

A map of the Metro-North rail line in Ireland, showing the route from Belinstown in the north to St. Stephen's Green in the south. The route is highlighted in yellow and passes through several stations. The map is overlaid on a blue background with a faint map of Ireland.

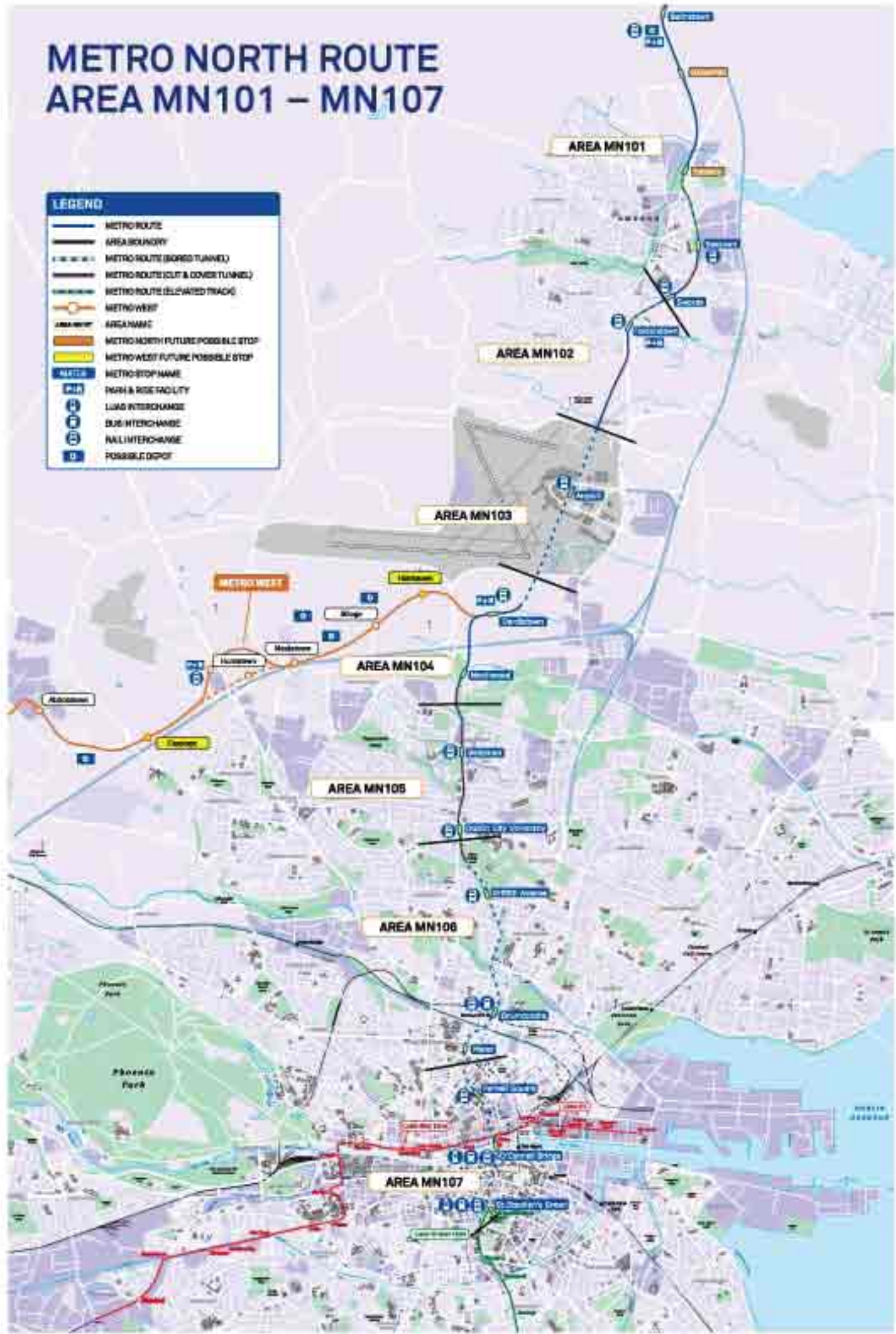
ENVIRONMENTAL IMPACT STATEMENT – METRO NORTH

BELINSTOWN TO ST. STEPHEN'S GREEN

NON-TECHNICAL SUMMARY

METRO NORTH ROUTE AREA MN101 – MN107

LEGEND	
	METRO ROUTE
	AREA BOUNDARY
	METRO ROUTE (BORED TUNNEL)
	METRO ROUTE (CUT & COVER TUNNEL)
	METRO ROUTE (ELEVATED TRACK)
	METRO WEST
	METRO NORTH FUTURE POSSIBLE STOP
	METRO WEST FUTURE POSSIBLE STOP
	METRO STOP NAME
	TRAM & RIDEABILITY
	LIGHT RAIL INTERCHANGE
	BUS INTERCHANGE
	RAIL INTERCHANGE
	POSSIBLE DEPOT



ENVIRONMENTAL IMPACT STATEMENT – METRO NORTH

BELINSTOWN TO
ST. STEPHEN'S GREEN

NON-TECHNICAL SUMMARY

PREFACE TO THE NON-TECHNICAL SUMMARY OF THE METRO NORTH ENVIRONMENTAL IMPACT STATEMENT

The Environmental Impact Statement (EIS) for the Metro North scheme comprises the following volumes:

Volume 1 Introduction and Baseline Environment

Volume 1 comprises one book containing the following:

- General introductory chapters of the EIS including a section describing the methodology used in the environmental impact assessment (EIA), the nature of the development, the means by which alternatives were considered, and an assessment of potential impacts on Human Health (Chapters 1 to 9);
- Description of the baseline environment with respect to all environmental topics (Chapters 10 to 25);
- List of Abbreviations and Glossary of Terms.

Volume 2 Impact Assessment

Volume 2 contains the impact assessments with respect to all environmental topics (Chapters 1-18). For the purposes of this EIS and for ease of local identification and interest, the 18km proposed alignment has been divided into seven areas (MN101 to MN107). Volume 2 comprises seven books, one for each of the areas MN101 to MN107. Collectively these make up Volume 2 of this EIS.

Volume 3 Maps and Relevant Annexes

Volume 3 contains all baseline and impact assessment maps and Annexes to the EIS. These provide additional and supporting information to the chapters in Volume 1 and Volume 2.

A table of contents for the EIS can be found at the front of each book.

Availability of the EIS

The EIS may be purchased as a complete document for a sum of €170.00 (Volumes 1, 2 & 3). The EIS can also be purchased as individual books e.g:

- Copies of Volume 1 may be purchased for €30.00 each;
- Copies of Volume 2 (individual book e.g. MN101) may be purchased for €15.00 each;
- Copies of Volume 3 (individual books e.g. Book 1 of 2) may be purchased for €15.00 each;
- Copies of the NTS of this EIS may be purchased for a sum of €5.00.

A DVD version of the EIS may be purchased for €15.00 which includes Volume 1, Volume 2 (Area MN101 - MN107); Volume 3 (Book 1 of 2 and Book 2 of 2) and the Non-Technical Summary.

Copies of the EIS including the Non-Technical Summary may be purchased by any member of the public during normal office hours at the following location:

Railway Procurement Agency (RPA)
Parkgate Business Centre
Parkgate Street
Dublin 8

This EIS is available for free download at www.dublinmetronorth.ie

Stage of design and limits of deviation

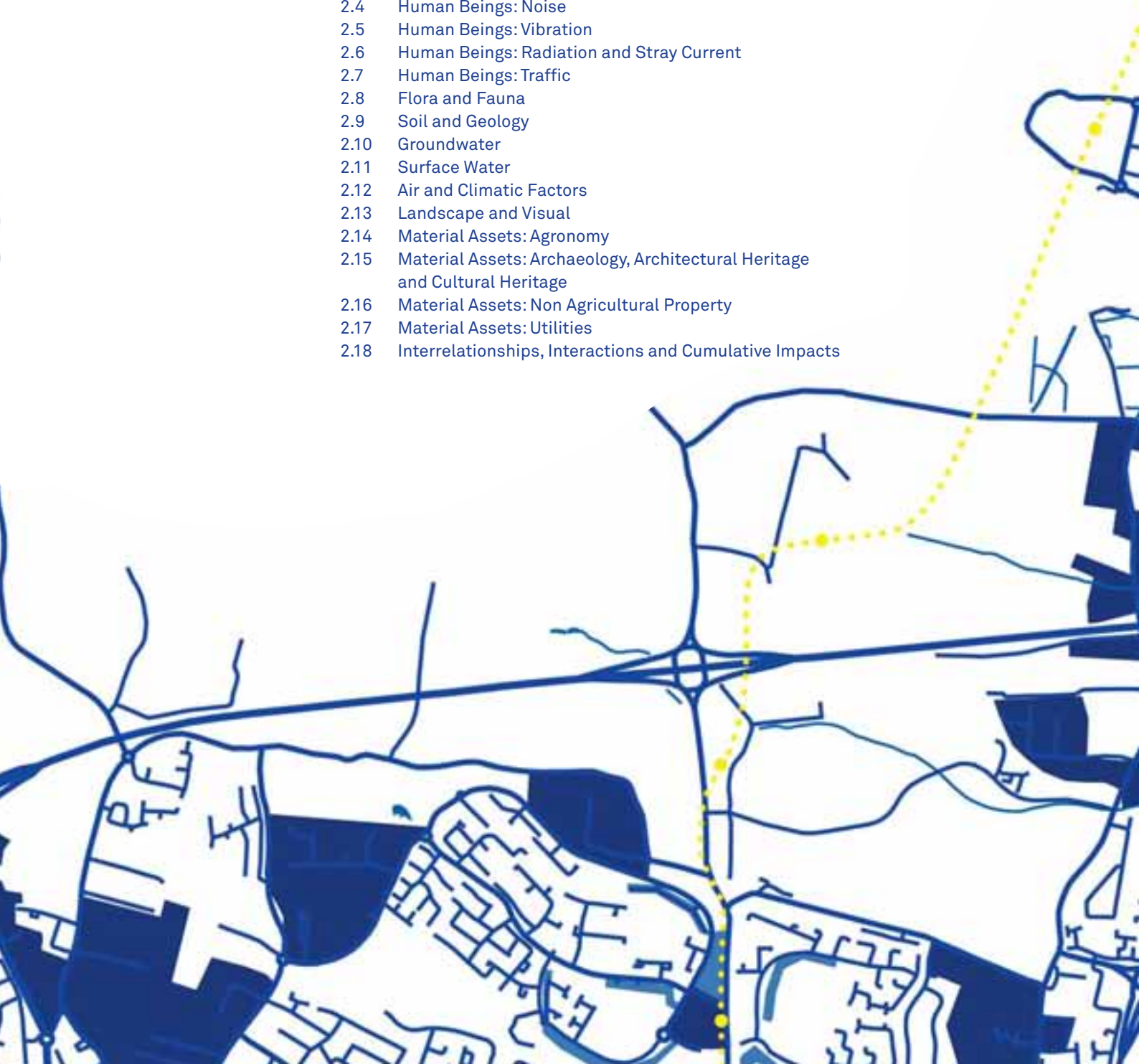
The Environmental Impact Assessment is based on the proposed Railway Order design. All proposed mitigation measures described in this EIS or shown on drawings are also based on this design. Deviations from this design may occur provided these have no significant adverse environmental effect in order to facilitate on-site construction or maintenance and to allow a limited degree of flexibility to react to on-site circumstances which are unforeseeable at this stage.

Lateral deviations of up to 2.5m are permitted where the works are situated in a public road, 10m where the works form part of an underground tunnel or stop and 5m elsewhere. Vertical deviations of up to 1m upwards or downwards are permitted where the works are situated in a public road; up to 5m upwards and 10m downwards where the works form part of an underground tunnel or stop and up to 2m upwards or downwards elsewhere. Longitudinal deviations are permitted up to 20m. In addition, the internal layout of underground stops may be amended provided that such amendments do not reduce the accessibility or amenity of the publicly accessible areas of the stop, and single or interlacing tracks may be laid where double tracks are shown.



NON TECHNICAL SUMMARY

- 1.1 Introduction
- 1.2 EIS Study Team
- 1.3 Need and Objectives
- 1.4 Planning and Policy Context
- 1.5 Alternatives
- 1.6 Description of the Scheme
- 1.7 Consultation
- 1.8 Human Health
- 2.0 Environmental Topics
(Baseline, Impacts and Mitigation Measures)
- 2.1 Introduction
- 2.2 Human Beings: Landuse
- 2.3 Human Beings: Socio-economics
- 2.4 Human Beings: Noise
- 2.5 Human Beings: Vibration
- 2.6 Human Beings: Radiation and Stray Current
- 2.7 Human Beings: Traffic
- 2.8 Flora and Fauna
- 2.9 Soil and Geology
- 2.10 Groundwater
- 2.11 Surface Water
- 2.12 Air and Climatic Factors
- 2.13 Landscape and Visual
- 2.14 Material Assets: Agronomy
- 2.15 Material Assets: Archaeology, Architectural Heritage
and Cultural Heritage
- 2.16 Material Assets: Non Agricultural Property
- 2.17 Material Assets: Utilities
- 2.18 Interrelationships, Interactions and Cumulative Impacts





The Transport (Railway Infrastructure) Act of 2001 as amended by the Planning and Development (Strategic Infrastructure) Act 2006, sets out the process under which statutory authority for new railway projects is to be granted. As part of this application for a Railway Order it is necessary to undertake an Environmental Impact Assessment of a proposed scheme, prepared in accordance with the legal provisions set out in the Transport (Railway Infrastructure) Act of 2001, Section 39. The findings of this report are then presented in an Environmental Impact Statement and are summarised in this Non-Technical Summary.

1.1 INTRODUCTION

In November 2005 the Government launched Transport 21, a capital investment framework under the National Development Plan developed to meet Ireland's current and evolving transportation needs. Under Transport 21, the Railway Procurement Agency (RPA) has been mandated by the Government to deliver two new metro lines and seven new light rail lines. Metro North, linking Dublin city centre to Dublin Airport and the north of Swords, is a central part of Transport 21.

The Transport (Railway Infrastructure) Act of 2001 as amended by the Planning and Development (Strategic Infrastructure) Act 2006, sets out the process under which authority for new railway projects is to be granted. As part of this application for a Railway Order it is necessary to undertake an Environmental Impact Assessment (EIA) of the proposed Metro North scheme (hereafter referred to as the 'proposed scheme'), prepared in accordance with the legal provisions set out in the Transport (Railway Infrastructure) Act of 2001, Section 39. The findings of this report are then presented in an Environmental Impact Statement (EIS).

This EIS presents the results of the EIA undertaken to inform the decision-making process. The objectives of the EIS are summarised as follows:

- To identify the likely significant environmental impacts of the proposed scheme during the construction and operational phases, having regard to the characteristics of the local environment;
- To evaluate the magnitude and significance of likely impacts and to propose appropriate measures to mitigate potential adverse impacts.

This document presents the Non-Technical Summary (NTS) of the EIS that has been prepared as part of the application for the Metro North Railway Order. Written in non-technical language, it presents the key findings of the EIA of the construction and operation of the proposed scheme. The complete EIS contains the detailed findings of the EIA and should be referred to for the detailed findings.

1.2 EIS STUDY TEAM

Environmental Resources Management (Ireland) Ltd ('ERM') was commissioned by RPA as lead consultant with overall responsibility for preparing the EIA for the proposed scheme. A number of specialists contributed to the preparation of the EIS. A summary of all contributors is provided in Table 1.1.

Table 1.1 Environmental topics and contributors

Input	Contributor
EIS management and compilation	ERM and RPA
Human Health	EHA Consulting Group
Human Beings: Landuse	ERM
Human Beings: Socio-economics	ERM
Human Beings: Noise	ERM
Human Beings: Vibration	Rupert Taylor F.I.O.A and ERM
Human Beings: Radiation and Stray Current	ERM
Human Beings: Traffic	MVA Consulting
Flora and Fauna	ERM
Soil and Geology	ERM and Jacobs Engineering Ireland Ltd.
Groundwater	AWN Consulting
Surface Water	AWN Consulting
Air and Climatic Factors	ERM
Landscape and Visual	ERM and Digitech
Material Assets: Agronomy	Curtin Agricultural Consultants
Material Assets: Archaeology, Architectural Heritage and Cultural Heritage	CRDS Ltd.
Material Assets: Non Agricultural Property	ERM and RPA
Material Assets: Utilities	ERM and RPA
Interrelationships, Interactions and Cumulative Impacts	ERM

1.3 NEED AND OBJECTIVES

The proposed scheme will connect the townland of Belinstown to Dublin's city centre. The selected route for the proposed scheme serves a number of key destinations including Dublin Airport, hospitals, universities and retail centres as well as high density residential and employment districts.

The proposed scheme is a key element in the creation of a fully integrated public transport network as envisaged in Transport 21. It will interchange with existing Luas Green Line services at St. Stephen's Green and Red Line services at O'Connell Street. It will also interchange with the DART (Dublin Area Rapid Transit), and with suburban rail services at St. Stephen's Green (via the proposed rail interconnector) and at Drumcondra following the electrification of the Iarnród Éireann line. 2,600 Park & Ride spaces will be provided at key locations along the route so the proposed scheme will benefit people from far beyond its immediate catchment area. The proposed scheme will also interchange with local and regional bus services, with bus interchange facilities being provided at most metro stops.

The proposed scheme will have significant reserve capacity to grow to meet Dublin's long term transport needs. When it opens, the metro will carry approximately 80,000 passengers per day. This is forecast to increase significantly over time. The proposed scheme will have an ultimate capacity in excess of 40,000 passengers per hour (20,000 in each direction). This is beyond the capacity of an on-street light rail system, but will easily be accommodated on metro, which can accommodate longer light metro vehicles (LMVs) operating at a higher frequency. The Dublin Transportation Office (DTO) supports proposals for a metro system as it is anticipated that the demand for travel in the Greater Dublin Area will increase significantly in the future.

With its dedicated track, the proposed scheme will offer a frequent, fast and reliable service for commuters. The journey time from Swords to the city centre will be about 26 minutes, less than half the time of the same journey by car at peak rush hour. As with Luas, metro passengers will not have to worry about timetables. From the start peak time services will run every four minutes, and more frequently as passenger numbers grow. The proposed scheme is expected to carry some 35 million passengers a year once it is operational.

Dramatic growth is forecast for Dublin Airport. Currently carrying over 20 million passengers each year, this is expected to grow to over 30 million by 2015 - 2016 as detailed in the Inspectors' Report 1, An Bord Pleanála, PL 06F (2007). The proposed scheme offers a journey time of less than 20 minutes from the Airport to the city centre and will become the preferred transport mode for many people travelling to and from Dublin Airport. The Dublin Airport Masterplan (2006) states that 'greatly enhanced public transport provision will be paramount to the success and sustainability of Dublin Airport'. The Dublin Airport Authority views the proposed scheme as a crucial means of enhancing the public transport provisions for Dublin Airport.

Park & Ride sites at strategic locations will encourage car drivers from beyond the proposed scheme catchment area to transfer to metro for a fast journey onwards to the city.

The proposed scheme will not only be used by people living and working along the alignment, but also those commuting from outlying towns who will make use of it. The proposed scheme will be used by people from all regions of the country travelling to Dublin Airport, since it will be connected with the two main intercity railway stations via the Luas Red Line and the proposed Interconnector, and will provide a gateway to Ireland for tourists.

1.4 PLANNING AND POLICY CONTEXT

The proposed scheme conforms to the objectives of all the policies identified of local, regional and national planning policy and to the objectives of social and environmental policy documents pertaining to the area. The proposed scheme will allow for greater sustainable development and social inclusion through the provision of a safe and integrated transport system. These are outlined below.

1.4.1 DTO Strategy – 'A Platform for Change'

In October 2000 the Dublin Transportation Office (DTO) published 'A Platform for Change - Outline of an integrated transportation strategy for the Greater Dublin Area - 2000 to 2016'. The strategy sets out a vision of an integrated multi-modal transportation strategy for the Dublin area. The strategy identifies a metro system as a key element of the transport network.

The proposed scheme complies with the broad principles of the 'Platform for Change' document. The document envisages a link from Dublin City Centre to Swords via Dublin Airport. However, this link is different to the current proposed scheme alignment. The key difference is that the scheme proposed in 'A Platform For Change' passes through the Finglas area of Dublin, whereas the proposed scheme passes through Ballymun and then to the airport and Swords.

1.4.2 Transport 21 (2005)

Transport 21 was announced in November 2005 and details the Government's capital investment framework for rail infrastructure in the Greater Dublin Area.

Specific reference is made to Metro North and Metro West and according to Transport 21 Metro North will begin at St. Stephen's Green and potentially serve DCU, Ballymun and Dublin Airport before terminating at Swords. The proposed scheme is an essential part of Transport 21 and is in compliance with the scheme as envisaged in Transport 21.

1.4.3 Section 49 Contributions

Both Dublin City Council and Fingal County Council have adopted a supplementary development contribution scheme for Metro North under Section 49 of the Planning and Development Act 2000. The purpose of this contribution scheme is to facilitate contributions from developers of new developments (residential, retail and commercial) which will benefit from the new infrastructure. These contributions are made to the scheme developers (RPA via the relevant local authority) and help cover the cost of the proposed scheme.

1.4.4 National Policy

1.4.4.1 Department of Transport Statement of Strategy 2005 – 2007 (DoT)

The overriding objective of the Department's strategy as embraced in the Mission Statement is, '...to underpin Ireland's economic growth and competitiveness and contribute to social development through the efficient and effective delivery of an appropriately regulated sustainable, safe and integrated transport system'.

Specifically, the department seeks to increase the number of people using public transport; to increase the modal share of public transport; and to adopt an integrated approach to public transport provision. The proposed scheme conforms to the objectives of the Department and provides for an appropriately regulated sustainable, safe and integrated transport system.

1.4.4.2 National Spatial Strategy 2002-2020

The National Spatial Strategy for Ireland (NSS) was published by the Department of the Environment and Local Government in 2002. The strategy is a twenty-year planning framework designed to achieve a better balance of social, economic, physical development and population growth between regions. With regard to public transportation in the Greater Dublin Area (GDA), the NSS states:

'The physical consolidation of Dublin, supported by effective landuse policies for the urban area itself, is an essential requirement for a competitive Dublin. Consolidation is also required for the public transport to function effectively. In turn, investment in public transport will assist in promoting a more efficient and competitive Greater Dublin Area.' The proposed scheme supports and facilitates the achievement of the goals of the NSS.

1.4.4.3 National Development Plan 2007 – 2013 (2007)

The National Development Plan (NDP) was published by the Irish Government in 2007. The plan sets out the economic, infrastructural and social investment priorities of the State. The priority of direct relevance to Metro North is 'Economic Infrastructure'. One of the key objectives under this priority is 'to deliver a radically upgraded public transport system in line with the timetable in Transport 21, especially in the Greater Dublin Area (GDA)'.

The NDP notes that 'over the Plan period 2007 - 2013, the specific projects will be advanced in line with the timetable in Transport 21' and the projects that are listed include the 'completion of Metro North line from city centre to Swords via Dublin Airport'. The proposed scheme therefore fully complies with this policy document and is supported by it.

1.4.4.4 Sustainable Development - A Strategy for Ireland (1997)

The sustainable development strategy for Ireland was published by the Department of the Environment in 1997. The overall aim of the strategy is to ensure that the economy and society in Ireland can develop to their full potential within a well-protected environment without compromising the quality of that environment and having regard for present and future generations as well as the wider international community.

This strategy sets out an agenda to render Irish transport more environmentally acceptable and to 'improve public transport systems and infrastructure with a view to increasing their market share'. The strategy states that funding for improvements in rolling stock, signalling and track network will further encourage commuters to switch from road to rail.

The proposed scheme supports the broad principles of this policy document by encouraging modal shift to a more sustainable form of transport.

1.4.4.5 National Climate Change Strategy 2007 – 2012 (2007)

The National Climate Change Strategy (NCCS) 2007 - 2012 was published by the Department of the Environment, Heritage and Local Government in 2007 and follows on from the original NCCS, which was published by the Government in 2000. The 2007 NCCS outlines the measures by which Ireland will meet its commitment to limit its greenhouse gas emissions over the 2008 - 2012 period to 13% above 1990 levels.

The NCCS recognises that one of the key ways of reducing transport-based greenhouse gas emissions is encouraging a modal-shift away from private car use and towards public transport systems. The proposed scheme supports this principle. The NCCS also supports the proposed scheme indirectly in that it supports the broad principles of Transport 21.

1.4.4.6 General National Policy

The following national policy documents have also been considered in the relevant chapters of the EIS:

- Ten-Year Framework Social Partnership Draft Agreement 2006 – 2015 (2006);
- National Action Plan for Social Inclusion 2007-2016: Building an Inclusive Society (2007);
- National Heritage Plan (2002);
- National Biodiversity Plan (2002).

1.4.5 Regional Policy

1.4.5.1 Regional Planning Guidelines for the Greater Dublin Area, 2004-2016

The Dublin Regional Authority and Mid-East Regional Authority published the Regional Planning Guidelines for the Greater Dublin Area 2004-2016 (RPGs) in July 2004.

The key objectives of the RPGs relate to consolidation of the urban centres located within the metropolitan area based on provision and facilitation of an integrated public transport system. The RPGs also promote greater use of sustainable transport modes through the integration of landuse and transport planning.

The proposed scheme facilitates the objectives of the RPGs by the provision of an integrated public transport service to provide better access to public institutions and centres of employment and encourages a modal shift to public transport.

1.4.5.2 Fingal County Development Plan 2005 – 2011 (2005)

This plan sets out Fingal County Council's policies and objectives for the development of the county from 2005 to 2011. A number of specific policies in the plan relate to the proposed scheme. For example; Policy TP12: will facilitate and promote 'the development of a new and improved rail-based transport system, including a metro link, from the city [Dublin] to Swords via the airport'. The Fingal County Development Plan supports the broad principle of the proposed scheme and recognises the important role that it will play in supporting the development of Fingal County.

1.4.5.3 Dublin City Development Plan 2005-2011 (2005)

The Dublin City Development Plan 2005-2011 was adopted by Dublin City Council and came into effect in March 2005. The overall vision for the city as outlined in the plan is to enhance the quality of life and experience of the city for the residents, workers, commuters and visitors and to consolidate the urban form of the city.

The development plan supports the measures currently being implemented or proposed by the RPA. Specific reference is made to the support of Dublin City Council for a 'City Centre rail connection to Dublin International Airport with a preference for stops at Dublin City University and Ballymun'. The proposed scheme complies with and supports the policies detailed in Dublin City Council's Development Plan 2005 - 2011.

1.4.5.4 Other Regional Policy

The following regional policy documents have also been considered in the relevant chapters of the EIS:

- Strategy for Economic, Social and Cultural Development of Fingal 2002-2011 (2002);
- Dublin – A City of Possibilities; Economic, Social and Cultural Strategy 2002-2012 (2002);
- Fingal Heritage Plan 2005-2010 (2005);
- Dublin City Heritage Plan 2002-2006 (2002);
- Dublin City Biodiversity Action Plan 2007-2010 (2007).

1.4.6 Local Policy and Local Plans

Local policy, masterplans and area plans which specifically refer to the proposed scheme and that have been considered in the design of the proposed scheme include:

- Dublin Airport Masterplan (2006);
- North Ballymun Local Area Plan (2005);
- General Local Policy;
- Dublin Airport Public Safety Zone Study, (ERM on behalf of Department of Transport and the Department of Environment, Heritage and Local Government, 2005);
- Masterplan for the new Ballymun, (Ballymun Regeneration Ltd. 1998 – 2004 - as amended).

1.5 ALTERNATIVES

Section 39(1)(d) of the 2001 Act requires that an EIS contains an outline of the main alternatives studied by the applicant and an indication of the main reasons for its chosen option, taking into account the environmental effects.

1.5.1 System Concept

The proposed scheme has been planned as a metro similar to the metro networks found in many European cities of similar size to Dublin. It is fully segregated along the busiest sections of the route between the city centre and Swords and has a limited number of road crossings in the outer suburban areas north of Swords.

During the development of the proposed scheme prior to the announcement of Transport 21 a number of fundamentally different system concepts were examined and rejected in favour of the metro concept. These included a direct main-line rail link to Dublin Airport, a pre-metro similar to Luas which would be upgraded over time, a fully automated metro and a magnetically levitated system. These were rejected in favour of the metro concept which best meets the project objectives.

1.5.2 Methodology for the Evaluation of Alternatives

The main alternatives considered for the proposed scheme were evaluated using a multi-criteria analysis. RPA's objectives with respect to the proposed scheme are:

- Compliance with transport and landuse strategy;
- Minimising environmental impacts including congestion and associated pollution problems;
- Generating social and economic benefits;
- Delivering good quality transport integration;
- Optimising capital and operating costs;
- Delivering a safe and operationally efficient system;
- Achieving efficiency and minimising risk during construction.

It was considered that these were of a generally equal importance and therefore all weighted equally.

1.5.3 Route Selection

The study of alternative route options generally concerns itself with the identification and evaluation of the broad route corridors and principal destinations that the proposed scheme will serve, rather than precise stop locations or track alignment. The main vertical alignment alternatives: tunnel, viaduct or surface running, are also considered at this stage.

Four main alternatives and two variants were studied as part of route selection. The main alternatives were the West Route (via Broadstone and Finglas), the Central Route (via Glasnevin and Ballymun), the East Route (via Drumcondra and Whitehall) and the Alternative Central Route, a combination of the Central and East Routes (via Drumcondra and Ballymun). The East Route Variant consisted of a deviation of the East Route to serve Kilmore (approximately 1km from Beaumont Hospital) and the Marlborough Street Variant which proposed relocating the proposed stop on O'Connell Street to the plaza of the Department of Education in Marlborough Street.

The Alternative Central Route scored strongly against the other route options under almost all assessment criteria including minimising environmental impacts.

1.5.4 Engineering and Architectural Design

Following the selection of a preferred route, the engineering and architectural design stage concerns itself with the identification and evaluation of detailed design options for individual stops, and the associated track alignment between stops, along the preferred route corridor.

During this process of engineering and architectural design, environmental assessment and consultation continued and more local alternatives were studied and evaluated to optimise the design of the proposed scheme and mitigate potential significant negative environmental effects.

The following categories of alternatives were studied:

- Proposed stop locations, access and design including the proposed Metro West interchange;
- Detailed horizontal and vertical track alignment between stops;
- Location of crossovers and turn backs between tracks;
- Location and design of Park & Ride car parks;
- Depot location and design.

This iterative process has also been informed by the results of intensive public consultation. A summary of the alternatives studied at major locations is given in the following sections.

1.5.4.1 Depot

The following depot location options were considered:

- Sillogue;
- Dardistown;
- Fosterstown;
- Lissenhall;
- Belinstown.

It was determined that Sillogue was the least preferable depot location based on operational and environmental reasons. The Dardistown location performed well operationally, however land costs and development plans at Dardistown rendered this location unsuitable. The Fosterstown location also performed well operationally however, there were many negatives with this site such as greenbelt designation, level changes and the need for watercourse diversions. Various locations at Lissenhall were eliminated as they occupied land designated by Fingal County Council for the future development of Swords. Belinstown was chosen as the preferred location and during the study of alternatives, the location of the depot was defined to avoid potential impacts on archaeology and optimise the operational efficiency of the depot.

1.5.4.2 Ballymun Vertical Alignment

Various alternatives for the vertical alignment through Ballymun have been studied, including:

- Elevated;
- At-grade (on the surface);
- In retained open cut;
- In cut and cover tunnel;
- In bored tunnel.

The elevated option has the benefit of a fully segregated track alignment at an economic cost, and minimises the long term traffic impacts along Ballymun Road, but it has significant visual impacts on properties close to the alignment, and its approach ramps cause severance on Ballymun Road.

The at-grade option offers significant cost savings and greater accessibility to the proposed scheme as the stops on this section of the alignment would be on the surface. However, this option has long term negative impacts on traffic at the busy Balbutcher Lane/Shangan Road junction and consequent impacts on the reliability of the service to be provided by the proposed scheme and the tunnel portal ramps cause some severance on Ballymun Road.

The retained open cut option also has the benefit of a fully segregated track alignment at an economic cost, and minimising the long term traffic impacts along Ballymun Road, but its high protective walls along either side of the open cut would have resulted in significant visual impacts and almost totally severed the properties along each side of Ballymun Road.

The cut and cover tunnel option has the benefit of a fully segregated track alignment and minimises the long term traffic impacts along Ballymun Road. It also eliminates any visual impacts and severance along Ballymun Road. The biggest disadvantage of this option is the high level of disruption which will be caused by the construction of the cut and cover tunnel. Despite this, the cut and cover option was supported overwhelmingly by local residents and was also supported by Ballymun Regeneration Ltd.

The bored tunnel option has the advantage over a cut and cover tunnel option of reducing construction disruption. It has considerable disadvantages, particularly in relation to a significantly higher construction cost and poorer accessibility as the stop is much deeper below ground.

For the above reasons, the cut and cover tunnel option was selected as the preferred option.

1.5.4.3 DCU Stop

Four alternatives were considered for DCU Stop:

- Option 1: Open air stop on Ballymun Road;
- Option 2: Underground stop on Ballymun Road;
- Option 3: Open air stop in Albert College Park;
- Option 4: Underground stop in Albert College Park.

Options 3 and 4 had significant environmental impacts including a permanent loss of amenity and landscape at Albert College Park, and had significant visual impact for residents on Ballymun Road. Options 1 and 2 avoid the long-term environmental impacts on Albert College Park (through loss of habitat) and also have less visual impacts for residents on Ballymun Road, but have potential for long term noise associated with the operation of the stop. This impact is less with Option 2 than with Option 1, so that Option 2 was identified as the preferred option. The impacts are further mitigated by moving the stop slightly south so that its northern entrance is further away from Albert College Court and its southern entrance is located inside the grounds of a disused presbytery.

1.5.4.4 Drumcondra to Griffith Avenue Tunnel Alignment

A total of six alignment options were considered for the tunnels between Griffith Avenue and Drumcondra Stops.

The preferred tunnel alignment was chosen as it passes under the fewest number of properties, thus reducing the impacts of settlement and vibration on properties during construction. It locates a required emergency crossover under green fields which minimises the risk of damage to overhead properties during its construction. It also follows an efficient alignment without significant curves and it avoids severe impacts to St. Patrick's Boys Senior National School, Drumcondra Education Centre, St. Patrick's College and Elmhurst Nursing Home and Convalescent Centre.

1.5.4.5 Drumcondra Stop

Five options for the stop at Drumcondra were considered:

- Option 1: Mined Stop beneath Drumcondra Road;
- Option 2: Partial mined/cut-and-cover stop in land adjacent to St. Joseph's Avenue;
- Option 3: Cut-and-cover stop beneath Drumcondra Road;
- Option 4: Mined stop under St. Joseph's Avenue;
- Option 5: Cut-and-cover stop in land adjacent to St. Joseph's Avenue.

Options 1, 2, 3 and 4 were eliminated due to engineering, construction and traffic impacts. Option 5 was identified as the preferred option as it avoids having a construction site located on a major traffic artery; it avoids major disruption to utilities on Drumcondra Road and reduces the overall construction period. Option 5 also permits the construction of a new interchange between the proposed scheme and the existing Drumcondra Rail Station, and offers a holding area for crowds from Croke Park. While this option requires the demolition of a number of properties, including St. Vincent's Centre for the Deaf, the option was only chosen following consultation with all affected property owners.

1.5.4.6 Mater Stop

A number of feasible design and location alternatives were considered in relation to this stop:

- Option 1: Cut and cover stop under the Mater Hospital car park;
- Option 2: Cut and cover stop to the west of Dorset Street;
- Option 3: Mined stop under Dorset Street.

Option 1 was identified as the preferred option as it minimises construction risk and the potential for disruption. Due to the requirement to demolish twenty residential properties in the case of Option 2 and the risks associated with mining a stop in boulder clay in the case of Option 3, options 2 and 3 were eliminated.

1.6 DESCRIPTION OF THE SCHEME

1.6.1 General Description of the Proposed Scheme

Metro North is the next phase of Dublin's integrated light rail network. The proposed scheme will serve an 18km corridor from Belinstown in the north of County Dublin to St. Stephen's Green in the city centre via Dublin Airport. Metro North is a metro system running under full signal control on a segregated alignment between St. Stephen's Green and Fosterstown Stops and running on a line of sight basis, at grade, in underpasses or on elevated sections between Fosterstown and Belinstown. Metro North will run in a mix of bored and cut and cover tunnels beneath the city and beneath Dublin Airport.

The forecast journey time between St. Stephen's Green and the Airport is approximately 20 minutes and from St. Stephen's Green to Belinstown is approximately 30 minutes. The proposed scheme has the capability to run with a minimum operating time of two minutes between services (i.e. two minute "headway"). The proposed scheme will operate using 45m long LRVs coupled together to form 90m trainsets.

The proposed scheme will be interoperable with the existing and proposed Luas and metro systems.

1.6.2 Interchange and Connectivity

The proposed scheme will interchange with the Luas Green Line at its current terminus at St. Stephen's Green and with the Luas Red Line at Abbey Stop, which is adjacent to the O'Connell Bridge Stop. The route for the proposed Lucan Luas line serving the west of the city is still to be determined but is expected to provide interchange with the proposed scheme at either St. Stephen's Green or O'Connell Bridge Stops. Transport 21 also includes an orbital light rail line (Metro West) running roughly parallel to the M50 from Tallaght in the south-west via Clondalkin and Blanchardstown to Dardistown. From here Metro West services will continue, using the proposed scheme infrastructure, to the Airport and Swords area to the north or the city centre to the south. The proposed scheme will also provide direct interchange with the Maynooth rail line and the future DART network at Drumcondra and at the proposed interconnector station at St. Stephen's Green.

Interchange with bus and taxi will be facilitated throughout the proposed scheme, with bus pull-in bays and pick-up/drop-off facilities being designed into all at grade stops. Park & Ride facilities are provided at three stops, (Belinstown, Fosterstown and Dardistown) which give access to potential users living beyond walking distance from public transport routes. Cycle facilities are provided at all stops (excluding the Airport Stop).

1.6.3 Characterisation of the Seven Areas of the Alignment

For ease of local identification, in this EIS the proposed scheme alignment has been divided into seven areas. These areas are numbered Area MN101 to Area MN107. The environmental impact of the proposed scheme in each of these areas is set out in individual books numbered MN101 to MN107 and which collectively make up Volume 2 of this EIS. A description of the proposed scheme with reference to each of these seven areas is as follows:

1.6.3.1 Area MN101: Belinstown to Swords Stop

Area MN101 begins at Belinstown which is located approximately 2km to the north of Swords, adjacent to and directly west of the M1 motorway, on land that is currently used for agriculture. The maintenance depot, stabling facilities and a 110kV substation serving the proposed scheme are to be located in this area. The northern terminus stop of the proposed scheme, Belinstown, lies immediately southwest of the depot. A Park & Ride facility with 2,000 parking spaces, designed as a multi-storey car park, is planned adjacent to the stop.

From Belinstown, the alignment passes southwards, across greenfield land at surface level, to a provisional stop at Lissenhall. This stop is located in a greenfield site to the west of the interchange between the M1 and R132 in an area of potential development proposed by Fingal County Council. The alignment continues southwards and crosses the Broad Meadow River and the Ward River and then runs at surface level along the western verge of the R132 to a second provisional stop at Estuary. The alignment then rises up onto an elevated section of track which crosses over the Estuary Roundabout, travels along the median of the R132 and over the Seatown Roundabout before descending to reach the next at grade stop, at Seatown. The Seatown Stop is located in the central median of the R132. The Estuary and Seatown Roundabouts are to be converted to signal controlled junctions.

After Seatown Stop, the alignment proceeds southwards on the surface along the central median of the R132 and then descends to pass under the Malahide Roundabout. To the south of the roundabout, the alignment emerges from the underpass and rises to the surface in the median of the R132 to the Swords Stop which is located opposite the Pavilions Shopping Centre. Initially, access to this stop is by pedestrian crossings of the R132. However, provision is made to allow this stop to be accessed from a possible future east-west bridge over the R132. Swords Stop marks the end of Area MN101.

1.6.3.2 Area MN102: Swords Stop to Dublin Airport North Portal

South of the Swords Stop, the alignment rises up onto an elevated section of track to cross over Pinnock Hill Roundabout and continues south to an at grade stop at Fosterstown. This stop is located north of the Airside retail park on the east side of the R132. An at grade Park & Ride car park with 300 spaces is to be provided to the east of this stop. The alignment then continues southwards along the east side of the R132 and then descends to cross under the R132 just south of the junction at Airside and Boroimhe.

The alignment emerges from the underpass, passes under a new accommodation bridge serving a local business at Fosterstown, to rise to the surface and onto embankments through a greenfield area. A turn back facility is provided in this area to the north of the airport to allow some metro services to reverse at the airport in the future. A new agricultural underpass is located beneath the turn back facility. The turn back facility marks the end of Area MN102.



Fosterstown Stop and Park & Ride

1.6.3.3 Area MN103: Dublin Airport

The alignment enters two bored tunnels (one for northbound metro services and one for southbound) to the north of Dublin Airport. A tunnel portal and ventilation building is located in this area. The alignment traverses the airport in a southerly direction passing under the Airport South Perimeter Road (Collinstown Lane) which marks the end of Area MN103. An underground stop, Airport, is located on this tunnelled section close to the existing airport terminal and the second terminal currently under construction on the site of the proposed airport Ground Transportation Centre.

1.6.3.4 Area MN104: Dublin Airport South Portal to Santry Avenue

South of the airport perimeter road, the alignment emerges from tunnel and rises to surface level. A tunnel portal and ventilation building is located in this area. The alignment then turns south-west to cross agricultural lands between Dublin Airport and the M50 motorway. Dardistown Stop is located in this area on a greenfield site to the north of the M50. An at grade Park & Ride facility with 300 parking spaces is proposed for this location, to the north of the stop. Space provision is made at this stop for a future operational link to the proposed Metro West line. A 110kV substation is to be located in this area. Continuing south, the alignment crosses the M50, associated slip roads, and Old Ballymun Road on bridges. South of these bridges the alignment passes over the culverted Santry River, and proceeds south descending to surface level at the next stop, Northwood, which is an at grade stop located near Santry Lodge, south of the M50.

South of Northwood Stop, the alignment descends into a cut and cover tunnel along the median of the R108 (Ballymun Road). This tunnel passes under Santry Avenue, and is the boundary between the Fingal County Council and Dublin City Council administration areas.

1.6.3.5 Area MN105: Santry Avenue to Albert College Park

The alignment continues southwards in a cut and cover tunnel beneath Ballymun Road, to a shallow underground stop at Ballymun, adjacent to the new civic plaza. Continuing south in a cut and cover tunnel along the Ballymun Road, crossing under Collins Avenue, the next stop is Dublin City University (DCU). This is a shallow underground stop on the east side of Ballymun Road beside Albert College housing estate. Area MN105 ends at the DCU access road, just south of the DCU Stop.

1.6.3.6 Area MN106: Albert College Park to Mater Stop

The alignment continues in a cut and cover tunnel across Albert College Park, entering twin bored tunnels near the southern boundary of the Park. The alignment remains underground in bored tunnel until its termination at St. Stephen's Green.

Continuing south in bored tunnel from Albert College Park, the next stop is Griffith Avenue. This stop is located in the southwest corner of the agricultural lands on the north side of Griffith Avenue. Proceeding in a south-easterly direction, the alignment continues in tunnel under St. Patrick's College playing fields. An emergency access and ventilation shaft is located in the southwest corner of the college playing fields. The alignment continues in tunnel under the Tolka River to Drumcondra Stop. This stop is located to the west of Lower Drumcondra Road and adjacent to St. Joseph's Avenue. An interchange with Iarnród Éireann's suburban rail services to Maynooth is provided at this stop. The alignment turns in a south-westerly direction passing under a second mainline railway and the Royal Canal, to the Mater Stop, located under the Mater Hospital's existing surface car park. Area MN106 ends 100m further south where the tunnels pass under St. Joseph's Parade.

1.6.3.7 Area MN107: Mater Stop to St. Stephen's Green

On leaving the Mater Hospital the alignment turns south easterly under the Dorset Street/North Frederick Street junction and on to Parnell Square East where a cut and cover stop, Parnell Square, will be constructed. To the south of Parnell Square, the alignment proceeds in tunnel under O'Connell Street to O'Connell Bridge Stop. This stop is located under the River Liffey and access to this stop is provided to the north and the south of O'Connell Bridge. Entrances to the north of the River Liffey will facilitate interchange with the Luas Red Line. From O'Connell Bridge the alignment proceeds beneath Westmoreland Street and College Green and under buildings between Clarendon Street and Grafton Street. The terminus stop, St. Stephen's Green, is located in the north west corner of the Green. Entrances to this stop are outside the Green on St. Stephen's Green North and St. Stephen's Green West. This stop will permit interchange with the Luas Green Line services and the proposed Iarnród Éireann Interconnector. Turn back of LMVs is via a tunnel loop under St. Stephen's Green.

1.6.4 Characterisation of the Proposed Scheme

1.6.4.1 Stop Locations

A total of 17 new stops are planned as part of the proposed scheme, nine underground and eight at grade. Two of the at grade stops, at Estuary and Lissenhall, are provisional stops to be provided at a later date with minimum disruption to services and systems.

1.6.4.2 Tunnels

The proposed scheme will run in tunnel from St. Stephen's Green to south of Northwood Stop, a distance of approximately 8km. The proposed scheme also runs in tunnel beneath Dublin Airport for a distance of approximately 2km. In addition there is a tunnel loop beneath St. Stephen's Green, to allow LMVs to turn around.

1.6.4.3 Intervention and Ventilation Shafts

An intervention and ventilation shaft is required where the distance between stops or between a stop and the tunnel portal exceeds 1km. The shaft provides a safe means of escape to the surface and access for the emergency services in the event of an emergency. It also allows smoke to be ventilated from the tunnels in the event of a fire. A ventilation and intervention shaft is provided between the stops at Drumcondra and Griffith Avenue at St. Patrick's College. Ventilation shafts are also provided at each stop.

1.6.4.4 Structures

The proposed scheme includes a number of permanent and temporary structures, the most significant of which are:

- Lissenhall Bridge to cross the Broad Meadow River;
- Ward River and Balheary Bridges to cross the Ward River;
- Estuary Viaduct to cross over the Estuary and Seatown Roundabouts (R132);
- Various footbridges along the R132;
- Various underpasses along the R132;
- Pinnock Hill Viaduct to carry the proposed scheme over the Pinnock Hill Roundabout (R132);
- M50 Bridge;
- Marlborough Street Temporary Bridge to provide an alternative route across the River Liffey during construction.

1.6.4.5 Depot

The depot at Belinstown includes the headquarters and administration building and associated facilities, the LMVs maintenance and stabling facilities and the infrastructure maintenance facility.

1.6.4.6 Vehicles

The LMVs are bi-directional, 2.4m wide and approximately 45m long, and will operate in a set of two coupled vehicles. Seats for about 80 passengers, baggage storage and other designated facilities for the mobility impaired will be provided. The drivers' cabs are air conditioned and the passenger saloons are equipped with a heating and ventilation system.

A fleet of 86 LMVs is required to operate services at a frequency of two minutes. The proposed scheme will initially operate services at a frequency of four minutes during the peak hour which requires a fleet of 44 metro vehicles.

1.6.4.7 Park & Ride Facilities

Three Park & Ride facilities are provided as part of the proposed scheme:

- A 2,000 space multi-storey car park at Belinstown Stop;
- A 300 space surface car park at Fosterstown Stop;
- A 300 space surface car park at Dardistown Stop.

1.6.5 Operating Characteristics

The proposed scheme is designed to be capable of operating services at a maximum frequency of two minute headways in each direction. At opening, services will run at a frequency of four minutes. Services will be increased over time to meet growing demand. Services will generally operate between 5.00 am and 1.00 am on weekdays with late night services operating on Fridays and Saturdays. Service hours will be shorter on Sundays and bank holidays. All services will stop at every stop on the route.

1.6.6 Construction of the Proposed Scheme

All construction work in connection with the proposed scheme will be carried out in accordance with relevant health and safety legislation and best practice.

Construction compounds will be established for the storage of materials, plant and equipment and for site offices. 25 compounds are proposed along the route. The location of the major construction compounds are:

- Belinstown Depot;
- Balheary Demesne to facilitate construction of the depot access road, Estuary Viaduct, and the Broad Meadow and Ward River bridges;
- Pinnock Hill to facilitate construction of the viaduct and Fosterstown Stop including Park & Ride and footbridge;
- Fosterstown to facilitate construction of the Fosterstown underpass, accommodation bridge and associated earthworks;
- North and south of the Airport to facilitate construction of the Airport tunnel and portals;
- Metropark to facilitate the construction of Dardistown Stop and Park & Ride and the M50 bridge;
- Northwood to facilitate the construction of the M50 bridge, Northwood Stop and associated earthworks, and the northern end of the Ballymun cut and cover tunnel;
- Albert College Park to facilitate the construction of DCU Stop, the cut and cover tunnel and the bored tunnels from Albert College Park to St. Stephen's Green;
- Compounds to facilitate construction of each of the underground stops Griffith Avenue, Drumcondra, Mater, Parnell Square and O'Connell Bridge;
- St. Stephen's Green to facilitate the construction of St. Stephen's Green Stop and to extract the tunnel boring machines.

1.6.6.1 Construction Activities and Phasing

Construction works are expected to start at the same time at various locations along the route, including all stop locations. Duration is expected to take up to 60 months. The first phase of construction involves the diversion of utilities and other advance works including archaeological excavations, temporary removal of statues and other heritage items, junction reconfigurations to facilitate traffic management and the installation of the temporary bridge over the River Liffey at Marlborough Street. Following these works, construction of the stops, tunnels, structures and track is completed. Throughout the construction phase, monitoring will be carried out e.g. for noise, vibration and air quality.

1.7 CONSULTATION

RPA has consulted widely with the public in relation to the proposed scheme, including consulting with residents, residents' associations, businesses, business representative bodies and elected representatives. Stakeholder statutory bodies, bodies with environmental responsibility and interest and other interested parties were also consulted in relation to the proposed scheme. Consultation started in 2006 before the Railway Order design started and focused on the following topics during the design process:

- Alternatives: This focused initially on route corridor options and then progressed to include stop locations, detailed tunnel alignment, and associated infrastructure designs and locations.
- Scoping: The EIS scoping exercise represented the beginning of the EIA process for the emerging preferred route corridor. The purpose of the scoping exercise was to establish the scope and methodology for the EIS and to provide the public and relevant bodies with environmental responsibility and other interested parties with information on the proposed scheme and to invite their input to the EIA process.
- Impacts and mitigation: Where the potential for significant effects was identified, detailed consultation with key stakeholders was undertaken in order to minimise the effects.
- Consultation evolved with the project design and environmental assessment from general topics to more specific topics. Various approaches were used to facilitate consultation on the project. These included:
 - Newsletters direct to peoples' homes including free post comment cards;
 - Open days in local civic centres, community halls and hotels;
 - Meetings with residents' associations, businesses, schools, sporting clubs and other groups;
 - Public meetings;
 - Direct correspondence and meetings with individual residents;
 - Detailed discussions and workshops with stakeholders;
 - Written correspondence including letters, emails and faxes;
 - Presentations and detailed discussions with local public representatives;
 - RPA website, including maps, drawings, newsletters, responses to frequently asked questions (FAQs), and an e-mail address to facilitate questions and information requests.

A summary of some of the issues raised to date during consultation are outlined below and are dealt with in the EIS. Concerns were raised in relation to the following:

- the impact of the proposed scheme on local businesses;
- the potential for negative health effects during construction;
- the potential for negative effects on existing utilities and the navigation system at Dublin Airport;
- nuisance and disturbance associated with noise and vibration and air quality;
- visual intrusion;
- the impact of the proposed scheme on ecology - flora and fauna;
- the potential to pollute surface water and groundwater;
- traffic disruption;
- impacts on buses, pedestrians and cyclists;
- the potential negative effects on property;
- the potential for negative effects on St. Stephen's Green.

1.8 HUMAN HEALTH

As part of the consultation process, feedback from the general public included concerns regarding human health. As a result, a human health assessment has been undertaken of the proposed scheme.

1.8.1 Baseline

The World Health Organisation (WHO) defines health as complete physical, psychological and social well being and not simply in terms of absence of disease or infirmity. There are clear great social and environmental positives from having an operational, efficient public transport system serving a large proportion of the Dublin population. These benefits will undoubtedly have positive impacts on human health.

There is remarkably little in the medical literature overall about the human health effect of railway lines. Most information that is available about transport noise indicates rail travel causes fewer human health problems in comparison to other transport modes.

1.8.2 Mitigation Measures and Residual Impacts During Construction

There are very limited effects of night time noise on sleep or day time noise on educational establishments identified in the EIS during the construction phase of the proposed scheme. Given the defined time period of these no adverse Human Health impacts are predicted.

Short term effects from vibration and ground borne noise are predicted on residential, health care, educational and other properties during the construction phase. Given the relatively short duration of these works however no detrimental health effects on human health are predicted.

No adverse effect on human health is predicted from changes in radon levels as local geology makes a detrimental change in radon levels unlikely. In the event that it would occur it will be detected by monitoring being carried out in the construction phase. If necessary, mitigation measures will be put in place.



Parnell Square Stop (platform level)

No detrimental human health effects from radiation are predicted in the construction phase of the proposed scheme.

As the measures proposed in the National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis During Construction/ Renovation Activities will be followed there is no significant risk of a detrimental effect from Aspergillus during the construction phase.

No significant impact on human health from increased incidents of Leptospirosis is predicted for the construction phase of the proposed scheme.

No significant impacts on human health from changes in groundwater or surface water are predicted for the construction phases of the proposed scheme.

No significant impacts on human health from changes in traffic are predicted for the construction phases of the proposed scheme.

No significant impacts on human health from dusts are predicted for the construction phases of the proposed scheme.

Current evidence suggests that uncovering unlicensed landfill sites during the construction phase is not likely. In the event of a landfill being exposed, its removal or other management will be as advised by the Environmental Protection Agency and no residual health impacts are predicted.

1.8.3 Mitigation Measures and Residual Operational Impacts

Once mitigation measures described in the Noise chapter are in place no ongoing adverse noise human health effects are predicted during the operational phase.

No adverse effects on human health from vibration or ground borne noise are predicted during the operational phase.

No adverse human health impact is predicted from radon as any changes in radon levels, although unlikely, will be identified in the construction phase and mitigated if necessary.

Given the relatively low voltages and currents used in the proposed scheme no detrimental human health effects from radiation are predicted in the operational phase of the proposed scheme.

While suicides and attempted suicides are an issue for railways worldwide there is no evidence that the presence of a railway increases the incidence of suicide in any way. Therefore no significant change in suicide rate is predicted during the operational phase.

The overall impact of the proposed scheme in the operational phase on psychosocial health is considered to be beneficial.

No significant impact on human health from increased incidents of Leptospirosis is predicted for the operational phase of the proposed scheme.

There are potentially great benefits for society, including therefore general health and well being benefits, with the development of the proposed scheme, particularly for people living along the route.

2.0 ENVIRONMENTAL TOPICS (BASELINE, IMPACTS AND MITIGATION MEASURES)

2.1 INTRODUCTION

The objectives of the Environmental Impact Assessment include:

- Identification of the likely significant environmental impacts of the proposed scheme during the construction and operational phases, having regard to the characteristics of the local environment;
- Evaluation of the magnitude and significance of the impacts and proposal of appropriate measures to mitigate adverse impacts.

The impacts related to the proposed scheme are summarised under the following environmental topics. Both the construction and operational impacts are described.

- Human Beings: Landuse;
- Human Beings: Socio-economics;
- Human Beings: Noise;
- Human Beings: Vibration;
- Human Beings: Radiation and Stray Current;
- Human Beings: Traffic;
- Flora and Fauna;
- Soil and Geology;
- Groundwater;
- Surface Water;
- Air and Climatic Factors;
- Landscape and Visual;
- Material Assets: Agronomy;
- Material Assets: Archaeology, Architectural Heritage and Cultural Heritage;
- Material Assets: Non Agricultural Property;
- Material Assets: Utilities;
- Interrelationships, Interactions and Cumulative Impacts.

2.2 HUMAN BEINGS: LANDUSE

2.2.1 Baseline

There are a variety of landuses along the route, including agricultural, residential, open space, educational, community, office, industrial, commercial, institutional as well as lands dedicated to recreation and transport infrastructure. From north to south, along the route, the most sensitive areas are: the Greenbelt lands north of Swords, where the depot is to be located, the open spaces to the north of Swords, the residential areas of Swords, Fosterstown and Nevinstown, the Ward River Valley Park, the residential and commercial areas of Northwood and Ballymun, DCU, Albert College Park and the residential areas of Glasnevin and Drumcondra, Griffith Park, Dorset Street environs as far as Parnell Street, Trinity College, Leinster House, St. Stephen's Green and its environs.

The proposed scheme will have impacts on current and future landuses along the proposed alignment, as well as on the ownership and rights over land and property within the area.

There will be impacts on landuse as a result of the construction of the proposed scheme. Some temporary land-take will occur for periods ranging from less than one year to five years to facilitate the construction of the alignment, stops and associated features. Permanent land-take is also required to accommodate the permanent features of the proposed scheme, such as the depot, at grade alignment, stops and associated features. In addition to the temporary or permanent change of landuse, some areas of land will be temporarily or permanently severed by the proposed scheme.

2.2.2 Mitigation Measures and Residual Construction Impacts

On agricultural lands north of Swords there will be temporary land-take as a result of the construction of the depot, the Lissenhall Stop and the alignment. These impacts are mitigated by taking as little land as necessary and by reinstating the land. The proposed scheme will also impact on open spaces adjacent to the R132. Construction compounds will be located on open space and on agricultural lands in order to minimise their impact in so far as these lands can be reinstated after construction. Temporary impacts will occur on open spaces connected to residential areas, where there will be temporary land-take for approximately two years.

As the proposed scheme travels further south, temporary land-take will occur to the eastern side of the R132. The area of temporary land-take will be minimised as much as possible and approximately 10% of the lands used will comprise existing streetscapes. Where necessary (i.e. on lands that are intended to be maintained as agricultural lands), a full programme of agricultural reinstatement will be implemented to ensure that agricultural land used temporarily during the construction phase will be reinstated to productive use post construction in area MN102. A construction compound is to be established at the proposed Fosterstown Stop and used for approximately two years. A second construction compound is to be established on agricultural lands on the western side of the R132 and will be used for approximately four years. Temporary impacts will occur at the location of the two construction compounds. Part of one of the construction compounds will form the planned Park & Ride area for the stop.

On agricultural lands north of Dublin Airport and the lands that form part of the Dublin Airport Zone, temporary land-take will occur to facilitate the establishment of a construction compound that will be used for approximately four years. Where possible, lands will be reinstated to their original use once construction is completed.

Between the Dublin Airport South Portal and Northwood, five construction compounds are to be established. The construction compound associated with the tunnel portal will be in use for approximately five years. The construction compound adjacent to the Northwood Stop will be in use for approximately four years and the construction compounds on either side of the M50 will be in use for approximately two years. Temporary land-take within the existing streetscape will also occur to the south of Northwood Stop where the alignment enters a cut and cover tunnel beneath Ballymun Road. The construction compounds will be located and designed in a manner that minimises impacts in the surrounding areas and minimises the area of land-take temporarily required.

Along Ballymun Road, from Northwood to Albert College Park, the proposed scheme will be tunnelled beneath the existing road and streetscape. A number of traffic lanes will be closed in order to facilitate the construction of the cut and cover tunnel and resulting disturbances of traffic will occur. In Area MN105 two construction compounds, both in use for approximately four years, will be located along Ballymun Road. One will be located on open space on the western side of the road, the other in the location of the proposed Ballymun Stop. within the existing streetscape. Temporary land-take from the gardens of several residential properties on either side of the Ballymun Road and in the vicinity of the junction with Glasnevin Avenue will occur. Lands will also be temporarily taken from Our Lady of Victories School and the Victory Credit Union to accommodate diverted traffic. Temporary land-take will also occur in the gardens of Our Lady of Victories Church.

Mitigation measures in this regard comprise the minimisation of the amount of land temporarily taken and the duration of land-take as well as measures to reinstate the lands to their original use. Some severance of Albert College Drive will occur; however, residential properties will remain accessible via alternative access. Temporary land-take will also occur from a property in Albert College Lawn.

In Albert College Park (Area MN106), two land parcels will be temporarily taken to accommodate two construction compounds and to facilitate the construction of the proposed scheme. One construction compound will be used for approximately two years before being reinstated as open space. The other construction compound will be used for approximately five years. Together the two compounds will cover approximately 4.7ha; approximately 35% of the overall open space of Albert College Park. There will also be temporary land-take from agricultural lands adjacent to Griffith Avenue to facilitate the construction of Griffith Avenue Stop. Where possible, current landuses will be reinstated post construction. Some temporary land-take will occur around the areas permanently taken to accommodate Drumcondra Stop and the Mater Stop as well as the intervention shaft on the lands of St. Patrick's National School and College. The construction of the Mater Stop will be in keeping with existing plans for the redevelopment of the lands that are part of the Mater Hospital.

Within the city centre, the significant temporary impacts are associated with the stops. At Parnell Square there will be temporary land-take from the existing streetscape to facilitate the construction of the stop. There will also be some land-take from lands that are part of the Garden of Remembrance and the Rotunda Hospital. Temporary land-take will be necessary from Westmoreland Street to facilitate the construction of the O'Connell Bridge Stop. In all instances the minimum amount of land necessary will be taken and provisions will be made for the redirecting of traffic. Approximately 20% of St. Stephen's Green will be temporarily used as a construction compound for approximately four years. This land-take will occur in the northwest corner of the green. By minimising the amount of land necessary to accommodate the construction compound, the significance of this impact will be reduced. The unaffected area of the park will remain accessible and useable throughout the construction period.

2.2.3 Mitigation Measures and Residual Operational Impacts

On lands to the north of Swords, permanent land-take impacts will occur to accommodate the depot, a multi-storey car-park, Belinstown and Lissenhall Stops and the alignment. These permanent impacts will occur on agricultural lands. The location and design of these permanent features mitigate their impact. In order to mitigate severance caused by the alignment in agricultural areas, appropriate mitigation measures will be put in place. As the proposed scheme travels south it will impact on open spaces adjacent to the R132. In order to reduce this impact the minimum amount of land necessary will be used. From just north of the Estuary Roundabout, travelling south, the proposed scheme will utilise lands in the existing streetscapes, thereby reducing its impact on adjacent landuses.

Between Estuary Roundabout and the junction of the R132 with Boromhe Elms and Lakeshore Drive, there will be permanent land-take of lands in the existing streetscape and lands on the eastern side of the R132. Where lands are permanently taken, only the minimum amount necessary will be taken. Lands to the north and south of the proposed Fosterstown Underpass will be taken and this will impact on several landuses. Permanent land-take from agricultural lands will also occur in order to accommodate the alignment and an access road. Severance caused by the alignment in agricultural areas will be mitigated by the provision of accommodation bridges.

To the north of the airport there will be permanent land-take due to the presence of a tunnel portal, an emergency vehicle parking area and an access road. The permanent land-take will occur within agricultural lands and lands that are part of the Dublin Airport Zone. The permanent structures that are to occupy those lands are designed to use the minimum amount of land.

South of the airport, permanent land-take will occur due to the alignment, stops, Park & Ride facility and new access roads. New access roads will be constructed to mitigate the severance caused by the presence of the alignment. In the vicinity of the proposed Northwood Stop there will be some permanent land-take to accommodate the permanent features; the stop; Park & Ride and the access roads. Permanent land-take of substratum layers beneath Ballymun Road will occur as the alignment travels in cut and cover. There will be a small amount of permanent land-take from open space in this area for a substation. The amount of land permanently taken will be kept to a minimum.

Along Ballymun Road, permanent land-take of substratum layers will occur to accommodate the cut and cover tunnel section of the proposed scheme beneath the existing streetscape. This will not impact on the current landuse or adjacent landuses once reinstatement of the construction areas is complete, but it will limit future uses directly above the tunnel. The permanent features of the Ballymun and DCU Stops require permanent land-take from lands in the existing streetscape. The DCU Stop will also require the permanent land-take of residential lands, open space and derelict lands and the demolition of two residential properties. Compensation will be made to those whose properties will be demolished. Sensitive design and reinstating current landuses where possible will mitigate the impact of these permanent land-takes.

Between Albert College Park and the Mater Hospital, the proposed scheme will run in tunnel resulting in permanent land-take of sub-stratum layers beneath areas of open space, residential areas, educational and community landuses. The tunnels will be constructed at a depth so as not to impact on current landuses above. Only the minimum amount of land necessary will be permanently taken to accommodate the above ground features of Griffith Avenue Stop. In order to mitigate against the impacts of the intervention shaft on lands part of St. Patrick's Boys National School, the school is to be provided with alternative lands for use as a playground. Both the Drumcondra Stop and the Mater Stop will result in permanent land-take from residential lands and lands under community or civic use. Compensation will be made to those whose properties will be demolished. Only lands necessary will be permanently taken and the permanent features will be designed to fit in with the existing environment.

Permanent impacts in the city centre will be associated with the permanent above ground features of Parnell Square Stop, O'Connell Bridge Stop and St. Stephen's Green Stop. A small amount of permanent land-take in the existing streetscape, in open space in the case of the St. Stephen's Green area, will be used to accommodate permanent features, such as stop entrances, passenger lifts, emergency escape stairs and lifts, vents and maintenance stairs and exhaust vents. There will also be permanent land-take of sub-stratum layers beneath areas of commercial, retail, residential and open space landuses and also beneath lands that form part of the existing streetscape. The tunnels will be constructed at a depth that ensures that they will not impact on the current surface level landuses directly above.

The impacts associated with landuse changes will also have a bearing on other aspects of the environment. Temporary and permanent land-take will contribute to impacts on the following environmental topics which are discussed further in Section 2:

- Socio-economics;
- Noise;
- Flora and Fauna;
- Landscape and Visual;
- Archaeology, Architectural Heritage and Cultural Heritage;
- Non Agricultural Property;
- Utilities;
- Traffic.

2.3 HUMAN BEINGS: SOCIO-ECONOMICS

2.3.1 Baseline

The key socio-economic baseline characteristics which emerge are that population is increasing at the highest rate in Fingal, especially around the Swords area, and these increases are well in excess of the averages for Dublin City, the Greater Dublin Area and the State. Employment rate also mirrors the population trends. Of particular note is the low level of employment in Ballymun, a reflection of the long-term social challenges in this location. In relation to travel to work data, commuting via non-car modes of transport is highest in the administrative area of Dublin City Council (this trend increasing with increased proximity to the city centre) and greater use of the car is made for commuting in Fingal.

Fingal has higher proportions of its working population employed in agriculture, forestry and fishing, building and construction, manufacturing industries, transport and communication, and public administration than Dublin City. Dublin City has higher proportions of its working population employed in commerce and trade, and professional services than Fingal.

The proposed scheme is essential to the current and future long-term development aspirations and objectives of both Fingal County Council and Dublin City Council. Fingal County Council estimates that the proposed scheme will permit the development and implementation of an ambitious economic development strategy along the Metro North corridor (termed the Metro North Economic Corridor or MNEC). In summary, it is estimated that the proposed scheme will permit Fingal County Council to plan for an increase in the MNEC's population of almost 59,000 (2006 data) to 128,100 (+117%) by the period 2025/2030. In parallel with this, the MNEC strategy is predicting the creation of an additional 37,000 jobs (an employment increase of 125% over 2006 MNEC employment levels) within MNEC and that around 69% of these jobs would be held by future MNEC residents. The strategy envisages that this growth will be focused at three main locations: Swords-Lissenhall, Dublin Airport and Metropark. Fingal County Council has already started the process of developing its planning and development policy around the MNEC Strategy and this implementation will continue in future years.

The proposed scheme is also essential to Dublin City Council's future development aspirations, especially the ongoing regeneration of Ballymun and the north inner city areas. Although the level of long-term population increases likely to arise in Fingal are unlikely to arise in Dublin City Council (as much of this administrative area is already developed, unlike parts of Fingal), the proposed scheme will still permit higher-density development at specific locations along the alignment in the Dublin City Council area.

2.3.2 Mitigation Measures and Residual Construction Impacts

The expenditure of construction workers' wages will result in a considerable portion of this expenditure being spent in the regional economy of the Greater Dublin Area over the approximate five year construction period, thereby resulting in indirect/secondary economic benefits. The estimated level of average direct employment during the five year construction programme is approximately 3,100. Overall, the proposed scheme will result in positive impacts due to overall employment creation during construction.

However, the construction of the proposed scheme over the five year programme will result in some negative socio-economic impacts. These will be focused on the areas of retail, commercial and office-based employment, where access to/from these areas is likely to be impacted by temporary delays and disruption. These areas are Westmoreland Street, O'Connell Bridge, O'Connell Street and Ballymun. There will be wider impacts in relation to traffic congestion and longer journey times during construction. These short-term impacts are detailed further in the Traffic section.

O'Connell Bridge Stop (escalator and lift -aerial view)



The implementation of mitigation measures in other environmental topics (noise and vibration, air quality, landscape and visual, traffic etc.) will, however, be important in minimising and managing potential negative socio-economic impacts during the construction process. In summary, these construction-based mitigation measures are all designed to minimise unnecessary disruption, nuisance impacts and temporary delays which might arise during construction. Additionally, a key objective will be maintaining access (or alternative access) to communities, retail, commercial and leisure areas during construction.

Cumulative impacts will arise due to landuse and traffic. Landuse and socio-economic issues are closely linked. The key cumulative impact is the short-term negative impacts associated with changes in landuse during construction and the subsequent loss of access to important landuses. However, in the long-term, the proposed scheme will permit the future planning and development (and thus future landuse) along its alignment to be optimised to take advantage of the significant benefits provided by the proposed scheme.

Regarding traffic, congestion and delays resulting from the construction of the proposed scheme, will have negative cumulative impacts with regards to short-term socio-economic costs to the key retail, commercial and office-based locations. However, in the long-term, the operation of the proposed scheme will result in some localised improvements across the traffic network.

2.3.3 Mitigation Measures and Residual Operational Impacts

The proposed scheme will result in a range of positive socio-economic impacts of very high significance. The proposed scheme will provide a high-quality, rapid and frequent transport option for existing and future commuters within the catchment area. In comparison to current public transport options, the proposed scheme will provide a substantial improvement in commuting, thereby resulting in significant reductions in journey time and congestion.

The proposed scheme will greatly increase access to employment across all of the Greater Dublin Area. With the alignment linking up some of the key employment destinations in Dublin (such as Swords, Dublin Airport, Dublin city centre), and due to its integration as part of the wider Dublin rail network, the proposed scheme will greatly improve employment accessibility for a significant proportion of residents in the Greater Dublin Area.

The proposed scheme will greatly assist in increasing the employment opportunities for residents along the alignment in areas where there are currently high-levels of unemployment, such as Ballymun and the north inner city. This will also assist with the ongoing regeneration and renewal projects in these socially-deprived areas.

The proposed scheme will greatly assist with increasing overall accessibility to a range of social and community facilities along the alignment, and (via the wider rail network) across the Greater Dublin Area. Examples of these facilities include town centre facilities, such as post offices, local shops, professional services (e.g. in Swords, Ballymun town centre, Drumcondra high street, Dublin city centre), medical facilities (e.g. Mater Hospital), 3rd & 4th-level institutions (DCU, Trinity College Dublin, Dublin Institute of Technology), and key retail and commercial areas (Airside Retail Park, North Ballymun, Dublin city centre, Dundrum Town Centre, Sandyford Industrial Estate).

As the majority of the socio-economic impacts of the proposed scheme are significantly positive, there are no specific mitigation measures required.

2.4 HUMAN BEINGS: NOISE

2.4.1 Baseline

Surveys of the baseline noise environment along the alignment have shown a varying noise environment into which the proposed scheme will be introduced. To the north of Swords, where few noise sensitive receptors exist, noise levels are influenced by the traffic on the M1 motorway during daytime. Baseline noise levels along the rest of the route are higher and generally dominated by local road traffic. Through the urban environment there is a wide range of noise sensitive receptors bordering the alignment. The sensitivity of these has been considered in the noise assessment by the use of appropriate noise assessment criteria.

2.4.2 Mitigation Measures and Residual Construction Impacts

There is potential for widespread noise impacts during construction. A series of noise control measures will be adopted so as to minimise these including: on-site noise control measures, limits on noise at sensitive receptors, and noise monitoring. Monitoring will be focused on the major structures and stop sites and at locations where night-time works are required.

The construction of a scheme of this scale will inevitably cause some noise disturbance. RPA aim to minimise this by enforcing the mitigation measures summarised above. Residual noise impacts are expected around the major underground stop construction sites, major structures and during the noisiest enabling works (groundworks and drainage) along the route.

Night work will be required during demolition of the existing Chapel Lane and Malahide Road footbridges. This is expected to result in significant impacts but only for one or two nights. Concrete pours may also be required outside of daytime hours at underground stops. Residual impacts would be expected where this is required, although for a short duration compared to the overall programme.

Residual construction noise impacts are likely during works on the cut and cover section of the alignment at properties off Ballymun Road, Ballymun Civic Centre and at Our Lady of Victories Church on Ballymun Road.

Stop construction is likely to lead to residual impacts during the construction of Fosterstown, DCU, Drumcondra, Mater Hospital and Parnell Square Stops.

Construction of structures is likely to lead to residual daytime noise impacts including construction of the Estuary, Pinnock Hill and M50 viaducts. The Malahide and Fosterstown underpasses will also result in residual noise impacts. Chapel Lane footbridge and St. Patrick's College intervention shaft are also likely to result in residual noise impacts.

Construction compounds will generally be used for relatively low noise activities where possible, but may still generate some noise impacts at the closest noise receptors.

Construction traffic is expected to give rise to some noise increases on road links around the works. It is expected that these noise increases will create significant noise impacts in only a small number of locations including on Dublin Road and Main Street in Swords.

2.4.3 Mitigation Measures and Residual Operational Impacts

For the operation of the proposed scheme noise attenuation measures will be incorporated into substations and ventilation buildings and shafts to control noise emission to acceptable levels. The design of viaducts, bridges, other structures and the trackform will minimise noise radiation. Noise impacts will be greatest at night when ambient noise levels are lower. Based on a series of conservative assumptions, concerning vehicle type, operating frequencies and speeds, noise modelling has identified a number of locations where noise mitigation may be necessary.

There are a number of options for further mitigation that will be developed through detailed design studies. The LMVs and track system will be designed to control noise. It is anticipated that in the areas where potential impacts have been identified mitigation can be achieved through LMVs and track design and low level noise screening incorporated into the viaduct and track design. If noise barriers are used they will be planted where feasible or practicable to give the appearance of hedges so as to minimise their visual impact. The design of noise control measures on the proposed scheme will aim to minimise noise impacts and will ensure that noise impacts are no greater than those reported in this EIS. It will also aim to minimise the use of visible noise barriers so as to minimise the visual impact of the proposed scheme.

A landscaped bund around the depot will provide noise screening and on-site barriers will be designed to protect properties to the west of the site. Depot buildings will be designed to contain noise to meet necessary standards.

2.5 HUMAN BEINGS: VIBRATION

2.5.1 Baseline

Vibration and groundborne noise are aspects of the same phenomenon, perceived differently or in different media. Vibration is movement of a surface or structure perceived by humans by the tactile sense, or which directly affects the function of an item of equipment such as an electron microscope. Groundborne noise is vibration of a surface or structure perceived by humans as sound.

Groundborne noise and vibration for the construction and operation of the proposed scheme have been predicted using a Finite Difference Time Domain model, validated from experience on the Dublin Port Tunnel project and modified for the geology encountered along the route.

2.5.2 Mitigation Measures and Residual Construction Impacts

The tunnel boring machines (TBM) have the potential to generate significant noise disturbance above much of the bored tunnel alignment from St Stephen's Green to Ballymun. Cross passages between tunnels at several locations near underground stops will be constructed using drilling and blasting techniques. This could cause disturbance and could affect structures and equipment if not properly controlled. The assessment has therefore resulted in the adoption of a series of controls to reduce these to acceptable levels as follows:

- Blasting will not take place in residential areas at night and suitable advanced warning will be given to anyone who may experience noise or vibration. Vibration from each blast will be monitored to enable blasting parameters to be optimised and to ensure that damaging levels of vibration are not reached. If necessary, alternative chemical or hydraulic splitting methods will be used.
- Coordination with sensitive neighbours, such as Mater and Rotunda hospitals, will be an important mitigation measure to prevent interference with sensitive equipment. The Mater Hospital may need to make alternative arrangements for the use of some of its equipment for approximately ten weeks as the TBM passes.

Two principal methods of mitigation are available for the TBM.

- The first is to limit hours of operation to avoid the more sensitive night period.
- The second method is optimisation of TBM characteristics including face pressure and selection of cutters and teeth. RPA will impose a groundborne noise limit which the contractor must adhere to, unless higher levels can be tolerated without complaints. This limit will apply to TBM noise outside of the daytime and evenings, six days a week (Monday to Saturday) and on Sundays and bank holidays.

In limestone, the TBMs are likely to advance at the rate of about 75m per week, operating five days per week. In the case of the Dublin Port Tunnel the TBM was sometimes audible for up to three weeks before and three weeks after reaching the closest point to a receiving location. The Dublin Port Tunnel was 11.2m in diameter. The proposed scheme tunnels will be 6.7m in diameter. Groundborne noise levels will therefore be less than those for the Dublin Port Tunnel with consequently shorter durations of impact. The TBMs are likely to be faster when boring through the boulder clay above the limestone. Groundborne noise levels are predicted to cause some disturbance, in particular to sensitive building uses such as hospitals, theatres and residential buildings. This will be experienced for each tunnel bore.

TBM driving at night will be restricted in locations where the noise limits within the EIS cannot be achieved by optimising TBM operating characteristics. TBM noise will be audible at night in many homes but the noise threshold is sufficient to ensure that TBM noise at night meets widely adopted standards for the prevention of sleep disturbance in the community. There will be monitoring in place to ensure that these thresholds are not exceeded.

2.5.3 Mitigation Measures and Residual Operational Impacts

Modern railways incorporate specific track forms and continuously welded rails which completely avoid significant effects due to vibration and groundborne noise, provided that an adequate maintenance regime is followed. These track forms will be provided in the tunnels and in surface areas where necessary. The design of the track under particularly sensitive buildings, such as hospitals and theatres, will require particular attention to meet the necessary standards. Embedded rail will be used to control vibration on some above ground sections.

Once in operation no significant vibration or groundborne noise impacts are expected.

2.6 HUMAN BEINGS: RADIATION AND STRAY CURRENT

2.6.1 Baseline

In order to facilitate detailed investigation of electromagnetic compatibility (EMC), representative exposed locations along the route were selected and predicted levels for these areas were estimated. The locations that were selected covered the range of different infrastructure configurations that occur in the proposed scheme including running tunnel, at grade and with or without stops.

Areas which are dominated by open greenfield or areas where sensitive receptors such as houses and schools are very rare and are considered to be of low to medium sensitivity. Locations such as Dublin Airport, Trinity College and some specific medical clinics are assumed to have sensitive equipment and therefore are considered to be of very high sensitivity.

2.6.2 Mitigation Measures and Residual Construction Impacts

There are no specific mitigation measures envisaged during the construction phase of the proposed scheme. Potential levels of Electromagnetic interference (EMI) and stray current during the construction phase (including the testing and commissioning of the LMVs and traction power supply system) are expected to be within those provided for the operational phase as described in Section 2.6.3.

2.6.3 Mitigation Measures and Residual Operational Impacts

Measures to minimise stray current have been incorporated into the design specifications and will be implemented during the construction and operation of the proposed scheme. These measures may include the use of a stray current collector system, together with other design measures such as resilient insulating polymer around the rails. Monitoring of the earthing system in the tunnel sections is to be carried out to locate any faults in the earthing system. Active and passive measures such as insulated shielding or cathodic protection can be applied to protect any critical components. The system contractor will ensure that the electrical systems and equipment associated with the proposed scheme comply with European legislation. With regard to some types of sensitive electric appliances, relocation of the affected appliance (even a short distance from a railway boundary) may be possible.

The potential for significant impacts to occur due to stray current is considered to be low provided that the mitigation measures detailed above are put in place. The technical design of the proposed scheme conforms to current best practice. During normal scheme operations, the expected direct current and electromagnetic effects have been evaluated and were found to be less than 50% of the field strength of the Earth's natural magnetic field. These levels are unlikely to pose a threat to the normal operation of receptors such as electro-magnetic equipment located along the alignment. The described impacts can be regarded of low significance and do not present any significant safety risk.

2.7 HUMAN BEINGS: TRAFFIC

2.7.1 Baseline

The implementation of the proposed scheme will transform public transport availability along its alignment. The proposed scheme will have an impact on all forms of traffic movement. The introduction of high quality public transport links will increase public transport use and reduce car use and car dependency. The proposed scheme will result in a substantial change in travel patterns throughout the entire city.

The proposed scheme is a major engineering project and will require a significant amount of construction works. In order to build the proposed scheme, a number of construction sites will be needed along the alignment. Many of these sites will be on or along existing roadways. As a result, there will be a reduction in traffic capacity during the construction phase which will have a significant impact on road transportation modes.

This assessment has taken into account all modes of transport, including pedestrians, cyclists, road traffic, construction traffic and all forms of public transport. Detailed transportation analysis has been undertaken to assess the likely impact during the construction and operational phases of the proposed scheme.

2.7.2 Mitigation Measures and Residual Construction Impacts

It is generally accepted that the traffic impact during the construction phase will be significant in some places. The main impact will arise out of the requirement to temporarily occupy road space for construction works, resulting in partial or full closure of particular roads. The main areas that will be directly affected are Swords, Ballymun and the city centre, where the level of construction works will be greatest. Elsewhere, the alignment will be mainly tunnelled and there will be significantly less impact at ground level.

Mitigation measures will be required to reduce the impact on traffic during the construction phase. The key impacts will occur within the city centre where the concentration of trips on the road/street network is greatest. It is vital that a comprehensive Scheme Traffic Management Plan is introduced to alleviate construction phase impacts. This plan will be developed jointly with the local authorities, public transport operators and other relevant stakeholders. The Scheme Traffic Management Plan will take into account all types of transport, such as general traffic, taxis, bus and pedestrians.

Another important mitigation measure will be the implementation of a Construction Vehicle Management Strategy. This will be devised based on the contractor's construction programme to reduce the impact of construction traffic on the road network.

During the construction period, there will be a reduction in average traffic speeds throughout the city.

In locations where construction is at street level, there will be a negative impact on the pedestrian environment. Some footpaths, and pedestrian crossings, adjacent to construction sites will be closed or narrowed. The reduction in footpath space and number of pedestrian crossing points will affect pedestrian movement. Temporary footpaths and pedestrian crossings will be provided at certain locations to mitigate these impacts.

As a result of road closures, bus routes will be diverted and bus stops will be relocated. Changes to the bus network will have an impact on bus operations. In particular, over 150 bus routes in the city centre will be altered due to the closure of roads that are heavily used by buses, such as Westmoreland Street. Bus stops will be located in areas agreed with the operators and comprehensive information on bus stop relocations and diversions will be provided to the public.

During the construction phase, it is likely that a significant amount of traffic will choose alternative routes to those worst affected. The traffic capacity on the Ballymun Road corridor will be reduced greatly. At present, a large volume of through traffic uses this corridor to access the city. The reduction in capacity will make this route less attractive to through traffic. As a result, traffic will redistribute onto other corridors such as the N2. The impact on all transport modes will be greatest in the vicinity of the alignment.

2.7.3 Mitigation Measures and Residual Operational Impacts

The most significant impact during the operational period will arise from increased levels of pedestrian activity at and near the stops. The proposed scheme will carry a very high volume of passengers, most of whom will walk to and from the stops. To mitigate for the increases in pedestrian activity, additional pedestrian infrastructure will be provided around the stop locations. New signalised pedestrian crossings will be introduced and footpaths will be upgraded.

When operational, the proposed scheme will allow people within its walking, cycling and bus interchange catchment (and those who can avail of the Park & Ride facilities at Belinstown, Dardistown and Fosterstown Stops) to use a high quality public transport service. The introduction of the proposed scheme services will reduce vehicular traffic on the surrounding road network as some people transfer from car to public transport. It is estimated that the proposed scheme will remove in the region of up to 5,000 peak hour car trips from the road network during its operational phase as a result of mode shift from car to metro. Overall, the operational phase will result in significant beneficial impacts.

2.8 FLORA AND FAUNA

2.8.1 Baseline

The proposed alignment passes predominantly through agricultural land and urban environments. The habitats recorded are largely of low to moderate local nature conservation value. Occasional areas of higher value occur along the route mostly along river corridors and there are several sites designated for their national or international nature conservation importance in the surrounding area.

The main fauna species of interest recorded were predominantly located in the area of the river corridors, with evidence of foraging/commuting bats, movements of little egret and kingfisher, and known use by salmonid fish species and otters. Occasional badger territories occur in the area surrounding the alignment and Irish hare was recorded on agricultural land in the northern part of the survey area. Three red list bird species were recorded (black-headed gull, lapwing and yellowhammer), all in the area north of Swords.

2.8.2 Mitigation Measures and Residual Construction Impacts

The proposed scheme will involve temporary loss of habitat along the alignment for features of the scheme including the construction compounds. Some temporary disturbance to a range of common fauna species will occur, but the impacts are not predicted to be significant. The habitats affected are largely common and widespread including agricultural land and those typical in urban locations, such as amenity grassland, street trees, scattered trees and parkland and areas of built land. These habitats will typically be replaced on completion of the works.

The construction compounds are to be largely located in habitats of low nature conservation value. Some temporary loss of habitat will occur in St. Stephen's Green, although this location is more important for its social value than its nature conservation value.

The proposed scheme alignment crosses several major watercourses and in-stream works will occur in the Sluice River and in the River Liffey. Measures will be implemented to reduce the risk of significant pollution to the watercourses during the construction, and also to ensure that significant impacts to fauna species such as otters and fish do not occur. An area of semi-natural grassland north of the airport will be temporarily affected. It will be restored on completion of the works by replacing the topsoil and the seedbank it supports.

Removal of habitat is likely to occur outside the period of 1 March to 31 August to avoid impacts to nesting birds. Pre-construction surveys will be undertaken to determine whether there has been any change in the status of protected species along the proposed scheme. The findings will be discussed with relevant bodies such as the National Parks and Wildlife Service (NPWS) and any necessary mitigation measures implemented.

2.8.3 Mitigation Measures and Residual Operational Impacts

The majority of the southern part of the proposed scheme between Albert College Park and St. Stephen's Green is in tunnel and will not have any effect on habitats and species. Small areas of permanent habitat loss will occur to accommodate above ground structures such as air vents and emergency accesses, however, the effects on habitats and species are not significant. The remaining sections of the alignment will result in the loss of largely intensively managed agricultural land or urban habitats of low nature conservation value. Permanent loss of semi-natural habitat is not deemed to be significant due to the low species diversity it supports. The landscaping strategy includes provisions for considerable new planting along the alignment, particularly of trees and shrubs to replace trees and hedgerows permanently lost to the proposals.

The only permanent in-river work associated with the proposed scheme is the culverting of a section of the Sluice River and its northern tributary. This watercourse is steep sided and has species-poor vegetation along its margins. Design measures will be included to ensure that fauna species such as fish and otter can still pass along the river. Significant impacts are not predicted to occur.

The habitats which will be permanently lost support a range of predominantly common fauna species. Some loss of foraging/commuting routes for bats will occur, although the effects are not predicted to be significant. The landscape strategy includes for considerable areas of new planting which will replace that lost and which provides new habitat for wildlife including foraging and commuting bats.

Once operational, the proposed scheme will have no significant impacts on habitats and surrounding wildlife. Little egret was recorded flying along the Broad Meadow River across the proposed alignment. Bird deflectors will be attached to the Lissenhall, Balheary and Ward River Bridges to reduce the risk of birds colliding with the LMVs and overhead lines.

2.9 SOIL AND GEOLOGY

2.9.1 Baseline

The baseline assessment included a desktop study and a review of the findings of the Main Ground Investigation (MGI) carried out by the project engineers. Baseline soils identified included boulder clay, sands and gravels, silts and sandy clays from river deposits and made ground including builders rubble and waste materials. Bedrock geology is predominantly of limestones with shales. Contamination samples were taken during the MGI. These were assessed against screening criteria and the future end use of the area the samples were taken from. All samples were below the screening criteria for a commercial end use. Limited exceedances were determined in some areas with respect to the screening criteria for residential properties.

2.9.2 Mitigation Measures and Residual Construction Impacts

The principle source of construction impacts are paving of areas, settlement and ground disturbance. Mitigation measures involve the implementation of specific settlement mitigation and protection measures including a Property Protection Scheme, the reinstatement of disturbed areas and the minimisation of the paved and disturbed areas. In general, the significance of the residual impacts are low to very low as the majority of the proposed scheme is through areas that are already paved or are of low sensitivity or importance.

2.9.3 Mitigation Measures and Residual Operational Impacts

The principle sources of operational impacts are related to maintenance and cleaning activities. Maintenance will be undertaken in controlled environments and cleaning will be undertaken in line with best practise. The residual impacts are of low to very low significance.

2.10 GROUNDWATER

2.10.1 Baseline

An extensive review of the baseline groundwater environment along the route of the proposed scheme was conducted. In addition, information on groundwater quality along the proposed alignment was assessed. The majority of the proposed scheme is underlain by a Locally Important Aquifer of moderate to extreme vulnerability with the exception of the area between Fosterstown and Dardistown where a Poor Aquifer of moderate to high vulnerability is present. Groundwater quality is impacted to some extent by existing urban activity and/or agricultural practices along the proposed scheme.

The Groundwater Baseline Assessment indicates that the groundwater environment along the proposed scheme is not highly sensitive with regards to potential impacts associated with the proposed scheme.

2.10.2 Mitigation Measures and Residual Construction Impacts

The construction phase will involve the handling, use and storage of materials, which have the potential to pollute the groundwater environment, such as fuel oils, lubricating hydrocarbons, paints and cleaning chemicals.

A range of mitigation measures will be implemented during the construction phase including the collection, assessment and appropriate management of groundwater encountered, the control and treatment of concrete wash waters, containment of potentially hazardous substances within bunded areas and the use of designated refuelling areas. Other measures comprise the provision of spill kits and suitable containment of hazardous waste storage areas, in order to ensure the impacts associated with the construction phase are of low significance.

2.10.3 Mitigation Measures and Residual Operational Impacts

Potential adverse impacts associated with the operational phase of the proposed scheme are likely to include minor alteration of groundwater flow by tunnels.

Mitigation measures, which are to be put in place during the operational phase, will include treatment, the use of hydrocarbon interceptors and grit chambers in carparks, the inspection of bunded waste storage areas and substations, in addition to the control of wastewater discharge. This will help ensure that the impact of the operational phase of the proposed scheme on the groundwater environment will be of low significance.

2.11 SURFACE WATER

2.11.1 Baseline

Surface water features along the route of the propose scheme include:

- Broad Meadow and Ward Rivers;
- Sluice River and tributaries;
- Mayne River;
- Santry River;
- River Tolka and its tributaries;
- Royal Canal;
- River Liffey;
- Ponds at St. Stephen's Green (which are fed by the Grand Canal);
- Unnamed streams and ditches along the alignment.

The surface water features listed above have been characterised with reference to the following:

- EU, National, regional and local legislation and planning and policy objectives;
- EPA water quality database, maps and reports;
- Water quality sampling carried out in September/October 2007 and April 2008.

Both the Broad Meadow and Ward Rivers are classified as moderately polluted and suffer from a degree of localised flooding. Some fishing activity takes place in the upstream reaches of the Ward River. Historically flooding occurred in the area however, the channels of both rivers have recently been improved to reduce flooding risk. These rivers are considered to be of medium importance and sensitivity.

The streams of Sluice River drain Dublin Airport and the Swords Urban area and both are generally of poor quality. Some local claims of flooding along sections of the stream have been noted but little flood or water quality data exists (however there is some water quality monitoring data from work carried out by Dublin Airport). According to the Office of Public Works (OPW) these streams can be subject to localised flooding. These streams are classed as being of Medium importance and sensitivity.

Wellfield Bridge, the only monitoring station on the River Mayne, has shown the river to be moderately polluted during the most recent EPA monitoring event (2005). The Mayne River has a small catchment and is subject to widely varying flows and can run very low in periods of dry weather. Some localised flooding can occur in areas according to the OPW. This river is considered to be of Medium importance and sensitivity.

The Santry River is classed as seriously polluted along much of its route, and suffers from urban drainage discharges. The Santry River has a small catchment and is subject to widely varying flows and can run very low in periods of dry weather, the flow regime and poor water quality mean that it is not a viable fishery. No significant flooding issues have been reported for the river. This river is considered to be of Low importance and sensitivity.

The River Tolka discharges into the Tolka Estuary and Dublin Bay, which is both a Special Protection Area (SPA) and a Special Area of Conservation (SAC). The NPWS have recently proposed to extend the SPA to include the Tolka Estuary. Water quality impacts from the Tolka could have knock-on impacts on the water quality in the SPA and SAC. A major flood study has been undertaken for the River Tolka. Historically flooding has occurred in different areas in close proximity to the route corridor. This river is considered to be of Medium importance and sensitivity.

The water quality of the Royal Canal is generally believed to be good, although little data is available. Historical data from the OPW has no information of flooding on the Royal Canal. This river is considered to be of High importance and sensitivity.

The River Liffey is classed as slightly polluted in the city centre area but the quality of the river has improved significantly in recent years. The Liffey is a salmonid river and therefore the route through the city, while the water may be slightly polluted, is a transit route for migratory salmon and therefore all efforts must be made to prevent negative water quality impacts. The OPW flooding data has shown that areas outside the route corridor are liable to flood (Islandbridge and Kilmainham). No areas within the route corridor recorded any historical floods. This river is considered to be of Medium importance and sensitivity.

Water quality of the Grand Canal is generally believed to be good, although little data is available. Historical data from the The OPW has no information of flooding on the Grand Canal. This river is considered to be of High importance and sensitivity.

2.11.2 Mitigation Measures and Residual Construction Impacts

During the construction phase, activities that have the potential to impact on flow regimes and flooding include the installation of hardstanding for temporary construction compounds and access roads, the construction of surface and elevated structures on existing greenfield sites and the installation of surface water drainage discharge points to watercourses and surface or foul water drains.

In addition ditch diversion, culverting and bridge strengthening works have the potential to impact on flow regimes and to lead to flooding of adjacent lands. These works may also impact on surface water quality through material deposition in the watercourse.

Discharge of contaminated surface water runoff and contaminated dewatered groundwater also has the potential to impact on surface water quality.

Potential construction impacts on flow regimes and flooding will be mitigated by designing the works to incorporate the requirements of the OPW, the Arterial Drainage Act 1945 and the Eastern Regional Fisheries Board Guidelines.

Within the proposed scheme, areas of hardstanding with low to medium risk of contamination (HGV parking and turning areas) will be contained and drained using a pipe and gully system. Runoff from these areas will be passed through an approved separator before discharging to the on-site drainage system. Areas of high risk of contamination will be fully protected and drained to a separate effluent drainage system and discharged to an on-site treatment plant.

Providing the mitigation measures specified are implemented, residual impacts due to construction activities are assessed as of low magnitude and the significance of impacts has been assessed as negligible to low.

2.11.3 Mitigation Measures and Residual Operational Impacts

During the operational phase, increased surface water runoff will arise from hardstanding surface and elevated areas associated with permanent features. Flooding of adjacent lands may arise from operation of the scheme's drainage features (including culverts, drainage discharge points). Storm water runoff will be managed using a combination of Sustainable Urban Drainage System (SUDS) techniques and conventional pipe drainage systems. The design of the drainage system will comply with the Greater Dublin Strategic Drainage Study, the Code of Practice for Drainage Works and any specific local authority requirements.

Park & Ride facilities will have a permeable pavement structure overlaying a modular geo-cellular storage tank. The tanks will be fitted with a flow control device and will discharge to ditches via oil interceptors and an emergency or by-pass system to safely pass forward flows that exceed the design event. Dewatering of groundwater from tunnelled sections may be necessary during the operational phase. If encountered, contaminated groundwater may require more specialised treatment such as chemical treatment, activated carbon or other absorbent systems. Treatment and discharge measures will be in accordance with local authority requirements.

Discharge of untreated wastewater or contaminated runoff to receiving water bodies has the potential to impact on surface water quality. On-site wastewater treatment at Belinstown Depot and at the Airport North Ventilation Building will comply with Fingal County Council's requirements and the EPA Wastewater Treatment Manual Treatment Systems for Small Communities, Business, Leisure Centres and Hotels (1999).

Re-fuelling operations will take place in designated bunded areas and spill kits and hydrocarbon packs will be available. Hazardous materials will be stored in appropriate metal or plastic containers prior to removal by local authority or EPA approved waste management contractors.

Herbicides used during the operational phase will be applied sparingly and in compliance with suppliers' guidance, and will be suitable for use in an environment in which receiving watercourses are present.

Providing the mitigation measures specified are implemented, residual impacts due to operation activities are assessed as of low magnitude and the significance of impacts has been assessed as negligible to low.

2.12 AIR AND CLIMATIC FACTORS

2.12.1 Baseline

The proposed alignment extends from the city centre out to the northern suburbs and passes through areas where airborne concentrations of pollutants such as nitrogen dioxide and particulate matter are at their highest anywhere in Ireland. In some places, chiefly near roads with heavy traffic flows, current concentrations are in excess of those defined by air quality standards. Most areas along the alignment, however, currently experience air quality that is compliant with air quality standards.

2.12.2 Mitigation Measures and Residual Construction Impacts

The construction phase of the proposed scheme will have a greater impact on air quality than the operational phase for two reasons. Firstly, construction activities have the potential to generate dust emissions and secondly, the changes to road traffic flows on the wider road network are greater for periods when road closures are in place than would be the case when it becomes operational.

It is not possible to eliminate the emission of dust from a construction site entirely; nevertheless, effective mitigation can be implemented to reduce substantially the impact on neighbouring residents and people in workplaces and community buildings. The impact of construction dust has been assessed by considering the proximity of people likely to be particularly sensitive to those places where construction activity will occur and where construction compounds are planned. Naturally, those people living or working closest to construction activities will be most likely to experience annoyance, should dust be deposited on prominent surfaces in sufficient quantities to make it noticeable. It is never possible in assessments of this kind to define impacts on individual properties in precise numerical terms. In general, it can be said, that people living and working within 50m of construction activity are likely to experience a residual impact, while those at distances of 150m and greater are unlikely to be affected. Rather more people are likely to experience an impact from construction dust in the city centre than elsewhere, simply because the density of people living and working there is higher than for other parts of the proposed scheme.

The construction phase would lead to route diversions and this in turn will affect road traffic flows on the road network across Dublin. The consequence for air quality would be greater for this period of time than in the future years when proposed scheme is operational, with air quality alongside more roads predicted to experience increases in pollutant concentrations rather than decreases. Furthermore, there would be a small number of locations where limit values for nitrogen dioxide are exceeded. Conversely, locations alongside some roads will become compliant with air quality limit values, as traffic flows diminish in response to the proposed scheme.

Overall, traffic movements would be reduced across the network during the construction phase, resulting in a short term decrease in emissions of CO₂ from road traffic of 1%.

2.12.3 Mitigation Measures and Residual Operational Impacts

Once operational, the proposed scheme would not have much potential for changing the air quality; the LMV would emit no pollutants. Any changes in local air quality would be associated with any changes in traffic flows on the whole of Dublin's road network that are a direct result of the proposed scheme. Careful analysis and assessment has been made of the effect that projected changes in traffic flows would have on concentrations of nitrogen dioxide and particulate matter alongside roads. This has shown that very small numbers of roads would experience meaningful changes, as a proportion of the wider network considered.

These changes in air quality would be both positive and negative, with no significant net difference in air quality across Dublin. Some locations alongside busy roads would experience concentrations of nitrogen dioxide and particulate matter above those defined by air quality standards, but this would be the case with or without the proposed scheme. There would be a small reduction in emissions of carbon dioxide from traffic using Dublin's road network, when the proposed scheme becomes operational.

There are no mitigation measures that can be applied to the very small number of locations where concentrations of airborne pollutants will increase.

2.13 LANDSCAPE AND VISUAL

2.13.1 Baseline

The landscape/townscape and visual impact assessment of the proposed scheme assesses the impacts on the landscape and townscape character and resources of the alignment across the Fingal County countryside and through the urban areas of Dublin City. In addition, it assesses the visual impacts on people who live, work, travel, visit and enjoy the area through which the proposed scheme operates.

St. Stephen's Green North (Lifts)



The assessment is restricted to a study area which approximately equates to the area where the components of the proposed scheme are likely to be seen and the impacts are likely to be significant to the so called visual envelope.

For the landscape/townscape baseline, the study area has been divided up into 25 landscape/townscape areas. Each area has been studied, both in the field and using desktop data, and assigned a landscape/townscape sensitivity. This sensitivity relates to the proposed scheme and is not just a general sensitivity.

12 areas have been judged as of high sensitivity, four as medium sensitivity and nine as low sensitivity. The distribution of the higher sensitivities is primarily within the countryside and the northern suburban area. They are also associated with key urban open spaces such as Albert College Park, residential areas as well as Dublin central open spaces and public civic areas. The lower sensitivities are primarily associated with undesignated areas, the airport and the land adjacent to the airport. In addition, where the proposed alignment in a particular area is below ground and within a bored tunnel, the sensitivity will also be considered low.

2.13.2 Mitigation Measures and Residual Construction Impacts

The major landscape and visual impacts during the construction phase are related to the presence of construction compounds including hoarding and lighting and removal of significant landscape features including trees and monuments. It is considered that there will be visual and amenity impacts of very high significance at the depot site at Belinstown, Albert College Park and St. Stephen's Green.

Mitigation measures include proper fencing and management of construction sites, removal of temporary fencing and barriers as soon as possible, restricting lighting of compounds and work sites to agreed working hours, protection of trees to be retained and reinstatement of sites as soon as possible after works are complete.

2.13.3 Mitigation Measures and Residual Operational Impacts

The magnitude of change in the landscape has been assessed by means of amount of trees or area of field lost, the change in the character, the loss of key townscape features or the introduction of new elements. The magnitude of visual change relates to the degree of change in a view, whether a special view has been blocked or a new obtrusive element has been introduced. The magnitude of visual change for each viewpoint has been assessed and compared with the sensitivity of the visual receptor.

It is considered that there will be landscape and visual impacts of high or very high significance at Lissenhall farmland, sections of the proposed scheme on viaduct or high embankments, Dublin City University, St. Patrick's College, Parnell Square and St. Stephen's Green.

Mitigation measures at Lissenhall include the creation of a landscape embankment around the depot to screen the multi-storey car park from the residential areas located west of the depot. Mitigation measures at St. Stephen's Green include the replanting of semi-mature trees and the reinstatement of the existing pond, monuments, walls and railings and Fusilier's Arch. Mitigation measures in other areas include a high standard of design of the infrastructure and new planting to screen views of the proposed scheme structures,

2.14 MATERIAL ASSETS: AGRONOMY

2.14.1 Baseline

The agronomy study area consists of nine farms (351 hectares of land). In order to describe the agronomy study area a baseline assessment was carried out in August 2007. The baseline evaluation included a desktop review of relevant development and local area plans, review of existing data resources including data from the Central Statistics Office (CSO), aerial photography and soil maps, review of land registry maps, field surveys and land owner interviews. Each farm in the study area is assigned a functional value which describes a farm in terms of its importance and sensitivity to potential impacts from the proposed scheme. For example, a farm with an intensive enterprise and good land will have a higher functional value than a farm which is not used intensively and has poor quality land. The baseline concluded:

- The average size of farms in the study area (approximately 64 hectares) is larger than the average farm size in Co Dublin (approximately 42 hectares).
- There is a higher proportion of tillage enterprises and lower proportion of livestock enterprises in the study area than in County Dublin.
- The majority of land in the study area is of high quality.
- Approximately 94% of the agronomy study area is located within the Fingal County Council area and 6% is located within the Dublin City Council area. Of this, approximately 24% of the land is zoned for commercial/residential uses, approximately 2% is zoned for uses which will allow efficient operation of Dublin Airport, approximately 68% is zoned for agriculture/greenbelt/high amenity and approximately 6% (which is located within the Dublin City Council Area) is zoned protected for existing environmental uses.
- The functional value of the farms in the study area is generally high (74% of the study area). This is due to large farm size, significant horticultural enterprises, excellent soil types and high potential yields of crops.

2.14.2 Mitigation Measures and Residual Construction Impacts

The major impacts on agriculture during construction are land loss, severance and disturbance caused by construction and other traffic, noise, lighting and dust.

The main mitigation measures are:

- Minimise the temporary land-take requirements so that only lands required for the proposed scheme are taken;

- Land owners will be compensated for land taken on a temporary basis during the construction phase, and this land will be reinstated on completion of the works;
- The land owner will be provided with access to all severed land during the construction of the proposed scheme where this is possible;
- Land owners may have to build additional farm facilities (e.g. cattle retaining and testing pens) on their severed land;
- The contractor will liaise with land owners prior to the finalisation of the design of the proposed scheme. A key contact will be appointed by the contractor during the construction phase to facilitate communications between affected landowners and the contractor;
- Boundary fencing will be erected to delineate the site boundary and prevent disturbance to adjacent land;
- Disrupted electricity and water supplies shall be restored within 12 hours or else alternative supplies shall be provided by way of generators or water tankers. If water or power supplies are permanently severed alternative supplies will be provided;
- The contractor will employ measures to prevent the spread of dust and mud onto adjoining lands;
- If soil disturbance occurs, the contractor shall ensure that all top soil is reinstated to facilitate successful crop establishment;
- The drainage design of the proposed scheme will intersect any existing field drains and carry the drainage water to a suitable outfall.

2.14.3 Mitigation Measures and Residual Operational Impacts

Approximately 51 hectares of agricultural land will be required for the operation of the proposed scheme (an 18% permanent reduction in the amount of farmland in the study area). The impact is considered to be of high significance. During the operational phase 29% of the land will be severed (83ha) in five farms. The impact on agriculture due to severance caused by the operation of the proposed scheme is considered to be of high significance.

Noise and light sources in the study area during operation include the road traffic, LMVs and the stops. The residual impact from this disturbance is considered to be not significant.

The main mitigation measures are:

- Minimise the permanent land-take requirements so that only lands required for the proposed scheme are taken;
- Land owners will be paid for the land taken, which will allow them to replace the lost land if they wish to do so;

- All severed land parcels will be accessible either via the local road network or via accommodation access roads or bridge provided as part of the overall scheme;
- Land owners may have to build additional farm facilities (e.g. cattle retaining and testing pens) on their severed land;
- The contractor will liaise with land owners prior to the finalisation of the design of the proposed scheme. A key contact will be appointed by the contractor during the operational phase to facilitate communications between affected landowners and the contractor;
- The drainage design of the proposed scheme will intersect any existing field drains and carry the drainage water to a suitable outfall.

2.15 MATERIAL ASSETS: ARCHAEOLOGY, ARCHITECTURAL HERITAGE AND CULTURAL HERITAGE

2.15.1 Baseline

The baseline assessment included a desktop study, a field survey; and the allocation of Heritage Constraint numbers (HC#) to all sites of archaeological, architectural and cultural heritage significance. Once the baseline was completed an impact assessment was made on the identified constraints.

2.15.2 Mitigation Measures and Residual Construction Impacts

The principal source of construction impacts is ground disturbance. The major construction impacts are as follows.

Construction of the permanent way and depot will impact on a number of recorded monuments at Belinstown, the removal of part of the protected structure and recorded monument of Lissenhall Bridge and Balheary Bridge as well as the curtilage of a protected structure Lissen Hall and the removal of the a number of townland boundaries. At Fosterstown the works will result in the removal of a number of townland boundaries and number of sites of archaeological potential.

The construction of the Northwood Stop and the alignment will result in the removal of the curtilage of a number of structures of architectural merit, as well as a number of townland boundaries and a number of sites of archaeological potential.

Construction of the stops at DCU, Drumcondra and Mater will result in the removal of a number of buildings of architectural merit. The area at Mater is a site of archaeological potential. Any surviving archaeology will be removed.

The basements of a number of protected structures at Parnell Square East, O'Connell Street, Westmoreland Street and Fleet Street will be removed to permit the construction of the stops. At Parnell Square the area comprises a site of archaeological potential. Any surviving archaeology will be removed.

Construction of the temporary Bailey bridge from Eden Quay to Burgh Quay will result in the temporary removal of part of the quay wall (a recorded monument) on both sides of the river. In addition the O'Connell Monument and the William Smith O'Brien monument, which are both National Monuments, will be temporarily removed. The Thomas Moore statue will also be removed. The area is a site of archaeological potential. Any surviving archaeology will be removed.

Construction of the stop box at St. Stephen's Green will involve the temporary removal of Fusilier's Arch, statues of Lord Ardilaun and Robert Emmet, the O'Donovan Rossa memorial, the African Rose bowl, foot rails, perimeter railings, perimeter granite footpath, granite bollards and metal bollards, and Victorian landscaping including the Pulham rock. St. Stephen's Green is a National Monument.

The following mitigation measures are proposed:

- Where there is an impact in the zone of archaeological potential for Dublin, an Archaeological Assessment (involving test excavation) after site clearance will take place. Should any deposits be shown to be present agreement on further mitigation will be sought from the Department of Environment, Heritage & Local Government (DoEHLG) and the National Museum of Ireland.
- Where there is an impact in Conservation Areas & Architectural Conservation Areas, sensitive design of above ground structures both temporary and permanent in order to lessen the impact on the conservation area. In addition all street furniture will be restored and paving re-laid with the original material.
- Where there is an impact on National Monuments, all mitigation measures will be agreed with the Department of Environment, Heritage & Local Government, the National Museum of Ireland, Dublin City Council and the Office of Public Works (OPW) prior to any works taking place. Detailed requirements and mitigation measures in relation to the St. Stephen's Green National Monument have been agreed with the OPW and DoEHLG. These requirements and mitigation measures will be further developed and detailed in consultation with DoEHLG and OPW. All preparatory works at St. Stephen's Green necessary to minimise the potential impacts on the Green will be managed by RPA as an Enabling Works package in advance of the main infrastructure contractor commencing works in the Green.

- Where there is an impact on Recorded Monuments (RMP sites), an Archaeological Assessment (involving test excavation) prior to any site works will take place. Should any deposits be shown to be present then any further mitigation measures will be agreed with the DoEHLG and the National Museum of Ireland.
- Where there is an impact on Sites of Archaeological Potential, an Archaeological Assessment (involving test excavation) prior to any site works will take place. Should any deposits be shown to be present then any further mitigation measures will be agreed with the DoEHLG and the National Museum of Ireland.
- Where there is an impact on a Protected Structure, a full measured, drawn and photographic survey of the structure will take place prior to any works on the structure. The results of this survey will be lodged with the Dublin City/Fingal Library as well as the Irish Architectural Archive.
- Where there is an impact on a Structure of Architectural Merit, a full measured, drawn and photographic survey of the structure will take place prior to any works on the structure. The results of this survey will be lodged with the Dublin City/Fingal County Library as well as the Irish Architectural Archive.
- Where there is an impact on a Townland Boundary, a full drawn section and photographic survey of the boundary will take place prior to removal. The results of this survey will be lodged with the Dublin City/Fingal County Library.

The proposed mitigation measures for archaeological impacts are developed and detailed in an Archaeology Strategy document for the proposed scheme. This document has been agreed with the DoEHLG and Dublin City Council. This strategy document is live and will continue to evolve through the detailed design and construction phase of the project.

2.15.3 Mitigation Measures and Residual Operational Impacts

Once construction has been completed the operation of the the proposed scheme will also have an impact. This will principally be a visual impact any new structures will have on their surroundings as well as a potential vibration impact through the running of the LMVs.

Potential vibration impacts are mitigated by the appropriate selection of track form in the tunnelled areas. Visual impacts are mitigated through careful architectural and landscaping design.

Some residual impacts will persist after mitigation measures have been put in place. The major residual impacts will be the visual impact above ground structures will have on the existing environment. The main visual impacts in relation to protected structures and recorded monuments will be at the Lissenhall Bridge, House at Ballymun Road, Charter School/Santry Lodge and Gate Lodge, Parnell Square, River Liffey quays, O'Connell Street and St. Stephen's Green. A number of protected structures and structures of architectural merit lie above the tunnels and there may be a residual impact in the form of vibrations from the operation of the LMVs.

2.16 MATERIAL ASSETS: NON AGRICULTURAL PROPERTY

2.16.1 Baseline

All non agricultural properties are viewed as being very important to the individual owners and occupiers and are very sensitive to acquisition, demolition and other impacts. The baseline assessment therefore comprises all non agricultural properties which are to be acquired and permanently demolished, partly acquired on a permanent basis, partly acquired on a temporary basis, or which will be subject to restricted or altered access as a result of the proposed scheme.

2.16.2 Mitigation Measures and Residual Construction Impacts

In cases where parts of properties are occupied, access to the remaining unoccupied parts will be maintained where it is possible and safe to do so. Protection such as hoarding will be used to ensure that the boundary of any construction site is maintained and damage does not occur outside of this boundary. Where damage cannot be avoided, it will be repaired. A Property Protection Scheme will be put in place prior to construction works commencing. Reinstatement of any natural boundaries will be carried out upon completion of construction phase.

Mitigation measures will be put in place to avoid potential impacts on property due to vibration, ground settlement, dust or changes in visual amenity.

Where demolition of properties is to occur, property owners will be compensated in accordance with the general compulsory purchase code. Appropriate compensation will also be payable to owners of property that is subject to temporary acquisition.

In light of the above mitigation measures and in all cases where compensation is agreed, the impact is not considered to be significant.

The following properties will be demolished as part of the proposed scheme:

- Westfield House, Ballymun Road, Dublin 9;
- 1 Albert College Lawn, Glasnevin, Dublin 9;
- Dunbeg, Saint Alphonsus Avenue, Drumcondra, Dublin 9;
- 2 Saint Alphonsus Avenue, Drumcondra, Dublin 9;
- 3 Saint Alphonsus Avenue, Drumcondra, Dublin 9;
- 4 Saint Alphonsus Avenue, Drumcondra, Dublin 9;
- 5 Saint Alphonsus Avenue, Drumcondra, Dublin 9;
- 6 Saint Alphonsus Avenue, Drumcondra, Dublin 9;
- Saint Vincent's Centre For The Deaf, Drumcondra Road Lower, Dublin 9;
- 398 North Circular Road, Dublin 7;
- 400 North Circular Road, Dublin 7;
- 24 Leo Street, Phibsborough, Dublin 7;
- 25 Leo Street, Phibsborough, Dublin 7;
- 26 Leo Street, Phibsborough, Dublin 7.

2.16.3 Mitigation Measures and Residual Operational Impacts

No mitigation measures are required with respect to the operational phase of the proposed scheme.

2.17 MATERIAL ASSETS: UTILITIES

2.17.1 Baseline

All utilities along the alignment that are operated by public and private utility companies and authorities are assessed. Substantial consultation has taken place with all relevant utility companies and authorities to ensure that all services that are needed to provide continuity of service are known.

2.17.2 Mitigation Measures and Residual Construction Impacts

Utilities infrastructure ensures reliable provision of power (electricity/gas), water and other amenity services in accordance with service level agreements. RPA recognises the importance of ensuring that disruption to any utility service is minimised and, where necessary, alternative measures will be taken to ensure continuity of the service whilst diverted.

A schedule of proposed utility diversions has been prepared which identifies infrastructure requiring diversion and includes information on the type and size of each utility. This schedule also identifies the necessary mitigation measures required by the utility company and the contractor to facilitate the implementation of works.

All utilities that cross the track or the proposed scheme infrastructure will be protected or lowered, relocated or diverted as necessary and spare capacity may be provided for future maintenance or expansion.

All works will be carried out in ongoing consultation with the relevant statutory undertakers and local authority representatives and will be in compliance with their requirements (including health and safety) and relevant codes of practice. Agreement will be reached prior to any works taking place and relevant design documentations prepared.

2.17.3 Mitigation Measures and Residual Operational Impacts

No mitigation measures are required with respect to the operational phase of the proposed scheme.

2.18 INTERRELATIONSHIPS, INTERACTIONS AND CUMULATIVE IMPACTS.

2.18.1 Introduction

Section 39(2)(b) of the Railway (Infrastructure) Act, 2001 specifies that an environmental impact statement must contain a description of the inter-relationship between the likely significant impacts on the aspects of the environment listed in Section 39.

The purpose of this section is to illustrate the key inter-relationships that exist between the various affected environmental topics. Cumulative impacts due to the proposed scheme are considered. Cumulative or combined impacts due to the combination of the proposed scheme and other projects in the same area are also examined. This includes cumulative impacts (impacts which accumulate over space or time to generate a larger overall impact), cross-media impacts and other impact interactions.

European guidelines state why this is an important process:

'An impact which directly affects one environmental medium may also have an indirect impact on other media (sometimes referred to as cross media impacts). This indirect effect can sometimes be more significant than the direct effect' (E.C. 1999).

For example, in some cases, changes in noise or vibration levels may have a profound effect on human beings. Whilst the additional noise may not constitute a significant increase when using simple assessment methods, vulnerable groups of individuals may be indirectly affected.

Visual intrusion may also have an indirect impact on the amenity value of sites of historical interest. Again, in the absence of the analysis of indirect impacts, visual intrusion may not be considered as significant. However, the indirect impacts may be considered as being substantial.' (E.C. 1999).

2.18.2 Methodology

Impact interactions and inter-relationships have been considered throughout the EIA process and in the preparation of the individual impact assessments so that the EIA can take into account the broader picture of how the proposed development may affect the various environmental media.

All environmental topics are interlinked to a degree such that interrelationships exist on numerous levels. A summary matrix has been developed to identify key interactions that exist with respect to this specific project. As such, does not represent a form of relative assessment of impacts and other interactions are recognised to exist and have been addressed in individual chapters of the EIS. The matrix is presented as Figure 1.1.

The consideration of impact interactions and potential cumulative impacts has been addressed during the preparation of the EIA in each of the individual impact chapters. A very diverse range of interactions has been considered as part of this EIA including, but not limited to, the examples described in Table 1.2.

Table 1.2 Key Impact interactions and interrelationships

Interaction	Description
Human Health, Air and Climatic Factors and Traffic	Impacts on air quality may occur due to emissions of dust from construction compounds. Impacts on air quality may also occur due to changes in traffic levels and thus exhaust emissions. In some cases, particularly during the construction phase, both impacts occur at the same location. The potential for interactions was therefore considered, particularly when defining the relevant mitigation measures and carrying out the assessment of potential impacts on human health. The potential for traffic emissions to have an indirect impact on climate (in terms of climate change) has also been considered.
Human Health, Noise and Traffic	Noise impacts may occur due to construction or operation activities. Noise impacts may also occur due to changes in traffic levels. In some cases, particularly during the construction phase, both impacts occur at the same location. The potential for interactions was therefore considered, particularly when defining the relevant mitigation measures and carrying out the assessment of potential impacts on human health.
Vibration and Archaeology, Architectural Heritage and Cultural Heritage	The potential for vibration impacts on features of architectural, archaeological or cultural importance has been considered and appropriate measures have been defined.
Groundwater, Soil and Geology and Surface Water	There are direct and physical links between surface water, groundwater, soils and geology. The impacts of the scheme are therefore considered in the chapters that support all three environmental topics in recognition of the fact that impacts to one component of this complex system may have knock-on, indirect effects on other components.
Landscape and Visual and Flora and Fauna	Mitigation measures for landscape impacts and ecological impacts were considered when defining the Landscape Insertion Plans (Volume 2, Chapter 13) in order to ensure that interactions between impacts were considered in an appropriate manner. In many cases, the mitigation measures that have been defined serve the dual purpose of mitigating both landscape and ecological impacts.
Landuse and Socio-economics	Impacts on commercial landuses can often have a knock-on effect in terms of socio-economics. Interactions between the two environmental topics were therefore considered to ensure that both direct and indirect impacts were considered and appropriate mitigation measures put in place.
Traffic and Socio-economics	Traffic impacts and mitigation measures have the potential to impact on socio-economic activity. The potential for indirect impacts of this nature has been considered when defining appropriate mitigation measures.

Interaction	Description
Landuse, Landscape and Visual and Archaeology, Architectural Heritage and Cultural Heritage	Cultural heritage comprises elements of the landscape which are important to individuals. Landscape elements which are important to individuals may include man-made buildings, traditional landuse, natural environmental features or features of archaeological or architectural importance. Impacts on all of these aspects of cultural heritage are considered in the relevant chapters of this EIS.
Water, Soil and Geology and Flora and Fauna	Direct physical links exist between these topics and potential impacts on surface water or soils were therefore also considered in the flora and fauna chapters.
Landuse, Non Agricultural Property and Agronomy	Land-take can have an impact on landuse, property and agricultural lands. Changes in landuse affecting Agronomy and Non Agricultural Property have been assessed as part of the EIA and are described in Volume 2, Chapters 14 and 16 respectively.
Soil and Geology and Human Health	The key issue here is radon emissions. The potential for radon emissions from disturbed/excavated soil and geology to have an impact on human health has been considered and appropriate mitigation measures have been established.

2.18.3 Cumulative Impacts

Cumulative impacts occur when the addition of single impacts from a number of individual schemes results in compounding effects. Cumulatively, these impacts may be significant if they occur close together in terms of location and time.

The proposed scheme will inevitably cause a degree of disruption during the construction phase, as with most major transport infrastructure projects. Next to disruption the construction equipment and hoardings are likely to be very visible. Drivers and public transport users may also experience delays during temporary road diversions. The combination of these construction effects is likely to heighten any overall sense of disruption felt by those living and working close to the route of the proposed scheme.

During the construction phase of the proposed scheme, several other projects are likely to take place within the study area. A review of planning applications has been undertaken (as described in the baseline Landuse chapter of this EIS (Volume 1, Chapter 10)) to identify such developments. Examples include, but are not limited to:

- the Irish Rail Interconnector project;
- the development of Dublin Airport;
- the Luas BX Line;
- the Marlborough Bridge across the River Liffey;
- the extension of Mater hospital.

The development of such schemes has the potential to cause cumulative impacts. In some cases, the timeframe within which the other developments will occur is not yet clearly defined. However, consultation has been undertaken with proponents of these other projects to ensure that the potential for cumulative impacts is considered and appropriate mitigation measures are put in place where relevant. Considerations in this regard were undertaken in relation to the Landuse, Socio-economics, Noise, Traffic and Air and Climatic Factors of this EIS (Volume 2, Chapters 2, 3, 4, 7 and 12 respectively). The means by which cumulative impacts are assessed is clearly defined, where relevant, in all chapters of the EIS.

Given the urban location of the proposed scheme, cumulative impacts arising due to other major construction projects are inevitable. Impacts of this nature have been assessed where possible and must be considered by the planning authority in exercising their development control function for future developments in the local area.

	Human Health	Human Beings: Landuse	Human Beings: Socio-Economics	Human Beings: Noise	Human Beings: Vibration	Human Beings: Radiation and Stray Current	Human Beings: Traffic	Air and Climatic Factors	Groundwater	Surface Water	Soil and Geology	Landscape and Visual	Flora and Fauna	Material Assets: Agronomy	Material Assets: Archaeological, Architectural Heritage and Cultural Heritage	Material Assets: Utilities	Material Assets: Non-Agricultural Property
Human Health																	
Human Beings: Landuse																	
Human Beings: Socio-Economics																	
Human Beings: Noise																	
Human Beings: Vibration																	
Human Beings: Radiation and Stray Current																	
Human Beings: Traffic																	
Air and Climatic Factors																	
Groundwater																	
Surface Water																	
Soil and Geology																	
Landscape and Visual																	
Flora and Fauna																	
Material Assets: Agronomy																	
Material Assets: Archaeological, Architectural Heritage and Cultural Heritage																	
Material Assets: Utilities																	
Material Assets: Non-Agricultural Property																	

Figure 1.1 Impacts Interaction and Interrelationship Matrix

