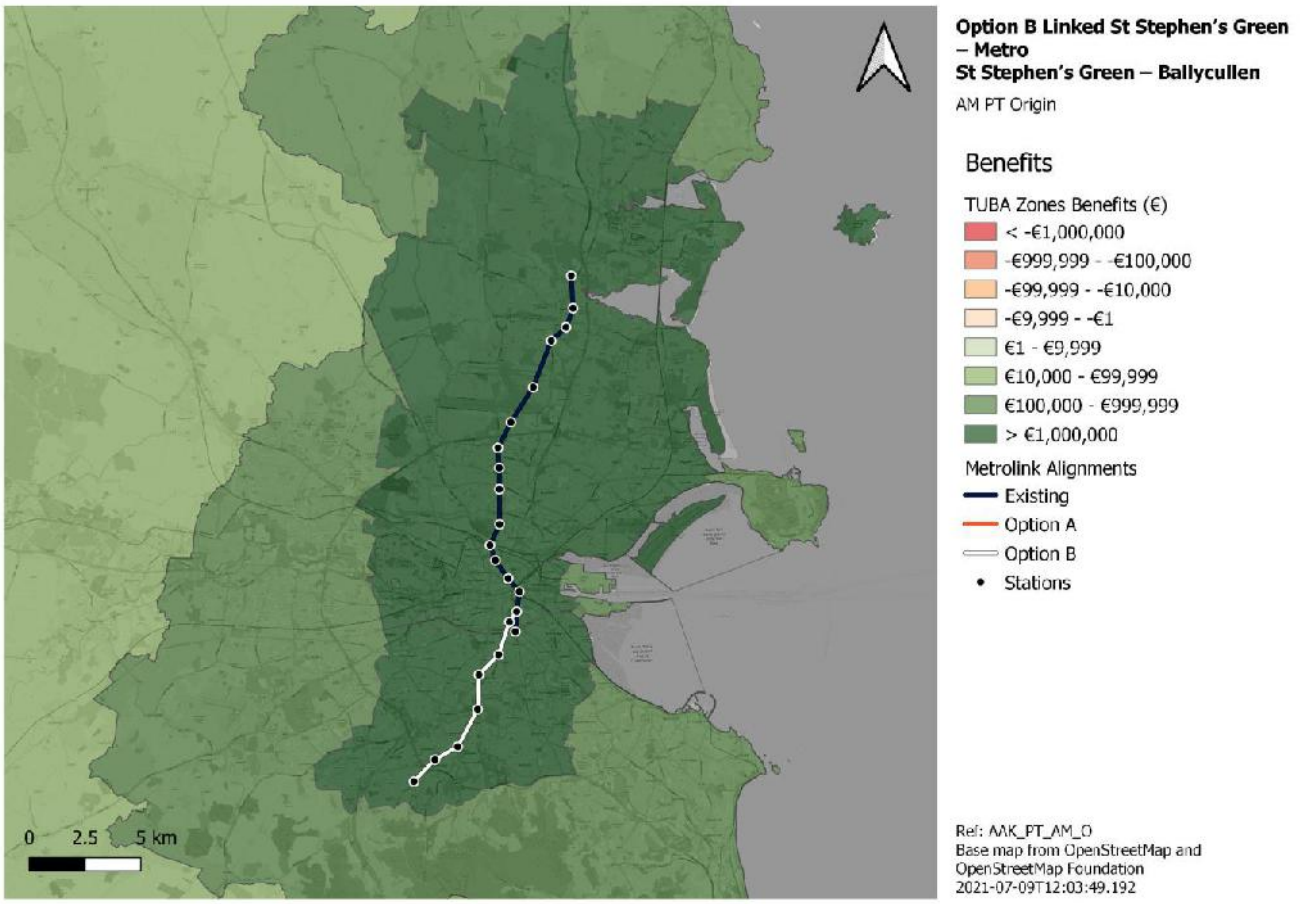


Figure 6-13: Total monetised user impact (€), AM, 2045, origins, 2011 prices and values.

Figure 6-14 illustrates the Public Transport impact of the proposed scheme for PM trip destinations. It shows a very similar distribution of benefits compared to Figure 6-13.

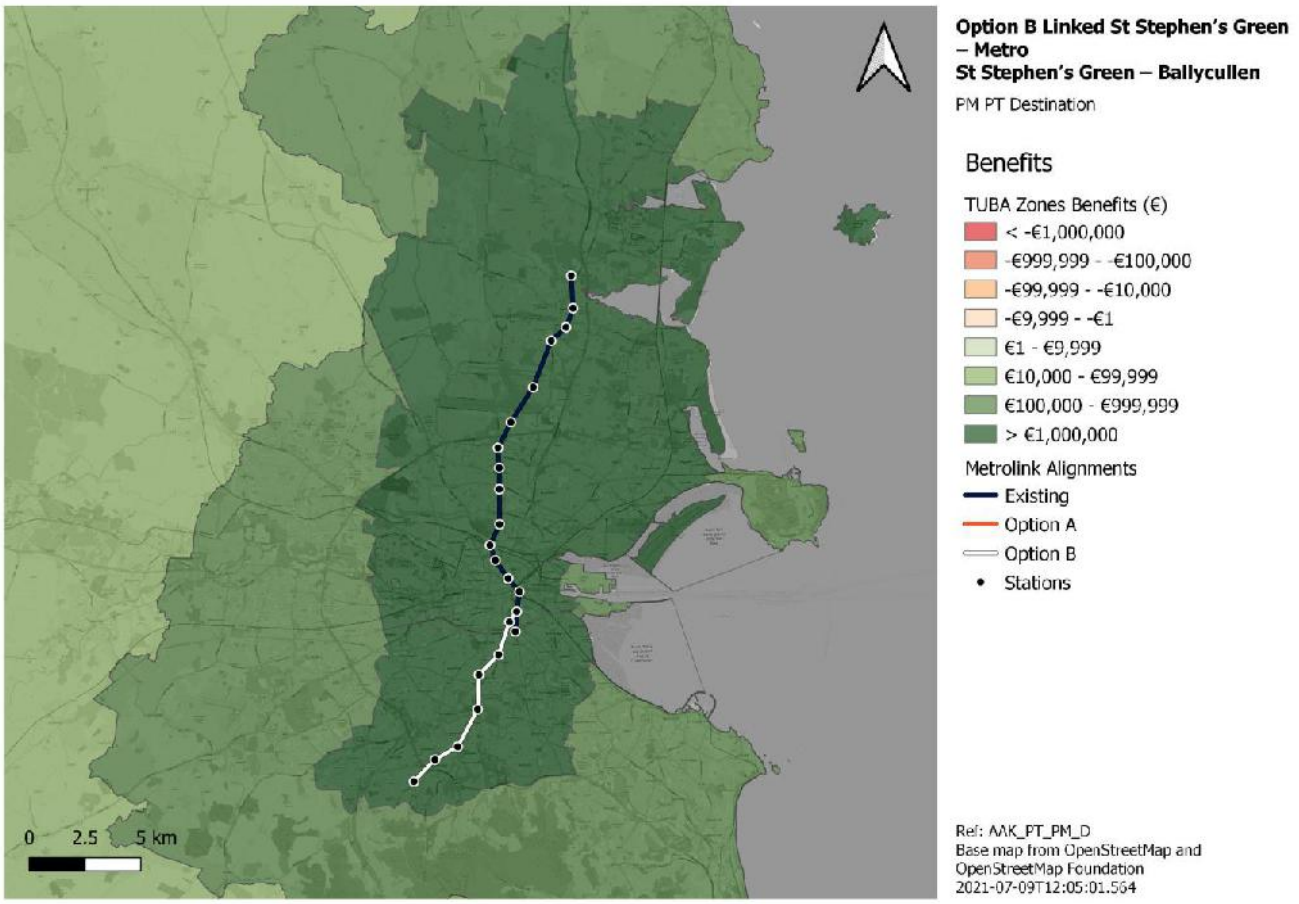


Figure 6-14: Total monetised user impact (€), PM, 2045, Destinations, 2011 prices and values.

Table 6-11 shows the distribution of monetised public transport user time impacts by trip purpose. All trip purposes receive a net monetised user time benefit as a result of the Option B Alignment. Leisure trips receive the greatest benefit, with aggregate user benefits of €697,900,000 (2011 prices and values) across the 60-year appraisal period. Benefits are distributed fairly consistently for business and commuting trip purposes.

The 'User Charges' column in **Table 6-11** indicates the welfare change for Public Transport users from the change in fare payments. A positive user charge value is expected for Leisure trips as a result of the Option B Alignment. Negative user charges are expected for commuting trips.

Table 6-11: Total monetised user impacts by trip purpose over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Trip Purpose	User Time impacts (€)	User Charges (€)
Business	359,200,000	-
Commuting	373,000,000	-1,100,000
Leisure	667,900,000	1,300,000
Education	-	-
Retired	-	-

Table 6-12 shows the total monetised public transport user impacts accrued across the 60-year appraisal period disaggregated by time period. All four time periods are expected to receive net benefits over the 2030-2089

appraisal period. The LT time period is expected to receive approximately €525,000,000 (2011 prices and values) of benefits – the most of any time period. This is significantly higher than the AM and PM time periods.

The 'User Charges' column in Table 6-12 represents the welfare change for Public Transport users from the change in fare payments. A positive user charge value is expected for the LT and SR time periods as a result of the Option B Alignment, suggesting Public Transport users spend less on Public Transport fares than previous. The greatest benefit is expected for LT trips, with benefits of over €1,800,000 (2011 prices and values). Both AM and PM time period are expected to experience a negative user charge value as a result of the scheme.

Table 6-12: Total monetised user impacts by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	User Time impacts (€)	User Charges (€)
AM	382,100,000	-1,500,000
LT	525,400,000	1,800,000
SR	145,200,000	300,000
PM	347,300,000	-400,000

Table 6-13 shows the change in operator revenue and indirect tax revenue as a result of the proposed scheme, disaggregated by time period. All four time periods are expected to see an increase in operator revenue as a result of the proposed scheme. This is because of an increase in MetroLink patronage for all time periods, with more people willing to use the scheme as a result of the proposed improvements. The greatest increase in operator revenue is experienced in the LT time period, with an increase of approximately €55,900,000 (2011 prices and values) in revenue.

A reduction in indirect tax revenue can be seen for all time periods, with the greatest reduction in the LT time period (over €6,000,000) (2011 prices and values). Indirect tax revenues are expected to fall as a result of the proposed scheme due to the increase in public transport patronage. Increased public transport usage is causes a re-allocation of personal expenditure towards public transport. As consumers spend a greater proportion of their income on public transport (which is not taxable) and less on alternative, taxable, consumption, indirect tax revenue falls.

Table 6-13: Total monetised provider impacts and changes in indirect tax revenues by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	Operator Revenue (PT fares) (€)	Indirect Taxes (€)
AM	39,200,000	-5,400,000
LT	55,900,000	-6,800,000
SR	14,600,000	-2,000,000
PM	34,600,000	-4,700,000

6.3.3 Highways

Figure 6-15 illustrates the Highways impact of the proposed scheme for AM trip origins. This primarily considers the benefits arising for commuters travelling to work, mapped by their origin. The metro Extension Sector sees benefits with all other parts expected to experience disbenefits. This includes the Reference Metro sector.

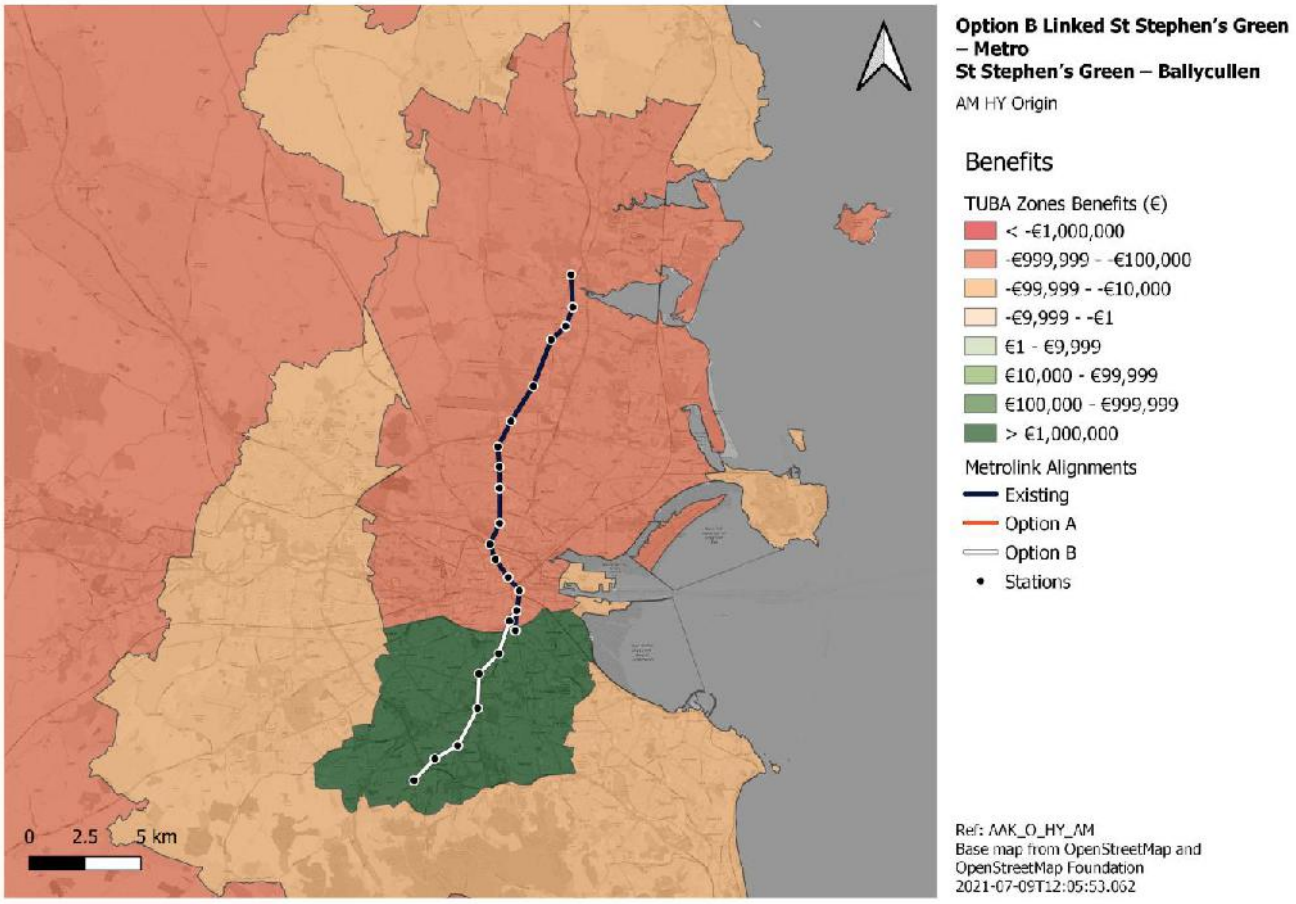


Figure 6-15: Total monetised user impact (€), AM, 2045, origins, 2011 Prices and Values.

Figure 6-16 illustrates the Highway impact of the proposed scheme for PM trip destinations. Whilst benefits are experienced by highway users in both the Metro Extension Area and the Rest of Dublin, the Reference Metro Area and the Rest of the GDA Area are expected to experience disbenefits.

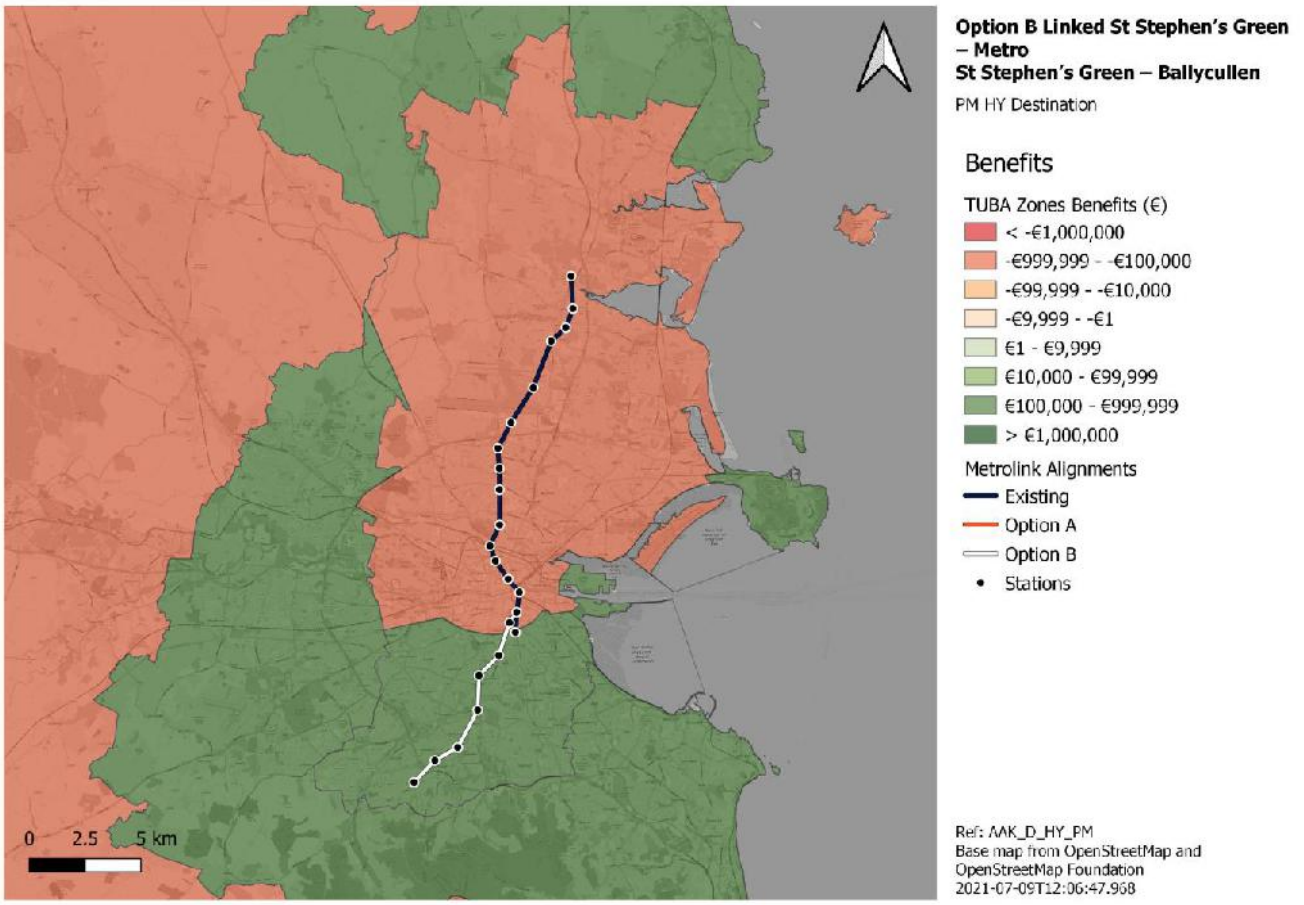


Figure 6-16: Total monetised user impact (€), PM, 2045, destination, 2011 prices and values.

Table 6-14 shows the distribution of monetised highways user time impacts by trip purpose. All five trip purposes experience a monetised user time benefit as a result of the Option B Alignment, with the greatest benefit being the €129,900,000 (2011 prices and values) received by business trips across the 60-year appraisal period. Disbenefits as a result of user charge changes (national toll) can be seen for all trip purposes apart from a minor increase lower than €100,000 for business trips.

Table 6-14 also shows the change in welfare resulting from changes in vehicle operating costs for highways users as a result of the scheme. Positive welfare benefits can be seen for fuel and non-fuel vehicle operating costs across all five trip purposes, with the greatest benefit for business travel and commuting. Positive welfare benefits indicate highways users have to pay lower operating costs as a result of the MetroLink improvements. A large proportion of this benefit is likely to be due to a reduction in congestion.

Table 6-14: Total monetised user impacts and vehicle operating costs by trip purpose over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Trip Purpose	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
Business	129,900,000	-	900,000	2,200,000
Commuting	105,600,000	-900,000	2,000,000	4,900,000
Leisure	31,200,000	-200,000	300,000	700,000
Education	11,000,000	-200,000	100,000	100,000
Retired	11,000,000	-200,000	100,000	100,000

Table 6-15 shows the distribution of monetised highways user time impacts, user charges and vehicle operating costs (fuel and non-fuel), disaggregated by time period. The greatest user time benefit is experienced in the LT time period, where benefits of €229,200,000 (2011 prices and values) accrue over the 60-year appraisal period. Time benefits are also experienced in the other time periods. These benefits are likely to accrue due to the reduction in highways congestion from the implementation of the MetroLink improvements allowing quicker road journeys.

Table 6-15 also shows the benefit impact of changes in user charge payments (tolls) as a result of the proposed scheme, disaggregated by time period. Both the AM and LT time periods see a disbenefit from changes in user charge payments over the 60-year appraisal period. This suggests highways users in these time periods are paying more toll charges than they were previously. Minor benefits are experienced in both the SR and PM time periods. The benefits are likely to be the result of reduced travel on toll roads due to a decrease in congestion on non-toll roads.

Table 6-15 also shows the change in welfare from changes in vehicle operating costs for highway users as a result of the scheme. A benefit can be seen as a result of changes in both fuel and non-fuel vehicle operating costs in the AM, LT and SR time periods. This suggests highways users are spending less on vehicle operating costs. However, disbenefits can be seen in the PM period.

Table 6-15: Total monetised user impacts by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
AM	27,800,000	-400,000	400,000	300,000
LT	229,200,000	-1,300,000	2,500,000	6,900,000
SR	70,800,000	100,000	800,000	1,500,000
PM	39,100,000	200,000	-100,000	-600,000

Table 6-16 shows the expected change in operator and indirect tax revenue as a result of the proposed scheme, disaggregated by time slice. The LT, SR and PM time periods experience a reduction in indirect tax revenue over the 60-year appraisal period. This indicates a reduction in taxable expenditure on road travel by highways users travelling in these time periods. The PM time period experiences a slight increase in indirect tax revenue.

Table 6-16: Total provider impacts and changes in indirect tax revenues by time period over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Time Period	Operator Revenue National Toll (€)	Indirect Taxes (€)
AM	300,000	-200,000
LT	-5,200,000	-700,000
SR	-900,000	-300,000
PM	-800,000	200,000

Table 6-17 shows the distribution of monetised highways user time impacts, user charges and vehicle operating costs (fuel and non-fuel), disaggregated by vehicle type. The greatest user time benefits are experienced by car users, who received over 50% of all highways benefits generated by the proposed scheme. Positive benefits are experienced by all vehicle types. Car users experience disbenefit from the change in user charge payments, of approximately -€2,900,000 (2011 prices and values).

Table 6-17 also shows the change in welfare from changes in vehicle operating costs for highway users as a result of the scheme. Benefits are seen for all vehicle types for both fuel and non-fuel operating costs, implying reductions in operating costs for all vehicle types. The greatest benefits are experienced by car users.

Table 6-17: User benefits and changes in revenues by submode/vehicle type over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Vehicle Type	User Time (€)	User Charges National Toll (€)	Vehicle Operating Cost (fuel) (€)	Vehicle Operating Cost (non-fuel) (€)
Car	145,100,000	-1,400,000	1,600,000	5,900,000
LGV	113,100,000	-700,000	1,900,000	500,000
OGV1	30,500,000	600,000	100,000	1,700,000
OGV2	-	-	-	-
All	288,700,000	-1,400,000	3,500,000	8,000,000

Table 6-18 shows the expected change in operator and indirect tax revenue as a result of the proposed scheme, disaggregated by vehicle type. A reduction in toll revenue of over €6,000,000 (2011 prices and values) is expected from car users. This is likely to be caused by car users switching to non-toll roads due to reductions in congestion as a result of the scheme. A decrease in indirect tax revenue is expected from all vehicle types as a result of the Option B Alignment over the 60-year appraisal period. This indicates a reduction in taxable expenditure on road travel by highways users travelling by these vehicle types.

Table 6-18: Total provider impacts and changes in indirect tax revenues by submode/vehicle type over a 60-year Appraisal Period (2011 Prices and Values, nearest €100,000).

Vehicle Type	Operator Revenue National Toll (€)	Indirect Taxes (€)
Car	-6,700,000	-100,000
LGV	700,000	-900,000
OGV1	-600,000	-
OGV2	-	-
All	-6,600,000	-1,000,000

6.3.4 Summary

For completeness, the tables are presented in their standard layout in the following pages (with the column for highways benefits included).

Figure 6-17 presents the Public Transport Economic Efficiency of the Transport System (TEE) Tables over a 60-year Appraisal Period (2011 prices and values).

Economy:Economic Efficiency of the Transport System (TEE)

Consumer - Commuting user benefits	**All Modes**	**Highway**	**Public Transport**
Travel Time	€ 478,523	€ 105,555	€ 372,968
Vehicle operating costs	€ 6,938	€ 6,938	€ 0
User charges	-€ 1,981	-€ 911	-€ 1,070
During Construction & Maintenance	€ 0	€ 0	€ 0
NET CONSUMER - COMMUTING BENEFITS	**€ 483,479**	**€ 111,581**	**€ 371,898**

Consumer - Other user benefits	**All Modes**	**Highway**	**Public Transport**
Travel Time	€ 721,095	€ 53,232	€ 667,863
Vehicle operating costs	€ 1,503	€ 1,503	€ 0
User charges	€ 705	-€ 553	€ 1,258
During Construction & Maintenance	€ 0	€ 0	€ 0
NET CONSUMER - OTHER BENEFITS	**€ 723,303**	**€ 54,182**	**€ 669,121**

	All Modes	**Highway**		**Public Transport**	
Business		Road Personal	Road Freight	Bus Personal	Bus Freight
Travel Time	€ 489,086	€ 99,402	€ 30,468	€ 359,216	€ 0
Vehicle operating costs	€ 3,100	€ 1,373	€ 1,727	€ 0	€ 0
User charges	€ 24	-€ 601	€ 643	-€ 19	€ 0
During Construction & Maintenance	€ 0	€ 0	€ 0	€ 0	€ 0
Subtotal	**€ 492,209**	**€ 100,174**	**€ 32,839**	**€ 359,197**	**€ 0**

Private Sector Provider Impacts	**All Modes**	**Highway**	**Public Transport**
Revenue	€ 137,641	-€ 6,605	€ 144,246
Operating costs	€ 0	€ 0	€ 0
Investment costs	€ 0	€ 0	€ 0
Grant/subsidy	€ 0	€ 0	€ 0
Subtotal	**€ 137,641**	**-€ 6,605**	**€ 144,246**

Other business Impacts			
Developer contributions	€ 0	€ 0	€ 0

NET BUSINESS IMPACT	**€ 629,850**

TOTAL	
Present Value of Transport Economic Efficiency Benefits (TEE)	**€ 1,836,632**

Note: Benefits appear as positive numbers, while costs appear as negative numbers.

Note: All entries are present values discounted to 2011, in 2011 prices

Figure 6-17: Public Transport TEE Tables (2011 Prices and Values €1000's).

Figure 6-18 shows the Public Transport Public Accounts (PA) Tables over a 60-year Appraisal Period (2011 prices and values).

Public Accounts			
Local Government Funding	**ALL MODES**	**Highway**	**Public**
Revenue	€ 0	€ 0	€ 0
Operating Costs	€ 0	€ 0	€ 0
Investment Costs	€ 0	€ 0	€ 0
Developer Contributions	€ 0	€ 0	€ 0
Grant/Subsidy Payments	€ 0	€ 0	€ 0
NET IMPACT	**€ 0**	**€ 0**	**€ 0**

Central Government Funding: Transport	**ALL MODES**	**Highway**	**Public**
Revenue	€ 0	€ 0	€ 0
Operating costs	€ 119,398	€ 0	€ 119,398
Investment costs	€ 3,350,636	€ 0	€ 3,350,636
Developer Contributions	€ 0	€ 0	€ 0
Grant/Subsidy Payments	€ 0	€ 0	€ 0
NET IMPACT	**€ 3,470,034**	**€ 0**	**€ 3,470,034**

Central Government Funding: Non-Transport			
Indirect Tax Revenues	**€ 19,853**	**€ 974**	**€ 18,878**

TOTALS			
Broad Transport Budget	**€ 3,470,034**	**€ 0**	**€ 3,470,034**
Wider Public Finances	**€ 19,853**	**€ 974**	**€ 18,878**

Note: Costs appear as positive numbers, while revenues and developer contributions appear as negative numbers.

Note: All entries are present values discounted to 2011, in 2011 prices

Figure 6-18: Public Transport PA Tables (2011 Prices and Values €1000's).

Figure 6-19 shows the Public Transport Analysis of Monetised Costs and Benefits (AMCB) Table over a 60-year Appraisal Period (2011 prices and values).

It should be noted that no accident valuation has been undertaken as part of this appraisal. However, the impact is expected to be small in comparison to overall scheme benefits and of similar value across schemes.

Analysis of Monetised Costs and Benefits	
Greenhouse Gases	**€ 143**
Economic Efficiency: Consumer Users (Commuting)	**€ 483,479**
Economic Efficiency: Consumer Users (Other)	**€ 723,303**
Economic Efficiency: Business Users and Providers	**€ 629,850**
Wider Public Finances (Indirect Taxation Revenues)	**-€ 19,853**
Present Value of Benefits (PVB)	**€ 1,816,922**
Broad Transport Budget	**€ 3,470,034**
Present Value of Costs (PVC)	**€ 3,470,034**
OVERALL IMPACTS	
Net Present Value (NPV)	**-€ 1,653,112**
Benefit to Cost Ratio (BCR)	**0.5**

Note: This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Figure 6-19: Public Transport AMCB Table (2011 Prices and Values €1000's).

The BCR for the scheme is 0.5. This represents a return of €0.50 for every €1 spent for direct transport users. Without consideration of other wider benefits which may be associated with the scheme, the Option B alignment provides poor value for money.

7. Conclusions and Recommendations

Following a demand-led approach, this study has reviewed the demand, economic, technical and environmental feasibility of two alternative Metro alignments which are considered broadly representative of the range of potential Metro options for serving the transport corridor from Central Dublin to Knocklyon via Rathmines.

Technical and environmental issues were reviewed at a high level, sufficient to provide initial confirmation of the expected feasibility around a number of key technical and environmental factors (including tunnel portal location, track alignment, feasibility of spoil removal from the portal site, avoidance of impacts on scheduled national monuments) and to support development of a scheme cost estimates.

Other more detailed aspects, for example disruption during construction, and potential land ownership constraints around the proposed station stop locations, have not been reviewed, but are considered resolvable during design development.

The demand subsequently assessed through use of the NTA's Regional Modelling System and, the results of which were taken forward to complete an assessment of the overall Transport User Benefits and calculate a benefit cost ratio (BCR) for each option. This was undertaken in line with the relevant guidance, and, as with the MetroLink scheme proposals was undertaken using a 60-year appraisal period.

The analysis of the benefits and costs of the proposals show that both have a benefit cost ratio (BCR) of below 1.0. This provides an initial indication that a Metro option is unlikely to be a cost-effective approach to enhancing public transport in this area of Dublin.

Although both options can be seen to offer a poor value of money in appraisal terms, there are significant differences between them, with the through running option offering a cheaper construction subtotal cost due to not having to construct a turnback facility and longer tunnelling as in the SSG linked option.

Review of the demand modelling results highlights that while demand in the AM is high for inbound movements, outbound movements are below 2,000 for off-peak periods. Similarly, for the PM period, demand is also high for outbound movements from the city centre towards Knocklyon.

It should also be noted that, population and employment densities within the corridor remain for the most part relatively low and the corridor is already served by a range of existing public transport services. It was also noted that previous studies for an LRT system in the south-west of the city were undertaken but ruled out, it should also be noted that future transport options in this part of the city should be investigated.

Appendix A. Planning and Policy Background

An overview of the relevant National, Regional and Local land-use and transport planning policy which sets the context for the Metro scheme is presented in this section of the report.

A.1 National Level

Metro is supported by wide ranging National land-use and transport planning policy and plans, including:

- Smarter Travel – A Sustainable Transport Future (DoT 2009), which sets out government policy to achieve a modal shift from the private car to public transport. It forms the basis on which all land-use and transport plans throughout the country are developed;
- Building on Recovery: Infrastructure and Capital Investment 2016-2021. This Capital Plan presents the Government's framework for infrastructure in Ireland over the period 2016-2021 and acknowledges that 'the single largest project will be a new metro link in Dublin' indicating that the metro is scheduled to commence construction in 2021 and be operational by 2026/2027;
- The Draft National Planning Framework ('Ireland 2040 Our Plan') released in September 2017 replaces the National Spatial Strategy for Ireland 2002-2020. This document is a long term, 20-year National Plan which seeks to provide a 'spatial expression of government policy' and provide 'a decision-making framework from which other plans will follow – such as Regional Plans, City and County Development Plans';
- The National Development Plan (2018 – 2027) sets out the investment priorities that will underpin the successful implementation of the new National Planning Framework (NPF) and has a fundamental objective to enhance Ireland's public transport and the environmental sustainability of our mobility systems;
- The 'Strategic Investment Framework for Land Transport' (DTTaS 2015);
- The 'Climate Action and Low Carbon Development Act 2015';
- The 'National Mitigation Plan' (DCCAE 2017); and
- The 'Climate Action Plan' (DCCAE 2019).

A.2 Regional Level

At a regional planning level, Metro is supported by the following land-use and transport planning policy and plans:

- GDA Regional Planning Guidelines (RPGs) 2010–2022 - The Regional Planning Guidelines (RPGs) for the GDA 2010–2022 is a policy document which "*aims to direct the future growth of the Greater Dublin Area over the medium to long term and works to implement the strategic planning framework set out in the National Spatial Strategy (NSS) published in 2002*".

  The RPGs specifically acknowledge the importance of Metro North in serving the airport through the provision of "*a high capacity, high speed connection from the airport to the city centre, feeding local, regional and national public transport hubs, improving the connectivity and operation of the airport*";

  Further reference is made to Metro North and its role in "*providing opportunities to develop new integrated economic development areas or regenerate existing sites and to broaden sectoral business opportunities at strategic locations, taking advantage of fast access to the Airport and the City Centre*";

- The Greater Dublin Area Transport Strategy (2016-2035), which is currently under review identifies Metro as a vital component of the overall, integrated public transport network for Dublin;

  The GDA Transport Strategy and the RPGs are required under legislation to be consistent with each other. It is therefore the role of the Strategy "*to establish the framework for the transport provision necessary to achieve the land use vision set out in the Regional Planning Guidelines*"; and

  The purpose of the GDA Transport Strategy is "*to contribute to the economic, social and cultural progress of the Greater Dublin Area by providing for the efficient, effective and sustainable movement of people and goods*".

A.3 Local Level

At a local planning level, the planning context for Metro is set out within the Dublin City Council Development Plan (2016–2022) and the South Dublin County Council Development Plan (2016–2022). The NTA's Greater Dublin Area Transport Strategy (2016-2035) also provides context for Metro and the Ballycullen-Oldcourt Local Area Plan (2014) is relevant to a portion of the proposed route.

Dublin City Council Development Plan (2016-2022)

Core Strategy

The 'Core Strategy' of the City Development Plan supports Metro North through "*the policies and objectives in this plan promote intensification and consolidation of Dublin City. This will be achieved in a variety of ways, including infill and brownfield development; regeneration and renewal of the inner city; redevelopment of strategic regenerations areas; and the encouragement of development at higher densities, especially along public transport catchments*".

Policy and Objectives

Metro is supported by a number of land-use and transport policies and objectives within the City Development Plan, including specifically 'Policy MT3', which seeks "*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*".

Land Use Zoning

The City Development Plan seeks to ensure a balanced approach to land-use zoning whilst ensuring the necessary services, including public transport facilities, are in place to support planned growth.

South Dublin County Council Development Plan (2016-2022)

Transport & Mobility Strategy

The Transport & Mobility Strategy of the County Development Plan supports Metro through promoting "*integrated strategy for transport and mobility that enhances access and movement within and through the County, while promoting change, in favour of sustainable modes*". It also specifies that "*the settlement, employment and transport strategies are aligned with the aim of strengthening the integration between employment, population and transport services*".

Policy and Objectives

Metro is supported by a number of land-use and transport policies and objectives within the City Development Plan, including specifically 'TM2 Objective 1' which seeks to "*secure the implementation of major public transport projects as identified within the relevant public transport strategies and plans for the Greater Dublin Area*" and

'TM2 Objective 3' which seeks to "*generate additional demand for public transport services through integrated land use planning and maximising access to existing and planned public transport services throughout the network*".

Greater Dublin Area Transport Strategy (2016-2035)

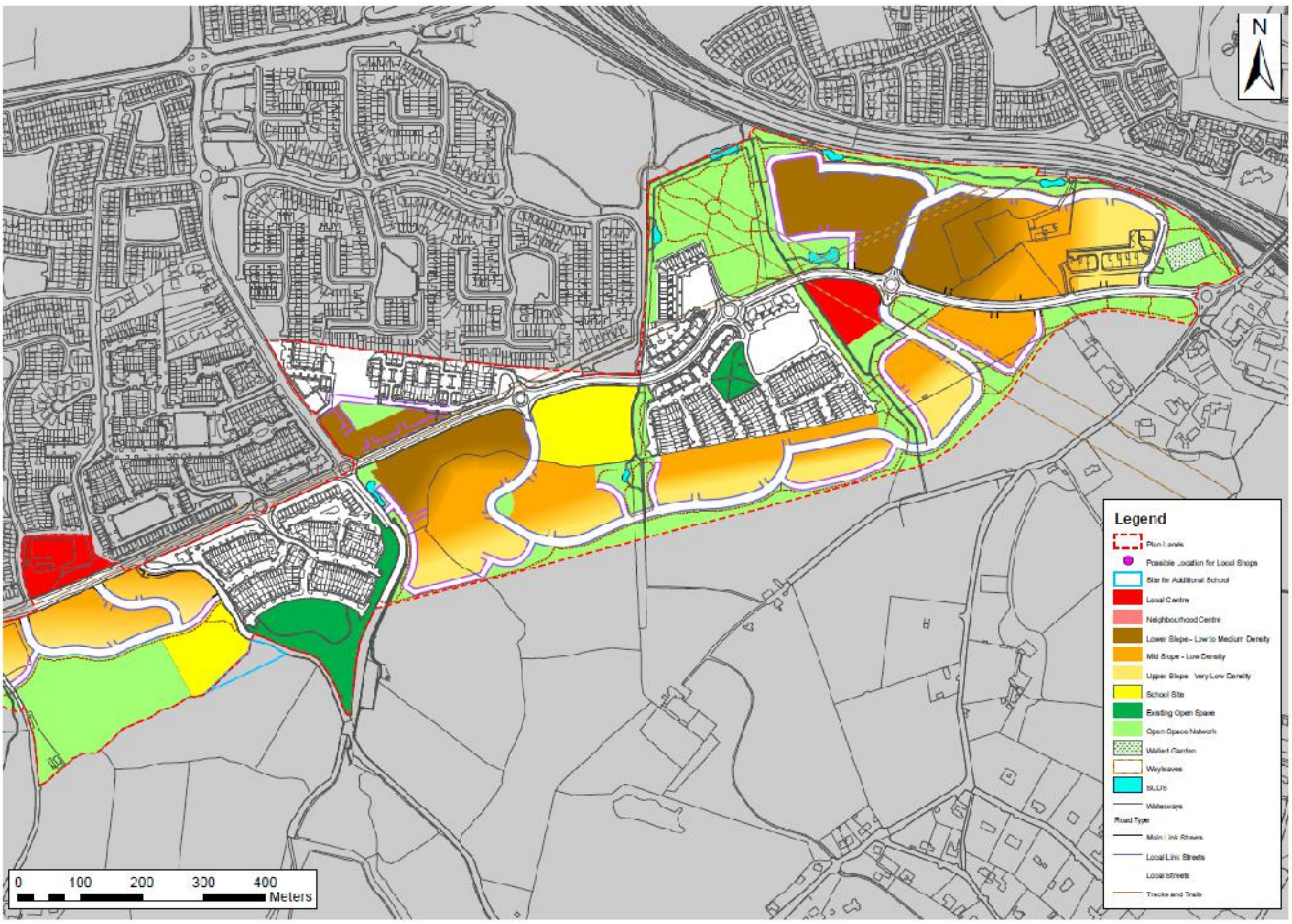
A portion of the proposed route falls under Corridor E (N81 Settlements – South Tallaght – Rathfarnham – to Dublin City Centre) of the GDA Transport Strategy.

"*For the Metropolitan parts of this corridor, the performance of the Rathfarnham Quality Bus Corridor is poor relative to others and requires enhancement. As such, a number of options, including Light Rail, have been examined. However, due to the land use constraints in the corridor and wing to the pressure on the existing road network, a Luas line was not deemed feasible. Instead, the emerging solution comprises a BRT to Tallaght via Rathfarnham and Terenure. This will result in a significant increase in capacity and reliability compared to existing public transport services and will balance public transport requirements with those of the private car. The BRT will be supplemented by a core radial bus corridor between Rathfarnham, Rathmines and the City Centre.*"

Ballycullen-Oldcourt Local Area Plan (2014)

Land Use and Density Strategy

The Strategy directs land uses and densities within three distinct areas (lower slope lands, mid slope lands and upper slope lands, where densities will vary according to the context. As such, it reflects the need to counterbalance some of the higher density residential development that has taken place on the eastern side of the Plan Lands, and the need to protect the setting of the Dublin Mountains, including the sloping topography, its visual prominence and natural heritage features such as hedgerows and streams.



Accessibility and Movement Strategy

Access to upgraded Main Link Streets (Stocking Avenue, Hunters Road, Oldcourt Road) and the new Main Link Street will be prioritised in the form of direct pedestrian and cycle routes to help sustain and improve the relatively frequent public transport services on the eastern side of the Plan Lands, and improve the viability of such services on the western side.

Appendix B. Identification of Study Area

B.1 Option A1 Harold's Cross

Option A1 Harold's Cross station is proposed to be located east of Rathmines at Harold's Cross Park, as shown in Figure B-1. It is a largely residential area served in the north, east and west by Harold's Cross Road (R137) and by a small access street in the south.

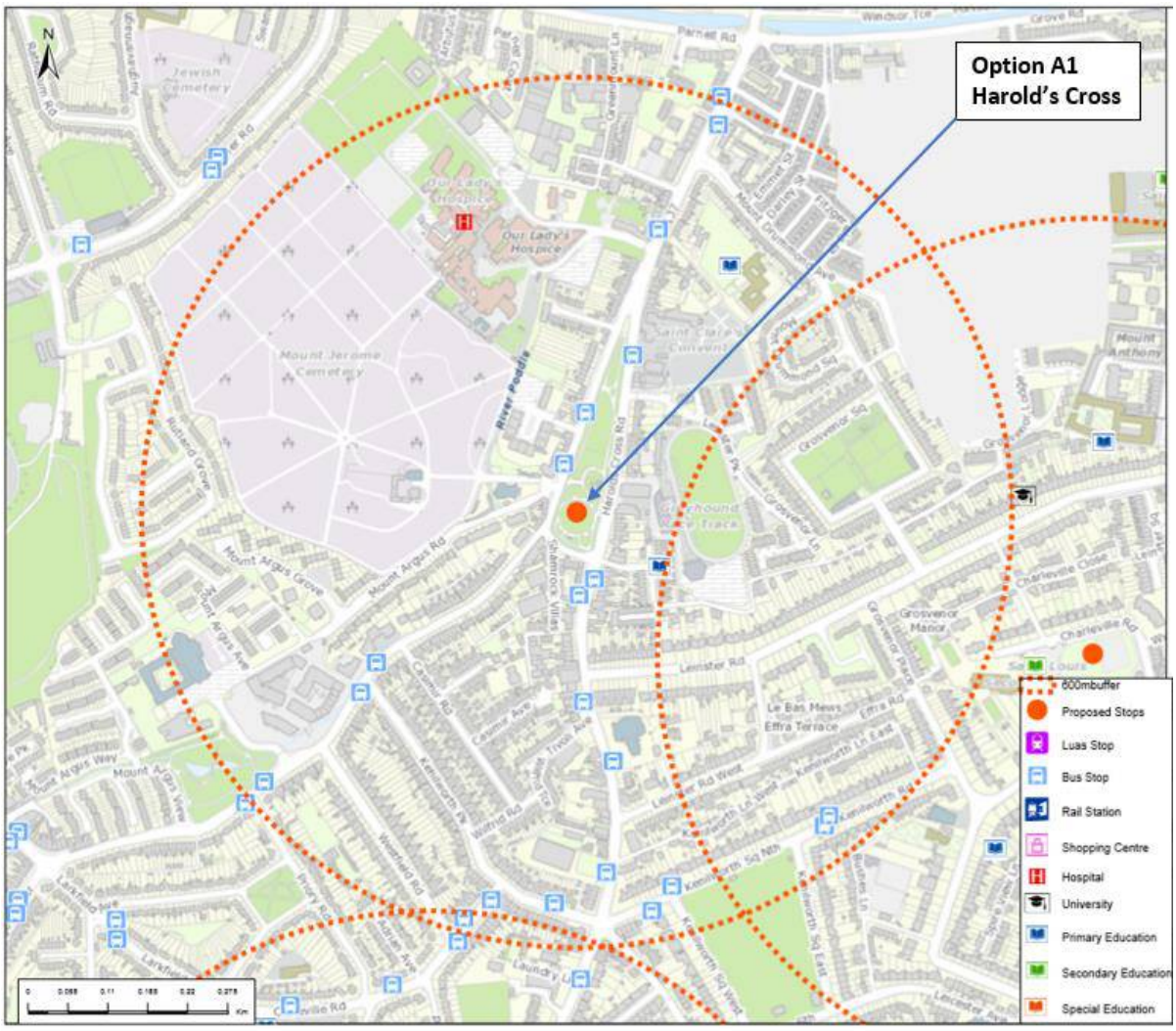


Figure B-1: Location of Option A1 Harold's Cross within 600m buffer

Figure B-2: Access Street south of Harold's Cross

2016 population data records a population of 11,335 people within the adjacent electoral divisions. The area is not listed within Dublin City Development Plan 2016-2022 zoning. The proposed station is mainly surrounded by a mix of semi-detached and terrace houses with some local commerce (see Figure B-3), and it is located in close proximity to Leinster Park Montessori, St. Claire's Convent National School and Mount Jerome cemetery. Our Lady's Hospice and Care Services is also close to the proposed location. The limited mix of land uses around the proposed station is set up for a lesser used local centre than Rathmines (see Figure B-5).

Figure B-3: Harold's Cross Rd (R137)

Figure B-4: Pedestrian Footpath at Harold's Cross Rd (west)

The area is served by the R137, which is a two-way single carriage way that includes a bus lane and shared cycle lane, with a number of bus stops along Kimmage Road Lower and Harold's Cross Road, allowing for options for interchange with bus services (see Figure B-6). Heavy car usage observed to the north and east of Harold's Cross Park with few pedestrians as junction layout north of park is not pedestrian friendly. The construction of approximately 150 residential units to the east of the park at site of St. Claire's Convent may bring more pedestrians to the area.

Figure B-5: Junction Layout North of Harold's Cross

Figure B-6: Bus Stop at Harold's Cross Rd (west)

From these observations the proposed station location meets a number of the MetroLink objectives. It caters for the growing travel demand in the area following completion of nearby development, as well as providing for interchange with other modes of public transport (bus). While the location does facilitate connection to some attractor nodes, these are minimal and therefore it may not be attractive and accessible to all users.

B.1.1 Option A2 Rathmines

Option A2 Rathmines is proposed to be located at the grounds of St. Louis' Convent in Rathmines, as shown in Figure B-7. The area is largely residential to the north, west and south of the station, with Rathmines centre to the east. The area is served by Charleville Road to the north and east, Grosvenor Road and Rathgar Road to the south, and Grosvenor Place to the west.

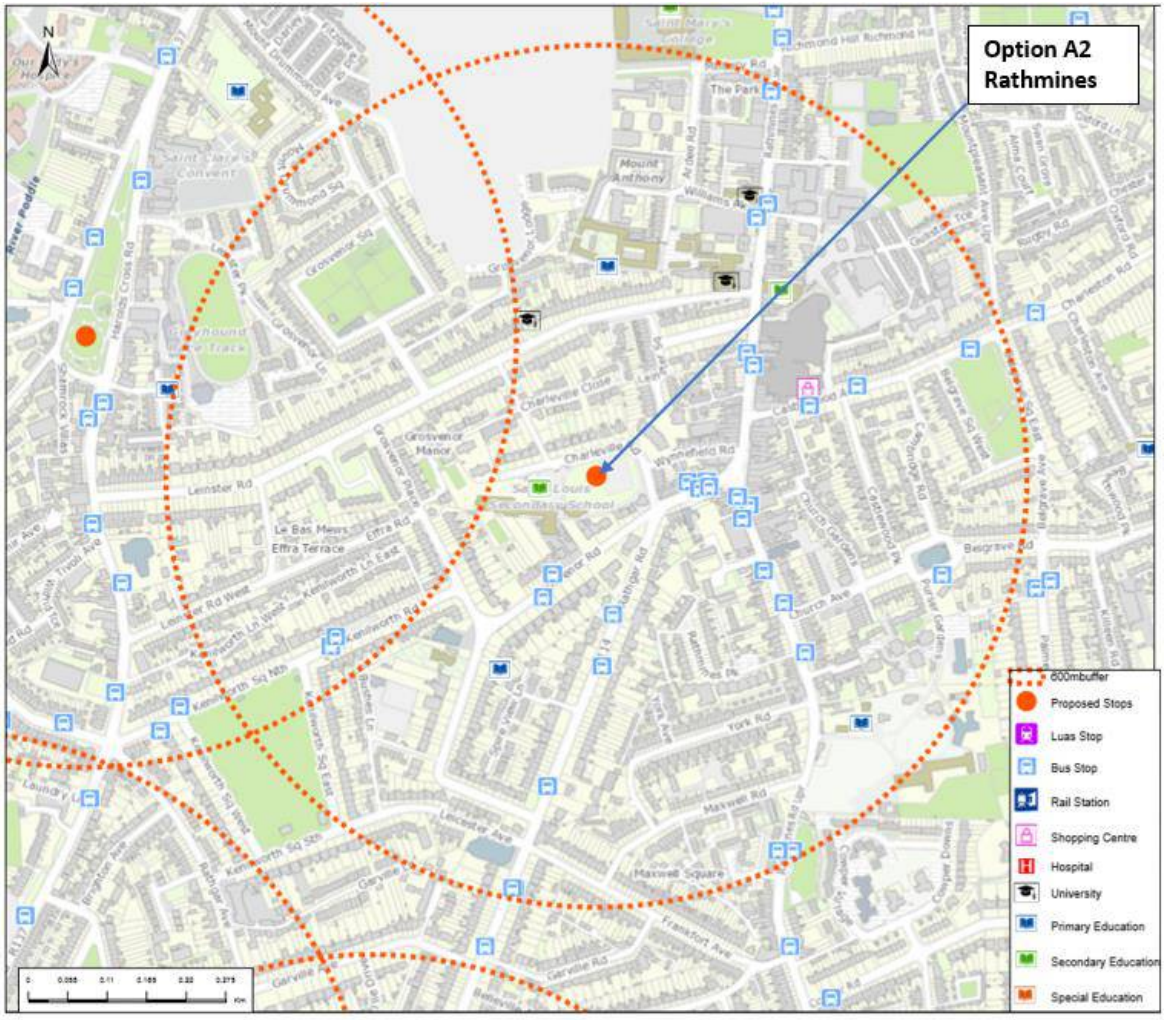


Figure B-7: Location of Option A2 Rathmines within 600m buffer zone

Figure B-8: Charleville Rd north of the station

Figure B-9: Grosvenor Road south of the station

Figure B-10: Rathgar Rd west of the station

2016 population data records a population of 14,435 people within the adjacent electoral divisions. Under the Dublin City Development Plan 2016-2022, Rathmines is zoned as a Key District Centre, with a core aim of the strategy seeking to develop sustainable urban villages, including Rathmines. As such, the proposed station is located within a mix of semi-detached houses and apartments. St. Louis' High School is within the grounds of the station, which is also in close proximity to Rathmines town centre where there are a number of cafés, restaurants, shops and other services.

The area is served by Grosvenor Road and Rathgar Road (R114) to the south, which are two-way single carriageways which merge to become Rathgar road (R114). Rathgar Road includes a shared bus and cycle lane northbound which merges into an advisory cycle lane, and a mandatory cycle lane southbound. Grosvenor Road does not have a bus or cycle lane in either direction but does have existing bus stops. There is a cycle-only exit from Charleville Road onto Rathgar Road. There is heavy car usage on all roads, with low pedestrian activity, however there are sufficient crossing facilities available.

Option A2 Rathmines suitably meets a number of the full MetroLink objectives. As it is an area of heavy car use and limited bus lanes, the provision of a MetroLink station could reduce levels of urban congestion in the area, also supporting environmental sustainability in this way. As this location is in close proximity to Rathmines town centre, it facilitates connection to attractor nodes in the area, therefore being attractive and accessible to all users. Similarly, being close in proximity to Rathmines, the provision of a station would facilitate further economic development in the area, thus contributing to its zoning as a Key District Centre.

B.1.2 Option B1 Terenure

Option B1 Terenure is proposed to be located within the grounds of CYM Sports Club on Terenure Road North, as shown in Figure B-11. The area is largely residential to the north, east and west beyond Terenure Sports Club, with

Terenure town centre to the south of the proposed location and limited services available to the north. The area is served by Terenure Road North (R137) leading to Harold's Cross Road northbound, and Rathfarnham Road (R114) southbound. St. Enda's Road to the east of the location is predominantly residential leading to Alexandra Terrace, Oaklands Terrace and Tower Avenue.

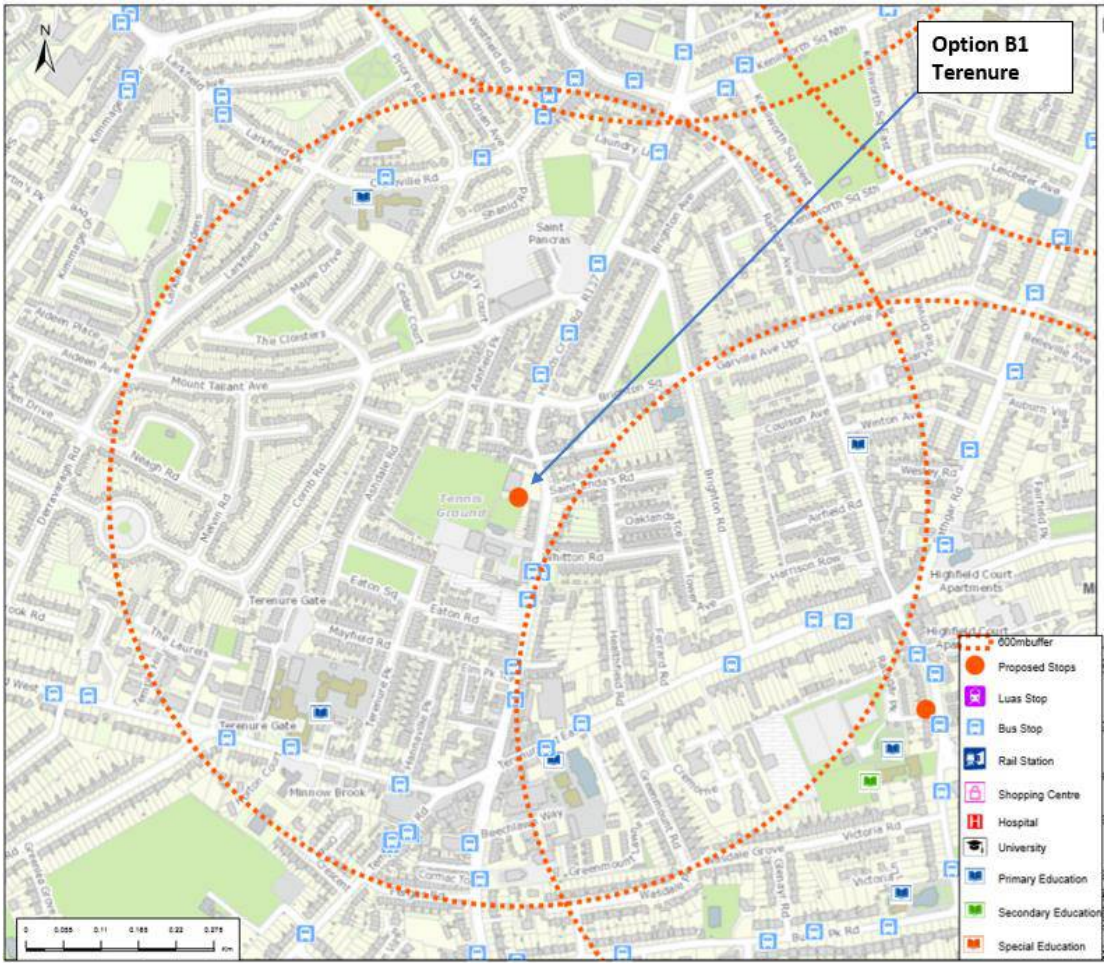


Figure B-11: Location of Option B1 Terenure within 600m buffer zone

2016 population data records a population of 3154 people in the adjacent electoral divisions, and the area is listed as a Consolidation Area within the Gateway in the South Dublin County Council Development Plan 2016-2022. The station is proposed to be located within the CYM Sports Club, which is surrounded by a number of cafés, restaurants, shops (including a Tesco, Lidl and Aldi) and other services north of the site and in Terenure town centre to the south. Manor Montessori School and Nursery and Highfield Montessori are also accessible from the proposed location.

The area is served by Terenure Road North (R137) which is a two-way single carriageway with advisory cycle lanes present in both directions. South of Eagle Hill Avenue the southbound advisory cycle lane merges to become a shared bus and cycle lane to accommodate existing bus stops along Terenure Road North. A taxi rank and shelter are also available nearby to the south of the proposed location. Behind the taxi rank there is also a car parking open to users all day. Whitton Road and St. Enda's Road to the east of the proposed location are both narrow and dominated by cars parking along both footpaths.

Figure B-12: Terenure Rd N (R137) east of the station

Based on these observations, Option B1 Terenure facilitates connection to few key attractors due to the limited transport public transport services in the area, however it might support economic development by encouraging people to travel to this area. The proposed location does provide integration with bus services and the nearby by car parking could be used as a 'Park and Ride' facility. As car usage is heavy in this area, the provision of a station may then reduce urban congestion by offering an alternative mode of transport.

Figure B-13: Bus Stop near the proposed station (R137)

Figure B-14: Eaton Rd and existing car parking (south of the station)

B.2 Option B2 Terenure

Option B2 Terenure is proposed to be located on Orwell Road, close to Rathgar Tennis and Bowling Club, as shown in Figure B-15. The area is largely residential to the east, west and south, with some local commerce present in the north along Orwell Road. The area is served by Orwell Road, leading to Terenure Road East and Rathgar Road in the north, and leading to Zion Road to the south. Stratford Haven to the east is a private cul-de-sac, and Orwell Mews/Rathgar Park to the west are residential areas.

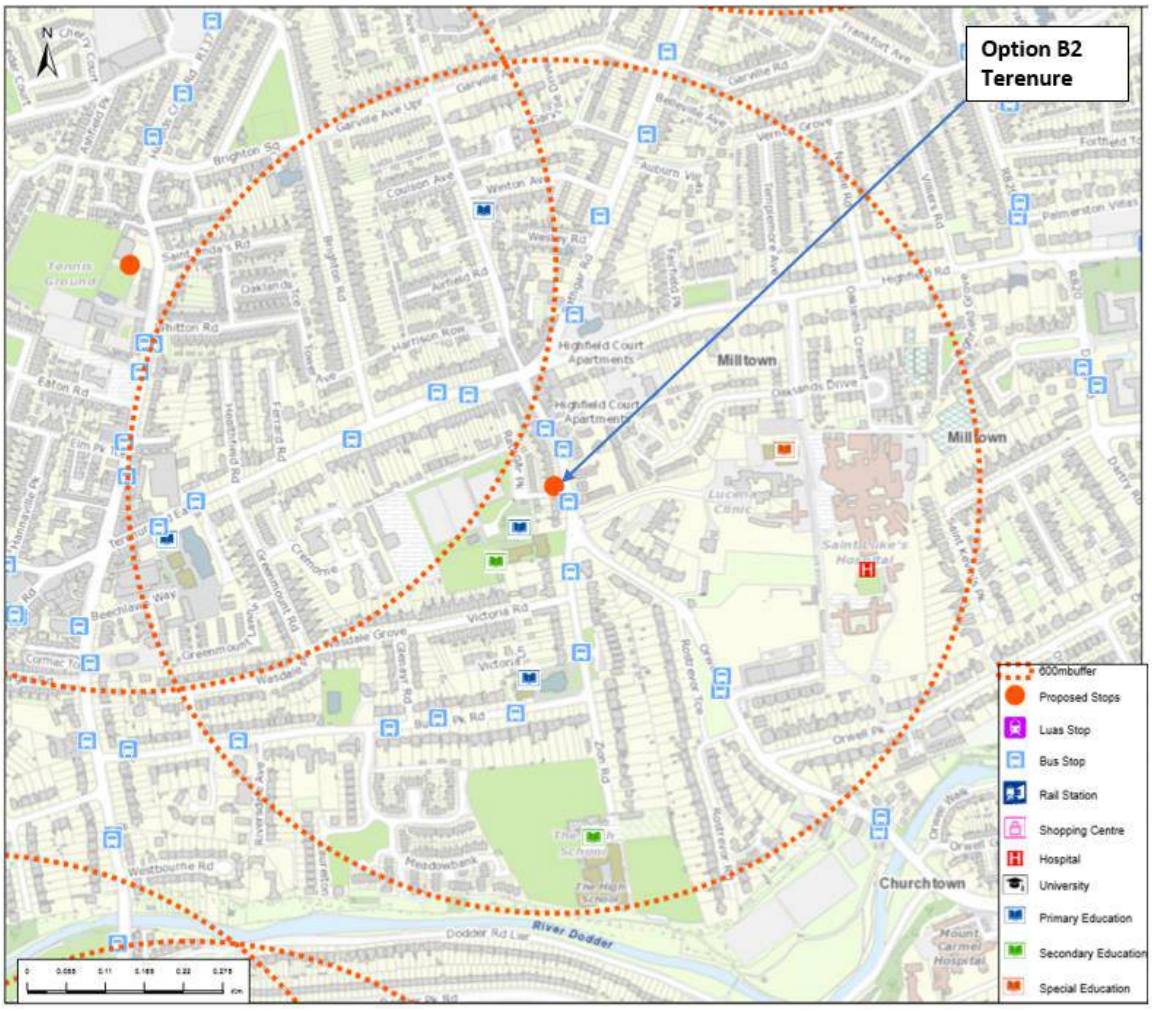


Figure B-15: Location of Option B2 Terenure within 600m buffer

2016 population data records a population of 4683 people in the adjacent electoral divisions, and the area is listed as a Consolidation Area within the Gateway in the South Dublin County Council Development Plan 2016-2022. The proposed station is located adjacent to Rathgar Tennis and Bowling Club, with Stratford College, St. Peter's School and Zion Parish Primary School nearby. St. Luke's Hospital and St. Luke's Institute of Cancer Research Library are also in the area. There is a busy local centre north of the site with cafés, restaurants, shops and other services available.

The area is served by Orwell Road, which is a two-way single carriageway with no bus or cycle lanes. However, wide pedestrian footpaths are provided, and existing bus stops are present close to the proposed station. Zion Road also does not have a bus or cycle lane present. Rathgar Road to the north of the proposed location includes a mandatory cycle lane southbound, and bus lane northbound, however this is blocked by parked cars on the footpath.

Figure B-16: Orwell View - entry to the proposed location from Orwell Rd (east of the station)

Figure B-17: Car parking at proposed site for location

Considering the full MetroLink scheme objectives, Option B2 Terenure provides some interchange with other modes of public transport and is located within a busy town centre. As such, the station may support the economic development of this area. The proposed station is hidden from the main street and can only be accessed by two small streets, therefore is not accessible for all users and does not facilitate connection to attractor nodes in the nearby area.

B.2.1 Option C1 Rathfarnham

Option C1 Rathfarnham is proposed to be located at the grounds of Rathfarnham Castle close to the northern entrance on Castleview/Castleside Drive, as shown in Figure B-18. There are low density residential areas to the north and south of the site, with Castle Golf Club to the east, and Rathfarnham local centre to the west. The area is predominantly served by Rathfarnham Road (R114) to the west of the proposed site leading to Butterfield Avenue (R114) and Grange Road (R115/R821) southbound, with Castleview providing access to Rathfarnham Castle, and Castleside Drive leading into a large residential development.

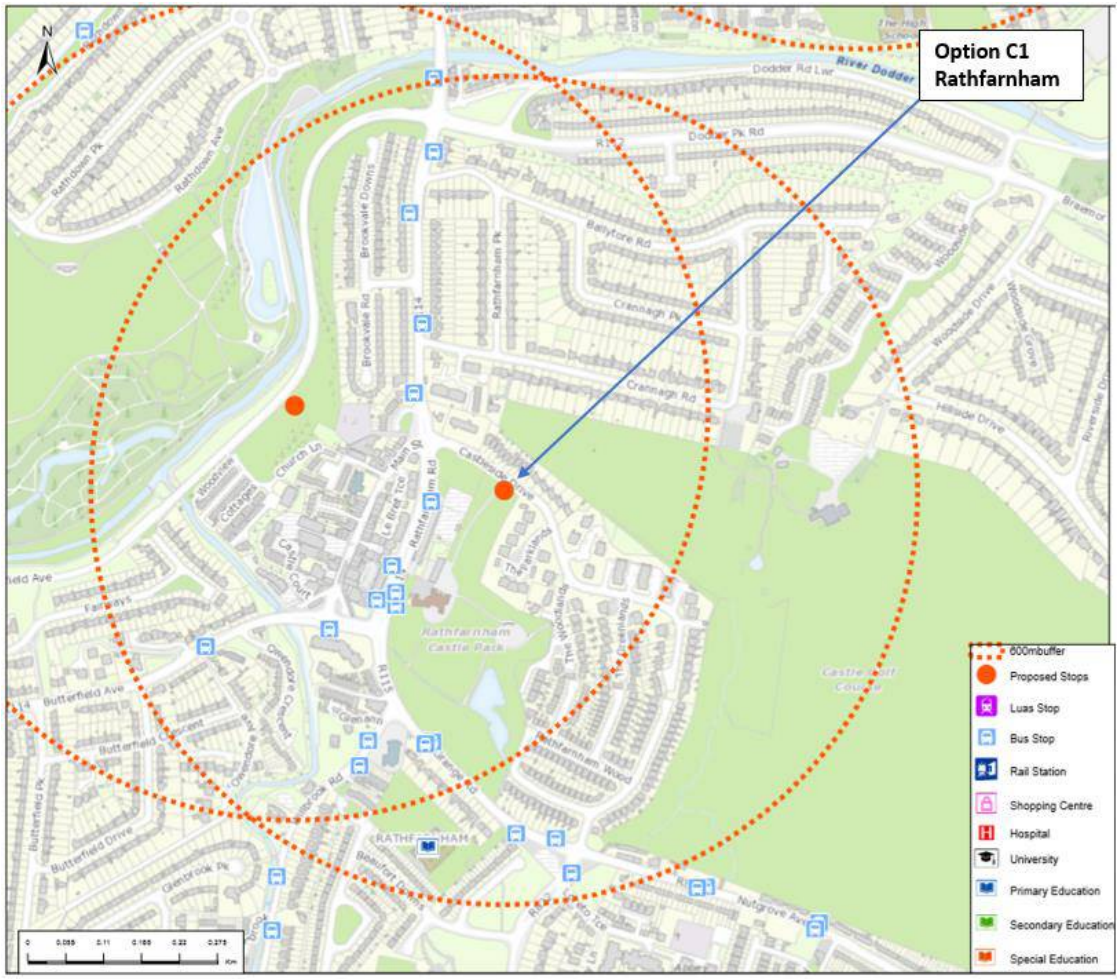


Figure B-18: Location of Option C1 Rathfarnham within 600m buffer zone

2016 population data records a population of 4575 people in the adjacent electoral divisions, and the area is listed as a Consolidation Area within the Gateway in the South Dublin County Council Development Plan 2016-2022. Rathfarnham Castle and Playground provide key trip generators in the area, as well as the close proximity to Rathfarnham Main Street, which includes a number of cafés, restaurants, shops and other services (see Figure B-23).

The area is served by Rathfarnham Road (R114) to the west of the proposed station location, which is a two-way single carriageway with a shared bus and cycle lane northbound and southbound. Castleview and Castleside Drive are two-way single carriageways with no bus or cycle lanes. A number of bus stops exist along Rathfarnham Road, as well as a car parking facility west of Rathfarnham Castle. Sufficient pedestrian crossings are provided from Rathfarnham Road to both Main Street and Castleview.

Figure B-19: Rathfarnham Rd (west of the proposed station)

Figure B-20: Bus Stop along Rathfarnham Rd (west of the proposed station)

Figure B-21: Exit from car parking at Rathfarnham Castle, west of the station

Figure B-22: Gardens of Rathfarnham Castle

Figure B-23: Rathfarnham Main Street, west of the station

Option C1 Rathfarnham suitably meets the objectives of the full MetroLink scheme as it facilitates connection to attractor nodes such as Rathfarnham Castle and the town centre, thus supporting economic development in these areas. The proposed station location also provides for interchange with other modes of public transport and whilst there is not a specific 'Park and Ride' designation there is a car park available close to the site, therefore making the station attractive and accessible to all users.

B.2.2 Option C2 Rathfarnham

Option C2 Rathfarnham is proposed to be located in the open lands to the north-east of Woodview Cottages along the R112, as shown in Figure B-24. The station is proposed to be situated in a low-density residential area, with local commerce east of the site, and Bushy Park and the River Dodder to the west. The area is served by the R112, with pedestrian access to Woodview Cottages and Church Lane, leading to Main Street Rathfarnham.

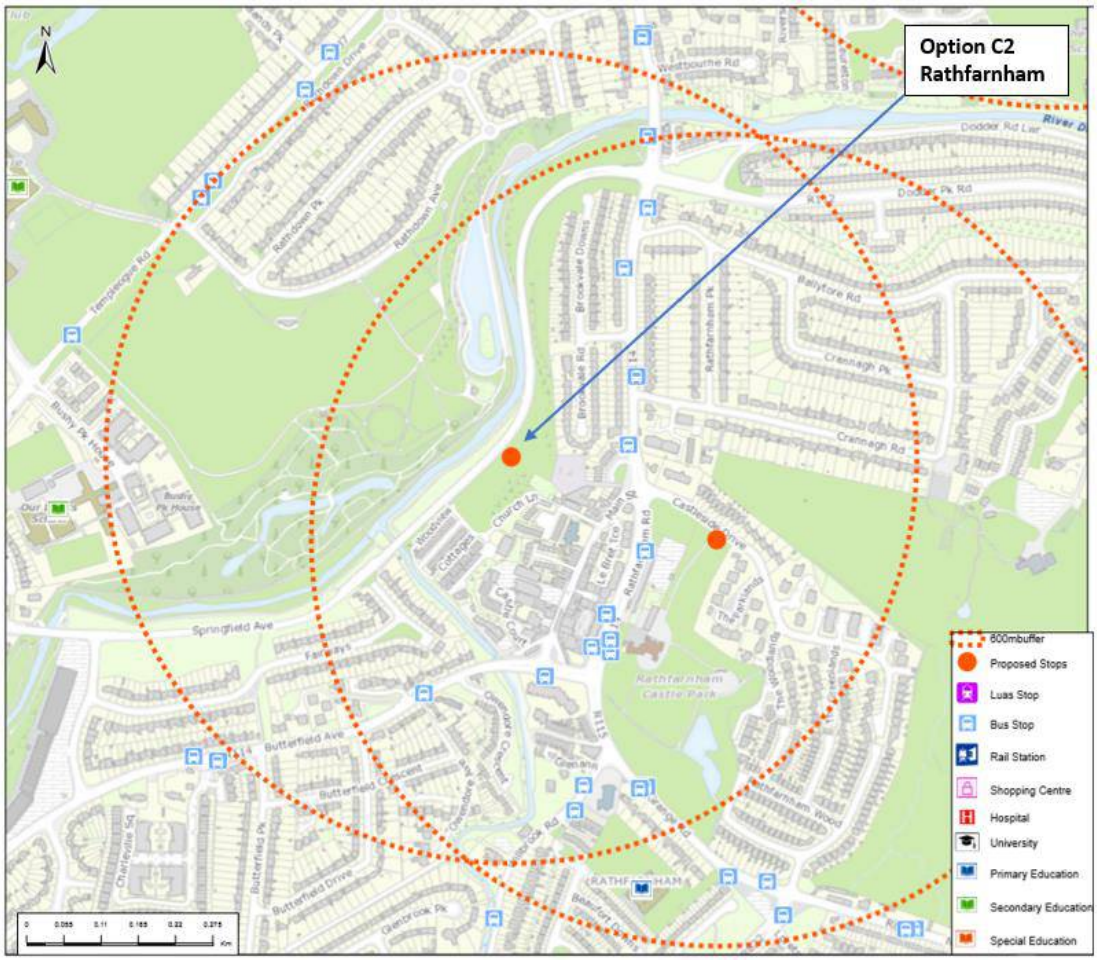


Figure B-24: Location of Option C2 Rathfarnham within 600m buffer zone

Figure B-25: Proposed Site Location for Option C2 Rathfarnham

2016 population data records a population of 3891 people in the adjacent electoral divisions. The area is listed as an Architectural Conservation Area and a Consolidation Area within the Gateway in the South Dublin County Council Development Plan 2016-2022 (see Figure B-26). Under the Dublin City Development Plan 2016-2022, this area is located within the Dodder Flood zone as shown in Figure 8, where new development is restricted in green areas without providing a detailed flood risk assessment. South Dublin County Council Development Plan 2016-2022 also proposes a Six Year Cycle Programme, within which the Dodder Greenway is proposed from Bohernabreena to Rathfarnham, linking to Dublin City Centre. There are limited attractor nodes surrounding this site, as passengers would be required to follow the steep pedestrian footpath through residential developments to access Main Street. Bushy Park is accessible from the east.

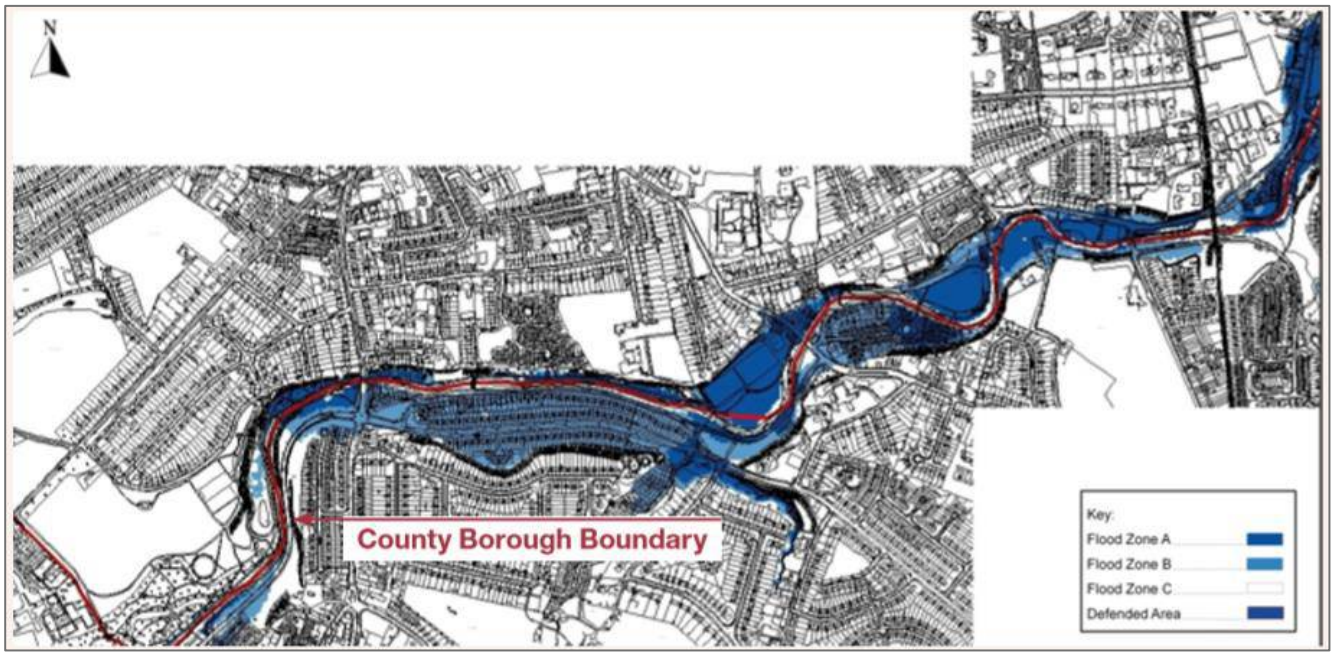


Figure B-26: Dublin City Development Plan 2016-2022 Dodder Flood Zone 12: Dundrum Road – Bushy Park Boundary

The area is served by the R112, which is a two-way single carriageway with a raised cycle path in both directions, which later becomes a shared cycle and pedestrian path. There is no bus lane present and there are no existing bus stops along this road, providing no interchange with other modes of public transport. There is one pedestrian crossing on the R112 to the south of Woodview Cottages, leading to an access point in Bushy Park.

Figure B-27: Church Ln (access to the station from Rathfarnham Main St)

Figure B-28: Proposed location viewed from access road Church Ln

Figure B-29: Church Ln viewed from proposed location

Option C2 Rathfarnham does not suitably meet the objectives of the full MetroLink scheme as it does not facilitate connection to attractor nodes and therefore does not fully support economic development in the area. Similarly, this location does not provide for key interchanges with other modes of public transport and therefore it is not an attractive or accessible location for all users. In this way, it does not reduce urban congestion or support economic sustainability and users cannot use public transport to access the site.

B.2.3 Option D Ballyboden

Option D Ballyboden is proposed to be located at Coláiste Éanna Sports Grounds, as shown in Figure B-30. The proposed station is located in a residential area, with two schools and some local commerce surrounding the site. The area is served by Ballyboden Road (R115) along the eastern boundary of the site, Ballyroan Road (R817) to the north, and Ballyboden Way to the south. Hillside Park, Owendoher Lodge and Taylor's Crescent are also in close proximity to the site.

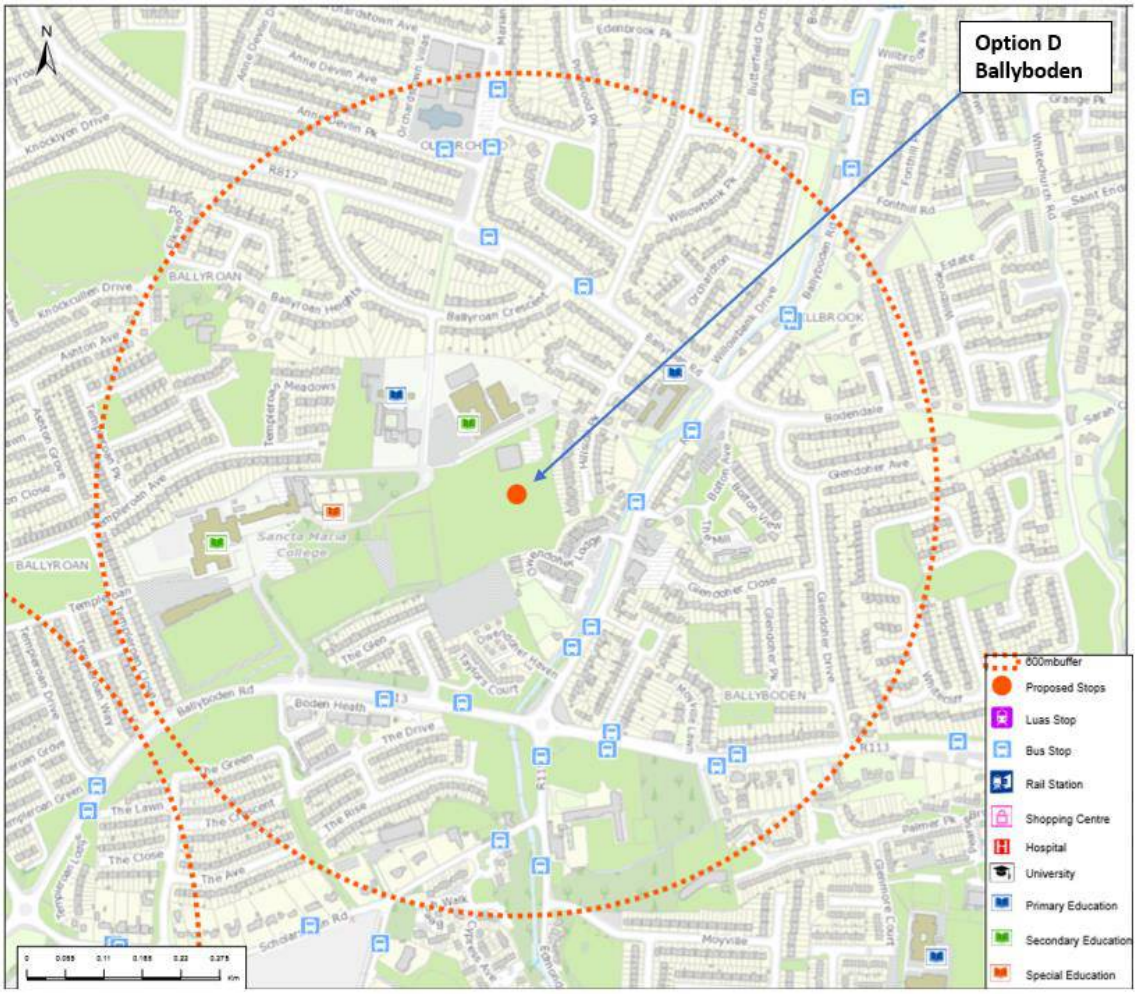


Figure B-30: Location of Option D Ballyboden within 600m buffer zone

2016 population data records a population of 8905 people in the adjacent electoral divisions, and the area is listed as a Consolidation Area within the Gateway in the South Dublin County Council Development Plan 2016-2022. The area is largely residential with a mix of single, duplex and semi-detached houses present. Coláiste Éanna School and Sports Grounds, Christian Brothers Secondary School, Kids Inc Creche and Montessori, Ballyroan Boys National School, Sapling Rathfarnham and Sancta Maria College are also in the area, with local commerce present to the east of the site along Ballyboden Road.

The area is served by Ballyboden Road (R115), which is a two-way single carriageway with pedestrian footpaths, an advisory cycle lane present in both directions, and existing bus stops. Ballyroan Road also has advisory cycle lanes and pedestrian footpaths present in both directions. There are raised cycle lanes and pedestrian footpaths present in both directions on Ballyboden Way. There is no designated bus lane, however there are existing bus stops on this road. Three pedestrian crossings are also present along Ballyboden Road.

Figure B-31: Ballyboden Rd (viewing south)

Figure B-32: Ballyboden Rd (viewing north)

Figure B-33: Ballyroan Rd (east of the proposed site)

Option D Ballyboden suitably meets a number of the objectives of the full MetroLink scheme. Further residential development has taken place at Owendoher Grove, and on Scholarstown Road, south of Ballyboden Way, and therefore the proposed station location would cater for the growing travel demand in this area. Due to the number of schools, colleges and local commerce in the area, this location would facilitate connection to attractor nodes, and also support economic development in the area. This location also provides for interchange with other modes of public transport due to the presence of existing bus stops, with the availability of cycle lanes and pedestrian footpaths making it attractive and accessible to all users. This location therefore supports environmental sustainability by reducing the need for the private car.

B.2.4 Option E Knocklyon

Option E Knocklyon is proposed to be located at open private lands to the north of Scholarstown Road, as shown in Figure B-34. The area is largely residential in all directions, with St. Colmcille's Community School south of the site and Knocklyon Shopping and Community centres in the north. The area is served by Scholarstown Road to the west and south of the site, leading to Ballyboden Way and Templeroan Road in the east, and Knocklyon Road in the north.

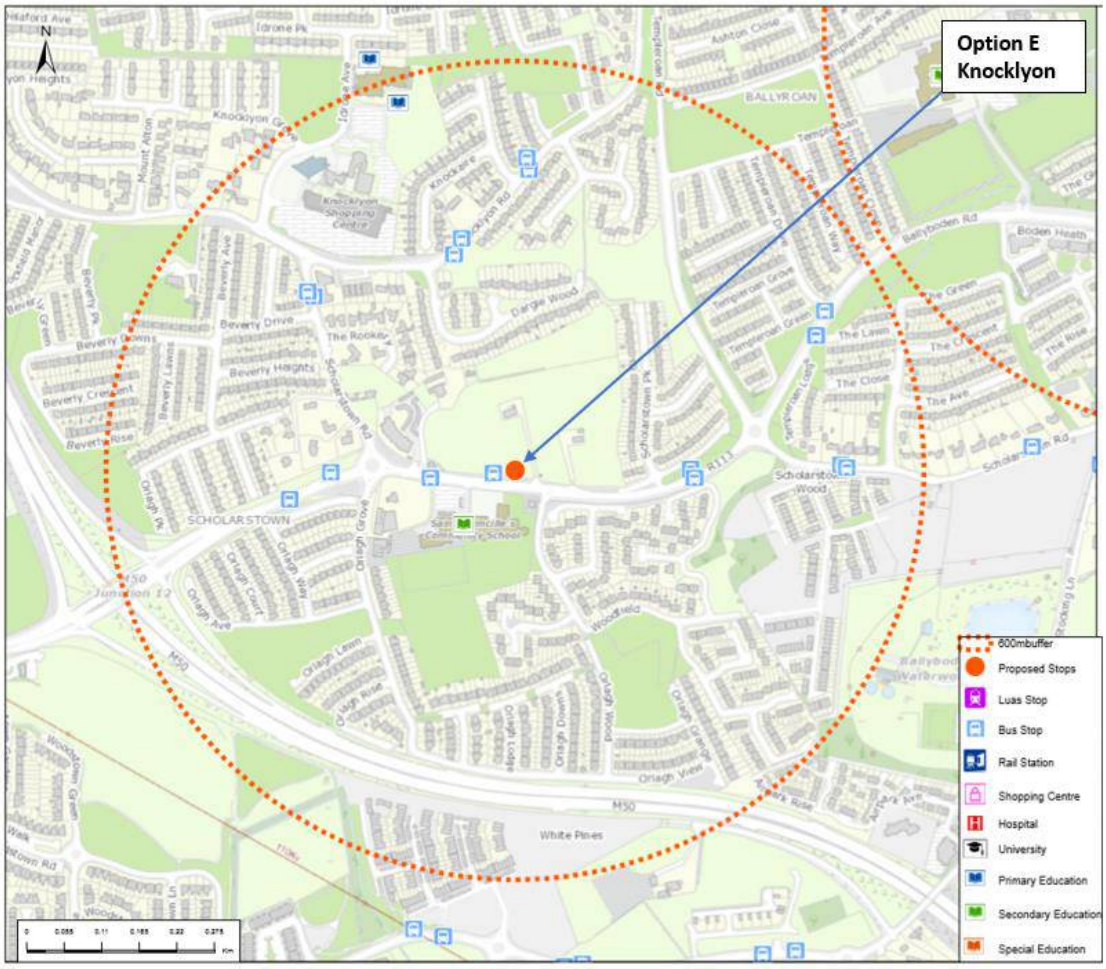


Figure B-34: Location of Option E Knocklyon within 600m buffer zone

2016 population data records a population of 16,763 people in the adjacent electoral divisions, and the area is listed as a Consolidation Area within the Gateway in the South Dublin County Council Development Plan 2016-2022, with the proposed location zoned for development under the Dublin City Development Plan 2016-2022. The proposed station location is in close proximity to Knocklyon Shopping Centre and Knocklyon Community Centre, as well as St. Colmcille's Junior and Senior National Schools at the north of the site. The east, south and west of the site are predominantly residential areas with a mix of single and semidetached houses.

The area is served by Knocklyon Road at the north of the site, which is a two-way single carriageway, with no bus or cycle lanes present, however there are pedestrian paths provided on both sides, separated by grass verges. Whilst there is no designated bus lane, there are existing bus stops along this road. Templeroan Road is a two-way single carriageway with no bus or cycle lanes present, however there are existing bus stops on this road. Pedestrian footpaths are also present on both sides of the road, separated by grass verges. Scholarstown Road at the south and west of the site is a two-way single lane carriageway, although this occasionally splits into dual lanes on approach to junctions. A shared raised cycle lane and pedestrian footpath is provided on both sides of the road, with existing bus stops also present.

Figure B-35: Proposed site location

Figure B-36: Scholarstown Rd (viewing west)

Option E Knocklyon suitably meets a number of the objectives of the full MetroLink scheme. As this area is zoned for development, a station at this location would cater for the growing travel demand in the area. By locating in this area, interchanges with other modes of public transport are also provided which may reduce urban congestion, thus supporting environmental sustainability. Due to the station's proximity to several schools and Knocklyon Shopping and Community Centres, this location would also facilitate connection to attractor nodes, making the station attractive and accessible to all users.

B.2.5 Option F Ballycullen

Option F Ballycullen is proposed to be located in lands zoned for development under the Ballycullen-Oldcourt Local Area Plan, as shown in Figure B-37. The proposed site is located in a predominantly residential area with Woodstown Shopping Centre at 1km to the north. The area is served by Stocking Avenue and Woodstown Avenue to the north and Ballycullen Road to the north-west and south-west. Small access roads of Woodstown Park and Woodstown Crescent also serve the area, as well as a pedestrian accessed route from Woodstown Avenue through to Woodstown Village.

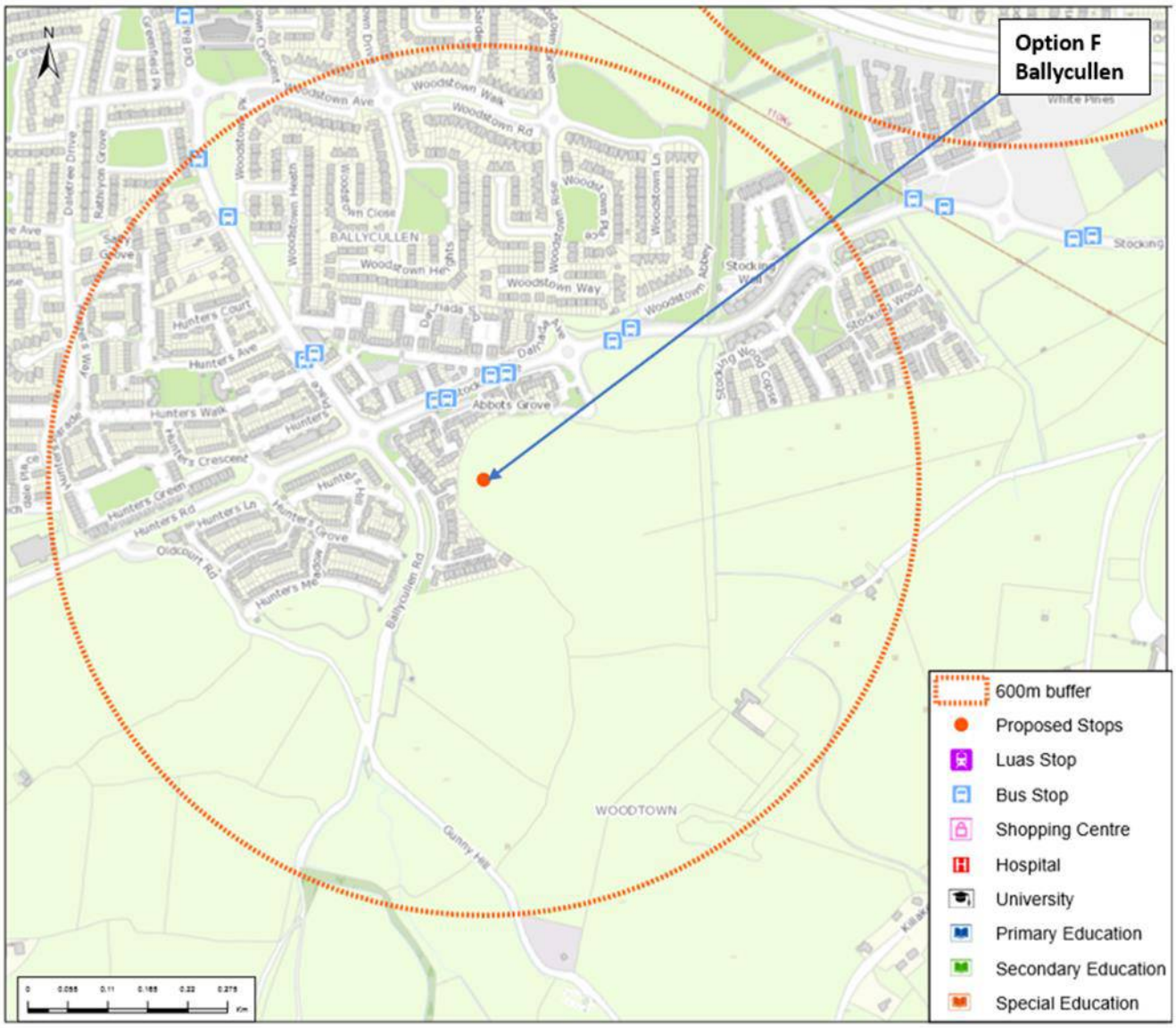


Figure B-37: Location of Option F Ballycullen within a 600m buffer zone

2016 population data records a population of 20,444 people in the adjacent electoral divisions, and the area is zoned for development under the Ballycullen-Oldcourt Local Area Plan. The proposed stop is mainly surrounded by detached and semi-detached houses. Other land uses include a Lidl, the Woodstown Shopping Centre and the Primacare Medical Centre, all within 1km from the proposed location.

Figure B-38: Proposed site location

Woodstown Avenue is a two-way single carriageway without bus or cycle lanes present. A pedestrian footpath is only provided on the northern side of the road. Stocking Avenue immediately adjacent to the north of the proposed stop is a two-way single carriageway with no bus lanes and cycle lanes that are shared with the pedestrian paths in both bounds. Ballycullen Road to the north-west of the site is a two-way single carriageway. An advisory cycle lane is present southbound, with a shared bus and cycle lane northbound. Ballycullen Road to the south-west of the site is a two-way single carriageway with a bus lane present northbound. A raised cycle lane is present southbound, with pedestrian footpaths on both sides of the road. There are 3 bus stops present on Ballycullen Road to the west of the proposed station. Daletree Drive, northwest of the proposed station, is a two-way single carriageway leading to residential developments. As such, it does not have bus lanes or cycle lanes present, with a pedestrian footpath present on one side of the road only.

Figure B-39: Roundabout at Stocking Avenue (north of proposed site)

Appendix C. Multi Criteria Analysis

C.1 Population Catchment

Population catchment within 1km was estimated for each of the station locations selected in Section 2.3. Estimations were made using ArcGIS modelling tools and Census Data 2016, therefore they do not include future population growth in areas set for further development such as Ballycullen. Results are shown in Table C-1.

Table C-1: Population within 1km from the stations

Station	Estimated Population within 1km catchment area	Population density (gross)
Station A2 Rathmines	14,760 inhabitants	47 inhabitants/hectare
Station B1 Terenure	11,997 inhabitants	39 inhabitants/hectare
Station C1 Rathfarnham	4,969 inhabitants	16 inhabitants/hectare
Station D Ballyboden	4,721 inhabitants	15 inhabitants/hectare
Station E Knocklyon	6,402 inhabitants	21 inhabitants/hectare
Station F Ballycullen	6,034 inhabitants	20 inhabitants/hectare
Full alignment (does not equal sum of the above)	**46,316 inhabitants**	---

C.1.1 Reduction in Urban Congestion

As a new public transport corridor providing fast, efficient and reliable transit, it is expected that the proposed Metro to Knocklyon will reduce the number of vehicular trips during its operation and will facilitate a modal shift from private car onto public transport. Therefore, it is anticipated that the proposed Metro will drive a reduction in urban congestion and its associated economic costs.

Based on this, it is considered that the Metro to Knocklyon, with preferred station options starting at Rathmines and finishing at Ballycullen, would fully address Category 1 – Economy of this Multi Criteria Analysis (MCA).

C.2 Integration with Government Policies

- Existing/proposed zoning and plans
- Approved planning applications
- Local, regional and national transport objectives

Appendix A includes general adherence to local, regional and national transport objectives While they comply with the GDA strategy, there is no specific mention of a Metro to Rathmines but a mention of movement of people etc. For this reason, the proposed Metro poorly integrates with these objectives, supporting their goals but not their specific plans.

C.2.1 Station A2 Rathmines

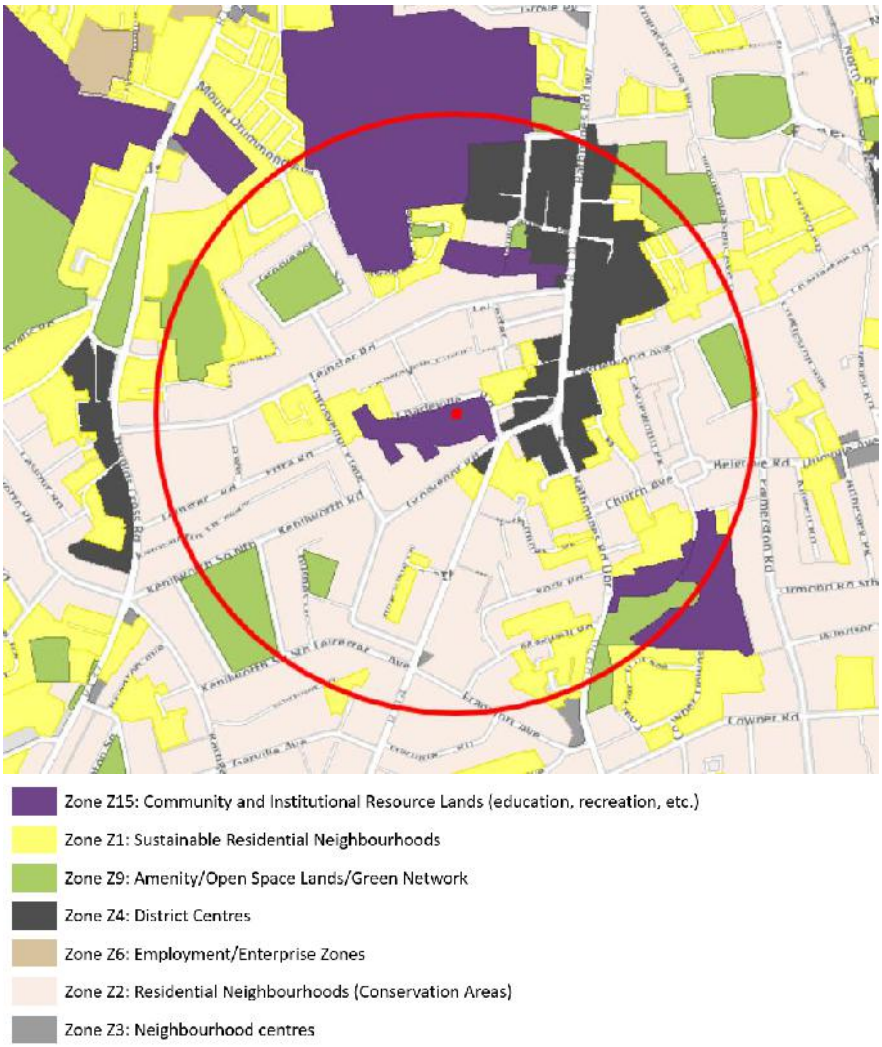


Figure C-1: Land Use Zoning at proposed site

According to Dublin City Council Development Plan 2016 – 2022, land use zoning for this station option is Z15 – Community and Institutional Resource Lands, such as education, recreation, community, green infrastructure and health.

The low-intensity residential area north of the site could be impacted by increased activity from the operation of a metro station. However, commerce and mixed uses along Rathmines Rd Lower (east of the site) could benefit from the operation of the station.

The station option in Rathmines is compatible with adjacent uses and minor impacts could be minimized. However, the construction of the station in this site would require the acquisition of lands from the Saint Louis High School.

There are no active planning applications which impact this site.

C.2.2 Station B1 Terenure

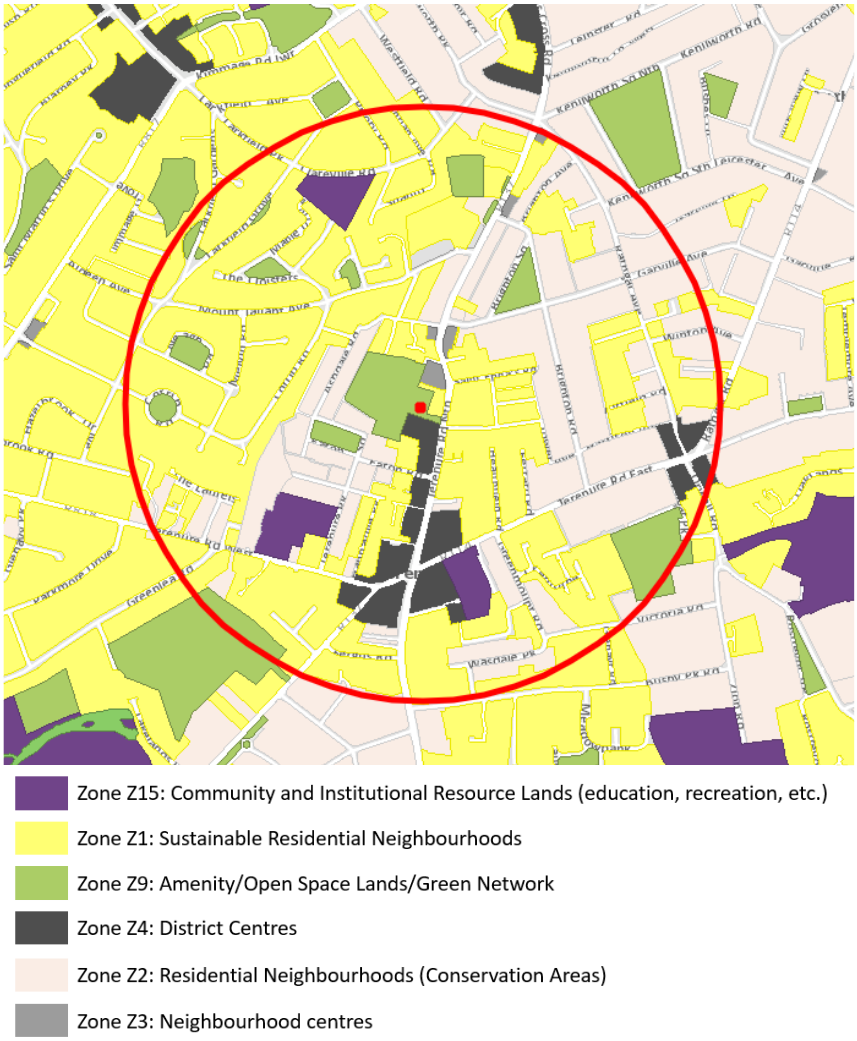


Figure C-2: Land Use Zoning at proposed site

According to Dublin City Council Development Plan 2016 – 2022, land use zoning for this station option is Z9 – Amenity / Open Space Lands / Green Network. The objective for this zoning is to provide and improve recreational amenity and open space and green networks.

Land uses adjacent to the proposed site are mid-intensity and the proposed metro station could support their further development. The construction of the station in this site would require the acquisition of lands from the Terenure Sports Club and therefore, the utilisation of an open space area, which is not in line with the specified zoning objectives.

There are no active planning applications which impact this site.

C.2.3 Station C1 Rathfarnham

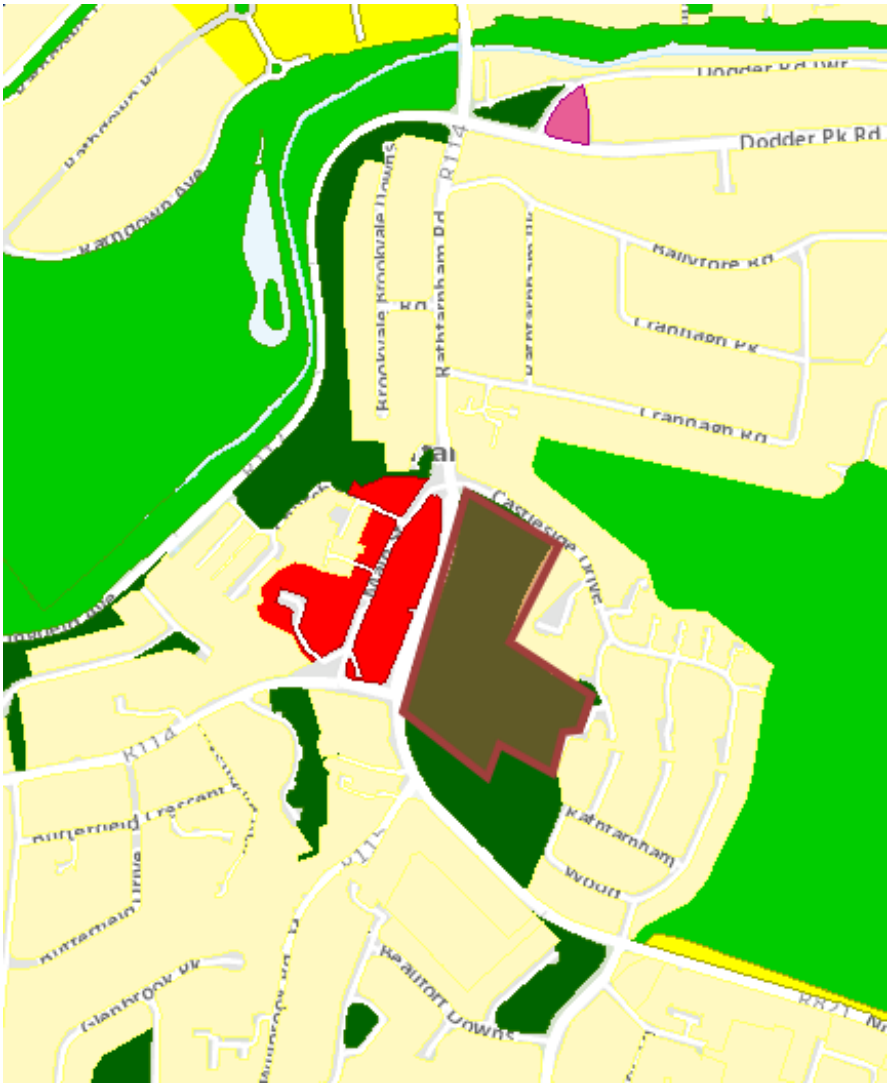


Figure C-3: Land Use Zoning at proposed site

Land Use Zoning for this station option is G1 - Open Space, with the objective to preserve and provide for open space and recreational activities under the South Dublin County Council Development Plan 2016 - 2022.

These low-intensity and predominantly residential land uses could be impacted by increased activity levels from the operation of a Metro station. In addition, the construction of the station would require acquiring lands from the Rathfarnham Castle which is classified as an open space and therefore is not in line with the defined zoning objectives.

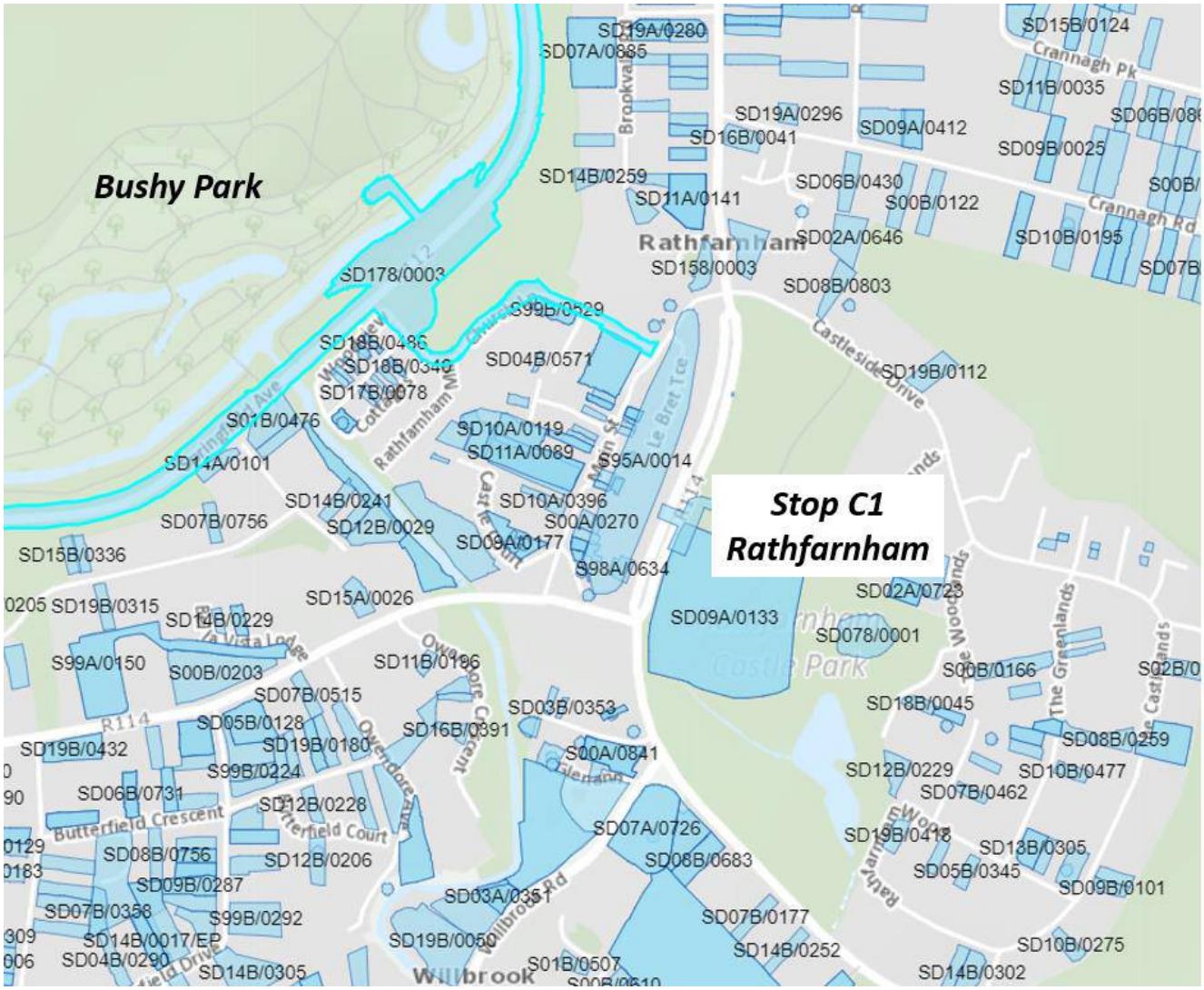


Figure C-4: South Dublin County Council planning application SD178/0003 (bright blue polygon) near proposed site

Planning applications SD178/0003 in the jurisdiction of South Dublin County Council is located adjacent to the proposed site, as seen in Figure C-4. This planning application was submitted by South Dublin County Council on 22/06/2017 as a Part VIII planning application. The application is in reference to the Dodder Greenway Scheme. This greenway aims to connect the linear parkland along the route, using the existing facilities within the Dodder Valley. The greenway route is approximately 14km in length and passes along the Dodder Valley from Orwell / Terenure through the outer suburbs of Tallaght to rural and upland Dublin to the entrance to the Bohernabreena reservoirs at Glenasmole. It will provide improved connectivity to communities, facilities and local business along the Dodder Valley corridor, using a shared pedestrian and cycle surface on the off-road sections, tying into suitable on-rod sections. The application includes a new 4m wide shared path through green area at Woodview Cottages and shared street along on Church Lane to Rathfarnham Main Street.

C.2.4 Station D Ballyboden

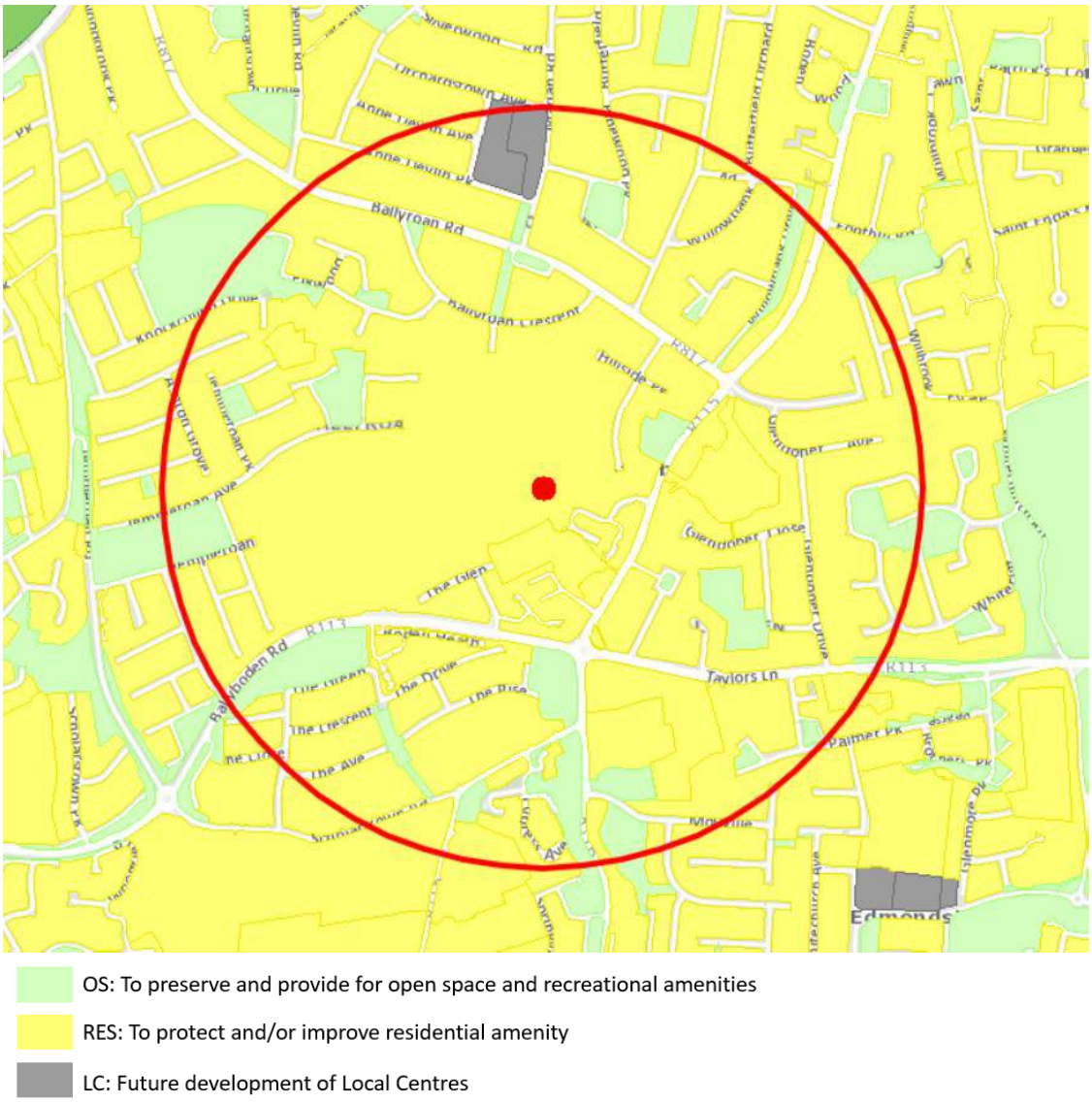


Figure C-5: Land Use Zoning at proposed site

Land Use Zoning for this station option is Residential with the objective of protect and/or improve residential amenity under the South Dublin County Council Development Plan 2016 - 2022.

The adjacent low-intensity land uses could be impacted by increased activity levels from the operation of a metro station. Adjacent schools and existing commerce along Ballyboden Rd could benefit from the operation of a metro station. The station option in Ballyboden is somewhat compatible with adjacent uses and minor impacts could be minimized.

There are no active planning applications which impact this site.

C.2.5 Station E Knocklyon

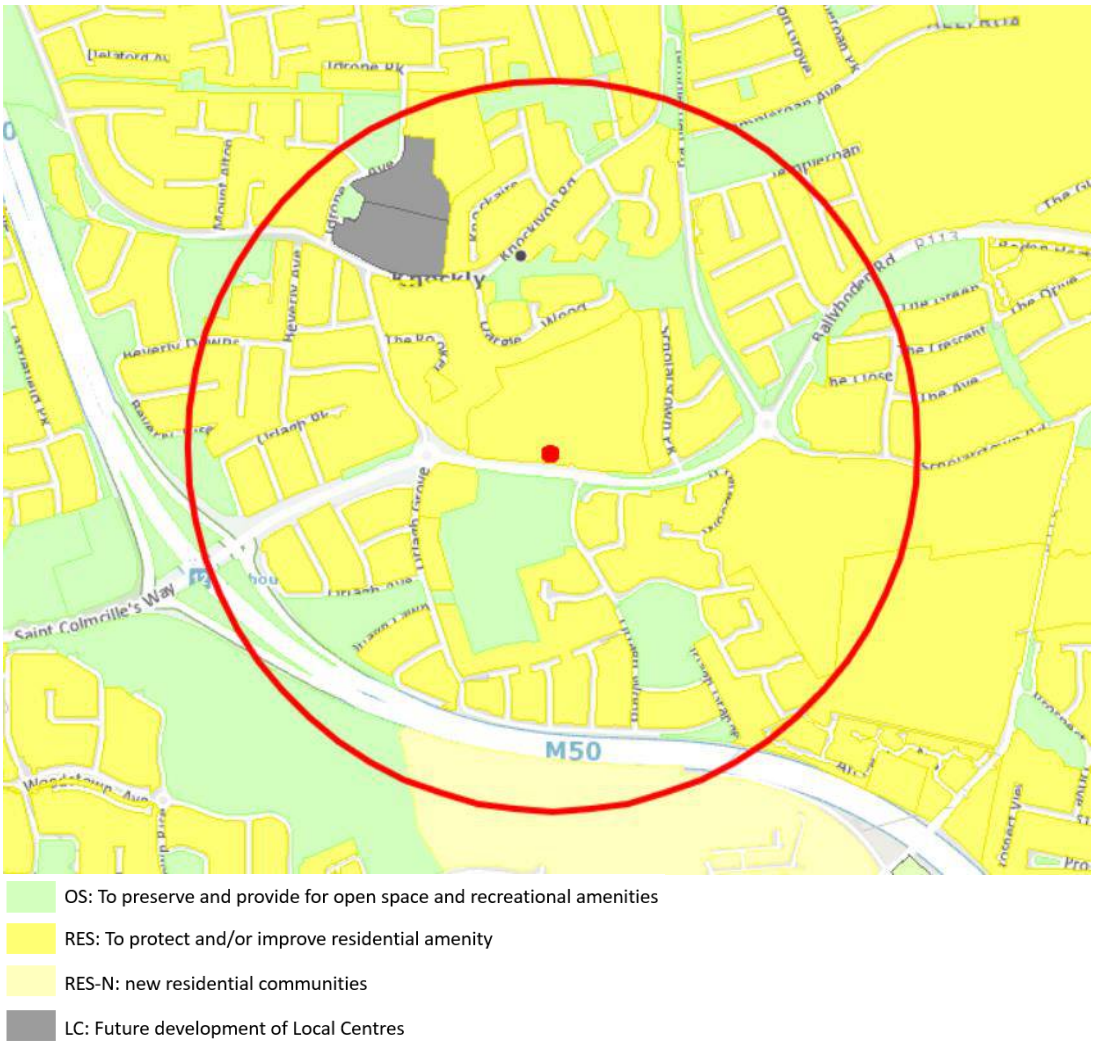


Figure C-6: Land Use Zoning at proposed site

Land Use Zoning for this station option is Residential with the objective of protect and/or improve residential amenity under the South Dublin County Council Development Plan 2016 - 2022.

The low-intensity land uses adjacent to the proposed site could be impacted by increased activity levels from the operation of a metro station. Additionally, the construction of the station in this site would require the acquisition of private lands. Therefore, the station option in Knocklyon is considered somewhat compatible with adjacent uses and minor impacts could be minimized.

Figure C-7: South Dublin County Council planning application SHD3ABP-305878-19 at proposed site (Source: John Fleming Architects)

Planning application SHD3ABP-305878-19 in the jurisdiction of South Dublin County Council is located in the proposed site, as seen in Figure C-7. This planning application was submitted by Ardstone Homes Limited on 11/11/2019 and was granted permission on 09/03/2020. The application is in reference to the construction of 590 residential units, ancillary residential support facilities and commercial floorspace.

C.2.6 Station F Ballycullen

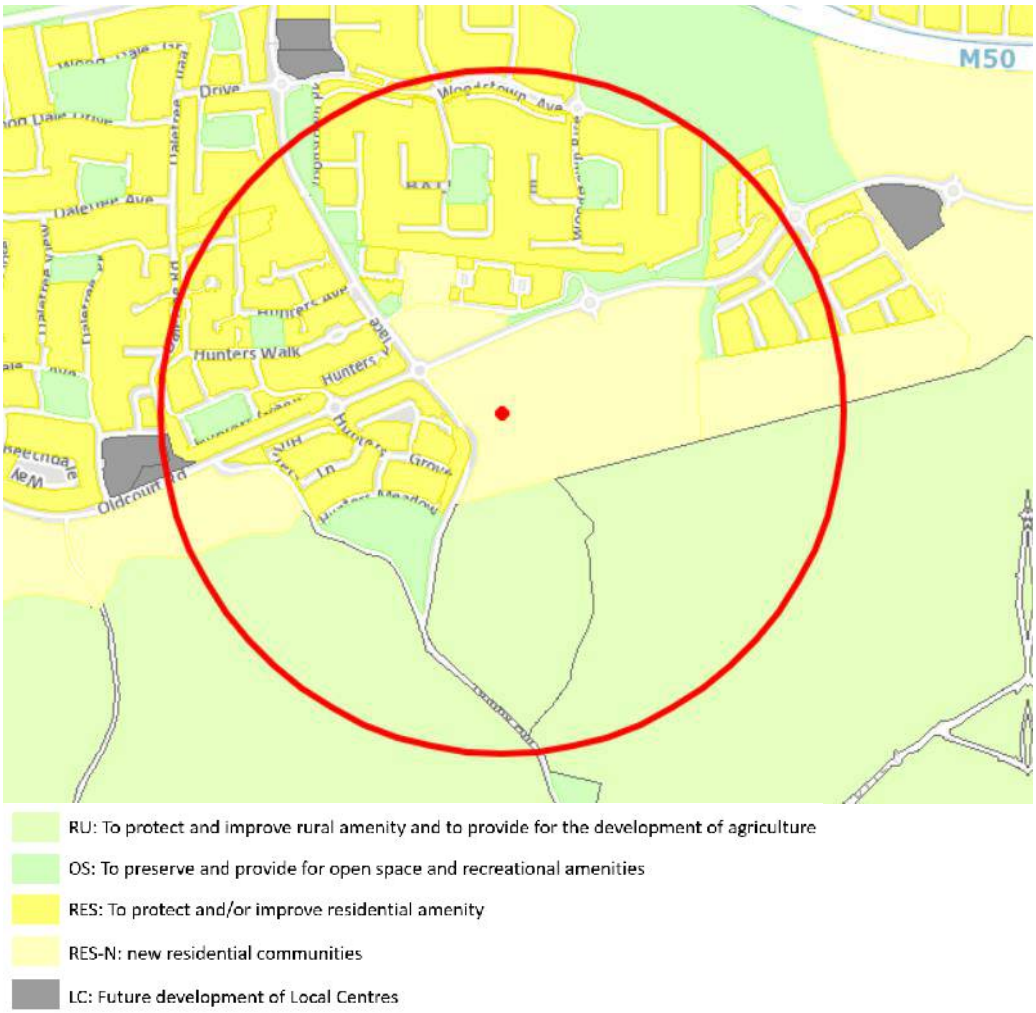


Figure C-8: Land Use Zoning at proposed site

Land Use Zoning for this stop option is R1 New or proposed residential, with the objective of providing for new residential communities in accordance with approved area plans under the South Dublin County Council Development Plan 2016 - 2022.

The quiet residential areas adjacent to the proposed site could be impacted by increased activity levels from the operation of a metro station. Therefore, the station option in Ballycullen is considered somewhat compatible with adjacent uses and minor impacts could be minimized.

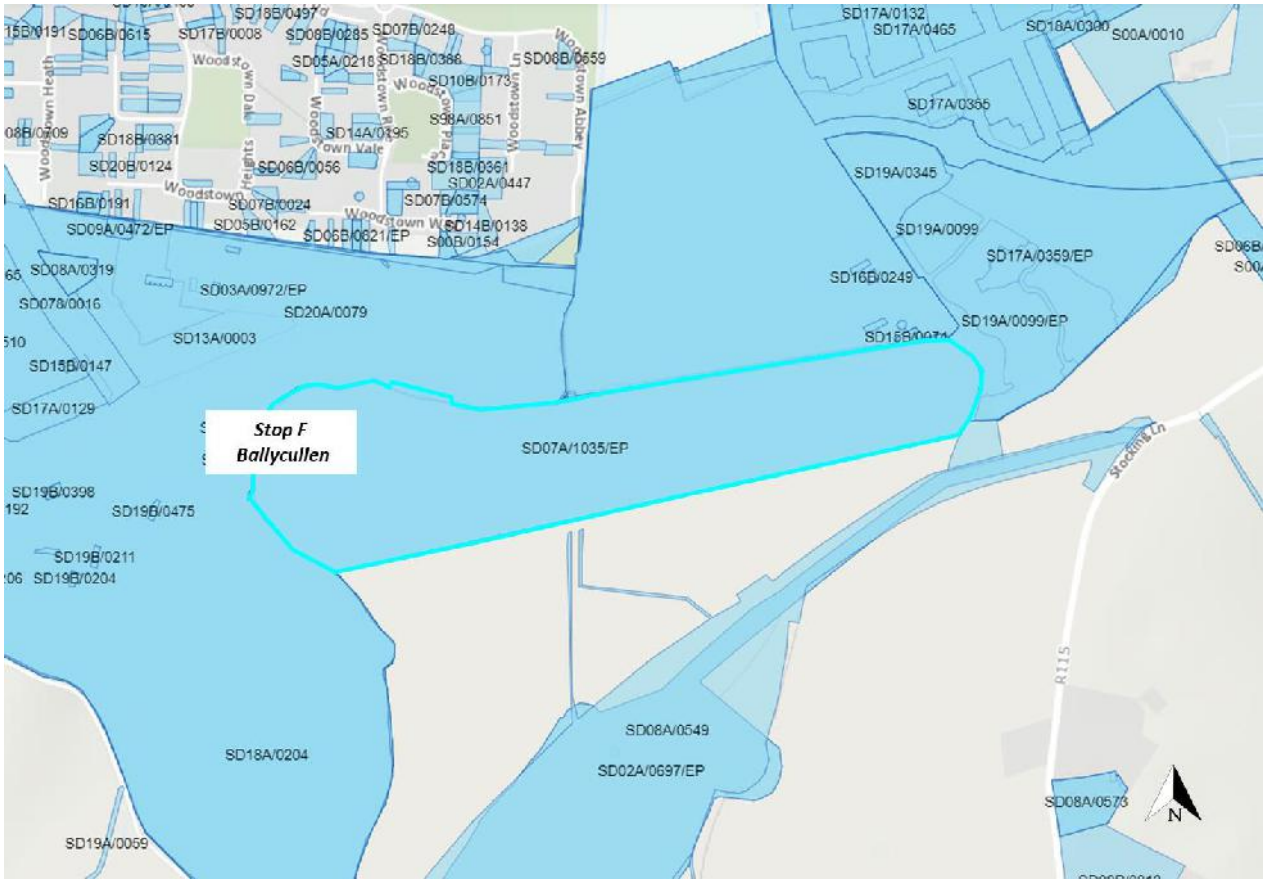


Figure C-9: South Dublin County Council planning application SD06A/0611 (bright blue polygon) near proposed site

Planning application SD06A/0611 in the jurisdiction of South Dublin County Council is located on the proposed site, as seen in Figure C-9. This planning application was submitted by the Ballycullen Limited Partnership on the 17/07/06.

The proposed application consisted on the construction of 396 residential units in a mix of 2, 4 and 4 storey buildings. The full development had a total gross floor area of 55,440 sqm. Vehicular access to the development is via 3 access roads.

This planning application was refused on September 2007 for the following reasons:

- The planning application was deemed 'obtrusive' due to the scale and height of the proposed development, which exceeded the dimensions established in the Ballycullen Oldcourt Action Area Plan (2000).

- The proposed application posed a considerable disruption to the existing contours and landforms in the site as it would require the level of the hillside into a platform to support the development. This was particularly relevant due to the proximity of the site to the Dublin Mountains.

- The proposed application was considered to be below the expected levels of residential amenity as indicated in the Residential Density Guidelines, therefore being inadequate for existing and future residents.

- The proposed development was considered to be opposite to the objective of the South Dublin County Development (2004 – 2010) to 'protect and preserve trees and woodland on the site', considering the high degree of proposed excavation and required cut down of existing trees.

- The open space layout within the proposed development was considered inadequate to integrate the areas at the east and west of the location, mainly due to the differences in height that would act as a barrier. This is against the objectives of the Ballycullen – Oldcourt Action Area Plan.

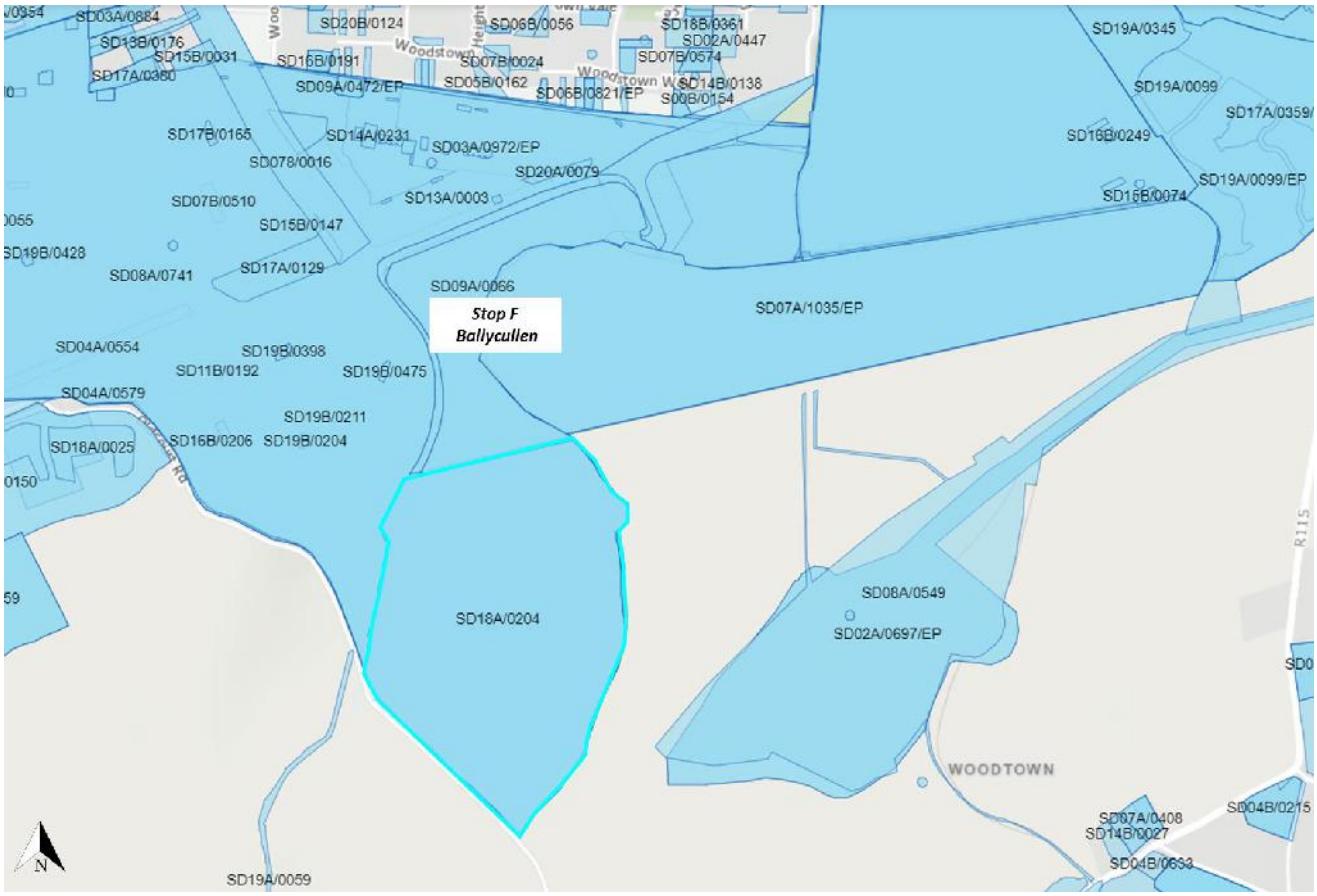


Figure C-10: South Dublin County Council planning application SD18A/0204 (bright blue polygon) near proposed site

Planning application SD18A/0204 in the jurisdiction of South Dublin County Council is located south-west of the proposed site, as seen in Figure C-10. This planning application was submitted by the Jones Investments Limited on the 01/06/18.

The proposed application consisted on a mixed-use scheme split into two sites (site A and site B) with a combined area of 10.14 hectares. Site A proposal consisted on a residential area comprising 65 residential units, including detached and semi-detached houses and apartment buildings, car and bike parking, access roads and private open space. Site B proposal consisted on an educational campus comprising a primary and a post primary school with a playing pitch, car and bike parking and soft landscaping.

This planning application was refused on June 2008 for various reasons mostly related to the noncompliance with the existing policies, plans and guidelines as indicated below:

- Proposed Site A did not fully comply with the zoning established in the South Dublin County Council Development Plan (2016 – 2022) and in the Ballycullen Oldcourt Plan (2014), in which the site is zoned as both residential and potential primary school. In addition, the share of houses, apartment buildings and open public spaces proposed for the site does not meet the requirements established in the mentioned development plans.

- Development proposed for Site B was opposite to the objectives presented in the National Planning Framework and South Dublin County Council Development plan which give priority to the intensification

and infill development of existing settlements within the Dublin Metropolitan Area. The site is zoned as rural lands and its development could encourage further urban sprawl. Additionally, the proposal does not comply with some of the rural economy objectives set in the South Dublin County Council Development Plan (2016 – 2022).

- It was considered that the development of school facilities in Site B under the existing transport conditions could encourage more journeys by car and discourage the use of more sustainable transport modes.

- The planning application failed to demonstrate that no detrimental impact on species protected under the Wildlife Acts (1976 and 2000), Birds Directive (1979) and Habitats Directive (1992).

C.3 Integration of Transport Networks

The following criteria was considered to assess the potential for integration of transport networks provided by the proposed Metro to Knocklyon stations.

- Station proximity to bus stop(s)

- Station proximity to other transport facilities (e.g. car parking; taxi rank; bike parking)

Proximity to public transport stops and other facilities is measured as the provision of transport facilities within 600m from the proposed station. Site locations served by bus routes that differ from the Metrolink alignment or that could function as feeder routes are considered to have higher contributions to the overall objectives of this category.

Proximity to Luas station has not been defined as criteria since the alternative alignment to Knocklyon and proposed stations are beyond 1km from both Red and Green Luas lines.

This analysis is based on the options selection analysis prepared in Section 2.2.

C.3.1 Station A2 Rathmines

This station option is located within the grounds of the St. Louis High School. There are several bus stops near the proposed station, mostly located at its east and south, along Rathmines Road Lower (R114), Rathgar Road, Grosvenor Road and Castlewood Avenue. This location facilitates interchange with bus services 83, 15, 15B, 65, 14, 18, 65B and 83A. Out of these, 15 (Main Street – Ballycullen), 14 (Maryfield Drive – Dundrum) and 18 (Palmerstown – Sandymount) serve areas not served by Metrolink.

Additionally, there are several stands for bikes provided within 600m from the proposed site, as shown in Figure C-11.

Based on the aspects above, the proposed station at Rathmines fully addresses Category 3 – Integration of Transport Networks.

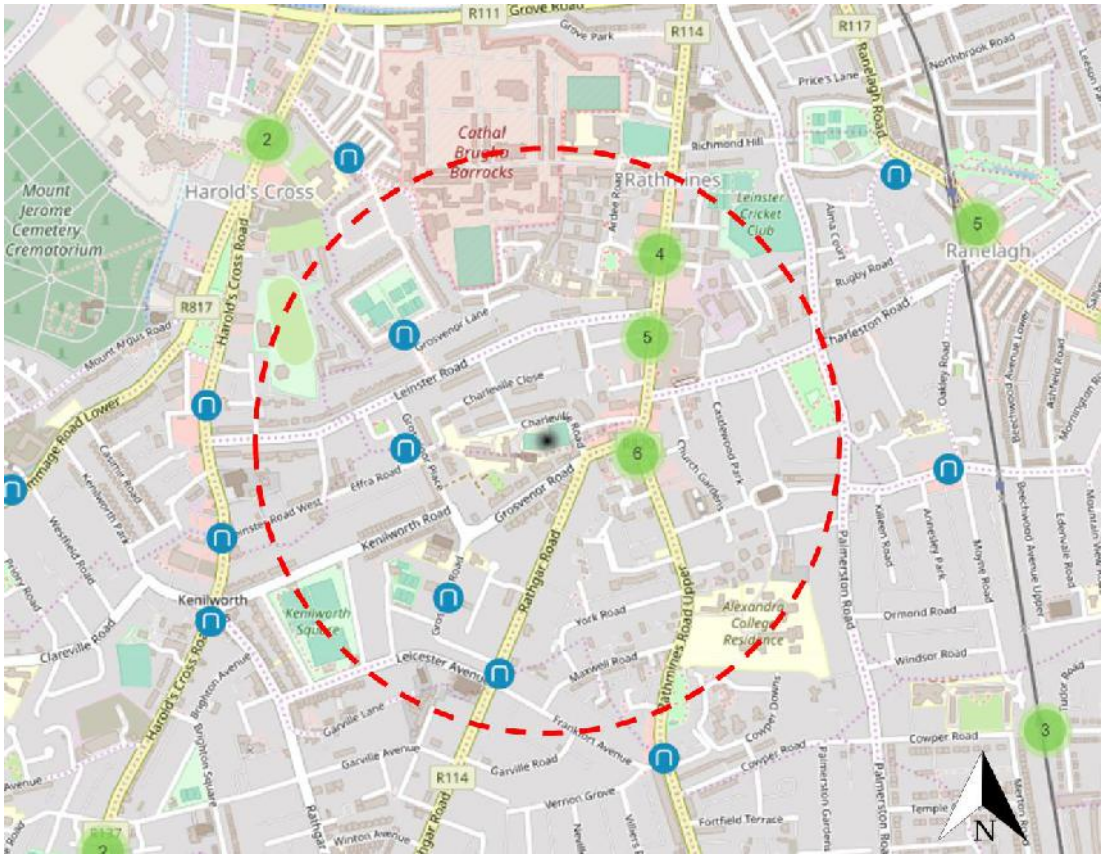


Figure C-11: Bike stands within 600m from Station A2 Rathmines

C.3.2 Station B1 Terenure

Station B1 Terenure is proposed to be located within the grounds of the CYM Sports Club. The street network around the station does not provide for on-street parking. However, the car parking within the Sports Ground. Alternatively, there is a taxi rank and a car park at the south-east of the proposed location, this last one available 24hour. In addition, there is a handful of bike racks within 600m from the proposed site, as shown in Figure C-12.

There few bus services operating at the bus stops located within 600m from the proposed station at Terenure. Most of these are located south and east of the station, along Terenure Road North, East and West. This location facilitates interchange with routes 15A, 16, 17 and 49. Out of these, 17 (Rialto – Blackrock) and 15A (Ringsend Rd – Limekiln Ave) are serving additional areas not served by Metrolink.

Based on the analysis above, the proposed station at Terenure Sports Club addresses Category 3 – Integration of Transport Networks well.

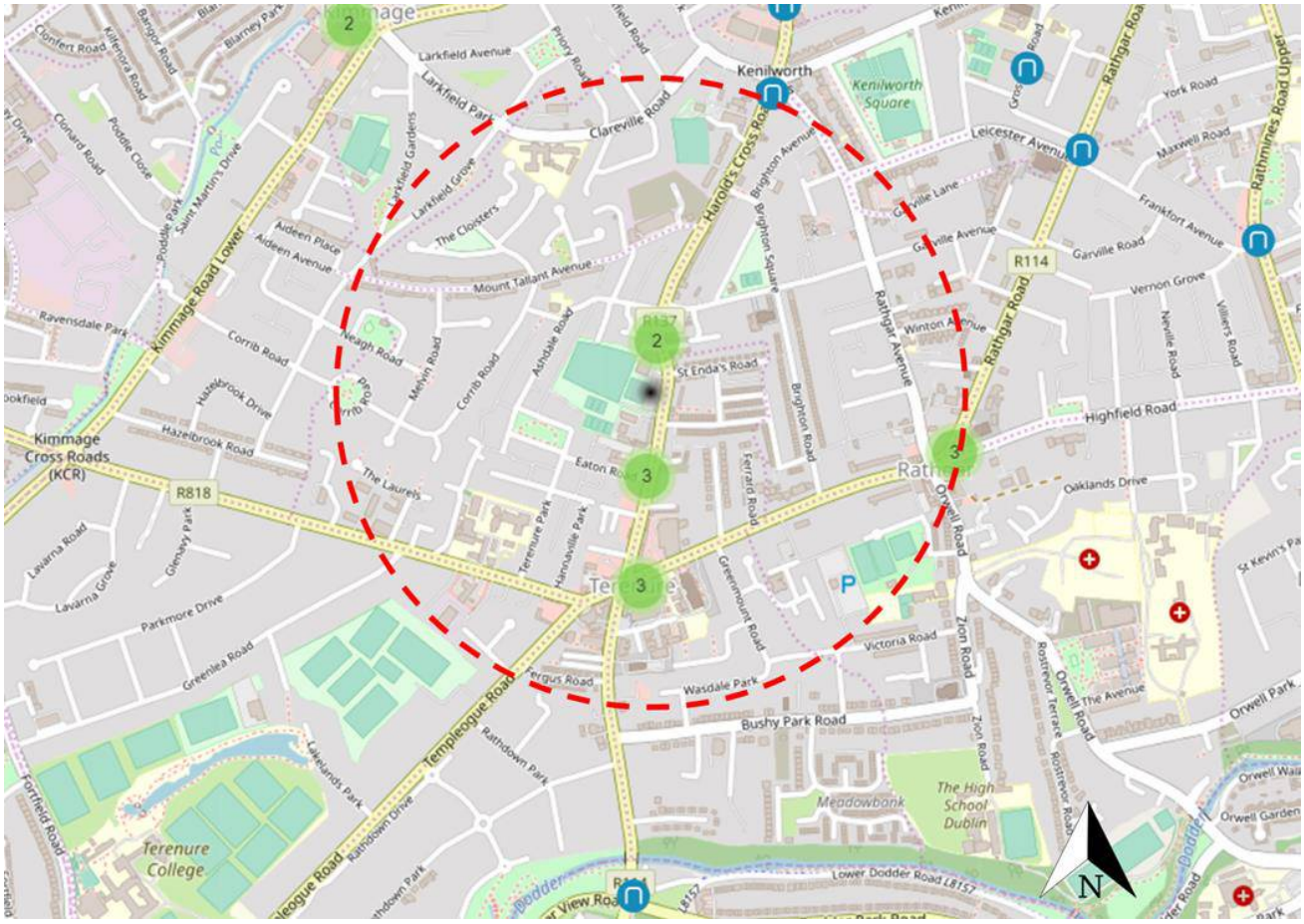


Figure C-12: Bike stands within 600m from Station B1 Terenure

C.3.3 Station C1 Rathfarnham

Station C1 Rathfarnham is located within the grounds of the Rathfarnham Castle. The street network around the location does not provide for on-street parking. There is a car parking at the west of the station currently serving visitors of the Castle. In addition, there is a handful of bike racks within 600m from the proposed site, as shown in Figure C-13.

There are several bus stops near the proposed station, mostly along the Rathfarnham Road at the east of the station and Grange Road at the south. This location facilitates interchange with routes 15B, 16, 17, 75 and 61. From these, 15B (Ringsend Rd – Dalriada Estate), 17 (Rialto – Blackrock) and 75 (The Square Tallaght – Dun Laoghaire) are serving areas not projected to be served by Metrolink.

Based on the analysis above, the proposed station at Rathfarnham addresses Category 3 – Integration of Transport Networks well.

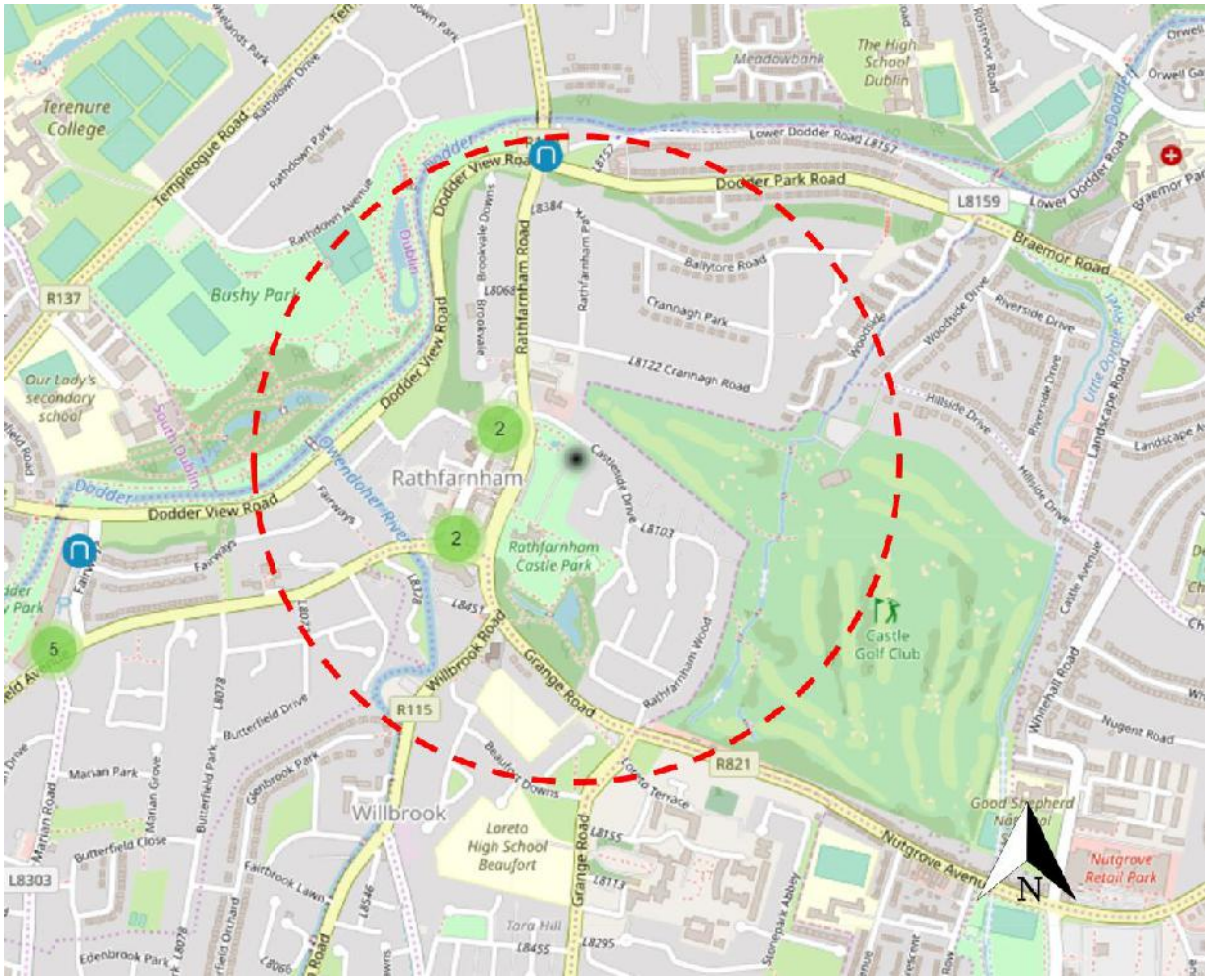


Figure C-13: Bike stands within 600m from Station C1 Rathfarnham

C.3.4 Station D Ballyboden

Station D Ballyboden is proposed to be located at Coláiste Éanna Sports Grounds. The street network comprises small residential streets in the northwest and the Ballyboden Way as the main road in the south, without provision of on-street parking. There are no bike racks provided within 500m from the proposed site, as shown in Figure C-14.

There are few bus services operating within the 600m buffer from the station, and most of the bus stops are located along the Ballyboden Way and Ballyboden Road at the south of the proposed location. The station only facilitates integration with routes 15B, 15D, 61, 161 and 175. From these, 15B (Ringsend Rd – Dalriada Estate), 15D (Ringsend Road - Church of Our Lady of Good Council), 175 (UCD – City West) and 161 (Rockbrook – Dundrum) are serving areas not projected to be served by Metrolink.

In 2012 South Dublin County Council, under a Part VIII planning application (SD128/0003), proposed the Tallaght to Ballyboden Cycle Route Scheme which included the construction of new off-road cycle tracks on Templeroan Road.

In 2016 South Dublin County Council, under a Part VIII planning application (SD168/0001), constructed a walking and cycling scheme which included upgrading and realignment of the existing footpath to a new walking and cycling route from Anne Devlin Park to Ballyroan Road, upgrading and realignment of the existing footpath to a new walking and cycling route from Ballyroan Road to Ballyroan Crescent including upgrading of existing access onto Ballyroan Road and upgrading and realignment of the existing access onto Ballyroan Crescent, and other works in the area.

Based on the aspects above, the proposed station at Ballyboden partially addresses Category 3 – Integration of Transport Networks.

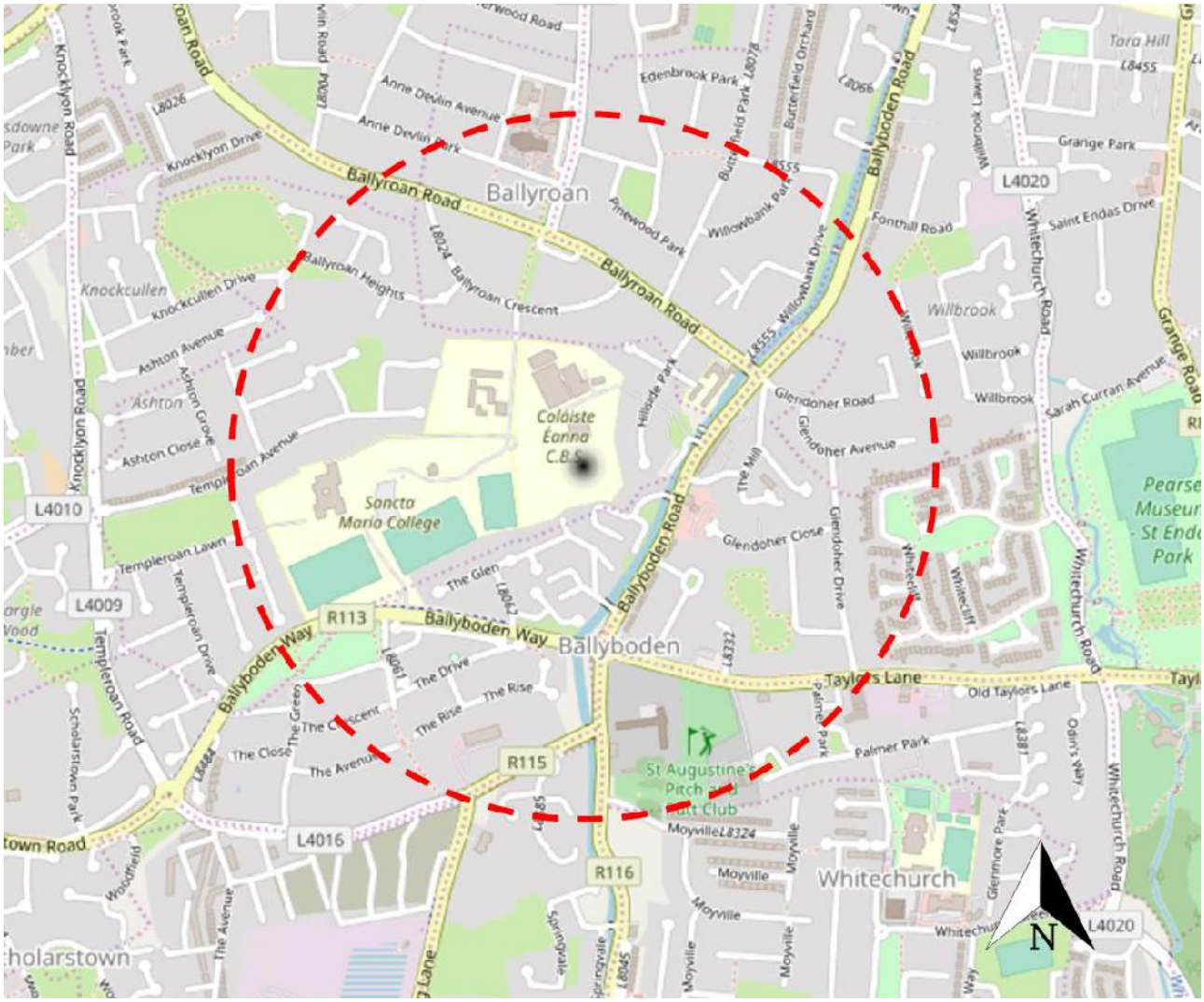


Figure C-14: Bike stands within 600m from Station D Ballyboden

C.3.5 Station E Knocklyon

Station D Knocklyon is proposed to be located at the undeveloped land between Knocklyon Rd and Scholarstown Rd, which compose the main roads near the station. None of these roads provides for on-street parking. There are no bike racks provided within 600m from the proposed site, as shown in Figure C-15

There are several stops along Scholarstown Rd within 600m from the station mostly served by bus routes 15 (Main Street – Ballycullen),15B (Ringsend Rd – Dalriada Estate) and 175 (UCD – City West). All three routes offer access to areas not projected to be served by Metrolink.

In 2012 South Dublin County Council, under a Part VIII planning application (SD128/0003), proposed the Tallaght to Ballyboden Cycle Route Scheme which included the upgrade of an existing off-road cycle track on Scholarstown Road.

Based on the aspects above, the proposed station at Knocklyon addresses Category 3 – Integration of Transport Networks poorly.

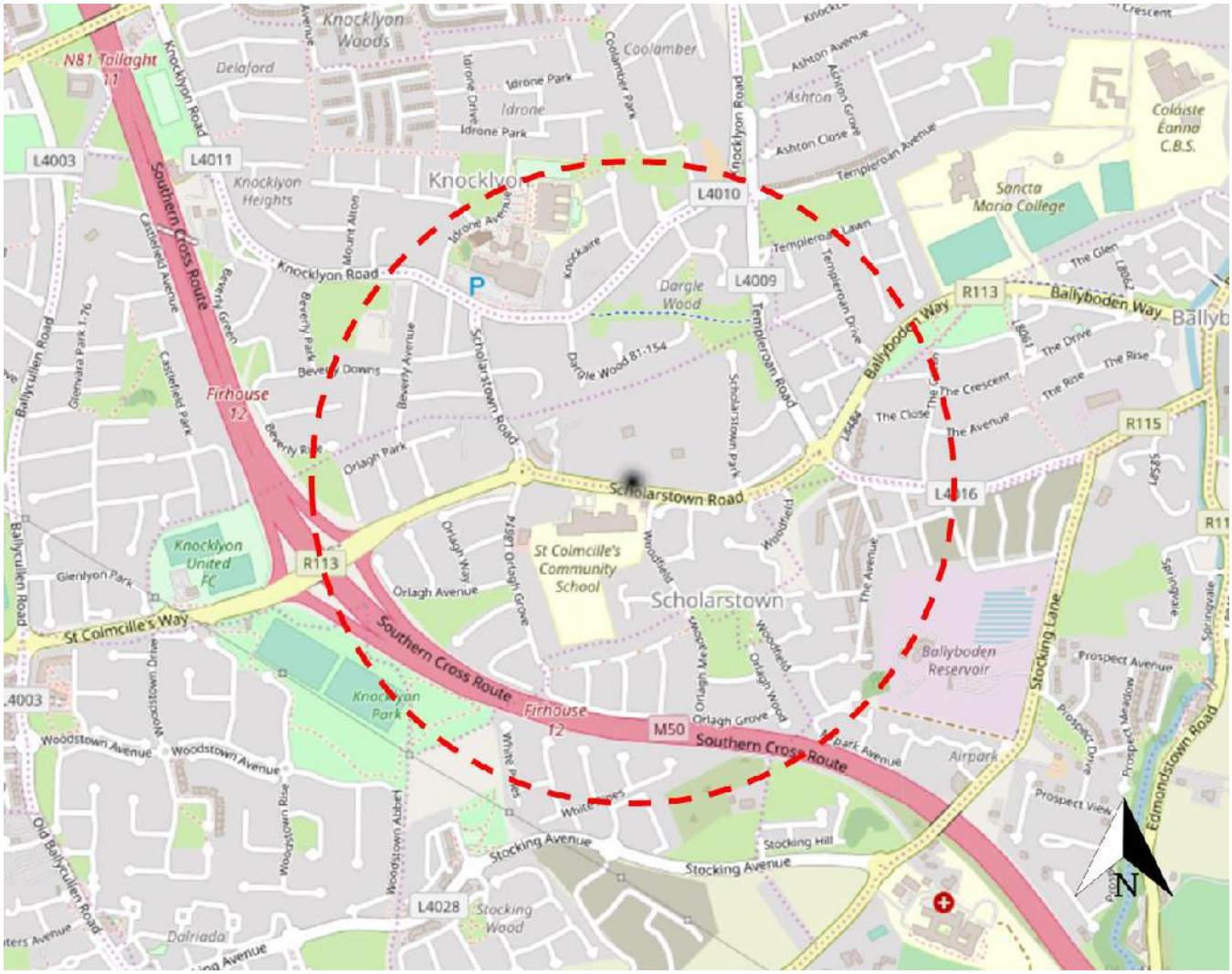


Figure C-15: Bike stands within 600m from Station E Knocklyon

C.3.6 Station F Ballycullen

Option F Ballycullen Station is proposed to be located in lands zoned for development under the Ballycullen-Oldcourt Local Area Plan. The main street network near the location is formed by Stocking Avenue at the north and Ballycullen Road at the west, which do not provide on-street parking. There are no bike racks provided within 600m from the proposed site, as shown in Figure C-16.

Most of the stops within 600m from the station are located along Stocking Avenue and Ballycullen Rd and are only served by buses 15 (Main Street – Ballycullen) and 15B (Ringsend Rd – Dalriada Estate).

Based on the analysis above, the proposed station at Ballycullen addresses Category 3 – Integration of Transport Networks poorly.

Figure C-16: Bike stands within 600m from Stop F Ballycullen

C.4 Accessibility and Social Inclusion

The following criteria was considered to assess the potential for social inclusion provided by the proposed stations.

- Station proximity to an urban centre
- Station proximity to key attractor(s) (hospital, school, university, shopping centre or park)

Proximity is considered to be adequate within 600m from the proposed stations.

In addition, the following criteria was considered to evaluate the potential for accessibility provided by the proposed stations.

- Station proximity to a direct access from main road
- Conditions of pedestrian and cycling infrastructure

Direct access and conditions of pedestrian and cycling infrastructure were evaluated within the immediate surroundings of the proposed stations.

This analysis is based on the options selection analysis prepared in Section 2.2.

C.4.1 Station A2 Rathmines

This proposed station is located within a quiet residential area. Charleville Rd at the north of the station does not lead back to a local centre but leads to many residential streets. The area is also in close proximity to the Rathmines town centre which comprises a number of cafes, restaurants, shops and other services. Key attractors within 600m from the station include Rathmines Library, Technological University Dublin, St. Louis Senior Primary School, Swan Shopping Centre and Lidl and Aldi supermarkets. Intensity of activities around the proposed station and Rathmines town centre is considered high.

This station option is located within the grounds of the St. Louis High School. The area is served by Grosvenor Road and Rathgar Road (R114) to the south, which are two-way single carriageways which merge to become Rathgar road (R114). The proposed station can be directly access from Charleville Rd at the north and Wynnefield Rd at the east Figure C-17. Direct access from Grosvenor Rd (main road) is limited by residential buildings but possible through Charleville Rd link to Grosvenor Rd which restricts vehicle access and gives priority to pedestrians and cyclists.

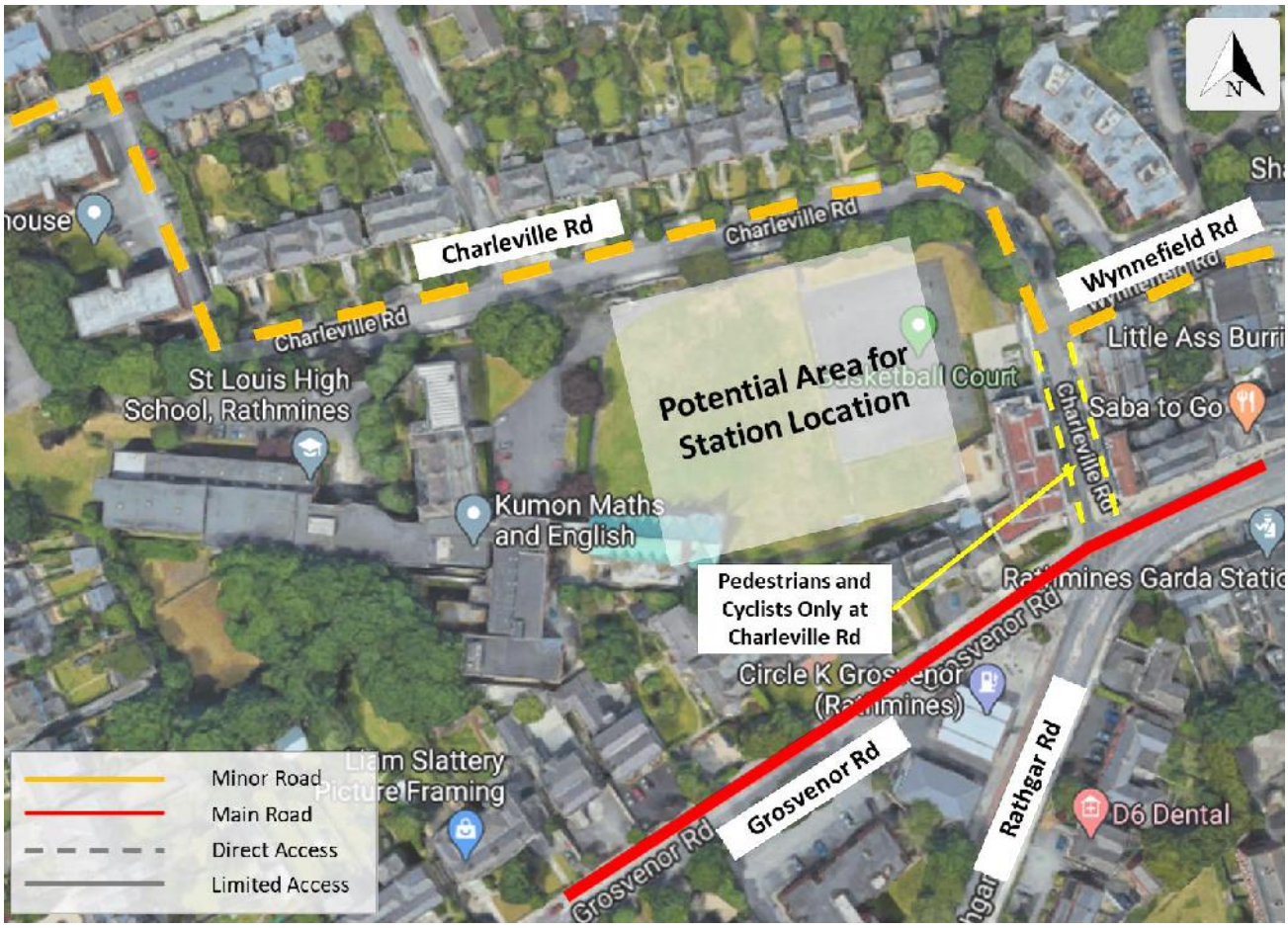


Figure C-17: Access to station from nearby roads - Stop A2 Rathmines

Figure C-18: Charleville Rd pedestrian / cycle only access

Advisory cycle lanes are provided along Rathgar Rd in both bounds with high demand of cyclists. No cycle lanes are provided along Grosvenor Rd. Pedestrian footpath and crossings are adequate in these two main roads.

Pedestrian footpaths along Charleville Rd are wide and well-lit with few pedestrian crossings towards St. Louis High School. Existing pedestrian crossings are not marked and do not have tactile pavement and dropped kerbs. Charleville Rd is a not busy residential road and provided speed bumps might suffice for safe crossing of pedestrians. There are no cycle lanes provided along this road.

Pedestrian footpaths along Wynnefield Rd are narrow and existing crossings at the junctions with R114 and Charleville Rd are not marked and not provided with tactile pavement and dropped kerbs.

Based on the analysis above, the proposed station at Rathmines addresses Category 4 – Accessibility and Social Inclusion well.

C.4.2 Station B1 Terenure

This station is proposed to be located in the grounds of the CYM Sports Club on Terenure Road North within a predominantly residential area. Terenure Village is a local centre located 600m from the proposed station and comprises a handful of cafes, restaurants and shops, including Lidl and Aldi. Other key attractors outside the local centre are Terenure Sports Club itself and Tesco Metro store, Eaton Square Park, community college and primary school, Rathgar Tennis and Bowling Club. Intensity of activities around the proposed station and Terenure town centre is considered medium.

The proposed station is served by Terenure Road North (R137) which is a main north-south road connecting with Harold's Cross and Rathfarnham. Direct access for pedestrians, cyclists and motorised vehicles is possible to this road from the proposed station, as shown in Figure C-19.

Figure C-19: Access to station from nearby roads - Stop B1 Terenure

The Terenure Road North section near the station is provided with wide pedestrian paths. However, there are few pedestrian crossings and not all the existing ones are provided with tactile pavement and dropped kerbs. Advisory cycle lanes are provided in both bounds of the road. One section of the advisory cycle lane in the southbound is interrupted to give space to on street-parking.

Based on the analysis above, the proposed station at Terenure addresses Category 4 – Accessibility and Social Inclusion well.

C.4.3 Station C1 Rathfarnham

This station is proposed to be located in the lands of the Rathfarnham Castle, within a low-density residential area. Around 200m from the station there a small local centre along the Main St, which comprises a number of shops, grocery store, restaurants and services. Intensity of activities around the proposed station and the Main St. is considered medium. There are no urban centres near to the proposed site.

Direct access to the proposed station is possible through Castleview, a residential street located at the north of the castle (see Figure C-20). The station could also be accessed from the Rathfarnham Rd at the west, passing the visitor's car parking serving the castle. However, this would require building a new path between the station and the road. Direct access limitations from Rathfarnham Rd are due to the wall separating the castle's gardens from the road.

Figure C-20: Access to station from nearby roads - Stop C1 Rathfarnham

Castleview is a residential street with narrow and well-lit pedestrian footpaths. No cycling lanes are provided along this street. Pedestrian crossing at the junction with Rathfarnham Road is well marked and provided with tactile pavement and dropped kerbs.

Pedestrian footpaths along Rathfarnham Road are wide but often interrupted by greenery and road signs. There are a number of crossings along this road and are adequately marked and provided with tactile pavements and dropped kerbs. No cycle lanes are provided along Rathfarnham Rd.

Based on the analysis above, the proposed station at Rathfarnham addresses Category 4 – Accessibility and Social Inclusion poorly.

C.4.4 Stop D Ballyboden

This station is proposed to be located Coláiste Éanna Sports Grounds, which is a predominantly residential area with a number of schools also surrounding the site. Main key attractors within 600m from the station are education facilities, including Christian Brothers Secondary School, Scoil Naomh Padraig, Ballyroan Boys National School, Sancta Maria College, among others. There are few other key attractors within this area including Ballyboden Medical Practice and some grocery stores and restaurants.

Main access to the proposed station from Ballyboden Way in the south, Ballyboden Rd in the east and Ballyroan Cres in the north is currently not allowed for general traffic (see Figure C-21). In addition, the proposed location is separated from Ballyboden Way and Ballyboden Rd by a low-density private estate that would limit direct access to the main road.

Figure C-21: Access to station from nearby roads - Stop D Ballyboden

Ballyboden Way, south west of the station, has a combination of shared pedestrian and cycle paths and advisory cycle lanes in the carriageway.

Ballyboden Rd (R115) has advisory cycle lanes in both side of the carriageway. Pedestrian footpaths have adequate widths, are well lit, and at some sections, are separated from carriageway by grass verge. There is a pedestrian crossing and a bus stop 50m from Owendoher Lodge. This pedestrian crossing is signalised, adequately marked and with tactile pavement. Pedestrian path along Ballyroan Rd are wide and separated from traffic by a wide grass verge. Cycle lanes shared with bus lanes are provided in both sides of the carriageway.

Based on the analysis above, the proposed station at Ballyboden partially addresses Category 4 – Accessibility and Social Inclusion.

C.4.5 Station E Knocklyon

This station is proposed to be located at open private lands to the north of Scholarstown Rd within a predominantly residential area. A local centre with schools and supermarkets is located within 600m north from the proposed station, including a SuperValu, the Knocklyon Shopping Centre, Knocklyon Community Centre, St. Colmcille's Senior and Junior National schools. Further facilities within this catchment area include a Spar shop and St. Collmcille's Community School. Intensity of activities around the proposed station is considered low.

The station is directly served by Scholarstown Rd (R113), which is an east-west regional road connecting Knocklyon, Ballyboden and Ballinteer. Direct access for pedestrians and cyclists is possible from this road to the proposed station, as show in Figure C-22.

Figure C-22: Access to station from nearby roads - Stop E Knocklyon

Scholarstown Rd to the south provides shared pedestrian and cycle lanes in both sides of the carriageway. Pedestrian crossings are well marked and provide for tactile pavement (Figure C-23).

Figure C-23: Pedestrian crossing at Scholarstown Rd (south of station)

Differently, at the west of the proposed location, Scholarstown Rd provides wide shared pedestrian and cycle paths only along the western side of the carriageway. During the site visit it was observed that cyclists do not use the shared cycle lane possibly due to an inadequate design of the access at the crossing point from the Scholarstown roundabout. No footpath is provided along the east side of the carriageway (Figure C-24).

Figure C-24: Pedestrian footpath at Scholarstown Rd (west of station)

Based on the analysis above, the proposed station at Knocklyon partially addresses Category 4 – Accessibility and Social Inclusion.

C.4.6 Station F Ballycullen

This station is proposed to be located in lands zoned for development within a predominantly low-density residential area. Near 750m north from the location there is the Woodstown Shopping Centre which comprises most of the local services for Ballycullen, including a medical centre (see Figure C-25). At 500m from the station (around 10m walking) there is a lack of key attractors. The main facility within this catchment area is the Chuckleberries Creche & Montessori School. Intensity of activities around the proposed station is considered very low.

Figure C-25: Woodstown Shopping Centre

Direct access to the selected lands is currently possible through Stocking Avenue (see Figure C-26). As the proposed lands are set for future development, further direct pedestrian connections between the station and Stocking Ave could be provided.

Figure C-26: Access to station from nearby roads - Stop F Ballycullen

Stocking Avenue provides for shared pedestrian and cycle paths of adequate width in both side of the carriageway. These paths are often separated from traffic by a grass verge. Crossings provide for tactile pavement and dropped kerbs.

Pedestrian footpaths along Ballycullen Rd have adequate widths, are well lit and separated from traffic by a grass verge.

Ballycullen Rd between Stocking Ave and Woodstown Ave provides for an advisory cycle lane shared with the Bus Lane for the southbound only. In some sections the cycle path and pedestrian footpath are shared.

Between Woodstown Ave and Killinniny Rd cycle lane is provided in both side of the carriageway and shared with the bus lane.

Based on the analysis above, the proposed station at Ballycullen partially addresses Category 4 – Accessibility and Social Inclusion.

C.5 Environment

The following criteria were considered to assess the environmental impacts of the proposed stations.

- Water / flood risk
- Air quality / Noise Sensitive Receptors

- Cultural Heritage

Negative impacts to air quality and noise were considered when evaluating the proposed sites. Impacts to groundwater were also considered, along with flood risks. The Record of Monuments and Places (RMP) and the National Inventory of Architectural Heritage (NIAH) were considered when assessing cultural heritage impacts.

This analysis is based on the options selection analysis prepared in Section 2.2.

C.5.1 Station A2 Rathmines

There are no surface waterbodies at the proposed site. The River Poddle is approximately 882m from the proposed site. The Ground Waterbody WFD Status 2013-2018 IE_EA_G_008 for the groundwater at the Proposed Site is Good. Ground waterbody IE_EA_G_008 is not at risk. There are no flood risk concerns at the proposed site.

The Proposed Site is in Air Quality Zone A – Dublin Conurbation. The air quality index is 2- Good.

The Sensitive Receptors are:

- Residential areas,
- St Louis High School, and
- Rathmines & Rathgar Junior School & Kindergarten.

There are a number of residential houses in very close proximity to the Proposed Site. There is potential for negative impacts to residents on Charleville Road, Grosvenor Road and Grosvenor Place as a result of the proposed works.

There are no RMP's or NIAH's at the proposed station location. There are a number of NIAH's approximately 500m from the site (Cathal Brugha Barracks - Reg. No. 50081028, Reg. No. 50081029 and Reg. No. 50081034).

Based on the above analysis, Station A2 Rathmines fully addresses Category 5 - Environment.

C.5.2 Station B1 Terenure

There are no surface waterbodies at the proposed site. The River Poddle is approximately 850m north of the proposed site. The Ground Waterbody WFD Status 2013-2018 IE_EA_G_008 for the groundwater at the Proposed Site is Good. There is no expected issue with flooding at the proposed site.

The Proposed Site is in Air Quality Zone A – Dublin Conurbation. The air quality index is 2- Good.

The Sensitive Receptors are:

- Residential areas,
- Dublin School of Music,
- Manor Montessori School & Nursery,
- Presentation Primary School & Secondary School,
- St. Joseph's BNS,
- Every Bebe – Montessori School,
- Harold's Cross National School,
- Terenure Health Centre,
- Rathgar Methodist Church,
- Saint Joseph's Church,
- Terenure Sports Club, and
- CYM Rugby Football Club.

There are a number of residential houses in very close proximity to the Proposed Site. There is potential for negative impacts to residents on Ashdale Road, Eaton Square, St. Enda's Road, Whitton Road and Eagle Hill as a result of the proposed works. There are also a number of retail shops in the area.

The closest RMP is 200m from the proposed location. DU0022-080 consists of a Windmill. The National Monument Service - Zone of Notification identifies the extend of the monuments for the purposes of notification under Section 12 of the National Monuments Act (1930-2004), see Figure C-27. There are no NIAH's at the proposed station location.

Based on the above analysis, Station B1 Terenure addresses Category 5 - Environment well.

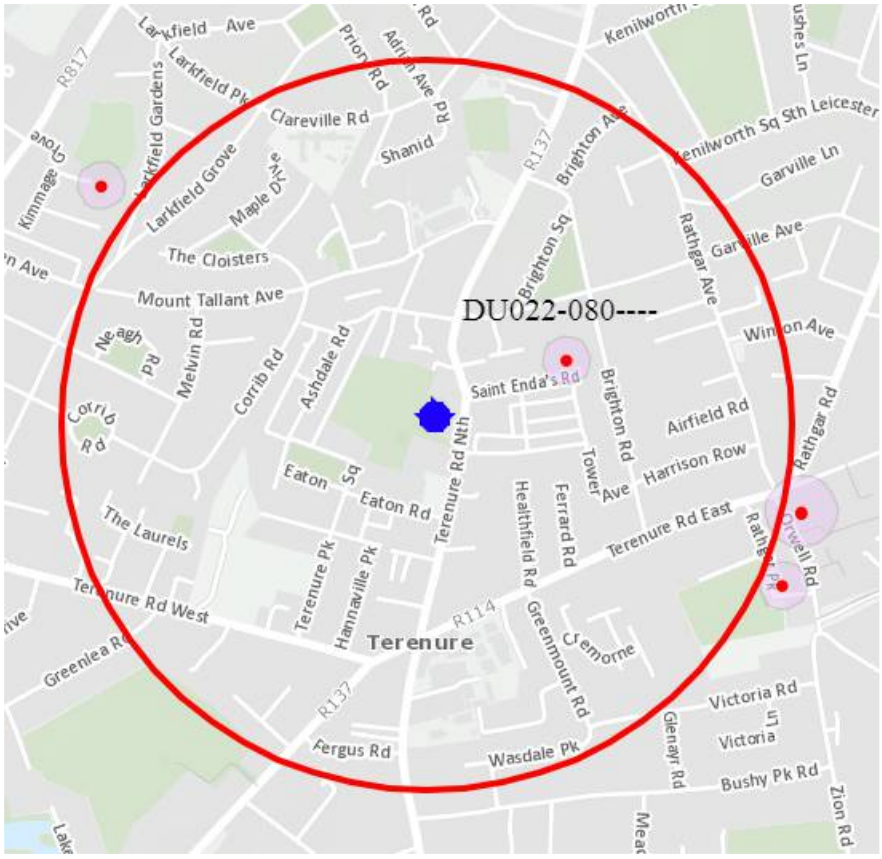


Figure C-27: National Monument Service – Zone of Notification at the Proposed Site. (www.webgis.archaeology.ie)

C.5.3 Station C1 Rathfarnham

There are three rivers in close proximity to the proposed site. The River Dodder is approximately 500m northwest of the proposed site. The Owendoher is approximately 170m west of the proposed site. The Dodder is approximately 400m east of the proposed site. The Ground Waterbody WFD Status 2013-2018 IE_EA_G_008 for the groundwater at the Proposed Site is Good. There is a low to medium probability of flooding from the River Dodder and Little Dodder at the proposed site, in a very extreme flood event.

The Proposed Site is in Air Quality Zone A – Dublin Conurbation. The air quality index is 2- Good.

The Sensitive Receptors are:

- Residential areas,
- Rathfarnham Dental Practice,
- Rathfarnham Daycare,
- Marley Montessori School,
- St. Mary's Boys National School,
- Rathfarnham Church of the Annunciation,
- Rathfarnham Parish Church of Ireland,
- Rathfarnham Castle Playground, and
- Rathfarnham Health Centre.

There are a number of residential houses in very close proximity to the Proposed Site. There is potential for negative impacts to residents Castleview Road, Castleview Drive, The Parklands and The Woodlands as a result of the proposed works.

There are NIAH's listed at the proposed station location; Rathfarnham Castle and the three outbuildings / stables. Rathfarnham Castle was built in the 16th century and is classified as a castle / fortified house. Rathfarnham Castle is also registered under the sites and monuments records as a National Protected Structure. The outbuildings and stables have over the last year couple of years undergone significant stabilization and conservation works. Works to the Castle by the Office of Public Works in 2015 unearthed a treasure trove of artefacts from the early 1600's including lead-crystal goblets, Chinese tea-sets, rare coins and armour. These works improved public access and facilities at the Castle as well as creating an elegant entrance courtyard off Rathfarnham Road. A Conservation Plan for the Council-owned lands in consultation with Office of Public Works, Statutory bodies as well as local groups and traders was produced by Shaffreys Conservation Architects and aims to address issues of archaeology, conservation and environmental impact for this site.

The National Monument Service - Zone of Notification identifies the extend of the monuments for the purposes of notification under Section 12 of the National Monuments Act (1930-2004), see Figure C-28.

Based on the above analysis, Station C1 Rathfarnham partially addresses Category 5 - Environment.

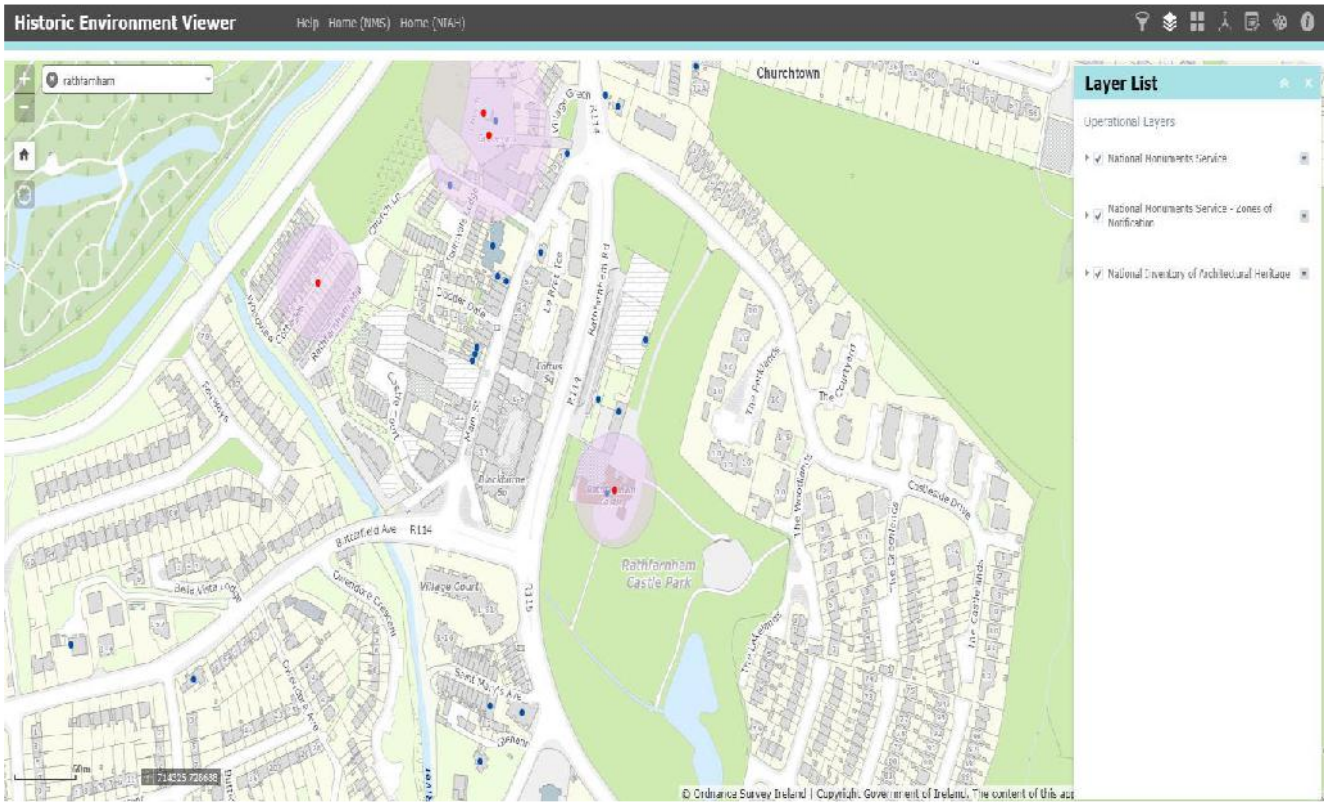


Figure C-28: National Monument Service – Zone of Notification at the Proposed Site. (www.webgis.archaeology.ie)

C.5.4 Station D Ballyboden

There is one river in close proximity to the proposed site. The Owendoher is approximately 160m from the proposed site. The Owendoher river body is classified as at Risk. The Ground Waterbody WFD Status 2013-2018 IE_EA_G_008 for the groundwater at the Proposed Site is Good. There is a low probability of flooding at the proposed site from the River Owendoher in a very extreme flood event. The proposed station location would not expect to be impacted from a flooding event.

The Proposed Site is in Air Quality Zone A – Dublin Conurbation. The air quality index is 2- Good.

The Sensitive Receptors are:

- Residential areas,
- Sancta Maria College,
- CBS Secondary School Rathfarnham,
- Scoil Naomh Padraig,
- Kids Inc Creche and Rathfarnham,
- Coláiste Éanna,
- Ballyroan Boys National School,
- Crescent Hill Pre School,
- Ballyboden Medical Practice,
- Rathfarnham Medical, and
- Ballyroan Parish Church.

There are a number of residential houses in very close proximity to the Proposed Site. There is potential for negative impacts to residents on Hillside Park and Owendoher Grove (currently being constructed) as a result of the proposed works. There are also some sports facilities in the area such as Éanna Basketball Club.

There are no RMP's in the vicinity of the proposed station location. There are a number of NIAH's in close proximity to the site (Ballyroan Gate Lodge - Reg. No. 11216053; St Mary's Convent - Reg. No. 11216034 and - Milepost- Reg. No. 11216002. See Figure C-29).

Based on the above analysis, Station D Ballyboden addresses Category 5 - Environment well.

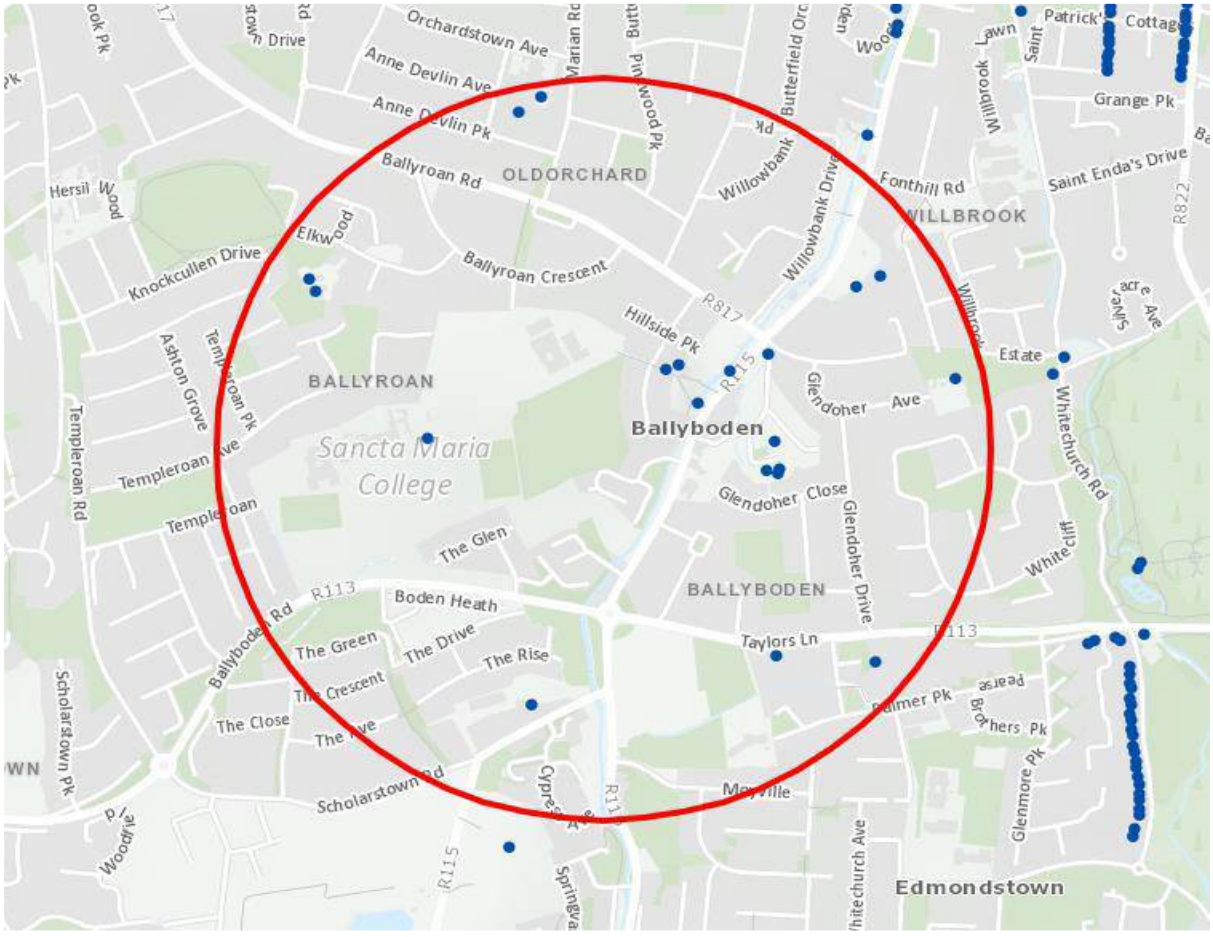


Figure C-29: National Monument Service – Zone of Notification at the Proposed Site. (www.webgis.archaeology.ie)

C.5.5 Station E Knocklyon

There are no surface waterbodies at the proposed site. The Ground Waterbody WFD Status 2013-2018 IE_EA_G_008 for the groundwater at the Proposed Site is Good. There is no potential flooding impact expected at the proposed site.

The Proposed Site is in Air Quality Zone A – Dublin Conurbation. The air quality index is 2- Good.

The Sensitive Receptors are:

- Residential areas,
- St. Colmcille's Community School,
- St. Colmcille's Senior National School,
- St. Colmcille's Junior National School,
- St. Colmcille's Church,
- Scholarstown Family Practice, and
- Ballycullen Community Church.

There are a number of residential houses in very close proximity to the Proposed Site. There is potential for negative impacts to residents on Scholarstown Road, Dargle Wood and Woodfield Road as a result of the proposed works. There are also some sports facilities in the area such as the Olympian Gymnastics Club.

There are no RMP's in the vicinity of the proposed station location. There are a number of NIAH's in close proximity to the site (Ros Mor Country House- Reg. No. 11216055; Willow House - Reg. No. 11216037 and Scholarstown House - Reg. No. 11216036. See Figure C-30).

Based on the above analysis, Station E Knocklyon addresses Category 5 - Environment well.

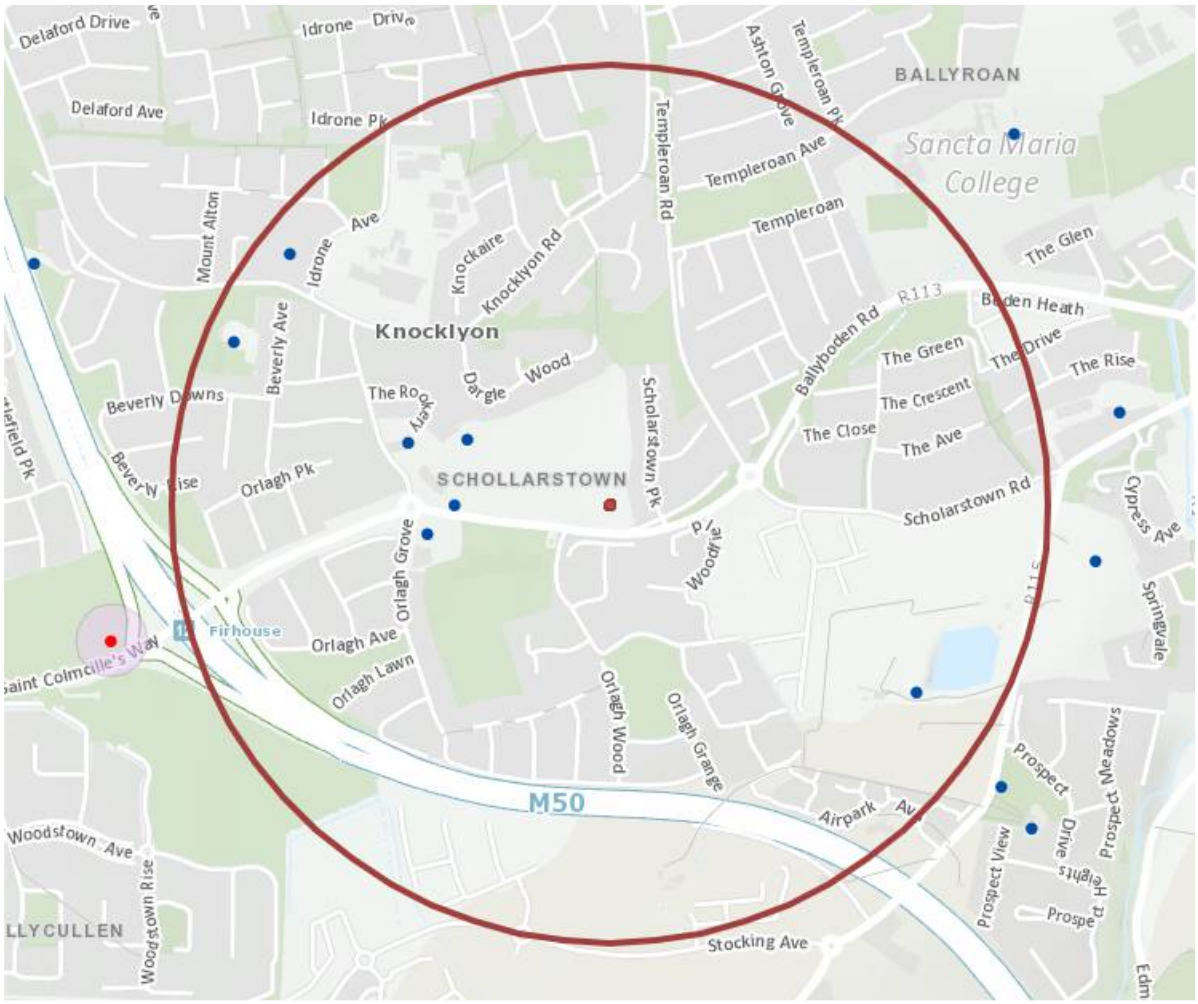


Figure C-30: National Monument Service – Zone of Notification at the Proposed Site. (www.webgis.archaeology.ie)

C.5.6 Station F Ballycullen

There is one waterbody in close proximity the proposed site. The Dodder is approximately 50m from the proposed site. The Dodder is classified as at Risk. The Ground Waterbody WFD Status 2013-2018 IE_EA_G_003 for the groundwater at the Proposed Site is Good. The Kilcullen groundwater body is not at Risk. There is no expected issue with flooding at the proposed site.

The Proposed Site is in Air Quality Zone A – Dublin Conurbation. The air quality index is 2- Good.

The Sensitive Receptors are:

- Residential areas,
- Chuckleberries Creche and Montessori School.
-

There are a number of residential houses in very close proximity to the Proposed Site. There is potential for negative impacts to residents on Stocking Avenue, Abbotts Grove Avenue and Stocking Wood Copse as a result of the proposed works.

There are no RMP's at the proposed station location. There are a number of NIAH's in close proximity to the site (Monument- Reg. No. 11220007; St Colmcille's Well - Reg. No. 11220020, Orlagh Retreat Centre - Reg. No. 11220008 and Woodtown Manor - Reg. No. 11221023). RMP DU022-028 (Ritual site - holy well) is 300m from the Proposed Site. See Figure C-31.

Based on the above analysis, Station F Ballycullen addresses Category 5 - Environment well.

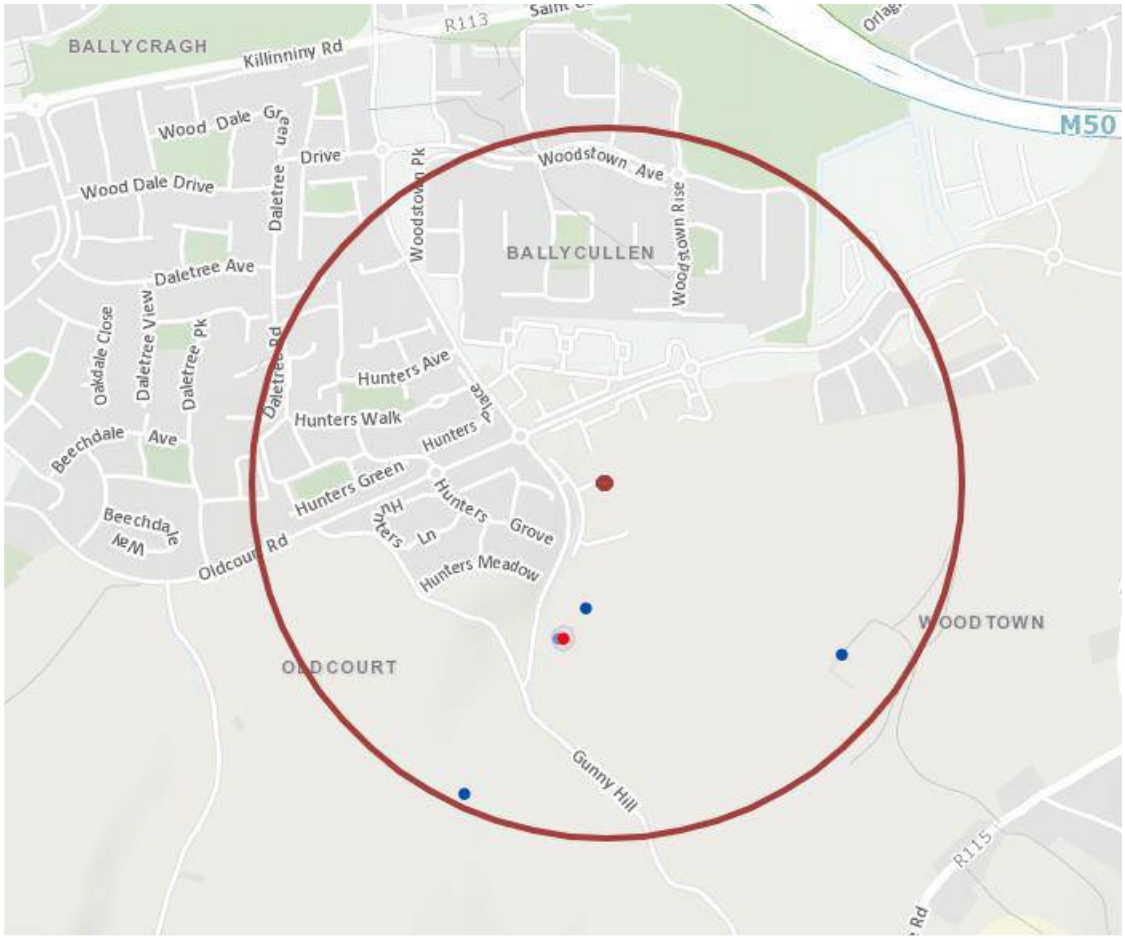


Figure C-31: National Monument Service – Zone of Notification at the Proposed Site. (www.webgis.archaeology.ie)

C.6 Safety

As a new public transport corridor providing fast, efficient and reliable transit, it is expected that the proposed Metro to Knocklyon will reduce the number of vehicular trips during its operation and will facilitate a modal shift from private car onto public transport. Decrease in the number of private cars is anticipated to drive a reduction in the number of accidents on road, therefore increasing safety for all users.

Based on this, it is considered that the Metro to Knocklyon, with preferred stop options starting at Rathmines and finishing at Ballycullen, would fully address Category 6 – Safety of this Multi Criteria Analysis (MCA).