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N11 Junction Q Scheme

Part 8 Environmental Report

VOLUME 1

December 2016

N11 Junction Q

Environmental Report – Volume 1

Dun Laoghaire Rathdown County Council

14 December 2016

Notice

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Document history

Job number: 5139036			**Document ref: 5139036DG005**			
Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev A	Environmental Report	EB	UOH	POD / UO'H	AFM	23-11-2016
Rev B	Environmental Report	EB	UOH	DC / UO'H	AFM	14-12-2016

Table of contents

Volume 1

Tables

Figures

Volume 2

Appendices

1. Introduction

Atkins was commissioned by Dún Laoghaire-Rathdown County Council to assess the potential for environmental impacts associated with the construction and operation of a new signalised junction on the N11. This environmental report accompanies the Part VIII planning application for the scheme.

The development is located in Dún Laoghaire-Rathdown in South County Dublin. The proposed junction is located on the N11, south of Cabinteely in Co. Dublin. Figure 1-1 illustrates the location of the proposed scheme.

The proposed junction lies partly within the Cherrywood Planning Scheme (CPS) for the Cherrywood Strategic Development Zone (SDZ), and the junction itself is critical to the Cherrywood Planning Scheme as it will facilitate access to the SDZ lands from the N11. The Cherrywood lands were designated as an SDZ on 25th May 2010.

The Druid's Glen Road (Q-P3), a key piece of infrastructure , identified within the SDZ, is located in Development Area 5 as per the Cherrywood Planning Scheme and is in the first growth area of the scheme (Figure 1-2). This infrastructure must have permission in place prior to any planning permission being granted in Development Area 5. The proposed new junction onto the N11 at point Q is required to facilitate the traffic generated from Development Area 5 (Phase 1) along the Druids Glen Road initially and ultimately in conjunction with the overall proposed road network identified with the SDZ, the traffic generated from all of the eight development areas within Cherrywood (Phase 2).

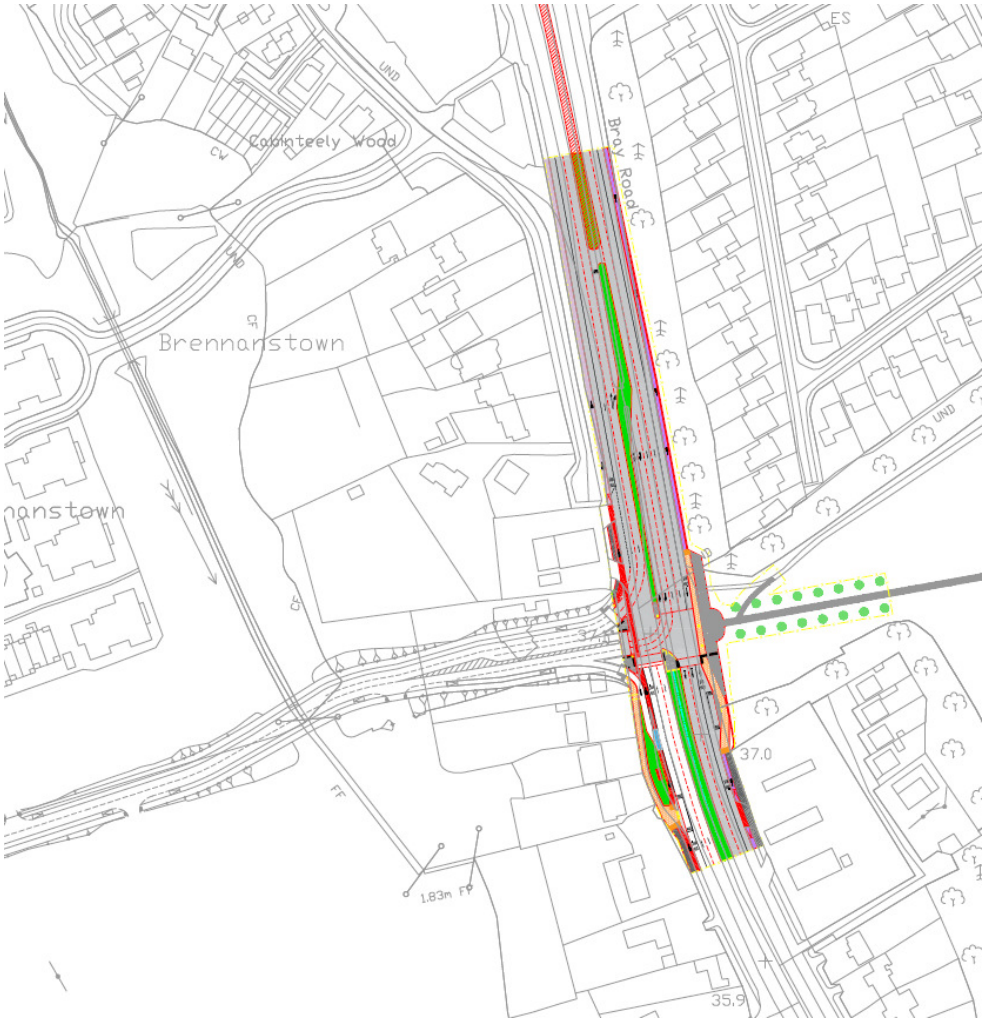

Figure 1-1 Site Location

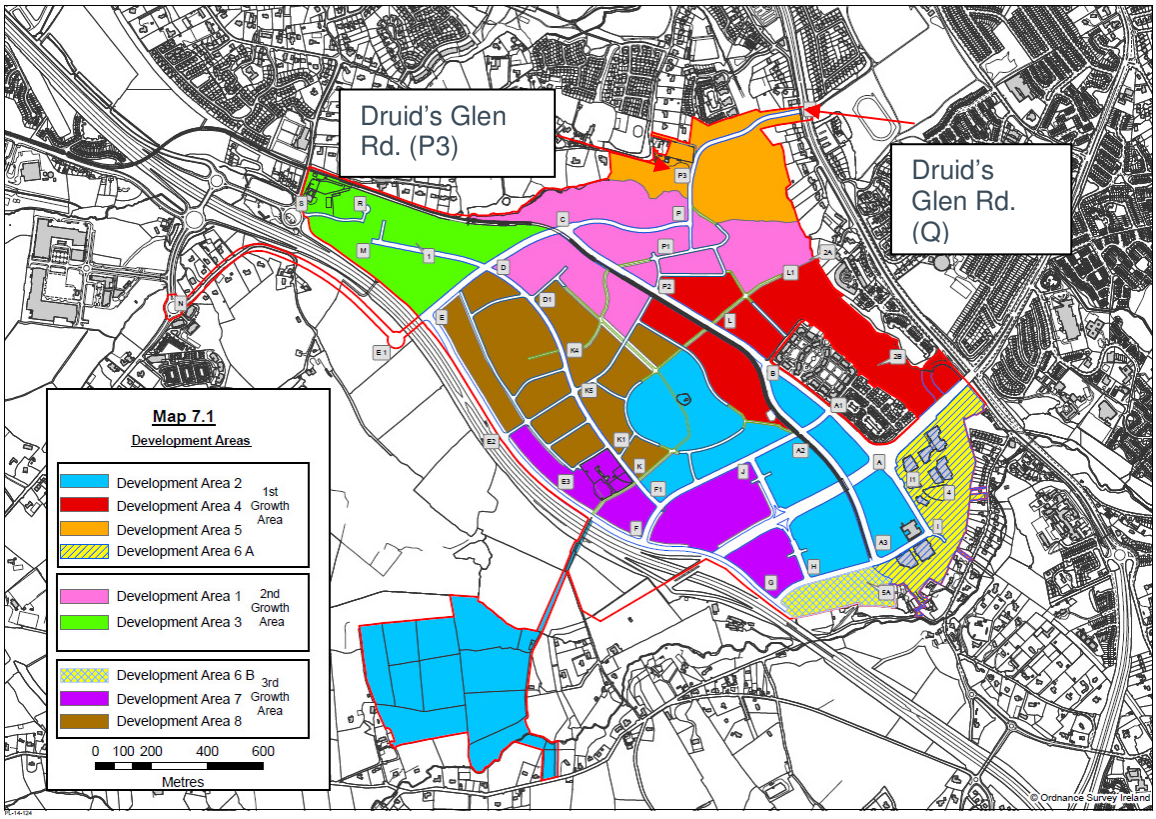

Figure 1-2 Cherrywood Development Areas (Source: Cherrywood Planning Scheme)

The Part VIII Planning application that accompanies this report relates only the proposed new signalised junction onto the N11 at point Q, upgrade works along the N11, and provision of a new entrance to Kilbogget Park. The proposed Druids Glen Road (Q-P3) will be subject to third party planning applications.

This Environmental Report assesses the baseline existing environment of the proposed junction, assesses the potential for impacts during construction and once operational, and details mitigation measures required to remove or reduce impacts on receptors.

The report is structured in a similar manner to an Environmental Impact Statement and has the following format: -

- Introduction
- Description of the Development
- Planning Context
- Socio-economics and Material Assets
- Flora and Fauna
- Landscape and Visual
- Soils, Geology and Hydrogeology
- Air Quality and Climate
- Noise and Vibration
- Archaeology
- Traffic and Transportation

This environmental report has been produced by Atkins with specialist assessments undertaken by Coakley O' Neill (Planning); Scott Cawley (Flora and Fauna and Stage 1 Screening for Appropriate Assessment); Cunnane Stratton Reynolds (Tree survey, landscape and visual assessment); Keohane Geological and Environment Consultancy (Soils, Geology and Hydrogeology); AWN (Air quality and climate; noise and vibration) and IAC (Archaeology).

Unless otherwise stated, the assessments contained within this report assess impacts based on the definitions outlined in Table 1-1.

Table 1-1 Quality of Effects

Quality of Effects	Definition
Positive	A change which improves the quality of the environment
Neutral	A change which does not affect the quality of the environment
Negative/Adverse	A change which reduces the quality of the environment

Table 1-2 Significance of Effects

Significance of Effects	Definition
Imperceptible	An effect capable of measurement but without noticeable consequences
Not significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant	An effect, which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Very significant	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Table 1-3 Magnitude of Effects

Magnitude of Effects	Definition
Extent	Describe the size of the area, the number of sites, and the proportion of a population affected by and effect
Duration	Describe the period of time over which the effect will occur
Frequency	Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Context	Describe whether the extent, duration or frequency will conform or contrast with established (baseline) conditions

Table 1-4 Probability of Effects

Probability of Effects	Definition
Likely	The effects that can reasonably be expected to occur as a result of the planned project if all mitigation measures are properly implemented
Indeterminable	When the full consequences of a change in the environment cannot be described
'Worst Case'	The effects arising from a project in the case where mitigation measures substantially fail

Table 1-5 Duration of Effects

Duration of Effects	Definition
Momentary	Effects lasting from seconds to minutes
Brief	Effects lasting less than a day
Temporary	Effects lasting less than a year
Short-term	Effects lasting one to seven years
Medium-term	Effects lasting seven to fifteen years
Long-term	Effects lasting fifteen to sixty years
Permanent	Effects lasting over sixty years

Table 1-6 Types of Effects

Types of Effect	Definition
Cumulative	The addition of many small effects to create one larger, more significant effects
Do Nothing	The environment as it would be in the future should no project of any kind be carried out
Indeterminable	When the full consequences of a change in the environment cannot be described
Irreversible	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost
Residual	The degree of environmental change that will occur after the proposed mitigation measures have taken effect
Synergistic	Where the resultant effect is of greater significance than the sum of its constituents
Indirect	Effects that arise off-site or are caused by other parties that are not under the control of the developer
Secondary	Effects that arise as a consequence of a project

2. Description of the Development

2.1. Introduction

This chapter sets out a description of the subject site in the context of its receiving environment and a description of the proposed development. The description provides details on the need for the scheme.

2.2. Site Context

The study area is located within the administrative area of Dún Laoghaire Rathdown County Council and is bounded to the east by Kilbogget Park and to the west by Cherrywood.

The proposed junction is located on the N11 between the Johnstown Road and Wyattville Road junctions as identified in Figure 2-1 below.

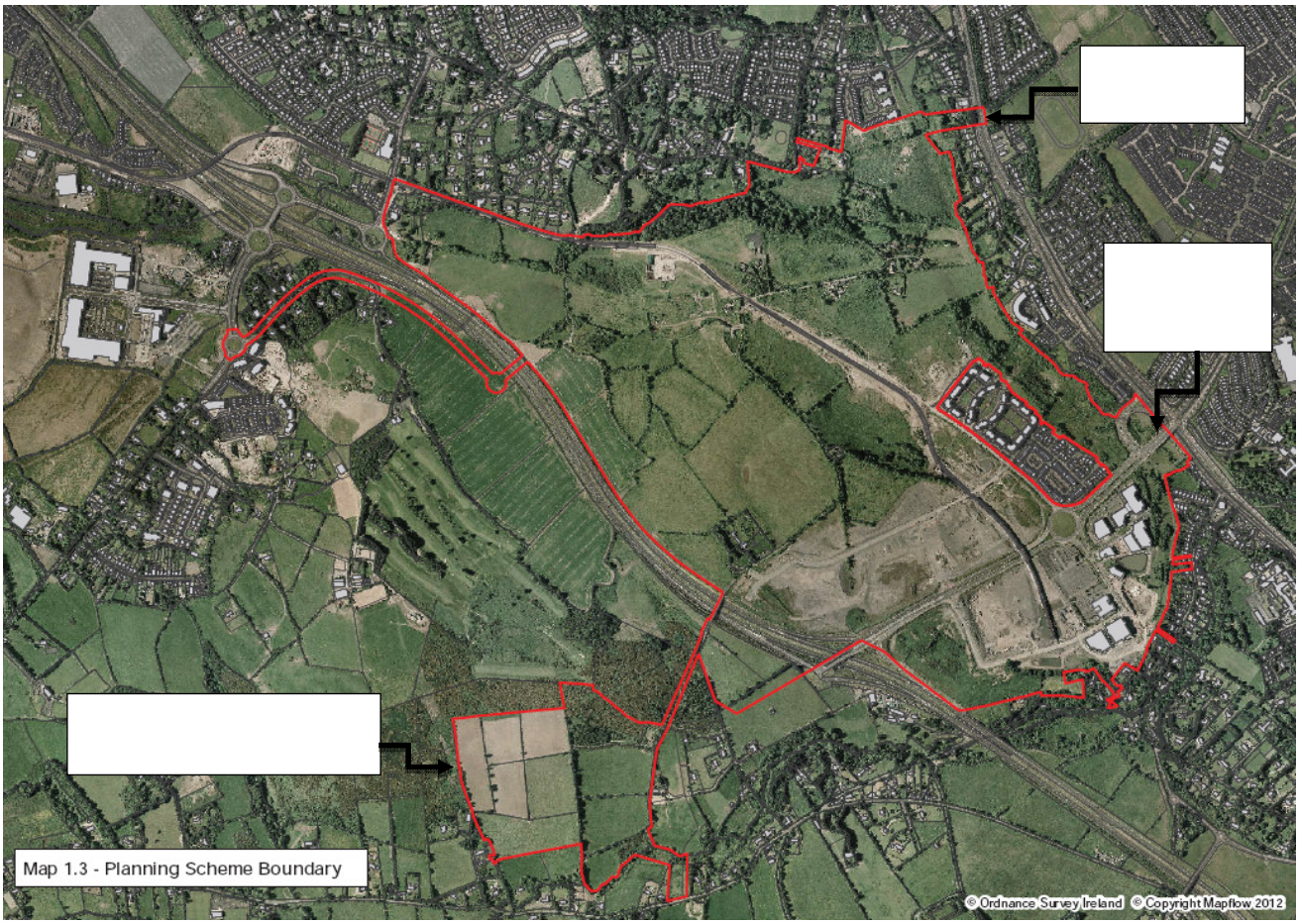

Figure 2-1 Planning Scheme Boundary

The key roads in the area are notably the N11 National Primary Route which runs North West to South East through the study area, and the M50 Motorway which lies west of the study area and also runs North West to South East.

2.3. Proposed Development

The Planning Scheme for the Cherrywood SDZ outlines a Future Road Strategy in Section 4.2.6 which identifies specific objectives (PI 14) for the implementation of road infrastructure proposed in the Planning Scheme that will facilitate access to and within the Planning Scheme Area.

The proposed junction under consideration in this report is identified as point Q in Figure 2-2 following.

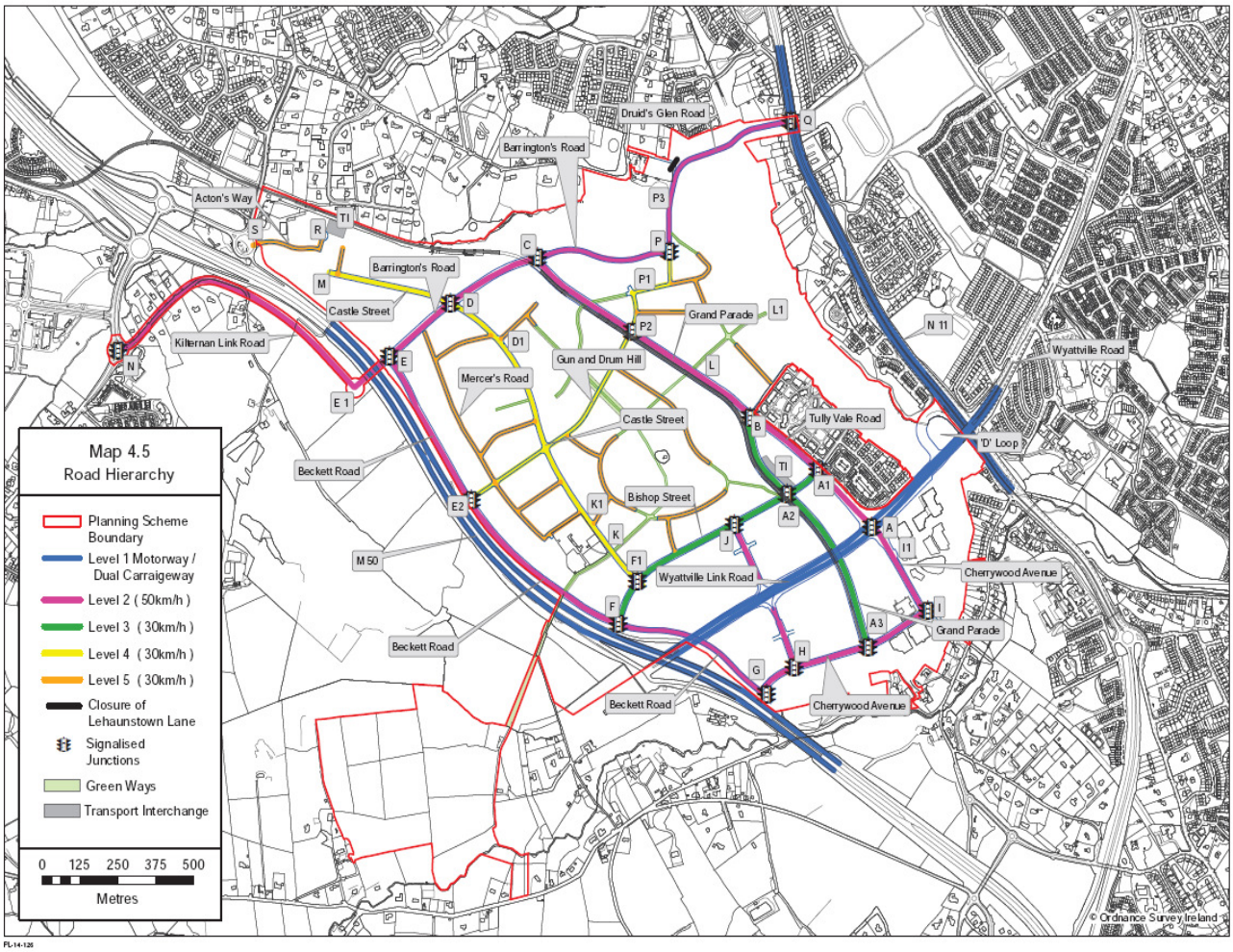

Figure 2-2 Planning Scheme Map 4.5 Road Hierarchy.

Within Map 4.5, the proposed junction is referenced as point Q. The proposed junction onto the N11 is required to facilitate the traffic generated from SDZ Development Area 5 (Phase 1) initially and ultimately in conjunction with the overall proposed road network identified within the Planning Scheme; the traffic generated from all of the eight development areas within the Planning Scheme (Phase 2). The proposed junction and infrastructure for which permission is sought is identified in drawing 5139036/HW/0104.

The length of the proposed works at point Q along the existing N11 is in the order of 350m. The proposed junction will provide for the connection of a five lane carriageway to facilitate the predicated traffic volumes and movements onto the existing N11 from the Druids Glen Road.

The proposed junction onto the existing N11 will comprise a three arm signalised at grade junction with provisions for pedestrian and cyclist movements across each arm. The proposed junction will comprise a double southbound right turning lane, a double left turn lane from the Druids Glen Road, a right turn lane from the Druids Glen Road onto the N11, a northbound left turning lane from the N11 onto the Druids Glen Road, two lanes for traffic flowing onto the Druids Glen Road from the N11 and left in/left out slip lanes on the Druids Glen Road. The preliminary design of the proposed N11 junction is based on a design speed of 85kph.

The proposed junction onto the existing N11 will also facilitate a new entrance into Kilbogget Park and the construction of a new boundary wall to the east of the N11.

2.3.1. Engineering Design

2.3.1.1. Principal Design Considerations

The preliminary design of the proposed junction onto the N11 has been undertaken in accordance with the following design standards: -

- Design Manual for Urban Roads and Streets (DMURS)
- National Cycle Manual – National Transport Authority 2011
- Traffic Management Guidelines – Department of Transport 2003
- Design Manual for Roads and Bridges - Transport Infrastructure Ireland
- Cherrywood Strategic Development Zone Planning Scheme 2012

The proposed design has been developed in close consultation with the relevant authorities including Dún Laoghaire-Rathdown County Council, Cherrywood Development Agency, Transport Infrastructure Ireland and the National Transport Authority.

Consultation with utility service providers is ongoing and will be maintained throughout the planning stage and subsequent detail design and construction phases of the scheme.

All other relevant third parties have been consulted with during the design process.

2.3.1.2. Engineering Planning Drawings

The planning package of engineering drawings submitted as part of this planning application is outlined below in Table 2-1.

Table 2-1 Planning Package of engineering drawings submitted as part of planning.

Drawing Number	Drawing Title
5139036/HW/0000	Cover Sheet
5139036/HW/0001	Site location Map
5139036/HW/0102	Proposed Site
5139036/HW/0104	Proposed Road Plan Layout
5139036/HW/0106A	Typical Road Cross Sections
5139036/HW/0526	Public Lighting Design
5139036/HW/0552	Existing Utilities

2.3.1.3. Proposed Road Cross Section of N11 Junction Q

On the approach to the proposed junction, the road cross section of Druids Glen Road widens to facilitate the predicated traffic volumes and movements onto the existing N11. Typical road cross sections for the N11 on approach to the proposed junction are indicated below in Figure 2-3 and Figure 2-4.

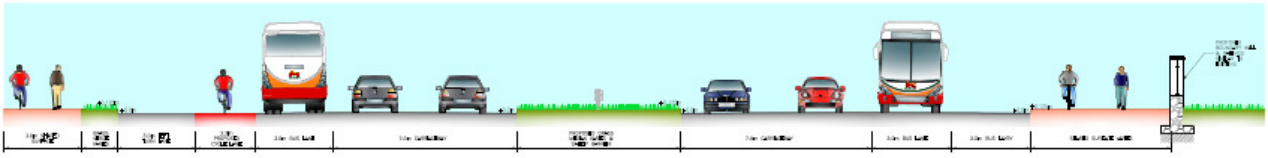

Figure 2-3 Proposed N11 Road Cross Section South of Junction Q

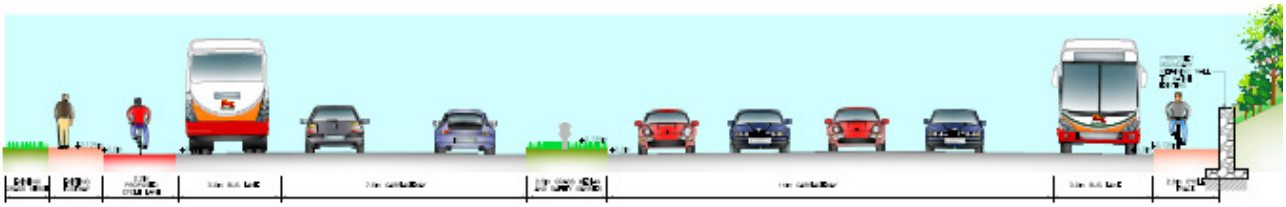

Figure 2-4 Proposed N11 Road Cross Section North of Junction Q

2.3.1.4. Design Speed

The design of the proposed N11 Junction Q is based on a design speed of 85kph.

2.3.1.5. Horizontal and Vertical Alignment

The horizontal and vertical geometry of the proposed junction will match the existing ground level. The junction visibility splays have been kept clear of obstructions such as public lighting poles and trees to ensure that the visibility envelope for all roads users is not impacted upon.

2.3.1.6. Junction Design

The proposed junction will comprise a three arm signalised at grade junction with provisions for pedestrian and cyclist movements. The proposed junction will comprise the following: -

- a double southbound right turning lane into the Druids Glen Road;
- provision for a double left turn lane from the Druids Glen Road onto the N11;
- provision for a single right turn lane from the Druids Glen Road onto the N11;
- a northbound left turn lane from the N11 onto the Druids Glen Road;
- provision for two lanes of traffic flowing into the Druids Glen Road from the N11 both north and south bound.

The proposed pedestrian crossings are 4m wide controlled Toucan crossings which will allow both pedestrians and cyclists to cross together. These crossing points have been provided on two of the three arms of the proposed N11 Junction Q. The crossings are staggered with refuge islands of sufficient width to ensure the safe movement of pedestrians and cyclists across the junction.

Northbound cyclists are catered for on the N11 through the introduction of a 2.25m on road cycle path through the junction. Southbound cyclist facilities are provided by means of a 2m minimum cycle track on the eastern side of the N11. All east and west cyclist movements across the proposed junction will be required to use the signalised Toucan crossings.

Bus priority is maintained both northbound and southbound by means of the continuation of the existing bus lane facilities through the junction. The existing bus layby and shelter south west of the proposed junction will be relocated further south where an Island Bus Stop arrangement is proposed in accordance with the requirements of the National Cycle Manual. The existing bus stop south east of the proposed junction will be removed and a new Kneeling Bus Stop arrangement is proposed in accordance with the requirements of the National Cycle Manual. Facilities for both pedestrians and cyclists movements in the vicinity of the proposed bus stop locations have been provided by means of shared surfaces behind the proposed bus shelters.

All vehicle lanes on the approach to the proposed N11 junction from the Druids Glen Road and N11 northbound and southbound are a minimum width of 3m. The proposed junction general arrangement has been based upon the traffic modelling analysis which is covered in Chapter 11 of this report.

2.3.1.7. Public Transport Infrastructure

The proposed junction maintains bus priority measures both northbound and southbound through the junction. Bus stop facilities are being provided as mentioned above.

2.3.1.8. Environmental Infrastructure

An existing 24inch watermain is situated on the N11 at the location of the proposed junction. A connection will be facilitated into the existing watermain on the N11 for future watermain proposals from the Cherrywood SDZ.

At the detailed design stage of the proposed junction, and unless otherwise agreed with Municipal Services, provision shall be made for off line SuDS measures, to include attenuation storage, in the adjoining Kilbogget Park. The design and configuration of such SuDS measures shall be subject to the agreement of Municipal Services.

2.3.1.9. Utilities and Telecoms

In terms of utilities and telecoms provision has been made within the proposed junction extents for the following;

- 4 number ESB Ducts 125mm diameter, located both sides of the proposed junction;
- 6 number telecom ducts 100mm diameter, located both sides of the proposed junction.

2.3.1.10. Public Lighting

The proposed public lighting design is identified in drawing 5139036/HW/0526. The lighting design has been carried out in accordance with the following standards;

- EN 13201:2014 – Road Lighting;
- Specification for Works - Transport Infrastructure Ireland (TII);
- Road Lighting Details specified by Dún Laoghaire-Rathdown County Council.

The proposed junction onto the N11 has been designed to lighting class C2.

2.3.1.11. Signage and Road Markings

All signage and road markings will be designed in accordance with the following standards;

- Traffic Signs Manual – 2010 Department of Transport
- Specification for Works - Transport Infrastructure Ireland (TII)
- Design Manual for Urban Roads and Streets (DMURS)
- National Cycle Manual – National Transport Authority 2011
- Traffic Management Guidelines – Department of Transport 2003
- Design Manual for Roads and Bridges - Transport Infrastructure Ireland

3. Planning Context

3.1. Introduction and Site Context

This section of the Environmental Report will consider the proposed Part VIII development of a new junction on the N11 - in the context of national, regional and local planning policy. It will also consider the implications of the recent planning history in the vicinity of the proposed development.

The study area is located within the administrative area of Dun Laoghaire Rathdown County Council and is located on the existing N11 National Road between the Johnstown Road and Wyattville Road junctions.

The subject lands are located in south Co. Dublin c. 5 km north of the county boundary with Co. Wicklow, and c. 16 km south east of Dublin city centre. Loughlinstown is located to the south east, Rathmichael to the south west, Cabinteely to the north and Carrickmines to the north-west.

Plate 3-1 Proposed location of junction with N11.

Plate 3-2 To the south of the proposed junction with the N11.

Plate 3-3 To the north of the proposed junction with the N11.

Plate 3-4 Kilbogget Park to the east of the N11.

3.2. Proposed Development

This report considers the proposed junction onto the N11 at Cabinteely. The layout of the proposed junction is illustrated in Figure 3-1.

The length of the proposed works at point Q along the existing N11 is in the order of 350m. The proposed junction will provide for the connection of a five lane carriageway to facilitate the predicated traffic volumes and movements onto the existing N11 from the Druids Glen Road.

Figure 3-1 Proposed Road Layout

The proposed junction onto the existing N11 will comprise a three arm signalised at grade junction with provisions for pedestrian and cyclist movements across each arm. The proposed junction will comprise a double southbound right turning lane, a double left turn lane from the Druids Glen Road, a right turn lane from the Druids Glen Road onto the N11, a northbound left turning lane from the N11 onto the Druids Glen Road, two lanes for traffic flowing onto the Druids Glen Road from the N11 and left in/left out slip lanes on the Druids Glen Road. The preliminary design of the proposed N11 junction is based on a design speed of 85kph.

The proposed junction onto the existing N11 will also facilitate a new entrance into Kilbogget Park and the construction of a new boundary wall to the east of the N11.

In order to facilitate the full extent of the works to the N11 and the entrance to Kilbogget Park, the boundary for the purposes of the application lies slightly within the boundary of the adopted Cherrywood Planning Scheme.

The proposed junction onto the N11 will incorporate underground services infrastructure within the proposed road cross section.

3.3. Planning Policy Context

3.3.1. The National Spatial Strategy

The National Spatial Strategy (NSS) (2001 – 2020) is a twenty year planning framework designed to achieve a better balance of social, economic, physical development and population growth between regions. The strategic spatial structure provided for in the NSS will facilitate a managed and planned response to future housing demand.

Two of the key concepts of the NSS are identified as:

- Critical mass – related to the size and concentration of population that enables a range of services and facilities to be supported. This in turn can attract and support higher levels of economic activity and improved quality of life.
- Gateways, which have a strong strategic location nationally and relative to their surrounding areas and provide national scale social and economic infrastructure and support services. Dublin is identified as one such gateway.

The proposed development is consistent with the provisions of the NSS in that it will assist in opening up strategic lands for the implementation of the Planning Scheme associated with the SDZ, which will lead to a critical mass of population for the area in line with adopted planning policy for the area The NSS planned to create a strong and internationally competitive Greater Dublin Area (GDA) driving both its own economy and national Development.

The National Spatial Strategy will be replaced by the National Planning Framework towards the end of 2016.

3.3.2. Regional Planning Guidelines for the Greater Dublin Area 2010 - 2022

The Regional Planning Guidelines (RPGs) is a policy document that aims to direct the future growth of the Greater Dublin Area over the medium to long term and works to implement the strategic planning framework set out in the National Spatial Strategy (NSS) published in 2002. The RPGs set out the population targets for each council. Table 3-1 below identifies the population target for the Dún Laoghaire-Rathdown County Council area. The proposed development will assist in unlocking the development potential of the Cherrywood SDZ area to deliver a critical mass of population in line with the RPGs.

Table 3-1 Population targets for Local Authorities

Council	Census	2016	2022
Dublin City	506,211	563,512	606,110
Dún Laoghaire-Rathdown	194038	222800	240338
Fingal	239992	287547	309285
South Dublin	246935	287341	308467
Kildare	186335	234422	252640
Meath	162831	195898	210260
Wicklow	126194	164280	176800
GDA Total	**1662536**	**1955800**	**2103900**

To balance the population growth within council areas to comply with the NSS and RPG Settlement Strategy for Gateways and Hubs, the RPGs set out a housing and population allocation figure in Table 7 for the GDA for the metropolitan area, which shall be accommodated by each Local Authority within their portion of the Metropolitan area. This figure should be regarded as a minimum requirement by councils and where possible should be exceeded. Table 3-2 below identifies the population and housing target for the Dún Laoghaire-Rathdown County Council area. The proposed development will assist in unlocking the development potential of the Cherrywood SDZ area to deliver a critical mass of population in line with the RPGs.

Table 3-2 RPG Housing and Population Distribution Table for Target Year 2016

Total Metropolitan Population	Population to be accommodated by each region	Metropolitan population allocated to each council (existing and proposed)	Housing Increase Proportion of total allocated to be directed to the Metropolitan area.
GDA: Minimum of 1373900 **Provided for: 1424844**	Dublin: 1287914	Dublin City: 563512	42421 (100%)
		Dún Laoghaire-Rathdown: 206322	19284 (94%)
		Fingal: 236157	24426 (85%)
		South Dublin: 281923	27610 (99%)
	Mid-East:	Kildare: 67012	8718 (35%)
		Meath: 13738	2032 (11)
		Wicklow: 5213	8090 (42)

The Settlement Hierarchy and Typology set out in Section 4.5 of the RPGs forms a critical part of the Settlement Strategy for the GDA. The Hierarchy for the RPGs is shown in Table 8. The table is sub-divided to reflect the different approaches needed within either the Metropolitan or Hinterland. The future growth of towns in the hierarchy is dependent on the provision of and investment in adequate infrastructure. Councils must have due regard to the settlement hierarchy, and distribution of population should be directed towards the upper 4 tiers in the hierarchy.

It is noted that Cherrywood is identified within Tier 4 – Large Growth Towns II, an active growth town in the Dun Laoghaire Rathdown County Council area. See Table 3-3 below.

Table 3-3 Settlement Typology and Hierachy

Hierarchy	Description	Location
Gateway Core	International business core and high density population, retail & cultural activities	Dublin City centre and immediate suburbs
Metropolitan Consolidation Towns	Strong active urban places within metropolitan area with strong transport links	Swords, Blanchardstown, Lucan75, Clondalkin76, Tallaght, Dundrum, Dún Laoghaire, Bray.
Large Growth Towns I	Key destinations, economically active towns supporting surrounding areas, located on	Navan, Naas, Wicklow, Drogheda.

	Multi Modal Corridor in metropolitan hinterland.	
Large Growth Towns II	Smaller in scale but strong active growth towns, economically vibrant with high quality transport links to larger towns/city	Newbridge, Greystones, Cherrywood, Arklow, Balbriggan, Dunboyne, Maynooth, Leixlip.79
Moderate Sustainable Growth Towns	(i) In Metropolitan area, strong edge of metropolitan area district service centres, high quality linkages and increased densities at nodes on public transport corridors (ii) In Hinterland areas,10k from large town on public transport corridor, serve rural hinterland as market town	Donabate, Celbridge, Lusk, Rush, Ashbourne, Kells, Trim, Dunshaughlin,80 Kildare, Monasterevin, Kilcullen, Kilcock, Athy, Newtownmountkennedy, Blessington.
Small Towns	Good bus or rail links; 10km from large growth towns	To be defined by the Development Plans
Villages		To be defined by the Development Plans

Section 3.7.4 of the RPGs identify primary economic growth towns in the GDA which are the “main centres of economic activity outside the city”. These areas are prioritised for regional population growth and are described as serve a pivotal role in serving their urban areas and wider suburban and rural hinterlands in terms of employment and provision of goods and services.

It is noted that Cherrywood/Bray/Greystones is identified as one such core economic area, with significant locational strengths including the developing Luas connections, proximity to strategic national road corridors such as the N11 and the M50, and location within the Metropolitan area of the gateway region.

The policy promoting the Strategic transport investment infrastructure for the GDA includes support for the proposed Luas extension from Cherrywood to Bray.

The proposed development is consistent with the provisions of the RPGs in that it will facilitate the future development of an active growth town in the Dun Laoghaire Rathdown County Council area.

3.3.3. Dún Laoghaire-Rathdown County Development Plan 2016 – 2022

The Dún Laoghaire-Rathdown County Development Plan (CDP) was adopted in March 2016. It is the county’s principal strategic planning document and its purpose is to protect and nurture the future growth of Dún Laoghaire-Rathdown. The CDP sets out a core vision of three goals to be achieved by 2022:

- To deliver Ireland’s best quality of residential life by 2022 with particular reference to achieving environmental excellence in planning and development decisions.
- To co-ordinate and facilitate economic actors towards achieving full employment in sustainable, meaningful jobs by 2022.

- To support and sustain economic and natural resources of Regional significance to 2022 and beyond.

The Cherrywood Strategic Development Zone is guided by the policies contained in the National Spatial Strategy, the Regional Planning Guidelines and the Dún Laoghaire-Rathdown CDP. The phased development of Cherrywood will be strictly guided by the overarching policies and guidelines set out in the Planning Scheme.

The central focus of the core strategy of the Dún Laoghaire-Rathdown CDP is on residential development and that there is an acceptable equilibrium between the supply of zoned, serviced land for residential development and the projected demand for new housing, over the lifetime of the Plan.

One of the primary implications of the RPGS for Dún Laoghaire-Rathdown, as set out in the CDP settlement hierarchy (section 1.2.2) is Dún Laoghaire-Rathdown falls almost exclusively within the Dublin Metropolitan Area where the primary objective is one of consolidation of the existing urban area.

In this regard, the strategic aim for Cherrywood is set out in the Settlement Strategy of the CDP:

> *Cherrywood, as a designated Large Growth Town within the Metropolitan Area, will accommodate significant new investment in transport, in economic and commercial activity and in housing. As a designated Strategic Development Zone it will help contribute to the overall competitiveness of the GDA and so assist the overall objective of promoting the GDA as an International 'Gateway' as set out in the National Spatial Strategy.*

Section 1.1.3.3 of the CDP states:

> *The Cherrywood area represents the most significant and strategic development node in Dún Laoghaire-Rathdown – extending as it does to c.360 hectares in total. The projected resident population could ultimately be in the order of 18-19,000. The Council proposes to guide the development and implementation of the overall Cherrywood area through the mechanism of the SDZ Planning Scheme recently approved by An Bord Pleanála. The implementation of the Planning Scheme will be subject to very strict phasing protocols directly linked to the commensurate delivery of both physical and community infrastructure – including the high quality Luas public transport system that is already operational in the Cherrywood area.*

Policy RES3 promotes sustainable communities with high residential densities where appropriate:

> *It is Council policy to promote higher residential densities provided that proposals ensure a balance between the reasonable protection of existing residential amenities and the established character of areas, with the need to provide for sustainable residential development.*

Table 3-4 identifies Table 1.2.2 from Section 1, Dún Laoghaire Rathdown County Development Plan 2016 the potential housing yield for Cherrywood. Critically, water, drainage and infrastructure services will be required to unlock this potential. The proposed development is one vital piece of infrastructure to assist in delivering up to 7,700 houses in the area.

Table 3-4 Section 1, Dún Laoghaire Rathdown County Development Plan 2016 (Table 1.2.2 Housing Land Availability Table)

Housing Land Availability Table			
Location	**Hectares (Approx.)**	**Potential Residential Yield (Approx.)**	**Services Required**
Serviced Land			
Includes Sandyford, Stepaside, Kiltiernan and all other suburban	410	18000	

infill			
Part Serviced Lands			
Cherrywood	70	7700	Water, Drainage and Infrastructure.
Unserviced Land			
Woodbrook/Shanganagh	25	2300	Water and Drainage Public Transport Roads Infrastructure
Old Conna	50	2000	
Rathmichael Lands	85	3600	
Total	160	7900	
Total*	**640**	**33600**	
***Total includes serviced, part serviced and unserviced lands in DLR.**			

Residential densities are defined in the Cherrywood Planning Scheme.

Section 3 of the CDP deals with the Enterprise and Employment Strategy for the county. The extent of employment-zoned land in Dún Laoghaire-Rathdown is described as "relatively low, compared with other Dublin Authorities" – 300ha within Dún Laoghaire-Rathdown compared to 2700ha of land in Fingal and 1600 in South Dublin. Approximately only 60ha of greenfield, undeveloped employment lands are located within the county. At the time of adoption of the CDP, the main area of undeveloped employment zoned lands in the county was in Cherrywood, with approximately 40ha Zoned Objective E.

Policy E1: *It is Council policy to ensure that sufficient serviced lands continue to be available for employment generation.*

The policies governing the Retail strategy, retail hierarchy and District Centres for DLR are interlinked. Policy RET2 relates to the *Retail Strategy for the Greater Dublin Area 2008 – 2016*.

The Strategy sets out the following retail hierarchy for the GDA Metropolitan and Hinterland Areas. Cherrywood is Level 3, a town and district centre. The Retail Strategy makes specific policy recommendations for Cherrywood (3.2.2.2 CDP);

> *To facilitate and promote the development of Cherrywood Town Centre on a phased basis as a large scale urban district centre located within a high density environment subject to the provision of light rail links, a sufficient resident population exceeding 10,000 and the preparation of an approved urban design master plan.*

At the heart of the Retail Strategy and the RPGs is a hierarchy of retail locations that form the basis for determining the quantum and location of new retail development. The proposed retail hierarchy and overarching strategy for each of the core retailing areas in Dún Laoghaire-Rathdown is set out in Table 3.2.1 of the CDP. Extracts from Table 3.2.1 which relate specifically to Cherrywood are identified in Table 3-5 below.

Table 3-5 Section 3, Dún Laoghaire-Rathdown County Development Plan 2016 (extracts from Table 3.2.1 CDP)

Dún Laoghaire-Rathdown Retail Hierarchy		
Description	Location	Overall Strategy

District Centre	Cherrywood	Promote a fully mixed-use sustainable town centre inaccordance with the approved SDZ Planning Scheme
Key Development Area	Cherrywood	Development of sustainable mixed-use urban villages in accordance with approved Local Area Plans/SDZ. Retail floorspace in line with planned population levels.

Policy RET5: *The future development and direction of the nascent Cherrywood Town Centre will be guided and driven by the detailed Planning Scheme approved for this Strategic Development Zone.*

Other policies within the CDP promote the development of green infrastructure and cycle networks at Cherrywood, and the connectivity of the site to the surrounding urban area. An orbital cycle route is proposed from Cherrywood to Dún Laoghaire.

Greenways proposed for Cherrywood include;

- Loughlinstown Greenway (Cornelscourt via Cabinteely Park and Cherrywood to the Coast at Shanganagh Cliffs).
- Marlay Park to Cherrywood (via Jamestown Park).
- Cherrywood to Shanganagh.
- Cherrywood to Shankill

Section 9 of the CDP, which deals with Specific Local Objectives, identifies and lists a series of targeted objectives which relate either to particular buildings, structures, areas or sites and/or particular development works the County Council itself is proposing or supporting. The council will undertake "to initiate and/or give effect to the package of Specific Local Objectives within the lifetime of the 2016-2022 County Development Plan. Nos. 52 relates specifically to Cherrywood, while 130 relates to proposed development along Brennanstown Road, which forms part of the northern boundary of the SDZ;

52: It is an objective of the council to implement and develop lands at Cherrywood in accordance with the approved Strategic Development Zone Planning Scheme.

130: To limit development along the Brennanstown Road to minor domestic infills and extensions until a Traffic Management Scheme for the area has been completed and its recommendations implemented.

The proposed development is consistent with the provisions of the County Development Plan as it will deliver important infrastructure to accommodate significant new investment in transport, in economic and commercial activity and in housing in the designated Large Growth Town of Cherrywood, in accordance with the phasing and priorities of the adopted SDZ Planning Scheme.

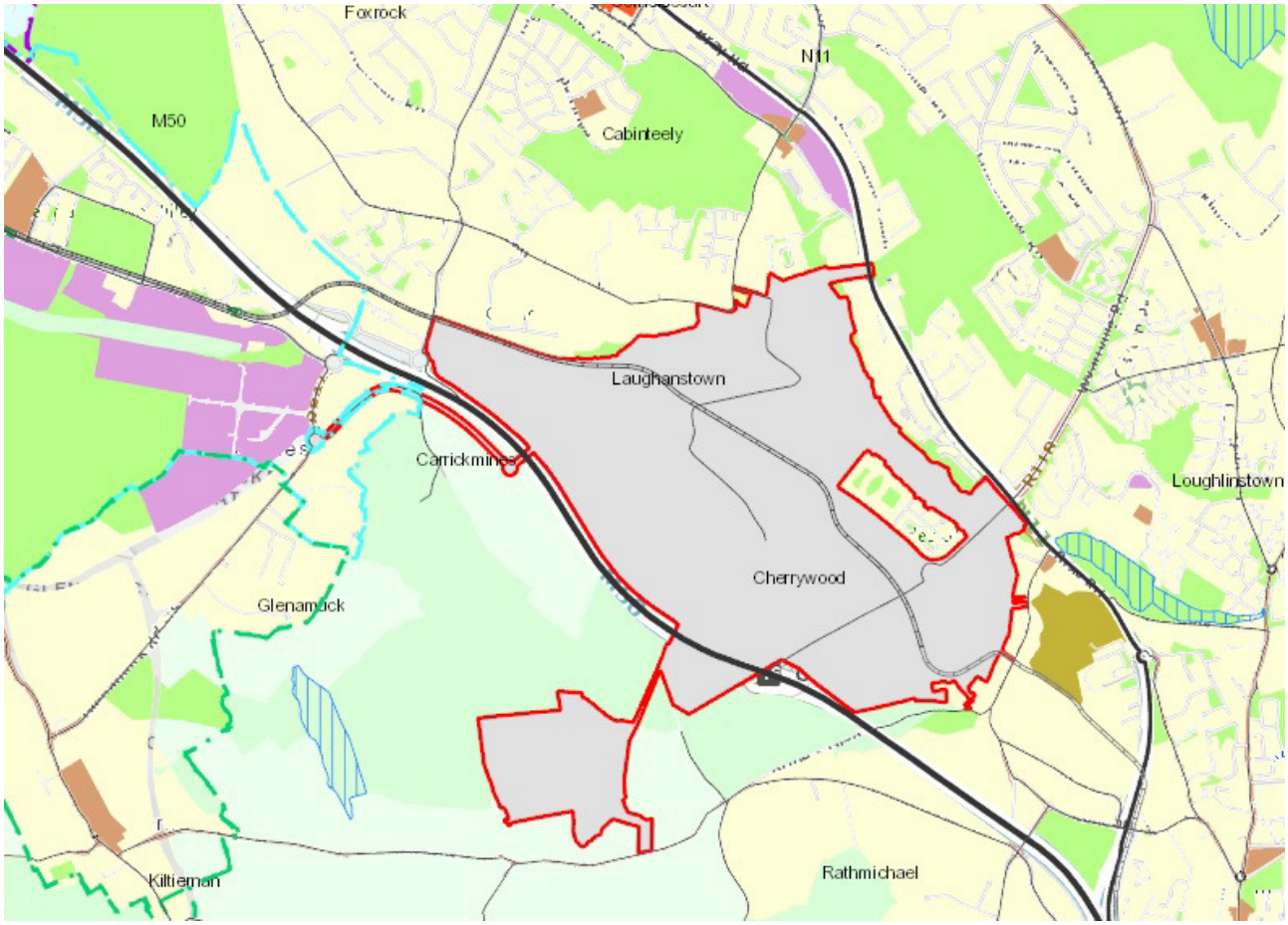

Figure 3-2 Boundary of Adopted Cherrywood SDZ Planning Scheme (CDP)

3.3.4. Cherrywood Strategic Development Zone Planning Scheme

Cherrywood was identified by Dún Laoghaire-Rathdown County Council in the 2004 – 2010 Development Plan as an area for which an LAP could be prepared, as the area is strategically located, with significant potential for development. In 2010 the area was designated as a Strategic Development Zone. Part IX of the Planning and Development Act 2000 – 2011 provides that the Government may designate a Strategic Development Zone, and specify the types of development which may be permitted. This designation is done to facilitate development, which in the opinion of the Government, is of economic or social importance to the State.

The types of development for which an SDZ may be established include industrial, residential and commercial development, the scale of which is of importance in a national context. It was recognised that Cherrywood had the potential to be a major new residential and employment settlement in the County and the Region in the context of the sustainable provision of all associated social and physical infrastructure. The Cherrywood lands, located approximately 16km south east from Dublin City Centre, are the largest undeveloped land bank in the County and one of the most sizable undeveloped areas within the Dublin Metropolitan Area.

The Cherrywood SDZ Planning Scheme was approved by An Bord Pleanála in April 2014. A Planning Scheme must indicate the types of development that may be permitted within an SDZ. The Government Order designating Cherrywood as a site for an SDZ, S.I NO. 535 of 2010, states that Cherrywood SDZ may accommodate:

> *"residential development and the provision of schools and other educational facilities, commercial activities, including office, hotel, leisure and retail facilities, rail infrastructure, emergency services*

and the provision of community facilities as referred to in Part III of the First Schedule to the Act, including health and childcare services".

The main principles guiding the Cherrywood SDZ planning scheme are identified as follows:

- To promote the growth of Cherrywood which enhances and supports balanced sustainable growth in the Greater Dublin Region and does not undermine the vitality and viability of other areas in the County and the Region.
- To create the framework for the development of a sustainable town and three villages with a supporting range of uses for the resident, working and visiting population.
- To link the area to its immediate hinterland and adjoining communities by restoring connectivity that has been severed by major roads.
- To work with the landscape by designing a form that is specific to Cherrywood, with a network of places each responding to its setting, landscape and climate.
- To balance the employment, commercial and retail base of Cherrywood with the future residential growth of the Plan Area.
- To create an environment that promotes / facilitates internal pedestrian and cycle movement meeting the requirements of Smarter Travel.

The overall Planning Scheme Area is divided into 8 Development Areas and Chapter 7 of the planning scheme sets out the sequencing of development for these areas. The sequence of development is ordered so that development will be confined to the identified Development Areas at all times. The 8 Development Areas are grouped together into 3 Growth Areas. The sequencing of Growth Areas within Cherrywood is as follows:

- **First Growth Area:** Development Areas 2, 4, 5, and 6A
- **Second Growth Area:** Development Areas 1, 2 and 3. (see specific objective H27)
- **Third Growth Area:** Development Areas 6B, 7 and 8.

To commence development in Second or Third Growth Areas the infrastructure requirements for the previous Growth Area will have been completed and/or the service provided. Within each Growth Area there are specific pieces of road infrastructure, schools and open space that require certainty on the timing of their delivery to ensure the orderly progression of the Development Areas.

The N11 Junction Q and Druids Glen Road Q-P3 lie within Development Area 5: Druids Glen as identified in Map 6.5 of the Planning Scheme. Table 6.5.2 of the Planning Scheme further describes the infrastructure requirements associated with Development Area 5.

The Druid's Glen Road from Q – P3 is identified as a specific piece of roads infrastructure for the First Growth Area (Table 7.1), and from P3 – P for the Second Growth Area. The proposed N11 Junction Q which is subject to this application is a critical piece of infrastructure that will facilitate access to the Druids Glen Road and Development Area 5 from the N11.

Chapter 4 of the Planning Scheme deals with the proposals for physical infrastructure, including Transportation, Utilities and ICT, and Environmental (water and drainage). Cherrywood is part of a larger catchment area for infrastructure and this needs to be considered when proposing future plans for the growth of Cherrywood. Chapter 4 contains a number of specific objectives relating to transportation infrastructure:

PI 13 It is an objective to develop and support a culture of sustainable travel into and within the Planning Scheme.

PI 14 It is an objective to implement the road infrastructure (including segregated pedestrian / cycle routes) proposed in this Planning Scheme to facilitate access to and within the area by all travel modes.

It is a fundamental objective of the Cherrywood Planning Scheme to ensure that the future demands for travel are met in a sustainable way.

The new route onto the N11 at Cabinteely is recognised as one of the key proposals to address some of the access constraints for the Cherrywood SDZ, as follows:

> *A new route onto the N11 at Cabinteely will provide essential access into the north-east area of Cherrywood and promote use of the N11 to the maximum extent, while protecting the village of Cabinteely and the character of Brennanstown Road (Barrington's Road and Druid's Glen Road.*

The proposed development complies with this requirement.

The Planning Scheme for the Cherrywood SDZ outlines a Future Road Strategy in Section 4.2.6 which identifies specific objectives (PI 14) for the implementation of road infrastructure proposed in the Planning Scheme that will facilitate access to and within the Planning Scheme Area.

The proposed junction under consideration in this report for which approval is being sought is identified as point Q in Figure 3-3 Planning Scheme Map 4.5 Road Hierarchy.

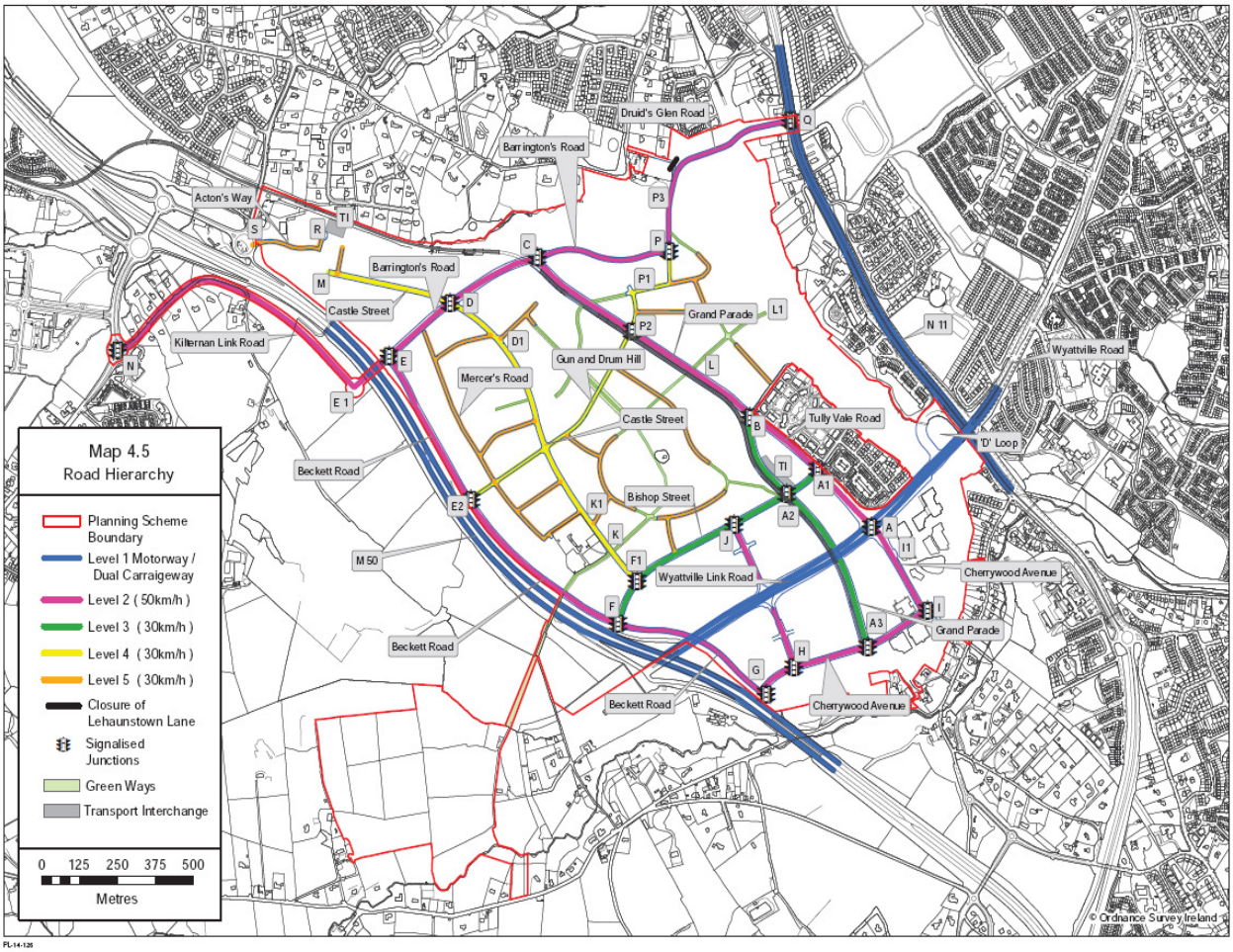

Figure 3-3 Planning Scheme Map 4.5 Road Hierarchy

Accordingly, the N11 Junction at point Q is identified as a specific piece of roads infrastructure for the First Growth Area of the Cherrywood SDZ Planning Scheme.

3.3.5. Planning History

The relevant planning history for the subject lands is set out below.

3.3.5.1. Cherrywood SDZ. An Bord Pleanála Ref PL 06D.ZD.2010. Approved by Board 14 April 2014

The Strategic Development Zone lands, of approx. 360 hectares are located in the administrative area of Dún Laoghaire-Rathdown. When land is designated as an SDZ by Government Order, in this case on the 25th May 2010, the Development Agency must prepare a Planning Scheme in respect of all or any part of the zone within 2 years of the Government Order. On the 17th December 2012 the planning authority gave notice of its decision to make a Planning Scheme for the Cherrywood SDZ. The Board subsequently received 16 no. appeals in relation to that decision and 10 no. observer submissions.

The Board approved the planning scheme on 14th April, 2014. The Board considered that, having regard to its nature, scale and location, and subject to the modifications set out below, the Planning Scheme would:

- be in accordance with the provisions of national, regional, and local planning and development policies,
- provide for the comprehensive planning and development of the site in accordance with the requirements of the Strategic Development Zone designation,
- constitute an appropriate and planned response to the housing and employment needs of the area and associated infrastructural and recreation requirements,
- constitute a reasonable means of enabling the development of the subject lands without compromising the strategic function and carrying capacity of the M50/N11 transport corridors subject to compliance with the planned phasing of development,
- be consistent with the provisions of the Planning Authority's Housing Strategy,
- be in accordance with the provisions of Section 168(2) of the Planning and Development Act, 2000, as amended,
- occupy a strategic location inside the M50, served by good public transport infrastructure, including proximity to the Luas transport corridor and to bus networks,
- respond positively to its landscape setting and topographical features, including Tully Hill and Druid's Glen, and would create a strong sense of place and of community identity within this discrete site, and
- would be in accordance with the proper planning and sustainable development of the area.

The Board, therefore, approved the Planning Scheme, subject to the certain modifications (21 modifications attached to the approval). The Board is satisfied that the modifications made are minor in nature, and would not be likely to have significant effects on the environment or adversely affect the integrity of a European site. Modifications no. 16 directly relate to the Druid's Glen area, as follows:

Development Area 5: Druid's Glen
17. (a) On Map 4.5 'Road Hierarchy' on page 39, Point P3 on Druid's Glen Road shall be moved further south on this road to the 'Indicative Access Point' immediately to the south of Glendruid House as indicated on Map 2.5 'Access & Movement' on page 18. The following maps shall be modified to record this location for point P3: Map 4.5 'Road Hierarchy'; Map 4.6 'Public Transport' on page 43; Map 7.1 'Development Areas' on page 85, and Map 7.2 'Growth Areas' on page 86.
(b) Furthermore, Table 6.1.2 'Infrastructure Requirements Development Area 1 Lehaunstown' on page 65, under 'Road Requirements', second bullet point, shall be modified to read as follows: "Extend Grand Parade B to C and close Lehaunstown Lane at its intersection with the western side of Druid's Glen Road".
(c) Table 6.5.2 'Infrastructure Requirements Development Area 5 Druid's Glen' on page 75, under 'Road Requirements', the first sentence shall be modified to read as follows: "Construct Road P3-Q, and close Lehaunstown Lane at its intersection with the western side of Druid's Glen Road".

Reason: In the interest of clarity, and to facilitate continued access onto Brennanstown Road for the existing development located along the western section of Lehaunstown Lane close to the Brennanstown Road/Lehaunstown Lane junction, and to facilitate the early development of lands in Growth Phase 1.

3.3.5.1.1. Planning Ref DZ16A/0587; RFI. This site was formed part of a larger site which was the subject of Planning application Ref; D15A/0385 (see (3.5.5 below).

Location: Beech Park, Bray Road, Cabinteely, Dublin 18/Loughlinstown, Co Dublin.

Permission sought by O'Flynn Capital Partners for residential scheme on site of approximately 2.79 ha approximately, comprising the lands of 6 no. existing houses; Silver Slope (Bray Road, Dublin D18 Y6H7), El Dorado (Bray Road, Dublin D18 T9C6), Greenhills (Bray Road, Dublin D18 R9C0), Capard (Bray Road, Dublin D18 A2Y6), The Galliard (Bray Road, Dublin D18 H9E2) and Teely Lodge (Bray Road, Dublin D18 E0K1) and, for the purposes of providing drainage connections, part of the rear gardens of Dún Baoi (No. 4 Beech Park, Bray Road, Dublin D18 TW75), Corrente (No. 5 Beech Park, Bray Road, Dublin D18 W7K7), Lynwood (No. 6 Beech Park, Bray Road, Dublin D18 A2R7), Foinavan (No. 7 Beech Park, Bray Road, Dublin D18 FA55) and Woodbrook (No. 8 Beech Park, Bray Road, Dublin D18 A5N5).The site includes some 0.78 ha, forming part of Development Area 5 (Druid's Glen) of the Cherrywood Strategic Development Zone Planning Scheme (April 2014). The site includes some 0.78 ha, forming part of Development Area 5 (Druid's Glen) of the Cherrywood SDZ Planning Scheme. The development will consist of; the demolition of 6 no. residential units and ancillary structures and the construction of 34 no. residential units. The development will also consist of the construction of part of the Cherrywood SDZ Planning Scheme's Druid's Glen Road (also known as P to Q) from its connection with the western boundary of the subject site for a distance of approx. 160m to its connection to the N11 and all associated development and infrastructural works, including the part-provision of the Druid's Glen Road bridge**.**

3.3.5.1.2. Planning Ref D15A/0385; Refused 31 July 2015. Judicial Review Appeal; Decision quashed 10 August 2016 (reasons below).

Location: Beech Park, Cabinteely, Dublin 18 / Loughlinstown, Co Dublin.

Permission refused to O'Flynn Capital Partners for development of a residential scheme on a site of approximately 5.295 ha, comprising the lands of Woodbrook (8 Beech Park), Foinavan (7 Beech Park), Lynwood, Corrente, Dun Baoi (4 Beech Park), Teely L odge, The Galliard, El Dorado, Capard, Greenhills and Silver Slope and the road area and associated open spaces at Beech Park, Bray Road, Cabinteely, Dublin 18/Loughlinstown, Co Dublin and its connection with the N11. The development will consist of the demolition of 11 no. residential units and ancillary structures and the construction of a scheme comprising 164 no. residential units. The site includes some 0.7892 ha forming part of Development Area 5 (Druid's Glen) of the Cherrywood Strategic Development Zone Planning Scheme (April 2014). (The balance of the site is located within the lands designated by Government for the establishment of a Strategic Development Zone (SI No. 535 of 2010), but is outside the Planning Scheme area).

Reasons for refusal:

1. The Submitted Flood Risk Assessment does not satisfy the requirements of the Justification Test. In Development Management, Section 5.15 of The Planning System and Flood Risk Management Guidelines for Planning Authorities.
2. The proposed development fails to provide a high quality, site specific design response for this site, in particular with respect to;
    - Layout
    - Ecology
    - Landscape design

The proposed development would, therefore, seriously injure the amenities or depreciate the value of property in the vicinity. The proposed development is contrary to the proper planning and sustainable development of the area.

3. The proposed development would, by itself or by the precedent that the grant of permission for it would set for other relevant development, would adversely affect the use of the N11 by traffic prior to implementation of the Cherrywood Planning Scheme Signalised Junction Q.
4. The proposed development is not consistent with the Cherrywood Planning Scheme in regard to the design and sequencing of development as set out in Chapter 4 and Chapter 7 of the Scheme.
5. The proposed development is not consistent with the Cherrywood Planning Scheme, as the applicant has not demonstrated that the proposed development has sufficient regard to Section 5.4.1 in particular GI 19 of the Scheme.

This refusal of permission was subject to a Judicial Review (O'Flynn Captial Partners v Dún Laoghaire-Rathdown County Council. [2016] IEHC 480) as a consequence of the decision was quashed on 10th August, 2016.

3.3.6. Assessment

3.3.6.1. Policy Context

The proposed development is consistent with the provisions of the national, regional and local planning policy in that it will assist in opening up strategic lands for the implementation of the Planning Scheme associated with the SDZ, which will lead to a critical mass of population for the area in line with adopted planning policy for the area.

The proposed development is consistent with the provisions of the NSS in that it will assist in opening up strategic lands for the implementation of the Planning Scheme associated with the SDZ, which will lead to a critical mass of population for the area in line with adopted planning policy for the area The NSS planned to create a strong and internationally competitive Greater Dublin Area (GDA) driving both its own economy and national Development.

The proposed development is consistent with the provisions of the RPGs in that it will facilitate the future development of an active growth town in the Dun Laoghaire Rathdown County Council area.

The proposed development is consistent with the provisions of the Dún Laoghaire-Rathdown County Development Plan 2016 – 2022 as it will deliver important infrastructure to accommodate significant new investment in transport, in economic and commercial activity and in housing in the designated Large Growth Town of Cherrywood, in accordance with the phasing and priorities of the adopted SDZ Planning Scheme. Critically, water, drainage and infrastructure services will be required to unlock this potential. The proposed development is one vital piece of infrastructure to assist in delivering up to 7,700 houses in the area.

In addition, the proposed N11 Junction Q is identified as a specific piece of roads infrastructure for the First Growth Area within Development Area 5 of the adopted Cherrywood SDZ Planning Scheme.

3.3.6.2. Environmental Impact Assessment

Section 50(1)(a) of the Roads Act, 1993, as amended, places a mandatory requirement on a roads authority to prepare an environmental impact statement in respect of any proposed road development comprising the construction of a motorway, busway, service area or any prescribed type of road development consisting of the construction of a proposed public road or the improvement of an existing public road as is presently defined in Article 8 of the Roads Regulations, 1994 (SI 119 of 1994) as follows:

a) *The construction of a new road of four or more lanes, or the realignment or widening of an existing road so as to provide four or more lanes, where such new, realigned or widened road would be eight kilometres or more in length in a rural area, or 500 metres in length in an urban area.*

b) The construction of a new bridge or tunnel which would be 100 metres or more in length.

With regard to sub-threshold development, Section 50(1)(c) of the Roads Act, 1993, as amended, states that where the road authority considers that any proposed road development (other than those described above), which consists of a proposed public road or the improvement of an existing public road, would be likely to have significant effects on the environment it shall inform the Minister in writing and where the Minister concurs with the road authority it is required to give a direction to the authority pursuant to Section 50(1)(b) of the Act to prepare an environmental impact statement in respect of the proposed road development and the authority is obliged to comply with any such direction.

50 (1) (b) states that Where the Minister considers that any proposed road development (other than development to which paragraph (a) applies) consisting of the construction of a proposed public road or the improvement of an existing public road would be likely to have significant effects on the environment, he shall direct the road authority to prepare an environmental impact statement in respect of such proposed road development and the authority shall comply with such direction.

Section 50(1)(d) of the Act, as inserted under Article 14 of the European Communities (Environmental Impact Assessment) (Amendment) Regulations, 1999 and as amended by the European Communities (Birds and Habitats) Regulations, 2011, provides that where a proposed road development which consists of the construction of a proposed public road or the improvement of an existing public road is located on:

i) A Special Area of Conservation,
ii) A site notified in accordance with Regulation 4 of the European Communities (Natural Habitat) Regulations, 1997 (SI 94 of 1997),
iii) An area classified pursuant to Paragraph 1 and 2 of Article 4 of Council Directive No. 79/409/EEC of 2nd April, 1979, on the conservation of wild birds (O.J. L103, 25th April, 1979) (i.e. the Birds Directive),
iv) A site where consultation has been initiated in accordance with Article 5 of Council Directive 92/43/EEC of 21st May, 1992, on the conservation of natural habitats and of wild fauna and flora (O.J No. L206, 22nd July, 1992) (i.e. the Habitats Directive),
v) Land established or recognised as a nature reserve within the meaning of Section 15 or 16 of the Wildlife Act, 1976 (No. 39 of 1976),
vi) Land designated as a refuge for fauna under Section 17 of the Wildlife Act, 1976 (No. 39 of 1979),

the road authority concerned shall decide whether the proposed development would or would not be likely to have significant effects on the environment and if it is concluded that the development is likely to have such effects, Section 50(1)(c) of the Act, as set above, will apply and the road authority shall prepare an EIS.

In accordance with Section 50(1)(e) of the Act, where a decision is being made on whether a road development would or would not be likely to have significant environmental effects, it is a requirement to have regard to the criteria specified for the purposes of Article 27 of the European Communities (EIA) Regulations, 1989.

The proposed development involves the provision of a new three arm signalised at grade junction on the existing N11 with provisions for pedestrian and cyclist movements.

Accordingly, on the basis of Article 8 of the Roads Regulations, 1994 (SI 119 of 1994), and Schedule 5 of the Planning and Development Regulations 2001, as amended, as set out above, the proposed development does not necessitate a mandatory EIS.

In relation to sub-threshold development, the proposed development i.e. N11 Junction Q has been subject to a thorough environmental assessment which has concluded that the proposed development, with mitigation, will not have any significant effects on the environment.

3.3.6.3. Compliance with the adopted Cherrywood SDZ Planning Scheme

In order to facilitate the full extent of the works to the N11 and the entrance to Kilbogget Park, the boundary for the purposes of the application is outside the boundary of the adopted Cherrywood Planning Scheme. These works are necessary to give effect to the proposed development of the N11 Junction Q and consequently the proposed Druids Glen Road.

In all other respects, the proposed development complies with the provisions of the adopted Cherrywood SDZ Planning Scheme as they relate to road infrastructure, as is set out below:

The proposed N11 Junction Q is identified as a specific piece of roads infrastructure for the First Growth Area within Development Area 5 of the adopted Cherrywood SDZ Planning Scheme. The proposed development involves the provision of an at-grade junction on the N11. The impact of this new junction on the existing environment has been assessed as part of this Environmental Report.

The route of the proposed development will involve the loss of trees within the extent of the site. The full extent of tree loss has been identified in the Tree Survey report which accompanies this Environmental Report. Where possible, retention of existing trees and hedgerows is recommended, consistent with the provisions of the adopted Planning Scheme.

In relation to cultural heritage, it is noted that the western boundary of the proposed development is located within the zone of archaeological potential associated with Recorded Monument DU026-119, which is listed as an early medieval cemetery. This area was tested in 2006 and nothing of archaeological significance was identified other than a patch of charcoal rich soil adjacent to the northern boundary of the plot.

There are a further three recorded monuments located within 500m of the proposed scheme.

In accordance with the adopted Planning Scheme, the content of any archaeological assessment that is carried out as part of a development within the SDZ is to be agreed with the National Monuments Service of the DoAHRRGA in advance. As such, consultations with National Monuments Service were carried out as part of the proposed scheme and a request for archaeological testing to form part of the assessment was made.

The cemetry area will not be impacted upon by the proposed development and will be preserved in-situ. However, it is possible that ground disturbances associated with the proposed development may negatively impact on previously unidentified isolated features of archaeological significance that may survive within the footprint of the proposed development. It is recommended that topsoil stripping along the western boundary of the proposed scheme be subject to archaeological monitoring.

Rockabill-Dalkey Island candidate SAC is located *c.* 4km to the east of the Planning Scheme area. The Screening Report for Appropriate Assessment has determined that there will be no likelihood of significant effects on any European sites and no impacts to European site integrity, either alone or in combination with other plans or projects, and an Appropriate Assessment is not required.

Critically, the proposed junction onto the N11 is required to facilitate the traffic generated from Development Area 5 (Phase 1) initially and ultimately in conjunction with the overall proposed road network identified within the Planning Scheme; the traffic generated from all of the eight development areas within the Planning Scheme.

3.4. Conclusion

It is the conclusion of this report that the proposed development is in the interests of the proper planning and sustainable development of the area, as it will deliver a critical piece of infrastructure that is fully in accordance with the provisions of the adopted Cherrywood SDZ Planning Scheme and that will unlock the development potential of the First Growth Area within Development Area 5 of the adopted Scheme, and enable developers to pursue applications for permission in line with the adopted Scheme. It has been subject to a thorough environmental assessment which has concluded that the proposed development, with mitigation, will not have any significant negative impact on the area.

In addition, the Screening Report for Appropriate Assessment has determined that there will be no likelihood of significant effects on any European sites and no impacts to European site integrity, either alone or in combination with other plans or projects, and an Appropriate Assessment is not required.

4. Human Beings and Material Assets

4.1. Introduction and Methodology

This chapter of the report addresses the potential for impacts on the community, economics, natural and man-made assets. Potential impacts arising on the local human environment may relate to visual intrusion, noise and vibration, dust and traffic, and these issues are discussed separately within the respective chapters.

Data was obtained from publically available information and included online searches such as: www.cso.ie, www.gsi.ie, www.npws.ie, www.ifi.ie, www.dlrcoco.ie.

The methodology for assessment follows EPA (2002) *Guidelines on the information to the contained in Environmental Impact Statements* Environmental Protection Agency; and EPA (2003) *Advice notes on current practice; in the preparation of Environmental Impact Statements* and also the draft EPA guidance – Advice notes for preparing environmental impacts statements (Draft, Sep 2015) and Revised guidelines on the information to be contained in environmental impacts statements (Draft, Sep 2015).

4.2. Existing Environment & Review of Impacts

The proposed junction is located in Dún Laoghaire-Rathdown. In terms of receptors in the vicinity of the scheme, there are properties located along either side of the new N11 junction. There will also be some works along the eastern side of the N11 and at the entrance to Kilbogget Park. To the north of this junction there are properties in Shrewsbury Lawn and to the south are properties in Kilbogget Grove. There are no schools or hospitals within the vicinity of the proposed junction. Figure 6.2 illustrates the proposed junction scheme overlaid on aerial photography where the location of properties within 100m of the scheme is evident.

In terms of population in Dún Laoghaire-Rathdown, the preliminary data for the 2016 census indicates a population of 217,274 people in 2016 compared with a population of 206,261 in 2011 – a growth of 5.3% over the period. In terms of housing stock and vacant properties, there were 87,264 houses in 2016 compared with 86,064 in 2011. In 2011 there were 6,616 vacant properties (including holiday homes) compared with 5,146 in 2016.

Due to the character of the proposed development the impact on human beings has in fact been considered in detail in the accompanying chapters of this environmental report, as follows: -

4.2.1. Project Description

Firstly a detailed description of the proposed development is presented in Chapter 2.0 – Project Description. This places the proposed development within the broader context of the Cherrywood Strategic Development Zone. It presents an overview of the site and then presents a detailed description of the scheme as being submitted for planning. This in turn allows the impact on human beings and indeed other sensitive receptors to then be considered in full.

4.2.2. Planning Review

Chapter 3.0 – Planning (prepared by Coakley O'Neill town planning) presents a summary of the site with respect to local, regional and national planning policy. Planning history in the environs of the site is also summarised. It is the conclusion of planning review that the proposed development is in the interests of the proper planning and sustainable development of the area, as it will deliver a critical piece of infrastructure that is fully in accordance with the provisions of the adopted Cherrywood SDZ Planning Scheme and that will unlock the development potential of the First Growth Area within Development Area 5 of the adopted Scheme, and enable developers to pursue applications for permission in line with the adopted Scheme. It has been subject to a thorough environmental assessment which has concluded that the proposed development, with mitigation, will not have any significant negative impact on the area.

4.2.3. Flora & Fauna

Chapter 5.0 – Flora & Fauna (prepared by Scott Cawley) presents the findings of an ecological impact assessment undertaken in line with published best practice. All surveys were also undertaken at a seasonally appropriate time of year. Both terrestrial habitats and species were considered. As well as the

inherent importance of ecological constraints; the importance of such features to the landscape character, as well as to amenity value and overall human well-being were considered both in this chapter and in Chapter 6.0 – Landscape and Visual (and associated tree survey).

Mitigation measures have been proposed to address any significant adverse effects and incorporate habitat protection, restoration and creation measures. When assumed to be successfully applied these impacts are deemed to be significant but only at the scale of the site itself.

In addition to the general ecological impact assessment an accompanying Screening Report for Appropriate Assessment has determined that there will be no likelihood of significant effects on any European sites and no impacts to European site integrity, either alone or in combination with other plans or projects, and an Appropriate Assessment is not required.

4.2.4. Landscape & Visual

Chapter 6.0 - Landscape and Visual; a landscape and visual impact assessment (LVIA) (Chapter (carried out by Cunnane Stratton Reynolds) was informed by a desktop study and survey of the site and receiving environment. It considered impacts both on landscape character and visual receptors (e.g. residential properties) in the environs of the proposed scheme; as appropriate it also considered related environmental topics such as ecology and built & cultural heritage; a tree survey was also undertaken.

The proposed development, the N11 Junction Q, is identified in the CPS as a key piece of the transport infrastructure for the SDZ, providing access from the N11 into the Cherrywood lands. The site is comprised of predominantly the existing N11 National Road, bounded to the east by Kilbogget Park and to the west by an existing service station and residential properties. Mature trees are located on the 'Silver Slope' residential property fronting the N11 to the west and along the north eastern boundary of the site. Overall the landscape can be considered of low sensitivity.

A Landscape Mitigation Plan has been prepared in parallel with the LVIA with mitigation measures proposes to compensate where necessary for the loss or disturbance of valued landscape features. Overall the potential landscape effects of the proposed development can be classified as neutral.

The potential visual effects of the proposed development have been assessed for three viewpoints representing visual receptors in the receiving environment. The viewpoints include public roads in the vicinity of the site, public open space and nearby residential properties. The sensitivity of the viewpoints was variously classified as low or medium. This classification took account of the location of the viewpoints'/visual receptors' location within or adjacent to the proposed junction and the condition of the landscape in view. It was found that the magnitude of change which would occur in the views would range from low to medium. The assessment took account of the fact that the context landscape will change most likely in the medium term, as the Cherrywood SDZ evolves into an urban environment. There are no adverse visual effects predicted to result from the proposed development.

In summary, there would be no significant medium to long term adverse landscape or visual impacts and the proposed development can be considered an appropriate intervention in the landscape.

4.2.5. Soils, Geology & Hydrogeology

Chapter 7.0 – Soils, Geology & Hydrogeology, prepared by Keohane Geological and Environment Consultancy, assesses the significant effects, if any, on soils, geology and hydrogeology which may occur as a result of the proposed development i.e. N11 Junction Q, at Cabinteely, County Dublin. Mitigation measures are provided to avoid or reduce the magnitude of potential impacts.

No historic or current land uses on the proposed development site would indicate the presence of contaminated land. The only nearby land use identified that could potentially be a source of contaminated soil and groundwater is the retail petrol station adjacent to the proposed N11 junction. Underground storage tanks for petrol and diesel can sometimes leak, causing soil and groundwater contamination. There is however no evidence that this is occurring.

According to the Environmental Protection Agency (EPA) web-mapping (http://gis.epa.ie/Envision) indicates that there are no licenced waste or IPPC (Integrated Pollution & Prevention Control) facilities at or within the immediate vicinity of the site. The closest are approximately 2km from the proposed development.

Dumping of builder's rubble, including tarmac, is noted at the gated entrance to the Cherrywood land bank on the N11.

The site has little or no potential for aggregate resources, nor has any known mineral reserves. The aquifer underlying the site is classified as a poor aquifer. There are no known groundwater wells within the extents of the junction scheme. While there may be groundwater wells servicing the older residences, the area is serviced by mains water. With the shallow depths of excavations required, impacts on wells is not predicted.

4.2.6. Air Quality & Climate

Chapter 8.0 – Air Quality & Climate outlines the findings of an assessment of the likely impact on air quality and climate associated with the proposed development (i.e. N11 Junction Q) which was undertaken by AWN Consulting Limited.

There are no Natura 2000 sites within the vicinity of the proposed development which require a detailed air quality assessment.

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust and PM_{10}/$PM_{2.5}$ emissions. While construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m.

There is the potential for a number of greenhouse gas emissions to the atmosphere during the construction phase of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions. During the operational phase of the proposed development there is the potential for a number of emissions to the atmosphere. In particular, the traffic-related air emissions may generate quantities of air pollutants such as NO_2, CO, benzene and PM_{10}. There is the also the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the proposed development. Road traffic may give rise to CO_2 and N_2O emissions.

However, in order to sufficiently ameliorate the likely air quality impact, a schedule of air control measures has been formulated for both construction and operational phases associated with the proposed development; these are set out in section 8.7.1 (construction phase) and section 8.7.2 (operational phase). When the dust minimisation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors. Furthermore, due to the size and nature of the construction activities with appropriate mitigation measures, CO_2 and N_2O emissions during construction will have a negligible impact on climate.

The results of the air dispersion modelling study indicate that the residual impacts of the proposed development on air quality and climate are predicted to be imperceptible for most parameters with respect to the operational phase local air quality assessment for the long and short term with a slight adverse impact with regard to NO_2 at one receptor in the long term (i.e. with respect to Phase 2 all traffic generated when all eight development areas of the Cherrywood SDZ are in place). This is discussed in detail in Chapter 8.0.

4.2.7. Noise & Vibration

Chapter 9.0 – Noise and Vibration was prepared by AWN Consulting Limited and assesses the impacts of noise and vibration associated with the proposed development; i.e. N11 Junction Q.

4.2.7.1. Noise – Operational Phase

For existing properties in the vicinity of the proposed development, residual noise levels (assuming a Phase 2 traffic scenario) will result in a minor to moderate noise impact at properties set back from the N11. The operational noise level at these properties are calculated, however, to be below or within 1dB of the traffic noise design goal set for national road schemes of 60dB L_{den}.

A residual negligible noise impact is calculated at properties which are currently exposed to road traffic along the N11 Road as a result of the proposed development.

4.2.7.2. Noise – Construction Phase

During the construction phase of the project there is potential for some temporary moderate to significant impact on nearby residential properties due to noise emissions from certain construction activities in the absence of specific mitigation measures. The application of binding noise limits and hours of operation,

along with implementation of appropriate noise control measures, will ensure that noise impact is kept to a minimum and will be short-term and transient in nature.

4.2.7.3. Vibration

A survey of vibration along the proposed development was not undertaken, as levels associated with existing roads would not be expected to be of a magnitude sufficient to cause disturbance to people or structural damage to property. Furthermore, vibration was not perceptible at any of the noise survey locations.

The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works, breaking operations and lorry movements on uneven road surfaces. The more significant of these is the vibration from excavation and breaking operations; the method of which will be selected and controlled to ensure there is no likelihood of structural or even cosmetic damage to existing neighbouring dwellings.

4.2.8. Archaeology

Chapter 10.0 – Archaeology, prepared by Irish Archaeological Consultancy, details an archaeological assessment undertaken to assess the impacts of the proposed development; i.e. N11 Junction Q in the environs of Cabinteely, Dublin 18.

The proposed scheme is located within the townlands of Loughlinstown and Brennanstown, which are located within the Parish of Killiney and the Barony of Rathdown. The length of the proposed works at point Q along the existing N11 is in the order of 350m.

There are three recorded monuments located within 500m of scheme. The closest of these is a recorded early medieval cemetery site (DU026-119). The proposed scheme is located within the southern section of the zone of archaeological potential that surrounds the site. The main portion of the cemetery site was subject to archaeological excavation in 1998 as part of the development of a service station. In 2006 archaeological testing was carried out within the eastern part of the Cherrywood Planning Scheme Area, to the west of the proposed scheme, as part of a previous planning application. This failed to identify any definite archaeological remains associated with the cemetery site. However, one area of charcoal-rich soil was identified within the northern part of the area (to the west of the proposed scheme), which remains in-situ today.

As described above, a review of the Excavations Bulletin (1970-2015) has shown that archaeological testing has been carried out in the eastern part of the Cherrywood Planning Scheme Area, to the west of the proposed scheme. One small area of charcoal-rich soil was identified, along with a number of more recent drains. A large amount of field work has been carried out to the immediate north, including the excavation of c. 1500 skeletons in 1998 at the site of the service station that fronts onto the N11 and the identification of the possible extent of the enclosure associated with the cemetery in 2006. More recently five further skeletons associated with the cemetery have been excavated to the immediate north of the service station. The topographical files of the National Museum reveal that human remains were recorded in 1957 and 1991 to the west of the service station.

With the exception of the eastern section of the Cherrywood Planning Scheme Area, to west of the proposed development, which is located within a zone of archaeological potential associated with a recorded monument, no specific features of archaeological potential have been noted during the course of the assessment.

Potential impacts as highlighted in Section 10.4.1 are as follows: -

- The western boundary of the proposed development, is located within the zone of archaeological potential associated with an early medieval cemetery (DU026-119). This area was tested in 2006 and nothing of archaeological significance was identified other than a patch of charcoal rich soil adjacent to the northern boundary of the Cherrywood Planning Scheme Area. This area will not be impacted upon by the proposed scheme.

4.2.9. Traffic

Chapter 11.0 – Traffic was prepared by Atkins and assesses the impacts of the traffic associated with the proposed N11 Druids Glen Road Q-P3 road and takes into consideration the local traffic impact associated with the provision of a new at-grade 3-arm signalised junction between the proposed N11 Druids Glen Road at point Q and the existing N11 carriageway.

The traffic analysis undertaken was aligned with the phasing and quantum of development as set down in Chapter 6 of the SDZ for Development Area 5 and upon completion of all three growth areas defined in the CPS.

The N11 is a strategic commuter corridor providing direct linkage to the south east quadrant of Dublin City for general traffic, multiple local and national bus services and also a range of vulnerable road users. The Cherrywood SDZ proposed road network includes the future N11 Druids Glen Road which will terminate with a new junction on the N11 dual carriageway.

The new junction onto the N11 is required to facilitate the traffic generated from Development Area 5 (Phase 1) along the future N11 Druids Glen Road initially, and ultimately in conjunction with the overall proposed road network identified with the SDZ, the traffic generated from all of the eight development areas within Cherrywood (Phase 2).

Two phases of development, Phase 1 and Phase 2 have been modelled to assess the associated traffic impact on an at-grade junction and its wider impacts on the N11 mainline traffic.

The main objective of the assessment was to recommend an appropriate junction layout that will minimise traffic impacts on the operation of the N11 network and the future Druids Glen Road. The recommended layout is identified in drawing 5139036/HW/0104.

4.3. Conclusion

In each instance, the potential impacts associated with the proposed development are assessed in terms of the construction and operational impacts, the do-nothing scenario, and the worse-case scenario. Due to the urban character of the site in each instance the potential for impacts on human beings is a key driver in each chapter. Furthermore, as noted each chapter also references other disciplines as appropriate in order to present a comprehensive assessment of potential impacts upon human beings and the environment in which they live.

A summary of the key findings as they relate to the human environment are presented above. There are no other issues that warrant stand-alone assessment in the Human Beings chapter.

5. Flora and Fauna

5.1. Introduction

An Ecological Impact Assessment (EcIA) of the proposed development, N11 Junction Q, at Druid's Glen, Cabinteely, Dublin 18, which will facilitate access to the Cherrywood Strategic Development Zone (SDZ), has been undertaken by Scott Cawley. The aims of this EcIA were to: -

- Establish baseline ecological data for the proposed development site;
- Determine the ecological value of the potential ecological features;
- Assess the impact of the proposed development on ecological features of value (flora and fauna); and
- Recommend mitigation measures to avoid, reduce, remedy or compensate any identified ecological impacts.

5.1.1. Development Overview

The subject lands are located at Druid's Glen, south of Cabinteely, Dublin 18 (Grid ref: O 23552 24332). The lands are within the administrative area of Dun Laoghaire Rathdown County Council and are bounded to the north and south by the townlands of Brennanstown and Cherrywood respectively. The proposed junction is located on the N11, south of Cabinteely in Co. Dublin. The subject site is composed of developed lands, specifically the N11 National Primary Route, a major transport corridor flanked by continuous, sub-urban development on both sides.

The N11 Junction Q will facilitate access to Development Area 5: Druids Glen as identified in Map 6.5 of the Planning Scheme. Table 6.5.2 of the Planning Scheme further describes the infrastructure requirements associated with Development Area 5. The proposed junction onto the N11 is required to facilitate the traffic generated from Development Area 5 (Phase 1) along the future Druids Glen Road Q-P3 initially and ultimately in conjunction with the overall proposed road network identified within the Planning Scheme; the traffic generated from all of the eight development areas within the Planning Scheme. The proposed junction and infrastructure for which permission is sought is identified in drawing 5139036/HW/0104.

The length of the proposed works at point Q along the existing N11 is in the order of 350m. The proposed junction onto the existing N11 will comprise a three arm signalised at grade junction with provisions for pedestrian and cyclist movements across each arm. The proposed junction will comprise a double southbound right turning lane, a double left turn lane from the Druids Glen Road, a right turn lane from the Druids Glen Road onto the N11, a northbound left turning lane from the N11 onto the Druids Glen Road, two lanes for traffic flowing onto the Druids Glen Road from the N11 and left in/left out slip lanes on the Druids Glen Road. The preliminary design of the proposed N11 junction is based on a design speed of 85kph.

The proposed junction onto the existing N11 will also facilitate a new entrance into Kilbogget Park and the construction of a new boundary wall to the east of the N11.

The proposed junction onto the N11 will incorporate underground services infrastructure within the proposed road cross section.

5.2. Assessment Methodology

5.2.1. Desk Study

A desktop study was undertaken in order to collate and update available information on the existing local ecological environment. The following resources and databases were consulted in the production of this report: -

- Data on rare/protected/threatened species held by the National Parks and Wildlife Service (NPWS) for Irish National Grid square O22, available online at http://www.npws.ie/mapsanddata accessed 10th August 2016;

- Data on designated sites was obtained from the online National Parks and Wildlife Service (NPWS) database http://www.npws.ie/mapsanddata accessed 10th August 2016;
- Data on rare/protected/threatened species within 2km of the proposed development held by the online National Biodiversity Data Centre database, available online at http://www.biodiversityireland.ie accessed 10th August 2016;
- Records of bat roosts in close proximity to the site were also queried using the Bat Conservation Ireland database (the precise location of these roosts is confidential);
- Watercourse maps were obtained from the online Environmental Protection Agency (EPA) database ENVision http://www.epa.ie;
- Ordnance Survey Mapping. Available online at www.osi.ie; and
- Aerial photography available online at Google Maps http://maps.google.com/ and Bing Maps http://www.bing.com/maps/.

Desktop records of protected, rare and other notable flora and fauna species in the area are included in Appendix 5.3.

5.2.1.1. Designated Sites

Natura 2000 sites (also known as European sites or more commonly as SACs and SPAs) are defined under the Habitats Directive (Article 3) as a European ecological network of special areas of conservation composed of sites hosting the natural habitat types listed in Annex I and habitats of the species listed in Annex II. The aim of the network is to aid the long-term survival of Europe's most valuable and threatened species and habitats.

Special Areas of Conservation (SAC) are designated under the EC Habitats Directive (92/43/EEC), as amended, for the protection of certain habitats (listed on Annex I of the Directive) and/or species (listed on Annex II) through the designation of SACs.

Special Protection Areas (SPAs) are designated under the Birds Directive (2009/147/EC), for the protection of protected bird species listed on Annex I of the Directive, regularly occurring populations of migratory species (such as ducks, geese or waders), and areas of international importance for migratory birds.

National Heritage Areas (NHAs) are designations under the Wildlife Acts 1976 & 2000 in order to protect habitats, species or geology of national importance. The boundaries of many of the NHAs in Ireland overlap with Natura 2000 sites. Although many NHA designations are not yet fully in force under this legislation (referred to as 'proposed NHAs' or pNHAs until such time), they are offered protection in the meantime under planning legislation which requires that planning authorities give recognition to their ecological value [1]

The proposed development site is not designated as an SAC, SPA, NHA or pNHA. The closest SAC to the proposed development site is the Rockabill to Dalkey Island SAC (003000), located c.3.8km east of the subject site. The closest SPA site are the Dalkey Islands (04172) which are located c.4.4km north-east of the subject site. See Appendix 3-1 for further information on these designated sites and qualifying interests, along with a list of other designated sites located within 15km of the proposed development. See Figure 5-1 for a map of designated sites located within 15km of the proposed development site.

There are two proposed Natural Heritage Areas (pNHAs) located within 15km of the proposed development site. See Figure 5.2 for a map of proposed NHAs located within 15km of the proposed development site. Again, the closest nationally designated sites are Loughlinstown Woods [001211] which lies c. 1.1km to the south-east of the development site. This woodland is designated as a good example of demesne-type mixed woodland.

The proposed site is located within the Avoca-Vartry catchment and in the Dargle subcatchment.

An Appropriate Assessment Screening Report prepared by Scott Cawley Ltd, has addressed the potential for significant effects on European Sites, and concluded that none are likely to arise as a result of the proposed development, either alone or in combination with other plans or projects.

[1] Source: NPWS Website. Available online at http://www.npws.ie/protectedsites/naturalheritageareasnha/. Accessed 22nd April 2016

5.3. Field Surveys and results

5.3.1. Habitats & Flora Survey

Habitats and flora within the proposed development were surveyed by Paul Scott CEnv, MCIEEM on the 10-11th August 2016 in bright, dry conditions, using methodology outlined in *Best Practice Guidance for Habitat Survey and Mapping* (Heritage Council, 2011). All habitats were classified using the *Guide to Habitats in Ireland* (Fossitt, 2000). Plant nomenclature follows the *Checklist of the Flora of Britain & Ireland* (BSBI, 2007).

It is unlikely that any notable flora species recorded[2] prior to the surveys undertaken for the Planning Scheme will occur within the proposed development site due to their rarity. Surveys to check historic records of rare species such as Basil Thyme *Clinopodium acinos* in the area near Tully Church in 2009 did not find any such species occurring.

Rare flora recorded in the Planning Scheme surveys in 2009-2012 included the relatively uncommon Pale Flax *Linum bienne*. This was recorded on disturbed ground south of Druid's Glen in 2015 and also near the Cherrywood Business Park and was recorded in very few other locations in County Dublin. In 2016 it was also recorded alongside the Luas line to the east of Lehaunstown Lane. Both areas are outside the development application boundary and were not recorded in the area of the proposed junction.

The following habitat types of the Heritage Council classification system (Fossitt 2000) were identified within the proposed development boundary and are mapped in Figure 5.3: -

- Scattered trees and Parkland
- Buildings and Artificial Surfaces

5.3.1.1. Scattered trees and Parkland

This habitat type includes the scattered trees to the east of the Silver Slopes house. It is made up predominantly of young pines, Sycamore and occasional Walnut *Juglans regia* and Horse Chestnut *Aesculus hippocastanum*. Tree planting is relatively dense so that a complete canopy is created across this area.

5.3.1.2. Stone Walls and other Stonework

A relatively new stone wall fronts onto the N11 on the western side of the dual carriageway. It is not associated with any significant vegetation growth.

5.3.1.3. Immature Woodland

Lands on the eastern side of the N11 include a narrow belt of Sycamore and Ash which was planted relatively recently and forms a screening belt between the road and nearby houses. Informal paths run through it despite the dense planting. Whilst of benefit to breeding birds and bat it is only of local ecological importance.

5.3.1.4. Amenity Grassland

Amenity grassland comprises the lands within Kilbogget Park on the eastern side of the N11. Species are dominated by grasses such as Creeping bent *Agrostis stolonifera*, Perennial ryegrass *Lolium perenne*, Docks *Rumex* sp. and Common mouse-ear *Cerastium fontanum*.

5.3.1.5. Fauna Survey

Habitats were assessed for field signs and/or usage by rare or protected (under national and European legislation) fauna species, bird species of "Medium" or "High Conservation Concern in Ireland" (Colhoun & Cummins, 2014) and birds protected under Annex I of the Birds Directive. Sampling of freshwater invertebrates to estimate the water quality in the stream was undertaken on 16th August 2016.

[2] Habitat Preferences and distribution data from Parnell & Curtis (2012), Curtis & McGough (2005), Doogue *et al.* (1998), and the online atlas of the British and Irish Flora https://www.brc.ac.uk/plantatlas/ Accessed 5th March 2015.

5.3.1.6. Mammals (excluding bats)

Of the mammal fauna recorded in the desktop study and in the SDZ surveys, there is low potential for Badger and Hedgehog to occur on the proposed development area due to suitable habitat within the proposed development or within close proximity to the site.

Badgers and their setts (occupied or unoccupied) are protected by the Wildlife (Amendment) Act. Badger *Meles meles* setts previously identified within the SDZ lands in 2009-2012 were monitored over a period of 8 days in May and June 2015 to determine activity levels via infrared wildlife monitoring cameras to determine the level of activity at each sett (under Licence 024/2015). There are no setts within the proposed development zone. Badger activity throughout the SDZ was recorded during multidisciplinary walkover surveys in September and May 2015 through the detection of field signs such as setts, tracks, feeding signs and droppings. Surveys for setts in August 2016 was hampered by the tall vegetation and setts within the hedgerows cannot be rule out although there was no feeding signs or paths suggesting that a sett would be present.

Other mammals that may potentially occur in the proposed development area include Hedgehog *Erinaceus europaeus*, and Pygmy Shrew *Sorex minutus*. Pine Marten *Martes martes* have been recorded in the area around Ticknick (T. Doherty, pers. comm, 2015) in 2015 but there were no signs of this species during the field surveys and their presence would be regarded to be unlikely. Sika deer *Cervus nippon* are known to frequent lands to the south but there have been no records in the area of the proposed development and their presence would be deemed to be unlikely.

5.3.1.7. Bats

All bats and their roosting sites are legally protected under the EC Habitats Directive as transposed by the Habitats Regulations, as well as under the Wildlife Act.

A daytime visual assessment of the trees within the study area was undertaken during multidisciplinary walkover surveys on the 10th August 2016. Trees were assessed at ground level and the focus of the visual assessment was to identify trees with potential bat roost features or evidence of bats. The trees were then rated using the *Bat Conservation Trust Guidelines (2012)* as set out in Table 5.1.

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Table 5-1 BCT Tree Classification

Tree category and description	Stage 1 Initial survey requirements	Stage 2 Further measures to inform proposed mitigation	Stage 3 Likely mitigation
Known or confirmed roost	Follow SNCO guidance and these guidelines wherever possible, to establish the extent to which bats use the site. This is particularly important for roosts of high risk species and/or roosts of district or higher importance and above		The tree can be felled only under EPS licence following the installation of equivalent habitats as a replacement.
Category 1* Trees with multiple, highly suitable features capable of supporting larger roosts	Tree identified on a map and on the ground. Further assessment to provide a best expert judgement on the likely use of the roost, numbers and species of bat, by analysis of droppings or other field evidence. ***A consultant ecologist is required***	Avoid disturbance to trees, where possible. Further dusk and pre-dawn survey to establish more accurately the presence, species, numbers of bats present and the type of roost, and to inform the requirements for mitigation if felling is required.	Felling would be undertaken taking reasonable avoidance measures' such as 'soft felling' to minimise the risk of harm to individual bats.
Category 1 Trees with definite bat potential, supporting fewer suitable features that category 1* trees or with potential for use by single bats	Tree identified on a map and on the ground. Further assessed to provide a best expert judgement on the potential use of suitable cavities, based on the habitat preferences of bats. ***A consultant ecologist required***	Avoid disturbance to trees, where possible. More detailed, off the ground visual assessment. Further dusk and pre-dawn survey to establish the presence of bats, and if present, the species and numbers of bats and type of roost, to inform the requirements for mitigation if felling is required.	Trees with confirmed roosts following further survey are upgraded to Category 1* and felled under licence as above. Trees with no confirmed roosts may be downgraded to Category 2 dependent on survey findings
Category 2 Trees with no obvious potential, although the tree is of a size and age that elevated surveys may result in cracks or crevices being found; or the tree supports some features which may have limited potential to support bats.	None. ***A consultant ecologist is unlikely to be required***	Avoid disturbance to trees, where possible. No further surveys.	Trees may be felled taking reasonable avoidance measures. Stop works and seek advice in the event bats are found, in order to comply with relevant legislation.
Category 3 Trees with no potential to support bats	None. ***A consultant ecologist is not required unless new evidence is found***	None.	No mitigation for bats required.

The walkover survey did not confirm any bat roosts within the study area and nocturnal surveys undertaken in this area did not record roosts in 2010. However, based on desktop data and with specific reference to the proposed development at Beech Park (Ref DZ16A/0587), there are confirmed bat roosts in various buildings in the locale of the proposed development. The former residence "Silver Slope" was checked for suitability for bat roosts on 11th August 2016 and was deemed to be suitable due to presence of crevices under lifting wooden panels. Interior checks of the structure did not indicate any presence of bats. It was subsequently subjected to a dusk and dawn survey to determine if bats were using the property and the general area.

BP04 and BP05 of the Biodiversity Plan identifies the need to undertake bat surveys where there is a risk that developments are near proposed bat roosts. There were no such known roosts near to the proposed development that required checks.

It is possible that mature trees in the study area in the area near Silver Slope and in the large Lime trees in the hedgerow support bat roosts on an occasional basis for small numbers of bats.

The bat activity surveys in 2010 also showed evidence of foraging in the vicinity of the proposed development. The survey in 2016 identified a number of BCT Category 2 trees, as per Hundt (2012), within the study area. Potential roost features recorded included: -

- Impact shatters;
- Tear outs;
- Hazard beams;
- Wounds and cankers; and
- Ivy.

Inspections in 2016 indicated 4 trees which were regarded to be Category 2 trees had high potential for such features but these were not visible at ground level so a precautionary approach was taken regarding their valuation. These trees include the Poplar and Cypress near Silver Slope and the two large Lime trees in the main hedgerow but are not scheduled for removal. None of the trees that are proposed for removal were regarded to be Category 1 (i.e. highest suitability for bats).

Nocturnal walkover surveys to record bat activity and surveys at Silver Slope recorded the following species:

- Common Pipistrelle bats *Pipistrellus pipistrellus* recorded frequently near Silver Slope and around Kilbogget Park. Also using the Lime trees as perches to broadcast territorial mating calls;
- Soprano Pipistrelle bats *Pipistrellus pygmaeus* recorded along Lehaunstown Lane in particular but also across the overall development footprint;
- Leisler's bats *Nyctalus leisleri* commuting across the area;
- Daubenton's bats *Myotis daubentonii* flying along the western edge of the riparian scrub, small numbers only;
- Natterer's Bats *Myotis nattereri* flying along the western edge of the riparian scrub, small numbers only.

The occurrence of the rarer *Myotis* bats is of greatest level of importance and suggest dark corridors that these light-sensitive species can navigate safely across the landscape. These bats were not feeding in the area but were regularly passing through. The timing of the surveys did not suggest a roost nearby. There are no known roosts within 2km.

5.3.1.8. Breeding Birds

All birds and their nests are protected under the Wildlife Act. There is potential for a range of common passerine bird species (e.g. Goldfinch, Linnet, Starling) to occur within the proposed development site and there may be nesting opportunities in vegetation within the site. It is less probable that bird species associated with coastal or wetland habitats would occur within the proposed development site, as vegetated areas appear rank and unsuitable for feeding grounds for wintering birds.

Due to the time of year of the surveys (August) signs of breeding would have been diminished and therefore no dedicated breeding bird surveys were undertaken.

The areas of highest value for breeding birds in the overall area includes the planted trees at Kilbogget Park.

Table 5-2 lists the species that were recorded during the surveys and describes their conservation significance. There were no Birds Directive Annex I species recorded within the site. None of these species are regarded to higher than locally important and have been recorded across the SDZ. House Martin and Meadow Pipit are all listed as Priority Species in the DLRCC Biodiversity Plan but occurred in singles during the surveys.

Table 5-2 Birds recorded within the study area

Table 5.2 Birds recorded within the study area			
Species	Conservation Importance		
	Annex I	BoCCI Status (Green/Amber/ Red)	LBPS[1]
Blackbird *Turdus merula*	No		No
Dunnock *Prunella modularis*	No		No
Hooded Crow *Corvus cornix*	No		No
Great tit *Parus major*	No		No
Long-tailed tit *Aegithalos caudatus*	No		No
Collared Dove *Streptopelia decaocto*	No		No
Magpie *Pica pica*	No		No
Meadow Pipit	No		Yes
Swallow *Hirunda rustica*	No		No
House Martin *Delichon urbicum*	No		
Wood Pigeon *Columba palumbus*	No		No
Wren *Troglodytes troglodytes*	No		No

5.3.1.9. Reptiles

Viviparous lizards *Lacerta vivipara* can be found in grassland, hedgerows, sea walls, and rail and road embankments. Highest densities of the lizard tend to be found in damp or wet areas where abundant grass tussocks are present to provide food, shelter, basking and hibernation site (Edgar *et al*., 2010). Potential for occurrence within the proposed development site is only likely in areas of rough grassland near Silver Slopes, which was mostly outside the proposed development area.

5.3.2. Limitations

Field surveys were conducted during the optimal survey periods except for surveys to detect breeding birds as field surveys in August would not have been able to detect breeding territories. It was assumed that all significant woody vegetation cover or rank grassland within the study area has the potential to support breeding birds during the breeding bird season.

All other surveys were undertaken to an appropriate level of survey effort given the nature of the site and the proposed development.

5.4. Ecological Evaluation and Impact Assessment methodology

5.4.1. Site Evaluation and Impact Assessment Criteria

The criteria used to assess the ecological value and significance of the development site follows the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009) and the *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal* (CIEEM, 2016). A combination of both approaches is regarded as good practice for a development application of this type.

In accordance with NRA guidelines (2009), impact assessment was only undertaken of "sensitive ecological receptors"[3]. These were features within the zone of influence of the development which were "both of sufficient value to be material in decision making and likely to be affected significantly" (NRA, 2009). Features qualifying as sensitive ecological receptors must as a minimum meet the ecological valuation criteria of "Local Importance (Higher Value)" or higher as per the NRA value criteria. Features of lower ecological value are excluded from impact assessment.

Table 5-3 Maximum level of impact significance for Sensitive Ecological Receptors

Table 5.3 Maximum level of impact significance for Sensitive Ecological Receptors	
Sensitive Ecological Receptor 'value' rating	**Highest possible significance level**
International Importance	Significant Positive/ Negative impact at International level
National Importance	Significant Positive/ Negative impact at National level
County Importance	Significant Positive/ Negative impact at County level
Local Importance (higher value)	Significant Positive/ Negative impact at Local level

[3] Termed "key ecological receptors" in NRA guidelines (2009).

5.4.2. Summary of Ecological Evaluation

Table 5-4 provides an ecological evaluation of all identified Sensitive Ecological Receptors. Sensitive Ecological Receptors have been identified as at risk of potentially significant impacts via a source-pathway-receptor link. Impact significance here is defined as producing a change in conservation status at a specified geographic level in line with NRA guidance. SER's are valued as Local (high) or above as per the criteria set out in Appendix 5.2, which takes into consideration legal protection, conservation status and local abundance of ecological features.

Table 5-4 Ecological Evaluation of Sensitive Ecological Receptors

Table 5.4 Ecological Evaluation of Sensitive Ecological Receptors		
Habitat / Species	**Highest Ecological Valuation Level**	**Sensitive Ecological Receptor?**
Designated Sites		
Rockabill to Dalkey Island SAC	International	No
Dalkey Islands SPA	International	No
Protected Species		
Bats	Local (higher) importance	Yes
Badgers (unconfirmed but likely)	Local(higher) importance	No
Breeding birds	Local (higher) importance	Yes
Reptiles	Local (higher) importance	No
Habitats		
Scattered trees and Parkland	Local (lower) importance	No
Buildings and Artificial Surfaces	Local (lower) importance	No
Stone Walls and other Stonework	Local (lower) importance	No
Immature Woodland	Local (lower) importance	No
Mixed Broadleaved Woodland	Local (higher) importance	No (not likely to be affected)
Amenity Grassland	Local (lower) importance	No

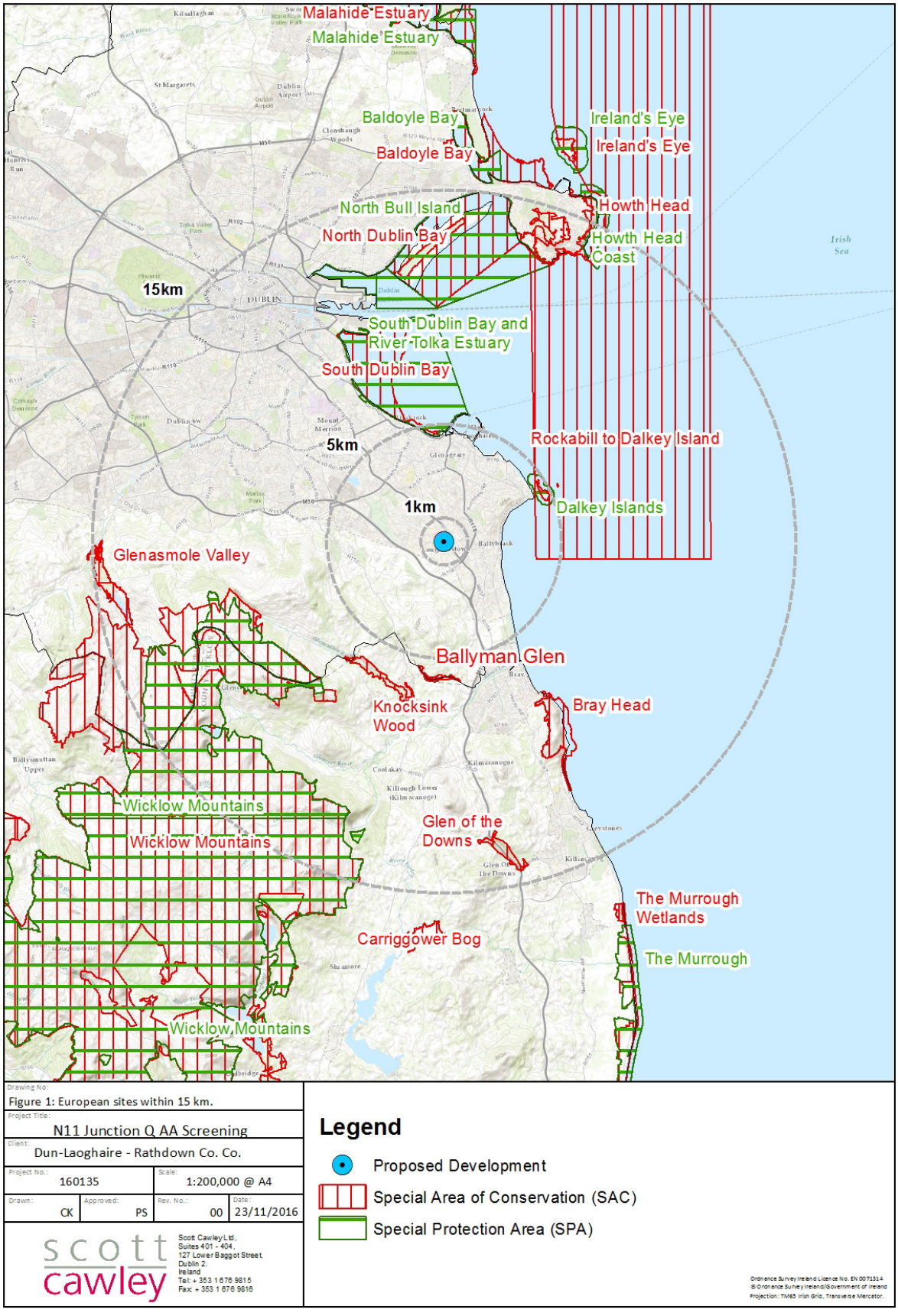

Figure 5-1 All European sites within 15km of the site

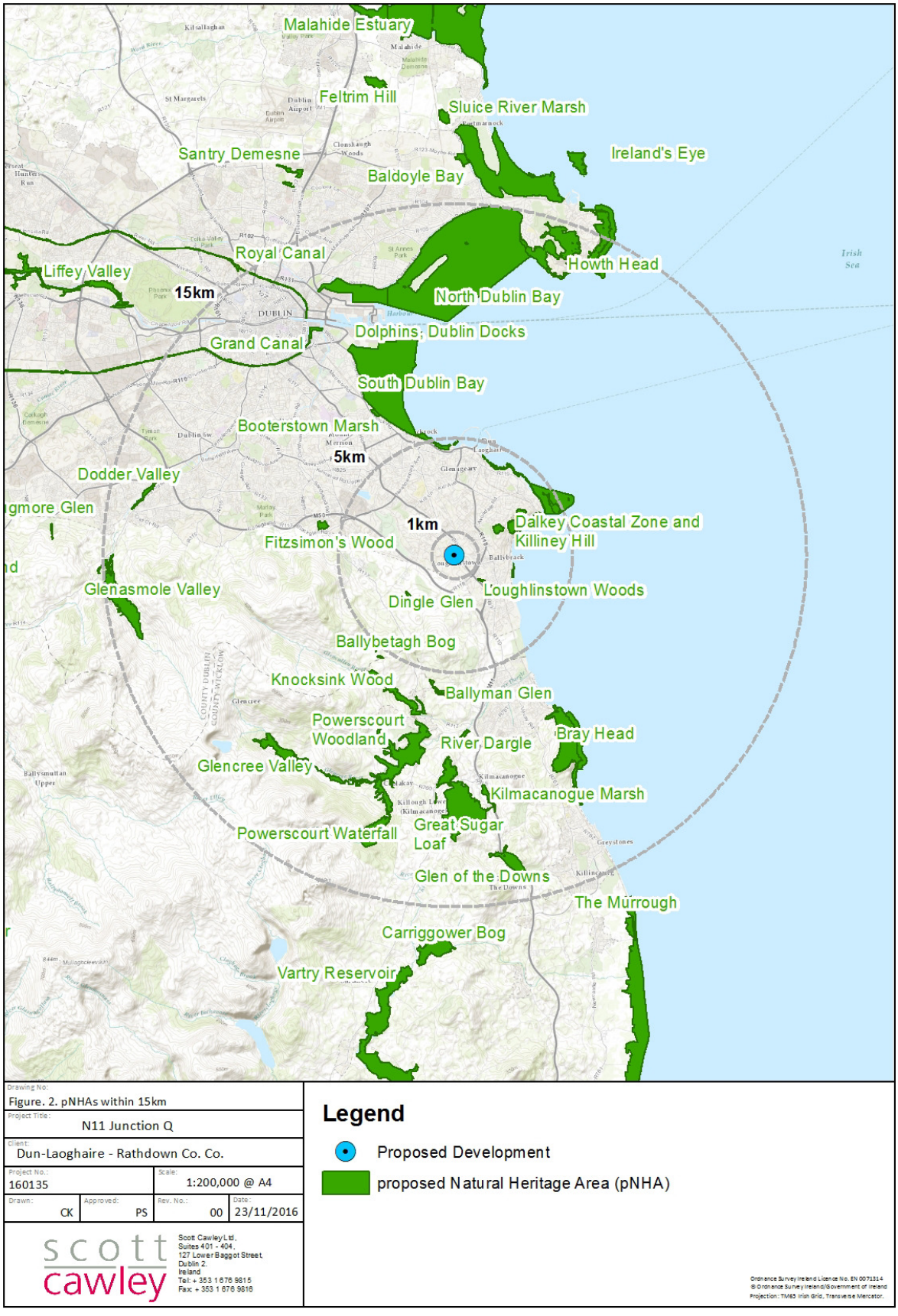

Figure 5-2 Proposed Natural Heritage Areas

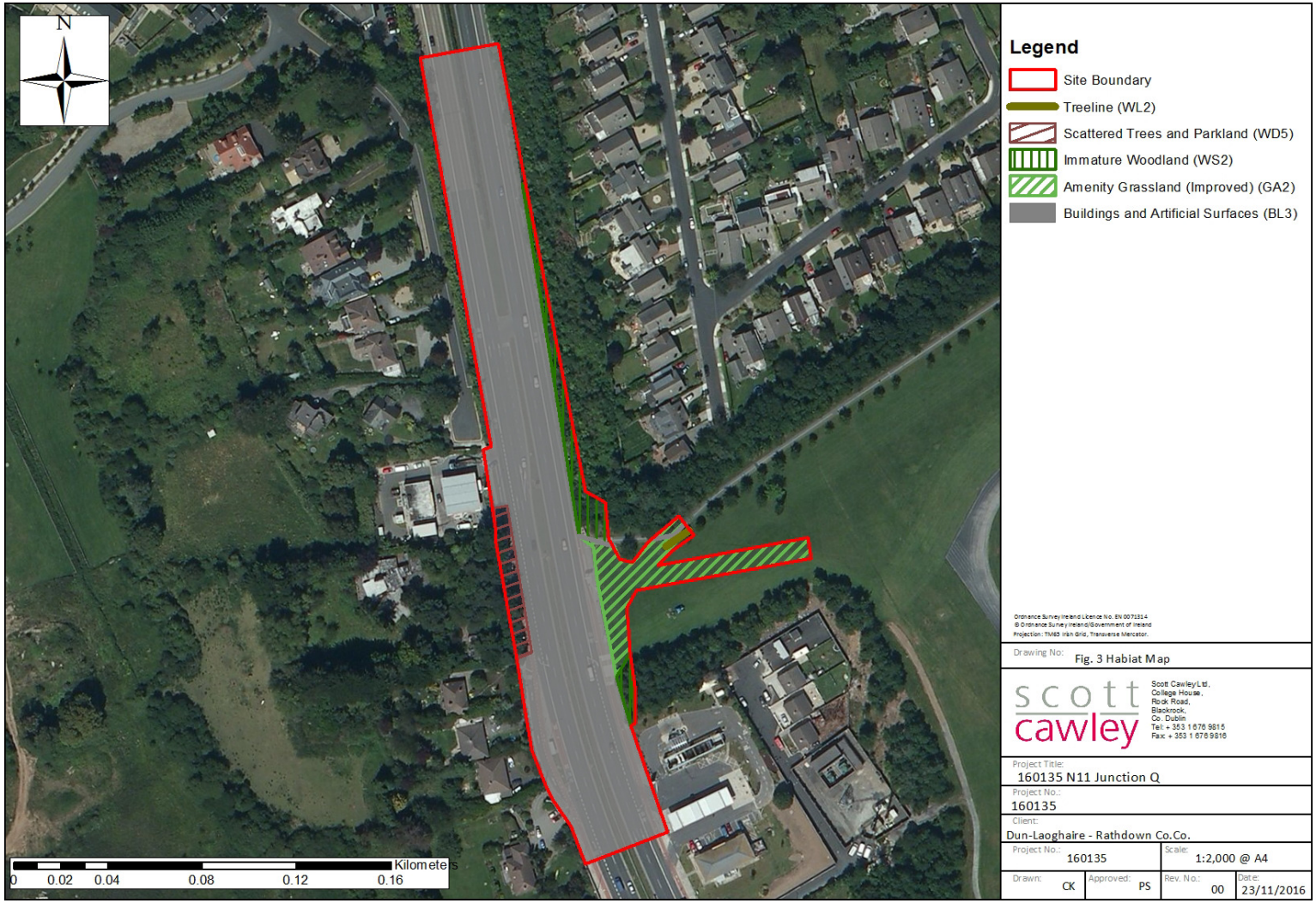

Figure 5-3 Habitat Map

5.5. Impacts and Mitigation

5.5.1. Construction Impacts

5.5.1.1. Habitat Loss/Disturbance

No habitats that are considered Sensitive Ecological Receptors are present within or adjacent to the development site. Features of ecological importance have been avoided by the proposed design or are not valued high enough to warrant consideration:

5.5.1.2. Loss of refuges for bats

M1: Loss of trees that may contain bats will be addressed by carrying out pre-felling checks of all such trees to determine if bats are present. Bat roosts and bat in trees may not be harmed or removed without a derogation licence in place. It is proposed to offset the loss of any potential of confirmed roosts by providing two bat boxes per tree being removed which has potential or confirmed bat roost. Boxes will be of the Schwegler type 1FD: -

http://www.schwegler-natur.de/index.php?main=produkte&sub=fledermaus&psub=sommerquartiere&pcontent=fledermaushoehle-1fd

5.5.1.3. Bats: Potential effects of temporary construction lighting

Construction will require removal of trees around Silver Slope, some of which are deemed to be of use for bats. Temporary and localized increases in the night-time lighting of the site, including facilitating working in winter or security lighting at site compounds and human presence/disturbance during the construction period has the potential to adversely impact on bats feeding and commuting through the area. The potential impact is considered to be a temporary impact at the local level.

M2: Any temporary external lighting proposed for construction on the site should therefore be sensitive to the presence of bats in the area. Lighting of the site during construction will be designed in accordance with the following guidance: -

- Guidance Notes for the Reduction of Obtrusive Light GN01 (Institute of Lighting Professionals, 2011);
- Bats & Lighting - Guidance Notes for Planners, Engineers, Architects and Developers (Bat Conservation Ireland, December 2010);
- Bats and Lighting in the UK – Bats and the Built Environment Series (Bat Conservation Trust UK, January 2008).

5.5.1.4. Breeding Birds: Potential physical disturbance/displacement

All birds and their nests are protected under the Wildlife Acts. Scrub and hedgerow clearance and tree cutting/removal during the breeding bird season (i.e. from the 1st March to the 31st August) could potentially result in negative impacts to local breeding bird populations. However, outside of this period, the loss of potential nesting habitat would result in a short-term, significant impact at the local level. During the breeding season noise, vibration, increased human presence and movement of construction vehicles associated with the construction phase of the proposed development has the potential to result in a disturbance impact to local breeding bird populations. This could result in reduced breeding success of birds in habitats adjacent to the construction zone. The impact of construction related disturbance on breeding birds in the construction zone is considered to be a short-term, significant impact at the local level.

M3: To limit the potential impact of construction on breeding birds, vegetation removal will be restricted to non-breeding season (beginning of September to the end of February). Where this seasonal restriction cannot be accommodated, a qualified ecologist will be required to check vegetation for nests (under license from NPWS to permit potential disturbance to nesting birds) prior to clearance. Clearance works must be suspended until repeat checks have been completed if a delay occurs between survey completion and site clearance. In some cases it may be necessary to construct exclusion areas around nest sites to prevent disturbance.

5.5.2. Operational Impacts

5.5.2.1. Potential disturbance and severance

Disturbance to breeding birds as a result of the change of use is regarded to be of local-scale significance. It has been minimised as far as possible by ensuring that all retained hedgerow and wall habitats are protected with a buffer zone that will be left to grow taller and more-tussocky in appearance to dissuade access. Scrub will be controlled in the buffer zone to prevent over-colonisation.

5.5.2.2. Bats

Increased lighting and increased human presence/disturbance during use of the junction could impact on bat feeding and commuting habitat. It is generally accepted that Leisler's bat are less vulnerable to light avoidance than other bat species which may avoid even low levels of illumination. There is a potential adverse effect on the bat foraging behaviour which would be significant at the local level.

M4: Any external lighting to be installed in the vicinity of the junciton should therefore be sensitive to the presence of bats in the area. Lighting of the junction has been designed in accordance with the following guidance: -

- Guidance Notes for the Reduction of Obtrusive Light GN01 (Institute of Lighting Professionals, 2011);
- Bats & Lighting - Guidance Notes for Planners, Engineers, Architects and Developers (Bat Conservation Ireland, December 2010);
- Bats and Lighting in the UK – Bats and the Built Environment Series (Bat Conservation Trust UK, January 2008).

The proposed lighting design has been reviewed, taking into account the guidelines highlighted above.

5.5.3. Cumulative Impacts

Good practice in Ecological Impact Assessment requires the consideration of not only the impacts of the proposed development in isolation but also the consideration of how the impacts (no matter how small) may combine with other pressures on ecological features to produce a significant cumulative impact. Since most of the proposed impacts from the proposal have been shown to be capable of being addressed by mitigation measures, it is not expected that there will be a high risk of cumulative impacts.

5.5.4. Residual Impacts

Potential significant adverse impacts include loss of hedgerow and scrub habitats, disturbance of mammals and breeding birds and lighting impacts on the surrounding habitats. Mitigation measures have been proposed to address all significant adverse effects and incorporate habitat protection, restoration and creation measures. When assumed to be successfully applied these impacts are deemed to be significant but only at the scale of the site itself.

Appendix 5.1 describes how the ecology-related Planning Scheme Objectives have been complied with.

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6. Landscape and Visual

6.1. Introduction

The Landscape and Visual Impact Assessment (LVIA) was carried out by Cunnane Stratton Reynolds, informed by a desktop study and survey of the site and receiving environment carried out on 15th August 2016.

In this chapter the potential effects of the proposed development, N11 Junction Q, on the landscape character and on views and visual amenity in the receiving environment are discussed.

The LVIA has been informed by the following documents: -

- Landscape Institute Guidelines for Landscape and Visual Impact Assessment 3rd Edition, 2013 (hereafter referred to as the GLVIA);
- The Department of Environment, Heritage and Local Government Consultation Draft of Guidelines for Landscape and Landscape Assessment, 2000;
- The Dún Laoghaire-Rathdown County Development Plan 2016 – 2022;
- The Cherrywood Strategic Development Zone Planning Scheme;
- The Dún Laoghaire-Rathdown Landscape Character Assessment;
- The National Roads Authority Guide to Landscape Treatments for National Road Schemes.

The format of this chapter is as follows: -

- Section 6.2: The methodology used for the LVIA is explained;
- Section 6.3: The existing environment is described. This section includes an identification of relevant policy contained in the Dún Laoghaire-Rathdown County Development Plan (CDP), the Cherrywood Strategic Development Zone Planning Scheme (CPS) and the Dún Laoghaire-Rathdown Landscape Character Assessment (LCA);
- Section 6.4: The proposed development is described. The description includes a summary of the proposed landscape mitigation plan which has been prepared in parallel with the LVIA, informed by consideration of the potential impacts;
- Section 6.5: The potential impacts of the proposed development are assessed. The assessment addresses the potential landscape effects and potential visual effects separately as required by the GLVIA;
- Section 6.6: Conclusions are drawn as to the significance of the predicted landscape and visual effects and the appropriateness of the proposed development in light of the assessment.

6.2. Methodology

The methodology is derived from the GLVIA. A key distinction to make in LVIA is that between the landscape effects and the visual effects of the proposed development.

6.2.1. Assessment of Both Landscape and Visual Impacts

'Landscape' results from the interplay between the physical, natural and cultural components of our surroundings. Different combinations of these elements and their spatial distribution create distinctive character of landscape in different places. 'Landscape character assessment' is the method used in LVIA to describe landscape and by which to understand the potential effects of a development on the landscape as 'a resource'. Character is not just about the physical elements and features that make up a landscape, but also embraces the aesthetic, perceptual and experiential aspects of landscape that make a place distinctive.

Views and 'visual amenity' refer to the interrelationship between people and the landscape. The GLVIA prescribes that this subject should be assessed separately from landscape, although the two topics are inherently linked. Visual assessment is concerned with changes that arise in the composition of available views, the response of people to these changes and the overall effects on the area's visual amenity.

6.2.2. Methodology of Landscape Impact Assessment

In Section 6.5.1 the potential landscape effects of the proposed development are assessed. The nature and scale of changes to key landscape elements and characteristics are identified and the consequential effect

on landscape character and value are discussed. Existing trends of change in the landscape are also taken into account.

The assessment of significance of the effects takes account of (1) the sensitivity of the landscape resource, and (2) the magnitude of change to the landscape which would result from the proposed development.

6.2.2.1. Sensitivity of the Landscape Resource

The sensitivity of the landscape is a function of its land use, landscape patterns and scale, visual enclosure and the distribution of visual receptors, and the value placed on the landscape. Landscape sensitivity is classified as: -

- High (exhibits a very strong positive character with valued elements and characteristics that combine to give an experience of unity, richness and harmony, therefore particularly sensitive to change in general);
- Medium (exhibits positive character but has evidence of alteration to/degradation/erosion of elements and characteristics resulting in an area of mixed character, therefore potentially sensitive to change in general); or
- Low (exhibits generally negative character with few valued elements or characteristics).

6.2.2.2. Magnitude of the Landscape Change

The magnitude of change to be imposed on the landscape by the proposed development is classified as: -

- High (total loss of or major alteration to the key elements or characteristics of the landscape, and/or introduction of elements considered totally uncharacteristic in the context of the receiving environment's landscape character);
- Medium (partial loss of or alteration to one or more key elements or features, and/or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic in the context of the receiving environment);
- Low (minor loss of or alteration to one or more key elements or characteristics, and/or introduction of elements that may not be uncharacteristic in the context), or
- Negligible (very minor loss, alteration or introduction of elements of the landscape).

6.2.2.3. Significance of the Landscape Effects

For landscape (and visual amenity) in order to classify the significance of the effects, the predicted magnitude of change is measured against the sensitivity of the landscape (or view) using the following guide in Figure 6-1. Significance of effects is classified as high, medium or low.

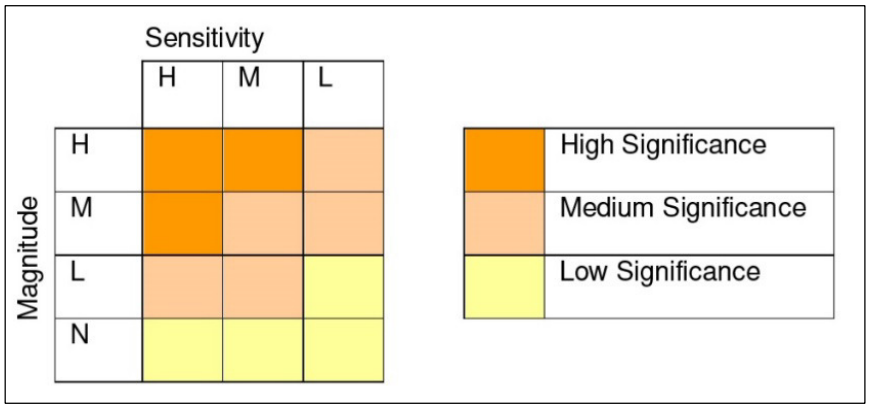

Figure 6-1 Guidance on Classification of Significance of Landscape/Visual Effects

The predicted effect is also classified as beneficial, neutral or adverse based on an evaluation of the likely impact on identified landscape values. This is not an absolute exercise; it is a professional judgement informed by the process of landscape character assessment particularly landscape values assessment (informed by the DoEHLG Consultation Draft of Guidelines for Landscape and Landscape Character Assessment 2000) and also taking into account relevant planning policy.

6.2.3. Methodology of Visual Impact Assessment

In Section 6.5.2 the potential visual effects of the proposed development are assessed. Visual assessment considers the potential changes to the composition of views, the character of the views and the visual amenity experienced by visual receptors.

The assessment is made for a number of viewpoints selected to represent the likely visual receptors in the receiving environment. For each viewpoint the significance of potential visual effects is classified based on measurement of the viewpoint sensitivity against the magnitude of change which would result from the proposed development.

6.2.3.1. Sensitivity of the Viewpoint/Visual Receptor

Viewpoint sensitivity is a function of the location and context of the viewpoint, the expectations and occupation/activity of the visual receptor and the importance (or value) of the view. Viewpoint sensitivity is classified as: -

- High (e.g. users of outdoor recreation facilities or centres of activity focused on the landscape, and occupiers of residential properties with views affected by the development);
- Medium (e.g. people travelling through or past the affected landscape in cars or on public transport, i.e. viewing but not focused on the landscape), or
- Low (e.g. people at their place of work or engaged in similar activities such as shopping, etc., whose attention will be focused on these activities).

6.2.3.2. Magnitude of Change to the View

Classification of the magnitude of change to the field of view (towards the site i.e. N11 Druids Glen Road Q-P3) takes into account issues such as the extent of the view that would be occupied by the intrusion, the proportion of the proposed development or particular features that would be visible, features or aspects of the view which might be obscured by the intrusion and whether the view of the proposed development would be static or a sequence or transient (as seen from a moving vehicle). The magnitude of change to each view is classified as: -

- High (total loss of or major alteration to the key elements or characteristics of the view, and/or introduction of elements considered totally uncharacteristic in the context of the view);
- Medium (partial loss of or alteration to one or more key elements or features, and/or introduction of elements that may be prominent but may not necessarily be considered to be substantially uncharacteristic in the context of the view);
- Low (minor loss of or alteration to one or more key elements or characteristics, and/or introduction of elements that may not be uncharacteristic in the context), or
- Negligible (very minor loss, alteration or introduction of elements of the view).

6.2.3.3. Significance of Visual Effects

As for landscape effects, in order to classify the significance of the visual effects the predicted magnitude of change to the view is measured against the sensitivity of the viewpoint/visual receptor. Significance of effects is classified as high, medium or low.

The effect is also classified as beneficial, neutral or adverse. This is an inherently subjective exercise. Visual receptors' attitudes to development of a certain type will vary and this will influence their perception of the effects of the proposed development as beneficial, neutral or adverse. However, a professional judgement is made, informed by a range of factors including existing landscape and visual character, policy for the affected area, the aesthetics of the proposed development relative to the context and the landscape architect's professional experience.

6.3. Existing Environment

The site is situated along the N11 National Primary Route in Cabinteely, south County Dublin between the Johnstown Road and the Wyatville Road junctions. The site includes a stretch of the N11 north and south of the proposed junction, where a rearrangement of the lanes and pavements would be required on the approaches to the junction. It also includes the western edge of Kilbogget Park which lies to the east of the N11.

Located adjacent to the site within the corridor of the future Druids Glen Road is a single residential property (known as '*Silver Slope*') which fronts onto the N11.

The site is largely situated on the existing N11 National Primary Route and is adjacent to and partly within the Cherrywood Strategic Development Zone Planning Scheme Boundary (SDZ). Refer to Figure 6-2 below for site extents.

Figure 6-2 Aerial photograph showing approximate site extent (Source: ESRI)

6.3.1. Development Policy Context

6.3.1.1. Dún Laoghaire-Rathdown County Development Plan 2016-2022

The site lies within the jurisdiction of Dún Laoghaire-Rathdown County Council. Chapter 1 of the Dún Laoghaire-Rathdown County Development Plan 2016-2022 (CDP) sets out the strategic objectives of the CDP. The CDP identifies the Cherrywood Strategic Development Zone (SDZ) as one of the 'primary growth nodes from which a significant portion of the supply of residential units will derive up to the 2022 horizon'. The CDP notes that the SDZ designation of Cherrywood indicates the area's economic or social importance to the State, and confirms that the designation is 'primarily to facilitate development'. This has significant implications for the existing landscape and associated visual amenity in the Cherrywood area.

The proposed junction lies partly within the Cherrywood SDZ, for which a Planning Scheme (the CPS) was adopted by An Bord Pleanála in April 2014. The CDP states in relation to the SDZ (p.21):

'The Planning Scheme provides a strong degree of certainty regarding the phasing and delivery of new development, in tandem with the provision of essential infrastructure to serve and facilitate development'.

The approaches to the proposed junction along the N11, and proposed changes to the western edge and gateway of Kilbogget Park, fall immediately outside of the SDZ.

6.3.1.2. CDP Sustainable Travel and Transportation Policies

Chapter 2 of the CDP includes sustainable travel and transportation policies. Sustainable travel and transportation is fundamental to the development of sustainable communities and is unavoidably tied to the landscape.

Policy ST5: Walking and Cycling

'It is Council Policy to secure the development of a high quality walking and cycling network across the County in accordance with relevant Council and National policy and guidelines.'

Policy ST6: Footways and Pedestrian Routes

'The Council will continue to maintain and expand the footway and pedestrian route network to provide for accessible pedestrian routes within the County in accordance with best accessibility practice.'

Policy ST7: County Cycle Network

'It is Council policy to secure improvements to the County Cycle Network in accordance with the Dún Laoghaire-Rathdown Cycle Network Review whilst supporting the NTA on the development and implementation of the Cycle Network Plan for the Greater Dublin Area'.

The proposed development includes provision for dedicated cycle lanes which link the Cherrywood SDZ to the N11 radial cycle route - Section 4 Johnstown Road to Wyattville Road.

Policy ST9: Directional/Information/Waymarking Signage

It is Council policy to provide directional signage for amenities, tourist attractions and local attractions and along cycle and pedestrian routes (waymarking) at appropriate locations throughout the County in accordance with planning and traffic regulations.

Policy ST10: Street Lighting

It is Council policy to provide and maintain street lighting on the public road/footway/cycleways throughout the County in accordance with commonly accepted best practice.

6.3.1.3. CDP Green County Strategy

Chapter 4 of the CDP includes landscape, heritage and biodiversity policies within its Green County Strategy. The policies are essential for the promotion and development of a coherent and integrated green infrastructure network across Dún Laoghaire-Rathdown.

Policy LHB2: Preservation of Landscape Character Areas

'It is Council policy to continue to preserve and enhance the character of the County's landscapes in accordance with the recommended strategies as originally outlined in the Landscape Character Assessment (2002 and since updated)…'

The county Landscape Character Assessment is discussed in 6.3.1.3 below.

Policy LHB6: Views and Prospects

'It is Council policy to protect and encourage the enjoyment of views and prospects of special amenity value or special interests.'

There are no protected views or prospects in the vicinity of the site or potentially affected by the proposed development.

Policy LHB19: Protection of Natural Heritage and the Environment

'It is Council policy to protect and conserve the environment including, in particular, the natural heritage of the County and to conserve and manage Nationally and Internationally important and EU designated sites - such as Special Protection Areas, candidate Special Areas of Conservation, proposed Natural Heritage Areas and Ramsar sites - as well as non-designated areas of high nature conservation value which serve as 'Stepping Stones' for the purposes of Article 10 of the Habitats Directive.

'Implementation of this policy will involve: Retention of trees, hedgerows and woodlands wherever practical.'

Policy LHB24 of the CDP states that it is the policy of the County Council to develop a Dún Laoghaire-Rathdown Ecological Network (see Figure 6-3 below for extract of CDP Map B1, Ecological Network Map). Kilbogget Park to the east of the N11 is part of this network, as is the Druid's Glen to the west and south of the site.

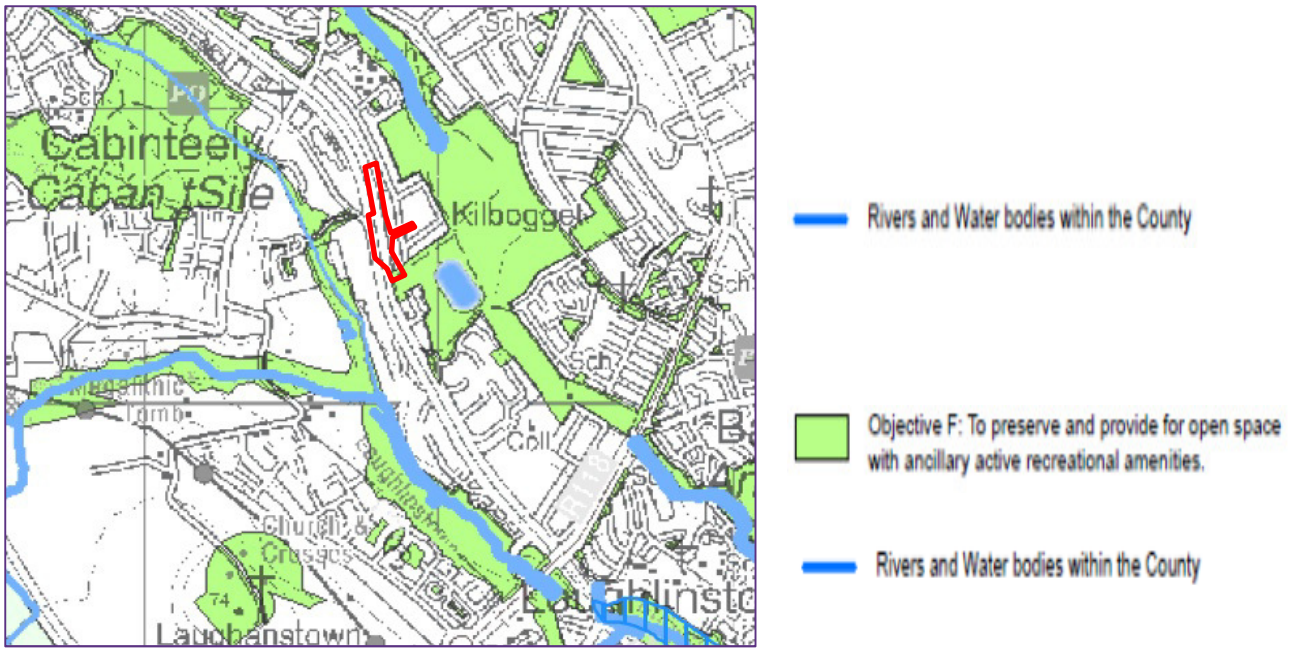

Figure 6-3 Dun Laoghaire-Rathdown County Development Plan 2016-2022, Map B1 "Ecological Network Map"

6.3.1.4. Cherrywood Strategic Development Zone Planning Scheme

Chapter 9 of the CDP has a specific objective to implement and develop lands at Cherrywood in accordance with the approved Strategic Development Zone Planning Scheme. The Cherrywood Strategic Development Zone Planning Scheme (CPS) provides the Council with a mechanism to guide the development of the Cherrywood area.

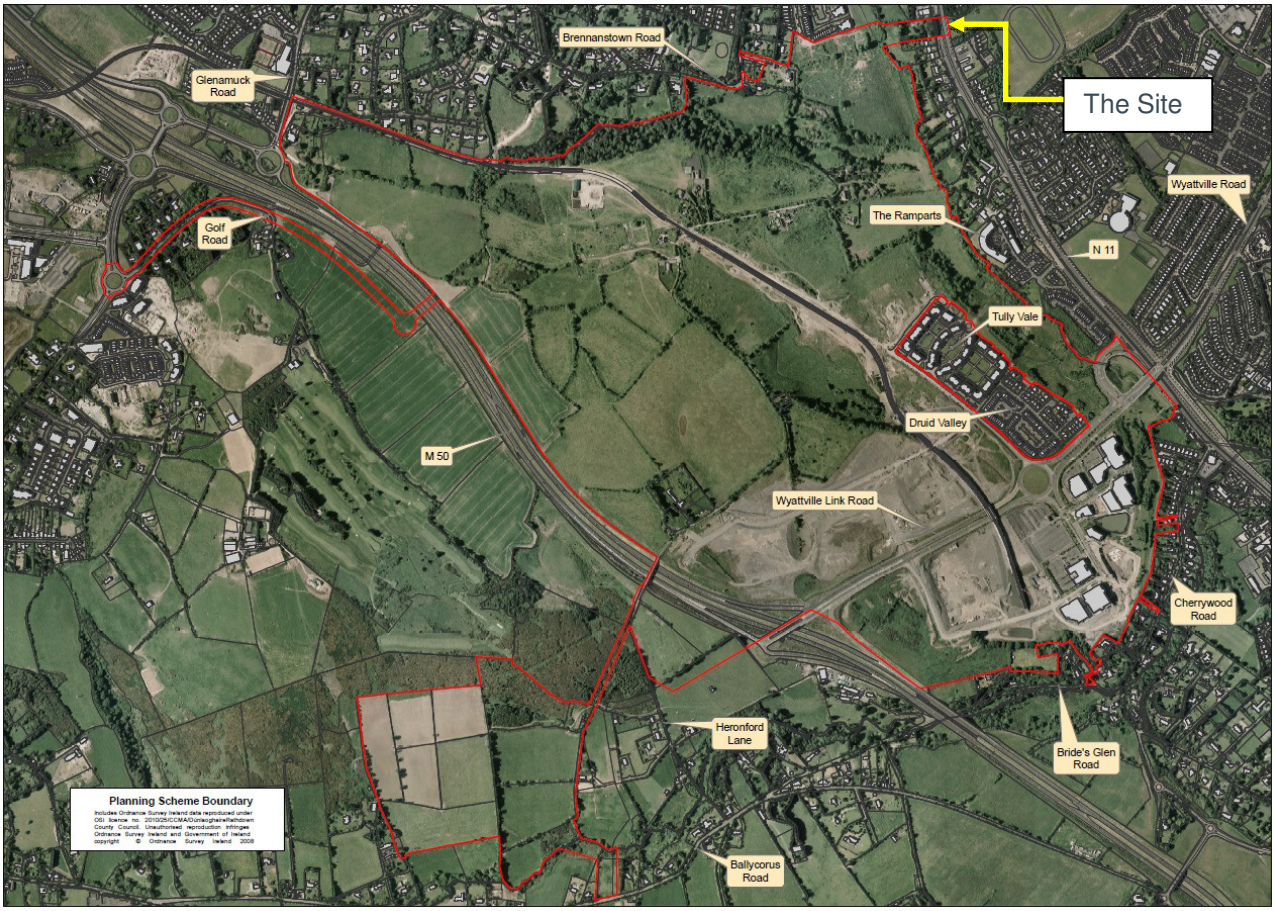

Figure 6-4 Cherrywood Strategic Development Zone Planning Scheme boundary.

The site lies on the north-eastern most edge of the SDZ (refer to Figure 6-4 above) occupying a strategic location providing a connection to the N11.

Chapter 2 of the CPS sets out the nature, type and extent of development that will be permitted in the Planning Scheme Area (refer Figure 6-5 below).

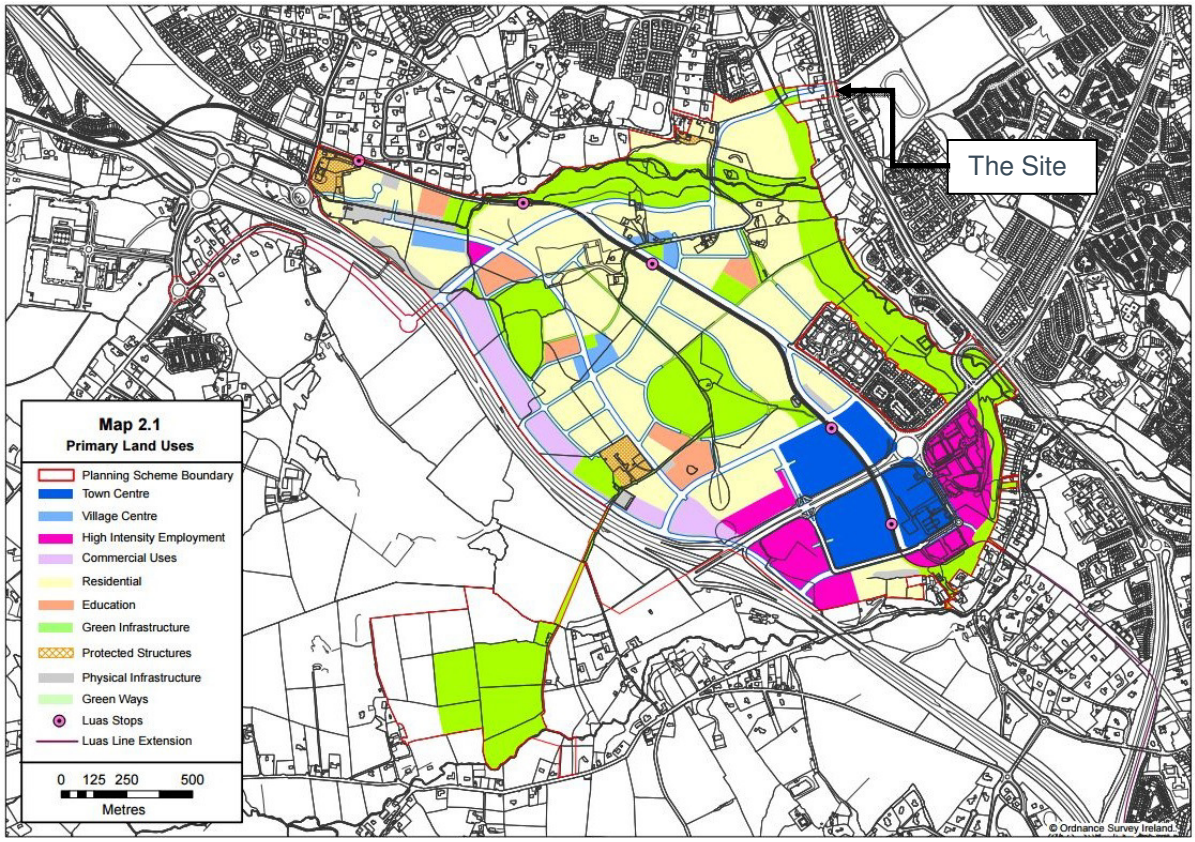

Figure 6-5 Cherrywood Strategic Planning Zone Map 2.1 Primary Land Uses

The proposed development, N11 Junction Q, is identified as a piece of the Physical Infrastructure required to serve the SDZ lands (refer to CPS Map 4.5, Figure 6-7 below).

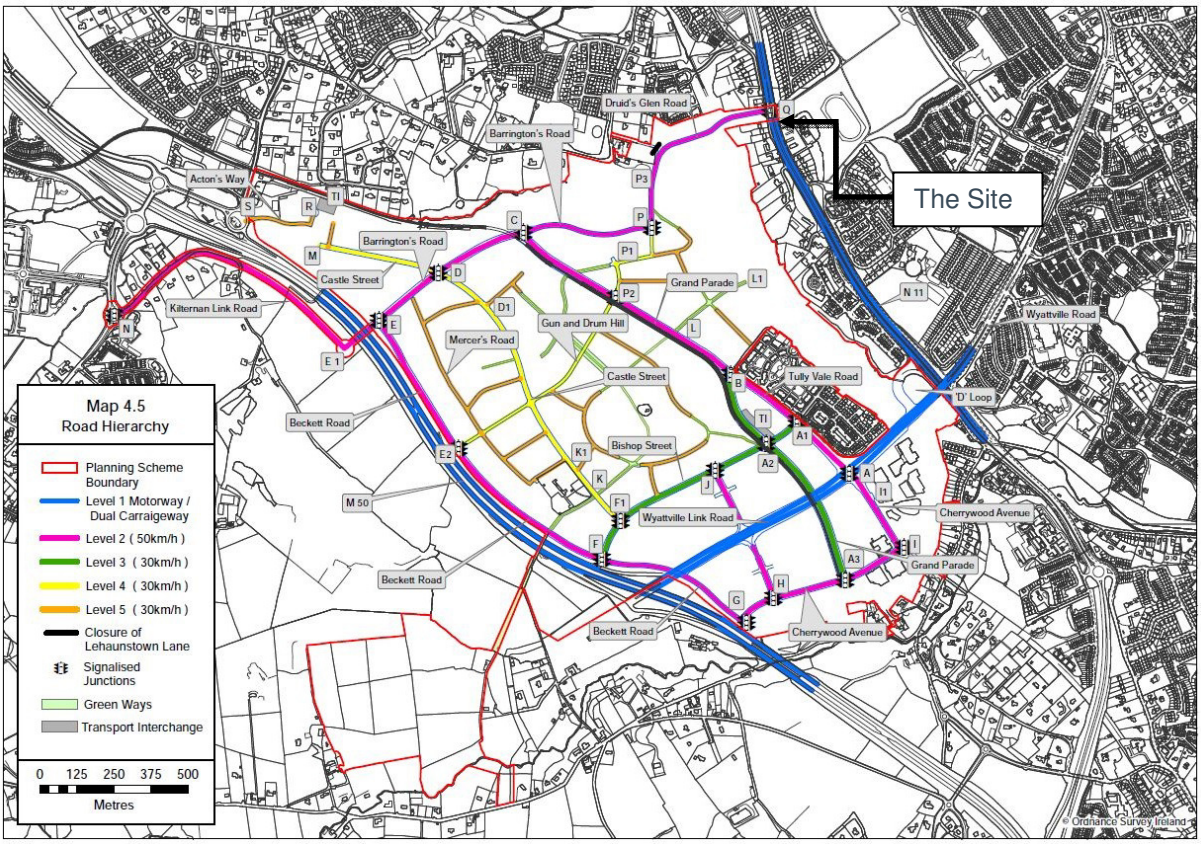

Figure 6-6 Cherrywood Strategic Development Zone 2016-2022, Map 4.5 'Road Hierarchy'

The proposed development, N11 Junction Q, will link the N11 to the internal road network serving the Cherrywood SDZ and facilitate access to Development Area 5 of the SDZ (refer to CPS Map 6.5, Figure 6-7 below). This area is zoned for residential development.

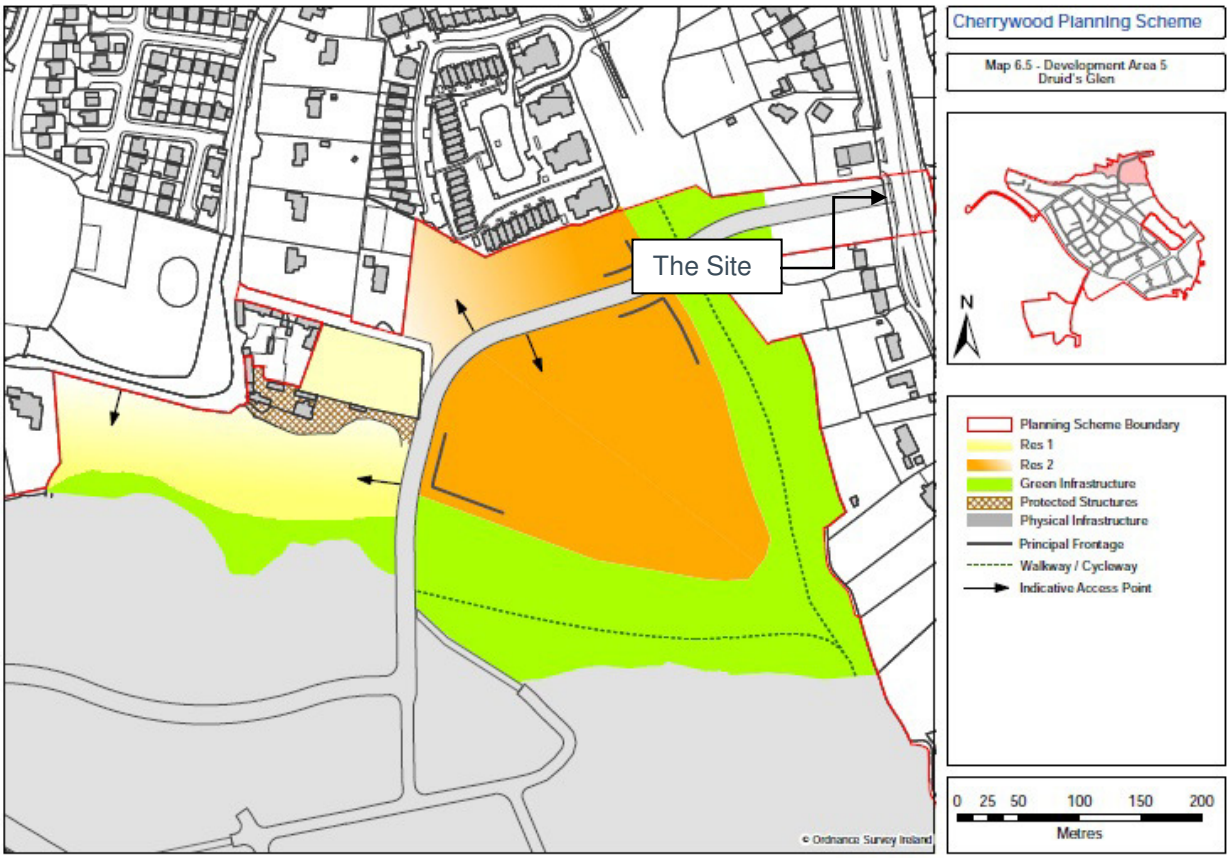

Figure 6-7 Cherrywood Planning Scheme Map 6.5 - Development Area 5 Druid's Glen

6.3.1.5. Heritage

Chapter 3 of the CPS includes the following specific relevant Heritage objectives for protected structures and lands associated with them:

H 23 '*To require a comprehensive landscaping scheme for each site to include details of trees to be retained, replacement planting where required, and the use of soft boundaries to demarcate/define private open space. Replacement trees where required to be semi-mature native species'.*

6.3.1.6. Dún Laoghaire-Rathdown Landscape Character Assessment

The Dún Laoghaire-Rathdown Landscape Character Assessment contained within Appendix 7 of the CPD identifies the site as lying within an undefined area to the north of Area 14 Cherrywood/Rathmichael (see Figure 6-8 below). The assessment notes that Landscape Character Area 14 '*is undergoing significant change with the introduction of the Luas B1 line and the development of the Cherrywood Science and Technology Park'.*

The '***Sensitivity/Strategy'*** for Area 14 is for development to '*be in accordance with the adopted SDZ scheme'*. Since the site is partly within (and immediately adjacent to) the SDZ, and located in the urban landscape adjacent to Landscape Character Area 14, it can be inferred that its development/management should also support the objectives of the SDZ scheme. None of the protected views or amenity areas identified in the Landscape Character Assessment in the wider landscape would be affected by the proposed development due to their distance from the site and the nature of the proposed development.

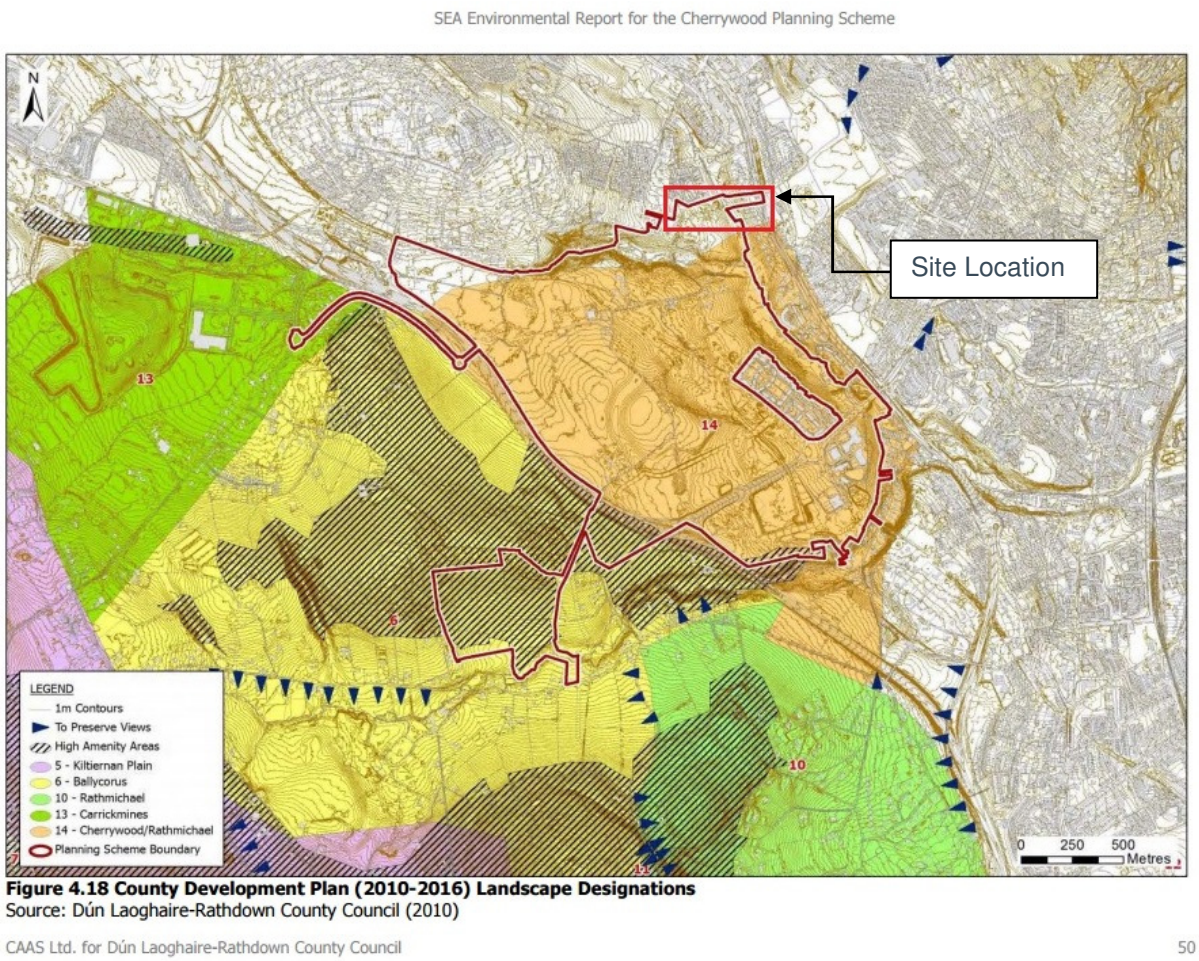

Figure 6-8 Cherrywood Planning Scheme Figure 4.18 County Development Plan (2010-2016) Landscape Designations

6.3.1.7. Landscape Implications of Development Plan Policy

The CPS (the implementation of which is the stated policy of the Dún Laoghaire-Rathdown County Development Plan) identifies the site for the development of a junction to provide access into the north-east area of Cherrywood from the N11. The principle of the proposed development is therefore established and the associated landscape change has been deemed acceptable by the strategic environmental assessment of the CPS.

There are a number of policies within the CDP and CPS which have implications for identifying landscape constraints on the proposed development. These include: -

- Provision of an appropriate level of tree planting for all roads according to specified design principles;
- Provision of management programmes for retained and newly planted trees and other vegetation;
- Use of native species in landscaping proposals allowing for biodiversity conservation and enhancement measures;
- Provision/planting of semi mature native species for replacement trees where required;
- Maximise the visual amenity and ecological value of retained semi-natural habitats;
- Protection of existing trees and hedgerows, where practical;
- Minimisation of significant adverse visual impacts within and adjacent to the Planning Scheme area;
- Protection of all key vistas and views;
- Visual impact assessment for protected structures;
- Where insufficient space for street tree planting is indicated in the road section or adjacent green infrastructure, sufficient space must be provided along the edge of adjacent development plots.

6.3.2. Landscape Characteristics of the Site and Receiving Environment

6.3.2.1. Landscape Context

The site lies predominantly within the N11 National Road corridor, a landscape dominated by road infrastructure. To the west of the proposed junction is *Silver Slope*, a disused residential property. The future Druid's Glen Road will traverse the *Silver Slope* property from the proposed development, N11 Junction Q, giving access to the Cherrywood SDZ lands to the west. To the east across the N11 from the proposed junction is Kilbogget Park.

- The *Silver Slope* former residential site on the western side of the proposed development is densely vegetated. The mature trees on the property include sycamore, alder, hawthorn, ash, cherry laurel, beech, pine and cypress (refer to the Arboricultural Report in Appendix 6.1). These trees are prominent in views from outside the site including the N11, Kilbogget Park and the nearby residential properties including Brennanstown. The proposed development would require the trees along the N11 boundary of *Silver Slope* to be removed;
- To the east of the N11 is Kilbogget Park. The park is comprised of extensive amenity grassland areas, including playing pitches, bordered in places by belts of woodland. Lime and field maple are planted as avenue trees in the park. The proposed development involves a realignment of the park boundary fence to widen the N11 road corridor outside of the park, the construction of a new pedestrian gateway into the park directly across from the proposed junction, and the planting of street trees outside of the new gateway in the N11 road corridor.

Plate 6-1 The mature trees of the *Silver Slope* property at the eastern end of the proposed development as seen from the N11.

Plate 6-2 The western boundary fence of Kilbogget Part opposite *Silver Slope* at the site of the proposed development, the N11 Junction Q.

6.3.2.2. Surrounding Land Use

The land use along the N11 road corridor approaching the site is mixed, and in transition as a result of the Cherrywood SDZ.

Immediately to the north of the site (and *Silver Slope* where the future Druid's Glen Road Q-P3 would meet N11) to the west of the N11 there is a petrol filling station. Beyond that there is a row of detached houses fronting the Old Bray Road, which runs alongside the N11 for a stretch (terminating in a cul-de-sac at the filling station). To the east across the N11 is the Shrewsbury Lawn housing estate, which list to the north of Kilbogget Park. The estate houses present their rear facades towards the N11 (and the site) and are buffered from the N11 by a broad belt of woodland.

Plate 6-3 **A view from Old Bray Road south toward the site. The mature trees on *Silver Slope* are visible behind the filling station.**

To the south of the site (and *Silver Slope*) to the west of the N11 there is a row of detached houses directly fronting the N11. The houses are on large plots sloping away from the N11 into the Cabinteely River Valley to the west. The houses are mostly enclosed by densely vegetated gardens and high boundary walls which limit their visual exposure to the N11 and the surrounding landscape. These houses have been assembled into a site which is the subject of a planning application for mixed density residential development (see DZ16A/0587). To the east of these houses across the N11 there is another petrol filling station.

Plate 6-4 **A view across the N11 showing the row of houses to the south of the site. The mature trees are on *Silver Slope*, where the proposed Druid's Glen Road Q-P3 would meet the N11.**

6.3.3. Summary of Landscape Values and Sensitivity

The site lies within and adjacent to the Cherrywood SDZ, in the N11 National Road corridor. The landscape dominated by the road infrastructure, with few valued elements, features or characteristics. Land use along the N11 corridor is mixed. Residential properties are typically buffered from the busy national road by boundary walls and vegetation. Commercial properties, such as the petrol filling stations, address the road corridor but limit the quality and visual amenity of the immediate environs.

Although there are certain elements in the landscape which have value and generate some visual amenity in their vicinity, notably the mature trees on *Silver Slope* and the open space and vegetation of Kilboogget

Park, the landscape of the receiving environment can be described as being of low sensitivity to change of the nature and scale proposed.

6.4. Characteristics of the Proposed Development

The proposed development i.e. N11 Junction Q comprises a new signalised junction onto the N11 at point Q. The proposed development incorporates raised adjacent cycleways, footpaths and green verges (refer to Drawing Nos. 5139036/HW/0104 and Figure 6-9 below).

Figure 6-9 N11 Junction Q, Proposed General Arrangement

The proposed signalised junction will require the removal of the existing low level boundary wall along the eastern edge of the N11, north and south of the existing entrance into Kilbogget Park, to be set back to facilitate the widening of the existing N11 road corridor. This will require the removal of a single row of young trees along this length. However, there is sufficient depth of tree planting behind the trees to be removed, such that there would not be any significant landscape or visual effect on the row of houses to the east (Shrewsbury Lawn).

In addition to this a new entrance into Kilbogget Park and associated connections to the internal path network within the park forms part of the proposed development. This will require the removal of a group of (c.10 year old trees) two to three deep at the existing entrance to the Park. These proposals would not change the character of the landscape and views from the N11 road or Kilbogget Park (Refer Arboricultural

Report Drawing Number 16420_T_103 in Appendix 6.1) and Landscape Mitigation Plan Drawing Number 16420-2-100 in Appendix 6.2).

A Landscape Mitigation Plan has been prepared in parallel with this LVIA (refer to Drawing no. 16420-2-100). The key elements and objectives of the proposed Landscape Mitigation Plan are as follows: -

- Where possible, retention of existing trees and hedgerows as recommended in the Arboricultural Report and CPS;
- A management plan for retained and newly planted vegetation during its establishment phase and for its protection during the development of adjacent lands;
- Re-use of existing topsoil and sub-soil to allow preservation of native seed bank;
- It is also proposed, as part of the proposed junction onto the N11 to re-develop the existing entrance into Kilbogget Park. This will involve construction of a new park boundary wall and railing and a new park entrance/gateway incorporating improved paving and street trees outside of the proposed park entrance.

6.5. Potential Impacts of the Proposed Development

6.5.1. Landscape Effects

The introduction of a new junction to the N11 National Road corridor would constitute a low magnitude of change. The composition and character of the landscape, being dominated already by road infrastructure, would not be significantly altered. There would be some loss of mature trees on *Silver Slope*, but this disused property including its gardens are no longer of great value in their context. In addition the loss of vegetation from *Silver Slope* would be mitigated by the improved Kilbogget Park gateway directly across the road including new trees inside and outside of the park boundary.

The sensitivity of the receiving environment landscape to development of the nature and scale proposed, is low (refer to 6.3.3 above). Applying the GLVIA guidance (refer to 6.2.2.3 above) the significance of the landscape effects can be classified as low, and the effects would be neutral.

6.5.2. Visual Effects

The assessment of visual effects involves the identification of representative viewpoints in the receiving environment and the assessment of the proposed development's potential effects on the composition and character and quality of the views at those locations.

6.5.2.1. Zone of Visual Influence and Potential Visual Receptors

The proposed development (comprising predominantly ground level elements within an existing built environment) has a limited zone of visual influence. The main groups of potential visual receptors are as follows: -

- **N11 road users.** The largest group of potential visual receptors are the people travelling along the N11. A c.350m length of the N11 is proposed to be upgraded to connect with the future Druid's Glen Road. These changes to the N11 along with the new junction would change the landscape of the existing N11 road corridor along this stretch. The N11 road users are of low sensitivity to change of the nature and scale proposed. Viewpoint 1 was chosen to represent these receptors;
- **The houses fronting onto the N11 to the south of the proposed new junction.** The row of houses south of the junction have been assembled into a development site which was the subject of a recent planning application. Residential properties are usually of high sensitivity to landscape change, but given the context (fronting the N11, adjacent to the Cherrywood SDZ and the subject of a planning application for development relying on the proposed development for the provision of access), their sensitivity is reduced;
- **Users of Kilbogget Park.** To the east of the site across the N11 people using Kilbogget Park would have exposure to the proposed development, particularly on entering and exiting the park. Given the context of the park, at the edge of the N11, these receptors are of medium sensitivity to the proposed change. Viewpoint 2 was chosen to represent these receptors;
- **The row of houses to the north of the site (north of the petrol filling station) along the Old Bray Road**. Most of these houses have no direct view of the site although the mature trees at the Silver Slope property do feature in views from Bray Road itself. Viewpoint 3 represents this view.

Three viewpoints were selected for detailed assessment of potential visual effects. They are as follows, and shown on

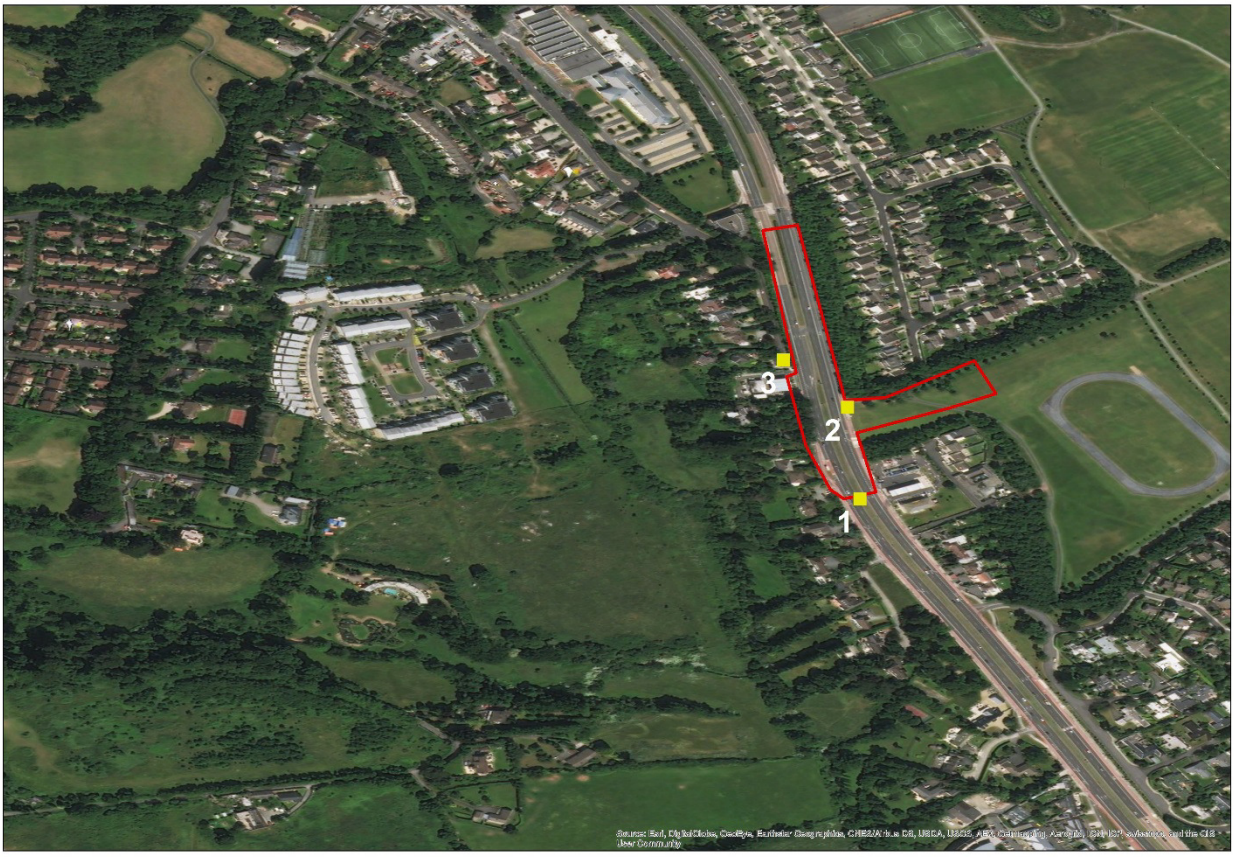

Figure 6-10 below:

- Viewpoint 1: N11 approaching the Druid's Glen Road junction from the south;
- Viewpoint 2: Residential properties/sites fronting the N11 south of the new road junction;
- Viewpoint 3: Bray Road c.50m north of proposed new junction;

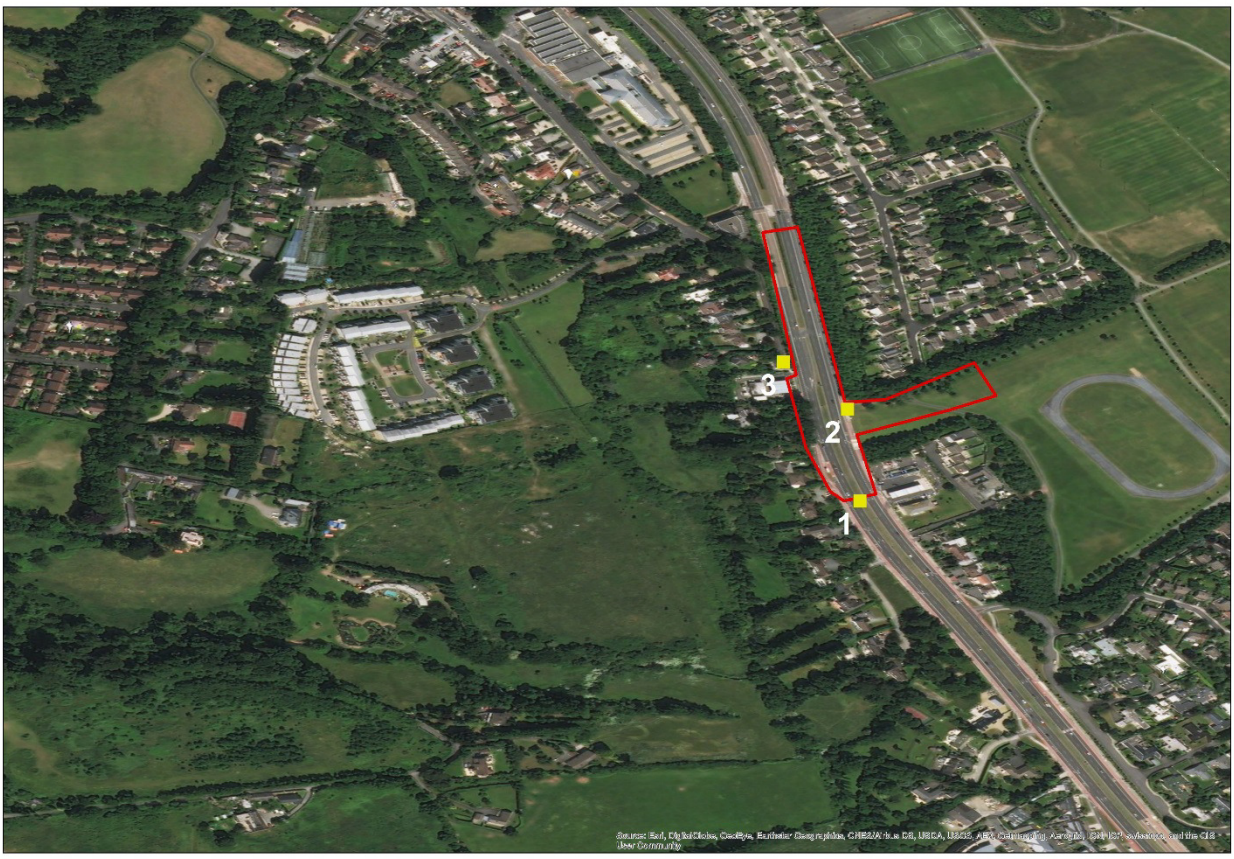

Figure 6-10 Viewpoint locations for visual impact assessment

6.5.2.2. Viewpoint 1: N11 approaching the new road junction from the south

The viewpoint represents the view from the N11 on the approach to the site from the south.

Plate 6-6 The view north from the N11 c.140m south of proposed Druid's Glen Road.

Plate 6-7 The view north from the N11 c.100m south of proposed Druid's Glen Road.

Plate 6-11 A view from the N11 adjacent to the site, looking west.

6.5.2.2.1. Existing view

Views along the N11 are dominated by the road corridor itself including the wide carriageways carrying a high volume of traffic, with cycle paths and footpaths to the side of the road along with lighting and signage. The boundary treatment of properties fronting the road varies and includes tall stone walls, fences, hedgerows and tree lines. Typically, lateral views from the N11 are restricted by walls and vegetation along the roadside. Exceptions include commercial properties fronting the road (including petrol filling stations, of which there are two in close proximity to the site) and where there is open space beside the road, such as Kilbogget Park. The mature trees on the *Silver Slope* property are a feature of the view on the approach to the site. Adjacent to the site however, the poor/neglected condition of the site landscape is apparent.

6.5.2.2.2. Viewpoint sensitivity

Representing the view from a busy dual carriageway in an urban setting, the viewpoint sensitivity is low.

6.5.2.2.3. Proposed change

The proposed development would result in the introduction of the new N11 Junction Q and the re-arrangement of the N11 road corridor on the approach to the new road junction. The proposed development would have an urban street treatment including street trees and associated road infrastructure such as public lighting and road signage. There would be a loss of mature trees from the view but these are not valued features in the context. The change would be visible for only a short stretch of the N11 north and south of the proposed junction. In the context this would amount to a low magnitude of change.

6.5.2.2.4. Significance of visual effects

The significance of the visual effects on users of the N11 would be low. The composition of views from the N11 would be altered in the vicinity of the proposed junction, but the character of the landscape in view from the N11 would not be significantly changed and there would be no reduction in visual amenity experienced along the N11. The effects would be neutral.

6.5.2.3. Viewpoint 2: Kilbogget Park Entrance

As part of the proposed development it is proposed to construct a new boundary wall and entrance to Kilbogget Park. The viewpoint is located on the eastern side of the N11 from the proposed junction, at the entrance to Kilbogget Park.

Plate 6-8 The view west from the entrance to Kilbogget Park (c.30m from the proposed N11 Junction Q).

Plate 6-9 The view west from within Kilbogget Park towards the site (off N11 and c.45m from the proposed N11 Junction Q).

6.5.2.3.1. Existing View

From within the park the view west is of well-maintained amenity grassland with belts of woodland to the left and right. A low stone wall and railing marks the park boundary adjacent to the N11 and across the N11 the mature trees of the *Silver Slope* property are prominent. In the view from the park entrance the existing N11 road corridor (including lighting, signage, etc.) and the passing traffic are the dominant features establishing the character and quality of the view. The trees on the *Silver Slope* property across the N11 are prominent, although the derelict condition of the property is apparent. The neighbouring petrol filling station is also prominent.

6.5.2.3.2. Viewpoint Sensitivity

The viewpoint represents visitors to Kilbogget Park. Ordinarily park users would be highly sensitive to landscape change; however in the context of the park exit onto the N11 and given the character and quality of the view currently the viewpoint sensitivity is considered medium.

6.5.2.3.3. Proposed Change

The proposed development includes a new park boundary wall and railing, curving into the park to form a more distinct gateway defined by four granite pillars and new paving and trees inside and outside of the park boundary. These changes would enhance the view west from within the park and also the views into the park from the N11. In the view west from the new park entrance the N11 road corridor would remain dominant although the loss of trees from *Silver Slope* across the road would be notable. The magnitude of change would be low.

6.5.2.3.4. Significance of Visual Effects

The significance of the visual effects on people exiting Kilbogget Park would be low. The composition of views from the western edge of the park would be altered by the loss of the trees from *Silver Slope* across

the road but the character and quality of the view – already dominated by the N11 - would be largely unaffected and there would be no significant reduction in visual amenity. The visual effects would be neutral.

It should be noted that the Kilbogget Park entrance as seen from outside of the park would be improved by the new boundary treatment and gateway and particularly by the new trees outside the park.

6.5.2.4. Viewpoint 3: Houses on Bray Road

The houses fronting the Old Bray Road to the north of the proposed junction (beyond the neighbouring petrol filling station) are mostly enclosed by garden vegetation and boundary walls which restrict views towards the site. From the southern end of Bray Road itself a view directly south towards the site is afforded. This is the only view potentially affected by the proposed development which residents on Old Bray Road may experience.

Plate 6-10 The view from Old Bray Rd towards the proposed N11 Junction Q.

6.5.2.4.1. Existing view (Viewpoint 3)

The view south along Old Bray Road is framed by the boundary walls and vegetation of the residential properties to the right and a dense tree line inside a wall along the N11 to the left. The petrol filling station is prominent behind a wall at the end of the road and the N11 can be seen through a gap in the wall for pedestrian access. The mature mixed deciduous and coniferous trees of the *Silver Slope* property can be seen protruding above the filling station roofline.

6.5.2.4.2. Viewpoint sensitivity (Viewpoint 3)

The viewpoint sensitivity is low. The context (adjacent to the N11 and a petrol filling station) and the current quality of the view are such that sensitivity to change of the nature and scale proposed is limited.

6.5.2.4.3. Proposed change (Viewpoint 3)

The proposed development would be largely screened by foreground elements in the landscape although alterations to the N11 road corridor by the proposed junction would be visible through the gap in the wall. The most notable, although minor change would be the loss of the mature trees behind the filling station from the view. This would amount to a low magnitude of change.

6.5.2.4.4. Significance of visual effects (Viewpoint 3)

The significance of the visual effects experienced by people using the Old Bray Road would be low. The composition of the view would be altered by the loss of trees from the skyline, but the character of the view would not change and there would be no significant loss of visual amenity. The visual effects would be neutral.

6.5.3. Summary of Assessment of Visual Effects

Table 6-1 presents a summary of the assessment of visual effects. Where the visual effect on receptors is described as neutral, even where the significance of effect is medium or high, this is because the potential visual effects of the proposed development are deemed to be in accordance with the planning and landscape policy for the area.

Table 6-1 Summary of Assessment of Visual Effects.

Viewpoint	Viewpoint Sensitivity	Magnitude of Change		Significance of Visual Effects	
		Short Term	Medium Term	Short Term	Medium Term
1: N11 approaching the Druid's Glen Road junction from the south	Low	Low	Low	Low neutral	Low neutral
2: Kilbogget Park entrance	Medium	Low	Low	Low neutral	Low neutral
3: Bray Road c.50m north or proposed new road	Low	Low	Low	Low neutral	Low neutral

6.6. Conclusions

The site is located on the boundary between the Cherrywood SDZ and the N11 National Road. The proposed development, the N11 Junction Q, is identified in the CPS as a key piece of the internal transport infrastructure for the SDZ, providing access from the Cherrywood lands onto the N11. In this context and considering the existing character and condition of the receiving environment the landscape can be considered of low sensitivity to development of the nature and scale proposed. The magnitude of landscape change which would result from the development is low. Accordingly, the significance of the landscape effects can be classified as low.

A Landscape Mitigation Plan has been prepared in parallel with the LVIA. Overall the potential landscape effects of the proposed development can be classified as neutral.

The potential visual effects of the proposed development have been assessed for three viewpoints representing potentially affected visual receptors in the receiving environment. The sensitivity of the viewpoints was variously classified as low or medium. This classification took account of the location of the viewpoints'/visual receptors' location within or adjacent to the N11 National Road corridor and the condition of the landscape in view, while also recognising the value of certain features particularly the mature vegetation on the site. It was found that the magnitude of change which would occur in the views would range from low to medium. There were no adverse visual effects predicted to result from the proposed development.

In summary, there would be no significant medium to long term adverse landscape or visual impacts and the proposed development can be considered an appropriate intervention in the landscape.

7. Soils, Geology and Hydrogeology

7.1. Introduction

This chapter assesses the significant effects, if any, on soils, geology and hydrogeology which may occur as a result of the proposed development i.e. N11 Junction Q, at Cabinteely County Dublin. Mitigation measures are provided to avoid or reduce the magnitude of potential impacts.

7.2. Methodology

This chapter was prepared having regard to the publication '*Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements*' by the Institute of Geologists of Ireland, 2013. In order to assess the site, a desk-based study of publicly available information on the regional soils and geology was conducted. The sources of information used were:-

- Geology of Kildare-Wicklow, Geological Survey of Ireland (GSI), 1994;
- Geological Survey of Ireland 6-inch to 1 mile 1850's field mapping sheets (unpublished);
- Soils Association of Ireland and their Land Use Potential, M. J. Gardiner and T. Radford, National Soil Survey of Ireland, 1980;
- Directory of Active Quarries, Pits, and Mines in Ireland, GSI 2014;
- Memoir of Localities of Minerals of Economic Importance and Metalliferous Mines in Ireland, The Mining Heritage Society of Ireland, 1998;
- Glendruid Lehaunstown, Site Investigation Summary, prepared by Waterman Moyland and dated 13 March 2015;
- Cherrywood SDZ – Roads & Infrastructure (Phase 1) Development – Preliminary Ground Investigation Factual Information, prepared by Arup and dated 27 October 2015;
- Phase 1 Hydrogeology Assessment of the Cherrywood SDZ, prepared by RPS and dated September 2011; and
- GSI online datasets - http://spatial.dcenr.gov.ie/imf/imf.jsp?site=GSI_Simple

In addition, a site walkover was undertaken on 09 August 2016 to confirm the local topography, soil and bedrock types. This included a walkover survey of the site and windscreen survey of the surrounding areas.

7.3. Receiving Environment

The proposed development is located in the townlands of Lehaunstown and Loughlinstown south County Dublin. The site is located along and adjacent to the N11 National Primary Route, a major transport corridor flanked by continuous, sub-urban development on both sides. An unoccupied residential property and petrol retail station are located on the western side of the proposed development. Kilbogget Park is located to the east of the proposed development. Surrounding lands are residential in nature, with older house on large sites and more recent developments consisting of apartment buildings. The proposed development consists of the provision of a new signalised junction and associated works on the N11. A detailed description of the proposed development is provided in Chapter 2.

7.3.1. Planning Objectives

The SEA Environmental Report for the Cherrywood Planning Scheme includes a number of objectives and targets in relation to soils and hydrogeology. For soils:

***SEO S1**: To avoid damage to the hydrogeological and ecological function of the soil resource in Cherrywood.*

Indicator S1: Soil extent and hydraulic connectivity

Target S1: To minimise reductions in soil extent and hydraulic connectivity.

In relation to groundwater: -

***SEO W2**: To prevent pollution and contamination of groundwater.*

Indicator W2: Groundwater Quality Standards and Threshold Values under Directive 2006/118/EC.

Target W2: Not to affect the ability of groundwaters to comply with Groundwater Quality Standards and Threshold Values under Directive 2006/118/EC.

7.3.2. Geological Heritage

In conjunction with the National Parks and Wildlife Service (NPWS), the GSI has been identifying sites of geological interest (geological heritage sites) across the Country since 1998. Sites are being categorised under 16 geological themes, such as economic geology, karst, Devonian, coastal, Quaternary, etc. These sites are being designated as Natural Heritage Areas or of importance at a County level. Dun Laoghaire - Rathdown County Council has developed a list of sites of geological interest for inclusion in the 2016 County Development Plan (CDP). Policy LHB27 (Geological Sites) of the County Development Plan states:- 'It is Council policy to protect, promote and preserve sites of Geological and Geomorphological importance, in particular the proposed Natural Heritage Areas (NHAs) and any County Geological Sites (CGS) that become designated during the lifetime of this Plan'.

In partnership with the GSI and the Heritage Council, the Council carried out an audit of geological sites in 2014. From this audit, twelve sites have been identified and listed in Table 4.1.3 of the CDP. The closest to the proposed site are listed in Table 7-1 and shown on Figure 7-1 (Bedrock Geology Map).

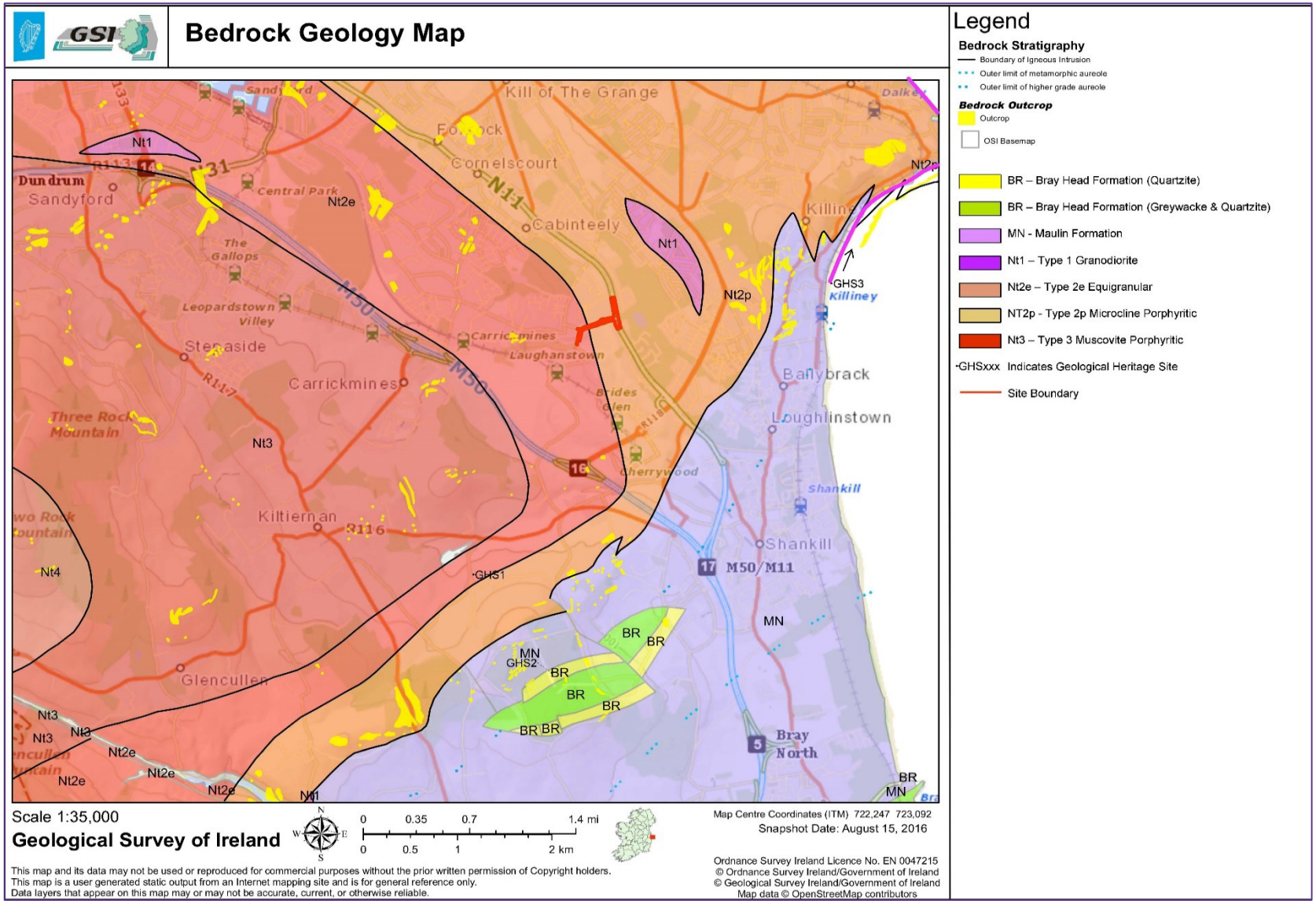

Figure 7-1 Bedrock Geology Map

Table 7-1 Geological Heritage Sites

Site Name	Co-ordinates	Principal Characteristics of Site
Ballycorus	722224 / 721629	Leinster Granite and associated mineralization. This is a historic mine site, with opencast workings and smelter chimney and flue. County Geological Site. Shown as GHS1 on Figure 7-1
Carrikgollogan	723055 / 720550	Carrickgollogan is a small but prominent hill. It is a geological anomaly as the Cambrian quartzites are much older than the Ordovician slates. County Geological Site. Shown as GHS2 on Figure 7-1
Killiney Bay (Bray Harbour to Killiney Station)	726023 / 724828 to 726823 / 729329	5.3km long coastal section of glacial sediments (interbedded diamicts). It is a particularly impressive exposure into deep tills with many sedimentological characteristics exposed. Proposed Natural Heritage Area (pNHA). Shown as GHS3 on Figure 7-1

The site is not listed as being an Area of Geological Interest / Importance. All of the sites listed in Table 7-1 are greater than 1km from the proposed development and there is no connectivity. As such the proposed development will have no direct or indirect impact.

7.3.3. Overburden Geology

The overburden geology of the area has a strong influence on the landscape at the eastern side of the Cherrywood SDZ in the vicinity of the proposed development, with the bedrock geology being more influential moving west across the SDZ. Thick deposits of tills cover the eastern part of the site, with overburden thicknesses decreasing to the west.

Following a review of available information on the GSI webpage (www.gsi.ie), the overburden at the site and surrounding area is shown on Figure 7-2 and consists of the following overburden soils types:-

- **Made ground (Made)** – this soil type dominates the site area due to the developed urban nature of the site.

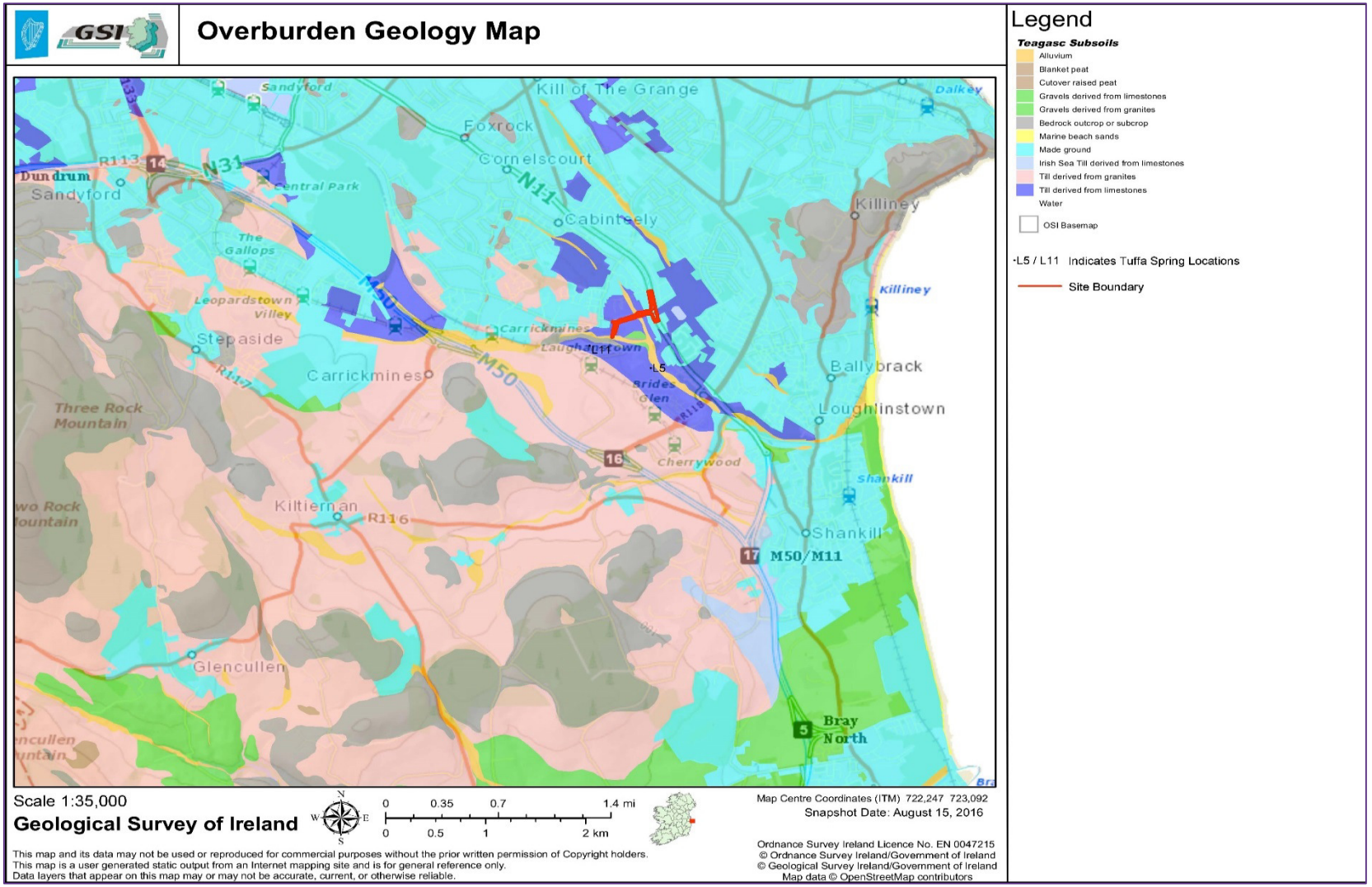

Figure 7-2 Overburden Geology Map

7.3.4. Bedrock Geology

According to the GSI – Geology of Kildare-Wicklow, the proposed development site lies at the north-eastern end of the Northern Pluton. This is a granite pluton intruded into the country rock of the Bray and Ribband groups.

The Lower Palaeozoic rocks of the Bray Group and Ribband Group lie to the south of the proposed development site. The Bray Group consists of greywackes, slates and quartzites deposited in a marine basin during the Cambrian period. The younger Ribband Group consists of fine-grained sedimentary rocks deposited as silt and mud in deep water of the then Iaputus Ocean during the Ordovician period. Tectonic activity during the Ordovician period (namely the closing of the Iaputus Ocean) is recorded by basalts and andesites within the rocks of the Ribband Group. During the Caledonian Orogeny (mountain building period), the rocks of the Bray Group were thrust over the rocks of the Ribband Group.

This was followed by the intrusion of granite, during a number of episodes, into the Bray and Ribband groups. The Northern Pluton which underlies the site extends in a northeast-southwest orientation from Dun Laoghaire to Hollywood County Wicklow. The intrusions resulted in thermal metamorphism of the rocks closest to the granite plutons and the deposition of economic reserves of metals. These were extensively mined along the edge of the granites in the 19th Century in counties Dublin and Wicklow.

Transgression of seas during the Carboniferous period resulted in the deposition of limestone bedrock in the Kildare Shelf and Dublin Basin located to the west and north of the site, respectively. These rocks are distant from the site and not represented at or near the proposed development site.

The regional bedrock geology is shown on Figure 7-1. The rocks found within and immediately adjacent to the site are described in greater detail. The symbol for each formation is given in brackets for cross-reference purposes with the bedrock geology map. These are described from the literature as follows:-.

- **Bray Head Formation (BR)** – The Bray Head Formation is Cambrian in age and belongs to the Bray Head Group. It consists of greywacke, sandstone and siltstone interbedded with green, purple, red and grey slates, and massive quartzites. It occurs approximately 3km to the south of the proposed development site.
- **Maulin Formation (MN)** – The Maulin Formation is Ordovician in age and belongs to the Ribband Group. It consists of dark blue-grey to black mudstones and shales with thin-bedded muddy cherts and limestones and fossiliferous marine bands. The Maulin Formation occurs approximately 1.2km to the southeast and south of the proposed development site.
- **Type 1 Granodiorite (Nt1)** – This rock type consists of fine-grained granodiorite to granite. It occurs to the northwest of the site with the T2p Microcline Porphyritic.
- **Type 2e Equigranular (Nt2e)** - This rock type is found in the Northern Pluton. It consists of pale grey fine to coarse-grained granite. It lies to the west of the site.
- **Type 2p Microcline Porphyritic (Nt2p)** – This rock type is found in the Northern Pluton. It consists of granite with microcline phenocrysts. It underlies the site.
- **Type 3 – Muscovite Porphyritic (Nt2p)** – This rock type is found in the Northern Pluton. It consists of granite with muscovite phenocrysts. It lies to the west of the site.

7.3.5. Economic Geology

There are a number of small gravel pits and quarries in the area, none of which are located within the development site. The nearest are at: -

- Bride's Glen at co-ordinates 723828 / 723323, approximately 1km to the south of the site. This gravel pit is disused; there is no information available on when the pit was active;
- Ballybrack at co-ordinates 724490 / 723810, approximately 500m to the east of the site. There is no information available on when the pit was active;
- Loughlinstown at co-ordinates 724113 / 724315, approximately 300m to the northeast of the site. There is no information available on when the pit was active;
- Kilbogget granite quarry at co-ordinates, approximately 1.2km to the northeast of the site. The granite was quarried for building stone and is now inactive. There is no information available on when the pit was active.

The nearest active quarry to the site is the Belgard Quarry, Fortunestown, County Dublin, approximately 16km to the west.

There are no mineral localities (metallic) within the site or within 2km of the site. Neither Lehaunstown nor Loughlinstown are mentioned in the Memoir of Localities of Minerals of Economic Importance and Metalliferous Mines in Ireland. The nearest recorded site is located in Rathmichael County Dublin (approximately 2.5km to the southwest) where galena was mined from quartzite.

7.3.6. Hydrogeology

The proposed scheme is located within Dublin Urban groundwater body. The Dublin Urban groundwater body has been ranked as having good water quality, but at risk due to pressures from urban areas, with an objective to protect, under the Water Framework Directive. The risks are associated with contaminated land and probable risks associated with groundwater dependent terrestrial ecosystems.

Groundwater is an important resource for drinking water supply, accounting for 25% of water supplies in Ireland. The igneous bedrock formations underlying the site (the Northern Pluton) is classified by the GSI as Poor Aquifers – Bedrock which is Generally Unproductive except for Local Zones (Pl). The aquifers underlying the site and surrounding area are shown in Figure 7-3. There are no gravel aquifers near the site, the closest being near Enniskerry, County Wicklow.

The aquifer vulnerability across the site varies from east to west from High to Extreme. Figure 7-4 shows aquifer vulnerability.

The area is serviced by mains water and according to the GSI well database, there are no wells located within the site. There is one well located in Loughlinstown, to the south of the site at co-ordinates 723324 / 723229 (323400 / 223200). The well is 61.3m deep with bedrock encountered at 39.5m. It has a good yield of 220 m^3/day. Its use is not known. It is shown on Figure 7-3 as W1. The next closest wells shown on the GSI database are greater than 3km to the south.

There are no source protection zones (SPZ) in the immediate vicinity of the site. The closest is located in Kilteel, approximately 22km to the west.

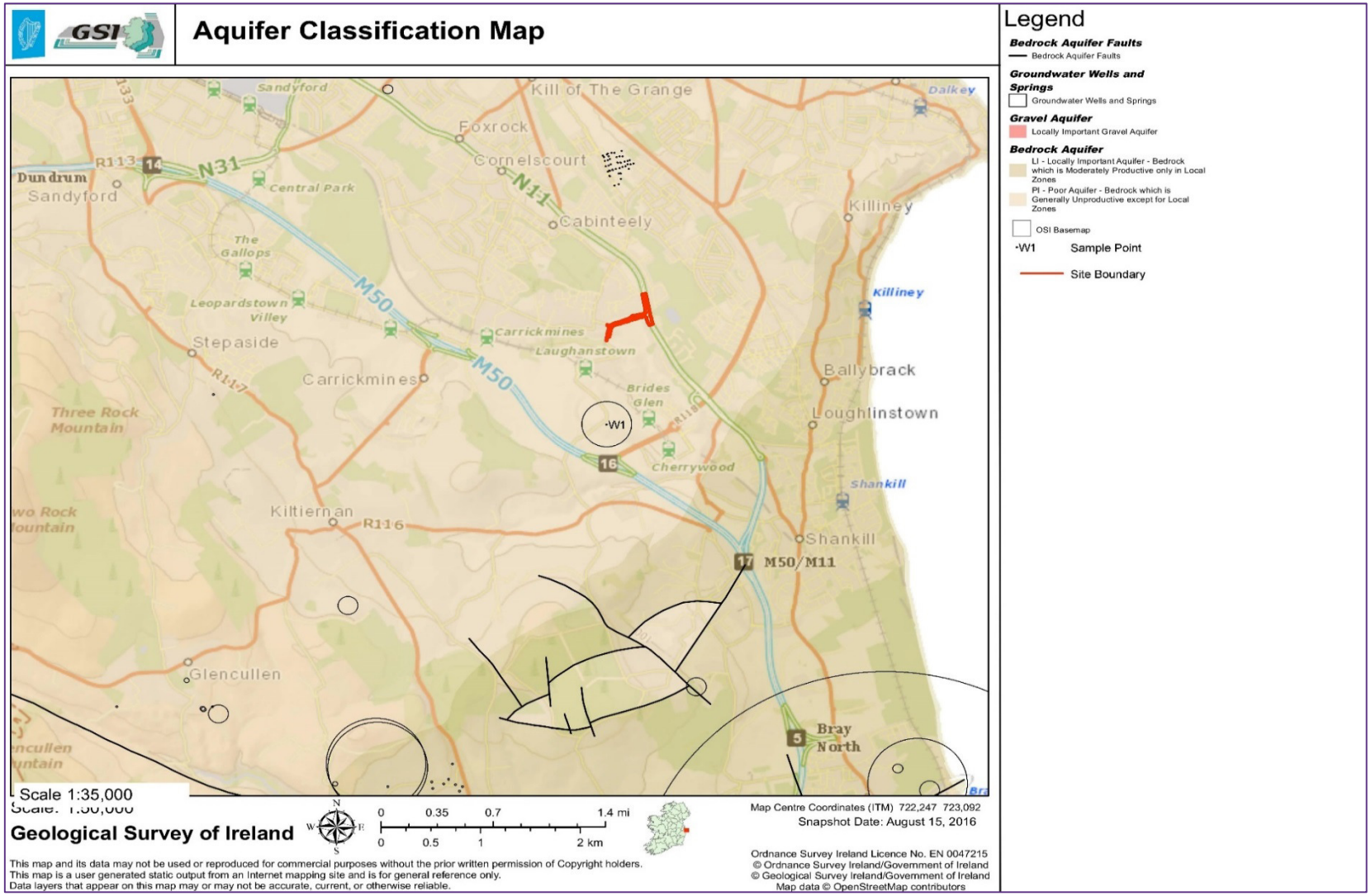

Figure 7-3 Aquifier Classification Map

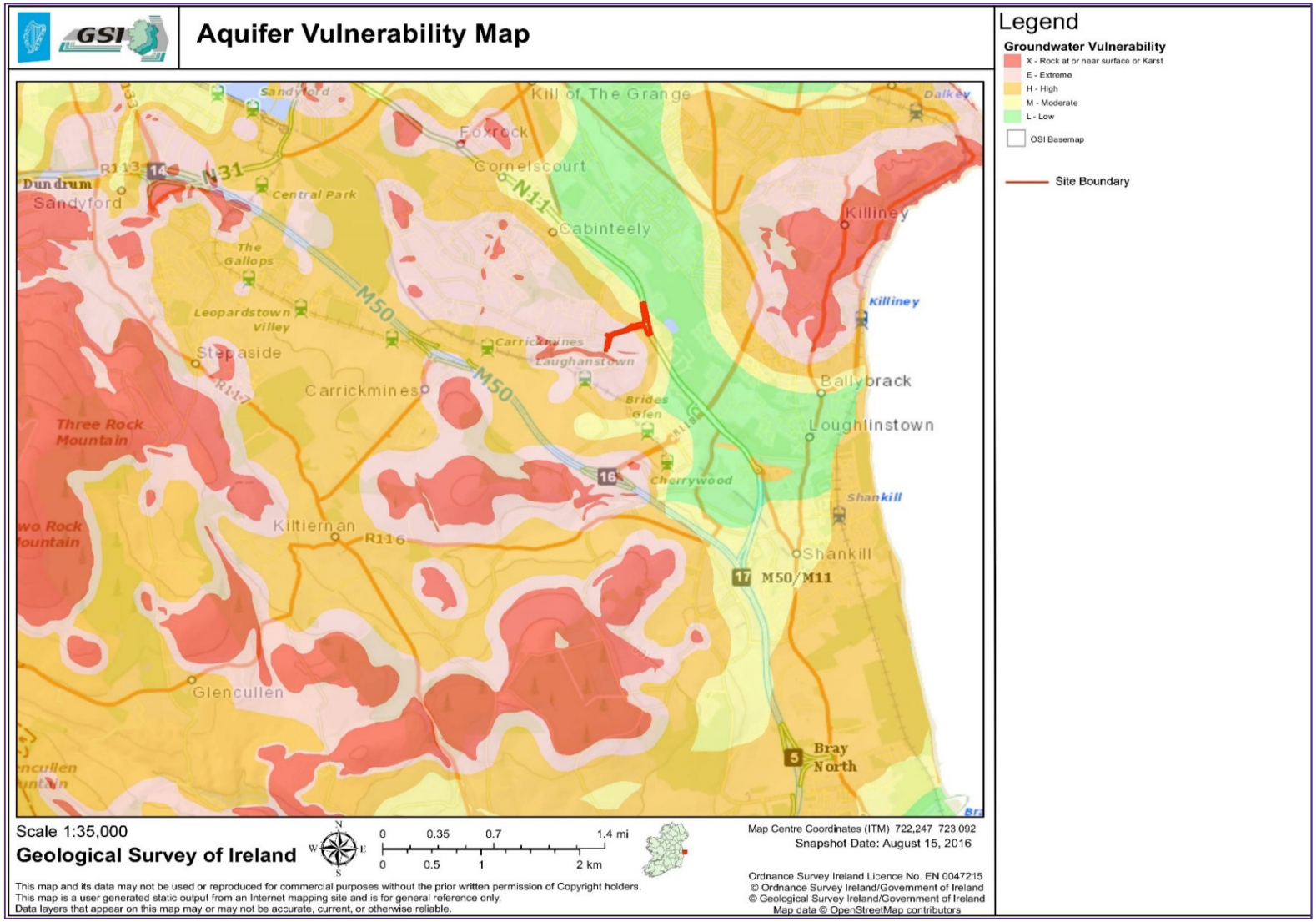

Figure 7-4 Aquifier Vulnerability Map

7.3.7. Site Investigation Data

A number of site investigations (SI) have been carried out near the proposed development site. These include: -

- Cherrywood SDZ Road & Infrastructure Phase 1. IGSL carried out a site investigation in March 2015 on behalf of Arup. The investigation consisted of the drilling of 3 No. boreholes and the excavation of 17 No. trial pits. The findings indicated made ground (up to 5.3m thick) overlying stiff gravelly silt/clay with cobbles. To a lesser extent, sand and gravel was encountered. The deepest borehole extended to 8.2m. Groundwater was encountered at depths of 1.1m to 6.7m. Bedrock was not confirmed at any of the borehole or trial pit locations.
- M50 South Eastern Motorway. Geotechnical reports available from the GSI website http://spatial.dcenr.gov.ie/GeologicalSurvey/GeoTechnicalViewer/index.html indicates a number of site investigations took place near the proposed development site. One cable percussion borehole (SEM711) located at co-ordinates 323818 / 224342 and extended to 5m depth. It indicated made ground to 1.4m overlying clay and sand.

Figure 7-5 shows the site investigation locations. As can be seen in Figure 7-5, all of the site investigation points are outside the proposed scheme.

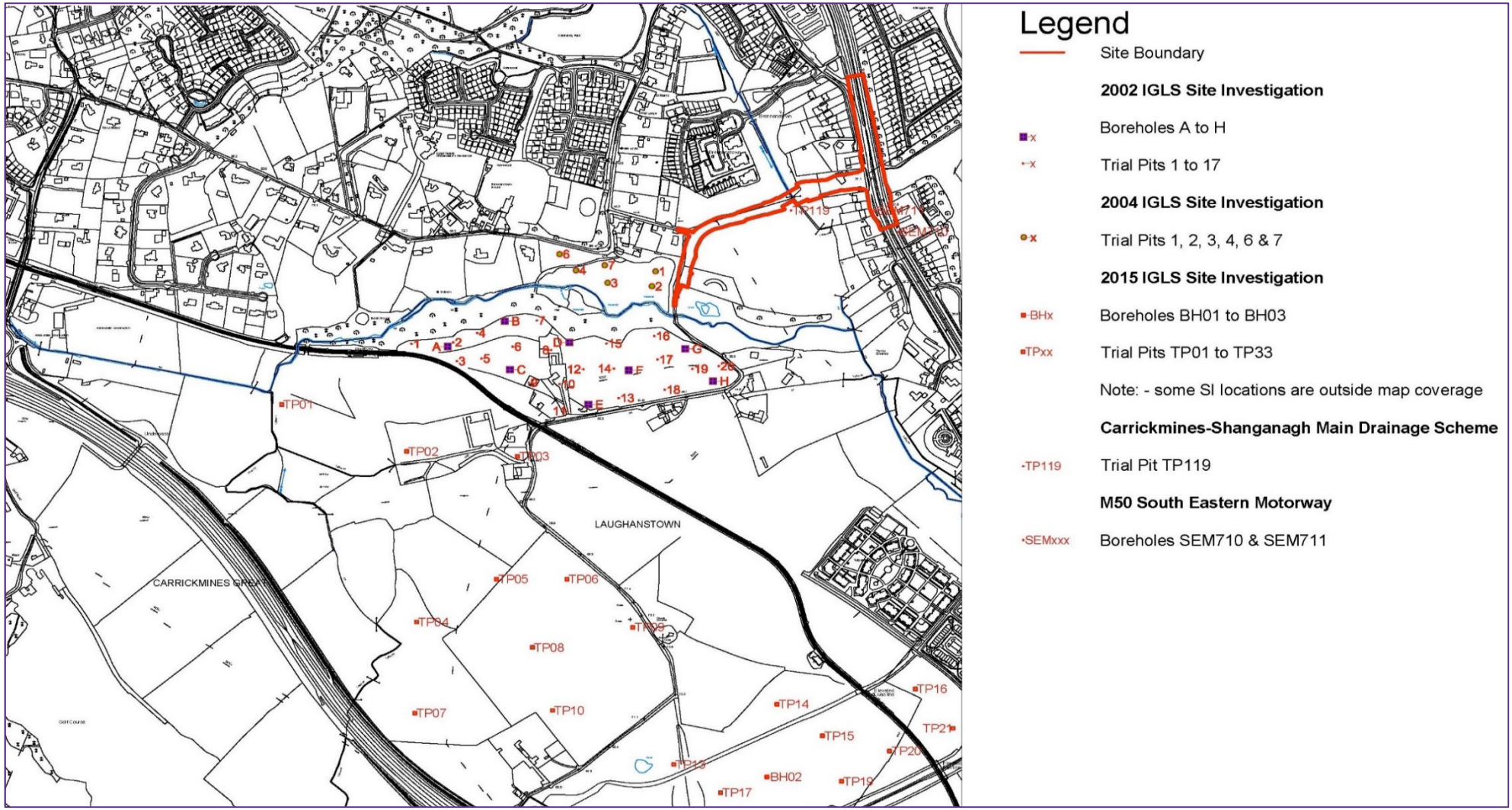

Figure 7-5 Site Investigation Locations

7.3.8. Contaminated Land

No historic or current land uses on the proposed development site would indicate the presence of contaminated land. The only nearby land use identified that could potentially be a source of contaminated soil and groundwater is the retail petrol station adjacent to the proposed junction. Underground storage tanks for petrol and diesel can sometimes leak, causing soil and groundwater contamination. There is however no evidence that this is occurring.

According to the Environmental Protection Agency (EPA) web-mapping (http://gis.epa.ie/Envision) indicates that there are no licenced waste or IPPC (Integrated Pollution & Prevention Control) facilities at or within the immediate vicinity of the site. The closest are approximately 2km from the proposed development.

Dumping of builder's rubble, including tarmac, is noted at the gated entrance to the Cherrywood land bank.

7.4. Potential Impacts

The potential impacts associated with the proposed development are assessed in terms of the construction and operational impacts, the do-nothing scenario, and the worse-case scenario. Impacts are discussed in terms of quality, significance and duration in the absence of mitigation measures. The residual impacts with the implementation of the proposed mitigation measures are discussed in Section 7.6.

The proposed development is not predicted to have any negative impact on the geological heritage sites in the area. There are no karst features present at the site (it is granite bedrock) and there is no history of slope instability at the site.

7.4.1. Construction Phase

The aspects of the proposed development that potentially have construction-related impacts on soils and geology are:-

- It is possible that during earthworks contaminated soil is encountered. The potential impacts associated with this would depend on the volume of contaminated soil encountered along with the type and level of contamination. Unmitigated this would likely range up to a medium-term, moderate negative impact.
- Hydrocarbons will be stored and used at the site for construction machinery. There is potential for leaks and spillages which would impact on soil and groundwater quality. The potential impact would depend on the volume and location of a fuel spill / leak. Fuel storage tanks on construction sites are typically no larger than 1,300 litres. Unmitigated, this would be a short-term slight negative impact.
- Concrete, concrete products and aggregates will be required for the construction of the proposed development. These materials will be sourced from authorised local quarries and considered a short-term moderate positive impact.

The aspects of the proposed development that potentially have construction-related impacts on groundwater and hydrogeology are:-

- Hydrocarbons will be stored and used at the site for construction machinery. There is potential for leaks and spillages which would impact on groundwater quality. The potential impact would depend on the volume and location of a fuel spill / leak. Fuel storage tanks on construction sites are typically no larger than 1,300 litres. Unmitigated, if spills/leaks reach the aquifer, it would be medium term slight-moderate negative impact on groundwater quality. Any leaks or spillage could compromise objective SEO W2.

There are no known groundwater wells within the extents of the scheme. While there may be groundwater wells servicing the older residences in the vicinity of the site, the area is serviced by mains water. With the shallow depths of excavations required, impacts on wells is not predicted.

7.4.2. Operational Phase

The operational phase of the proposed development is not expected to present significant impacts to soils, geology and hydrogeology. The aspects of the proposed development that potentially have operational-related impacts are:-

- There is potential that vehicles using the roads will leak / spill hydrocarbons onto the road surface. These could make their way to the underlying soils and groundwater, but more likely will be contained in the surface water environment. The potential impact on soils, geology and hydrogeology is therefore considered imperceptible.
- In winter months, it is now common practice to apply salt to the roads to prevent freezing, thus maintaining safer driving conditions. In some locations, it has been found that this has resulted in salt contamination of the groundwater. Aquifers most at risk are those with extreme vulnerability – this occurs at western end of the road scheme where bedrock is close to surface. According to Met Eireann the mean number of days per annum (calculated for the period 1981 to 2010) with ground frost at Dublin Airport synoptic station was 82 days and the number of days with snow was 16.6. Application of salt is therefore likely to occur for approximately 2 months during winter. With extreme aquifer vulnerability at the western end of the site, the impact is considered long term slight negative.

7.4.3. 'Do-Nothing' Scenario

The site is situated on a major existing transport corridor, the N11 National Primary Route, and the proposed development will provide access to lands zoned in the CDP for commercial and residential development. In the absence of the proposed scheme, it is unlikely that the adjacent lands will be developed in the short to medium term without the benefit of this strategic link to service the lands.

7.5. Mitigation Measures

The mitigation measures to be employed to avoid, reduce and / or mitigate potential impacts during the construction and operational phases are set out in the sections below.

7.5.1. Construction Phase

The mitigation measures to be employed during the construction phase to address the identified potential impacts on soils and geology are:-

- The following measures will be implemented for soil handling to minimise erosion:-
    - The areas stripped of topsoil and overburden will be kept to a minimum.
    - Stockpiled soils will be profiled to minimise erosion from wind and rain. Clean surface water runoff will be diverted around earthworks areas to minimise erosion (and the volume of silted water generated). To achieve this, shallow cut-off drains or temporary plastic diversion barriers will be installed.
    - Stockpiles of topsoil will be kept to a maximum of 2m high to avoid anaerobic conditions and maintain fertility for reuse.
    - Vegetation of stockpiles will be promoted to minimise erosion.

  The residual impact is considered short-term, imperceptible negative.

- The following measures will be implemented for the storage and use of hydrocarbons on site:-
    - Diesel tanks, used to store fuel for the various items of machinery, will be self-contained and double-walled.
    - Refuelling will be carried out from these tanks or from delivery vehicles and will not be left unattended.
    - Fuels, lubricants and hydraulic fluids for equipment used on the construction site will be carefully handled to avoid spillage, properly secured against unauthorised access or vandalism, and provided with spill containment according to best codes of practice - (Enterprise Ireland BPGCS005).
    - Any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated soil removed from the site and properly disposed of.
    - Waste oils and hydraulic fluids will be collected in leak-proof containers and removed from the site for disposal or recycling.

    - Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction site to deal with any accidental spillage.

With this mitigation, the residual impact is considered short-term, imperceptible negative.

- Concrete, concrete products and aggregates needed for the construction will only be sourced from authorised quarries, at which appropriate environmental controls are implemented per planning conditions. Support of local authorised quarries is considered a medium-term moderate positive impact.

Mitigation measures to be implemented during the construction stage to avoid or reduce the potential impacts on groundwater and hydrogeology are:-

- The proposed development has been designed to minimise excavations so that vulnerability to groundwater aquifers is not, as far as possible, increased. The residual impact will remain permanent imperceptible negative to neutral.
- Storage / handling of oils and diesel on site are detailed above. These measures will also reduce the risk of impact on the groundwater quality. With the reduction of the likelihood and magnitude of spillage / leaks reaching the groundwater, the residual impact would be medium term imperceptible to slight negative on groundwater quality.

7.5.2. Operational Phase

The mitigation measures to be employed during the operational phase to address the identified potential impacts on soils and geology are:-

- Spillage and leaks of oil from cars and trucks using the road during the operational phase is unavoidable. To reduce the potential impacts, oil interceptors will be incorporated into the scheme drainage design. As most of the incident rainfall will runoff to the surface water collection system, the impacts on soils and geology are unlikely and the residual impact is long-term imperceptible to slight negative. A programme to maintain and clean the interceptors will also be put in place to ensure that the interceptors work efficiently over their design life.

Mitigation measures to be implemented during the operational phase to avoid or reduce the potential impacts on groundwater and hydrogeology are as follows:-

- As noted above, oil interceptors are included in the drainage design. The residual impact associated with hydrocarbons contaminating the groundwater is long-term imperceptible negative. As the surface water collection system will discharge to the existing storm water system along the N11, it is unlikely that saline water will enter the groundwater environment.

7.5.3. Monitoring & Reinstatement Measures

Supervision will be carried out during the construction phase to ensure that the proposed mitigation measures are implemented. An environmental clerk of works (ECofW) will be appointed in this regard. Responsibilities will include:-

- Ensuring topsoil and subsoil are segregated and stocked properly.
- Inspection of earthworks to identify any contaminated soils or waste material. Ensuring waste materials encountered are removed from site, disposed of properly and that the records are maintained.
- Ensuring that surplus soils taken offsite is done so in accordance with the regulations and that records are maintained.
- Ensuring that soil erosion control measures are put in place.
- Ensure that oils and diesel are stored and used on site in an appropriate manner.

8. Air Quality and Climate

8.1. Introduction

AWN Consulting Limited has been commissioned to conduct an assessment of the likely impact on air quality and climate associated with the proposed development i.e. N11 Junction Q. The proposed development will consist of a new at-grade signalised junction on the N11 dual carriageway, linking it to Development Area 5 of the Cherrywood Strategic Development Zone Planning Scheme (CPS). The proposed junction will connect the SDZ to the N11 across from Kilboggett Park, approximately 3 km north of Junction 17 where the N11 meets the M50.

This chapter outlines the methodology used to assess the air quality and climate impacts of the proposed development. The assessment takes account of the worst case scenario with respect to traffic impacts, associated with the phasing and quantum of development as set down in Chapter 6 of the CPS for Development Area 5 and all Development areas thereafter.

8.2. Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, National and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or “Air Quality Standards” are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 8-1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate European Commission Directive 2008/50/EC which has set limit values for the pollutants SO2, NO2, PM10, benzene and CO (Table 8-1). Council Directive 2008/50/EC combines the previous Air Quality Framework Directive (96/62/EC) and its subsequent daughter directives (including 1999/30/EC and 2000/69/EC). Provisions were also made for the inclusion of new ambient limit values relating to PM2.5 (see Appendix 8.1).

Table 8-1 Air Quality Standards Regulations 2011 (based on EU Council Directive 2008/50/EC)

Pollutant	Regulation Note 1	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	None	200 µg/m^3 NO_2
		Annual limit for protection of human health	None	40 µg/m^3 NO_2
		Annual critical level for protection of vegetation	None	30 µg/m^3 NO + NO_2
Lead	2008/50/EC	Annual limit for protection of human health	100% Note 2	0.5 µg/m^3
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 µg/m^3	350 µg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 µg/m^3
		Annual & Winter critical level for protection of vegetation	None	20 µg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 µg/m^3 PM_{10}
		Annual limit for protection of human health	20%	40 µg/m^3 PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	20% from June 2008. Decreasing linearly to 0% by 2015	25 µg/m^3 $PM_{2.5}$
$PM_{2.5}$ (Stage 2)	-	Annual limit for protection of human health	None	20 µg/m^3 $PM_{2.5}$
Benzene	2008/50/EC	Annual limit for protection of human health	100% until 2006 reducing linearly to 0% by 2010	5 µg/m^3
Carbon Monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m^3 (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air for Europe (CAFE) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Note 2 EU 2008/50/EC states - 'Stage 2 — indicative limit value to be reviewed by the Commission in 2013 in the light of further information on health and environmental effects, technical feasibility and experience of the target value in Member States'.

8.2.1. Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the European Union burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six Greenhouse Gases under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012 (Environmental Resources Management, 1998).

The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP21) to the agreement was in Paris, France in December 2015. COP21 was an important milestone in terms of international climate change agreements. The "Paris Agreement", agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions.

8.2.2. Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. COM (2013) 917 Final is the "*Proposal for a Council Decision for the acceptance of the Amendment to the 1999 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone*" which sets out the initial objectives of the Protocol to control and reduce emissions of Sulphur Dioxide (SO_2), Nitrogen Oxides (NO_X), Volatile Organic Compounds (VOCs) and Ammonia (NH_3). To achieve the initial targets Ireland was obliged, by 2010, to meet national emission ceilings of 42 kt for SO_2 (67% below 2001 levels), 65 kt for NO_X (52% reduction), 55 kt for VOCs (37% reduction) and 116 kt for NH_3 (6% reduction). In 2012, the Gothenburg Protocol was revised to include national emission reduction commitments for the main air pollutants to be achieved in 2020 and beyond and to include emission reduction commitments for $PM_{2.5}$. In relation to Ireland, 2020 emission targets are 25 kt for SO_2 (65% below 2005 levels), 65 kt for NO_X (49% reduction), 43 kt for VOCs (25% reduction), 108 kt for NH_3 (1% reduction) and 10 kt for $PM_{2.5}$ (18% reduction).

European Commission Directive 2001/81/EC and the National Emissions Ceiling Directive (NECD), prescribes the same emission limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of these four transboundary pollutants has been in place since April 2005 (Department of the Environment, Community and Local Government, 2004). The Data available from the EU in 2010 indicated that Ireland complied with the emissions ceilings for SO_2, VOCs and NH_3 but failed to comply with the ceiling for NO_X (European Economic Area, 2011). COM (2013) 920 Final is the *"Proposal for a Directive on the reduction of national emissions of certain atmospheric pollutants and amending Directive 2003/35/EC",* which will apply the 2010 NECD limits until 2020 and establish new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_X, NMVOC, NH_3, $PM_{2.5}$ and CH_4. In relation to Ireland, 2020-29 emission targets are for SO_2 (65% below 2005 levels), for NO_X (49% reduction), for VOCs (25% reduction), for NH_3 (1% reduction) and for $PM_{2.5}$ (18% reduction). In relation to 2030, Ireland's emission targets are for SO_2 (83% below 2005 levels), for NO_X (75% reduction), for VOCs (32% reduction), for NH_3 (7% reduction), for $PM_{2.5}$ (35% reduction) and for CH_4 (7% reduction).

8.3. Methodology

8.3.1. Local Air Quality Assessment

The air quality assessment was carried out following procedures described in the publications by the EPA (EPA 2002, 2003) and using the methodology outlined in the policy and technical guidance notes, LAQM.PG (09) and LAQM.TG (16), issued by UK Department for Environment, Food and Rural Affairs (UK DEFRA 2001, 2009a, 2009b; UK Department of the Environment, Transport and Roads 1998, UK Highways Agency 2007), as outlined in Appendix 8.2. The assessment of air quality is carried out using a phased approach as recommended by the UK Department for Environment, Food and Rural Affairs (UK DEFRA 2009a). The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of key pollutants will be carried out at sensitive receptors. These sensitive receptors have the potential to be impacted on by the concentration of key pollutants due to the proposed development. An examination of recent EPA and Local Authority data in Ireland (EPA 2016, 2015), has indicated that SO_2 and smoke and CO are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out. However, the analysis did indicate potential problems in regards to nitrogen dioxide (NO_2) and PM_{10} at busy junctions in urban centres (EPA 2016, 2015). Benzene, although previously reported at quite high levels in urban centres (EPA 2016, 2015), has recently been measured at several city centre locations to be well below the EU limit value (EPA 2016, 2015). Historically, CO levels in urban areas were a cause for concern. However, CO concentrations have decreased significantly over the past number of years and are now measured to be well below the limits even in urban centres (EPA 2016, 2015). The key pollutants reviewed in the assessments are NO_2, PM_{10}, $PM_{2.5,}$ benzene and CO, with particular focus on NO_2 and PM_{10}.

Key pollutant concentrations were predicted for nearby sensitive receptors for the following scenarios:

- The Existing scenario (2015), for model verification;
- Do-Nothing scenario (DN), which assumes the retention of present site usage with no Junction Scheme in place (2025);
- Do-Something scenario (DS), which assumes Phase 1 (Cherrywood SDZ Development Area 5 + O'Flynn Development traffic - Single right turning lane from N11 into Cherrywood SDZ) in place (2025);
- Do-Something scenario (DS), which assumes Phase 2 (All Cherrywood SDZ Development Area traffic - Two right turning lanes from N11 into Cherrywood SDZ) in place (2025);

The assessment methodology involved air dispersion modelling using the UK Design Manual for Roads and Bridges Screening Model (UK Highways Agency 2007) (Version 1.03c, July 2007), the NO_x to NO_2 Conversion Spreadsheet (UK Department for Environment, Food and Rural Affairs, 2014) (Version 4.1), and following guidance issued by Transport Infrastructure Ireland (TII 2011), UK Highways Agency (UK Highways Agency 2007), UK Department for Environment, Food and Rural Affairs (UK DEFRA 2009a) and the EPA (EPA 2002, 2003).

Transport Infrastructure Ireland guidance states that the assessment must progress to detailed modelling if:

- Concentrations exceed 90% of the air quality limit values when assessed by the screening method; or
- sensitive receptors exist within 50m of a complex road layout (e.g. grade separated junctions, hills etc).

The UK Design Manual for Roads and Bridges guidance (UK Highways Agency 2007), on which Transport Infrastructure Ireland guidance was based, states that road links meeting one or more of the following criteria can be defined as being 'affected' by a proposed development and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGVs flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or

- Peak hour speed changes by 20 km/h or more.

Concentrations of key pollutants are calculated at sensitive receptors which have the potential to be affected by the proposed development. For road links which are deemed to be affected by the proposed development and within 200 m of the chosen sensitive receptors inputs to the air dispersion model these consist of; road layouts, receptor locations, annual average daily traffic movements (AADT), percentage heavy goods vehicles, annual average traffic speeds and background concentrations. The UK Design Manual for Roads and Bridges guidance states that road links at a distance of greater than 200 m from a sensitive receptor will not influence pollutant concentrations at the receptor. Using this input data the model predicts the road traffic contribution to ambient ground level concentrations at the worst-case sensitive receptors using generic meteorological data. The Design Manual for Roads and Bridges model uses conservative emission factors, the formulae for which are outlined in the Design Manual for Roads and Bridges Volume 11 Section 3 Part 1 – HA 207/07 Annexes B3 and B4. These worst-case road contributions are then added to the existing background concentrations to give the worst-case predicted ambient concentrations. The worst-case ambient concentrations are then compared with the relevant ambient air quality standards to assess the compliance of the Proposed Scheme with these ambient air quality standards. Transport Infrastructure Ireland *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (TII 2011) detail a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the proposed development. Transport Infrastructure Ireland significance criteria have been adopted for the proposed development and are detailed in Table 8-2, Table 8-3 and Table 8-4. The significance criteria are based on PM_{10} and NO_2 as these pollutants are most likely to exceed the annual mean limit values (40 µg/m^3). However, the criteria have also been applied to the predicted 8-hour CO, annual benzene and annual $PM_{2.5}$ concentrations for the purposes of this assessment.

Table 8-2 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations.

Magnitude of Change	Annual Mean NO_2 / PM_{10}	No. days with PM_{10} concentration > 50 µg/m^3	Annual Mean $PM_{2.5}$
Large	Increase / decrease ≥ 4 µg/m^3	Increase / decrease >4 days	Increase / decrease ≥ 2.5 µg/m^3
Medium	Increase / decrease 2 - < 4 µg/m^3	Increase / decrease 3 or 4 days	Increase / decrease 1.25 - <2.5 µg/m^3
Small	Increase / decrease 0.4 - < 2 µg/m^3	Increase / decrease 1 or 2 days	Increase / decrease 0.25 - <1.25 µg/m^3
Imperceptible	Increase / decrease < 0.4 µg/m^3	Increase / decrease <1 day	Increase / decrease < 0.25 µg/m^3

Source: Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)

Table 8-3 Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations.

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Moderate	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25 µg/m^3 of $PM_{2.5}$)	Slight adverse	Moderate adverse	Substantial adverse
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight adverse	Moderate adverse	Moderate adverse
Below Objective/Limit Value With Scheme (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight adverse	Slight adverse
Well Below Objective/Limit Value With Scheme (<30 µg/m^3 of NO_2 or PM_{10}) (<18.75 µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥40 µg/m^3 of NO_2 or PM_{10}) (≥25 µg/m^3 of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Substantial beneficial
Just Below Objective/Limit Value With Scheme (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Moderate beneficial
Below Objective/Limit Value With Scheme (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight beneficial	Slight beneficial
Well Below Objective/Limit Value With Scheme (<30 µg/m^3 of NO_2 or PM_{10}) (<18.75 µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Source: Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)

Table 8-4 Air Quality Impact Significance Criteria.

Absolute Concentration in Relation to Objective / Limit Value	Change in Concentration		
	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value With Scheme (≥35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value With Scheme (32 - <35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value With Scheme (26 - <32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value With Scheme (<26 days)	Negligible	Negligible	Slight Beneficial

Note 1 Where the Impact Magnitude is Imperceptible, then the Impact Description is Negligible

Source: Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes - Transport Infrastructure Ireland (2011)

8.3.2. Regional Impact Assessment (Including Climate)

The impact of the proposed development at a national / international level has been determined using the procedures given by Transport Infrastructure Ireland (TII 2011) and the methodology provided in Annex 2 in the UK Design Manual for Roads and Bridges (UK Highways Agency 2007). The assessment focused on determining the resulting change in emissions of volatile organic compounds (VOCs), nitrogen oxides (NOx) and carbon dioxide (CO2). The Annex provides a method for the prediction of the regional impact of emissions of these pollutants from road schemes. The inputs to the air dispersion model consist of information on road link lengths, AADT movements and annual average traffic speeds.

8.3.3. Conversion of NO_x to NO_2

NOx (NO + NO_2) is emitted by vehicles exhausts. The majority of emissions are in the form of NO, however, with greater diesel vehicles and some regenerative particle traps on HGVs the proportion of NOx emitted as NO_2, rather than NO is increasing. With the correct conditions (presence of sunlight and O_3) emissions in the form of NO have the potential to be converted to NO_2.

Transport Infrastructure Ireland states the recommended method for the conversion of NOx to NO_2 in "Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes" (TII, 2011). Transport Infrastructure Ireland guidelines recommend the use of the UK Department for Environment, Food and Rural Affairs NOx to NO_2 calculator (UK DEFRA, 2016) which was originally published in 2009 and is currently on version 5.1. This calculator (which can be downloaded in the form of an excel spreadsheet) accounts for the predicted availability of O_3 and proportion of NOx emitted as NO for each Local Authority across the UK. O3 is a regional pollutant and therefore concentrations do not vary in the same way as concentrations of NO_2 or PM_{10}.

The calculator includes Local Authorities in Northern Ireland and Transport Infrastructure Ireland guidance recommends the use of Craigavon as the choice for local authority when using the calculator. The choice of Armagh Banbridge and Craigavon provides the most suitable relationship between NO_2 and NOx for Ireland. The "All other Urban UK Traffic" traffic mix option was used.

8.3.4. Ecological Sites

For routes which pass within 2 km of a designated area of conservation (either Irish or European designation) Transport Infrastructure Ireland requires consultation with an Ecologist (TII 2011). However, in practice the potential for impact to an ecological site is highest within 200 m of the proposed scheme and when significant changes in AADT (>5%) occur.

Transport Infrastructure Ireland's Guidelines for Assessment of Ecological Impacts of National Road Schemes (Rev. 2, Transport Infrastructure Ireland, 2009) and Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (Department of the Environment, Heritage and Local Government, 2010) provide details regarding the legal protection of designated conservation areas.

If the assessment criteria, of a designated area of conservation within 200 m of the proposed development and a significant change in AADT flows, are met an assessment of the potential for impact due to nitrogen deposition should be assessed. There are no designated sites within the vicinity of the proposed development; Rockabill to Dalkey Island SAC is over 2km from the proposed site. As no site is within 200 m from the site an assessment is not required.

8.4. Receiving Environment

8.4.1. Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (World Health Organisation, 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles (PM_{10} - $PM_{2.5}$) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The windrose from Casement Meteorological Station for the years 2007 - 2011 is shown in Figure 8-1. Casement Meteorological Station is located at Casement Aerodrome, circa 20 km north west of the proposed development. The windrose indicates the prevailing wind speed and direction over the five-year period. The prevailing wind direction is from south to westerly in direction, with generally moderate wind speeds, averaging around 5.5 m/s.

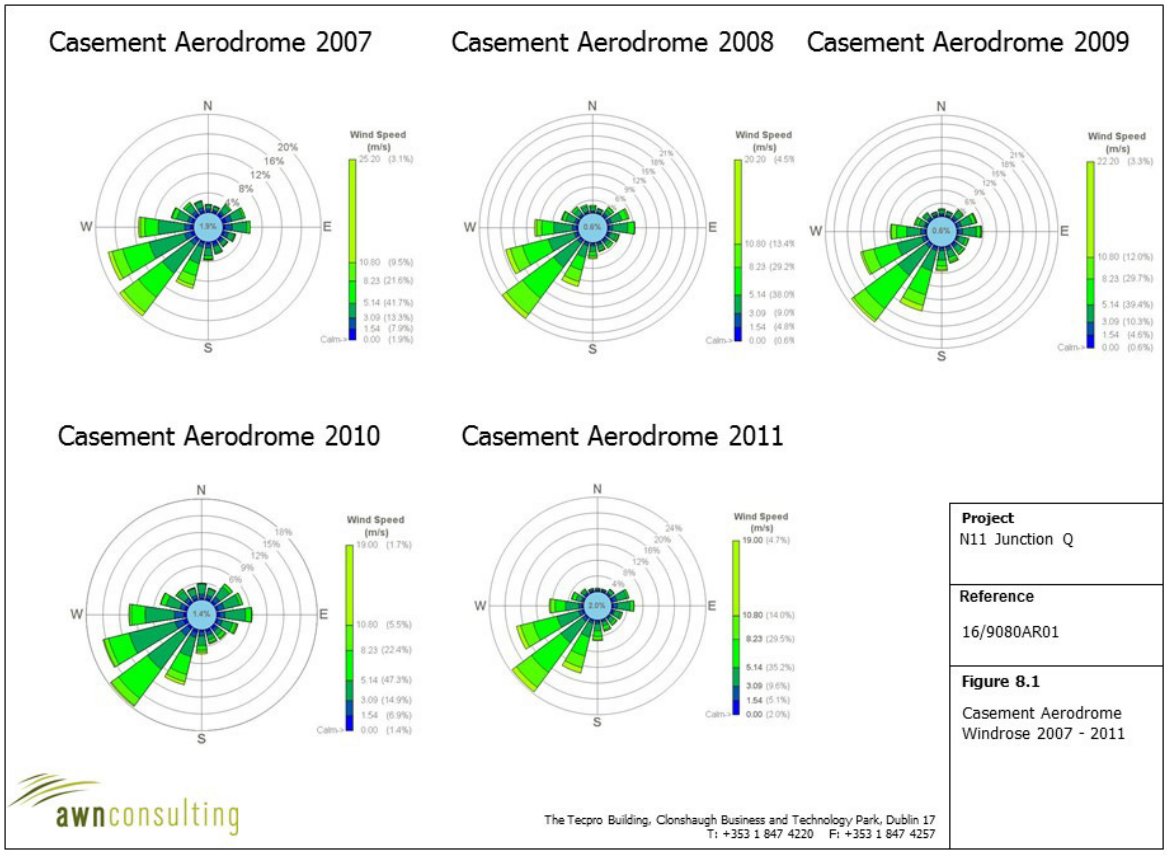

Figure 8-1 Casement Aerodrome Windrose 2007-2011.

8.4.2. Trends in Air Quality

Air quality is variable and subject to both significant spatial and temporal variation. In relation to spatial variations in air quality, concentrations generally fall significantly with distance from major road sources (UK Highways Agency 2007). Thus, residential exposure is determined by the location of sensitive receptors relative to major roads sources in the area. Temporally, air quality can vary significantly by orders of magnitude due to changes in traffic volumes, meteorological conditions and wind direction.

In 2011 the UK Department for Environment, Food and Rural Affairs published research (UK DEFRA 2011) on the long term trends in NO_2 and NOx for roadside monitoring sites in the UK. This Study found a marked decrease in NO_2 concentrations between 1996 and 2002, after which the concentrations stabilised with little reduction between 2004 and 2010. The result of this study is that there now exists a gap between projected NO_2 concentrations which UK Department for Environment, Food and Rural Affairs previously published and monitored concentrations. The impact of this 'gap' is that the Design Manual for Roads and Bridges screening model can under-predict NO2 concentrations predicted for future years. Subsequently, the UK Highways Agency published an Interim advice note (IAN 170/12) in order to correct the Design Manual for Roads and Bridges results for future years.

8.4.3. EPA Monitoring Data and Background Concentrations

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality "Air Quality Monitoring Annual Report 2014" (EPA, 2015), details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2016). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D.

In terms of air monitoring and assessment, the proposed development is within Zone A (EPA, 2015). The long-term monitoring data has been used to determine background concentrations for the key pollutants in the region of the proposed development. The background concentration accounts for all non-traffic derived emissions (e.g. natural sources, industry, home heating etc.).

With regard to NO_2, continuous monitoring data from the EPA at urban and suburban locations in Rathmines, Coleraine Street, Dun Laoghaire and Blanchardstown show that current levels of NO2 are below both the annual and 1-hour limit values (see Table 8-5), with average long term annual mean concentrations ranging from 15 – 31 µg/m3 in 2014. Sufficient data is available for urban station at Dun Laoghaire to observe trends over the period 2011-2014. Dun Laoghaire is an urban background station roughly 4 km north east of the site and therefore representative of background concentrations. The station has an average annual mean NO_2 concentrations of 18 µg/m^3 over the period of 2010-2014. Based on these results, a conservative estimate of the background NO_2 concentration in the region of the proposed scheme in 2015 is 18 µg/m^3.

Table 8-5 Trends In Zone A Quality - Nitrogen Dioxide (NO_2)

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year				
			2010	2011	2012	2013	2014
Rathmines	Urban Background	Annual Mean NO_2 (µg/m^3) Note 1	25	20	21	19	17
	Distance From Road = 3 m	Max 1-hr NO_2 (µg/m^3) Notes 2,3	[139]	[118]	[138]	[107]	[165]
Coleraine Street	Urban Traffic	Annual Mean NO_2 (µg/m^3)	33	26	26	26	25
	Distance From Road = 3 m	Max 1-hr NO_2 (µg/m^3)	[168]	[167]	[142]	[118]	[127]
Ringsend	Urban Traffic	Annual Mean NO_2 (µg/m^3)	29	32	25	-	-
		Max 1-hr NO_2 (µg/m^3)	[151]	[202]	[122]	-	-
Dun Laoghaire	Suburban Background	Annual Mean NO_2 (µg/m^3)	23	18	18	16	15
		Max 1-hr NO_2 (µg/m^3)	[154]	[127]	[136]	[123]	
Blanchardstown	Urban Traffic	Annual Mean NO_2 (µg/m^3)	-	31	30	29	31
		Max 1-hr NO_2 (µg/m^3)	-	[163]	[136]	[119]	[134]

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 2 1-hour limit value - 200 µg/m^3 as a 99.8th%ile, i.e. not to be exceeded >18 times per year (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Continuous PM_{10} monitoring carried out at the urban locations of Rathmines, Blanchardstown and Ringsend showed average annual mean concentrations of 12 – 23 µg/m^3 over the 2010-2014 period, with at most 11 exceedances (in Blanchardstown) of the 24-hour limit value of 50 µg/m^3 (36

exceedances are permitted per year) (EPA, 2015). The average annual mean concentration at Dun Laoghaire from 2010-2014 was 14.5 µg/m^3, based on the EPA data (Table 8-6). A conservative estimate of the background PM_{10} concentration in the region of the proposed development in 2015 is 14 µg/m^3.

Table 8-6 Trends In Zone A Quality – PM_{10}.

Station	Station Classification Council Directive 96/62/EC	Averaging Period	Year				
			2010	2011	2012	2013	2014
Rathmines	Urban Background Distance From Road = 3 m	Annual Mean (µg/m^3) Note 1	18	16	14	17	14
		24-hr Mean > 50µg/m^3 Note 2 (days)	10	2	8	8	3
Blanchardstown	Urban Traffic Distance	Annual Mean PM_{10} (µg/m^3)	-	16	-	20	18
		24-hr Mean > 50µg/m^3 (days)	-	11	-	11	5
Ringsend	Urban Traffic	Annual Mean PM_{10} (µg/m^3)	23	20	20	-	-
		24-hr Mean > 50µg/m^3 (days)	10	17	1	-	-
Phoenix Park	Suburban Background Distance From Road = 250m	Annual Mean PM_{10} (µg/m^3)	11	12	11	14	12
		24-hr Mean > 50µg/m^3 (days)	1	3	0	3	0
Dun Laoghaire	Suburban Background	Annual Mean PM_{10} (µg/m^3)	15	15	12	17	14
		24-hr Mean > 50µg/m^3 (days)	5	11	1	5	2

Note 1 Annual average limit value - 40 µg/m^3 (EU Council Directive 2008/50/EC & S.I. No. 180 of 2011).

Note 2 24-hour limit value - 50 µg/m^3 as a 90.4th%ile, i.e. not to be exceeded >35 times per year (EU Council Directive 1999/30/EC & S.I. No. 180 of 2011).

Continuous $PM_{2.5}$ monitoring carried out at the Zone A locations of Coleraine Street, Rathmines, Finglas and Marino showed average levels of 7 - 9 µg/m3 respectively in 2014. The annual average level measured in Rathmines in 2014 was 9 µg/m^3, with an average $PM_{2.5}/PM_{10}$ ratio of 0.64. Based on this information, a ratio of 0.64 was used to generate a background $PM_{2.5}$ concentrations in the region of the proposed development in 2015 of 9.3 µg/m^3.

In terms of benzene, the annual mean concentration in Rathmines for 2014 was 0.94 µg/m^3. This is well below the limit value of 5 µg/m^3 (EPA, 2015, 2016). 2006 to 2014 annual mean concentrations ranged from 0.8 - 2.8 µg/m^3. Based on this EPA data, a conservative estimate of the background benzene concentration in the proposed development in 2015 is 0.94 µg/m^3.

Background concentrations for Phase 1 and Phase 2 of the Cherrywood SDZ for 2025 have been calculated. These have used 2014 background concentrations and the year on year reduction factors provided by National Roads Authority in the Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes and the UK Department for Environment, Food and Rural Affairs LAQM.TG(09).

8.5. Characteristics of the Proposed Development

The proposed development will involve the construction of the N11 Junction Q, which will facilitate access to the Cherrywood SDZ lands. The proposed development has a Phase 1 and Phase 2 year of 2025.

- Phase 1 includes Cherrywood SDZ Development Area 5 + O'Flynn Development traffic - Single right turning lane from N11 into Cherrywood SDZ in place (2025);
- Phase 2 includes all Cherrywood SDZ Development Area traffic - Two right turning lanes from N11 into Cherrywood SDZ in place (2025);

When considering a development of this nature, the potential air quality and climate impact on the surroundings must be considered for each of two distinct stages:

A. construction phase, and;
B. operational phase.

The primary sources of air and climatic emissions in the operational context are deemed long term and will involve the change in traffic flows or congestion in the local area which are associated with the phasing and quantum of development as set down in Chapter 6 of the CPS for Development Area 5 and all Development areas thereafter.

During the operational phase of the proposed development there will be different sources of potential air quality impacts. The following describes the primary sources of potential air quality impacts which are deemed long term and which have been assessed in detail as part of this assessment.

8.6. Potential Impact of the Proposed Development

8.6.1. Construction Phase

The greatest potential impact on air quality during the construction phase of the proposed development is from construction dust emissions and the potential for nuisance dust and PM_{10}/$PM_{2.5}$ emissions (Table 8-7). While construction dust tends to be deposited within 200m of a construction site, the majority of the deposition occurs within the first 50m. There are sensitive receptors within the immediate boundary of the site in the form of other developments adjacent to the proposed site.

There is the potential for a number of greenhouse gas emissions to the atmosphere during the construction phase of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions.

Table 8-7 Assessment Criteria for the Impact of Dust from Construction, with Standard Mitigation in Place (TII 2011).

Source		Potential Distance for Significant Effects (Distance From Source)		
Scale	Description	Soiling	PM_{10}	Vegetation Effects
Major	Large construction sites, with high use of haul roads	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul roads	50m	15m	15m
Minor	Minor construction sites, with limited use of haul roads	25m	10m	10m

8.6.2. Operational Phase

8.6.2.1. Air Quality

There is the potential for a number of emissions to the atmosphere during the operational phase of the proposed development. In particular, the traffic-related air emissions may generate quantities of air pollutants such as NO_2, CO, benzene and PM_{10}.

8.6.2.2. Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the proposed development. Road traffic may give rise to CO_2 and N_2O emissions. There is the potential for a number of greenhouse gas emissions to atmosphere during the operational phase of the proposed development.

8.7. Mitigation Measures

In order to sufficiently ameliorate the likely air quality impact, a schedule of air control measures has been formulated for both construction and operational phases associated with the proposed development.

8.7.1. Construction Phase

8.7.1.1. Air Quality

The greatest potential impact on air quality during the construction phase is from construction dust emissions, $PM_{10}/PM_{2.5}$ emissions and the potential for nuisance dust.

In order to minimise dust emissions during construction, a series of mitigation measures have been prepared in the form of a dust minimisation plan. Due to the sensitivity of the current residential receptors to the site additional mitigation measures recommended in the Institute of Air Quality Management Guidance on the Assessment of Dust from Demolition and Construction (2014) for sensitive receptors have been included. Provided the dust minimisation measures outlined in the Plan (see Appendix 8.3) and construction management plan are adhered to, the air quality impacts during the construction phase should be not be significant.

In summary the measures which will be implemented will include:

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic.

- Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.
- Vehicles exiting the site shall make use of a wheel wash facility where appropriate, prior to entering onto public roads.
- Vehicles using site roads will have their speed restricted, and this speed restriction must be enforced rigidly. On any un-surfaced site road, this will be 20 kph, and on hard surfaced roads as site management dictates.
- Vehicles delivering material with dust potential (soil, aggregates) will be enclosed or covered with tarpaulin at all times to restrict the escape of dust.
- Public roads outside the site will be regularly inspected for cleanliness, and cleaned as necessary.
- Material handling systems and site stockpiling of materials will be designed and laid out to minimise exposure to wind. Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods.
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, these procedures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movements of materials likely to raise dust would be curtailed and satisfactory procedures implemented to rectify the problem before the resumption of construction operations.

8.7.1.2. Climate

Construction vehicles, generators etc., may give rise to some CO_2 and N_2O emissions. However, due to the short-term and temporary nature of these works the impact on climate will not be significant.

8.7.2. Operational Phase

8.7.2.1. Air Quality

Mitigation measures in relation to traffic-derived pollutants have focused generally on improvements in both engine technology and fuel quality. EU legislation, based on the EU sponsored Auto-Oil programmes, has imposed stringent emission standards for key pollutants (REGULATION (EC) No 715/2007) for passenger cars which was complied with in 2009 (Euro V) and 2014 (Euro VI).

As outlined in TII (2011), the guidance states that “for the purpose of the EIS, it should be assumed that pollutant concentrations will decline in future years, as a result of various initiatives to reduce vehicle emissions both in Europe and in Ireland” (Page 52). A range of legislation in Europe over the period 1992 – 2013 has significantly reduced the allowable steady cycle emissions of both NOX and PM from road vehicles with NOX emission reductions for HDV (Heavy Diesel Vehicles) a factor of 20 and PM a factor of 36 over this period (Euro I to Euro VI). In relation to LDV (Light Diesel Vehicles) the reduction of NOX and PM from road vehicles has also been significant with NOX emission reductions from HDV a factor of 12 and PM a factor of 40 over this period (Euro I to Euro VI). Although actual on-road emission reductions will be less dramatic, significant reductions in vehicle-related NOX and PM emissions are to be expected over the next 5-10 years as the fleet turns over.

Emissions of pollutants from road traffic can be controlled most effectively by either diverting traffic away from heavily congested areas or ensuring free flowing traffic through good traffic management plans and the use of automatic traffic control systems (UK Department for Environment, Food and Rural Affairs, 2009b).

8.7.2.2. Climate

Improvements in air quality are likely over the next few years as a result of the on-going comprehensive vehicle inspection and maintenance program, fiscal measures to encourage the use of alternatively fuelled vehicles and the introduction of cleaner fuels.

CO_2 emissions for the average new car fleet were reduced to 120 g/km by 2012 through EU legislation on improvements in vehicle motor technology and by an increased use of biofuels. This measure has reduced CO_2 emissions from new cars by an average of 25% in the period from 1995 to 2008/2009

whilst 15% of the necessary effort towards the overall climate change target of the EU has been met by this measure alone (Department of Environment, Heritage and Local Government, 2000).

Additional measures included in the National Climate Change Strategy (Department of Environment, Heritage and Local Government, 2006, 2007) include: (1) VRT and Motor Tax rebalancing to favour the purchase of more fuel-efficient vehicles with lower CO_2 emissions; (2) continuing the Mineral Oils Tax Relief II Scheme and introduction of a biofuels obligation scheme; (3) implementation of a national efficient driving awareness campaign, to promote smooth and safe driving at lower engine revolutions; and (4) enhancing the existing mandatory vehicle labelling system to provide more information on CO_2 emission levels and on fuel economy.

8.8. Predicted Residual Impacts of the Proposed Development

8.8.1. Construction Phase

8.8.1.1. Air Quality

When the dust minimisation measures detailed in the mitigation section of this Chapter are implemented, fugitive emissions of dust from the site will be insignificant and pose no nuisance at nearby receptors.

8.8.1.2. Climate

Due to the size and nature of the construction activities with appropriate mitigation measures, CO_2 and N_2O emissions during construction will have a negligible impact on climate.

8.8.2. Operational Phase

8.8.2.1. Local Air Quality

The results of the air dispersion modelling study indicate that the residual impacts of the proposed development on air quality and climate are predicted to be imperceptible for most parameters with respect to the operational phase local air quality assessment for the long and short term with a slight adverse impact with regard to NO2 at two receptors in the long term.

The receptors modelled represent the worst-case locations close to the proposed development and were chosen due to their close proximity (within 200 m) to the proposed development. The worst case traffic data used in this assessment is shown in Table 8-8, with the percentage of HGV's shown in parenthesis below the AADT. Two sensitive residential receptors in the vicinity of the proposed development have been assessed. Sensitive receptors have been chosen as they have the potential to be adversely impacted by the development, these receptors are shown in Table 8-9 and Figure 8-2.

Table 8-8 Traffic Data used in this Assessment.

Link	Road Name	Speed	Base Year	Do-Nothing		Do-Something	
			2015	Phase 1	Phase 2	Phase 1	Phase 2
1	N11 North	85	41405 (2.9%)	44715 (2.9%)	44715 (2.9%)	46864 (2.9%)	69345 (2.9%)
2	N11 South	85	41405 (2.9%)	44715 (2.9%)	44715 (2.9%)	45194 (2.9%)	50051 (2.9%)
3	N11 Druids Glen Road Q-P3	50	0 (0%)	0 (2.9%)	0 (0%)	2665 (2.9%)	30003 (2.9%)

Note: Traffic data expressed in AADT, percentage HGV shown in parenthesis

Table 8-9 Description of Sensitive Receptors (UTM Co-ordinates).

Name	Receptor Type	X	Y
R1	Residential	690377	5904481
R2	Residential	690489	5904388

Figure 8-2 Receptor Locations

8.8.2.2. "Do Something' Modelling Assessment'

Transport Infrastructure Ireland "Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes" (TII 2011) detail a methodology for determining air quality impact significance criteria for road schemes. The degree of impact is determined based on both the absolute and relative impact of the Proposed Scheme. Therefore, in order to assess the impact of the scheme using the 'Do Something' modelling scenario, the 'Do Nothing' modelling scenario must first be assessed.

8.8.2.2.1. "Do Nothing" (Existing) Scenario

CO and Benzene

The results of the "do nothing" modelling assessment for CO and benzene for Phase 1 and Phase 2 are shown in Table 8-10 and Table 8-11. Concentrations are well within the limit values at all worst-case receptors. Levels of both pollutants are at maximum 28% and 21% of the respective limit values in 2025.

PM_{10}

The results of the "do nothing" modelling assessment for PM_{10} for Phase 1 and Phase 2 are shown in **Error! Reference source not found.**. Concentrations are well within the annual limit value at all worst-case receptors. In addition, the 24-hour PM_{10} concentration of 50 µg/m^3, which can only be exceeded 35 times per year within the limit, is found to be in compliance at all receptors (Table 8-13). There are no days of exceedance predicted at any of the receptors. Annual average PM_{10} concentrations are 38% of the limit value in 2025.

$PM_{2.5}$

The results of the "do nothing" modelling assessment for $PM_{2.5}$ for Phase 1 and Phase 2 are shown in Table 8-14. The predicted concentrations at all worst-case receptors are well below the $PM_{2.5}$ limit value of 25 µg/m^3. The annual average $PM_{2.5}$ concentration peaks at 40% of the limit value in 2025.

NO_2

The results of the "do nothing" assessment of annual average NO_2 concentrations for Phase 1 and Phase 2 are shown in Table 8-15 for the Highways Agency IAN 170/12 and Table 8-16 using the UK Department for Environment, Food and Rural Affairs technique respectively. The purpose of IAN 170/12 was to account for the conclusions of UK's Department for Environment, Food and Rural Affairs advice on long term trends that there is now a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality as previously published in UK Department for Environment, Food and Rural Affairs technical guidance and observed trends. Hence, the projections calculated via the IAN 170/12 technique show a slower than previously predicted reduction between the base year and future year predictions. The concentrations are below the limit value at all locations, with levels ranging up to 56% in 2025, using the more conservative IAN prediction.

The hourly limit value for NO_2 is 200 µg/m^3 is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The Maximum 1-hour NO_2 concentration for the "do nothing" scenario is not predicted to be exceeded in 2025.

8.8.2.2.2. "Do Something" (Proposed) Scenario

CO and Benzene

The results of the modelled impact of the scheme for CO and benzene for Phase 1 and Phase 2 are shown in Table 8-10 and Table 8-11 respectively. Predicted pollutant concentrations with the proposed development in place are below the ambient standards at all locations. Levels of both pollutants range from 21% to 28% of the respective limit values (see Table 8-1) for Phase 1 and 2 in 2025. Future trends indicate similarly low levels of CO and benzene. There are some increases in traffic flows between Phase 1 and 2, therefore any reduction in concentrations is due to reduced background concentrations and greater efficiencies predicted in engines.

The impact of the proposed development can be assessed relative to "Do Nothing" levels in 2025 for Phase 1 and Phase 2. Relative to baseline levels, some imperceptible increases in pollutant levels at the worst-case receptors are predicted as a result of the proposed development. Thus, using the

assessment criteria for NO_2 and PM_{10} and applying these criteria to CO and benzene, the impact of the proposed development in terms of CO and benzene is negligible.

PM_{10}

The results of the modelled impact of the proposed development for PM_{10} for Phase 1 and Phase 2 are shown in Table 8-12. Predicted annual average concentrations in the region of the proposed development are below the ambient standards at all worst-case receptors with levels 39% of the limit value in Phase 1 or Phase 2. In addition, the 24-hour PM_{10} concentration of 50 µg/m^3, which can only be exceeded 35 times per year whist remaining in compliance with the limit value, is found to be in compliance at all receptors. It is predicted that the worst case receptors will have no exceedances of the 50 µg/m^3 24-hour mean value for either Phase 1 or Phase 2 (Table 8-1). Future trends with the proposed development in place indicate similarly low levels of PM_{10}. Annual average PM_{10} concentrations are also 38% of the limit (see Table 8-1) for Phase 1 or 38 % of the limit during Phase 2.

The impact of the proposed development can be assessed relative to "Do Nothing" levels for Phase 1 or Phase 2. Relative to baseline levels, some small increases in PM_{10} levels at the worst-case receptors are predicted as a result of the proposed Road Scheme. With regard to impacts at individual receptors, none of the five receptors assessed will experience an increase in concentrations of over 1.8% of the limit value for Phase 1 or Phase 2. Thus, the magnitude of the change in air quality is at most small based on the criteria outlined in Table 8-2 to Table 8-4.

Thus, using the assessment criteria outlined in Table 8-2 to Table 8-4, the impact of the proposed development with regard to PM_{10} is negligible at all of the receptors assessed.

$PM_{2.5}$

The results of the modelled impact of the proposed development for $PM_{2.5}$ in the opening and design years are shown in Table 8-14. Predicted annual average concentrations in the region of the proposed development are below the ambient standards at all worst-case receptors, with levels of 40% of the limit value (see Table 8-1) in 2025 during Phase 1 or Phase 2. Future trends with the proposed development in place indicate similarly low levels of $PM_{2.5}$.

The impact of the proposed development can be assessed relative to "Do Nothing" levels during Phase 1 or Phase 2. Relative to baseline levels, some small increases in PM2.5 levels at the worst-case receptors are predicted as a result of the proposed development. None of the receptors assessed will experience an increase or decrease in concentrations of over 0.3% of the limit value during Phase 1 or 1.9% of the limit value during Phase 2. Thus, the magnitude of the changes in air is negligible at all receptors based on the criteria outlined in Table 8-2 to Table 8-4.

NO_2

The result of the assessment of the impact of the proposed development for NO2 in the opening and design years are shown in Table 8-15 for the Highways Agency IAN 170/12 and Table 8-16 using the UK Department for Environment, Food and Rural Affairs technique respectively. The annual average concentration is within the annual limit value (see Table 8-1) at all worst-case receptors using both the UK Department for Environment, Food and Rural Affairs and more conservative IAN technique. Levels of NO_2 are 56% and 61% of the annual limit value in Phase 1 and Phase 2 using the IAN technique, while concentrations are 41% and 42% of the annual limit value in Phase 1 and Phase 2 using the UK Department for Environment, Food and Rural Affairs technique in the Do-Something Scenario. Maximum one-hour NO_2 levels with the proposed development in place are not predicted to exceed using either technique. The impact of the proposed development on annual mean NO_2 levels can be assessed relative to "Do Nothing" levels in Phase 1 and Phase 2. Relative to baseline levels, some large increases in pollutant levels are predicted as a result of the proposed road scheme. With regard to impacts at individual receptors, none of the receptors assessed will experience an increase in concentrations of more than 2% of the annual mean limit value for Phase 1, however, one of the two receptors assessed will experience an 11% increase in concentrations with respect to the limit value for Phase 2. 11% is classified as a large increase, however even with this increase, concentrations of NO_2 remain significantly less than the annual mean limit value (61%) at the worst case receptor. Thus, using the assessment criteria outlined in Table 8-2 to Table 8-4, the impact of the proposed development in terms of NO_2 is slight adverse.

The hourly limit value for NO_2 is 200 µg/m^3 is expressed as a 99.8th percentile (i.e. it must not be exceeded more than 18 times per year). The Maximum 1-hour NO_2 concentration for the “Do Nothing” scenario is not predicted to be exceeded in either Phase 1 or Phase 2 (Table 8-17).

Table 8-10 Maximum 8-hour CO Concentrations (mg/m^3)

Receptor	Impact Phase 1 (2025)						Impact Phase 2 (2025)					
	DM*	DS**	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	2.64	2.67	0.028	0.28	Imperceptible	Negligible Increase	2.64	2.85	0.211	2.11	Imperceptible	Negligible Increase
2	2.76	2.76	0.005	0.05	Imperceptible	Negligible Increase	2.76	2.80	0.041	0.41	Imperceptible	Negligible Increase

*Do minimum; **Do something

Table 8-11 Annual Mean Benzene Concentrations (µg/m^3).

Receptor	Impact Phase 1 (2025)						Impact Phase 2 (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	1.00	1.00	0.007	0.14	Imperceptible	Negligible Increase	1.00	1.07	0.078	1.56	Imperceptible	Negligible Increase
3	1.05	1.05	0.002	0.04	Imperceptible	Negligible Increase	1.05	1.07	0.023	0.46	Imperceptible	Negligible Increase

Table 8-12 Annual Mean PM_{10} Concentrations (µg/m^3).

Receptor	Impact Phase 1 (2025)						Impact Phase 2 (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	14.8	14.9	0.10	0.24	Imperceptible	Negligible Increase	14.8	15.5	0.73	1.84	Small	Negligible Increase
3	15.3	15.4	0.02	0.05	Imperceptible	Negligible Increase	15.3	15.5	0.16	0.40	Imperceptible	Negligible Increase

Table 8-13 Number of days with PM_{10} concentration > 50 µg/m^3.

Receptor	Impact Phase 1 (2025)		Impact Phase 2 (2025)	
	DM	DS	DM	DS
1	0	0	0	0
3	0	0	0	0

Table 8-14 Annual Mean $PM_{2.5}$ Concentrations (µg/m^3).

Receptor	Impact Phase 1 (2025)						Impact Phase 2 (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	9.6	9.7	0.06	0.25	Imperceptible	Negligible Increase	9.6	10.1	0.48	1.91	Small	Small Increase
3	10.0	10.0	0.01	0.05	Imperceptible	Negligible Increase	10.0	10.1	0.10	0.41	Imperceptible	Negligible Increase

Table 8-15 Annual Mean NO_2 Concentrations (µg/m3) (using Interim advice note 170/12 V3 Long Term NO_2 Trend Projections).

Receptor	Impact Phase 1 (2025)						Impact Phase 2 (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	19.7	20.4	0.64	1.60	Small	Small Increase	19.7	24.5	4.74	11.84	Large	Large Increase
3	22.3	22.4	0.11	0.28	Imperceptible	Imperceptible Increase	22.3	23.3	0.97	2.42	Small	Small Increase

Table 8-16 Annual Mean NO2 Concentrations (µg/m3) (using UK Department for Environment, Food and Rural Affairs Technical Guidance).

Receptor	Impact Phase 1 (2025)						Impact Phase 2 (2025)					
	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description	DM	DS	DS-DM	Impact as % of Limit Value	Magnitude	Description
1	13.6	14.0	0.44	1.10	Small	Small Increase	13.6	16.8	3.25	8.13	Medium	Medium Increase
3	16.1	16.2	0.08	0.20	Imperceptible	Imperceptible Increase	16.1	16.8	0.70	1.75	Small	Small Increase

Table 8-17 Annual 99.8th percentile of daily maximum 1-hour for NO_2 concentrations (µg/m3).

Receptor	IAN 170/12 V3 Long Term NO_2 Trend Projections Technique				Defra's Technical Guidance Technique			
	Impact Phase 1 (2025)		Impact Phase 2 (2025)		Impact Phase 1 (2025)		Impact Phase 2 (2025)	
	DM	DS	DM	DS	DM	DS	DM	DS
1	69.1	71.3	69.1	85.7	69.1	71.3	69.1	85.7
3	78	78.4	78	81.4	78	78.4	78	81.4

8.9. Monitoring

AWN recommend that monitoring of dust deposition levels (via the Bergerhoff method) takes place at a number of locations at the site boundary of the proposed development to ensure that dust nuisance is not occurring at nearby sensitive receptors. This methodology will ensure that the dust mitigation measures outlined in the dust minimisation plan (Appendix 8.3) remain effective.

8.10. Reinstatement

This is not applicable to the air quality & climate assessment.

8.11. Conclusions

In order to protect nearby sensitive receptors, worst case construction and operational phase impacts have been assumed to be worst case throughout the assessment.

Potential construction phase impacts have been taken to be worst case and therefore strict mitigation measures have been outlined in a dust minimisation plan (Appendix 8.3). The mitigation measures for dust are designed with a number of layers of protocol, therefore if one fails in the short-term it should be eliminated by the next. Construction dust monitoring should be put in place to ensure that, should mitigation measures fail and construction dust impacts occur, they will be short term in nature.

Mitigation measures with regard to the operational phase focus on engine efficiency and diverting traffic away from heavily congested areas or ensuring free flowing traffic through good traffic management plans and the use of automatic traffic control systems. Worst case receptors and traffic data have been chosen when modelling air quality impacts in the operational phase. These receptors are located nearby to the proposed scheme which will experience traffic impacts due to the proposed development. With regard to impacts at individual receptors, none of the receptors assessed will experience an increase in concentrations of over 2% of the annual limit value for Phase 1 however one of the two receptors assessed will experience an increase in concentrations of over 11% of the annual limit value for Phase 2. These maximum impacts occur for NO_2. Even with this increase, the annual average concentration is within the limit value at all worst-case receptors using the more conservative IAN technique. The results of the air dispersion modelling study indicate that the residual impacts of the proposed development on air quality and climate are predicted to be imperceptible for most parameters with respect to the operational phase local air quality assessment for the long and short term with a slight adverse impact with regard to NO_2 at one receptor in the long term. Levels of NO_2 are 56% and 61% of the annual limit value in Phase 1 and Phase 2 using the IAN technique. Concentrations of all other pollutants are 40% or less than their respective limit values.

Thus, using the assessment criteria which takes into account background concentrations, the impact of the operational phase proposed development in terms of air quality is slight adverse.

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9. Noise and Vibration

9.1. Introduction

This chapter assesses the impacts of noise and vibration associated with the proposed development i.e. N11 Junction Q. The proposed development will consist of a new at-grade signalised junction on the N11 dual carriageway, linking it to Development Area 5 of the Cherrywood Strategic Development Zone Planning Scheme (CPS)

The chapter has been prepared with reference to the most appropriate standards and guidelines applicable to the proposed development in question.

9.2. Methodology

In order to assess the noise impact of any proposed development, the following methodology is normally adopted.

The first stage is to assess and quantify the existing noise environment in the vicinity of sensitive receptors that may be affected by the proposed development. In the case of a road scheme, the selected noise-sensitive locations are likely to be those in closest proximity to the proposed road.

The noise levels resulting from both the construction and operational phases are then calculated using established prediction techniques. The noise levels associated with the operational phase of the proposed development are predicted in accordance with guidance set out in Calculation of Road Traffic Noise (CRTN), giving results in the form of $L_{A10(18hour)}$ values. These are then converted to L_{den} values in accordance with the procedures detailed in the Transport Infrastructure Ireland (TII) guidance identified below. The derived values for L_{den} should be rounded to the nearest whole number, with 0.5 being rounded up.

The results of the predicted assessment are compared against the most appropriate criteria for both construction and operational phases. Where predicted noise levels are in excess of the adopted criteria, mitigation measures are proposed.

Further details of each phase of the assessment are set out in the individual sections of the chapter.

9.2.1. Assessment Criteria

9.2.1.1. Operational Phase

9.2.1.1.1. TII Guidelines for New National Road Schemes

There are no statutory guidelines or standards for noise mitigation in Ireland applicable for Road Schemes. For new national roads in Ireland, it is standard practice to adopt the traffic noise design goal contained within the TII document *Guidelines for the Treatment of Noise and Vibration in National Road Schemes 2004* and Guidance contained within the TII's *Good Practice Guide for the Treatment of Noise during the Planning on National Road Schemes* (2014). Both documents note the use of a traffic noise design goal of 60dB L_{den} (free field residential façade criterion i.e. without the influence of building reflections) for new national roads.

The following three conditions must be satisfied under the TII guidelines in order for noise mitigation to be provided:

- the combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal of 60dB L_{den};
- the relevant noise level is at least 1dB more than the expected traffic noise level without the proposed road scheme in place, and;
- the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1dB.

It should be noted that the Design Goal is applicable to new national road schemes only. In the case of this scheme the proposed new signalised junction and upgrade works to the existing N11 do not fall under the

requirements for noise design goals set within the TII's guidance document as it is an existing road. It is therefore acknowledged that it will not always be sustainable to achieve the 60dB L_{den} design goal.

The 2014 Good Practice Guide recognises that "*in some cases the attainment of the design goal may not be possible by sustainable means".* The guidance also notes that the benefit gained by the insertion of a barrier is limited and notes that for caution should be exercised specifying substantial screening where small benefits (<3dB) are only achieved, given a change of 3dB(A) is the smallest change that would give a reliable difference in public response.

9.2.1.1.2. Evaluation of Impacts

In terms of the change in noise experienced at properties assessed, reference is made to the DMRB's Volume 11, Section 3 which prescribes a magnitude of impact relating to changes in road traffic noise. Table 9-1and Table 9-2 summarises the classification of magnitude of impacts relating to traffic noise in both the short term (typically the year of opening) and the long-term impact (typically the design year).

Table 9-1 Classification of Magnitude of Short-term Noise Impacts

Noise Change, dB	Magnitude of Impact
0	No Change
0.1 – 0.9	Negligible
1 – 2.9	Minor
3 – 4.9	Moderate
5+	Major

Table 9-2 Classification of Magnitude of Long-term Noise Impacts

Noise Change, dB	Magnitude of Impact
0	No Change
0.1 – 2.9	Negligible
3 – 4.9	Minor
5 – 9.9	Moderate
10+	Major

9.2.1.2. Construction Phase

The TII guidance document specifies noise levels that it typically deems acceptable in terms of construction noise. These limits are set out in Table 9-3.

Table 9-3 Maximum Permissible Noise Levels at the Façade of Nearby Dwellings during Construction

Days & Times	$L_{Aeq\ (1hr)}$ dB	L_{Amax} dB(A)
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60	65
Saturday 08:00 to 16:30hrs	65	75
Sundays and Bank Holidays 08:00 to 16:30hrs	60	65

It should be noted that the noise criteria quoted in the table above are specific to construction activities only (i.e. these levels are not cumulative with the existing noise environment from road traffic and other surrounding sources).

9.3. Receiving Environment

An environmental noise survey was conducted in the vicinity of the proposed development in proximity to the nearest noise sensitive locations. These locations have been chosen in order to quantify the existing noise environment in the vicinity of the noise-sensitive locations that may be affected by the proposed works.

9.3.1. Survey Periods

Attended monitoring was conducted at 2 locations (AN2 to AN3) on 25 August between 10:00 and 17:00 hours.

9.3.2. Measurement Locations

The measurement location descriptions are presented in Table 9-4 below and illustrated in

Figure 9-1.

Table 9-4 Baseline Noise Monitoring Locations.

Survey Locations	Description
AN2	At the cul-de-sac fronting residential property along N11 to north-east of link road.
AN3	Within Kilbogget Park in line with rear facades of residential properties

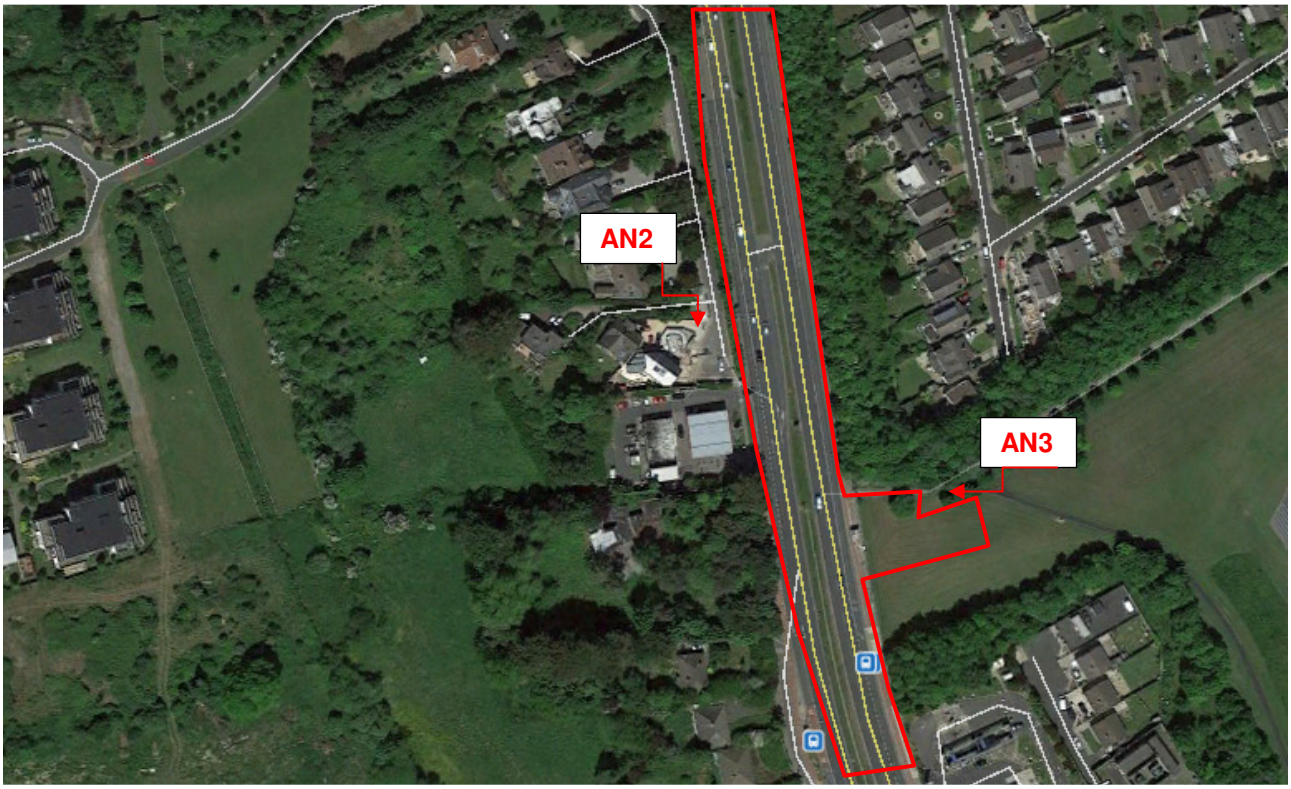

Figure 9-1 Noise Monitoring Locations

9.3.3. Instrumentation

The measurements were performed using a Larson Davis Type 831 Sound Level Meter. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

9.3.4. Procedure

9.3.4.1. Attended Noise Measurements

The surveys were conducted on a cyclical basis with sample periods of 15 minutes. The results were noted onto a Survey Record Sheet immediately following each sample, and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up. The survey work was conducted in accordance with the shortened measurement procedure as laid down in the TII guidance document.

When surveying traffic noise, the acoustical parameters of interest are $L_{A10\ (1hour)}$ and $L_{A10\ (18hour)}$, expressed in terms of decibels (dB) relative to 2×10^{-5}Pa. The value of $L_{A10\ (1hour)}$ is the noise level exceeded for just 10% of the time over the period of one hour. $L_{A10\ (18hour)}$ is the arithmetic average of the values of $L_{A10\ (1hour)}$ for each of the one hour periods between 06:00 and 24:00hrs.

The measurement procedure involves a method whereby $L_{A10\ (18hour)}$ values are obtained through a combination of measurement and calculation as follows:

- noise level measurements are undertaken at the chosen location over three consecutive hours between 10:00 and 17:00hrs;
- the duration of the sample period during each hour is selected to encompass sufficient traffic flows to ensure reliable results;
- the $L_{A10\ (18hour)}$ for the location is derived by subtracting 1dB from the arithmetic average of the three hourly sample values,
- i.e. $L_{A10\ (18hour)} = ((\Sigma L_{A10\ (1hour)}) / 3) - 1$ dB.

The L_{den} for the location is then derived from the calculated $L_{A10\ (18hour)}$ value,

i.e. $L_{den} = 0.86\ L_{A10\ (18hour)} + 9.86$ dB.

9.3.5. Survey Results

Table 9-5 presents the results of the measured noise levels at the two survey locations.

Table 9-5 Attended Survey Results at locations AN2 and AN3

Survey Location	Start Time	Measured Noise Levels			L_{den} Derived (short-term)	Notes
		L_{Aeq}	L_{A10}	L_{A90}		
AN2	13:18	67	70	61	68	N11 traffic dominant source
	14:20	66	69	58		
	15:30	67	69	60		
AN3	13:36	59	61	54	61	N11 traffic dominant source, leaf rustle, birdsong
	14:38	59	62	54		
	15:38	60	62	57		

Measured noise levels at locations AN2 and AN3 were dominated by road traffic along the N11 resulting in noise levels above 60dB L_{den} being recorded. Higher noise levels were recorded at Location AN2 due to the monitoring location being in closer proximity to the N11 road and also from the contribution of local vehicle movements along the cul de sac road and activities within the adjacent petrol station. At Location AN3, measured noise levels were dominated by road traffic along the N11.

9.4. Potential Impact of the Proposed Development

9.4.1. Operational Phase

9.4.1.1. Noise Model

A computer-based prediction model has been prepared in order to quantify the traffic noise level associated with the operational phase of the proposed development. This section discusses the methodology behind the noise modelling process and presents the results of the modelling exercise.

9.4.1.2. Brüel & Kjær Type 7810 Predictor

Proprietary noise calculation software was used for the purposes of this impact assessment. The selected software, Brüel & Kjær Type 7810 *Predictor*, calculates traffic noise levels in accordance with CRTN and TII guidance.

Brüel & Kjær Type 7810 *Predictor* is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. *Predictor* predicts noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of sound power or traffic flow and average velocity;
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces, and;
- the hardness of the ground between the source and receiver.

9.4.1.3. Prediction of Traffic Noise

Noise emissions during the operational phase of the project have been modelled using *Predictor* in accordance with CRTN and with the application of the relevant conversion factors as detailed in the TII Guidance. The CRTN method of predicting noise from a road scheme consists of the following five elements:

- divide the road scheme into segments so that the variation of noise within this segment is small;
- calculate the basic noise level at a reference distance of 10 metres from the nearside carriageway edge for each segment;
- assess for each segment the noise level at the reception point taking into account distance attenuation and screening of the source line;
- correct the noise level at the reception point to take account of site layout features including reflections from buildings and facades, and the size of source segment, and;
- combine the contributions from all segments to give the predicted noise level at the receiver location for the whole road scheme.

9.4.1.4. Input to the Noise Model

The noise model was prepared using the following data:

- Ordnance Survey mapping, and alignment data of the proposed development supplied by Atkins Consulting Engineers, and;
- Predicted Traffic flows and speed data as supplied by Atkins Consulting Engineers.

Hourly noise predictions were conducted based on these traffic figures in accordance with Method A of the TII guidelines. The hourly predictions were carried out using the diurnal traffic profiles provided in Appendix 1 of the TII guidelines.

9.4.1.5. Output of the Noise Model

Predictor calculates noise levels for a set of receiver locations specified by the user. The results include an overall level in dB L_{den}.

9.4.1.6. Choice of Receiver Locations

Free-field traffic noise levels (have been predicted at 8 properties which are currently built in the vicinity of proposed development. These receiver locations are detailed in Appendix 9.1.

For the purpose of this assessment, we have considered two assessment scenarios:

- Assessment of existing properties in the vicinity of the proposed development. Under this scenario, specific noise levels have been calculated at the identified existing sensitive buildings.

9.4.1.7. Model Calibration

The purpose of noise model calibration is to ensure that the software is correctly interpreting the input data and providing results that are valid for the scenario under consideration. It should be noted that the purpose of the model calibration is not to validate the prediction methodology in use as the CRTN prediction methodology has itself been previously validated.

The most appropriate mechanism for calibration would be to compare the output of a road model, using the AADT traffic flows for the existing road network in 2015, with the measured L_{den} values measured during baseline survey. The results of the calibration are presented in Table 9-6.

Table 9-6 Model Calibration Results

Survey Location	Measured L_{den}, dB	Model Predicted L_{den}, dB	Variation (dB)
AN2	68.3	69.4	1.1
AN3	60.7	63.1	2.4

The differences between the measured and predicted results are in the range of 1.1 and 2.4 dB (A), which demonstrates a strong correlation and confirms that the model is correctly interpreting the input data.

9.4.1.8. Traffic Noise Levels

Traffic noise predictions have been conducted for the operational phase of the scheme for the following scenarios:

- 2025 Do Nothing (i.e. Junction is not built)
- 2025 Do Something Phase 14 i.e. Cherrywood SDZ Development Area 5 + O'Flynn Development traffic
- 2025 Do Something Phase 25 i.e. All Cherrywood SDZ Development Areas traffic

The following Table 9-7 traffic flows have been modelled as provided by Atkins Consulting Engineers.

Table 9-7 Traffic Volumes Associated with N11 Junction Q

Link	AADT 2025 Do Nothing	AADT 2025 Do Something Phase 1	AADT 2025 Do Something Phase 2
A – N11 South of N11 Junction Q	44,715	45,194	69,345
B – N11 North of N11 Junction Q	44,715	46,864	50,051

As part of this project, approximately 300m of the eastern section of the N11 will be widened to accommodate additional traffic lanes and pedestrian and cyclist facilities. This will result in the partial removal of the existing wall and some trees located along this section. Review of the proposed cross section for the widened road indicates that a new retaining wall will be re-instated as part of the base development works. In this instance, the noise assessment has assumed that the Do Something scenarios will incorporate a structure equal in height to that already in place.

[4] Phase 1 relates to the development Area 5 + O' Flynn's Development
[5] Phase 2 relates to the development of the above in addition to Phase 2 of the SDZ lands at Cherrywood

9.4.1.9. Assessment of Existing Properties

The results of the traffic noise predictions at the properties in the vicinity of the proposed development are presented in Table 9-8.

Table 9-8 Predicted Noise Levels for 2025 Do Nothing and Do Something

Receiver Location Reference	Year 2025						
	Do Nothing	Do Something – Phase 1	Magnitude of Impact - Short Term	Mitigation Required?	Do Something Phase 2	Magnitude of Impact- Long Term	Mitigation Required?
	L_{den} (dB)	L_{den} (dB)			L_{den} (dB)		
9	63	63	No change	No	65	Negligible	No/ Note 1
10	67	67	No change	No	68	Negligible	No/ Note 1
11	67	68	Negligible	No	68	Negligible	No/ Note 1
12	68	69	Negligible	No	70	Negligible	No/ Note 1
13	69	69	No change	No	70	Negligible	No/ Note 1
14	64	64	No change	No	65	Negligible	No/ Note 1
15	63	63	No change	No	64	Negligible	No/ Note 1
16	61	61	No change	No	63	Negligible	No/ Note 1

Note 1 Traffic noise levels at these properties are dominated by induced traffic along the N11 Road and will experience a negligible to minor noise impact as a result of the proposed development. Given the location of existing walls, property entrances and boundary treatments, the use of noise mitigation is not deemed practical for these properties.

Traffic noise levels at the modelled properties are calculated to increase by the order of 1 to 2dB (A) as a result of induced traffic along the N11 during the Phase 2 scenario which assumes the worst case traffic volumes. The magnitude of change at these properties is determined to be negligible. It should also be noted that whist noise levels at these properties are above 60dB L_{den}, it is not possible to reduce noise levels to within or below the Do Nothing scenario without significantly increasing the heights and potentially lengths of existing boundary walls and earth berms along the N11. Given the negligible change in noise levels, the incorporation of noise mitigation would not result in any significant perceived benefit to residents.

9.4.2. Construction Phase

A variety of items of plant will be in use during the construction works. These will include breakers, excavators, dump trucks, and generators in addition to general road surfacing and levelling equipment. The key phases of works will involve ground breaking, earthworks, surfacing works and landscaping. Due to the nature of the activities undertaken on a road construction site, there is potential for generation of high levels of noise at nearby noise sensitive properties.

As per TII guidance noise levels associated with construction may be calculated in accordance with the methodology set out in *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise*. This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations. However, it is often not possible to conduct detailed prediction calculations for the construction phase of a project in support of the EIS. This is due to the fact that the programme for construction works has not been established in detail.

BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise sets out typical noise levels for items of construction plant. Table 9-9 and Table 9-10 set out assumed plant items during the key phases of construction with the associated source reference from BS

5228-1:2009+A1:2014. The closest property to the proposed works is approximately 20m from the upgrade works. Construction noise calculations have been conducted at distances of 20 to 50m from the works for different work phases, representing the nearest properties to the works.

The calculations assume that plant items are operating for 66%[6] of the time and that all plant items associated with the individual phases are operating simultaneously and at the same distance for any one scenario. The use of a standard construction site hoarding around the perimeter of the construction works has been included in the noise calculations.

Table 9-9 Indicative construction noise calculations during site preparation

Site Clearance & Preparation (BS 5228 Ref)	Calculated $L_{Aeq,T}$ at distance from proposed development (m)		
	20m	30m	50m
Wheeled loader (C2.26)	66	68	63
Tracked excavator (loading dump truck) (C1.10)	72	74	69
Dozer (C.2.10)	67	69	64
Dump Truck (C2.30)	66	68	63
Combined L_{Aeq}	75	76	72

Table 9-10 Indicative construction noise calculations during road works

Road Works (BS 5228 Ref)	Calculated $L_{Aeq,T}$ at distance from proposed development (m)		
	20m	30m	50m
Tracked excavator (C2.21)	58	60	55
Dump Truck (C2.30)	66	68	63
vibration rollers (C5.20)	62	64	59
Asphalt Paver & Tipping Lorry (C.5.31)	64	66	61
Diesel Generator (C4.76)	48	50	45
Road Rollers (C5.19)	67	69	64
Combined L_{Aeq}	72	73	69

The reference values outlined in Tables 9.9 and 9.10 indicate that at distances of up to 50m from the works, there is potential for the construction noise limit of 70dB L_{Aeq} to be exceeded from Monday through Friday (07:00 to 19:00hrs), depending on the number and type of equipment occurring at any one time.

It should be noted that the calculations set out in the above tables are indicative and are used for the purposes of comparison only with the adopted criteria. Where exceedance of the recommended criteria has been predicted, the use of specific additional noise mitigation measures will be used as part of the construction works. In this instance, where construction works are planned within 50m of noise sensitive properties, a schedule of noise mitigation measures will be required to ensure noise levels are minimised. Further details are set out in Section 9.5.2.

[6] This estimate assumes that the plant will operate a full 8 hour shift over the proposed 12 hour working period which equates to a 66% on-time over a daytime period or 40 minutes over a 1 hour period. The dynamic nature of construction sites is such that this is deemed to be a conservative estimate.

9.5. Mitigation Measures

9.5.1. Operational Phase

The results of the assessment have indicated that noise mitigation measures are not required along the section of N11 as part of this project.

9.5.2. Construction Phase

The contract documents will clearly specify that the Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of BS5228-1 2009+A1 (2011). These measures will typically include:

- No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
- Any plant, such as generators or pumps, which is required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen.
- During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Section 9.2 using methods outlined in BS5228:2009+A1 2011 *Part 1.*
- Erecting portable screens around noisy items of plant in noise sensitive areas, where required.

9.5.2.1. Working Hours

Normal working times are assumed to be 07:00 to 19:00hrs Monday to Saturday. Works other than the pumping out of excavations, security and emergency works will not be undertaken outside these working hours without the written permission of the Contracting Authority.

Works other than the pumping out of excavations, security and emergency works will not be undertaken at night and on Sundays without the written permission of the Contracting Authority.

9.5.2.2. Emergency Work

The emergency work referred to above may include the replacement of warning lights, signs and other safety items on public roads, the repair of damaged fences, repair of water supplies and other services which have been interrupted, repair to any damaged temporary works and all repairs associated with working on public roads.

9.6. Residual Noise Levels

9.6.1. Operational Phase

For existing properties in the vicinity of the proposed development, residual noise levels (assuming a Phase 2 traffic scenario) will result in a negligible noise impact at properties along the N11.

9.6.2. Construction Phase

During the construction phase of the project there is potential for some temporary moderate to significant impact on nearby residential properties due to noise emissions from certain construction activities in the absence of specific mitigation measures. The application of binding noise limits and hours of operation, along with implementation of appropriate noise control measures, will ensure that noise impact is kept to a minimum and will be short-term and transient in nature.

9.7. Vibration

A survey of vibration along the proposed development was not undertaken, as levels associated with existing roads would not be expected to be of a magnitude sufficient to cause disturbance to people or structural damage to property. Furthermore, vibration was not perceptible at any of the noise survey locations.

9.7.1. Potential Impacts – Operational Phase

Ground vibrations produced by road traffic are unlikely to cause perceptible, cosmetic, or structural vibration in properties located near to well-maintained and smooth road surfaces. Problems attributable to road traffic vibration are therefore largely avoided by maintenance of the road surface. Given that the existing N11 does not generate any significant vibration levels at present, vibration levels associated with the proposed works will similarly not result in any perceptible vibration levels.

9.7.2. Potential Impacts – Construction Phase

The potential for vibration at neighbouring sensitive locations during construction will typically be limited to breaking operations and lorry movements on uneven road surfaces. The more significant of these is the vibration from ground breaking operations; the method of which will be selected and controlled to ensure there is no likelihood of structural or even cosmetic damage to existing neighbouring dwellings. The contractor will be required to ensure that any works undertaken will not exceed the construction limit values outlined in Table 9.11.

Table 9-11 Maximum Allowable Vibration Levels During Construction Phase

Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	**10 to 50Hz**	**50 to 100Hz (and above)**
8 mm/s	12.5 mm/s	20 mm/s

It may be concluded that the proposed development is not expected to give rise to vibration that is either significantly intrusive or capable of giving rise to structural or even cosmetic damage.

9.8. Summary

9.8.1.1. Operational Phase

The noise impact assessment has concluded that traffic noise levels associated with the Phase 1 modelled scenario will result in a neutral to negligible noise impact at the existing properties adjacent to the proposed development. The noise impact assessment has concluded that traffic noise levels associated with the Phase 2 modelled scenario will result in a negligible noise impact at the existing properties adjacent to the proposed development.

Operational phase vibration associated with the proposed development are considered to be negligible.

9.8.1.2. Construction Phase

During the construction phase of the project there is potential for some temporary moderate to significant impact on nearby residential properties due to noise emissions from certain construction activities in the absence of specific mitigation measures. The application of binding noise limits and hours of operation, along with implementation of appropriate noise control measures, will ensure that noise impact is kept to a minimum and will be short-term and transient in nature.

10. Archaeology

10.1. General

The following report details an archaeological assessment undertaken to assess the impacts of the proposed development i.e. N11 Junction Q in the environs of Cabinteely, Dublin 18. The assessment aims to ascertain any potential impacts that the proposed development may have on the existing archaeological and historical resource. The assessment has been carried out by Faith Bailey of Irish Archaeological Consultancy Ltd, on behalf of Dún Laoghaire Rathdown County Council.

The archaeological assessment involved a detailed study of the archaeological and historical background of the proposed scheme and the immediate surrounding area. This included information from the Record of Monuments and Places of County Dublin (Appendix 10.1, Figure 11.1), the topographical files within the National Museum and all available cartographic and documentary sources for the area. A field inspection has been carried out with the aim to identify any previously unrecorded features of archaeological or historical interest. In addition a programme of archaeological testing has been undertaken as agreed with the National Monuments Service of the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs (DoAHRRGA).

10.2. Methodology

Research for this report was undertaken in two phases. The first phase consisted of a paper survey of all available archaeological, historical and cartographic sources. The second phase involved a field inspection of the site.

10.2.1. Paper Survey

- Record of Monuments and Places for County Dublin;
- Sites and Monuments Record for County Dublin;
- National Monuments in State Care Database;
- Preservation Orders List;
- Topographical files of the National Museum of Ireland;
- Cartographic and written sources relating to the study area;
- Dún Laoghaire Rathdown Development Plan 2016–2022;
- Cherrywood Planning Scheme 2014;
- Aerial photographs;
- Excavations Bulletin (1970–2015)

Record of Monuments and Places (RMP) is a list of archaeological sites known to the National Monuments Section, which are afforded legal protection under Section 12 of the 1994 National Monuments Act and are published as a record.

Sites and Monuments Record (SMR) holds documentary evidence and field inspections of all known archaeological sites and monuments. Some information is also held about archaeological sites and monuments whose precise location is not known e.g. only a site type and townland are recorded. These are known to the National Monuments Service as 'un-located sites' and cannot be afforded legal protection due to lack of locational information. As a result these are omitted from the Record of Monuments and Places. SMR sites are also listed online on a website maintained by the DoAHRRGA – www.archaeology.ie.

National Monuments in State Care Database is a list of all the National Monuments in State guardianship or ownership. Each is assigned a National Monument number whether in guardianship or ownership and has a brief description of the remains of each Monument.

The Minister for the DoAHRRGA may acquire national monuments by agreement or by compulsory order. The state or local authority may assume guardianship of any national monument (other than dwellings). The owners of national monuments (other than dwellings) may also appoint the Minister or the local authority as guardian of that monument if the state or local authority agrees. Once the site is in ownership or guardianship of the state, it may not be interfered with without the written consent of the Minister.

Preservation Orders List contains information on Preservation Orders and/or Temporary Preservation Orders, which have been assigned to a site or sites. Sites deemed to be in danger of injury or destruction can be allocated Preservation Orders under the 1930 Act. Preservation Orders make any interference with the site illegal. Temporary Preservation Orders can be attached under the 1954 Act. These perform the same function as a Preservation Order but have a time limit of six months, after which the situation must be reviewed. Work may only be undertaken on or in the vicinity of sites under Preservation Orders with the written consent, and at the discretion, of the Minister.

Topographical files of the National Museum of Ireland is the national archive of all known finds recorded by the National Museum. This archive relates primarily to artefacts but also includes references to monuments and unique records of previous excavations. The find spots of artefacts are important sources of information on the discovery of sites of archaeological significance.

Cartographic sources are important in tracing land use development within the development area as well as providing important topographical information on areas of archaeological potential and the development of buildings. Cartographic analysis of all relevant maps has been made to identify any topographical anomalies or structures that no longer remain within the landscape.

- Ordnance Survey maps of County Dublin 1844, 1871, 1911
- John Rocque's Map of County Dublin, 1760
- John Taylor's Map of the Environs of Dublin, 1816
- Sir William Petty, Down Survey Map, 1655-56, Barony of Rathdown

Documentary sources were consulted to gain background information on the archaeological and cultural heritage landscape of the proposed development area.

Development Plans contain a catalogue of all the Protected Structures and archaeological sites within the county. The Dún Laoghaire Rathdown Development Plan (2016-2022) and Cherrywood Planning Scheme document (2014) were consulted to obtain information on cultural heritage sites in and within the immediate vicinity of the proposed development.

Aerial photographic coverage is an important source of information regarding the precise location of sites and their extent. It also provides initial information on the terrain and its likely potential for archaeology. A number of sources were consulted including aerial photographs held by the Ordnance Survey and Google Earth.

Excavations Bulletin is a summary publication that has been produced every year since 1970. This summarises every archaeological excavation that has taken place in Ireland during that year up until 2010 and since 1987 has been edited by Isabel Bennett. This information is vital when examining the archaeological content of any area, which may not have been recorded under the SMR and RMP files. This information is also available online (www.excavations.ie) from 1970–2015.

10.2.2. Field Inspection

Field inspection is necessary to determine the extent and nature of archaeological and historical remains, and can also lead to the identification of previously unrecorded or suspected sites and portable finds through topographical observation and local information.

The archaeological field inspection entailed: -

- Inspecting the proposed scheme and its immediate environs;
- Noting and recording the terrain type and land usage;
- Noting and recording the presence of features of archaeological or historical significance;
- Verifying the extent and condition of any recorded sites;
- Visually investigating any suspect landscape anomalies to determine the possibility of their being anthropogenic in origin.

10.3. Receiving Environment

10.3.1. General

The proposed development is located within the townlands of Loughlinstown and Brennanstown, which are located within the Parish of Killiney and the Barony of Rathdown. The length of the proposed works at point Q along the existing N11 is in the order of 350m.

The western edge of the proposed scheme is located within the zone of archaeological potential associated with recorded monument DU026-119 (Appendix 10.1, Figure 11.1), which is listed as an early medieval cemetery. There are a further three recorded monuments located within 500m of the proposed scheme (Appendix 10.1, Figure 11.1).

10.3.1.1. Prehistoric Period

The Mesolithic Period (c. 7000-4000BC) is the earliest time for which there is clear evidence for prehistoric activity in Ireland. During this period people hunted, foraged and gathered food and appear to have had a mobile lifestyle. The most common evidence found to show the presence of Mesolithic communities at a site are scatters of worked flint material, a by-product from the production of flint implements. The current archaeological evidence suggests that the environs of the proposed development was first inhabited towards the later part of the Mesolithic period. At this time people made crude flint tools known as Larnian Flakes. Small numbers of these flakes have been found at Dalkey Island, Dun Laoghaire and Rathfarnham and may indicate small-scale transient settlement along the riverbanks and seashores (Corlett 1999, 10).

During the Neolithic period (c. 4000–2500BC) communities became less mobile and their economy became concentrated on the rearing of stock and cereal cultivation. This transition was accompanied by major social change. Agriculture demanded an altering of the physical landscape, forests were rapidly cleared and field boundaries constructed. There was a greater concern for territory, which saw the construction of large communal ritual monuments called megalithic tombs, which are characteristic of the period. The most common type of megalithic tomb within the Rathdown area is the portal tomb, of which one example is recorded c. 500m west of the proposed scheme (DU026-007).

The Bronze Age (2500-800BC) was marked by the widespread use of metal for the first time in Ireland. As with the transition from Mesolithic to Neolithic the transition into the early Bronze Age was accompanied by significant social change. Megalithic tombs were no longer constructed and the burial of the individual became typical. Cremated or inhumed bodies were often placed in a cist, which is a small stone box set into the ground or a stone lined grave. These were often accompanied by pottery. A number of burials were identified in the Dún Laoghaire Rathdown area in the 19th and 20th centuries, which may date to this period. Isolated stone-lined burials was noted during drainage works in Dalkey and two cist burials, possibly of Bronze Age date were identified at Stillorgan Park (NMI 1955:42-73) and Cabinteely (NMI R2454.1-3).

The most common Bronze Age site within the archaeological record is the burnt mound or *fulacht fiadh*. Over 4500 *fulachta fiadh* have been recorded in the country making them the most common prehistoric monument in Ireland (Waddell, 1998, 174). Although burnt mounds of shattered stone and charcoal-rich soil occur as a result of various activities that have been practiced from the Mesolithic to the present day, those noted in close proximity to a trough are generally interpreted as Bronze Age cooking/industrial sites. *Fulachta fiadh* generally consist of a low mound of burnt stone, commonly in horseshoe shape, and are found in low lying marshy areas or close to streams or rivers. Often these sites have been ploughed out and survive as a spread of heat shattered stones in charcoal-rich soil with no surface expression in close proximity to a trough. Much debate exists as to the function of these monuments. Current hypotheses range from transient cooking sites to more semi-permanent activities including textile dyeing or beer production.

In 2003 pre-development testing revealed a *fulacht fiadh* (DU026-159) c. 160m northwest of the proposed scheme in Brennanstown (Bennett 2003:462, Licence Ref.: 03E1494). This site was preserved *in-situ* as part of a residential development and added into the RMP. In 2006, archaeological testing was carried out to the west of the proposed scheme as part of a separate application (Bennett 2006:573, Licence Ref.: 06E1077). This investigation uncovered the remains of a small area of charcoal-rich soil, which has the potential to relate to *fulachta fiadh* activity associated with a water course that is located only 40m to the west-southwest (Cabinteely Stream). The site was not subject to archaeological excavation and is still present.

10.3.1.2. Early Medieval Period (AD500-1100)

The early medieval period is depicted in the surviving sources as entirely rural characterised by the basic territorial unit known as *túath*. Byrne (1973) estimates that there were probably at least 150 kings in Ireland

at any given time during this period, each ruling over his own *túath*. During this sometimes violent period, roughly circular defensive enclosures known as ringforts were constructed to protect farmsteads. Although most of the ringforts that have been excavated are shown to date to this period, some have earlier origins and may have been originally constructed during the Iron Age, or even earlier.

The Rathdown area was a relatively densely populated area during this period, especially when considering the number of ecclesiastical establishments within the area and the close proximity to the coastal resource. It is therefore surprising that there is not greater evidence for secular settlement in the form of ringforts, within the area. It is of course possible that there was a reduced need for a large number of defended settlements within the Rathdown area, given the lack of evidence for predatory expeditions from local magnates such as the Kings of Meath to the north of Dublin city and the Kings of Leinster to the west of the Wicklow Mountains. It is also possible that many of the smaller scale secular settlement sites were removed during the medieval period, with the arrival of the Anglo-Normans. An intensification of agricultural practices may have also resulted in the physical removal of the sites from the landscape (Corlett 1999, 53).

Whilst there are no recorded ringforts located within the landscape surrounding the proposed scheme, a previously unknown enclosed cemetery (DU026-119) was identified in Loughlinstown during archaeological testing associated with the construction of a service station in 1995 (Bennett 1995:103, Licence Ref.: 95E131). Indications of the site being present within the landscape were recorded in 1957, when a stone lined burial was identified in the garden of a house named as 'Ards' (NMI 1957:350). The burial was located to the south of the house and to the west of the area that was subject to excavation in the 1990s. In 1991 further human remains were identified in the same garden after a tree fell (NMI 1991:40). The portion of the site that was excavated is located to the immediate west of the proposed scheme. Excavation at the site in 1998 revealed a complex of 5th or 6th century burials, terminating sometime around 11th or 12th century. At least 1553 individual burials were uncovered, along with numerous deposits of disarticulated remains and two charnel pits (Bennett 1998:124, Licence Ref.: 98E0035). In 1957 it was recorded that the house, now known as 'Ards' was constructed in 1938 and bones were recovered during this work and reburied. In addition, the NMI files record that locally this area was known as 'Moat field' or 'Raheen'. This would indicate that some memory of the site was passed down through the generations.

The range and type of objects recovered from the site, especially the imported pottery of 6th/ 7th century date, suggests that the site was of considerable status and importance. The exact dimensions of the enclosure surrounding the burials can only be estimated, but based on further investigations in 2006 (Bennett 2006:572, Licence Ref.: 06E0828), it would appear that the main central enclosure measured c. 50m east-west by c. 45m north-south. Based on the high level of burials, it is possible that the site represents the remains of an early medieval ecclesiastical site and may have contained a church and ancillary buildings including probable workshops. However, it is worth noting that no archaeological features relating to the site were identified during the testing exercise carried out to the west of the proposed scheme during 2006 (Bennett 2006:573, Licence Ref.: 06E1077).

More recently (October 2015), a further five skeletons were excavated to the immediate north of the existing service station prior to the construction of a house (www.irisharchaeology.ie). These burials appear to form part of the main cemetery although their dates are currently unknown. The recently discovered burials were located to the immediate west of the proposed scheme.

10.3.1.3. Medieval Period (AD1100-1600)

The beginning of the medieval period was characterised by political unrest that originated from the death of Brian Borumha in 1014. *Diarmait MacMurchadha*, deposed King of Leinster, sought the support of mercenaries from England, Wales and Flanders to assist him in his challenge for kingship. Norman involvement in Ireland began in 1169, when Richard de Clare and his followers landed in Wexford to support *MacMurchadha*. Two years later de Clare (Strongbow) inherited the Kingdom of Leinster and by the end of the 12th century the Normans had succeeded in conquering much of the country (Stout & Stout 1997, 53).

Towards the end of the 13th century many of the English settlers had withdrawn on account of the war in Scotland. The Irish tribes took advantage of this and carried out many raids on those that remained. During the course of the Scottish invasion under Edward Bruce during 1315-1317, Irish tribes occupied many outlying districts in County Dublin with the remainder being uncultivated and laid to waste. Towards the middle of the 14th century steps were made to restrict the military capacity of the Irish tribes and to protect the remaining area of Anglo Norman influence. A military garrison was stationed at Bray and the lands in the area were re-invested with new tenants including the Lawless and Walsh families who remained in the area for many centuries.

There are a large amount of tower house and fortified buildings within the Rathdown area and this was in part due to an increased concentration on defence in the hinterland around the centre of Anglo Norman rule based in Dublin, which became known as The Pale. During the 15th century the 'Subsidised Castles Act' provided grants of ten pounds to encourage the construction of castles to defend the Pale against the native Irish. The Pale was also strengthened in other ways including a 1494 Act of Parliament requiring landowners to construct a line of defences along its borders. However, it is unlikely that all complied with the conditions. The best preserved area of such pale defences can be seen at Ballyogan, where an earthwork survives for 500m. It consists of a flat top bank that has a height of 2.5m and is flanked by deep ditches on both sides.

There are no recorded medieval sites located within the landscape containing the proposed scheme, with the exception of 11th and 12th century activity that was identified in the cemetery area to the immediate west of the scheme (DU026-119). Within the wider area, a tower house is recorded in Laughanstown (DU026-093) c. 1.14km to the south-southwest of the proposed scheme.

10.3.1.4. Post Medieval Period (AD1600-1900)

The 17th century saw dramatic rise in the establishment of large residential houses around the country. The large country house was only a small part of the overall estate of a large landowner and provided a base to manage often large areas of land that could be located nationwide. Lands associated with the large houses were generally turned over to formal gardens, which were much the style of continental Europe. Gradually this style of formal avenues and geometric gardens designs was replaced during the mid-18th century by the adoption of parkland or demesne landscapes – which enabled the viewing of a large house within a designed 'natural' setting. Although the creation of a parkland landscape involved working with nature, rather than against it, considerable constructional effort went into their creation. Earth was moved, field boundaries disappeared, streams were diverted to form lakes and quite often roads were completely diverted to avoid travelling anywhere near the main house or across the estate.

A number of large houses and demesne landscapes once surrounded the area containing the proposed scheme. These included Cabinteely House, Brennanstown House and Glendruid House to the west; Kilbogget House to the north and Loughlinstown House, Ballybrack Grove and Beechwood to the southeast. These buildings were accompanied by naturalised demesne landscapes, which today have become substantially denuded due to suburban residential development. The best preserved building and landscape within the vicinity is Cabinteely House and demesne, c. 500m to the northwest of the proposed scheme.

Approximately 300m to the southeast of the proposed scheme is the northern boundary of the zone of archaeological potential that surrounds the post medieval Lehaunstown Military Camp (DU026-127). The military camp was established in 1794 as part of a comprehensive military strategy in response to an unsettled political climate and a fear of a Napoleonic invasion. The site, which covers c. 120 acres, had been farmed as one unit in recent years until parts of it underwent development. Archaeological testing was carried out at the site in 1994 (Licence Ref.: 94E201). A large amount of stray finds were identified across the site, which dated from the period when it was in use. In addition a series of large middens were identified, along with drainage features.

10.3.2. Summary of Previous Archaeological Fieldwork

A review of the Excavations Bulletin (1970-2015) has revealed that archaeological testing was carried out to the west of the proposed scheme in 2006. A large number of investigations have also been carried out within the surrounding landscape. These are summarised below.

In 2006 a total of 16 trenches were excavated to the west of the scheme as part of a previous planning application (Bennett 2006:573, Licence Ref.: 06E1077). The only features of potential archaeological interest uncovered during the course of testing were two possible shallow drains, downslope and to the west of the existing house, as well as a spread of charcoal-rich soil in a trench adjacent to the Cabinteely Stream. A possible drain was also located adjacent to the western boundary of the site (to the immediate south of the Esso Station and the site of the cemetery excavated in 1998. No artefacts of archaeological or historical interest were recovered during the course of the work. A quantity of disturbed and fragmented bone was recovered from the topsoil, none of which was associated with any features of archaeological interest. Analysis of the bone undertaken by Clare Mullins proved that all was derived from animals.

In 1995 archaeological testing associated with the construction of a service station to the immediate north of the eastern part of the proposed scheme revealed the presence of significant human remains (Bennett 1995:103, Licence Ref.: 95E131). Excavation of the site in 1998 revealed a complex of 5th or 6th century burials, culminating sometime around 11th or 12th century. At least 1553 individual burials were uncovered, along with numerous deposits of disarticulated remains and two charnel pits (Bennett 1998:124, Licence

Ref.: 98E0035). A number of enclosure ditches were noted to the west of the site. It appears that these had been moved further to the east over time in order to accommodate the expansion of the cemetery. In 1998 a small investigation was also carried out at the site of a proposed extension on an existing house located to the immediate north of the service station. Whilst no human remains were identified, a section of large ditch was identified, which may have formed part of the enclosing element to the cemetery (Bennett 1998:123, Licence Ref.: 98E0582). Further archaeological monitoring was undertaken at this location in 2010 Bennett 2010:242, Licence Ref.: 10E308). However, nothing of archaeological significance was identified. More recently investigations associated with the construction of a new house within this plot revealed the presence of five skeletons, likely associated with the cemetery. These were excavated in October 2015 (www.irisharchaeology.ie) and were located to the immediate west of the proposed scheme.

In 2006 further investigations were carried out to the west of the proposed scheme and to the service station (Bennett 2006:572, Licence Ref.: 06E0828). The western enclosure ditch to the cemetery was identified although no further human remains were found. It would appear that the main central enclosure measured c. 50m east-west by c. 45m north-south. Testing to the west of the cemetery (and to the northwest of the proposed development area) revealed the presence of archaeological soil, ditches and deposits that are consistent with early medieval enclosed settlement remains. These deposits included evidence for burning, possible smithing activity, occupation deposits including food waste discarded in ditches or enclosures and possible habitation areas.

In 2003 archaeological testing was carried out on an 11 acre site c. 200m to the west of the proposed scheme in Brennanstown (Bennett 2003:462, Licence Ref.: 03E1494). Testing revealed a brick-making facility, measuring approximately 625m^2, and a *fulacht fiadh* that possessed a diameter of c. 8–10m. The *fulacht fiadh* was preserved *in-situ* and added to the RMP as DU026-159. The site is located c. 200m west of the proposed scheme. The post medieval brick clamp was subject to archaeological excavation prior to the construction of the residential development (Bennett 2003:463, Licence Ref.: 03E1681).

10.3.3. Cartographic Analysis

Sir William Petty, Down Survey Map, 1655-56, Barony of Rathdown

This map shows the rough path of the Carrickmines and Cabinteely Streams, which run to the west of the proposed scheme. It shows a number of buildings at Loughlinstown Village, which is located further to the south. No structures or features are marked in the approximate area of the proposed scheme.

Rocque's Map of County Dublin, 1760

This map provides the first relatively detailed mapping coverage of the proposed development area (Appendix 10.1, Figure 11.4). The map shows the approximate location of the proposed scheme as open green fields with the Cabinteely Stream shown along with the precursor of the N11. A building is marked to the south of the scheme and adjacent to the road as 'Gentleman's Hall'.

Taylor's Map of the Environs of Dublin, 1816

By the time of this map more detail is shown within the surrounding landscape. The structures marked on the previous 1760 map are still shown present adjacent to the road but are not labelled.

First edition Ordnance Survey map, 1844, 1:10560

This map shows the first accurate cartographic record of the landscape containing the proposed scheme. Within the extents of the scheme is the road that predates the realigned N11 (Appendix 10.1, Figure 11.5). In addition, no features, other than the slightly curving road, denote the presence of the early medieval cemetery and enclosure site, which is located to the immediate north (DU026-119).

Second edition Ordnance Survey map, 1871, 1:10560

There are no major changes to note within the cartography of this map that relate to the proposed scheme.

Ordnance Survey map, 1:2500, 1911

There are no major changes to note within the cartography of this map that relate to the proposed scheme (Appendix 10.1, Figure 11.6).

10.3.4. County Development Plan

The Dún Laoghaire-Rathdown Development Plan (2016-2022) recognises the statutory protection afforded to recorded monuments and protected structures. The western boundary of the proposed scheme is located within the southern zone of archaeological potential that surrounds DU026-119 (early medieval cemetery). However, archaeological testing has already been carried out in this area during 2006 and no features that were relating to the cemetery were identified. This zone of potential is marked within the mapping that accompanies the development plan. The proposed development area is also located c. 300m north-northwest of the northern boundary of the zone of archaeological potential that surrounds the post medieval military camp DU026-127. However, this zone is not marked within the development plan maps as this area is covered by the Cherrywood SDZ of 2014.

The closest protected structure is Glendruid House, which is located c. 500m southwest of the proposed scheme.

The Cherrywood Planning Scheme document was reviewed as part of this assessment, which was published by Dún Laoghaire-Rathdown County Council in April 2014. A section of the proposed scheme is located within this zone, which covers a total of c. 360ha. SDZ planning objectives state that the content of any archaeological assessment that is carried out as part of a development within the SDZ should be agreed with the National Monuments Service of the DoAHRRGA in advance. As such, consultations with National Monuments Service were carried out as part of the proposed scheme and a request for archaeological testing to form part of the assessment was made.

10.3.5. Aerial Photographic Analysis

Inspection of the aerial photographic coverage of the proposed development area held by the Ordnance Survey (1995, 2000 and 2005), Google Earth (2005-2013) and Bing Maps was undertaken as part of this assessment. No previously unrecorded features or areas of archaeological potential were noted within the footprint of the proposed scheme or its immediate environs.

10.3.6. Field Inspection

The field inspection sought to assess the proposed scheme footprint, its previous and current land use, the topography and whether any areas or sites of archaeological or historical potential were present. The field inspection was carried out on 9th August 2014 in sunny and dry conditions.

10.3.7. Conclusions

The proposed scheme is located within the townlands of Loughlinstown and Brenanstown, which are located within the Parish of Killiney and the Barony of Rathdown. The length of the proposed works at point Q along the existing N11 is in the order of 350m.

There are three recorded monuments located within 500m of scheme. The closest of these is a recorded early medieval cemetery site (DU026-119). The western boundary of the proposed scheme is located within the southern section of the zone of archaeological potential that surrounds the site. The main portion of the cemetery site was subject to archaeological excavation in 1998 as part of the development of a service station. In 2006 archaeological testing was carried out to the west of the proposed scheme as part of a previous planning application. This failed to identify any definite archaeological remains associated with the cemetery site. However, one area of charcoal-rich soil was identified within the northern part of the area, which remains in-situ today.

A review of the historical mapping has shown that during the post medieval period the road that predates the realigned N11 was situated in the location of the proposed scheme.

As described above, a review of the Excavations Bulletin (1970-2015) has shown that archaeological testing has been carried out to the west of the proposed scheme. One small area of charcoal-rich soil was identified, along with a number of more recent drains. A large amount of field work has been carried out to the immediate west, including the excavation of c. 1500 skeletons in 1998 at the site of the service station that fronts onto the N11 and the identification of the possible extent of the enclosure associated with the cemetery in 2006. More recently five further skeletons associated with the cemetery have been excavated to the immediate north of the service station. The topographical files of the National Museum reveal that human remains were recorded in 1957 and 1991 to the west of the service station.

With the exception of the western boundary of the proposed scheme, which is located within a zone of archaeological potential associated with a recorded monument, no specific features of archaeological potential have been noted during the course of the assessment.

10.4. Impact Assessment and Mitigation Strategy

Impacts can be identified from detailed information about a project, the nature of the area affected and the range of archaeological resources potentially affected. Archaeological sites can be affected adversely in a number of ways: disturbance by excavation, topsoil stripping; disturbance by vehicles working in unsuitable conditions and burial of sites, limiting access for future archaeological investigation.

10.4.1. Impact Assessment

The area to the west of the proposed scheme is located within the zone of archaeological potential associated with an early medieval cemetery (DU026-119). This area was tested in 2006 and nothing of archaeological significance was identified other than a patch of charcoal rich soil adjacent to the northern boundary of the plot. This area will not be impacted upon by the proposed scheme and will be preserved in-situ.

10.4.2. Mitigation

It is recommended that topsoil stripping within the western section of the proposed scheme be subject to archaeological monitoring. This should be carried out by a suitably qualified archaeologist. Full provision should be made available for the resolution of any archaeological features or deposits that may be discovered, if this is deemed the most appropriate manner in which to proceed.

Please note that all recommendations are subject to approval by the National Monuments Service of the Heritage and Planning Division, Department of Arts, Heritage, Regional, Rural & Gaeltacht Affairs.

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Cartographic Sources

Sir William Petty, Down Survey Map, 1655-56, Barony of Rathdown

John Rocque's Map of Dublin County, 1760

John Taylor's Map of the Environs of Dublin City, 1816

Ordnance Survey 6" & 25" maps of County Dublin (1844, 1871, 1911)

Electronic Sources

www.excavations.ie – Summary of archaeological excavation from 1970–2015

www.archaeology.ie – DoAHRRGA website listing all SMR sites

www.googleearth.com – Aerial photographs of the development area (2005-2013)

www.maps.osi.ie/publicviewer - Aerial photographs of the development area (1995-2005)

www.bingmaps.com - Aerial photographs of the development area (2012)

www.irisharchaeology.ie/2015/10/medieval-burials-discovered-at-cabinteely-co-dublin - Description of burials identified in Cabinteely

11. Traffic

11.1. Introduction

Cherrywood SDZ, located in southeast County Dublin, comprises the single largest development land bank in the administrative area of Dun Laoghaire-Rathdown County Council. The location is approximately 16km southeast of Dublin City Centre within 1 to 2km of the Irish Sea coastline and about 3 to 4km from the Dublin Mountains.

In 2008 RPS were commissioned by Dun Laoghaire Rathdown County Council to carry out a traffic modelling exercise entitled "Cherrywood Traffic Study – Update of Traffic Model" for the Cherrywood Infrastructure Implementation Plan Report dated February 2008.

The main objective of the "Cherrywood Traffic Study update of Traffic Model" was to produce an updated SATURN Model for the Cherrywood Development as represented in the Implementation Plan. This traffic model was completed in May 2010 and was used as the basis for the Traffic Management Plan that was used to support the Cherrywood Strategic Development Zone (SDZ) submittal to An Bord Pleanala in 2013.

Throughout the preparation of the Cherrywood Planning Scheme the National Transport Authority in conjunction with the National Roads Authority and Rail Procurement Agency worked collaboratively to ensure an overall approach to transport planning within the area. An Bord Pleanala approved the planning scheme for the Cherrywood SDZ in April 2014. The SDZ sets out the type, extent and scale of the Planning Scheme by dividing the area into eight development areas which are identified in Map 7.1 of the SDZ. The eight Development Areas are further grouped together into 3 Growth Areas.

In order to facilitate the development of the lands within the Planning Scheme Boundary, Map 4.5 Road Hierarchy (Figure 11-1) of the SDZ identifies the road infrastructure proposed within the SDZ to facilitate access to and from the development site by all modes of travel. Therefore, associated with each growth area is a road network that must be in place prior to the growth area being developed.

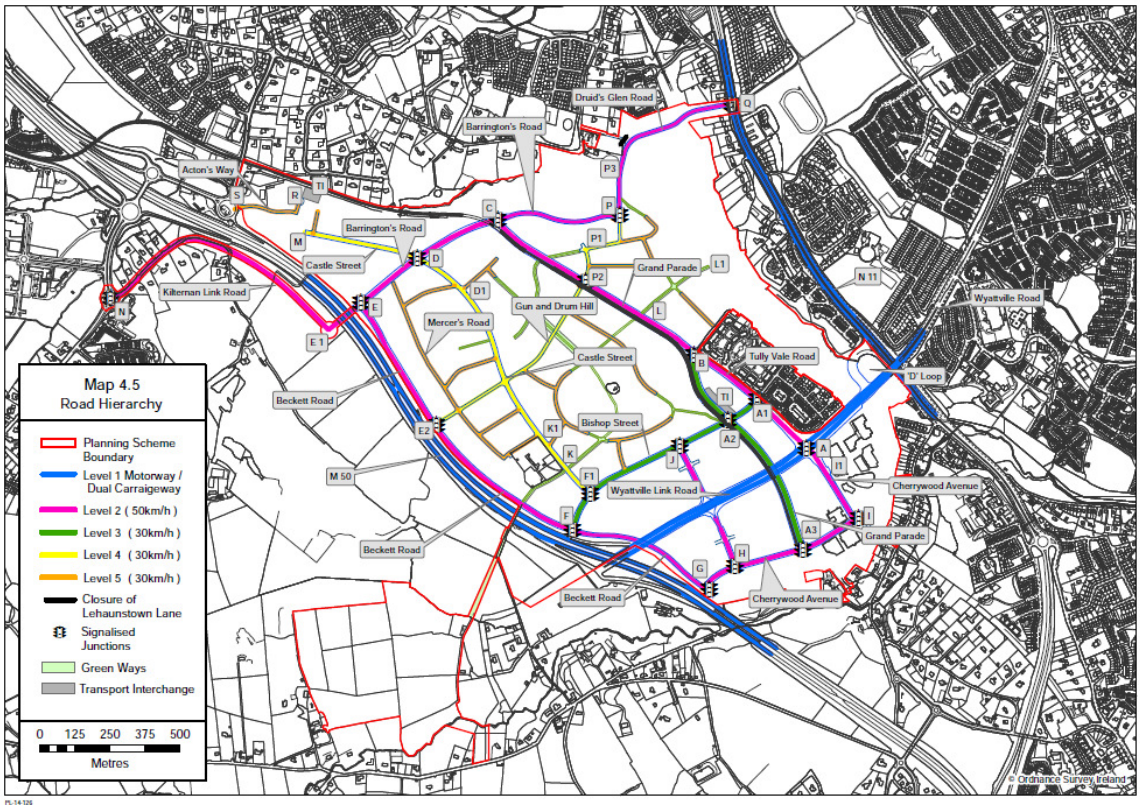

Figure 11-1 SDZ Map 4.5 Road Hierarchy

In April 2015 Atkins was commissioned by DLRCC to prepare a preliminary design for a new at-grade 3-arm signalised junction at point Q and for the N11 Druids Glen Road from point Q to point P3 as identified in the aforementioned Map 4.5. The proposed N11 Junction Q that is subject to this planning application, and proposed N11 Druids Glen Road Q-P3, will facilitate the development of the Development Area 5 which is in the First Growth Area as Identified in Map 7.1 (Figure 12.2).

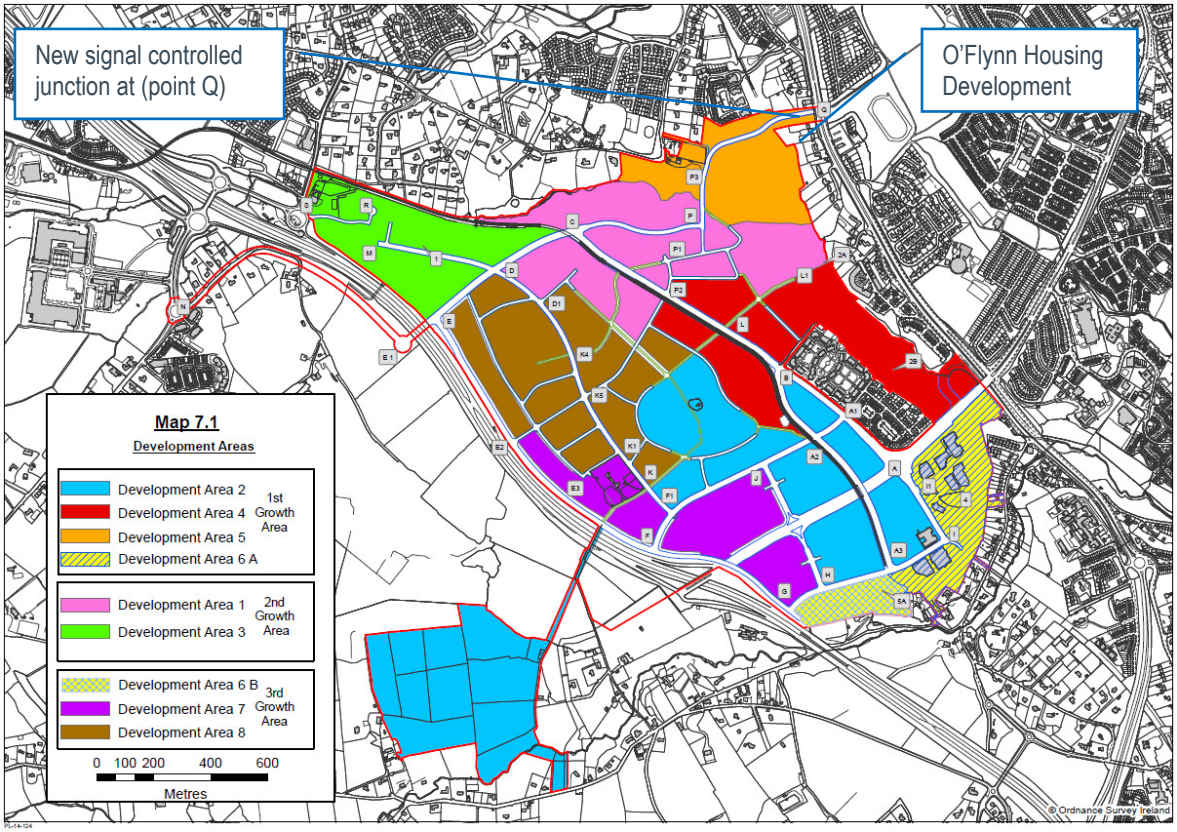

Figure 11-2 Map 7.1 Development Areas & O'Flynn Housing Development

As part of the consideration given to Cherrywood SDZ Development Area 5, Atkins was asked to consider the development of 164 residential units which are planned to be developed by O'Flynn at Beech Park Cabinteely. Whilst strictly outside the boundary of the Cherrywood Planning Scheme, the O'Flynn development will gain direct access to the future Druid's Glen Road between points Q and P3.

The future N11 Druids Glen Road will terminate with a new at-grade signalised junction on the N11 dual carriageway i.e. Point Q on Map 7.1.

This report has been written in consideration of the local traffic impact associated with the provision of this new at-grade 3-arm signalised junction between the future N11 Druids Glen Road for Cherrywood and the existing N11 carriageway.

The traffic analysis undertaken as part of this report is aligned with the phasing and quantum of development as set down in Chapter 6 of the Cherrywood SDZ for Development Area 5 initially and all Development areas thereafter.

This traffic modelling served as an update to the parent study completed by RPS in 2010 (Refer to document 'Cherrywood Traffic Study – Update of Traffic Model'), referred to hereafter as 'the parent study'.

11.2. Cherrywood Traffic Study – Update of Junction Analysis for N11/Druids Glen Road Junction (Atkins 2015)

11.2.1. Background

In April 2015 Atkins was commissioned by DLRCC to prepare a preliminary design for a new at-grade 3-arm signalised junction at point Q and for the N11 Druids Glen Road from point Q to point P3 as identified in the aforementioned Map 4.5. When completed, the N11 Druids Glen Road will terminate with a new at-grade signalised junction on the N11 dual carriageway i.e. Point Q which is the same location at identified in the RPS 2010 report as the N11/Cabinteely Link Road junction.

This chapter takes into consideration the local traffic impact associated with the provision of this new at-grade 3-arm signalised junction between the N11 Druids Glen Road for Cherrywood and the existing N11 carriageway.

The traffic analysis undertaken is aligned with the phasing and quantum of development as set down in Chapter 6 of the Cherrywood SDZ for Development Area 5 and upon completion of all three growth areas.

The main objective of the traffic modelling exercise was to produce an updated LinSig model of the proposed N11/Druids Glen junction considering the Base Year and Future Year Scenarios. The following stages were completed for the junction analysis:

- Updating (and reducing) the Residential & Employment Populations in Cherrywood
- Review and application of Future Year 2025 Traffic Flows Retrieved from the Parent Study
- Trip Generation for the Updated Residential & Employment Populations in Cherrywood
- Trip Distribution and Assignment
- Traffic Modelling and Sensitivity Testing
- Summarising of Findings and Conclusions

11.2.2. Forecasted Residential & Employment Populations in Cherrywood

11.2.2.1. Development Quantum

The ultimate forecasted residential and employment populations utilised within this study have been extracted from the DLRCC "Technical Note No. 1 Cherrywood Planning Scheme Traffic Modelling Data" dated 6th July 2015.

Figure 11-3 compares the predicted maximum development quanta and predicted populations for the original Cherrywood Common Infrastructure – Implementation Plan (RPS March 2008) with the current and adopted Cherrywood Planning Scheme (April 2014).

Comparison of Cherrywood Maximum Development Quanta		
	Cherrywood Common Infrastructure - Implementation Plan	Cherrywood Planning Scheme
Residential (units)	13,051 units	8,336 units
High Intensity Employment (sqm)	356,493 sqm	350,000 sqm
Gross Retail Floor Space (sqm)	90,905 sqm	53,034 sqm

Comparison of Cherrywood Predicted Population		
	Cherrywood Common Infrastructure - Implementation Plan (2.63 persons/household) (1 person/20.26sqm)	Cherrywood Planning Scheme (2.5 persons/household) (1 person/20sqm)
Residential Population	34,300	20,840
Employment Population	17,600	17,500

Figure 11-3 Forecasted Residential & Employment Populations

The above Figure 11-3 includes all existing and permitted development within the Cherrywood Planning Scheme and identifies that the predicted residential population for the Cherrywood Planning Scheme has

reduced by 13,460 (or 39.24%) compared to the original predictions provided within the Cherrywood Common Infrastructure – Implementation Plan upon which the RPS Parent study was based.

The revised development (residential and commercial) in the adopted planning scheme is expected to result in a reduction in trips exiting Cherrywood in the AM and a corresponding reduction in trips entering Cherrywood in the PM.

The reduction in gross retail floor space by 37,871sqm (or 41.66%) is not considered to have a significant effect on peak hour trips.

11.2.2.2. Cherrywood Planning Scheme 2014 - Development Phasing

The Cherrywood Planning Scheme, Chapter 7 (Sequencing and Phasing of Development), describes how the overall Cherrywood SDZ is divided into 8 Development Areas.

The 8 Development Areas are grouped into 3 Growth Areas. The sequencing of Growth Areas is as follows:

- **First Growth Area:** Development Area 2, 4, 5, and 6A
- **Second Growth Area:** Development Areas 1, and 3
- **Third Growth Area:** Development Areas 6B, 7 and 8

Figure 11-4 shows an extract (Map 7.1) from the Cherrywood Planning Scheme document outlining the 8 Development Areas.

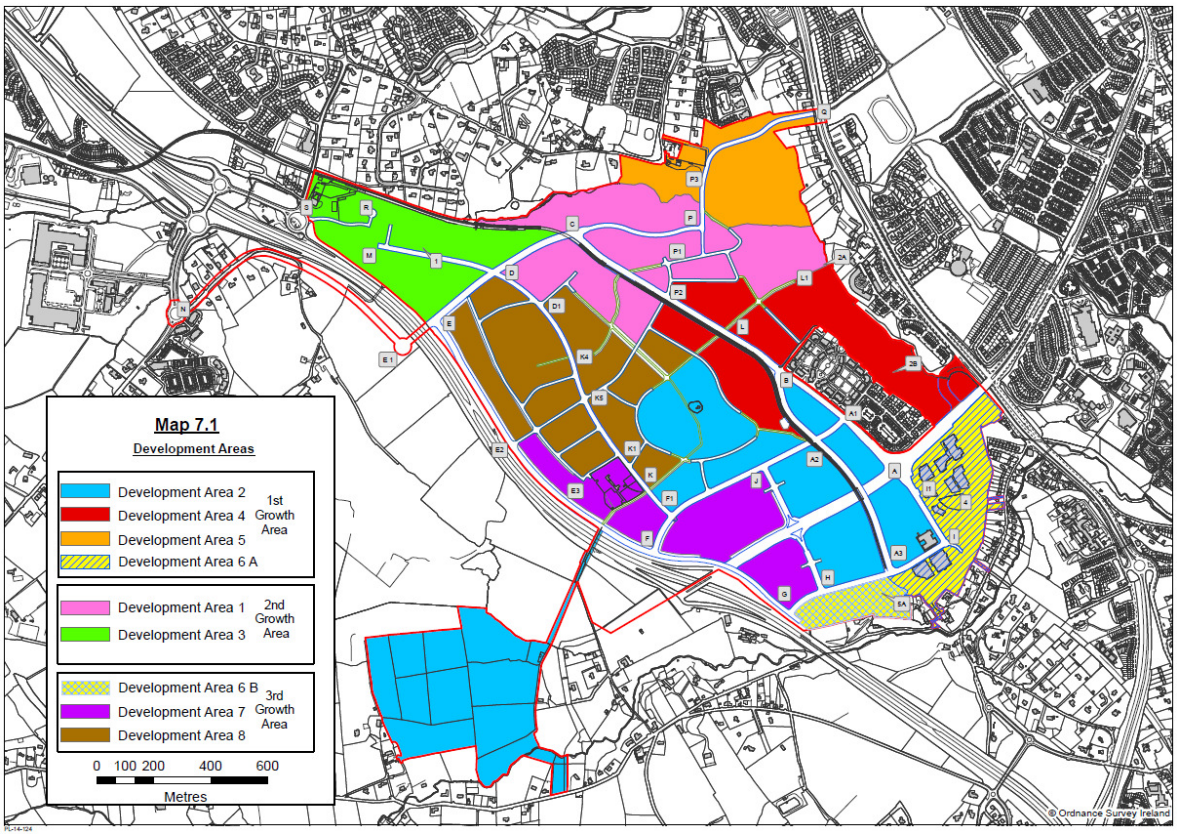

Figure 11-4 Cherrywood Planning Scheme Development Areas

As part of this study, Atkins has modelled the following three potential development situations:

- **Phase 1**: Cherrywood SDZ Development Area 5 + O'Flynn Development traffic - Single right turning lane from N11 into Cherrywood SDZ
- **Phase 2(a):** All Cherrywood SDZ Development Area traffic - Single right turning lane from N11 into Cherrywood SDZ
- **Phase 2(b):** All Cherrywood SDZ Development Area traffic - Two right turning lanes from N11 into Cherrywood SDZ

The proposed development of 164 residential units by O'Flynn at Beech Park Cabinteely is outside the boundary of the Cherrywood Planning Scheme. However, the proposed access to this development will be via the N11 Junction Q and Druid's Glen Road Q-P3. Therefore, the trips generated by this development have been included with the trips generated by the development of Area 5 when undertaking the analysis documented in this report.

Phases 1, 2(a) and 2(b) were modelled through four different traffic signal staging scenarios which have been set out later on in this report.

11.2.3. Recorded Network Traffic Growth between 2008 - 2015

11.2.3.1. Existing Traffic Count Data

To assess the accuracy of the traffic projections set out within the parent study, the 2008 traffic counts were compared to existing traffic count information collected at similar locations during the current year 2015.

The 2008 traffic flow data was taken from the Abacus Transportation Survey's traffic counts contained in Appendix A1 of the parent study. The 2015 counts were retrieved from the Cherrywood Traffic Model network.

A comparison of the 2008 traffic count data and the 2015 traffic count data was carried out and has been summarised graphically in the following Figure 11-5.

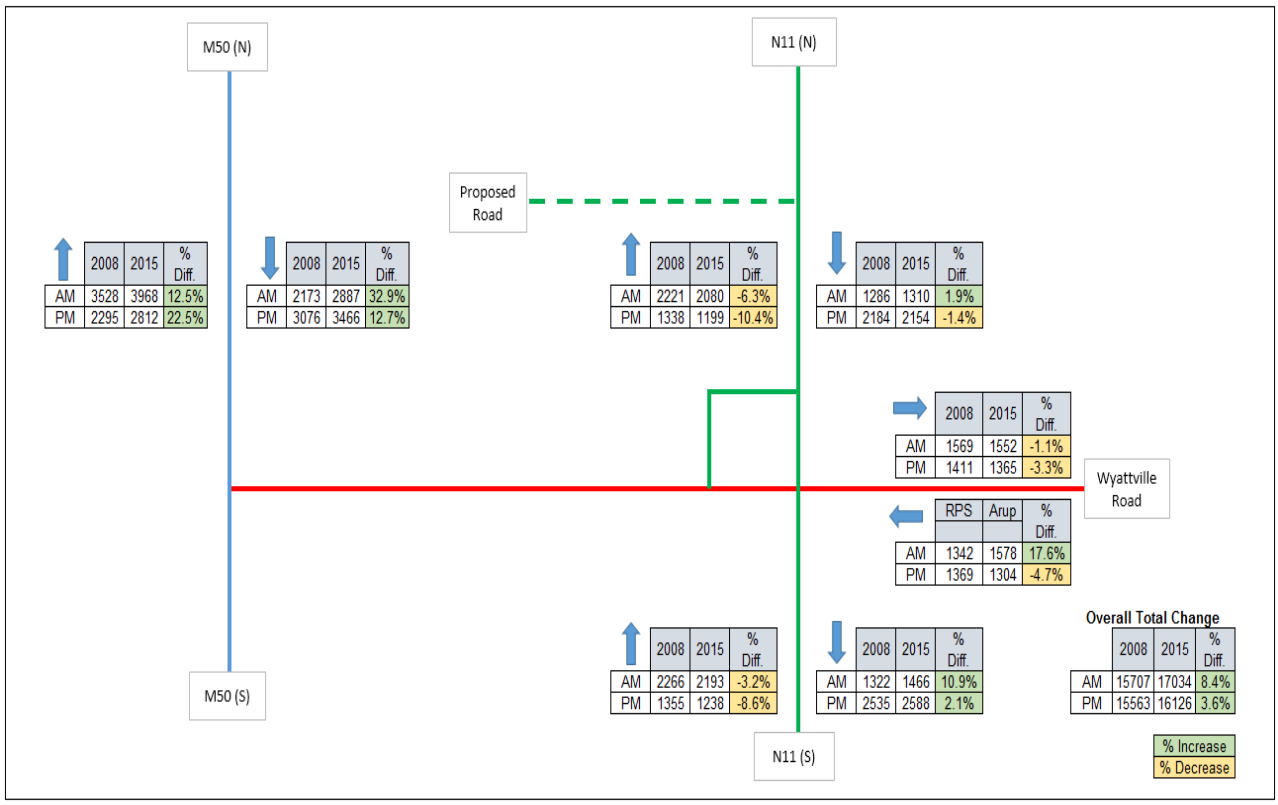

Figure 11-5 Comparison of 2008 and 2015 Existing Traffic Counts

The counts have shown on average, a reduction in traffic flows along the N11 which is not representative of previous or current NRA guidance for traffic growth forecasting.

Note, the current NRA traffic growth factors provide national guidance for traffic growth forecasting. The current growth factors can be found within the NRA Project Appraisal Guidelines under "Unit 5.5 Link-Based Traffic Growth Forecasting".

The parent study used a previous version of the NRA growth factors published in August 2003 "Future Forecasts 2002 – 2040". This document was less comprehensive and provided a lesser amount of flexibility in terms of forecasting growth for low, medium and high traffic growth scenarios.

11.2.3.2. Traffic Projections – Establishing the Rate of Actual Growth

Traffic projections collected from the parent study for both 2008 and 2025 have been graphed in the following Figure 11-6.

The 2025 AM and PM peak hour background traffic projections were taken from Appendix D1 and D2 of the parent study.

The following graph compares plots of projected traffic growth with the actual traffic growth in the interim years.

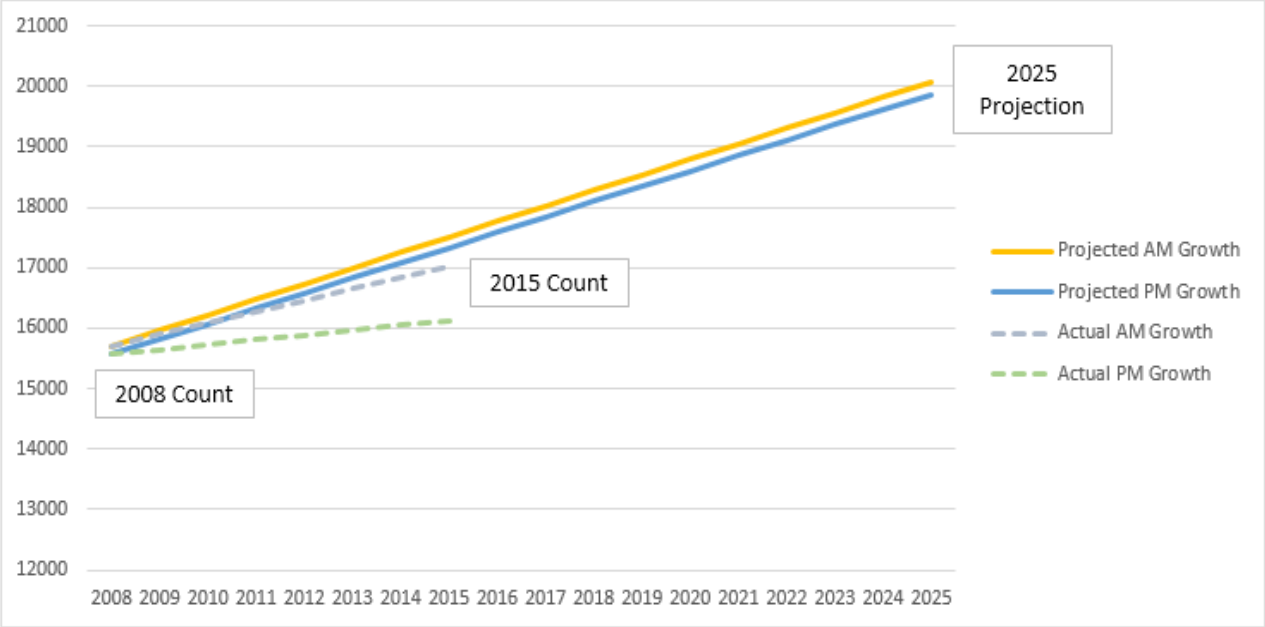

Figure 11-6 Comparison of Forecasted and Recorded Traffic Flows

The graph indicates that actual network traffic growth between 2008 and 2015 has been lower than anticipated within the parent study.

The base line traffic data utilised within this study was extracted from traffic counts conducted in 2008 for the original parent study. In this regard the findings of the parent study may be considered conservative i.e. traffic queuing and delay through the proposed junction are observed to be less than originally predicted.

In terms of future year forecasting, the 2025 traffic flows for the junction were also extracted from the parent study. This method was used as it adopted a worst case scenario in relation to predicted background traffic flows.

11.2.4. Development Trip Generation

11.2.4.1. Trip Generation

The quantum of the proposed Cherrywood SDZ Development has changed since the parent study and therefore the trips generated by the new Development figures were examined further as outlined below. TRICS database information was referenced for this exercise.

The TRICS database was interrogated to predict trips generated by and attracted to the proposed Cherrywood SDZ Development (referred to hereafter as development specific traffic generation). Refer to Table 11-1 for the TRICS rates assigned to each Phase of Development.

Table 11-1 TRICS Rates

	AM Peak			PM Peak		
	Arrival	Departure	Total	Arrival	Departure	Total
PHASE 1: AREA 5 & O'FLYNN	0.136	0.391	0.527	0.383	0.249	0.632
PHASE 2: FLATS PRIVATELY OWNED	0.057	0.178	0.235	0.195	0.079	0.274
PHASE 2: BUSINESS PARK	0.268	0.038	0.306	0.056	0.257	0.313

A summary of the TRICS output data used for the forecasted trip generation for Phase 1 Development is outlined in Table 11-2.

Table 11-2 Phase 1 Forecasted Trip Generation

	Trips					
	AM Peak			PM Peak		
	Arrival	Departure	Total	Arrival	Departure	Total
AREA 5	74	212	286	208	135	343
O'FLYNN	22	64	86	63	41	104
Total	96	276	373	271	176	447

Phase 1 comprises Development Area 5 with a max no. of 543 residential dwellings, and the O'Flynn (Beech Park) Development with 164 residential units. Therefore Phase 1 is assumed to have a total of 707 residential dwellings.

Neither Development Area 5 nor the O'Flynn Development have commercial, retail, educational or employment uses.

A similar exercise was carried out using TRICS to predict the forecasted trips generated and attracted to Phase 2, the full (ultimate planned) Cherrywood Development. The forecasted trip generation is outlined in Table 11-3.

Table 11-3 Phase 2 Forecasted Trip Generation

	Trips					
	AM Peak			PM Peak		
	Arrival	Departure	Total	Arrival	Departure	Total
FLATS PRIVATELY OWNED	475	1,484	1,959	1,626	659	2,284
BUSINESS PARK	4,690	665	5,355	980	4,498	5,478
Total	5,165	2,149	7,314	2,606	5,156	7,762

11.2.4.2. Trip Distribution and Assignment

The updated (and in terms of the parent study reduced quantum of development) development trip generation, was then distributed and assigned through the proposed junction using the proportions set out within the parent study. Extracts from the parent study describing AM trip distribution has been provided in Table 11-4.

Table 11-4 Development AM Trip Distribution (based on the parent study)

To/From	Revised Trip Distribution	
	Depart	Arrive
M50 North	37%	29%
N11 North	39%	14%
Glenamuck/Kilternan	3%	10%
Dun Laoghaire	16%	14%
Bray/Wicklow	5%	33%

The parent study set out trip distribution proportions for the AM peak hour only, and these proportions have been described in Figure 11-7.

PM peak hour trip distributions were not considered within the original parent study.

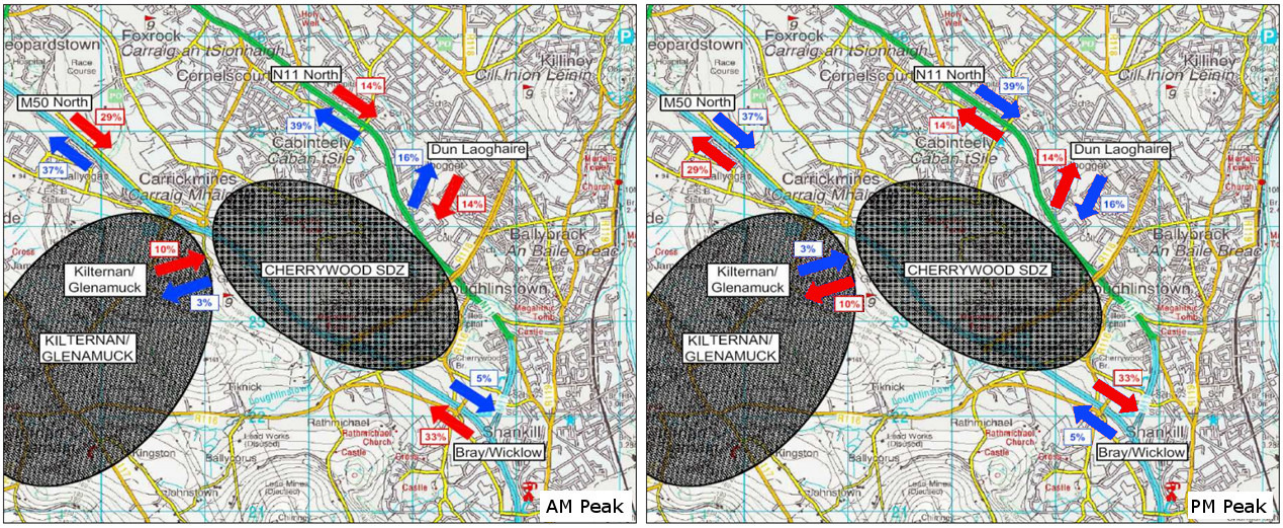

Figure 11-7 AM Distributions (based on the parent study) & PM Distributions (calculated by Atkins)

To address the absence of consideration given to the PM peak hour scenario in the parent study, Atkins took the AM peak hour distributions and inverted them to create a PM peak hour trip distribution model.

This was designed to reflect the tidal nature of commuter traffic along the N11 corridor at this location i.e. heavy inbound AM flows and heavy outbound PM flows during the normal working weekday scenario. Table 12-5 identifies the Development PM Trip Distribution.

Table 11-5 Development PM Trip Distribution

To/From	Revised Trip Distribution	
	Depart	Arrive
M50 North	29%	37%
N11 North	14%	39%
Glenamuck/Kilternan	10%	3%
Dun Laoghaire	14%	16%
Bray/Wicklow	33%	5%

For Phase 1 (Area 5 only + O'Flynn Traffic), 100% of trips were assigned via the proposed N11 Junction Q as the N11 is the single access for the Phase 1 development.

For Phase 2 (the full development) and based on the parent study, 14% of arrival trips and 39% of departure trips were assigned via the proposed N11 Junction Q. These percentages were reversed for the PM peak with 39% arriving and 14% departing.

Both Phases 1 and 2 trips were distributed and assigned to the N11 Junction Q with the proportions set out within the parent study. The distribution percentages illustrated in Figure 11-8 will be added onto the N11 traffic volumes when the Cherrywood development is constructed.

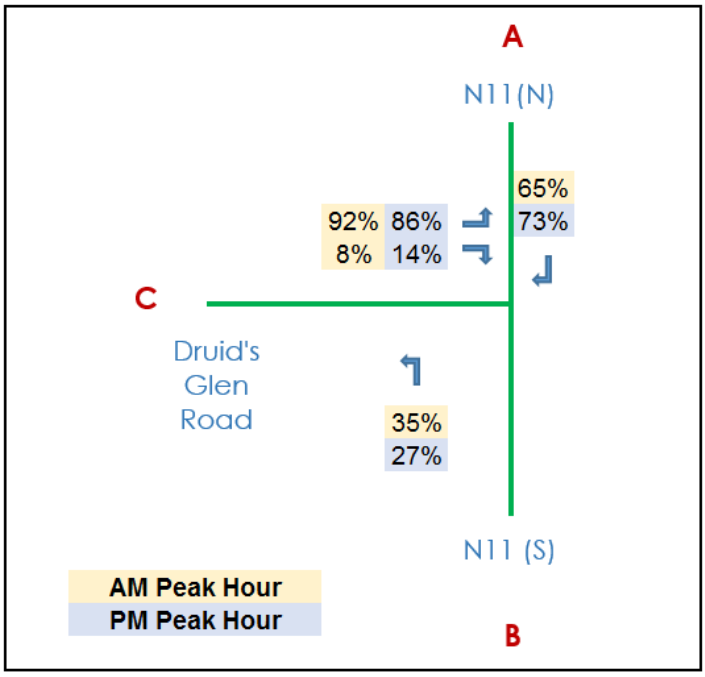

Figure 11-8 Phase 1 & 2 Development Trip Distribution (based on the parent study)

11.2.4.3. Pass-By Trips

Not all traffic using the development will be new trips; a percentage will be existing traffic within the network. As described in the NRA guidance document Traffic and Transportation Guidance Document (May 2014), a 'pass-by' trip is made by traffic already using the road network and enters a site as an intermediate stop on the way to/from another destination. The trip may not be necessarily generated by the proposed land use and thus is not a new trip to the network.

Similar to the parent study, a pass-by and internal traffic rate of 47% (12% for buses and 35% for all other vehicles) was applied to the calculated development specific traffic flows.

11.2.5. Future Year 2025 Scenario Testing

11.2.5.1. Development Phasing and Scenario Testing

The development trip generation was then superimposed across the Future Year 2025 network traffic forecast taken from the parent study, using the distribution philosophy described above.

The proposed N11 Junction Q was modelled using LinSig with consideration given to the following three potential development situations:

- **Phase 1:** Cherrywood SDZ Development Area 5 + O'Flynn Development traffic – Single right turning lane from N11 into Development
- **Phase 2(a):** All Development Areas traffic - Single right turning lane from N11 into Development
- **Phase 2(b):** All Development Areas traffic - Two right turning lanes from N11 into Development

The above 3 development situations were all modelled for the following traffic signal staging scenarios:

- Scenario 1: Pedestrian crossings provided on all junction arms with pedestrian phases being called every cycle (the worst-case scenario).
- Scenario 2: Pedestrian crossings provided on all junction arms with pedestrian phases being called every 2nd cycle.
- Scenario 3: Pedestrian crossing modelled on Druid's Glen Road only, with no pedestrian crossings provided across the N11 mainline (i.e. pedestrian bridge installed over N11).
- Scenario 4: Pedestrian crossings were not called throughout the signal cycle.

11.2.6. N11 Junction Q Analysis for Future Year 2025 Peak Flows

11.2.6.1. Background

One of the key issues under consideration is the provision for incoming N11 southbound right-turning vehicles destined for the Cherrywood site and the minimisation of the impact on the N11 mainline traffic

This report considers a situation where the works are constructed in two phases; Phase 1 being Development Area 5 plus trips associated with the adjacent the O'Flynn development and Phase 2 being the construction of all Development areas.

The traffic modelling for Phase 2 has been analysed in two ways; the first being the provision of a single right turning lane from the N11 and the second being the provision of a double right turning lane from the N11.

The proposed junction was also modelled for Phase 1 and Phase 2 utilising different traffic signal staging scenarios to assess the effect that pedestrian signals would have on the operation of the proposed junction and the N11.

Scenario 1 includes pedestrian signal phase on every cycle. Scenario 2 includes pedestrian signal phase every 2nd cycle. Scenario 3 includes pedestrian signal phase on the Druids Glen Road arm and Scenario 4 includes no pedestrian signals.

Scenarios 3 and 4 can be achieved by the introduction of a pedestrian footbridge or by introducing traffic islands and slip roads and staging the pedestrian crossings to be complementary with green phases. Scenario 1 may be considered overly conservative, i.e. the likelihood of the pedestrian signals being called every signal cycle.

The results associated with Scenario 2 (pedestrian phases called every 2nd signal cycle) are considered to be the situation most likely to reflect future pedestrian demand if a pedestrian footbridge is not provided. Further sensitivity analysis shown later in the report, demonstrate that the introduction of traffic islands and left in – left out slip roads reflect the best possible staging scenario without a footbridge.

11.2.6.2. Future Year 2025 AM and PM peak hour flows

Figure 12.9 and Figure 12.10 indicate the Future Year 2025 AM & PM peak hour flows for both Phase 1 and Phase 2 of the works.

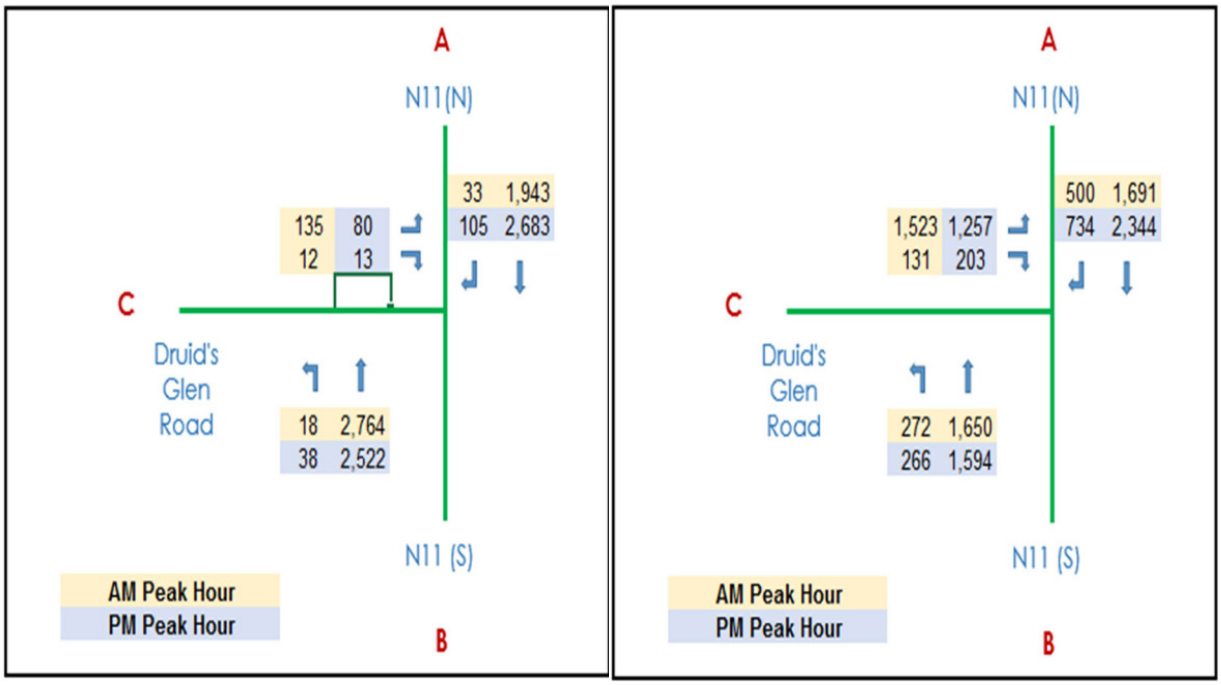

Figure 11-9 Phase 1 Turning Movements (2025) Figure 11-10 Phase 2 Turning Movements (2025)

11.2.6.3. Junction Analysis for Phase 1 Future AM & PM Peak Flows

Figure 11-9 summarise the findings of the traffic modelling exercise undertaken for the various Phases and Scenarios tested.

Note, the results shown in the tables below highlight the largest queue length experienced for each scenario considered. In the case where several lanes exist for a particular turning movement, the largest queue length has been recorded in the summary tables provided.

All Staging Plans associated with the following summary tables are shown in Appendix A of this report.

Table 11-6 sets out a summary of the scenario testing completed for Development Phase 1 (Area 5 and O'Flynn).

Table 11-6 Phase 1 Traffic Impact, Traffic Signal Staging Scenarios 1 to 4

Mean Max Queue (PCUs)		Peds Every Cycle		Peds Every 2nd Cycle		Peds Druids Glen only		No Peds	
		AM	PM	AM	PM	AM	PM	AM	PM
Northbound	Ahead	138	74	72	50	35	29	35	29
	Left	1	1	1	1	1	1	1	1
Southbound	Ahead	19	40	18	38	9	18	9	18
	Right	2	7	2	7	2	5	2	5
Druids Glen	Left	4	3	6	3	5	3	5	3
	Right	1	1	1	1	1	1	1	1
PRC %		-25.2%	-14.3%	-8.6%	0.3%	4.2%	11.8%	4.2%	11.8%

Phase 1 AM Peak Flows – The traffic modelling for Phase 1 AM Peak flows would indicate the following:

- The demand for southbound right turning vehicles is small, with a maximum of 7 PCU's anticipated for Scenario 1 or 2.
- Similarly the southbound straight ahead movement is relatively small, with a maximum of 40 PCU's anticipated for Scenario 1.
- The demand for northbound left turning vehicles is small, with a maximum of 1 PCU anticipated for Scenario 3. A left turning lane of 30m can be provided at the expense of a localised extinguishment of the Bus Lane on approach to the junction.
- The northbound straight ahead movement is the critical movement in the AM, which is anticipated to reach 138 PCU's (794m) for Scenario 1. For Scenario 2 this figure reduces to 72 PCU's (414m). Such a vehicle queue would not extend to the Wyattville Interchange which is in the order of 950

metres from the proposed junction. However, Scenarios 3 and 4 indicate that with the introduction of the pedestrian footbridge, the northbound straight ahead AM peak movement reduces to 35 PCU's (202m).
- The Druids Glen left turn movement is a minor movement in the AM, which is anticipated to reach 6 PCU's (35m) for Scenario 2.

Phase 1 PM Peak Flows - The traffic modelling for Phase 1 PM Peak flows would indicate the following:

- The demand for southbound right turning vehicles has a queue of 7 PCU's (36.75m lane length) anticipated for Scenarios 1 and 2. A single right turning lane of this length is achievable within the existing central median along the N11 and would not require the acquisition of additional land. A right turning lane of this length would result in the closure of the existing u-turn facility immediately north of the proposed junction location.
- The southbound straight ahead movement is relatively small, with a maximum of 40 PCU's (210.0m) anticipated for Scenario 1. A queue length of this order would not extend back as far as the existing N11/Johnstown Road junction.
- The demand for northbound left turning vehicles is small, with a maximum of 1 PCU anticipated for Scenario 3. The bus lane would need to be stopped short of the junction to enable left turning traffic to undertake the left turn manoeuvre.
- The northbound straight ahead movement is the critical movement in the PM, which is anticipated to reach 74 PCU's (426m) for Scenario 1 and 50 PCU's (288m) for Scenario 2. However, Scenario 3 and 4 indicate that with the introduction of a pedestrian footbridge, the northbound straight ahead PM peak movement reduces to 29 PCU's (168m) which would not extend as far as the Wyattville Interchange.
- The Druids Glen Road left turn movement is a minor movement in the PM, which is anticipated to reach 3 PCU's (18m) for Scenario 2.

11.2.6.4. Junction Analysis for Phase 2 (a) Future AM & PM Peak Flows

Table 11-7 describes a summary of the scenario testing for Phase 2(a) (all Development Areas - single right turning lane):

Table 11-7 Phase 2(a) Traffic Impact (Single Right Turning Lane) Scenarios 1 to 4

Mean Max Queue (PCUs)		Peds Every Cycle		Peds Every 2nd Cycle		Peds Druids Glen only		No Peds	
		AM	PM	AM	PM	AM	PM	AM	PM
Northbound	Ahead	227	180	218	165	171	115	171	115
	Left	9	8	9	8	19	11	8	7
Southbound	Ahead	15	29	14	27	9	18	9	18
	Right	15	64	15	38	12	27	12	27
Druids Glen	Left	389	261	403	250	288	169	288	169
	Right	6	23	7	14	5	9	5	9
PRC %		-92.3%	-67.8%	-73.5%	-50.8%	-58.3%	-36.9%	-58.3%	-36.9%

Phase 2 (a) AM Peak Flows – The traffic modelling for Phase 2 (a) AM Peak flows would indicate the following:

- The demand for southbound right turning vehicles is small, with a maximum of 15 PCU's anticipated for Scenario 1 and 2. A single right turning lane of this length is achievable within the existing central median along the N11. This would result in the closure of the existing u-turn facility immediately north of the proposed junction location.
- Similarly the southbound straight ahead movement is small, with a maximum of 15 PCU's anticipated for Scenario 1 and 2.
- The demand for northbound left turning vehicles is relatively small, with a maximum of 19 PCU's anticipated for Scenario 3. This demand reduces to 9 PCU's for Scenarios 1 and 2. The proposed length of the left turning lane is 30m. The left turn will be on the same stage as the ahead stage so the left turn will not block the ahead movements.
- The northbound straight ahead movement is a significant movement in the AM, which is anticipated to reach 227 PCU's (1,305.25m) for Scenario 1. A queue length of this magnitude would extend beyond the Wyattville Interchange. The introduction of a pedestrian footbridge in Scenario 3 and 4 reduces the AM peak demand to 171 PCU's (983.25m) which still extends beyond the Wyattville

Junction. In addition to the provision of a pedestrian footbridge and in order to improve northbound movements, the signal timings at the proposed junction can be optimised to ensure the northbound traffic movements are given extra green time in the morning to alleviate potential impacts on the Wyattville Interchange. This has been developed later in this report.

- The Druids Glen left turn movement is the critical movement in the AM, which is anticipated to reach 403 PCU's (2,318m) for Scenario 2. A queue length of this magnitude would be considered unacceptable. Therefore, in order to reduce the left turn demand queue the benefits associated with the introduction of an extra left turn lane from the Druids Glen Road arm was investigated. The results of this analysis are described in Section 12.2.8.

Phase 2 (a) PM Peak Flows – The traffic modelling for Phase 2 (a) PM Peak flows would indicate the following:

- The demand for southbound right turning vehicles is significant, with a maximum of 64 PCU's (368m) anticipated for Scenario 1. A single right turning lane of this length would be considered excessive. The introduction of the pedestrian footbridge in Scenario 3 and 4 would reduce the PM demand to 27 PCU's (155.25m), which is still considered excessive.
- The southbound straight ahead movement is small, with a maximum of 29 PCU's anticipated for Scenario 1.
- The demand for northbound left turning vehicles is relatively small, with a maximum of 11 PCU's anticipated for Scenario 3. This demand reduces to 8 PCU's for Scenario 1 and 2. The proposed length of the left turning lane is 30m. The left turn will be on the same stage as the ahead stage so the left turn will not block the ahead movements
- The northbound straight ahead movement is a significant movement in the PM, which is anticipated to reach 180 PCU's (1,035m) for Scenario 1. A queue length of this magnitude would extend beyond the Wyattville Interchange. The introduction of a pedestrian footbridge in Scenarios 3 and 4 reduces the PM peak demand to 115 PCU's (661.25m) which would not extend as far as the Wyattville Interchange. In addition to the provision of a pedestrian footbridge and in order to improve northbound movements, the signal timings at the proposed junction can be optimised to ensure the northbound traffic movements are given extra green time in the morning to alleviate potential impacts on the Wyattville Interchange. This has been developed later in this report.
- The Druids Glen left turn movement is the critical movement in the PM, which is anticipated to reach 261 PCU's (1,501m) for Scenario 2. A queue length of this magnitude would be considered unacceptable. Therefore, in order to reduce the left turn demand queue the benefits associated with the introduction of an extra left turn lane from the Druids Glen Road arm was investigated. The results of this analysis are described in Section 12.2.8.

11.2.7. Sensitivity Analysis - Signal Optimization to Limit Impacts on Wyattville Junction

Analysis of the northbound traffic lanes during the Phase 2 (b) (double right turning lane) for Scenario 2 (pedestrian stage is called once every two cycles) indicates that this arm experiences a mean max queue of 220 PCU's or 1265m. It is therefore anticipated that traffic associated with the northbound approach has the potential to impact negatively on the Wyattville Interchange.

A sensitivity analysis was therefore undertaken to examine the impact that would occur on the N11 Junction Q as a whole, associated with the effect of constraining or limiting the queue lengths on the northbound approach lanes to ensure that they do not impact on the upstream Wyattville Interchange.

This sensitivity analysis was carried out on Phase (2b) (double right turning lane) for Scenario 2 (pedestrian stage is called once every two cycles). However, the same principle can be extended to all phases.

The available queuing length between both junctions is in the order of 950m. To provide a reasonable factor of safety, and as part of the sensitivity analysis, the queue limit (referred to as Excess Queue Limit within LinSig) was set to 75% of the distance between the new interchange and Wyattville Junction.

On this basis, the N11 northbound queue limit was set to 712m or 124 PCU's and the model was re-run establish the impact this would have on the overall junction practical reserve capacity (PRC).

The following Figure 11-11 and Figure 11-12 summarise the findings of the sensitivity analysis. Note the alterations to the signal timings for each stage, which have been highlighted within a red box for clarity – note that the timings in the small boxes are amended within the optimisation.

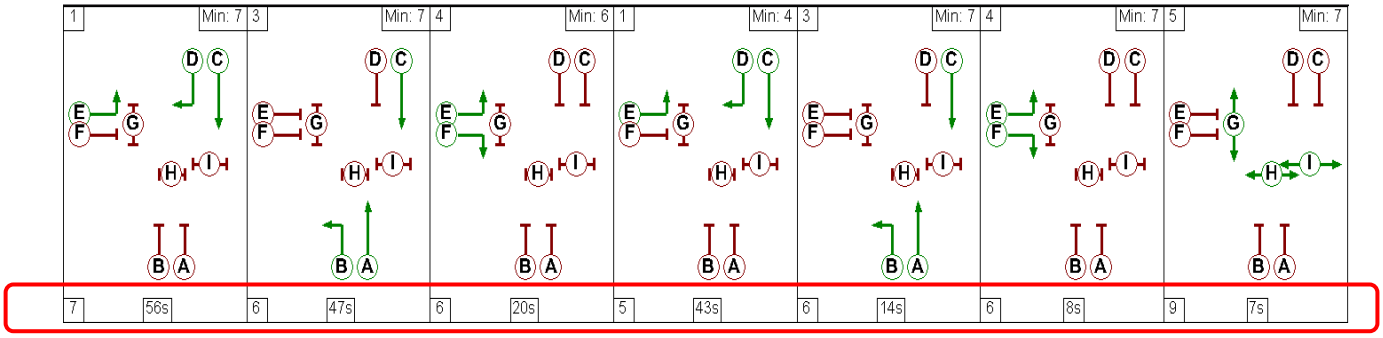

Figure 11-11 Optimising for PRC with no Queue Constraints Applied to N11 Northbound Lanes

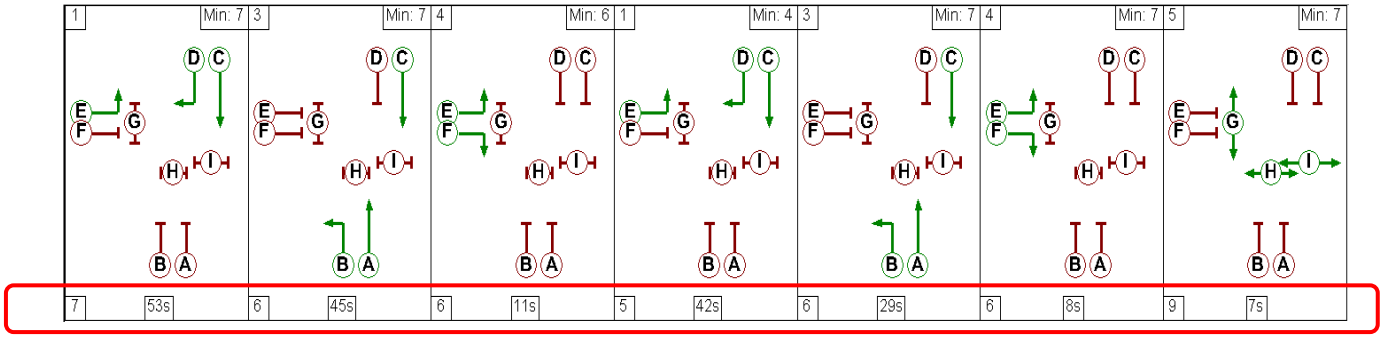

Figure 11-12 Optimising for PRC with N11 Northbound Queues Limited to 712m (124 pcu)

As can be seen the Optimiser Queue Constraints tool has provided more green time to the northbound stage. To limit the N11 northbound queue length, the majority of the green time provided here has been reallocated from opposing phases, for example Phases E and F.

More detailed information relating to the findings of the sensitivity analysis have been provided in Table 11-8 and

Table 11-9 following.

Table 11-8 Optimising for PRC with no Queue Constraints Applied to N11 Northbound Lanes

Mean Max Queue		**Scenario 2 - Peds Every 2nd Cycle**	
		AM	**PM**
Northbound	Ahead	219	165
	Left	9	8
Southbound	Ahead	15	28
	Right	7	10
Minor Arm	Left	402	249
	Right	6	10
PRC%		**-73.5%**	**-50.4%**

Table 11-9 Optimising for PRC with Queue Constraints Applied to N11 Northbound Lanes

Mean Max Queue		Scenario 2 - Peds Every 2nd Cycle	
		AM	PM
Northbound	Ahead	146	137
	Left	9	8
Southbound	Ahead	15	31
	Right	7	11
Minor Arm	Left	455	269
	Right	6	10
PRC%		**-91.6%**	**-55.7%**

The above tables illustrate the junction impact associated with constraining the queue on the northbound approach lanes to limit the risk of upstream junction blocking. The LinSig model run has optimised the signal timings accordingly and has achieved a MMQ of 146 PCU's during the critical AM peak hour. This equates to a queue length of 839.5m, which means the Wyattville Interchange is not impeded. Corresponding queues on the Druids Glen Road are significantly dis-improved.

11.2.8. Sensitivity Analysis – Introduction of Double Left Turn Lane and Signal Optimization to Limit Impacts on Druids Glen Road and Northbound Straight ahead movement.

Analysis of the Druids Glen Road left turn demand during the Phase 2 for Scenario 2 (pedestrian stage is called once every two cycles) indicates that this arm experiences a mean max queue of 402 PCU's or 2,311m. It is therefore anticipated that traffic associated with the left turn out of Druids Glen Road has the potential to impact negatively on the operation of the Druids Glen Road and also has a negative impact on the northbound straight ahead movement on the N11 during both the AM and PM peak hour.

In order to address the significant left turn queue from Druids Glen Road, due consideration was given to the introduction of a second left turn lane and optimisation of the signal staging of the entire junction to analyse the impacts on the critical turning movements at the proposed junction.

The analysis was carried out on Phase 2 (b) for all Scenarios. The results of the analysis are indicated in Table 11-10 below.

Table 11-10 Optimising for double left hand turning lane on Druids Glen Arm for Phase 2 (b)

Mean Max Queue (PCUs)		Peds Every Cycle		Peds Every 2nd Cycle		Peds Druids Glen only		No Peds	
		AM	PM	AM	PM	AM	PM	AM	PM
Northbound	Ahead	76	41	48	31	32	26	32	26
	Left	7	7	8	7	8	8	6	6
Southbound	Ahead	15	31	15	29	9	19	9	19
	Right	8	16	8	14	8	13	8	13
Druids Glen	Left	71	27	39	25	30	22	30	22
	Right	6	12	6	11	6	9	6	9
PRC %		-24.1%	-10.7%	-11.6%	0.2%	-1.6%	9.3%	-1.6%	9.3%

The above table indicates a significant improvement to the critical movements at the proposed junction. The introduction of an additional left turn lane has reduced the northbound straight ahead movement to a maximum of 76 PCU's (437m) in the AM Peak for Scenario 1, which will not extend back to the Wyattville Interchange. For Scenario 2 this figure reduces to 48 PCU's (276m).

The Druids Glen Road left demand movement for Scenario 2 has reduced to 39 PCU's (225m) per lane which is considered acceptable for the scale of the proposed development.

The southbound right turn queue extends to 14 PCU's (Scenario 2), which represents a double right turning lane of 80.5 m.

The junction is still operating above capacity but the second left turn lane improves overall performance for all movements.

11.3. Conclusion

The N11 is a strategic commuter corridor providing direct linkage to the south east quadrant of Dublin City for general traffic, multiple local and national bus services and also a range of vulnerable road users. The Cherrywood SDZ proposed road network includes the N11 Druids Glen Road which will terminate with a new junction on the N11 dual carriageway at point Q.

The new N11 Junction Q is required to facilitate the traffic generated from Development Area 5 (Phase 1) along the future Druids Glen Road Q-P3 initially and ultimately in conjunction with the overall proposed road network identified with the SDZ, the traffic generated from all of the eight development areas within Cherrywood.

Two phases of development, Phase 1 and Phase 2 have been modelled to assess the associated traffic impact on an at-grade junction and its wider impacts on the N11 mainline traffic.

The main objective of the assessment is to recommend an appropriate junction layout that will minimise traffic impacts on the operation of the N11 network and the future Druids Glen Road.

The actual rate of traffic growth from 2008 to 2015 has been lower than anticipated in the parent study. In this regard the findings of the parent study are considered conservative and consequently delays are considered correspondingly conservative.

The recommended infrastructure provision for stages 1 and 2 are summarised below.

Phase 1 - Development Area 5 + O'Flynn Development Traffic

- The provision of a single southbound right turn lane 37m in length.
- A northbound left turning lane in the order of 30m will be provided at the expense of a 30m localised extinguishment of the northbound Bus Lane.
- Pedestrian and cyclist facilities will be included as part of the development.
- Provision to be made for a CCTV system to be located at the junction.

Phase 2 - All Development Area Traffic

- The provision of a double southbound right turning lane 68.25m in length should be provided. Additional land from the eastern side of the junction is required to develop this feature. The land required is presently within the ownership of the Local Authority.
- The provision of a double left turn lane from the Druids Glen Road in the order of 130m in length should be provided. The provision of a right turn lane from the Druids Glen Road arm in the order of 50m in length should be provided.
- A northbound left turning lane in the order of 30m will be provided at the expense of a 30m localised extinguishment of the northbound Bus Lane.
- Two lanes for traffic flowing into the development will be provided over 50m length which is considered adequate for the movements anticipated.
- Left in/left out slip lanes on the Druids Glen Road provide greater optimisation of the junction in that pedestrian movements can be provided during traffic movements. This would be a preferable way of dealing with pedestrians over providing a pedestrian footbridge.

- Pedestrian and cyclist facilities will be included as part of the development.
- As Phase 2 will be developed over a period of a number of years, the development infrastructure should be added when the forecast demand necessitates.
- Provision to be made for a CCTV system to be located at the junction.