ENVIRONMENTAL IMPACT ASSESSMENT REPORT – VOLUME 2 (MAIN REPORT)

STRATEGIC HOUSING DEVELOPMENT (SHD) AT LANDS AT FORMER GREENPARK RACECOURSE, LIMERICK.

PREPARED FOR:

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1.0 INTRODUCTION

1.1 Introduction

This Environmental Impact Assessment Report (EIAR) relates to a Strategic Housing Development (SHD) application by Voyage Property Limited[1] (referred to as the Applicant throughout) for the redevelopment of lands at the former Greenpark Racecourse, Dock Road, Limerick.

This EIAR provides an assessment of the environmental impact and associated mitigation measures arising as a result of the proposed development. It has been prepared in accordance with the requirements of the Planning and Development Act 2000 (as amended), the Planning and Development Regulations 2001 (as amended) and the relevant guidance documents.

The SHD application site measures c.10.5 ha and is located off Dock Road (N69), Limerick and principally bounded by existing undeveloped lands to the north, south and west and the adjoining Log na gCapall Housing Estate to the east.

The proposed SHD comprises 371 No. residential units, consisting of 3 no. apartment blocks, duplexes and houses. The proposal also includes the proposed access road which joins the Dock Road and a 550 sq m childcare facility.

The SHD application site is part of a wider land holding which is subject to a Masterplan in respect of the future development of the lands. Whilst this planning application and EIAR relates to the SHD lands only, the Masterplan accompanies this planning application for information purposes only.

1.2 The Applicant

As noted above, the Applicant for the proposed development is Voyage Property Limited. As well as the SHD application site, the wider Masterplan lands are also within the control of the Applicant. This is illustrated on the Site Location Plan (Dwg. No. ZZ-ZZ-DR-A-02 1000 Rev B), prepared by Reddy Architecture + Urbanism.

1.3 The Proposed Project

The proposed project (also referred to as the ‘proposed development’) has a total gross floor area of 36,879 sq m and will consist of 371 no. residential units comprising the following:

- 157 no. two storey houses, consisting of 10 no. 4 bedroom units, 110 no. 3 bedroom units and 37 no. 2 bedroom units;
- 76 no. three storey duplex units, consisting of 14 no. 3 bedroom units, 38 no. 2 bedroom units and 24 no. 1 bedroom units;

[1] Voyage Property Ltd, Ashbourne Hall, Ashbourne Business Park, Dock Road, Limerick, V94 NPEO.

- 138 no. apartments, consisting of 92 no. 2 bedroom units and 46 no. 1 bedroom units; and
- Childcare facility/ creche (550 sq m).

The development is located on a c.10.5 ha portion of the former Greenpark Racecourse lands. The overall lands are bordered to the east by a number of established residential estates and to the north-west by Dock Road. The Ballinaclogh River runs close to the southern perimeter of the Racecourse lands.

The proposed development site itself is bordered to the east by Log Na gCapall residential estates and to the southeast by the Vances Land which are in the ownership of Limerick City and County Council.

1.4 Environmental Impact Assessment (EIA)

EIA requirements are governed by Directive 2014/52/EU, which amends the previous EIA Directive (Directive 2011/92/EU). The primary objective of the EIA Directive is to ensure that projects that are likely to have significant effects on the environment are subjected to an assessment of their likely impacts.

EIA forms part of the planning consent process and is carried out by the Competent Authority. An EIAR is prepared by/ on behalf of an Applicant in respect of a project seeking planning consent. The EIAR thus becomes an integral informing element in the Competent Authority's EIA. The 2014 Directive has introduced new requirements in respect of the competency of experts responsible for the preparation of the EIAR (see Section 1.5.1 below for details on the experts involved in the preparation of this document).

The environmental assessment presented in this EIAR has evaluated the *Construction* (initial site development works) and *Operational* (the day-to-day functioning/operation of the site) Phases of the proposed Project.

The EIAR describes the existing environment (baseline); identifies potential impacts of the proposed project; details any mitigation measures required to reduce or eliminate potential impacts; and predicts any residual impacts.

An overview of the EIA process and the steps involved are set out in Table 1.1 below. Further information on the approach to EIA are presented in Chapter 2 (The EIA Process).

Table 1.1: Overview of the EIA Process

Stage	Description	Status
1. Screening	Is an EIA required?	Yes
2. Scoping	The outline of the likely significant effects of the proposed project and the aspects to be considered in the impact assessment.	Completed
3. Environmental Impact Assessment	This stage includes: • Collection of baseline information; • Analysis of the proposed project; • Assessment of impacts; • Developing mitigation measures; and • Setting out requirements for monitoring.	Current Stage
4. Review and Decision	The EIAR accompanies the planning application to the planning authority (i.e. An Bord Pleanála) for determination of the application.	
5. Monitoring	Implementation and monitoring of the proposed Mitigation Measures.	Next Stage

1.5 Format and Structure of the EIAR

Table 1.2 below sets out the format and structure of this Environmental Impact Assessment Report.

Table 1.2: Structure of the EIAR

Chapter No.	Description
Volume 1: Non-Technical Summary (NTS)	
NTS	Summary of the EIAR in non-technical language
Volume 2: Main Report	
Chapters 1 - 3	Provide an introduction and background to the proposed project
Chapter 4	An assessment of the alternatives considered for the proposed project
Chapter 5	Description of proposed project assessed in the EIA.
Chapter 6	Consultation
Chapter 7	Population and Human Health
Chapter 8	Biodiversity
Chapter 9	Land, Soils, Geology and Hydrogeology
Chapter 10	Hydrology
Chapter 11	Air Quality and Climate
Chapter 12	Noise and Vibration
Chapter 13	Landscape and Visual
Chapter 14	Cultural Heritage, Archaeology and Architectural
Chapter 15	Microclimate – Daylight/ Sunlight
Chapter 16	Material Assets – Roads and Traffic
Chapter 17	Material Assets - Waste
Chapter 18	Material Assets – Built Services
Chapter 19	Interactions
Chapter 20	Cumulative Impacts
Chapter 21	Environmental Commitments/ Mitigation measures included in the EIAR document for ease of reference
Volume 3: Appendices	
TBC	Technical reference information supporting the EIAR Chapters

1.5.1 EIAR Project Team

The EIAR was project managed, co-ordinated and produced by Tom Phillips + Associates (TPA). TPA coordinated the EIA process and liaised between the design team and various environmental specialist consultants.

Environmental specialists were commissioned for the specialist environmental chapters of the EIAR document as required of the EIA Directive and Regulations. The amended EIA Directive (Directive 2014/52/EU) states the following in relation to the persons responsible for preparing the environmental impact assessment reports:

> *"Experts involved in the preparation of environmental impact assessment reports should be qualified and competent. Sufficient expertise, in the relevant field of the project concerned, is required for the purpose of its examination by the competent authorities in order to ensure that the information provided by the developer is complete and of a high level of quality."*

In compliance with this requirement, and in line with emerging best practice, including with the 2018 EIA Guidelines for Planning Authorities, Table 1.3 provides the names of the professionals who have prepared each element of the EIAR. It also lists their qualifications and relevant experience, demonstrating that the EIAR has been prepared by competent experts.

Table 1.3: EIAR Project Team and Environmental Specialists

Name	Role	Company	Qualification/ Experience
Lizzie Donnelly	EIAR Project Manager, Planner, Co-ordinator and Population and Human Health.	Tom Phillips + Associates	• MA (Planning, Policy and Practice) • Associate Planner • Corporate Member of the Irish Planning Institute (IPI) and Chartered Member of the Royal Town Planning Institute (RTPI) • Over 7 years' experience in Planning and EIA.
Gavin Fennessy	Biodiversity Assessment	Ecology Ireland Ltd.	• BSc (Zoology) PhD MCIEEM • Director & Principal Ecologist • Full member of the Chartered Institute of Ecology & Environmental Management (CIEEM) • Member of Irish Policy Group of CIEEM • Over 20 years of experience in professional consultancy, acting as lead ecological consultant on numerous projects including large infrastructural developments. • Guest Lecturer at University College Cork on topics including Environmental Impact Assessment & Appropriate Assessment.
Daniel Hopkins	Land, Soils, Geology Assessment	Gavin + Doherty Geosolutions	• Senior Engineering • Geologist BSc (Hons) Geology)

			• eight years post graduate experience. • Associate Member of Royal Institute of Chartered Surveyors
Joseph McGrath	Hydrogeology Assessment	RPS	• BSc Biochemistry MSc Applied Environmental Science • Chartered Water and Environmental Manager with the Chartered Institute of Water and Environmental Management (CIWEM) • Chartered Scientist • Over 15 years experience with contaminated land and EIA
Mark Magee	Hydrology Assessment	RPS	• Technical Director • Chartered Scientist (CSci), Chartered Environmentalist (CEnv), Chartered Water and Environmental Manager (CWEM), Member of the Chartered Institute of Water and Environmental Management (MCIWEM) • Over 22 years' experience in Environmental Assessment and Catchment Management
Christina Higgins	Air Quality and Climate Assessment	RSK	• Chartered Environmentalist (CEnv) with PhD in Chemistry, University of Bristol • Senior Air Quality Consultant • Full member of the Institute of Environmental Science (MIEnvSc), full member of the Institute for Air Quality Management (MIAQM) and associate

			member of the Royal Society of Chemistry (AMRSC) • Over 7 years' experience as project manager for air quality consultancy, modelling and monitoring, including EIAR and development planning applications.
James Mangan	Noise and Vibration Assessment	RSK	• PgDip (Acoustics and Noise Control), University of the West of England • Associate Director • Corporate Member of the Institute of Acoustics (MIOA) • Chairman of the Irish Branch of the Institute of Acoustics; • Over 16 years' experience in Planning and EIA Noise & Vibration Chapters.
Jim Bloxham	Landscape and Visual Assessment	Murray + Associates	• Senior Associate • Master's in Landscape Architecture • Full corporate Member of the Irish Landscape Institute • Over 8 years experience in LVIA.
Frank Coyne	Cultural Heritage Assessment	Aegis Archaeology Ltd.	• BA (Archaeology and History NUIG) and H Dip in Ed (NUIG) • Currently undertaking an MA in Conservation of the Historic Environment (Birmingham City University). • Founder member of the Institute of Archaeologists of Ireland (AIA)

			• Director of Aegis Archaeology Ltd since 1998, with 23 years experience in EIAR and Archaeological and Cultural Heritage Impact Assessments.
Amy Hastings	Microclimate – Daylight and Sunlight Assessment	ARC Architectural Consultants Ltd.	• BCL BL MSc. (Spatial Planning) MIPI • Over 17 years' experience in undertaking sunlight and daylight analysis
Julie Tiernan	Roads and Traffic Assessment	PUNCH Consulting Engineers	• Julie Tiernan BE MSc CEng MIEI • Julie is a Technical Director at PUNCH consulting engineers. • Over 15 years' experience as a civil/traffic engineer.
Tim O'Shea	Waste Assessment	Gavin + Doherty Geosolutions	• BE CEng, MIEI • Civil Engineer with 18 years post graduate experience
Donal Gallery Aiden O'Connell	Built Services Assessment	PUNCH Consulting Engineers	Donal: • BEng MIEI • Donal is a Technical Director at PUNCH consulting engineers. • Over 14 years' experience as a civil engineer. Aiden: • BE CEng MIstructE CEng MIEI • Aidan is a Director at PUNCH consulting engineers. • Over 20 years' experience as a civil/structural engineer.

Norman Woods	Built Services Assessment	WoodsPS Ltd.	• BEng MCIBSIE • Managing Director WPS • Over 20 Years Experience • Building Services Eng

2.0 THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS

2.1 EIA Legislation

The European EIA Directive 85/337/EEC was introduced in 1985. The Directive along with its three subsequent amendments was eventually codified by Directive 2011/92/EU. The 2011 Directive was further amended by Directive 2014/52/EU. The amending Directive took effect in Ireland on 16th May 2017, and the transposing legalisation (*European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018* (S.I. No. 296 of 2018)) came into effect on 1st September 2018.

The EIA Directive aims to provide a high level of protection to the environment and ensures that environmental considerations are taken into account in the preparation of a proposed development or project, with the view to reducing environmental impacts. EIA also includes public participation in decision-making and thereby strengthens the quality of decisions.

The 2014 Directive requires that certain developments be assessed for *likely environmental effects* before planning approval be granted. When submitting a planning application for such development, the applicant must also submit an accompanying Environmental Impact Assessment Report (EIAR).

The Department of Housing, Planning, Community and Local Government has brought forward the *Planning and Development Regulations 2001-2018* to provide for the transposition of the Directive into the Irish planning code. To this effect, the *European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018* transposed the 2014 Directive into Irish law.

The Department has also issued the updated the '*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment'* in August 2018, to provide practical guidance on legal and procedural issues arising from the requirement to undertake EIA in accordance with Directive 2014/52/EU. These Guidelines have informed the preparation of this EIAR. The preparation of the EIAR has also had regard to the EPA *Draft Guidelines on the Information to be Contained in EIARs* (2017).

2.2 EIA Process

EIA is the process for anticipating the effects on the environment caused by a proposed development or project. Where effects are unacceptable, design or other measures can be taken to avoid or reduce these effects to acceptable levels. The EIAR is the document produced as a result of the Environmental Impact Assessment (EIA) process, that:

- Provides a description of the baseline environment;
- Identifies the potential effects as a result of the proposed development or project; and
- Provides a description of any mitigation measures required to reduce or eliminate such potential effects.

The EIA process is summarised as follows:

- **Screening**

  Is an EIA required?

- **Scoping**

  What issues should be considered within the EIAR?

- **Baseline data collection**

  Establishing a robust baseline of the existing environment on/around the proposed site.

- **Impact assessment**

  Assessment of the environmental impacts and establishing their significance.

- **Mitigation**

  A description of the mitigation measures and/or factors that reduce or eliminate any significant environmental impacts identified, which cannot be avoided practically through design.

- **Consultation**

  With statutory stakeholders, the public and other bodies.

- **Decision**

  The competent authority, in this case An Bord Pleanála, taking into account the results of consultations, decides if the proposed project can be authorised.

- **Monitoring**

  Implementation and monitoring of mitigation measures.

In accordance with the requirements of Article 3 of the 2014 Directive, the EIA shall identify, describe and assess the direct and indirect significant effects of the proposed projects, in an appropriate manner, on the following factors:

a) population and human health;
b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;
c) land, soil, water, air and climate;
d) material assets, cultural heritage and the landscape;
e) the interaction between the factors referred to in points (a) to (d).

2.3 EIA Methodology

2.3.1 EIA Guidance

This assessment of environmental impacts has been completed in accordance with, but not limited to, the following legislation and current guidance:

- DHPLG (2018) *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment;*
- DHPLG (2017) *Circular letter PL 1/2017 - Advice on Administrative Provisions in Advance of Transposition*;
- EC (1999) *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions*;
- EC (2013) *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment*;
- EC (2017) *Environmental Impact Assessment of Projects. Guidance on Scoping*;
- EC (2017) *Environmental Impact Assessment of Projects. Guidance on the preparation of Environmental Impact Assessment Report;*
- EPA (2015) *Draft Advice Notes on Current Practice in the Preparation of Environmental Impact Statements* (2015);
- EPA (2017) *Draft Guidelines on the Information to be Contained in EIARs*;
- EU (2014) Directive 2014/52/EC, amending Directive 2011/92/EU on the *Assessment of the Effects of Certain Public and Private Projects on the Environmen*t;
- *Planning and Development Act 2000*, as amended; and
- *Planning and Development Regulations 2001*, as amended.

In addition to these guidance documents, all EU Directives and national legislation relating to the specialist areas (e.g. Biodiversity, Air and Climate, Noise) have been considered under each relevant environmental aspect. Specific guidance is addressed in the relevant chapters of this EIAR.

2.3.2 The Need for EIAR (EIA Screening)

Screening is Stage 1 in the process, whereby a decision is made on whether or not an EIA is required. In order to determine whether an EIA is required for the proposed project, it is necessary to determine whether it is a project listed in one of the Annexes to the Directive

2011/92/EU, as amended by Directive 2014/52/EU.

The 2014 Directive specifies the classes of project for which an EIA is required and the information which must be contained within the EIAR. In accordance with *Article 4(1)* of the 2014 Directive, all projects listed in Annex I are considered as having significant effects on the environment and shall be subject to EIA. For projects listed in Annex II of the Directive, the national authorities may determine whether an EIA is needed, either on the basis of thresholds/criteria or on a case by case examination.

These Annexes have been transposed into Irish law by the provisions of the *Planning and Development Act 2000-2020* and the *Planning and Development Regulations 2001-2020*. Specifically projects requiring mandatory EIA are listed in Part 1 and Part 2 of Schedule 5 of the *Planning and Development Regulations 2001-2020*.

Schedule 5 (Part 1) of the *Planning & Development Regulations 2001* (as amended) lists major project classes for the purposes of mandatory EIA, which typically include industrial, chemical, energy, waste, infrastructure and intensive agricultural developments. The proposed project does not correspond to a development set out in this Part and therefore, EIA is not a requirement under this provision.

Schedule 5 (Part 2) of the *Planning & Development Regulations 2001* (as amended) sets mandatory thresholds for each project class above which EIA is required. Sub-sections 10(b)(i) and 10(b)(iv) addresses '*infrastructure projects'* referring to housing and urban developments, and require that the following class of project, relevant to this project, be subject to EIA:

> **Class 10(b)(iv):**
>
> *"Urban development which would involve an area greater than 2 hectares in the case of a business district, 10 hectares in the case of other parts of a built-up area and 20 hectares elsewhere."*

In summary, this project relates to a site of 10.5 hectares and is located within an area which falls under the definition of "other parts of a built-up area". As the application site exceeds the stated threshold of 10 hectares, it is maintained that the proposed development requires an EIAR in respect of this Class.

2.3.2.1 Appropriate Assessment

European sites are also known as Natura 2000 Sites (Special Areas of Conservation (SAC) and Special Protection Areas (SPA). These are a network of sites designated for nature conservation under Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the "*Habitats Directive"*) and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (the "*Birds Directive*"). The requirements for Appropriate Assessment are set out under Article 6 of the Habitats Directive, transposed into Irish law by the European Union (Birds and Natural Habitats) Regulations 2011-2015[5] (the "*Birds and*

Natural Habitats Regulations") and the Planning and Development Act, 2000 - 2018 (the "*Planning Acts*").

Article 6(3) of the Habitats Directive states that:

> *(3) Any plan or project not directly connected with or necessary to the management of the site but likely to have significant effect thereon, either individually or in combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.*

The first test is to establish whether, in relation to a particular plan or project, appropriate assessment is required. Sections 177U of the Planning Acts and Regulation 42 of the Birds and Natural Habitats Regulations require that the AA screening test must be applied to the proposed development/project, as follows:

- To assess, in view of best scientific knowledge, if the development, individually or in combination with another plan or project is likely to have a significant effect on the European site;
- An appropriate assessment is required if it cannot be excluded, on the basis of objective information, that the development, individually or in combination with other plans or projects, will have a significant effect on a European site.

The AA Screening process has been followed and a Natura Impact Assessment (NIS) has been prepared in accordance with the requirements of the Birds Directive, the Habitats Directive, the Planning Acts and the Birds and Natural Habitats Regulations.

2.3.3 Information to be included in the EIAR (EIA Scoping)

The EPA Guidelines state that 'Scoping' is a process of deciding what information should be contained in an EIAR and what methods should be used to gather and assess that information. It is defined in the EC (2001) guidance as: '*determining the content and extent of the matters which should be covered in the environmental information to be submitted in the EIAR'.*

The EIAR will be prepared to address those aspects identified in Article 5 and Annex IV of the EIA Directive and Schedule 6 of the Regulations. The EIAR will also be prepared in the context of Section 4 of the Draft *Guidelines on the Information to be Contained in the Environmental Impact Assessment Reports,* prepared by EPA (2017). Table 2.1 below documents the scoping exercise undertaken in respect of this EIAR.

Table 2.1: Scoping exercise – potential for significant effects arising from the proposed project.

Environmental Aspect	Detailed Assessment	Justification
Population and Human Health	Yes	The proposed development has the potential to impact on population and human health, employment, local community and amenity uses, during the construction and operational phases.
Biodiversity	Yes	The subject lands are not located within any Natura 2000 or nationally designated conservation sites but is located within 15km of a number of designated sites. There are a number of habitats that have been recorded on site. The proposed development therefore has potential to impact on biodiversity.
Land, Soils, Geology and Hydrogeology	Yes	The proposed development includes a cut and fill exercise that involves the movement and deposition of soil. The impacts on geology and hydrogeology should therefore be assessed in terms of the groundworks, construction and operational phase of the proposed development.
Hydrology – Surface Water	Yes	The proposed development does have the potential to impact on water (including flood risk, hydrology and drainage) as there will be ground disturbance associated with the proposed development.
Air Quality and Climatic Factors	Yes	Construction and operational phases will have the potential to give rise to air quality impacts, principally relating to traffic associated with the proposed development.
Noise and Vibration	Yes	Construction and operational phases will have the potential to give rise to impacts relating to noise and vibration. A baseline noise survey has been undertaken to determine the prevailing noise level representative of the site and nearest noise sensitive locations.

Landscape and Visual	Yes	Given the height and scale of the buildings proposed when compared to the existing undeveloped nature of the subject lands, the LVIA will consider effects on the landscape character of the existing setting (i.e. as a result of the construction and existence of the proposed development) and visual impacts (i.e. the extent to which the proposed development when built will effect the landscape).
Cultural Heritage, Archaeology and Architectural	Yes	The site is not identified as being in an area with any relevant Archaeological, Architectural or Cultural Heritage, however, given the largely undeveloped nature of the lands, an assessment is considered necessary.
Daylight and Sunlight	Yes	The proposed development is located in close proximity to a number of existing two storey residential properties. Given the scale of development proposed, particularly the 4 and 5 storey apartment buildings, there is potential for the receiving environment to be affected from a daylight, sunlight and/or overshadowing perspective.
Wind	No	Due to the nature of the proposed development and nature of the surrounding area, it is not expected that the significant impact will arise in respect to wind and pedestrian comfort and safety.
Material Assets – Roads and Traffic	Yes	The transportation chapter of the EIAR is required to present an assessment of the potential traffic and transport impacts of the proposed development. The assessment will be influenced by the requirements set out within *Traffic and Transport Assessment Guidelines* TII, 2017.
Material Assets – Waste Management	Yes	The proposed development may generate waste arisings that will require management during construction and operation.

Material Assets – Built Services	Yes	The Material Assets section of the EIAR will examine the likely significant effects of the construction and operation of the proposed development on intrinsic and valuable assets of material value.
Major Accidents and Disasters	No	The subject site is noted located within any consultation distances of any Serveso II sites. As a result, there is no expected impact arising from major accidents or disasters in respect of the proposed development.
Interactions	Yes	There is the potential for multiple direct or indirect effects (from various environmental aspects) to result in an accumulation or magnified effects from the proposed development.
Cumulative Impacts	Yes	The proposed development will be in proximity to other development permitted and proposed development and thus has the potential to exacerbate or create larger, more significant effects.

Scoping was carried out on an informal basis through the submission of draft EIAR chapters and an informal scoping exercise (contained within a 'Summary of Environmental Impacts' document) submitted to both Limerick City and County and An Bord Pleanála at the pre-application consultation stage. In this document, the environmental aspects that were proposed to be considered in detail in this EIAR, on the basis that there is potential for significant effects, were identified. That said, scoping is considered to be an iterative process and is ongoing throughout the development and preparation of the EIAR.

2.4 EIA Consultation

Consultation with key stakeholders, including Limerick City and County Council and An Bord Pleanála has taken place at the pre-application stage via the Strategic Housing Development Pre-Application Consultation process.

Furthermore, this document enables the competent authority to determine the acceptability of the proposed development in the full knowledge of the project's likely significant impacts on the environment (if any). The decision-making process follows a statutory process that allows for public consultation and the receipt of advice from other key stakeholders and statutory authorities with specific environmental responsibilities. Further information on the Consultation Process is set out in Chapter 6 of this EIAR.

3.0 PLANNING AND DEVELOPMENT CONTEXT

3.1 Introduction

This Chapter provides the legislative context in relation to the planning and development of the proposed project, including an overview of the national, regional and local planning policy pertaining to the site. Regard is also given to other relevant statutory and non-statutory planning documents where appropriate.

In this case, the project is defined as a Strategic Housing Development (SHD) on the basis that it comprises *"…100 or more houses on land zoned for residential use or for a mixture of residential and other uses"*, as set out in Section 3 of the *Planning and Development (Housing) and Residential Tenancies Act 2016.*

3.2 National Planning Context

3.2.1 National Planning Framework – Project Ireland 2040

The *National Planning Framework (NPF),* published in February 2018, sets out a strategic development framework for Ireland over the period to 2040. The NPF is the Government's plan to cater for the extra one million people that will be living in Ireland, the additional two thirds of a million people working in Ireland and the half a million extra homes needed in Ireland by 2040. The Framework focuses on:

- Growing regions, their cities, towns and villages and rural fabric;
- Building more accessible urban centres of scale;
- Better outcomes for communities and the environment, through more effective and coordinated planning, investment and delivery.

As a strategic development framework, the Plan sets the long-term context for Ireland's physical development and associated progress in economic, social and environmental terms and in an island, European and global context. *Project Ireland 2040* will be followed and underpinned by supporting policies and actions at sectoral, regional and local levels.

A recurring theme in the *Framework* is the requirement to facilitate balanced development throughout all regions of Ireland, and particularly, to accommodate significant growth in Ireland's cities other than Dublin.

Under the heading of 'Compact Growth', the NPF is:

> *'Targeting a greater proportion (40%) of future housing development to happen within and close to existing built-up areas.* ***Making better use of under-utilised land, including 'infill' and 'brownfield' and publicly owned sites*** *together with higher housing and jobs densities, better serviced by existing facilities and public transport'.* [Our Emphasis]

Specifically, the NPF notes that Limerick has the potential to generate and be the focus of significant employment and housing growth to 2040. It is necessary for Limerick to further strengthen its position as the principal focus within the Region and to continue to address the legacy of regional growth having occurred outside the City area. This requires growing and diversifying the City's employment base and attracting more people to live in the City, both within the City Centre and in new, accessible green-field development areas. This means improving housing choice, supported by facilities and infrastructure.

The NPF further notes in National Policy Objective 10:

> *'There will be a presumption in favour of development that encourages more people, jobs and activity within existing urban areas, subject to development meeting appropriate planning standards and achieving targeted growth'.*

The proposed development at this location complies with the overarching themes of the NPF. It proposes a well-designed sustainable form of mixed-use and residential development on an existing, underutilised site located in close proximity to high quality public transport services and a well-established social infrastructure that will contribute to the consolidation of Limerick.

The NPF provides a detailed narration on the Government's aspirations for Limerick and the Mid-West Region. The NPF states:

> *"As a well-located regional centre situated mid-way between Cork and Galway on Ireland's Atlantic Economic Corridor and with good connectivity to Dublin, Limerick has the potential to generate and be the focus of significant employment and housing growth.*
>
> *It is necessary for Limerick to further strengthen its position as the principal focus within the Region and to continue to address the legacy of regional growth having occurred outside the City area."*

The NPF continues:

> *"A series of innovative, practical and institutional measures have been put in place to achieve this in recent years and there is evidence of a positive turnaround in terms of both population and employment growth. Limerick Regeneration, the amalgamation of Limerick City and County and most recently, the Limerick 2030 initiative, have all contributed to enhancing Limerick's growth potential. Working together with the City's third level institutions, Shannon Airport and bodies such as Shannon Development and the Shannon-Foynes Port Company, there is capacity to build on recent successes and add to the ambitious vision for Limerick."*

Several of the key future growth enablers for Limerick, identified in the NPF are particularly relevant when considering the proposed development at this location. These include:

- Identifying infill and regeneration opportunities to intensify housing and employment development throughout inner suburban areas;

- Enabling enhanced opportunities for existing communities as development and diversification occurs, particularly through employment, learning and education support;

- The continued expansion of the City's third level institutions and integration with the wider City and region.[2]

National Policy Objectives

The NPF outlines National Policy Objectives, which set out broader aspirations for national and regional planning. Several of these are relevant when considering the proposed development at this subject site. These include:

- ***National Policy Objective 5*** - *Develop cities and towns of sufficient scale and quality to compete internationally and to be drivers of national and regional growth, investment and prosperity.*

- ***National Policy Objective 6*** - *Regenerate and rejuvenate cities, towns and villages of all types and scale as environmental assets, that can accommodate changing roles and functions, increased residential population and employment activity and enhanced levels of amenity and design quality, in order to sustainably influence and support their surrounding area.*

- ***National Policy Objective 7*** - *Apply a tailored approach to urban development, that will be linked to the Rural and Urban Regeneration and Development Fund, with a particular focus on:- Dublin; the four Cities of Cork,* ***Limerick,*** *Galway and Waterford; Strengthening Ireland's overall urban structure, … Encouraging population growth in strong employment and service centres of all sizes, supported by employment growth; Reversing the stagnation or decline of many smaller urban centres, by identifying and establishing new roles and functions and enhancement of local infrastructure and amenities; Addressing the legacy of rapid unplanned growth, by facilitating amenities and services catch-up, jobs … In more self-contained settlements of all sizes, supporting a continuation of balanced population and employment growth.*

- ***National Policy Objective 11*** - *In meeting urban development requirements, there will be a presumption in favour of development that can encourage more people and generate more jobs and activity within existing cities, towns and villages, subject to development meeting appropriate planning standards and achieving targeted growth.*

- ***National Policy Objective 28*** - *Plan for a more diverse and socially inclusive society that targets equality of opportunity and a better quality of life for all citizens, through improved integration and greater accessibility in the delivery of sustainable communities and the provision of associated services.*

[2] *Project Ireland 2040 - The National Planning Framework*, p 51.

National Policy Objective (NPO) 3b imposes a target of at least 50% of future urban development on infill/brownfield development sites within the built envelope of existing urban areas, including Cork City. This is applicable to all scales of settlement, from the largest city, to the smallest village.
The NPF further notes in *National Policy Objective 10:*

> *"There will be a presumption in favour of development that encourages more people, jobs and activity within existing urban areas, subject to development meeting appropriate planning standards and achieving targeted growth."*

It states that the key test is meeting appropriate planning standards, which should be performance-based to ensure well-designed, high quality outcomes, rather than absolute in all cases. Although sometimes necessary to safeguard against poor quality design, the NPF notes that planning standards should be flexibly applied in response to well-designed development proposals that can achieve urban infill and brownfield development objectives in settlements of all sizes.

3.2.2 Urban Development and Building Heights – Guidelines for Planning Authorities (2018)

The *Urban Development and Building Height Guidelines - Guidelines for Planning Authorities* (2018) set out the national planning policy guidelines on building heights in urban areas in response to specific policy objectives set out in the National Planning Framework and Project Ireland 2040. The Guidelines state that it is Government policy to promote increased building height in locations with high quality public transport services.

3.2.3 Rebuilding Ireland – Action Plan for Housing and Homelessness (2016)

Rebuilding Ireland was launched in 2016 with the aim of addressing ongoing supply issues for residential accommodation in Ireland. The overarching aim of the *Action Plan* is to increase the delivery of housing from its current undersupply across all tenures and to help individuals and families meet their housing needs.

The Action Plan provides a target to double the number of residential dwellings delivered annually by the construction sector and to provide 47,000 social housing units in the period up to 2021.

3.2.4 Sustainable Urban Housing: Design Standard for New Apartments: Guidelines for Planning Authorities (2018)

The *Sustainable Urban Housing Design Standards for New Apartment* (2018) provides for an update on guidance on apartment developments in response to the National Planning Framework and Rebuilding Ireland.

These Guidelines seek to promote high density apartment development on residentially zoned land in appropriate locations in line with the above referenced NPF overarching policies in relation to encouraging residential development within existing urban settlements.

3.2.5 Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas (2009)

The *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas* (2009) aim to ensure the sustainable delivery of new development throughout the Country.

The Guidelines also provide guidance on the core principles of urban design when creating places of high quality and distinct identity. The Guidelines recommend that planning authorities should promote high quality design in their policy documents and in their development management process. In this regard, the Guidelines are accompanied by a Design Manual, discussed below.

Furthermore, the Guidelines provide national guidance in relation to the appropriate locations for the siting of higher density residential development, having regard to the locational characteristics of the lands in question.

3.2.6 Urban Design Manual – A Best Practice Guide (2009)

The *Urban Design Manual – A Best Practice Guide* (2009) notes 12 no. criteria that should be used to facilitate assessment of planning applications and should, therefore, be used as a guide to steer best design practice for residential proposals.

3.2.7 Delivering Homes, Sustaining Communities (2007)

This document provides the overarching policy framework for an integrated approach to housing and planning. It notes that demographic factors will continue to underpin strong demand for housing, which in turn will present considerable challenges for the physical planning of new housing and the provision of associated services. Sustainable neighbourhoods are areas where an efficient use of land, high quality design, and effective integration in the provision of p people want to live in.

3.2.8 Childcare Facilities – Guidelines for Planning Authorities (2001)

The *Childcare Guidelines* (2001) generally recommend the provision of childcare facilities for residential development with 75 no. units or more, albeit having regard to the existing geographical distribution of such facilities in the area and the emerging demographic profile of the area.

3.2.9 Design Manual for Urban Roads and Streets (DMURS) (2013)

A key objective of DMURS is to achieve safe, attractive and vibrant streets by balancing the needs of all users, and prioritising alternatives to car journeys. The manual advocates a design-led approach, which takes account of both the physical and social dimensions of place and movement.

3.2.10 The Planning System and Flood Risk Management (2009)

The Office of Public Works (OPW) and the Department of Environment, Heritage and Local Government (DEHLG) published *The Planning System and Flood Risk Management Guidelines for Planning Authorities*, November 2009. The *Planning Guidelines* introduce the principle of a risk-based sequential approach to managing flood risk.

3.2.11 Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities (2009)

The Appropriate Assessment Guidance was published to guide compliance with the Birds Directive, 1979 and the Habitats Directive, 1992.

3.2.12 Climate Action Plan (2019)

The Government's *Climate Action Plan* (2019) documents a broad spectrum of potential actions which can mitigate the effects of climate change as caused by pollution and the over-exploitation of natural resources. With regard to the built environment, these measures include the rational siting of urban development, the building of compact, dense and well-designed neighbourhoods, and the imposition of higher energy efficiency performance standards.

3.3 Regional Planning Context

3.3.1 Regional Spatial & Economic Strategy for The Southern Region (2020)

The RSES came into effect in January 2020, the purpose the RSES is to translate the high level objectives in the NPF into local policy objectives. The RSES provides the strategic framework to guide development in the southern region, including Limerick, Cork and Waterford City, the vision for each is set out in the Metropolitan Area Strategic Plan (MASP).

To achieve the Vision the MASP identifies a number of Guiding Principles for the sustainable development of the Limerick-Shannon Metropolitan Area including Compact sustainable growth, which aims to:

> *"The MASP highlights the need to increase residential density in Limerick City and Shannon through a range of measures including, reductions in vacancy, re-use of existing buildings, infill and site-based regeneration. The MASP supports the densification of Limerick City Centre, the assembly of brownfield sites for development and City Centre rejuvenation and consolidation."*

The Limerick- Shannon MASP contains the following policy objectives:

MASP Policy Objective 1 includes the following components:

> *"a. It is an objective to strengthen the role of the Limerick-Shannon Metropolitan Area as an international location of scale, a complement to Dublin and a primary driver of economic and population growth in the Southern Region.*
>
> *b. It is an objective to promote the Limerick-Shannon Metropolitan Area as a cohesive Metropolitan Area with*
>
> > *(i) the City Centre as the primary location at the heart of the Metropolitan Area and Region;*
> > *(ii) compact growth and regeneration of Limerick City Centre and Suburbs;*
> > *(iii) compact growth and regeneration of Shannon (iv) active land management initiatives to deliver housing and employment locations in a sustainable, infrastructure led manner"*

MASP 10 Policy Objective 10 refers to a 'Housing and Regeneration' and states the following:

> *"a. It is an objective to support the environmentally sustainable densification of Limerick City Centre, the assembly of brownfield sites for development and the regeneration and redevelopment of Limerick City and Suburbs to accommodate residential use. The MASP recognises that initiatives such as the Living City and Living Georgian City initiatives and other interventions by agencies such as the Land Development Agency (and any environmental mitigation arising from the environmental assessment of such strategies) are essential to facilitate compact growth and increased residential density in the City Centre."*

Further to this, RPO 10 of the RSES supports 'Compact Growth in Metropolitan Areas'.

3.4 Local level – *Limerick City Development Plan 2010-2016, including Limerick 2030*

The Limerick City Development Plan (LCDP) 2010-2016 sets out Limerick City Council's policies for the development of Limerick City to 2016 and beyond. The plan was amended with Variations that came into effect in May 2017. As set out in the *LCDP 2010-16*, the vision for Limerick City is to continue to grow as the centre of economic, social and cultural development for the Mid-West Region.

Variation number 4 to the *Limerick City Development Plan 2010 – 2016*, was adopted in January 2015 and comprised of the incorporation of the *Limerick 2030 Economic and Spatial Plan* into the LCDP. The Limerick 2030 Plan sets out the medium-term and long-term strategy for the development of Limerick City and County for the next 15 years.

3.4.1 Core Strategy – *Limerick City Development Plan 2010-2016*

Chapter 2 of the Development Plan sets out its Core Strategy and addresses the issues of housing, employment and infrastructure.

In relation to housing, the Core Strategy makes reference to role that the County's 'Undeveloped Zoned Housing Land' will play in the delivery of the required quantum of housing. In this regard, the Strategy makes specific reference to the subject lands ('Former Racecourse') and notes that the overall site has capacity to deliver 1,188 units.

3.4.2 Zoning Objective – *Limerick City Development Plan*

Chapter 15 of the Development Plan contains the Land Use Zoning Objectives for Limerick City.

The majority of the application site is subject to **Zoning Objective 2A – Residential**:

> *"To provide for residential development and associated uses."*

In addition to this, part of the proposed access road spans land which is subject to **Zoning Objective 5A – General Mixed Use:**

> *"To promote the development of mixed uses that serves an area greater than its immediate catchment and to ensure the creation of a vibrant and sustainable urban area. The primary purpose of this zoning is to provide for a range of employment and related uses. Permissible uses within this zone includes general offices, conference centre, third level education, hospital, hotel, commercial leisure, cultural, **residential**, public institutions, childcare services, business and technology/research uses (including software development, commercial research and development, publishing, information technology, telemarketing, data processing and media activities), light industrial uses and in addition, local convenience stores/corner shops and community/civic uses. Residential uses are also permitted."*

The proposed access road also incorporates land which is subject to **Zoning Objective ZO.5 (C) Neighbourhood Centres:**

> *"To protect, provide for and/or improve the retail function of neighbourhood centres and provide a focus for local services."*

> *"The primary purpose of these centres is to fulfill a local shopping function, providing a mix of convenience shopping, lower order comparison shopping, and local services to **residential** and employment areas. Some of these centres need to be enhanced significantly in terms of their retail offering, mix of uses, public realm, and overall viability and vitality. Limited retail offices will be acceptable in these centres to serve local needs and are subject to restrictions on size and extent including a cap of 100m² per unit. **Residential uses are also acceptable within this zone.**"*

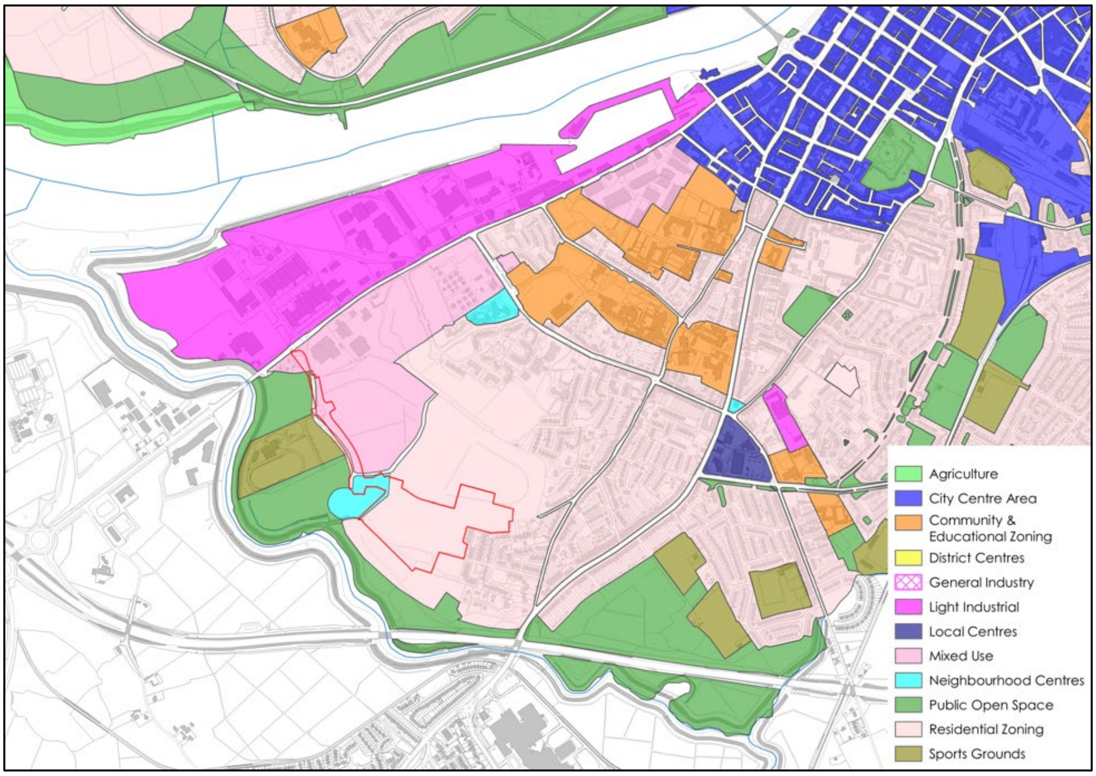


Figure 3.1: Extract from *Limerick City Council Development Plan 2010-2016*, Land Use Zone Map, with indicative red site boundary (annotated by Reddy Architecture and Urbanism, 2021)

3.4.3 Residential Development – *Limerick City Development Plan*

Chapter 6 of the Development Plan relates to 'Housing' and seeks to achieve mixed, balanced and self-sustaining communities. It sets out the following relevant 'overall objectives':

"To ensure that a good mix of both housing and apartment types and sizes is provided to meet the needs of the likely population."

"To encourage the development of sustainable residential neighbourhoods and the provision of high quality accommodation."

"To promote increased residential density where appropriate to do so."

Policy H.3 has regard to housing mix and states:

"It is the policy of Limerick City Council to encourage the establishment of sustainable residential communities by ensuring that a mix of housing and apartment types, sizes and tenures is provided within the City."

The text supporting this policy objective also sets out the following:

"The provision of a range of housing types and sizes in the City will increase in importance as trends show a decline in family housing and an increase in elderly and single person households."

"Providing a good mix of house types can create neighbourhoods for people of different ages and lifestyles. Encouraging good housing mix also allows people the choice and opportunity to remain in a given area while availing of accommodation that caters to their changing needs at a particular stage of their life."

Policy H.6 relates to sustainable residential development and states:

"It is the policy of Limerick City Council to ensure a balance between the reasonable protection of existing residential amenities, the established character of the area, and the need to provide for sustainable residential development."

3.5 Planning History of the Site

A planning history search of the site using Limerick City and County Council's online planning history search facility and that of An Bord Pleanála has been conducted, in order to establish the planning history of the subject site and of similar sites in the vicinity.

LCCC Reg. Ref.	Decision & Date	Brief Development Description	Appeal? Decision at Appeal. Extension of Duration?
01/770130	Approved subject to 19 no. conditions, 04/06/2002	For the development of lands for infrastructure to include a new roundabout on the N69 (Dock Road), roads, sewers, watermains, other underground services and landscaping (construction of the roads and services for the future development of lands).	1st Party and 3rd Party Appeal. Grant permission with revised conditions. (ABP Ref. 30.130232)
03/770343	Approved, subject to 5 no. conditions, 26/02/2004	Permission for a new roundabout on the N69 (Dock Road).	
04/770586	Withdrawn	Mixed use scheme including 30,881 sq m retail space, including a supermarket, two ancho comparison units and 39 no. additional retail units. The development also included a c. 3,500 sq m food court, car parking and recreation amenity area with 1 no. full size soccer pitch, 10 no. 5-a-side pitches and 4 no. tennis courts.	

05/770014	Approved, subject to 26 no. conditions, 09/03/2007	Mixed use scheme including 353 no. residential units (112 no. apartments, 17 no. maisonette apartments, 54 no. semi-detached units, 70 no. detaches houses, 43 no. terraced houses, 29 no. duplex units and 28 no. apartments below duplex units.) The application also includes a neighbourhood centre incorporating a creche, retail unit, coffee shop and doctor/dentist unit with associated car parking, play pitches and amenity area.	1st Party Appeal withdrawn. Extension of duration refused in 2013)
05/770390	Withdrawn	Raise land levels at the old racecourse using clean inert construction and demolition waste and subsoil.	
07/770237	Approved, subject to 4 no. conditions, 12/03/2008	Raise land levels at the old racecourse using clean inert construction and demolition waste and subsoil	
07/770453	Refused, for 2 no. reasons, 14/08/2008	Housing scheme and a creche. Development including 222 no. residential units (90 no. houses, 78 no. duplex/apartment units and a 54 no. unit retirement village.)	1st Party Appeal, Refused (inadequate public space, amenity space lacking in retirement home element) (ABP. Ref. 30.230944)
07/770470	Approved, subject to 21 no. conditions, 01/07/2008	Provision of a greyhound racing stadium, with associated access road and car parking.	
08/770311	Withdrawn	Housing development consisting of 300 no. units (17 no. 4 bed detached units, 12 no. 6 bed detached units, 16 no. 4 bed semi detached units with garage, 36 no. 4 bed semi detached units without garage, 78 no. 3 bed semi detached units, 63 no. 4 bed 3 storey town houses, 27 no. 3 bed duplexed and 27 no. 3 bed apartments and 24 no. apartments;) filling of lands by over 300 mm in certain areas to allow for houses to be constructed, associated access roads and car parking.	

15/428	Refused, for 1 no. reason, 11/12/2015	The construction of 110 housing units (comprising 31 no. 4 bed detached units, 72 no. 4 bed semi-detached units, 4 no. 3 bed semi-detached units, 3 no. 3 bed terraced unit), including the filling of lands in certain areas to allow housing to be constructed.	1st Party Appeal Refused (traffic, particularly impact on Log na gCapall) and piecemeal and premature development pending provision of a wider masterplan for the Greenpark Racecourse lands.) (ABP. Ref. 91.246035)

4.0 CONSIDERATION OF ALTERNATIVES

4.1 Introduction

The consideration of alternatives is necessary to evaluate the likely environmental consequences of a range of development strategies for the site within the constraints imposed by environmental and planning conditions.

4.2 Legislative Context

Article 5 (1) of the 2014 Directive requires the consideration of reasonable alternatives which are relevant to the project and take into account the effects of the project on the environment. It states under Article 5 (1) that;

> *"Where an environmental impact assessment is required, the developer shall prepare and submit an environmental impact assessment report. The information to be provided by the developer shall include at least…"*
>
> *"…a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment."*

Schedule 6 of the *Planning and Development Regulations, 2001* (as amended) sets out the information which is to be contained in an EIAR and Part 1 (d) of Schedule 6 states that the following shall be included:

> *"A description of the reasonable alternatives studied by the person or persons who prepared the EIAR, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed development on the environment."*

In accordance with draft EPA Guidelines, different types of alternatives may be considered at several key stages during the process. As environmental issues emerge during the preparation of the EIAR, alternative designs may need to be considered early on in the process or alternative mitigation options may need to be considered towards the end of the process.

The EPA Guidelines (Draft) states:

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

The consideration and examination of alternatives is set out below.

4.3 Alternatives Examined

4.3.1 *'Do-Nothing'* Alternative

A 'do-nothing scenario' has been considered in respect of the site. It was found to represent an unsustainable and inefficient use of strategically important lands for the delivery of residential development, as reflected by the land zoning objective and Core Strategy contained within the *Limerick City Development Plan 2010-2016*.

As a result of the zoning of the lands and the specific reference to the strategic importance of the site from a residential capacity perspective contained within the Development Plan, together with consideration of the proximity of the lands and accessibility to Limerick City, the 'do-nothing scenario' was discounted.

4.3.2 Alternative Locations

Voyage Property Limited (The Applicant) acquired the site due to its residential and mixed-use zoning under the *Limerick City Development Plan 2010-2016* which was itself subject to the Strategic Environmental Assessment (SEA) process.

The Core Strategy of the Development Plan envisages makes reference to role that the County's 'Undeveloped Zoned Housing Land' will play in the delivery of the required quantum of housing. In this regard, the Strategy makes specific reference to the subject lands ('Former Racecourse') and notes that the overall site has capacity to deliver 1,188 units.

As such, the site was considered appropriate for a development of the proposed nature (Strategic Housing Development) and scale.

4.3.3 Alternative Design and Layout

A site wide Masterplan, incorporating the subject site, has been prepared in respect of the overall former Greenpark Racecourse lands. During the design process for the Masterplan and the SHD project itself, a number of design iterations were considered. As part of this, a number of different site layouts were considered in respect of this initial SHD phase.

The key urban design considerations during the preparation of the Masterplan were as follows:

- To preserve the memory of the Greenpark Racecourse;
- To maximise connectivity and permeability with adjoining and future developments;
- To promote a healthy working and living lifestyle close to public open space with a high degree of biodiversity and sustainability;
- The provision of well-defined open spaces/ amenity spaces of varying sizes for the enjoyment of the local community.

The key principles that were applied to the proposed project were as follows:

- The creation of a new residential community;

- The creation of a series of new permeable connections to the surrounding areas that are fully compliant with DMURS;
- The creation of a series of high-quality pocket parks and open spaces overlooked by housing;
- The provision of a new neighbourhood with a mix of residential typologies such as apartments, own door duplex and housing, suiting a range of tenures;
- The provision of different character areas which will enhance the setting for the community; and
- The provision of an appropriate residential density in line with national policy and appropriate for the location.

4.3.3.1 Alternative Design 1 – Initial Massing and Layout

At initial project inception and feasibility stage, a low-density housing scheme was explored, based on market advice surrounding a demand for 3 no. bedroom and 4 no. bedroom houses in the area surrounding the South Circular Road.

This was discounted due to its failure to provide residential density in line with national policy requirements. It was further considered that a mix of typologies would be required not just to increase the residential density at the site, but to provide a mix of typologies that could meet the needs of different demographics and tenure typologies.

Different internal road layouts were also explored at this stage, including the provision of vehicular access via Log na gCapall. Through consultation with Limerick City and County Council and concerns relating to impact upon the local road network, vehicular connections were orientated solely to/ from Dock Road.

The issues raised at this stage, from an environmental perspective, related to Population and Human Health and Roads and Transportation.

Figure 4.1: Initial inception drawing of the Phase 1 residential scheme.

4.3.3.2 Alternative Design 2 – The Pre-Application Scheme

Figure 4.2 provides an extract from the Masterplan showing the SHD scheme submitted to An Bord Pleanála and Limerick City and County Council during the pre-application consultation stages of the SHD process. This scheme comprised majority houses and duplexes and one apartment block. The unit mix was designed to respond to the suburban location of the site and the level of public transport connectivity associated with the site.

The Alternative Design 2 resulted in increased residential density, good pedestrian and cyclist permeability and a vehicle access strategy that did not result in adverse impacts upon the local road network. It was however considered by An Bord Pleanála and Limerick City and County Council that the proposed residential density should be further considered in the context of national policy requirements and the locational characteristics of the site.

This scheme resulted in environmental improvements in terms of Population and Human Health and Roads and Transportation.

Figure 4.2: Pre-application Consultation stage SHD scheme in wider Masterplan context.

4.3.3.3 Alternative – The Proposed Project

The proposed project constitutes the final alternative, and preferred, option. The design has been progressed via an iterative process with design amendments arising from consultation with An Bord Pleanála and Limerick City and County Council during the pre-application process. The current design takes account of both planning and environmental considerations and has particular regard to the following items:

- Increased residential density;
- Changes to housing mix, including provision of increased number of smaller units;
- Enhanced potential for future connectivity to adjoining lands; and
- Revised site attenuation.

Figure 4.3: Extract from Design Report prepared by Reddy Architecture + Urbanism showing the final alternative and preferred option.

4.3.4 Alternative Process

Due to the scale and nature of the proposed development and the legislative provisions surrounding Strategic Housing Development, the consideration of an alternative process is not considered relevant to this EIAR. Under the provisions of the relevant legislation, a planning application for residential development of the proposed scale is required to be submitted to An Bord Pleanála for determination.

5.0 DESCRIPTION OF THE PROPOSED PROJECT

5.1 Introduction

This Chapter, in accordance with Article 5(1)(a) of the 2011 Directive as amended by Directive 2014/52/EU, provides: *"…information on the site, design, size and other relevant features of the project".*

The assessment provided in the following Chapters, undertaken by the various specialists, is underpinned by the description of the project as set out below.

5.2 Background to the Site

5.2.1 Site History

The site is part of the former Greenpark Racecourse which is situated in the townland of Ballinacurra (Hart) and connected to Limerick City by Dock Road.

The townland of Ballinacurra (Hart) was located beyond the 17th century fortifications and earthworks constructed (or at least proposed at that time) around Limerick City. It also was located beyond the expansion of the town to the south of its medieval core into what was named Newtown Pery in the 18th and 19th centuries. Following increased wealth and prosperity of Limerick City, demand grew for recreational activities. At this time, a racecourse was already established in Newcastle, but due to its poor and infamous reputation, a new racecourse was established at Greenpark in the 1980's. It is thought that the racecourse is likely to be the first development at the site, although not documented.

The Greenpark racecourse was used for horse racing and for other events such as horse shows and trade fairs. It also hosted GAA events prior to the construction of the Gaelic Grounds on the Ennis Road. Greenpark closed as a race course in 1999 after 130 years of racing; the last race meeting at the venue took place on 21st March 1999.

Refer to Chapter 13 (Landscape and Visual) and Chapter 14 (Cultural Heritage, Archaeology and Architectural) for more details relating to the history of the site.

5.2.2 Current Site Use

The site is currently a disused racecourse. The adjacent lands to the east of the site comprise residential development.

5.2.3 Site Location and Surrounding Area

The application site is c.10.5 ha and is located c.2km to the south-west of Limerick City Centre and within the townland of Ballinacurra (Hart). The site is principally bounded by existing undeveloped lands to the north, south (open land, formerly part of the racecourse) and west (open ground with the greyhound track) and the adjoining Log na gCapall Housing Estate and Greenpark Avenue to the east and north-east.

The application site has a substantive development area of c.7.9 ha which will accommodate the residential development. The remaining 2.6 ha includes the proposed access road and the 'over burden area' in respect of the earthworks associated with site levelling and achieving the required formation levels.

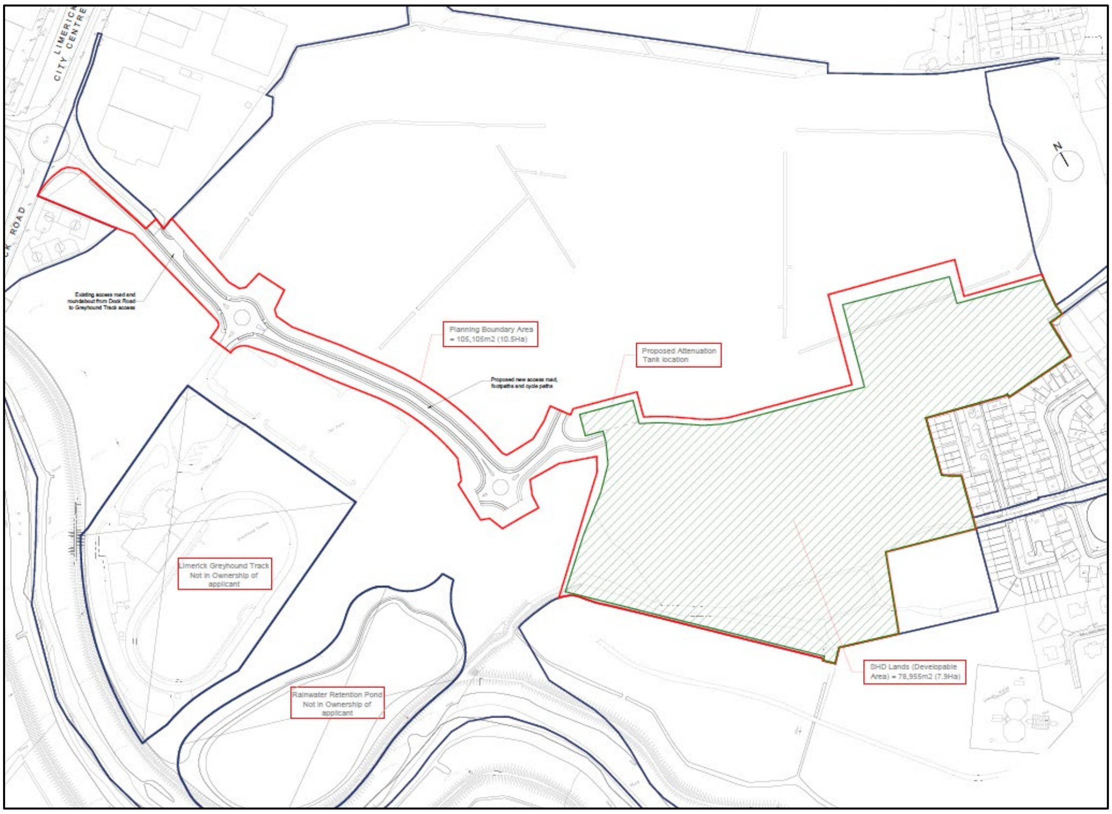


Figure 5.1: Extract from Reddy Architecture + Urbanism's Dwg. No. ZZ-ZZ-DR-A-02.1020 Rev A showing extent of the substantive development area (c. 7.9 ha) hatched in green.

The surrounding area comprises a number of land uses. The primary form of development to the east of the site is low rise residential development. To the north, north-west and west of the site is a number of commercial buildings, with a number of community use, schools and retail buildings in the vicinity. The Limerick Greyhound Stadium adjoins the Applicant's lands and continues to operate as a greyhound stadium.

The Ballinaclogh River, a tributary of the River Shannon, flows to the south-west of the site but does not directly abut its boundary.

In terms of proximity and accessibility to the wider environs, the site is located approximately 2km from Limerick City Centre, 1.2km from Crescent Shopping Centre, 1.6km from the Regional Hospital and 4.1km to Raheen Business Park. There are a number of bus routes (e.g. 304 and 301) that service the bus stops closest to the site, including the stops at Lifford Gardens and on the corner of South Circular Road and Ballinacurra Road and provide access to the City Centre.

5.2.4 Site Specific Flood Risk Assessment

A Site Specific Flood Risk Assessment has been prepared by RPS and is enclosed with this planning application, entitled *Flood Risk Assessment*. The Report defines the flood risk to the proposed development and demonstrates that, with appropriate mitigation, the subject lands can be developed as housing in accordance with the requirements of *The Planning System and Flood Risk Management Guidelines* (DEHLG 2009)

Following the sequential approach set out in the aforementioned Guidelines, the effects of any existing defences were ignored when establishing flood zoning. Taking this into account, a large part of the site is located within Flood Zone C with areas of the site in Flood Zone A and a very small part in Flood Zone B. The Guidelines require a Development Management Justification Test to be carried out for a residential development within Flood Zones A and B.

In accordance with Paragraph 5.16 of the Guidelines, a precautionary approach to development behind existing defences is to raise the finished levels to at least the 1% fluvial or 0.5% AEP coastal flood level.

This approach has been adopted for the SHD area. The SHD site will be filled to ensure all roads will be built up to approximately 5.0m OD, and then all FFLs will be constructed to a minimum of 5.3m OD. This provides over 1m freeboard to all new properties above the 0.5% AEP breach flood level, thus providing a very high standard of protection.

Modelling of the impact of raising the proposed development was then undertaken considering both the 0.5% AEP and 0.5% AEP climate change (MRFS) flood events when a breach of the defences occurs. The modelling shows that there was no identified increase in risk to existing development as a result of the proposed SHD site raising, either in the present day or climate change scenarios.

Based on the proposed mitigation measures, consideration of the designated zoning and the proposed urban design, each of criteria in the Development Management Justification Test was shown to be satisfied. Therefore, it was concluded that the proposed development complies with the requirements of the Development Management Justification Test and hence is compliant with *The Planning System and Flood Risk Management Guidelines*.

5.3 The Need for the Proposed Project

5.3.1 Introduction

The proposed project, a large-scale residential development, is supported by planning policy at all tiers. The project delivers a significant number of new homes as required to meet housing objectives outlined throughout the relevant policy documents.

The relevant national, regional and local planning policy is outlined in in Chapter 3 (Planning and Development Context) and further in the supporting planning documentation.

5.4 Overview of the Proposed Project

The proposed project will comprise 371 no. units arranged in two storey houses, three storey duplexes and three 4 to 5 storey apartment blocks. The proposed project also includes a two storey, 550 sq m childcare facility, designed to accommodate 65 no. children and 14 no. staff.

Figure 5.2: Extract from Reddy Architecture + Urbanism's Dwg. No. ZZ-ZZ-DR-A-02.1004 Rev A showing extent of the site layout plan in respect of the SHD substantive development area.

The housing mix is set out below:

Housing Type	No. of units
Houses	**157**
Duplexes	**76**
Apartment	**138**

The unit mix is as follows:

Unit Mix	1 bed	2 bed	3 bed	4 bed	Total
Houses	**0**	**37**	**110**	**10**	**157**
Duplexes	**24**	**38**	**14**	**0**	**76**
Apartment	**46**	**92**	**0**	**0**	**138**
	70	**167**	**124**	**10**	**371**

The proposed project includes the construction of an access road between the existing Greenpark roundabout within the former Greenpark Racecourse lands and the proposed development site. The proposed road is approximately 374m in length and includes a roundabout, pedestrian footpath and cycle lanes.

Figure 5.3: Extract from Reddy Architecture + Urbanism's Dwg. No. ZZ-ZZ-DR-A-02.1003 Rev A showing extent of the site layout plan in respect of the proposed access road.

The proposed apartment blocks are located in the north east of the site (Apartment Blocks A and B) and to the south (Apartment Block C). The duplex units and houses are arranged across the site, all with street frontage. The proposed childcare facility is located in the north western corner of the site, close to the proposed access road.

Figure 5.4: Extract from Reddy Architecture + Urbanism's Dwg. No. ZZ-ZZ-DR-A-02.1014 Rev A showing the arrangement of the proposed unit typologies (houses, duplexes and apartments).

In terms of access arrangements, vehicular movement will occur via the proposed access road, via the Dock Road. Vehicular access at the Greenpark Avenue and Log na gCapall site entrances will be limited to emergency vehicles only. These site entrances will also facilitate pedestrian and cyclist movement to and from the surrounding road network.

As set out in more detail in section 5.4.1 below, 11,511 sq m of public open space will be provided across the site. Communal amenity space is provided for the apartment blocks and private open space is provided in the form of balconies and terraces at ground floor. Private open space is provided for the proposed duplex units by way of a combination of rear garden and terrace. Private rear gardens are provided for the proposed houses.

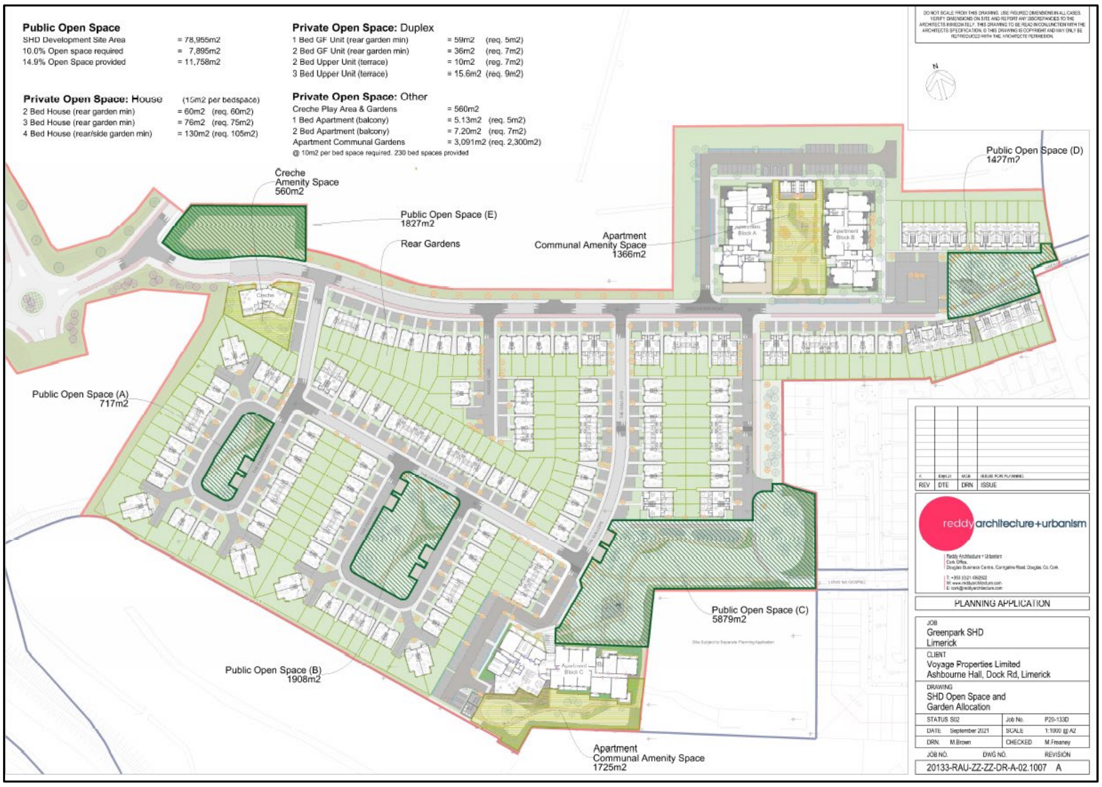


Figure 5.5: Extract from Reddy Architecture + Urbanism's Dwg. No. ZZ-ZZ-DR-A-02.1007 Rev A showing the location of the public open space provision.

5.4.1 Landscape Strategy and Design

The design intent is to create a high quality and appropriate landscape for future residents which will meet their recreational needs and provide an attractive visual setting and associated social amenity spaces. The principles of inclusivity for all age groups, universal accessibility and sustainable development are applied to ensure an inclusive and environmentally responsible design solutions. The main objective of the landscape strategy for the residential area is to place the new residential and community facilities within a cohesive landscape that responds to and integrates the proposed development within the overall site.

The landscape strategy also seeks to create a permeable network of green infrastructure and open spaces throughout the development and pay attention to future links to the development lands outside this application boundary.

Within the proposed project, there are 4 no. public open spaces in total, amounting to 11, 511 sq m (14.6%) of the total net residential area. In addition to the public open space, 3091 sq m of communal amenity space is provided in respect of the apartment development and 560 sq m is provided as creche amenity space.

Natural Play elements will be incorporated within the open spaces. Natural Play incorporates designed elements that enable play spaces to blend in with their surroundings and encouraging interaction with the natural landscape. Local Areas for Play (LAP) and Local Equipped Areas for Play (LEAP) will be incorporated within a five minute walk of the residential developments. All appropriate age ranges will be catered for and play spaces will be fully accessible, inclusive and comply with the relevant safety standards. In total, 580 sq m of formal and natural play areas are provided.

The proposed soft landscaping includes meadow areas, natural open space areas, native trees and shrub species, ornamental shrubs, perennials and hedging. The landscaping strategy will provide approximately 620 new trees, 2,170 sq m of native woodland and a further 1,300 sq m of native woodland and shrub planting to the access road area (totalling 3,470 sq m).

The proposed hard landscaping includes the following materials to the open spaces: compacted gravel paths/ asphalt paths within open spaces, concrete block pavers within specimen seating areas, reinforced grass/ bark within play areas; brushed concrete footpaths and concrete block to entrances/ thresholds. In terms

For full details, refer to the *Landscape Design Report* and *Outline Landscape Works Specification (incorporating a Landscape Management Plan)*, prepared by Murray & Associates.

5.4.2 Site Utilities

5.4.2.1 Electricity and Gas Infrastructure

ESB have HV lines traversing the site and MV Lines in close proximity which will be used to facilitate several cabinet Kiosk type MV/LV substations.

There will be a separate Kiosk substation per 150 units, the LV network will be distributed via underground ducting and ESB Mini pillars.

The existing gas infrastructure to the Greyhound Stadium will be retained, new infrastructure is not proposed for this project.

5.4.2.2 Water Supply

It is proposed to provide a 250mm diameter watermain, 180mm diameter watermain and 125mm diameter watermain branch lines for the development. A connection will be made to the existing 600mm diameter watermain.

5.4.2.4 Telecommunications

There is currently EIR ducts servicing the Greyhound Stadium, these will be extended into the site to provide telecoms & broadband services to each home user.

A full duct infrastructure to facilitate EIR FTTH (Fibre To The Home) 10Gigabit Broadband will be provided so each unit will have access to the national broadband plan. This infra structure will ensure EIR can provide current and next generation broadband to each home.

5.4.3 Site Infrastructure

5.4.3.1 Wastewater Services

Foul Water Disposal

It is proposed that foul water from the proposed SHD development shall discharge by gravity to the existing 225mm diameter foul sewer prior to discharging to the Limerick Main Drainage Network.

Surface Water Disposal

A new surface water sewer network will be provided for the proposed SHD development which will be entirely separate from the foul water sewer network. Surface water run-off from roof areas and hardstanding areas are designed to be collected by a gravity pipe network. Surface water will be collected and discharged via a mixture of traditional and Sustainable urban Drainage System (SuDS) to the existing lagoon via existing 1350mm/1500mm diameter surface water sewer. Each unit will have its own independent connection to the surface water sewer network.

It is proposed that surface water will discharge via attenuation tanks, a class 1 bypass separator and flow control device prior to discharging to the existing surface water network at a rate of 4l/s/ha.

5.4.3.2 Site Access

Vehicular access to the site will be from the N69 Dock Road, via the proposed access road as shown on Reddy Architecture + Urbanism's *Proposed Site Plan – Sht 1* Dwg. No. ZZ-ZZ-DR-A-02. 1003 Rev A. Pedestrian and cyclist access will be from Dock Road, via the proposed access road and also via Log na cGapall and Greenpark Avenue.

5.4.3.3 Fire Access

Emergency access will be via Greenpark Avenue and Log na gCapall; both access points are sufficiently sized to cater for emergency vehicles.

5.4.3.4 Car and Bicycle Parking

The proposed project will provide a total of 510 no. spaces which will be broken down as per the below extract from PUNCH Consulting Engineer's *Traffic and Transportation Assessment.* All houses with on-curtilage car parking will be first fixed for EV charge points. All common area parking spaces will have ducting run to them to facilitate future installation of additional EV charge points. 10% of common area parking spaces will have EV charge points installed.

Development type	No Units	Minimum Requirement per Development Plan	Parking Spaces Provided
Houses - 2 Bed	37	1.5 space per house	56
Houses - 3/4 Bed	120	2 spaces per house	240
Duplexs	76	1 space per 1.43 units (0.70/unit)	53
Apartments	138	1 space per 1.43 units (0.70/unit)	97
Visitor	446 (spaces)	11.0% of residential requirement	49
Creche	14 staff, 65 children		15
Total			510

Figure 5.6: Extract from *Traffic and Transportation Assessment* prepared by PUNCH Engineering Consultants.

In addition, 391 no. cycle parking spaces will be provided, incorporating 1 space per residential unit (371 no. spaces) and 20 no. visitor/ staff spaces associated with the proposed childcare facility.

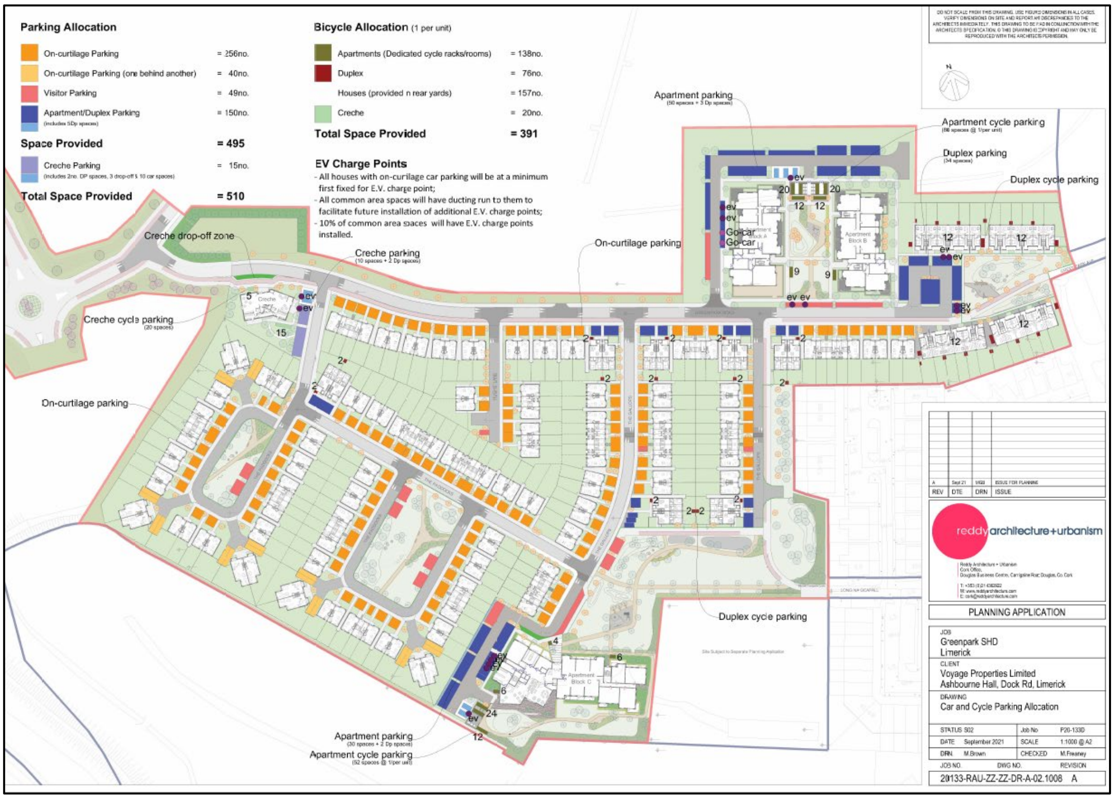


Figure 5.7: Extract from Reddy Architecture + Urbanism's Dwg. No. ZZ-ZZ-DR-A-02.1008 Rev A showing the car and cycle parking allocation across the site.

5.5 Construction Phase and Construction Works

The below paragraphs provide an overview of the construction phase and construction related management. For full details, rjamefer to the *Planning Stage Construction Environmental Management Plan* (CEMP) and *Construction Waste Management Plan* (CWMP), prepared by Gavin & Doherty Geosolutions which accompany this submission.

5.5.1 Construction Phase

This planning application seeks a five year planning permission from An Bord Pleanála. In line with this, it is expected that the construction phase will last for approximately 60 months (five years).

5.5.2 Proposed Construction Works and Methods

Site Establishment and Security

The first activity to be carried out at the site will be the establishment of site facilities and security. The site office and welfare facilities (site compound) will be confirmed in advance of the commencement of site works.

All the sub-contractors as well as the main contractor and project managers will occupy offices within the construction compound. The site parking for all staff, contractors and visitors will also be located in this area.

Erection of perimeter hoarding will take place at the start of the project alongside the site establishment and security works. The hoarding will be installed around the complete perimeter, except for dedicated access points. The extent of hoarding will be subject to the detailed phasing of the development and will ensure that areas under construction will be fenced off at all times. Gates will be provided at the access points and will be locked outside of working hours. Hoarding will consist of solid painted plywood on a timber support frame or similar. Hoarding will be properly designed to be secure and durable and will be maintained until it can be dismantled on completion of the development (or phase of the development).

Site Clearance

To facilitate the earthworks operation, site clearance will have to be carried out to remove vegetation. Removal of woody vegetation shall only take place outside the bird breeding season (1st March to 31st August). No removal of habitats or movement of construction machinery will occur outside of the development works area/footprint during the construction phase. Existing trees and hedgerows shall be retained where possible. Temporary surface water management measures will be put in place prior to stripping of topsoil and will remain in place until the completion of the development, or until the completion of each phase.

Topsoil will be stripped from the area to developed and from the area where site won fill is to be excavated to bring the development to the correct level. All excavated topsoil will be stored in dedicated stockpiles with environmental controls in place.

Prior to topsoil clearance, an Invasive Species Management Plan and survey is recommended to ensure areas of invasive plant species (if any) are identified and managed prior to or during site clearance works. There is a responsibility on the Environmental Manager or Ecological Clerk of Works (ECoW) to regularly inspect and supervise maintenance of the environmental controls throughout the process.

Earthworks

Once surface water management measures are in place and topsoil has been stripped, earthworks operations can commence. This will consist of moving fill from the higher ground at the east to the lower ground to the west. Material will be excavated by 360° excavators and transported to the deposition area by articulated dumpers. The fill will then be placed by dozers and compacted using vibratory rollers. A testing regime will be implemented to ensure the acceptability of the fill and that the degree of compaction is sufficient. Fill will be brought to the required level across the site to allow construction of roads and foundations. An overall earthworks balance has been targeted i.e. no imported fill will be required for the bulk earthworks and no soil will be removed from the site.

Construction of Housing

On completion of the bulk earthworks, construction of foundations for housing will commence. The exact construction sequence has not been determined, but it will be similar to what is described below:

- Temporary roads will be constructed to provide access to each row of units. This will include the construction of surface water management and silt control infrastructure, including settlement ponds and silt fencing.
- Construction of foundations. It is envisaged that raft foundations will be used on this site. The locations of foundations will be set out on the ground. Importation of certified stone fill will be required for the layers under the foundations in compliance with the Building Regulations. Reinforcement will be fixed, formwork installed and all required ducting placed prior to placement of concrete. Construction of foundations will require concrete deliveries to the site. Controls will be required to prevent any concrete material reaching local watercourses.
- Once foundations have cured, timber frames will be delivered to site and erected, followed by roofs.
- Scaffolding will be erected and construction of the masonry/brick outer leaf will then be completed.
- Windows and doors will be installed and first fix plumbing and wiring will be completed prior to external and internal rendering.
- On completion of rendering, second fix, plumbing wiring and carpentry will be completed, followed by floors, painting and finishing.
- At this stage, installation of drainage and services is likely to progress and the roads will be completed. Drives, footpaths, boundary walls and lawns will be finished and final road pavements will be installed.

The construction of apartment blocks will generally follow the construction sequence outlined below:

- Installation of piles
- Construction of pile caps, foundations and ground floor
- Erection of steel or reinforced concrete frame
- Construction of floors and roof slab
- Facades
- Fit out

5.5.3 Construction Working Hours

The proposed hours of work on site will be stipulated in the planning conditions attached to the planning grant. Any working hours outside the normal construction working hours will be agreed with the planning authority. The planning of such works will take consideration of sensitive receptors.

5.5.4 Site Access and Egress

Construction site access will be from the N69 Dock Road. There is an existing track through the site that is connecting to the entrance road at a roundabout junction with the entrance to the Greyhound Stadium. The road will be raised to the correct alignment using compacted stone fill. At the early stages of construction, the access road may be constructed from unbound stone. The access road will be paved and completed, including street furniture, cycle ways and footpaths, in advance of occupation of the first phase of the development.

5.5.5 Air Quality – Dust

The aim is to ensure good site management by avoiding dust becoming airborne at source. This will be done through good design, planning and effective control strategies. The siting of construction activities and soil stockpiles will take note of the location of sensitive receptors and prevailing wind directions to minimise the potential for significant dust nuisance. In addition, good site management will include the ability to respond to adverse weather conditions by either restricting operations on-site or using effective control measures quickly before the potential for nuisance occurs.

- During working hours, technical staff (e.g. Environmental Manager/ECoW) will be available to monitor dust levels as appropriate; and
- At all times, the dust management procedures put in place will be strictly monitored and assessed.

The dust minimisation measures will be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust generation. In the event of dust nuisance occurring outside the site boundary, site activities will be reviewed, and procedures implemented to rectify the problem. Dust levels shall comply with the mitigation measures and any planning conditions.

Refer to the *Planning Stage Construction Environmental Management Plan* for specific dust control measures to be employed.

5.5.6 Noise and Vibration

Specific noise abatement measures shall comply with the recommendations of BS5228-1 2009. These measures will include:

1. No plant used on site will be permitted to cause an ongoing public nuisance due to noise.
2. The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations.
3. All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
4. Compressors and generators 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.
5. Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
6. Any plant, such as generators or pumps, required to operate before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen.
7. Location of plant shall consider the likely noise propagation to nearby sensitive receptors.

The earthworks will generate typical construction activity related noise and vibration sources from use of a variety of plant and machinery such as rock breakers (where required), excavators, lifting equipment, dumper trucks, compressors and generators. The noise levels shall comply with the mitigation measures and any planning conditions.

A designated noise liaison will be appointed to site during construction works. Any complaints will be logged and followed up in a prompt fashion. In addition, prior to particularly noisy construction activity, e.g. excavation close to a property, etc., the site contact will inform the nearest noise sensitive locations of the time and expected duration of the works.

All works on site shall comply with BS 5228 2009+ A1 2014 (Parts 1 & 2) which gives detailed guidance on the control of noise and vibration from construction activities. In general, the contractor shall implement the following mitigation measures during the proposed infrastructure works:

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal haul roads well maintained and avoid steep gradients.
- Minimise drop height of materials.
- Start-up plant sequentially rather than all together

5.5.7 Preliminary Construction Traffic Management Plan (CTMP)

A Construction Traffic Management Plan (TMP) will be prepared for the site works in accordance with the principles outlined below and shall comply with the requirements of:

- Department of Transport Traffic Signs Manual 2010 – Chapter 8 Temporary Traffic Measures and Signs for Roadworks;
- Department of Transport Guidance for the Control and Management of Traffic at Road Works (2010); and
- Any additional requirements detailed in the Design Manual for Roads and Bridges (DMRB) & Design Manual for Urban Roads & Streets (DMURS).

The Contractor shall prepare a detailed traffic management plan for works at that interface with the existing road network and obtain all required road opening licenses. Access for construction of the development will be via the proposed primary access for the development from the Dock Road.

The earthworks plan has been developed to ensure an earthworks balance on site. Excavated material will be reused as part of the site development works where possible to minimise HGV movements to and from the site via the Dock Road.

5.5.8 Health and Safety

The appointed Contractor will be required to prepare a Construction Health & Safety Plan which will be put in place prior to commencement of the works. At a minimum, this plan will include:

- Construction Health & Safety training requirements
- Induction procedures
- Emergency protocols
- Details of welfare facilities
- Risk assessments and Method Statements.

5.5.9 Construction Waste

This section outlines the measures that will be undertaken to minimise the quantity of waste produced at the site and the measures to handle the waste in such a manner as to minimise the effects on the environment. A site-specific *Construction Waste Management Plan* (CWMP) has been prepared and will be employed to ensure sustainable and effective waste management throughout the construction and demolition phases of the project.

Adherence to the CWMP prepared for the construction works will ensure that the management of waste arising is dealt with in compliance with the provisions of the Waste Management Acts 1996 – 2015 and amendments. The waste management hierarchy to be adopted will be as follows:

1. Prevention and Minimisation
2. Reuse of Waste
3. Recycling of Waste:
4. Disposal

Typical waste materials that will be generated from the demolition and construction works will include:

- Soil and stones
- Concrete, bricks, tiles and ceramics
- Wood, glass and plastics
- Metals
- Gypsum-based construction material
- Paper and cardboard
- Mixed C&D waste
- Chemicals (solvents, paints, adhesives, detergents etc.)

The management of all hazardous waste arisings, if they occur, shall be coordinated in liaison with Health and Safety Management.

Waste minimisation measures proposed are summarised as follows (and are described in more detail in the CWMP):

- Materials will be ordered on an 'as needed' basis to prevent over supply.
- Materials will be correctly stored and handled to minimise the generation of damaged materials.
- Materials will be ordered in appropriate sequence to minimise materials stored on site.
- A waste tracking log will be established.
- Sub-contractors will be responsible for similarly managing their wastes.
- All wood waste generated by site works will be inspected and examined and will be segregated as re-useable wood and scrap wood waste.

The main waste storage area will be located in the site compound A dedicated and secure area containing bins, and/or skips, and storage areas, into which all waste materials generated by construction site activities, will be established within the development.

Waste materials generated will be segregated at the site compound, where it is practical to do so. Where the on-site segregation of certain waste types is not practical, offsite segregation will be carried out. There will be skips and receptacles provided to facilitate segregation at source. All waste receptacles leaving site will be covered or enclosed. The appointed waste contractor will collect and transfer the wastes as receptacles are filled.

The site Construction Manager will ensure that all staff are informed of the requirements for segregation of waste materials by means of clear signage and verbal instruction. Appointed employees will be made responsible for ensuring good site housekeeping.

5.6 Description of Development (Operational Phase of the project)

The proposed project is described as follows on the Statutory Notices:

Voyage Property Limited intend to apply to An Bord Pleanála (the Board) for permission for a strategic housing development with a total application site area of c.10.5 ha (with a substantive residential site development area of c.7.9 ha), on lands at the former Greenpark Racecourse, Dock Road, Limerick, principally bounded by existing undeveloped lands to the north, south and west and the adjoining Log na gCapall Housing Estate and Greenpark Avenue to the east. The application site includes the proposed access road (374m in length, including two lanes for vehicles, a roundabout, cycle lanes and pedestrian footpath) which connects to Dock Road at the north-western corner of the former Greenpark Racecourse lands and runs adjacent to the Limerick Greyhound Stadium.

The development, with a total gross floor area of c. 36, 879 sq m, will consist of the provision of 371 no. residential units comprising 157 no. two storey houses (consisting of 10 no. 4 bedroom units, 110 no. 3 bedroom units and 37 no. 2 bedroom units); 76 no. three storey duplex units (consisting of 14 no. 3 bedroom units, 38 no. 2 bedroom units and 24 no. 1 bedroom units) and 138 no. apartments (consisting of 92 no. 2 bedroom units and 46 no. 1 bedroom units arranged in 3 no. blocks ranging between 4 and 5 storeys together with communal amenity space) and a two storey childcare facility (550 sq m), including all private, communal and public open space provision (including balconies and terraces, private rear gardens and related play areas); surface car parking (510 no. spaces, including accessible spaces); car sharing provision; electric vehicle charging points; bicycle parking (long and short stay spaces); storage areas; internal roads and pathways; hard and soft landscaping and boundary treatments; piped infrastructural services and connections; plant; revised entrances and tie-in arrangements to adjoining roads, including emergency access via Log na gCapall and Greenpark Avenue and pedestrian and cyclist access via Log na gCapall; waste management provision; solar panels; attenuation tank and related SUDS measures; signage; public lighting; bulk earthworks; and all site development and excavation works above and below ground. Vehicular access to the site will be from Dock Road, via the proposed access road.

6.0 CONSULTATION

6.1 Introduction

This Chapter describes the consultation process in respect of the proposed project.

The 2014 directive places emphasis on effective public participation in decision-making procedures for projects that require EIA. During the preparation of this EIAR, the involvement of the public and other stakeholders has been considered.

This planning application is following the consultations prescribed by the SHD legislation (*Planning and Development (Housing) and Residential Tenancies Act, 2016* and *Planning and Development (Strategic Housing Development) Regulations 2017*) and includes:

Stage 1 – Consultation with the Planning Authority under Section 247 of the *Planning and Development Act 2000*, as amended.

Stage 2 – Pre-application Consultation with An Bord Pleanála under Section 6 of the *Planning and Development (Housing) and Residential Tenancies Act, 2016*.

Stage 3 – Planning Application to be submitted directly to An Bord Pleanála with statutory public consultation.

6.2 Stage 1 - Consultation with Limerick City and County Development Plan

Pre-application consultation with the local planning authority (Limerick City and County Council (LCCC)) took place prior to the engaging with An Bord Pleanála in respect of the proposed project.

The meeting was held on 29th January 2021. The minutes of this meeting, detailing the attendees and key points of discussion are appended to the SHD Application Form which accompanies this application.

Prior to this, there had been a number of meetings with the various departments at LCCC in respect of the Masterplan.

6.3 Stage 2 - Pre-Application Consultation

In line with Section 6 of the *Planning and Development (Housing) and Residential Tenancies Act, 2016*, pre-application consultation was requested with An Bord Pleanála and a tripartite meeting was held on 24th June 2021. The pre-application consultation was allocated reference no. ABP 310233-21.

6.4 Stage 3 - Planning Application

This planning application is submitted directly to An Bord Pleanála for assessment; as part of this, further consultation will take place. This will comprise the public display of the application and all accompanying documents. Any submissions arising from the consultation process will be submitted directly to An Bord Pleanála and considered as part of the decision-making process.

Pursuant to Article 285(5)(a) of the Planning and Development (Strategic Housing Development) Regulations 2017, the following authorities have also been notified in respect of this planning application:

1. Irish Water
2. Transport Infrastructure Ireland
3. National Transport Authority
4. Limerick County Childcare Committees
5. Health and Safety Authority

7.0 POPULATION AND HUMAN HEALTH

7.1 Introduction

This chapter of the Environmental Impact Assessment Report has been prepared by Tom Phillips + Associates and examines the likely impacts of the proposed development on population and human health. The scope of the work includes an evaluation of the likely direct and indirect effects on human beings and addresses any likely impacts on amenity and the local economy.

7.2 Methodology

The following guidelines have informed the preparation of this chapter:

- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessments (Department of Housing, Planning and Local Government – August, 2018);*
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, Draft August 2017);*
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2002);*
- *Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment (European Union, 2017);*
- *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DHPLG, 2018).*

The preparation of this Chapter was also informed by desktop studies of relevant policy documents and data sources including:

- Central Statistics Office (2021) – *Census 2016, Census 2011, Census 2006*
- Central Statistics Office (2021) – *CSO PxStat*
- ESRI (2021) - Quarterly Economic Commentary, Winter 2020
- DoHPLG (2017) - Rebuilding Ireland – Action Plan for Housing and Homelessness
- Childcare Act (1991) - (Early Years Services) Regulations 2016
- Tusla Early Years Inspectorate Reports (2021) – Registered Childcare Facilities
- Department of Health (2021) – Health in Ireland, 2019
- Health Safety Authority (2021) – www.hsa.ie
- HSE Service Records (2021) – www.hse.ie
- ECAD (2021) – Eircode Address Database
- Google Maps and Places (2021)

In order to assess the likely significant impacts of the proposed development on population and human health, an analysis of recent Census data was undertaken relating to the economic, demographic and social characteristics of the study area. For the purposes of this demographic analysis, the study area comprises 2 No. distinct enumeration areas identified by the Central Statistics Office (CSO) of relevance to the subject development, as follows:

1) The local Electoral Division (ED) study area to which the subject site belongs, comprised of 6 No. ED's within a c. 1km radius of the site (ED Study Area comprised of Ballinacurra A to which the site belongs; Ballinacurra B; Ballycummin; Dock C; Dock D; and Prospect B); and

2) The larger combined Limerick City and County Local Authority (LA) administrative boundary.

These enumeration areas are identified in Figure 7.2 and provide demographic information for the local and regional populations which are likely to be impacted by the subject development. Where relevant, information with relation to the national averages in each demographic area is also provided.

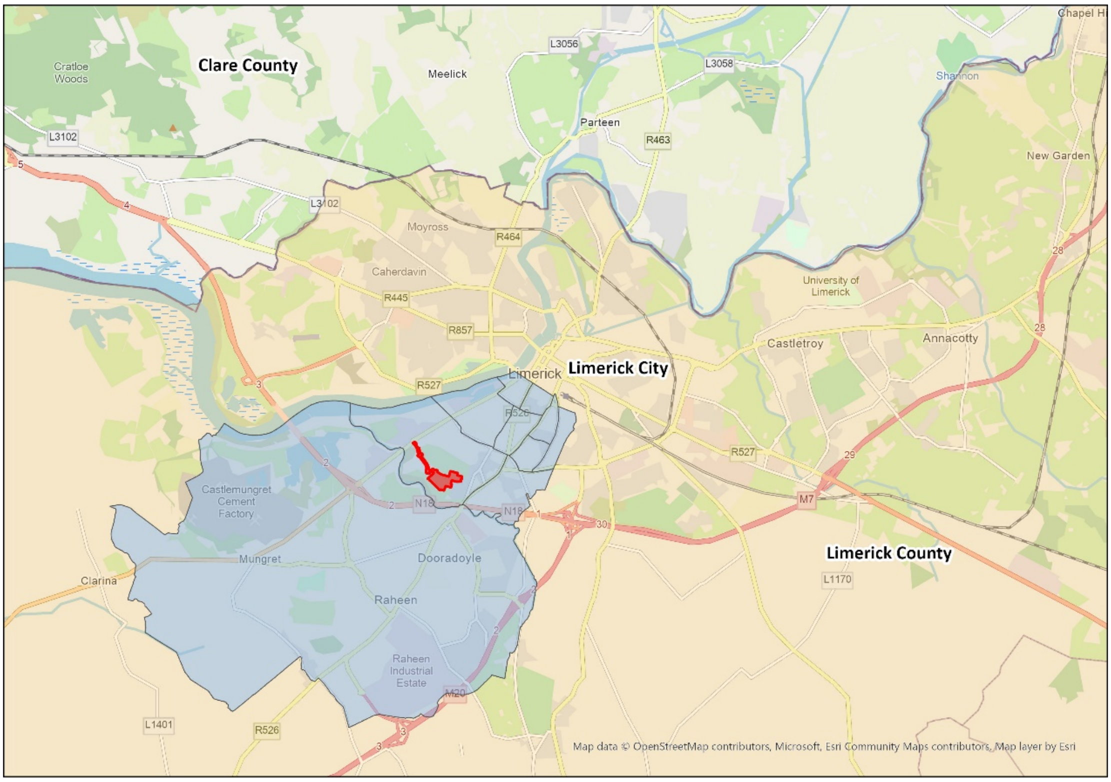


Figure 7.1: Extent of CSO enumeration areas utilised in demographic analysis. Location of subject site within the ED Study Area indicated by red polygon. Source: CSO/TPA, 2021.

7.3 Baseline Environment

7.3.1 Social Patterns and Population Trends

Population demographics for each of the study areas were obtained from the Central Statistics Office (CSO) for the purposes of this assessment and have been summarised in Tables 7.1 and 7.2. As outlined previously, the local study area is comprised of 6 No. Electoral Divisions (EDs), including: Ballinacurra A to which the site belongs; Ballinacurra B; Ballycummin; Dock C; Dock D; and Prospect B.

During the period 2011 to 2016, all of these EDs recorded an increase in population, for a cumulative growth rate of 2% in the recent 5-year period. This is higher than the growth recorded in Limerick City and County (1.6%), but lower than the State average (3.8%) for the same period. We note that the population of Ballinacurra A, including the proposed development site, decreased by more than 8% from 2011-2016.

Table 7.1: Population Trends at LA and State Level (Source: CSO 2011, 2016).

Study Area	2011	2016	% Change
Limerick City and County	191,809	194,899	+1.6%
Ireland	4,588,252	4,761,865	+3.8%

Table 7.2: Population Trends at Local Electoral Division Level (Source: CSO 2011, 2016).

Local Electoral Divisions	2011	2016	% Change
Ballinacurra A	2,137	1,962	8% decrease
Ballinacurra B	1,375	1,371	<1% decrease
Ballycummin	17,490	18,388	5% increase
Dock C	1,028	976	5% decrease
Dock D	872	773	11% decrease
Prospect B	751	715	5% decrease
Cumulative ED Study Area	**23,653**	**24,185**	**2% increase**

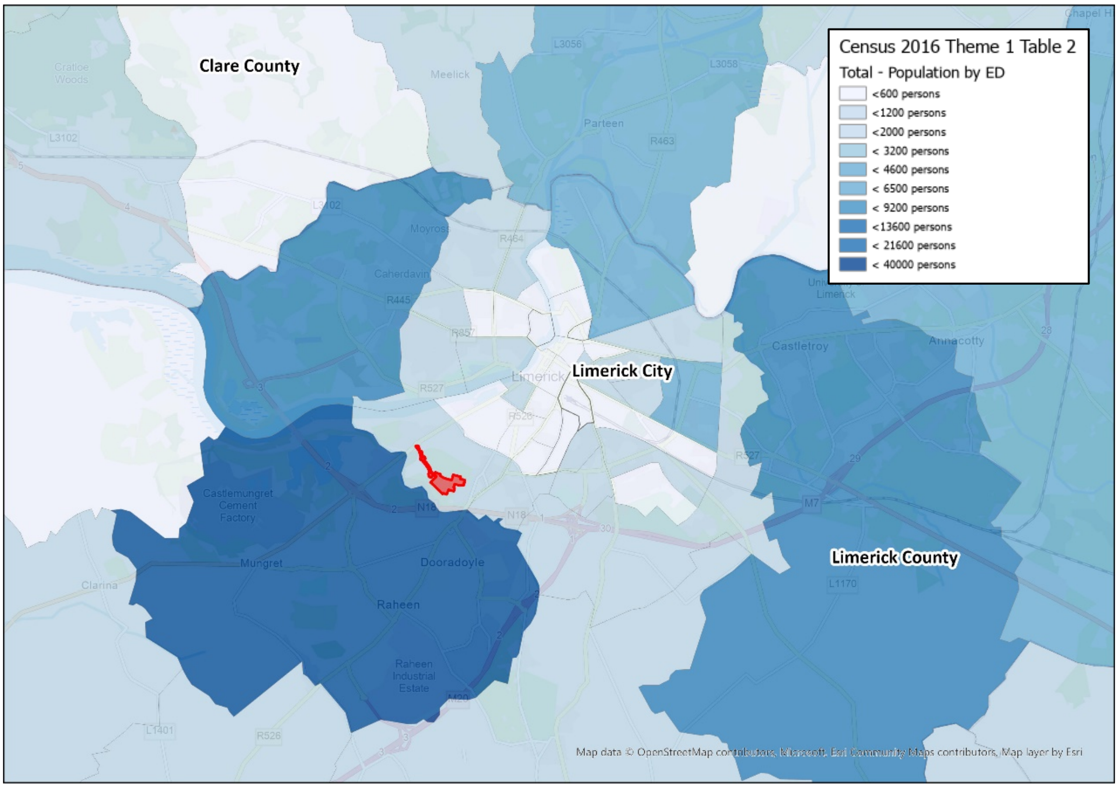


Figure 7.2: Population Density by Electoral Division (2016) Map showing population concentrations within Limerick City and County. Location of proposed development indicated by red polygon. (Source: CSO, 2016).

With respect to the population breakdown of the study area, the age profile of the local ED area is similar to that of the wider LA area, as shown in Table 6.3. However, the Adults (25-64 years) cohort forms a higher percentage of the local ED area (55%), compared to the rest of Limerick City and County (52%). As a result, the Older Adults (65+ years) cohort is proportionally lower at 11% of the local population, compared to 14% within the larger LA.

Table 7.3: Comparison of Age Profile of ED and LA Study Areas (Source: CSO 2016).				
Age Cohorts	**ED Study Area**		**Limerick City and County**	
Population	**Population**	**% Total**	**Population**	**% Total**
Preschool (0-4 years)	1,970	8%	13,135	7%
Primary (5-12 years)	2,716	11%	21,500	11%
Secondary (13-18 years)	1,688	7%	15,243	8%
Young Adults (19-24 years)	1,647	7%	15,550	8%
Adults (25-64 years)	13,420	55%	102,053	52%
Older Adults (65+ years)	2,744	11%	27,418	14%
Total	**24,185**	**100%**	**194,899**	**100%**

The average age of the local ED population was slightly higher at 38.7 than the local authority population (37.7) and national average (37.4) in 2016, ranging from 34.5 (Ballycummin) to 44.9 (Ballinacurra B) across the study area. The average dependency ratio within the local ED area (49.5) was also lower than elsewhere in the local authority or state (52.4-52.7), with an even lower ratio of 40.5 recorded for Ballinacurra A, which includes the proposed development site. We note that the ED area with the highest dependency ratio, Ballinacurra B (69.3) includes St. Paul's Nursing Home in Dooradoyle.

Table 7.4: Dependency Ratio of LA and State Study Areas (Source: CSO 2016).				
Enumeration Area	**Average Age**	**Population**	**Dependent Population**	**Dependency Ratio**
Limerick City and County	37.7	194,899	67,012	52.4
Ireland	37.4	4,761,865	1,644,119	52.7

Table 7.5: Dependency Ratio of Local ED Study Area (Source: CSO 2016).				
Local Electoral Divisions	**Average Age**	**Population**	**Dependent Population[3]**	**Dependency Ratio[4]**
Ballinacurra A	37.2	1,962	566	40.5
Ballinacurra B	44.9	1,371	561	69.3
Ballycummin	34.5	18,388	6,069	49.3
Dock C	42.2	976	321	49.0
Dock D	36.4	773	220	39.8
Prospect B	36.7	715	270	60.7
Cumulative ED Study Area	**38.7**	**24,185**	**8,007**	**49.5**

7.3.2 Land Use and Settlement Patterns

With respect to land use patterns within the country, the latest Economic and Social Research Institute’s (ESRI) *Quarterly Economic Commentary (Winter 2020)* notes that national construction activity, particularly housing, has been negatively impacted by the ongoing COVID-19 crisis and related restrictions on movement, as follows:

> ***“In Q3 2020 there were 5,118 new residential completions, a 9.4 per cent decline on the same period the previous year.*** *While any decline in housing completions is unwelcome given the ongoing issue of undersupply in the market, the scale of the decline is significantly less than that experienced in Q2 when the initial lockdown restrictions were in place…*
>
> ***While construction work can continue under these restrictions, the COVID-related health protocols are likely to have an adverse impact on housing supply as they likely reduce the level of efficiency on construction sites. Given the reduced level of activity throughout the year, we now forecast there will be just over 18,500 new completions in 2020.”***
>
> *[ESRI Economic Commentary (Winter 2020) -* ***Our emphasis****].*

[3] Population aged 0-14 years of age or 65+ years of age at time of 2016 Census.
[4] *Census of Population 2016 - Profile 3 An Age Profile of Ireland:* Dependents are defined for statistical purposes as people outside the normal working age of 15-64. Dependency ratios are used to give a useful indication of the age structure of a population with young (0-14) and old (65+) shown as a percentage of the population of working age (15-64).

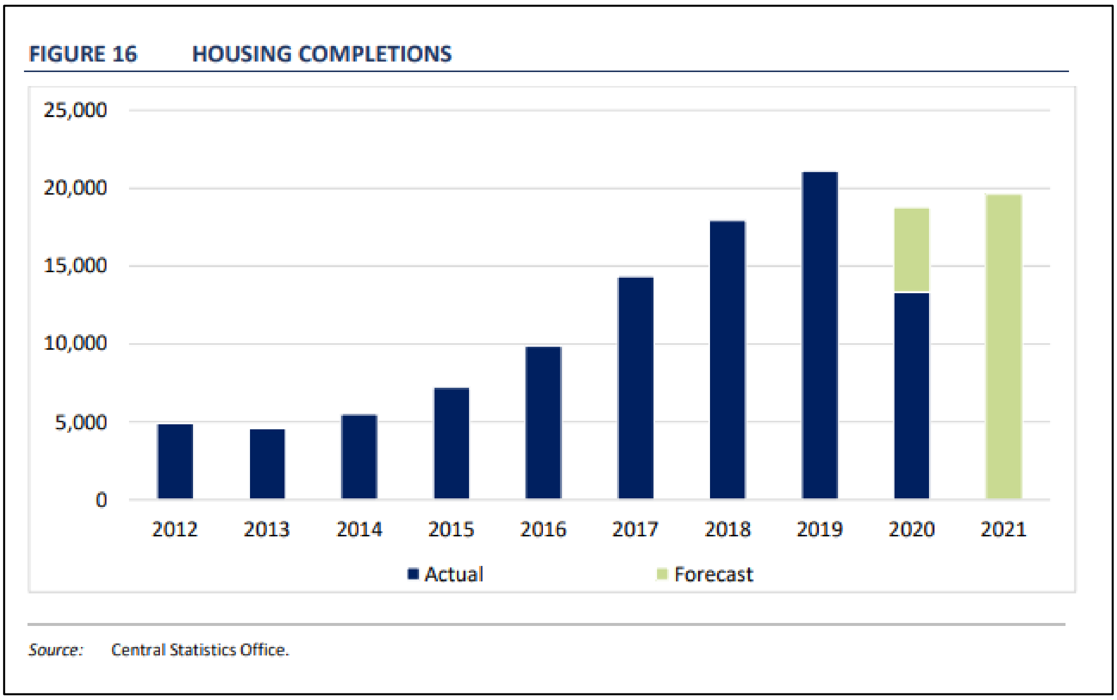


Figure 7.3: Housing Completions Forecast provided by ESRI Economic Commentary, Winter 2020. Source: ESRI.

At the local level, we note that the total permanent private housing stock recorded for the local ED study area was 9,759 No. units in 2016, of which some 1,029 No. units were located within the Ballinacurra A Electoral Division (incl. the subject development site). The vacancy rate for the study area was much lower (6.0%) than the national average of 12.3% in 2016, with only 119 No. housing units identified as vacant within Ballinacurra A (see Table 7.6).

Table 7.6: Change in Total Permanent Private Housing Stock (CSO 2011-2016)

Year	2011			2016		
Study Area	Total Stock[5]	Vacant Stock[6]	Vacancy Rate	Total Stock	Vacant Stock	Vacancy Rate
Ballinacurra A	1,015	-	-	1,029	119	11.6%
ED Study Area	9,721	-	-	9,759	590	6.0%
Limerick City and County	82,553	10,114	12.3%	82,741	8,856	10.7%
Ireland	1,994,845	289,451	14.5%	2,003,645	245,460	12.3%

The most recent Census figures for the area also indicate that housing completions in Limerick have generally increased from 2014, with a peak of 552 No. dwellings completed in the area in 2019 (see Table 7.7). The average number of dwelling completions within Limerick City and County was 348 No. units per annum from 2012-2020.

[5] The housing stock is defined as the total number of permanent residential dwellings that were available for occupancy at the time of census enumeration. In this report, the housing stock consists of permanent private households (inhabited by both usual residents and visitors), holiday homes, vacant houses or apartments along with dwellings where all the occupants were temporarily absent on Census Night. However, communal establishments, temporary private households (e.g., caravans and mobile homes), along with dwellings categorised by the enumerators as being derelict, commercial only, or under construction are excluded from this definition. Applies to both 2011 and 2016 figures.

[6] Includes vacant houses, apartments and holiday homes. Applies to both 2011 and 2016 figures.

Table 7.7: New Dwelling Completions by LA and Year (Source: CSO)										
Area	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
Limerick City and County	237	214	132	212	278	476	514	552	519	3,134

7.3.3 Economic and Employment Activity

The Economic and Social Research Institute's (ESRI) *Quarterly Economic Commentary (Winter 2020)* suggested that there will be significant recovery in the Irish economy in Q3 of 2021, as COVID-19 restrictions are eased and the vaccination program ramps up for the general population.

At the beginning of the COVID-19 crisis, it was unclear how the supply and demand sides of the economy would be impacted in comparison to the previous financial crisis of 2008. The unemployment rate was expected to settle around 20% at the end of 2020, an increase from the average of 5% at the start of the year; however, the GDP was expected to increase by 3.4 per cent as a result of strong export performance bolstered by medicinal and pharmaceutical products and ICT services. There is also potential for recovery of domestic sources of growth in 2021 due to increased consumption, which could result in an overall output growth of nearly 5% when combined with continued growth of the exports sector.

We note that a Brexit trade deal with the EU was reached in December 2020, with effect from January 1, which should somewhat mitigate the impacts of the break on the UK's closest trading partners in the long term. Ireland is set to receive supportive funds for the transition from the Brexit Adjustment Reserve Fund over the course of the year to further offset potential economic impacts.[7]

7.3.3.1 Employment Rates

With respect to national employment figures, the ESRI Commentary anticipates that the national unemployment rate as a percentage of the total labour force will rise to c. 20% by the end of 2020 from the previous average of c. 5% at the start of the year[8]. Current CSO data in relation to unemployment identified the seasonally adjusted unemployment rate for the country stood at 21% in November 2020, a substantial increase from the 5% recorded in the previous November 2020[9]. This is largely due to the unprecedented impact of the COVID-19 pandemic on the Irish labour market.

At the local level, unemployed persons comprised c. 7% of the working population (aged 15+ years) within the ED Study Area in 2016, which is on par with the national average for the same period. More recent unemployment figures are provided by the CSO Labour Force Survey[10], which was last released for Q3.2020 and adjusted to account for the impact of COVID-19 on the national economy. This survey identified a standard unemployment rate of

[7] https://www.irishtimes.com/news/politics/ireland-awarded-over-1bn-from-eu-fund-to-offset-brexit-impact-1.4456771
[8] *ESRI (Winter 2020) Quarterly Economic Commentary*
[9] CSO statistical release, January 2021: https://www.cso.ie/en/releasesandpublications/er/lr/liveregisterdecember2020/
[10] Source: https://www.cso.ie/en/releasesandpublications/er/lfs/labourforcesurveylfsquarter32020/

7.1% nationally in Q3.2020 for persons aged 15-74 years within the labour force, adjusted to 15.9% with respect to COVID-19 estimates.

Table 7.8: Socio-Economic Status of Population Aged 15+ (Source: CSO 2016).				
Economic Status	**ED Study Area**	**% Total**	**Ireland**	**% Total**
At work	10,519	**56%**	2,006,641	**53%**
Looking for first regular job	153	**<1%**	31,434	**<1%**
Unemployed	1,287	**7%**	265,962	**7%**
Student	2,256	**12%**	427,128	**11%**
Looking after home/family	1,311	**7%**	305,556	**8%**
Retired	2,479	**13%**	545,407	**15%**
Unable to Work	809	**4%**	158,348	**4%**
Other	108	**<1%**	14,837	**<1%**
Total	**18,922**	**100**	**3,755,313**	**100%**

The CSO Live Register is a monthly measurement of the numbers of people (with some exceptions) registering for Jobseekers Benefit (JB) or Jobseekers Allowance (JA) or for various other statutory entitlements at local offices of the Department of Employment Affairs and Social Protection (DEASP). This data source, whilst not an unemployment register, can provide a general indication of recent employment trends and economic activity in the local area.

Live Register figures are available at a national, county or local level, with respect to the jurisdiction of DEASP welfare offices. We note that the number of people on the register decreased at all levels in the recent 3-month period, but more much more significantly within Limerick City (24% decrease) and Limerick County (22% decrease) than the rest of the country (4-7% decrease).

Table 7.9: Persons on Live Register by Month and Area, 2020-2021 (Source: CSO[11]).						
Area Definition	**2020.11**	**2020.12**	**2021.01**	**2021.02**	**1-mo. trend**	**3-mo. trend**
DEASP - Limerick City	7,398	5,788	7,275	5,651	-23%	-24%
DEASP – Limerick Co.	7,243	5,659	7,242	5,661	-22%	-22%
Ireland – Unadjusted	194,058	189,860	188,543	186,702	-1%	-4%
Ireland – Seas. Adjusted	203,700	195,200	191,300	188,500	-1%	-7%

7.3.3.2 Deprivation Index

Regarding the socio-economic status of local residents, the Pobal Deprivation Index utilises CSO statistics to analyse areas with high levels of affluence or disadvantage throughout the country. The Ballinacurra A Electoral District (including the subject site) was identified as an 'affluent' area in 2011 at 20.00 and a 'marginally above average' area in 2016 at 8.98 by Pobal, values which represent much higher levels of affluence than the surrounding Local

[11] Live Register, Selected from CSO PxStat Table LRM02 and LRM07.

Development Company (LDC) area and county for the same period. We note that the deprivation index declined in the ED area of Ballinacurra A from 2011-2016, resulting in a downgraded rating from 'affluent' to 'marginally above average'; however, both the LDC and County index retained their status as 'marginally below average'.

Table 7.10: Deprivation Indices (Source: Pobal 2021, based on CSO 2011, 2016)		
Area Definition	**2011**	**2016**
Ballinacurra A	20.00 - affluent	8.98 - marginally above avg
LDC - People Action Against Unemployment Ltd	-6.66 - marginally below avg	-6.31 - marginally below avg
Limerick City and County	-1.32 - marginally below avg	-1.31 - marginally below avg

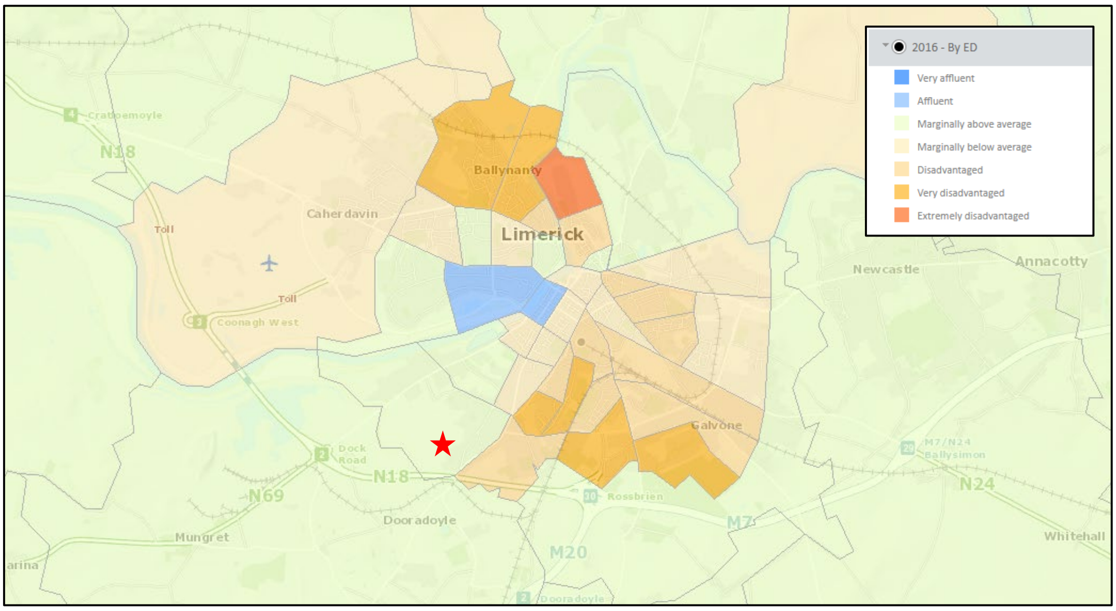


Figure 7.4: Extract of 'Deprivation Indices' Map showing 2016 deprivation index rates by Electoral District. Location of proposed development indicated by red star. (Source: Pobal 2021/CSO 2016).

7.3.3.3 Commuter Patterns

A total of 6,185 No. commuters were recorded as resident within the ED Study Area in 2016, in contrast to the 11,934 No. commuters which enter the area for work, school or college each day. This net inflow points to the nature of the area as an employment hub in its own right, home to University Hospital Limerick, Crescent Shopping Centre and the Docklands Business Park within c. 1.5km of the subject site, with ties to the larger employment centres elsewhere in Limerick City. We note that a total of 2,697 No. workers were identified as living and working within the same ED, for a total daytime workforce of 14,631 No. workers within the area.

Table 7.11: Commuting Patterns of Local Residents, 2016. (Source: CSO 2016).			
Local Electoral Divisions	**Commuters Out**	**Commuters In**	**Net Flow into ED**
Ballinacurra A	762	732	-30
Ballinacurra B	304	139	-165
Ballycummin	4,571	9,235	+4664
Dock C	270	599	+329
Dock D	180	1,034	+854
Prospect B	98	195	+97
Cumulative ED Study Area	6,185	11,934	+5,749

Within the ED Study Area, the majority of residents travel to work by private car (67%) as a driver or passenger, followed by pedestrians (15%) and bus/coach passengers (8%). Figures for the rest of Limerick City and County indicated a similar profile of private car users (64%), followed by pedestrians (14%) and bus/coach passengers (7%) respectively. We note that a slightly higher proportion of commuters within the county use van services (4%) than within the local ED area (2%), while the remaining modes each account for less than 3% of the total mode share in each area.

Table 7.12: Means of Travel for Population Aged 5+ Years (Source: CSO 2016).				
Transport Mode	**ED Study Area**		**Limerick City and County**	
	No. Persons	**% Mode share**	**No. Persons**	**% Mode share**
On foot	2,349	**15%**	17,537	**14%**
Bicycle	308	**2%**	1,888	**2%**
Bus, minibus or coach	1,338	**8%**	8,611	**7%**
Train, DART or LUAS	34	**<1%**	221	**<1%**
Motorcycle or scooter	40	**<1%**	234	**<1%**
Car driver/passenger	10,613	**67%**	78,358	**64%**
Van	387	**2%**	5,053	**4%**
Other (incl. lorry)	23	**<1%**	524	**<1%**
Work mainly at or from home	251	**2%**	3,912	**3%**
Not stated	575	**4%**	5,826	**5%**
Total	15,918	**100%**	122,164	**100%**

7.3.4 Social Infrastructure and Amenity

A social infrastructure audit was undertaken for the proposed development site within a c. 1.5 km radius, which identified more than 250 No. relevant social infrastructure facilities in the vicinity of the subject proposal for further assessment, comprised of education and training facilities, childcare services, community and cultural facilities, religious and burial sites, healthcare services, open space and recreation facilities and retail centres, as summarised in Figure 7.7 overleaf.

There is sufficient provision of existing social infrastructure in the vicinity of the subject site to support the proposed project. The site is served by an existing schools' network of 7 No. primary schools and 7 No. post-primary schools, as well as 18 No. existing childcare facilities within c. 1.5km of the proposed development, which held an estimated 27% capacity for new enrolments at the time of the survey (see Figure 7.6).

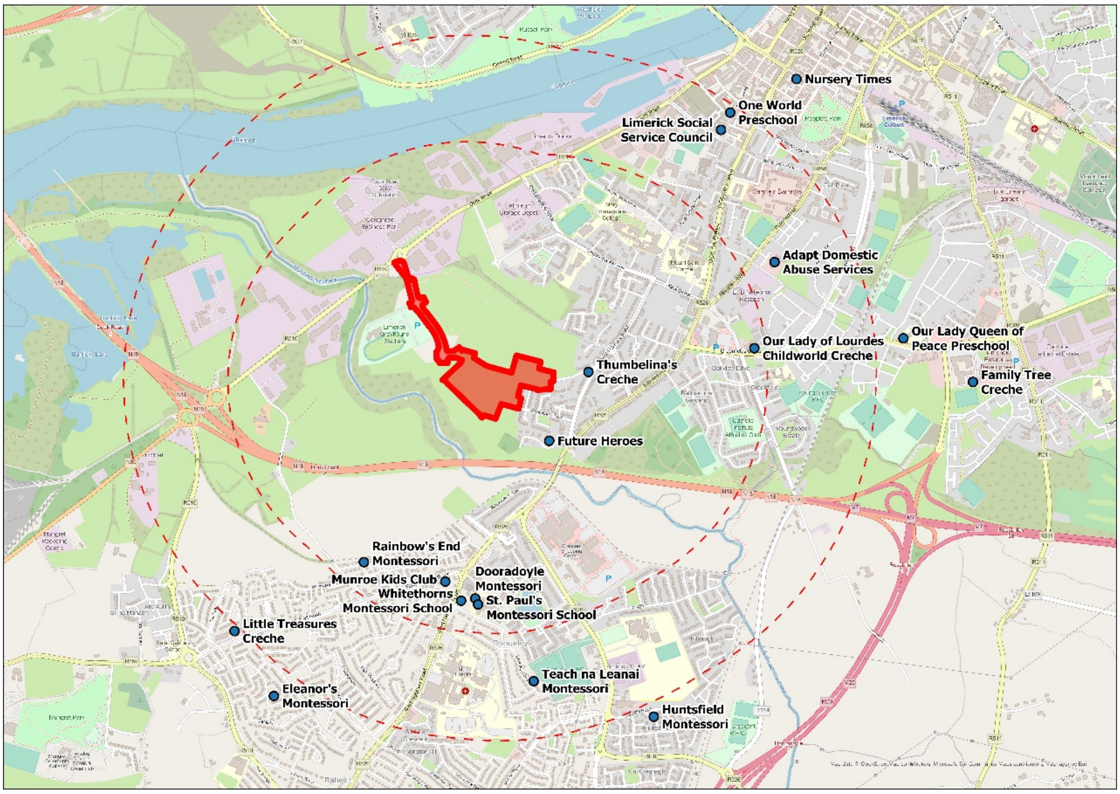


Figure 7.5: Location of existing childcare facilities (shown in blue) within study area. Indicative 1km and 1.5km radius from subject site provided in red dash. Source: TUSLA/TPA, 2021.

There is an adequate supply of community and cultural facilities, religious institutions, health care services (incl. University Hospital Limerick) within a reasonable distance of the subject lands, as well as a range of sports and recreational facilities (incl. children's play areas) to serve the growing population. The site's proximity to Limerick City Centre to the north and Crescent Shopping Centre to the south also ensures an appropriate quantum of retail services for future residents.

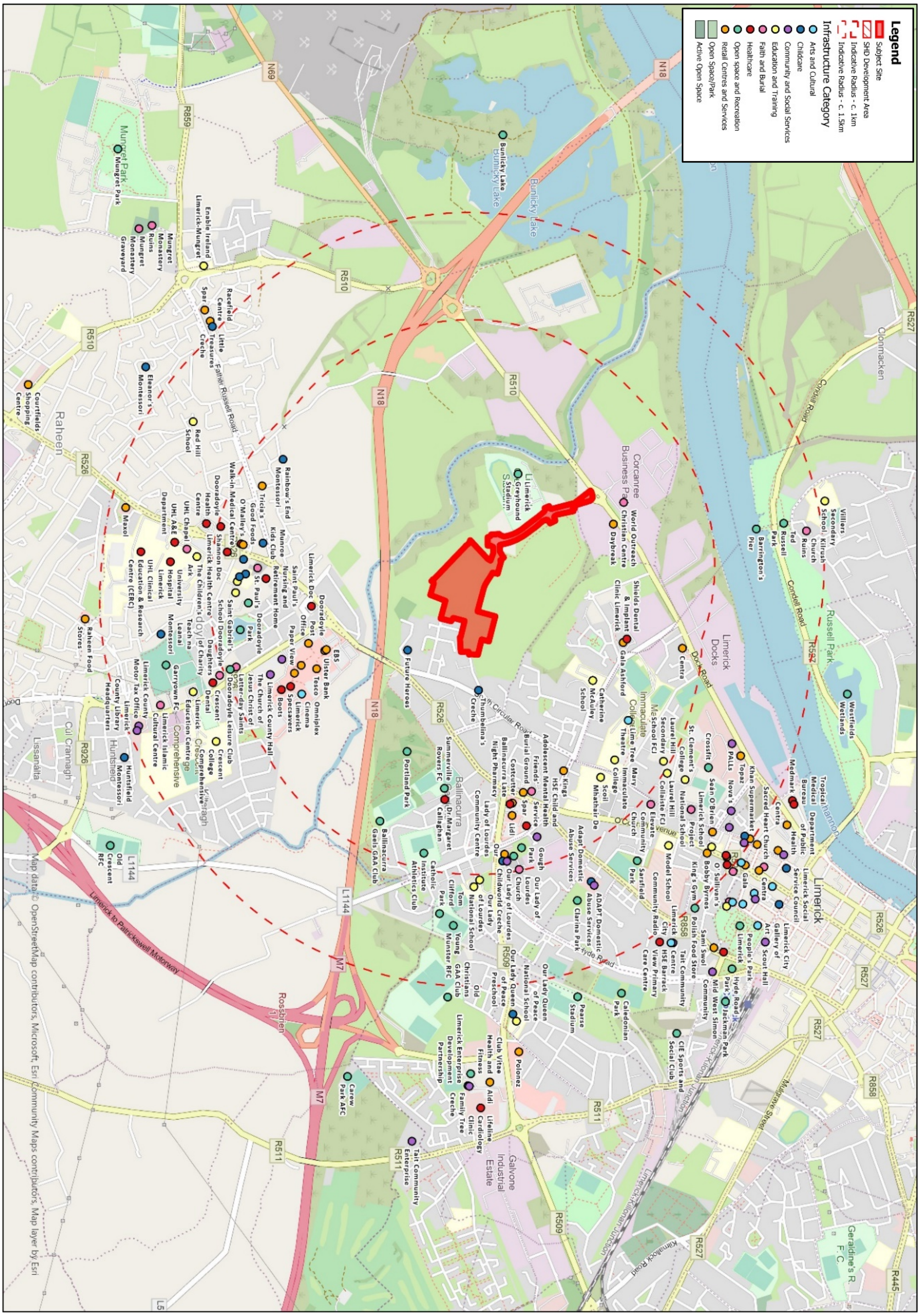


Figure 7.6: Indicative location of 250+ No. social infrastructure facilities identified in the vicinity of subject site. Indicative 1km and 1.5km radius from subject site provided in red dash. Source: TPA, 2021.

On the basis of this audit, potential gaps in the existing social infrastructure serving the catchment area are limited to a broader range of cultural facilities (such as museums, music venues and art galleries) and specialty recreation amenities such as food-growing allotments and community gardens. Additional playground facilities may also be desirable for the growing primary school population within the area. We note that the proposed scheme includes a number of supporting residential open spaces and pedestrian links, as well as a 550 sq. m childcare facility, which will positively contribute to the amenity of the area once completed.

7.3.5 Human Health

Human health is defined by the World Health Organisation as:

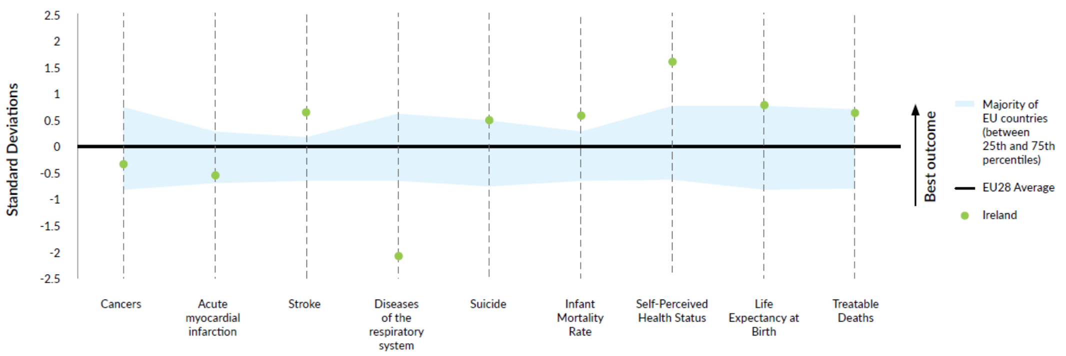
> *"A state of complete physical mental and social well-being and not merely the absence of disease of infirmary."*

The Department of Health's latest policy report *Health in Ireland: Key Trends 2019* provides statistical analysis on health in Ireland over the last 10 years and deals specifically with issues such as life expectancy, mortality and other health indicators within the country. An update of this information for 2020 is not yet available, likely due to the impacts of COVID-19 on national healthcare administration to date.

Some of the key factors which contribute to population health are identified in Figure 7.8 below, which shows the position of Ireland relative to the EU28 average with respect to each issue. We note that the country was performing at pace or better than the rest of the EU28 in the majority of these factors (incl. stroke, suicide and treatable death rates), but held a significantly higher 'Self-Perceived Health Status' than elsewhere in the European cohort. These issues are discussed further in Sections 7.3.5.1-7.3.5.3 to follow.

Further to this, human health has the potential to be impacted upon through environmental factors such as soil, water and air and their association with potential contamination, particularly during the construction phase. Nuisances also have the potential to arise from construction related noise and disturbance and incompatible adjacent lands uses. A key consideration in respect of human health also arises from the extent to which new development is supported by the required level of infrastructure and the maintenance of air, water and soil quality.

Figure 2.1
Summary of Population Health, Ireland and EU28 Average, 2016



Source: Eurostat

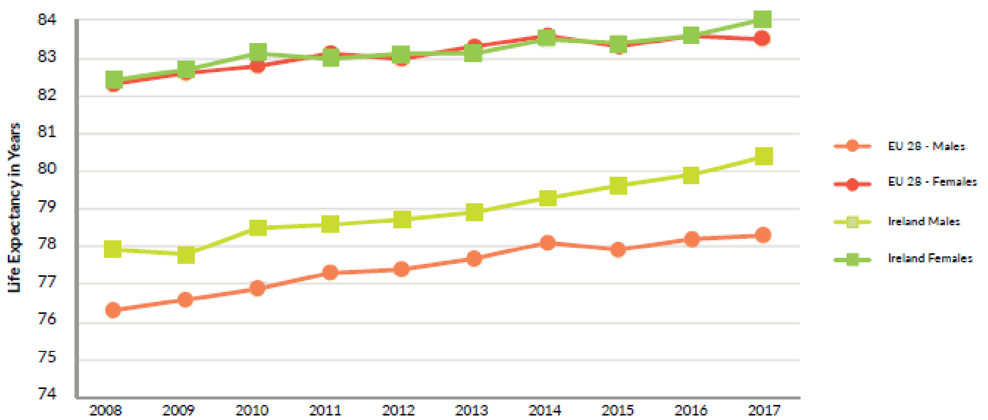
Notes:
(i) Standard deviation is a measure of how much a value varies from the mean average.
(ii) Values have been adjusted so that the upper half of the graph is more desirable. For example, Ireland's stroke mortality rate is lower than the EU average, but as this is the more desirable outcome Ireland is positioned higher up on the graph.
(iii) For details on the measurement of these indicators, see the following graphs: Table 2.4 and Figure 2.9.

Figure 7.7: Extract from *Health in Ireland: Key Trends 2019,* Figure 2.1 showing Summary of Population Health, Ireland and EU28 Average, 2016. Source: Department of Health, 2019.

7.3.5.1 Life Expectancy

The average life expectancy is continuing to increase in Ireland, with estimates of 84 years for women and 80.4 years for men as of 2017. Both of these figures are higher than the average estimates for their EU counterparts, as shown in Figure 7.9 and 7.10. Male life expectancy has increased by 3 years and female life expectancy by almost 2 years since 2007, while the gap between the life expectancy of men and women continues to narrow. The greatest gains in life expectancy have been achieved in the older age groups, due to decreasing mortality rates from major diseases.

Figure 1.6
Life Expectancy at Birth by Gender, Ireland and EU-28, 2008 to 2017



Source: Eurostat.

Notes:
(i) Data for 2016 and 2017 are provisional.
(ii) There is a break in data for EU-28 for 2010-2012.

Figure 7.8: Extract from *Health in Ireland: Key Trends 2019,* Figure 1.6 showing Life Expectancy at Birth by Gender. Source: Department of Health, 2019.

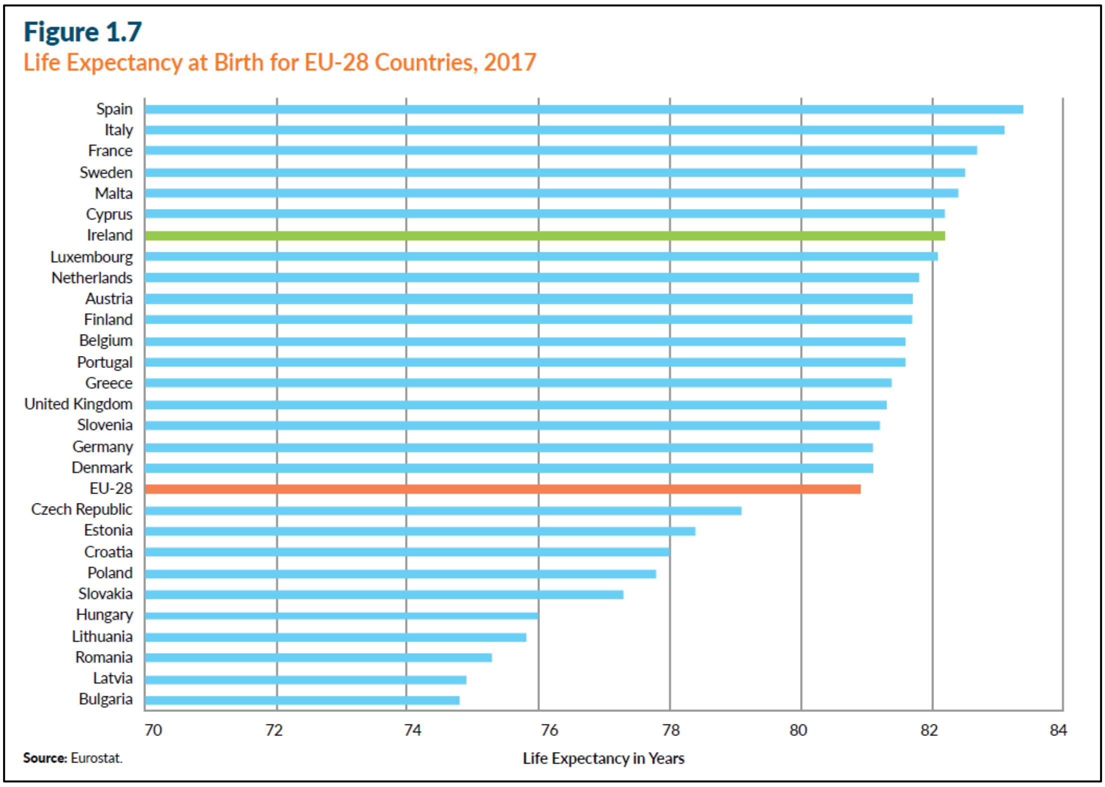


Figure 7.9: Extract from *Health in Ireland: Key Trends 2019,* Figure 1.7 showing Life Expectancy at Birth for EU28 Countries, 2017. Source: Department of Health, 2019.

7.3.5.2 Mortality

National health figures show that there has been in improvement in overall mortality rates and a rise in life expectancy in the country over the last ten years; however, these figures may be impacted in the medium-term by the COVID-19 pandemic and its effect on the healthcare system. The Health in Ireland report also states:

> *"Mortality rates have declined 10.5% since 2009. Age-standardised death rates for major causes of death such as cancers and circulatory system diseases have declined by 10% and 25% respectively over the past ten years."*
>
> *[Dept. of Health, Health in Ireland: Key Trends 2019]*

With respect to the particular causes of death within the population, the report identifies strong decreases in the mortality rates for suicide (-37.8%), pneumonia (-36.8%) and stroke (-35.7%), as shown in Figure 7.11 below. Infant mortality rates within the country have also declined by 5.2% since 2009 and remain lower than the EU average for the same period.

Table 2.4

Principal causes of death and infant mortality rate: numbers and age-standardised death rates per 100,000 population, 2009-2018

						% change	
		2009	2013	2017	2018(p)	2009-2018	2017-2018
All Causes	Number	28,380	29,504	30,418	31,116	9.6	2.3
	Rate	1092.4	1043.9	955.5	977.9	-10.5	2.3
Diseases of the circulatory system							
All Circulatory System Diseases:	Number	9,507	9,473	8,889	8,938	-6.0	0.6
	Rate	391.6	354.8	291.4	293.1	-25.1	0.6
Ischaemic Heart Disease:	Number	5,016	4,642	4,160	4,140	-17.5	-0.5
	Rate	204.0	171.6	133.8	133.3	-34.7	-0.4
Stroke:	Number	2,054	1,959	1,706	1,680	-18.2	-1.5
	Rate	86.5	75.0	56.6	55.6	-35.7	-1.6
Cancer							
All Malignant Neoplasms:	Number	8,336	8,725	9,141	9,198	10.3	0.6
	Rate	302.7	288.8	270.4	272.6	-10.0	0.8
Cancer of the Trachea, Bronchus and Lung:	Number	1,728	1,831	1,911	1,812	4.9	-5.2
	Rate	62.3	60.1	56.2	53.2	-14.7	-5.4
Cancer of the Female Breast:	Number	662	704	724	773	16.8	6.8
	Rate	41.6	40.6	37.8	40.4	-2.9	7.1
Diseases of the Respiratory system*							
All Respiratory System Diseases:	Number	3,606	3,504	4,059	4,165	15.5	2.6
	Rate	154.4	135.6	135.7	138.1	-10.5	1.8
Chronic Lower Respiratory Disease	Number	1,516	1,657	1,611	1,743	15.0	8.2
	Rate	62.0	61.6	52.2	56.1	-9.5	7.6
Pneumonia	Number	1,320	983	1,088	1,084	-17.9	-0.4
	Rate	59.8	40.5	38.4	37.8	-36.8	-1.5
External causes of injury and poisoning							
All Deaths from External Causes:	Number	1,726	1,491	1,299	1,341	-22.3	3.2
	Rate	44.4	38.1	32.5	33.9	-23.6	4.3
Transport Accidents:	Number	225	167	127	106	-52.9	-16.5
	Rate	4.9	3.9	3.0	2.5	-49.7	-18.8
Suicide:	Number	552	487	383	352	-36.2	-8.1
	Rate	12.2	11.1	8.3	7.6	-37.8	-8.5
Infant deaths							
Infant Mortality Rate (per 1,000 live births)	Number	247	245	174	187	-24.3	7.5
	Rate	3.3	3.6	3.0	3.1	-5.2	3.3

Source: Central Statistics Office, Public Health Information System (PHIS) - Department of Health.

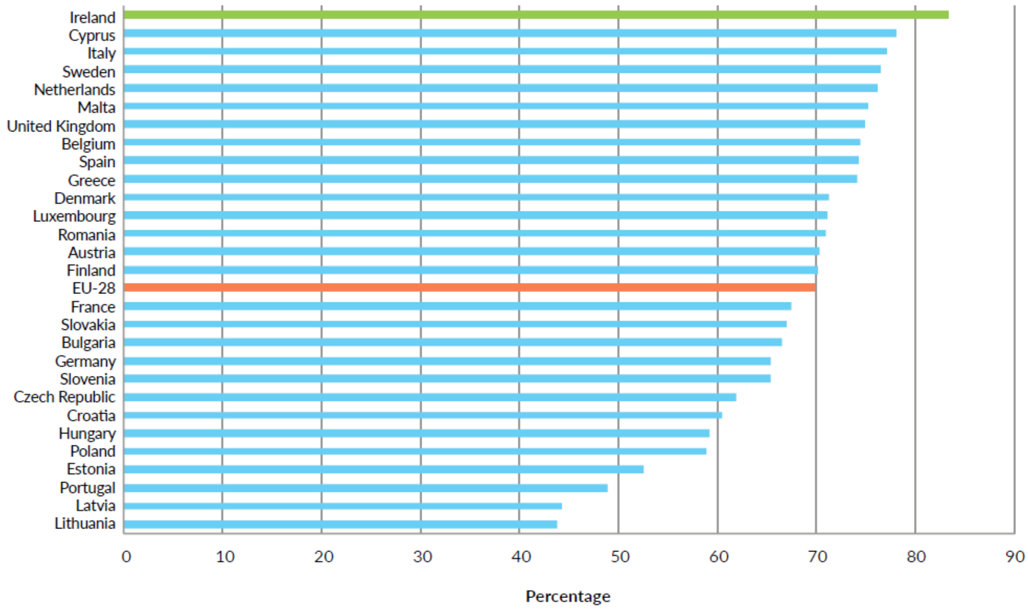
Notes:
(i) (p) The figures for 2018 are provisional. They should be treated with caution as they refer to deaths registered in these years and may be incomplete.
(ii) The rates provided in the table are age-standardised to the European standard population and are presented as rates per 100,000 population except for infant mortality rates which are expressed as deaths per 1,000 live births.
(iii) *Excludes cancer of the trachea, bronchus and lung.

Figure 7.10: Extract from *Health in Ireland: Key Trends 2019,* Table 2.4 showing Principal Causes of Death and Infant Mortality Rate: Numbers and Age Standardised Death Rates Per 100,000 Population 2009 to 2019. Source: Department of Health, 2019.

7.3.5.3 Perceived Health Status

At the national level, the Health in Ireland report identified that 44.5% of the male population and 44.8% of the female population in Ireland held a self-perceived health status of ‘Very Good’ in 2017, compared to only 24.8% for the male population and 21.2% of the female population within the greater EU28 population. Ireland also topped the list of EU28 countries in this area in 2017 as shown in Figure 7.12, with 82.9% of the population rating their health as good or very good. However, health status varies in respect of income inequality, with fewer low-income earners reporting good health both in Ireland and across the EU.

Figure 2.3
Percentage of the Population Reporting Good or Very Good Health in EU-28 countries, 2017



Source: EU-SILC, Eurostat.

Figure 7.11: Extract from *Health in Ireland: Key Trends 2019,* Figure 2.3 showing Percentage of the Population Reporting Good or Very Good Health in EU-28 Countries, 2017. Source: Department of Health, 2019.

At the local level, c. 86% of people living in Limerick City and County reported their health to be "Good" or "Very Good" in 2016, accounting for 167,799 people within the area. This places Limerick within the top tier of healthiest counties in Ireland, according to self-reported figures. These figures are mirrored within the ED Study Area, which reported c. 88% of the population as having 'Good' or 'Very Good' health in 2016.

Table 7.12: Population by general health status – self reported (Source: CSO, 2016).

General Health	ED Study Area		Limerick City and County	
	No. Persons	% Total	No. Persons	% Total
Very good	14,407	**60%**	110,934	**57%**
Good	6,746	**28%**	56,865	**29%**
Fair	1,904	**8%**	17,003	**9%**
Bad	362	**2%**	2,998	**2%**
Very bad	94	**<1%**	644	**<1%**
Not stated	672	**3%**	6,455	**3%**
Total	24,185	**100%**	194,899	**100%**

7.3.6 Health and Safety

The site is in close proximity to a number of existing residential, commercial and amenity related land uses. The Construction Environmental Management Plan that accompanies the planning application has regard to the health and safety of the on-site workers and proposes measures to manage and mitigate potential health and safety risk to the public during the construction phase.

7.4 Potential Effects of the Proposed Project

7.4.1 Social Patterns (Population)

7.4.1.1 Construction Phase

During the construction phase of the proposed project, it is unlikely that there will be any significant impact upon social patterns in the surrounding area. The construction phase will result in a number of workers at the site, however, it is not envisaged that their place of residence will change as a result of the development. For example, it is envisaged that construction workers would travel from their existing place of residence rather than moving, temporarily, to the area surrounding the site.

As a result, the impact on the local population during the construction phase is considered to be *neutral, not significant* and *temporary* in nature and therefore, no *significant* impacts are expected to arise in this regard.

Giving consideration to local residents, it is predicted that there may be some impacts which are likely to be associated with construction traffic, nuisance and disturbance. Such impacts are dealt with separately and assessed elsewhere in the EIAR and are considered to be *short-term negative* impacts.

The level of impact predicted above is considered to align with the normal disturbance associated with the construction industry where a site is efficiently, sensitively and properly managed in the context of surrounding existing neighbouring development. The *Construction Environmental Management Plan* (CEMP) employs mitigation to address and minimise any potential impacts to nearby residents.

7.4.1.2 Operational Phase

The proposed development will consist of 371 no. residential units and a childcare facility of 550 sq m. Based on the number of bedspaces proposed, the project has the potential to yield approximately 2,186 no. persons. This will result in a sizeable population addition to the local area but provide much needed homes in the Limerick City area. This will help contribute to the significant demand for housing within Limerick as outlined within national, regional and local planning policy which is not being met at present.

Further to this, the introduction of additional residents to the local area will improve the vibrancy and support existing community and social infrastructure. The proposed childcare facility, designed at a sufficient size to support the child yield arising from the development, will mitigate any pressure upon existing childcare facilities.

In light of the above, it is considered that the proposed project will have a *positive, significant* and *permanent* impact on the local population.

7.4.2 Land Use and Settlement Patterns

7.4.2.1 Construction Phase

In terms of land use, the proposed project accords with the statutory land use zoning policies of the *Limerick City Development Plan 2010-2016* (as amended) and the national and regional planning policies pertaining to the delivery of housing, the efficient use of currently underutilised land and compact growth.

The construction phase will comprise earthworks and construction works and will not result in any severance of land, loss of rights of way or amenities. However, given the nature of construction, this phase has the potential to result in *short-term negative* impact due to the *temporary* degradation of the visual environment. This is further discussed in Chapter 13 (Landscape and Visual) of this EIAR.

7.4.2.2 Operational Phase

The site is currently a disused racecourse which is subject to a residential land use zoning objective in the *Limerick City Development Plan 2010-2016*. The proposed project will introduce 371 no. residential units to the site. Which, in addition to bringing a currently underutilised site back into active use, will provide a notable contribution to the delivery of much needed housing in the local area and wider Limerick City area.

The proposed project also constitutes a continuation of existing adjacent residential development and associated social infrastructure.

On this basis, it is considered that the proposed project will have no significant adverse impact upon land use or settlement patterns.

7.4.3 Economic and Employment Activity

7.4.3.1 Construction Phase

The construction arising from the proposed project is considered to give rise in a positive impact in terms of economic activity within the area. This is likely to include the construction sector and building services industries. The positive impact is expected to last for the duration of the construction phase.

In terms of extent of employment, it is predicted that there will initially be 15-30 no. staff on site on a typical day, however during peak construction periods this is expected to fluctuate up to 70-100 no. staff and contractors on site per day. It is anticipated that the key project managers and main contractor representatives will maintain a presence on site for the whole duration of the project and the labour workforce will be determined by the specialist contractors required on site.

In terms of indirect impacts, ancillary local support services such as professional and technical services, retail services, the extraction sector, building support services.

As a result, the proposed project will have a positive, temporary impact upon employment and the economy.

7.4.3.2 Operational Phase

The operational phase of the development will result in 371 no. residential units and a 550 sq m childcare facility. Based on the maximum number of bedspaces per unit, the development will yield up to 2,186 no. persons. It is likely that the increase in persons residing in the local area will increase local spending and support a wide range of local businesses, services, transport infrastructure and employment opportunities.

The proposed childcare facility will also generate a small number of employment opportunities.

The impact is therefore considered to be positive and have a medium to long term duration.

7.4.4 Social Infrastructure and Amenity

7.4.4.1 Construction Phase

During the construction phase, there will be no social infrastructure or amenity provision at the site. The impact is therefore considered to be neutral in that regard.

Due to the presence of construction workers, the use of existing surrounding services and amenities may increase, however it is not considered likely that this would generate a significant adverse impact.

7.4.4.2 Operational Phase

The proposed project is located on residentially zoned lands, close to existing residential development and in close proximity to a multitude of social infrastructure.

The Social Infrastructure Audit demonstrates that there is a good range of existing social infrastructure in the surrounding area to serve the proposed project. The development will create an increased demand for such services but due to the range of services available, it is not envisaged that the development would result in a significant adverse impact in this regard.

The play areas and public open space included within the development will provide a slight long term positive addition to the local area from a recreational amenity perspective.

7.4.5 Human Health

7.4.5.1 Construction Phase

The EPA Draft Guidelines (2017) sets out how human health should be considered through assessment environmental pathways through which health could be affected.

The relevant pathways in relation to human health during the construction phase are considered to be air quality, noise and vibration, water and soil.

The expected air quality effects are detailed in Chapter 11 along with proposed mitigation measures to ensure the protection of human health.
Similarly, the potential noise and vibration related impacts arising from the construction phase and associated mitigation measures are contained in Chapter 12.

As with all construction projects, there will be inherent health and safety risks at this stage of the development. In order to manage this, a *Planning Stage Construction Environmental Management Plan* has been prepared for the project to ensure that the relevant health and safety legislation is complied with.

7.4.5.2 Operational Phase

Given the nature of the proposed project, it is not likely that any significant impacts on health and safety will arise during the operational phase.

The development has been designed to provide a safe environment for future occupiers and visitors. The public realm, inclusive of pathways, roads and communal open spaces, have been designed in accordance with the best practice and relevant planning policy standards. Similarly, the proposed residential units are all designed in accordance with the relevant guidelines and standards and are capable of meeting all relevant building standards and regulations. Having regard to the above, it is considered that the proposed project will result in a high standard of health and safety for all residents and visitors.

Once operational, the proposed project will not result in any significant impact on human health and safety.

7.5 Mitigation Measures

7.5.1 Construction Phase

The potential impacts upon human environment relate to other environmental aspects such as air quality, noise and vibration and traffic. Where required, the related mitigation measures are dealt with in the corresponding chapters of this EIAR. Other than this, no significant adverse effects will arise in respect of the population during the construction or operational phase of this development.

Otherwise, all of the proposed mitigation measures contained within the *Planning Stage Construction Environmental Management Plan* will be implemented in respect to potential impacts arising from the construction phase.

7.5.2 Operational Phase

The operational phase is likely to have positive impacts on human beings as a result of the provision of additional residential units, amenity spaces and a childcare facility. The development will contribute to the delivery of additional housing and related facilities for the growing population, in line with national, regional and local planning policy objectives, including the residential zoning objective for the site.

There have been no significant risks to the population and human health identified in respect of the operational phase of the proposed project. The proposed project is considered to have a positive and significant impact and as a result, no further mitigation measures are proposed.

7.6 Residual Effects

Adherence to the mitigation measures referred to above will ensure that the proposed project will not give rise to significant adverse effects upon population and human health during the construction and operational phases of the proposed project.

As noted above, the proposed provision of residential accommodation will likely result in significant positive effects for the local area,

7.7 Monitoring

In the context of the impact upon Population and Human Health, it is considered that the monitoring measures set out in relation to the other environmental topics assessed within this EIAR are sufficient to address monitoring requirements.

As outlined in the *Planning Stage Construction Environmental Management Plan,* site specific health and safety requirements will be implemented.

7.8 Reinstatement

There are no reinstatement plans proposed in respect of Population and Human Health.

7.9 Interactions

There are a number of inter-related environmental topics assessed as part of the EIAR which are of relevance to human health. These have been addressed in greater detail in the relevant Chapters. The key interactions are considered to be:

- Land, Soils, Geology and Hydrogeology (potential health effects arising mainly through the potential for soil and ground contamination);
- Air Quality and Climate (potential effects arising from dust soiling and possible exposure to air quality pollutants);
- Noise and Vibration (potential effects on human health arising from noise/ vibration emissions form the construction phase);

Landscape and Visual (potential effects arising from visual effects upon surrounding existing dwellings);

- Daylight and Sunlight (potential effects arising from changes to the sunlight environment in the immediate surrounding area); and

- Waste (potential effects arising from the generation of waste at construction and operational phase).

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated on Population and Human Health in respect of the above identified interactions. Refer to the relevant Chapters for full details of mitigation measures.

7.10 Cumulative Effects

The proposed project, when considered in combination with the nursing home development currently under assessment by LCCC (Reg. Ref. 21/1222) and the permitted residential development at Greenpark Avenue (LCCC Reg. Ref. 17/1190; ABP Ref. 302015-18), is not expected to give rise to significant adverse effects upon population and human health. Any cumulative impacts arising in respect of inter-related environmental topics are outlined in the relevant chapters.

7.11 'Do-Nothing' Effect

Given the scale and residential zoning of the lands, the do-nothing approach is not considered to be a valid approach. The lands are capable of accommodating a significant residential development together with the associated infrastructure.

In the event that the proposed project does not proceed, it is likely that the site will remain as a disused racecourse until an alternative redevelopment proposal is granted planning permission.

7.12 Difficulties in Compiling the Chapter

No difficulties were encountered in compiling this chapter of this EIAR.

8.0 Biodiversity

8.1 Introduction

Ecology Ireland Wildlife Consultants Ltd. Were commissioned by Tom Phillips + Associates on behalf of Voyage Property Limited., to undertake an appraisal of the potential ecological impacts of a proposed project. The proposed project consists of a total application site area of c.10.5 ha (with a substantive residential site development area of c.7.9 ha), on lands at the former Greenpark Racecourse, located off Dock Road (N69) and Greenpark Ave., Limerick. The site is principally bounded by existing undeveloped lands to the north, south and west and the adjoining Log na gCapall Housing Estate to the east. Vehicular access to the site will be from Dock Road, via the proposed access road.

8.2 Methodology

This ecological assessment has been prepared for the proposed development following a thorough desktop review of available ecological information and a series of field surveys carried out in 2020 and 2021. A team of specialist ecologists have carried out intensive surveys at the former Limerick Race Course site from June 2020 to March 2021. Extensive surveys were carried out on the proposed SHD site as well as the adjoining lands ("the study area") to record the fauna, flora and habitats that are present in the receiving environment (Figure 8.1). The team was led by Dr. Gavin Fennessy (BSc PhD MCIEEM; Birds & Mammals) and other key contributors were Dr. Ross Macklin (Aquatic Ecology), Claire Deasy (BSc MRes Habitats & Botanical), Tom O'Donnell (Bats, General Ecology), Marie Kearns (Botanical, General Ecology) Barry O'Mahony (Birds and Thermal Imagery) and Athena Michaelides (General Ecology). The methodology employed in the carrying out of this ecological assessment is outlined below.

8.2.1 Desktop Review

The desk study undertaken for this assessment included a thorough review of available ecological data including the following:

- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA (Envision), Water Framework Directive (WFD), Geological Survey of Ireland (GSI) & Inland Fisheries Ireland (IFI).
- Review of the Bat Conservation Ireland (BCI) Private Database.
- Review of the publicly available National Biodiversity Data Centre (NBDC) webmapper.
- Data on potential occurrence of protected bryophytes – as per NPWS online map viewer; Flora Protection Order Map Viewer – Bryophytes .
- Inland Fisheries Ireland (IFI) Reports.
- Records from the National Parks and Wildlife Services ('NPWS') WS web-mapper and review of specially requested records from the NPWS Rare and Protected Species Database for the hectad in which the Proposed Development is located.
- Review of NPWS Article 17 Metadata and GIS Database Files

Further details of the desktop review and baseline field assessments are described in the relevant sections below.

Figure 8.1: Site location map, showing the application site and the lands under the ownership of the applicant.

8.2.2 Field Studies

The following ecological surveys were completed over the period spanning June 2020-March 2021:

- Habitat and Botanical Survey (June, July and September 2020)
- Aquatic Ecology Survey (June 2020)
- Mammal camera survey (June 2020 – February 2021)
- Mammal walkover surveys (June, July 2020)
- Active bat detector survey (Summer/Autumn 2020; BCT 2012)
- Passive bat detector survey (Summer 2020 through to Spring 2021)
- Other Fauna Survey (Amphibians, Invertebrates – June, July, September 2020)

8.2.3 Designated Conservation Sites

Designated nature conservation sites in the hinterland of the proposed development site were identified through desktop review. An arbitrary distance of 15km is employed in many assessments however all potential pathways for impact on designated sites have been included for in the environmental impact assessment both within and outside the 15km zone. Where a 15km buffer of the proposed development site is shown it is important to note that this is for illustrative purposes only. Nature Reserves and Refuges for Fauna are protected under the Irish Wildlife Acts (1976 – 2012). Designated conservation sites include national sites, Natural Heritage Areas (NHAs) and Proposed Natural Heritage Areas (pNHAs).
European sites, Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), have been designated under the EU Habitats Directive (92/43/EEC) and the EU Birds Directive (2009/147/EC) respectively. SACs and SPAs are collectively known as Natura 2000 sites and are legally protected by Irish law. Many designated sites overlap, e.g. a site can be designated as both an NHA and SAC.

In accordance with Article 6(3) and 6(4) of the EU Habitats Directive a Natura Impact Statement was also produced to assess the potential for significant impacts upon Natura 2000 sites in the wider hinterland of the site. The main purpose of this report was to identify whether adverse impacts on a Natura 2000 site are likely to arise from the proposed development. The conservation objectives of Natura 2000 sites (*i.e*. to maintain the favourable conservation status of habitats and species for which the sites are selected) are referred to when carrying out assessments for plans and projects that might impact on these sites. The following guidelines were used in the completion of the associated screening statement:

- Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites – European Commission Methodical Guidance on the provisions of Article 6(3) and 6(4) of the 'Habitats' Directive 92/43/EEC (European Commission 2001 [9]);
- Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities (DoEHLG 2009).

8.2.4 Habitats and Botanical Assessment

The habitat and flora study involved undertaking a desktop review and a baseline field assessment of the habitats and flora within the study area. The desktop study involved a review of botanical data available for the area to identify botanical species of conservation interest (*e.g.* rare, legally protected, invasive species) which have historically occurred in the area. The habitat and flora field assessment was carried out in accordance with best practice guidance (Smith *et al.* 2011). This involved a dedicated walkover of the entire lands under the Applicant's ownership at this site on a number of occasions between June and August 2020, where the dominant habitats present were mapped and classified according to Fossitt (2000). Evaluation of the conservation importance of habitats was conducted in accordance with NRA (2009) and Nairn & Fossitt (2004). The correspondence of any habitats within the study area to those listed on Annex I of the EU Habitats Directive 92/43/EC was evaluated with reference to the European Commission (2013) and the NPWS (2013). The conservation status of habitats and flora was also considered in respect of the following: Irish Red List for Vascular Plants (Wyse Jackson *et al.* 2016); Irish Red List for Bryophytes (Lockhart *et al.* 2012), Flora Protection Order (1999 as amended 2015); the EU Habitats Directive (92/43/EEC).

8.2.5 Bird Survey

Existing data on bird use of the study site and surrounding area was gathered from existing ecological data. In addition, a series of dedicated breeding and wintering bird surveys were carried out. The conservation status of bird species recorded was considered by their inclusion in one or more of the following: Irish Wildlife Acts (1976 – 2012); Birds of Conservation Concern in Ireland (BoCCI) Red, Amber and Green lists (see Gilbert *et al*., 2021); EU Birds Directive (2009/147/EC) Annex I list.

A baseline bird assessment of the study area was completed by undertaking a series of line transect surveys (see Bibby *et al*. 2000 and Sutherland et al. 2004). A total of five transects, each of approximately 500m length were surveyed across the study area, ensuring that an adequate distance was maintained between them in order to minimise double-counting individual birds across the site (Figure 8.2). Two breeding bird survey walkovers were carried out in the summer months of 2020 (Appendix 8.1) and the same transects were surveyed on a total of three occasions during the winter of 2020/2021 (Appendix 8.1).

On each transect, all bird species encountered (seen or heard) within three distance bands from the observer were recorded (<25m, 25-100m and >100m) and their abundance noted. Any species occurring more than 100m from the observer were not included in the abundance analysis but were recorded as 'additional' species present on transect. All bird species encountered during the ecology field survey walkovers, but outside of the dedicated bird surveys, were also casually recorded as 'additional' species.

Given, the low-lying and relatively undisturbed nature of the former race course lands it was important to ascertain if there was any usage of the proposed development site and adjoining lands by wintering birds, particularly those listed as special conservation interests (SCIs) of the nearby SPA. The entirety of the Greenpark lands were surveyed each month between October 2020 and March 2021. In daylight the site was walked to record the presence/absence of any of these SCI species and after dark a pair of ecologists walked the site using a Thermal Imaging

Scope (Pulsar Helion 2 XP 50) to scan the grasslands and any pooled or waterlogged areas for signs of the presence of such species. The thermal imager uses an IR sensor (uncooled microbolometer) which does not require an external light source and is not affected by bright light exposure. The scope can detect and record bird and mammal activity at several hundred metres distance. The dates of these winter surveys are summarised in Appendix 8.1.

8.2.6 Mammal Survey

A mammal survey of the site was also undertaken which involved a walkover of the site, identifying mammal species or signs of mammal activity seen (e.g. droppings, tracks, burrows etc.) and recording observations using field notes and/or handheld GPS units. Techniques used to identify mammal activity followed recognised guidelines (e.g. Clark 1988, Sutherland 1996, Bang & Dahlstrom 2004 and JNCC 2004). The mammal survey walkovers were carried out by Dr. Gavin Fennessy, assisted by Tom O'Donnell and Marie Kearns.

In addition, a number of digital trail cameras (Camera-traps) which take photographs and/or video when triggered by heat or motion, were also deployed at the site to record mammal activity within and adjacent to the proposed development site. In all cameras (Browning Dark Ops HD) were deployed at a total of 14 sampling locations around the study area for an average of 42 days (Figure 8.2). The cameras were set to take still images which were later analysed to identify the mammal (and bird) species present. The cameras are equipped with no-glow infrared 'flash' technology which enable clear night-time (as well as diurnal) images to be captured. Cameras were rotated between sampling locations with several cameras on-site from June 2020 through to March 2021.

The National Parks and Wildlife Service (NPWS) and National Biodiversity Data Centre (NBDC) online databases were consulted to identify any rare or protected mammal species located within the relevant grid squares surrounding the site.

The conservation status of mammal species was considered. The conservation status of mammals within Ireland and Europe is indicated by inclusion in one or more of the following: Irish Wildlife Acts (1976 – 2010); Red List of Terrestrial Mammals (Marnell et al. 2009); EU Habitats Directive.

8.2.7 Bat Survey

As part of an initial desk-top review, the model of Bat Landscapes, available on the NBDC website was consulted. This model is based on the relative importance of landscape and habitat associations for bat species in Ireland and the index ranges from 0 to 100, where 100 is the most suitable for bats (Lundy *et al*. 2011).

There are no suitable structures on the proposed development site or in the adjoining lands under the Applicant's ownership which have potential for roosting bats. A visual assessment was made of the roost potential of natural and man-made features within and adjoining the proposed development site.

In order to record the usage of the proposed development site and surrounding areas by bats, a multi-season deployment of passive bat detectors was carried out. Multiple bat detectors (Wildlife Acoustics SM4 & SM4 Mini) were deployed at a total of 16 locations in the area between July 2020 and March 2021 (Figure 8.2). The survey deployment schedule is summarised in Appendix 8.1

The survey generated a large dataset of bat calls (registrations) for analysis using Kaleidoscope Pro software. The registrations captured during each deployment were identified using *post hoc* analysis and the relative abundance of the species identified was calculated. The activity pattern of key species was investigated further to ascertain if the pattern of occurrence was suggestive of the presence of locally roosting bats.

The conservation of Bat species was considered. All Irish bat species and their breeding, roosting and resting locations are legally protected under both the Irish Wildlife Acts (1976 – 2010) and as Annex IV species in the EU Habitats Directive (92/43/EEC).

Figure 8.2: Bird survey transects, wildlife camera and passive bat detector deployment locations (June 2020 – March 2021).

8.2.8 Other Taxa Assessment

A desktop study was conducted to review available records for other taxa such as invertebrates (butterflies, damselflies, dragonflies, moths, beetles etc.), amphibians and reptiles. NBDC records for the 2km grid squares which overlap the Application Site Boundary were reviewed and used to inform the scope of ecological surveys required.

Other taxa (e.g. Lepidoptera, Odonata, Amphibians and reptiles) encountered during the ecological field surveys were casually recorded for inclusion in this assessment. The conservation status of other taxa was assessed by examining their inclusion in one or more of the following: Irish Wildlife Acts (1976 – 2012); Irish Red List for Butterfly (Regan *et al.* 2010); Irish Red List for Damselflies & Dragonflies (Nelson *et al.* 2011); Irish Red List for Amphibians, Reptiles & Freshwater Fish (King *et al.* 2011); Regional Red List of Irish Bees (Fitzpatrick *et al.* 2006); and the EU Habitats Directive.

8.2.9 Non-native invasive Species

During the habitat and botanical walkover surveys, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended) (S.I. 477 of 2015).

8.2.10 Aquatic Ecology

8.2.10.1 Desktop review

A desktop review was undertaken to collate and review available information, datasets and documentation sources pertaining to the natural environment of the aquatic survey sites and wider Greenpark Racecourse study area. Records available from the National Biodiversity Data Centre (NBDC), Biological Society of Britain and Ireland (BSBI) and National Parks and Wildlife Service (NPWS) were reviewed.

A sensitive species data request for aquatic flora and fauna covering the 10km grid square containing and adjoining the redevelopment site (i.e. R55) was requested from the Department of Culture, Heritage and the Gaeltacht on Friday 2nd October 2020 and received on Monday 5th October 2020.

8.2.10.2 Walkover surveys

All watercourses within or adjoining the redevelopment site were considered as part of the current baseline assessment. This included two sites on the adjoining Ballynaclogh River and *n*=10 sites on nine individual drainage channels located within the site boundary (Table 8.1). A constructed wetland (lagoon) located in the western extent of the redevelopment site also formed part of the aquatic baseline survey. The development site adjoins an existing lagoon (constructed wetland) with a built capacity of c. 23,000m^3 based on the topographical survey, which is capable of servicing an area of 39 hectares, while the total application site of the SHD site is circa 10.5ha. Therefore, a total of *n*=13 survey sites formed the basis of the aquatic baseline assessment (Figure 8.4).

Visits of the aquatic survey sites were conducted on Thursday 21st May and Monday 8th June 2020 by Triturus Environmental Ltd. (two staff). Survey sites were assessed in light of the proposed land redevelopment, with survey effort focused on both instream and riparian habitats. Surveys at each aquatic site included a fisheries habitat appraisal, amphibian assessment, biological water quality sampling and physiochemical analysis (where applicable). Rare, protected and or conservation interest aquatic species such as otter were also searched for at each survey site and in the wider study area. This holistic approach informed the overall aquatic ecological evaluation of each site in context of the proposed redevelopment.

A broad aquatic habitat assessment was conducted at each site utilising elements of the methodology given in the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003'* (EA, 2003) and the Irish Heritage Council's *'A Guide to Habitats in Ireland'* (Fossitt, 2000). All sites were assessed in terms of:

- Stream width and depth and other physical characteristics
- Substrate type, listing substrate fractions in order of dominance, i.e. bedrock, boulder, cobble, gravel, sand, silt etc.
- River profile (i.e. extent of riffle, glide and pool in the sampling area, where applicable)
- In-stream macrophyte, bryophytes occurring and their percentage coverage of the stream bed and or surface coverage at the sampling sites
- Riparian vegetation composition

Each aquatic survey site was described in terms of the important aquatic habitats and species. This helped to evaluate species and habitats of ecological value in the vicinity of the proposed redevelopment site at Greenpark Racecourse. The aquatic baseline prepared also informed mitigation for land redevelopment.

Table 8.1: Aquatic survey site locations in the footprint of the land redevelopment site at Greenpark Racecourse, Dock Road, Limerick City.

Site no.	Watercourse/waterbody	EPA code	Location	ITM (x)	ITM (y)
1A	Drainage channel	n/a	Along northern site boundary	555621	655775
1B	Drainage channel	n/a	Downstream of northern site boundary	555433	655605
2A	Drainage channel	n/a	North extent of site	555723	655761
2B	Drainage channel	n/a	Northern extent of site	555833	655614
2C	Drainage channel	n/a	Northern extent of site	555874	655592
3	Drainage channel	n/a	North-western extent of site	556090	655579
4A	Drainage channel	n/a	Western extent of site	556077	655364
4B	Drainage channel	n/a	Western extent of site	556093	655528
4C	Drainage channel	n/a	Western extent of site	556036	655528
5	Drainage channel	n/a	Southern extent of site	555862	654968
6	Wetland	n/a	South of Limerick Greyhound Stadium	555475	655314
7A	Ballynaclogh River	n/a	N18 road bridge	555810	654947
7B	Ballynaclogh River	n/a	North-east of Limerick Greyhound Stadium	555359	655622

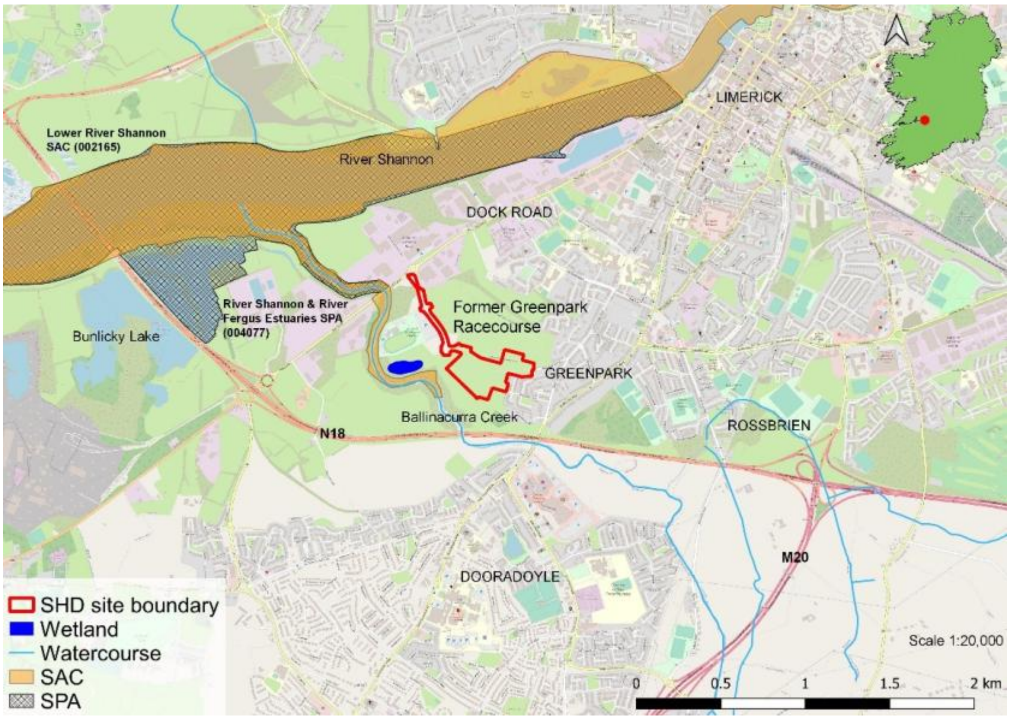


Figure 8.3: Location of aquatic habitats at Greenpark Racecourse, Dock Road, Limerick City.

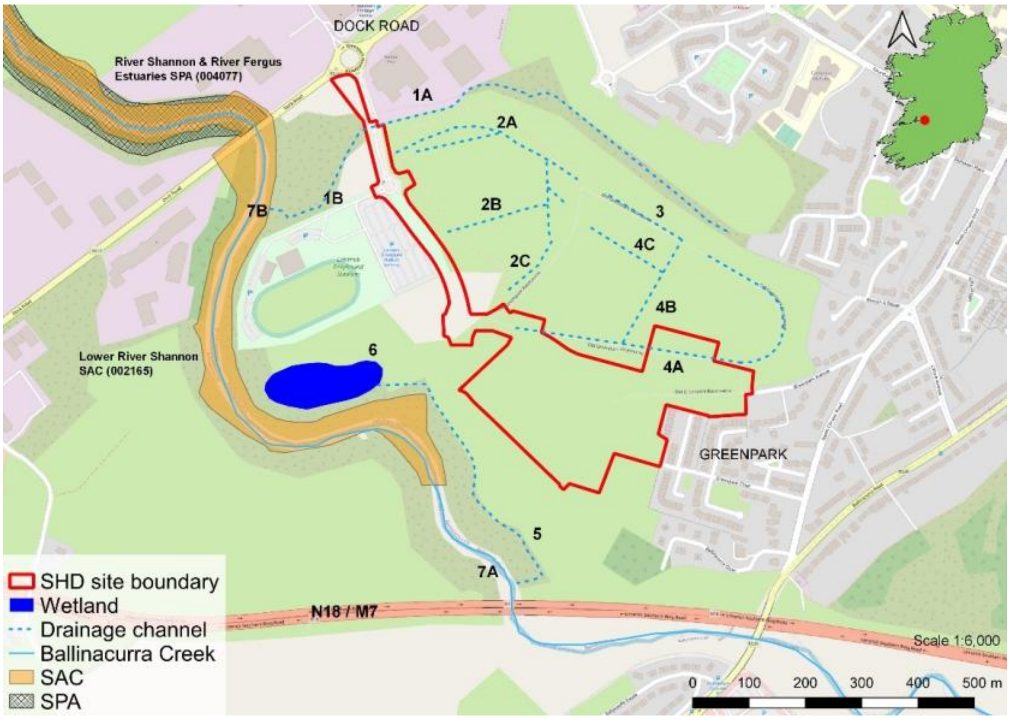


Figure 8.4: Location of aquatic survey sites within the footprint of the land redevelopment site at Greenpark Racecourse, Dock Road, Limerick City.

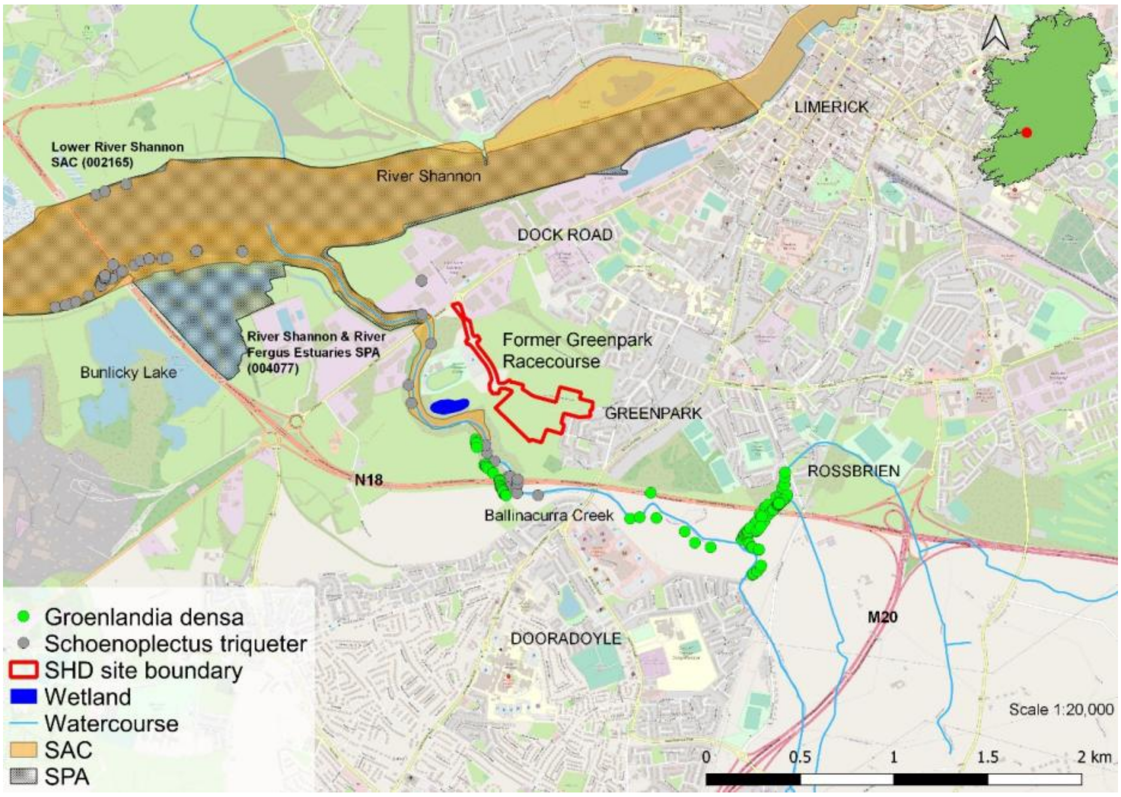


Figure 8.5: Flora Protection Order aquatic species at Greenpark Racecourse, Dock Road, Limerick City.

8.2.10.3 Fisheries habitat

A broad fisheries habitat appraisal of the watercourses and waterbodies in the footprint of the proposed land redevelopment site was undertaken to establish their importance for European eel and other fish species. A broad appraisal / overview of the upstream and downstream habitat at each aquatic survey site was also undertaken to evaluate the wider contribution to general fisheries habitat. Aquatic habitat surveys and fisheries assessments were also carried out utilising elements of the approaches in the River Habitat Survey Methodology (Environment Agency, 2003) and Fishery Assessment Methodology (O'Grady, 2006) to broadly characterise the river sites (i.e. channel profiles, substrata etc.).

8.2.10.4 Physiochemical water quality

Water quality samples were collected from n=4 aquatic survey sites (i.e. sites 1A, 5, 6 and 7B) on the 8th June 2020. Samples were cooled and delivered to the laboratory on the same day for analysis. Dissolved oxygen (mg/l and % saturation) and conductivity (µS/cm) were measured onsite using handheld meters. In order to collate a broad water quality baseline for the study area, a range of physio-chemical parameters for each site were laboratory-tested, namely;

- pH
- Salinity (ppt)
- Alkalinity (mg CaCO3/l)
- Total Ammonia (mg N/l)

- Total Oxidised Nitrogen (TON) (mg N/l)
- Molybdate Reactive Phosphorus (MRP) (mg P/l)
- Total phosphorus (mg P/l)
- Biochemical Oxygen Demand (BOD) (mg O2/l)
- Chemical Oxygen Demand (COD) (mg O2/l)
- Chlorophyll a (µg/l) (site 6 only)
- Suspended solids (mg/L)

8.2.10.5 Macro-invertebrates

The macro-invertebrate community composition was examined at two drainage channel sites (sites 1A & 5), one wetland site (site 6) and one transitional site (site 7B). Given the lack of freshwater riverine habitats in the study area, Q-sampling was not possible. All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size), which was used to sweep macrophytes/sediment to capture macro-invertebrates. The net was also moved along the bed to collect epibenthic and epiphytic invertebrates from the substratum (as per Cheal et al., 1993). A 3-minute sampling period was divided amongst the range of meso-habitats present to get a representative sample for sub-habitats. Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), stoneflies (Feeley et al., 2020), mayflies (Kelly-Quinn & Regan, 2012) and other relevant taxa (e.g. Byrne et al., 2009; Nelson et al., 2011).

8.2.10.6 Aquatic ecological evaluation

The evaluation of ecological receptors contained within this report uses the geographic scale and criteria defined in the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009).

8.3 Baseline Environment

A summary of the results of the baseline ecological assessment is outlined in this section.

8.3.1 Designated Sites

All potential pathways for impact on designated sites have been considered in the impact assessment both within and outside the nominal 15km buffer area around the development site. This buffer area is an arbitrary distance used to display the sites most proximate to the proposed development. However, all sites within and outside of 15km are considered when assessing the potential for ecological impacts arising from the proposed development.

The proposed development area does not lie within any EU Natura 2000 or nationally designated conservation site (Figure 8.6). In all, 7 Natura 2000 sites are located within 15km of the proposed development site. The closest of these are;

- **Lower River Shannon SAC (002165)** – c. 60m from the proposed development site;

- **River Shannon & River Fergus Estuaries SPA (004077)** – c. 130m from the proposed development.

All of the other Natura 2000 sites are located well over 5km from the proposed development site (Table 8.2; Figure 8.6). There are 16 NHA and pNHA sites located within this 15km hinterland area (Table 8.2; Figure 8.6). The closest of these sites is Inner Shannon Estuary – South Shore pNHA (000435; 0.12km).

The potential impacts of the proposed development on Natura 2000 sites in the surrounding area is considered in the Natura Impact Statement (under the EU Habitats Directive) which accompanies this EIAR.

Table 8.2: Summary of designated conservation sites within 15km.

Site Name & Designation	Site Code	Key Conservation Objectives	Minimum Distance (km)
Lower River Shannon SAC	002165	The conservation objectives of this site are to maintain the favourable conservation condition of the Annex I habitats and fauna listed as Special Conservation Interests for this SAC: • Sandbanks • Estuaries • Tidal Mudflats and Sandflats • Coastal Lagoons* • Large Shallow Inlets and Bays • Reefs • Perennial Vegetation of Stony Banks • Vegetated Sea Cliffs • *Salicornia* Mud • Atlantic Salt Meadows • Mediterranean Salt Meadows • Floating River Vegetation • *Molinia* Meadows • Alluvial Forests* • Freshwater Pearl Mussel *Margaritifera margaritifera*	0.06

Site Name & Designation	Site Code	Key Conservation Objectives	Minimum Distance (km)
		• Sea Lamprey *Petromyzon marinus* • Brook Lamprey *Lampetra planeri* • River Lamprey *Lampetra fluviatilis* • Atlantic Salmon *Salmo salar* • Bottle-nosed Dolphin *Tursiops 91aubenton* Otter *Lutra lutra*	
River Shannon & River Fergus Estuaries SPA	004077	The conservation objectives of this site are to maintain the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA: Breeding and Wintering • Cormorant *Phalacrocorax carbo* Wintering • Whooper Swan *Cygnus cygnus* • Light-bellied Brent Goose *Branta bernicla hrota* • Shelduck *Tadorna tadorna* • Wigeon *Anas 91aubento* • Teal *Anas crecca* • Pintail *Anas acuta* • Shoveler *Anas clypeata* • Scaup *Aythya marila* • Ringed Plover *Charadrius hiaticula* • Golden Plover *Pluvialis apricaria* • Grey Plover *Pluvialis squatarola* • Lapwing *Vanellus vanellus* • Knot *Calidris canutus* • Dunlin *Calidris alpina* • Black-tailed Godwit *Limosa limosa* • Bar-tailed Godwit *Limosa lapponica* • Curlew *Numenius arquata* • Redshank *Tringa 91aubent* • Greenshank *Tringa nebularia* • Black-headed Gull *Chroicocephalus ridibundus* Wetlands	0.13

Site Name & Designation	Site Code	Key Conservation Objectives	Minimum Distance (km)
Tory Hill SAC (& pNHA)	000439	• Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] • Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7210] • Alkaline fens [7230]	11.19
Glenomra Wood SAC (& pNHA)	001013	• Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	12.34
Askeaton Fen Complex SAC	002279	The conservation objectives of this site are to maintain the favourable conservation condition of the Annex I habitats listed as Special Conservation Interests for this SAC • Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae* • Alkaline fens	12.75
Curraghchase Woods SAC	000174	The conservation objectives of this site are to maintain the favourable conservation condition of the habitats and fauna listed as Special Conservation Interests for this SAC: • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* • *Taxus baccata* woods of the British Isles* • Lesser Horseshoe Bat *Rhinolophus hipposideros*	14.59
Ratty River Cave SAC	002316	• Caves not open to the public [8310] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	14.76
Nationally Designated Sites			
Inner Shannon Est. – South Shore pNHA	000435	This pNHA is part of the River Shannon Estuary and is comprised of extensive intertidal mudflats, fringing reedbeds, swamps, polders, salt marsh and wet marsh habitats; habitats which support many thousands of wading birds and duck. Greenland White-fronted and Greylag Geese frequent the southern shores of the estuary during the winter months. The estuary is also a	0.12

Site Name & Designation	Site Code	Key Conservation Objectives	Minimum Distance (km)
		stronghold for two rare plant species; triangular rush *Scirpus triqueter* and summer snowflake *Leucojuin pestirum*. The Inner Shannon Estuary – South overlaps with section of the Lower Shannon River SAC and The River Shannon and Fergus Estuaries SPA Natura 200 sites (see above for conservation objectives).	
Fergus Est. & Inner Shannon – North Shore pNHA	002048	Fergus Estuary & Inner Shannon, N. Shore pNHA overlaps with The River Shannon and River Fergus Estuary and as such is of conservation significance for bird species and coastal/wetland habitats.	0.59
Loughmore Common Turlough pNHA	000438	Loughmore is an unusual example of Turlough habitat type. Due to the site's southerly location, its shallowness, its proximity to the sea and some calcium enrichment, the flora of Loughmore includes some unique elements, which enhance the conservation value of this turlough.	2.52
Knockalisheen Marsh pNHA	002001	The site is considered important as a good example of grassland/wetland, with high plant species diversity which is an increasingly scarce habitat, especially close to a large city. In addition, the site serves as feeding ground for common wading species such as snipe.	3.25
Garranon Wood pNHA	001012	A small deciduous wood located immediately east of Cratloe, it is a good example of mature, intact oak woodland.	7.33
Woodcock Hill NHA	002402	An area of upland blanket bog and heath.	7.38
Cloonlara House pNHA	000028	A three-storey domestic dwelling house which contains over l00 Leisler's bats (*Nyctalus leisleri*) during the summer months. It is one of the biggest nursery sites in Ireland and in Europe and is a site of international importance.	8.37
Castleconnell pNHA	000433	This site is a nursery roost of the Daubenton's Bat (*Myotis 93aubentoniid*). Approximately 150 bats roost in the roof of modern privately owned dwelling house in Castleconnell, Co. Limerick. It is the largest known nursery site in Ireland and is therefore of national importance.	9.72
Dromore & Bleach Loughs pNHA	001030	An area of low-lying lakes and fen with underlying calcareous substrate, some woodland and scrub also occur onsite.	10.18
Tory Hill pNHA	000439	See Tory Hill SAC above.	11.19

Site Name & Designation	Site Code	Key Conservation Objectives	Minimum Distance (km)
Adare Woodlands pNHA	000429	This site is of significant conservation value for the stands of broad-leaved woodland and associated flora and fauna that it supports. These dry, broad-leaved woodlands are believed to be amongst the oldest in the country.	11.65
Skollhill pNHA	001996	An area of woodland with native tree species such as ash, hazel, hawthorn and oak as well as exotics like beech and sycamore. It is the only known location in Ireland of the grass *Festuca heterophylla*	11.68
Glenomra Wood pNHA	001013	See Glenomra Wood SAC above.	12.34
Castle Lake pNHA	000239		14.19
Gortacullin Bog NHA	002401	Gortacullin Bog NHA is a site of considerable conservation significance containing upland blanket bog and wet heath. The site supports a good diversity of blanket bog microhabitats, including hummock/hollow complexes, flushes and regenerating cutover with willow and birch scrub.	14.26
Curraghchase Woods pNHA	000174	See Curraghchase Woods SAC above.	14.76

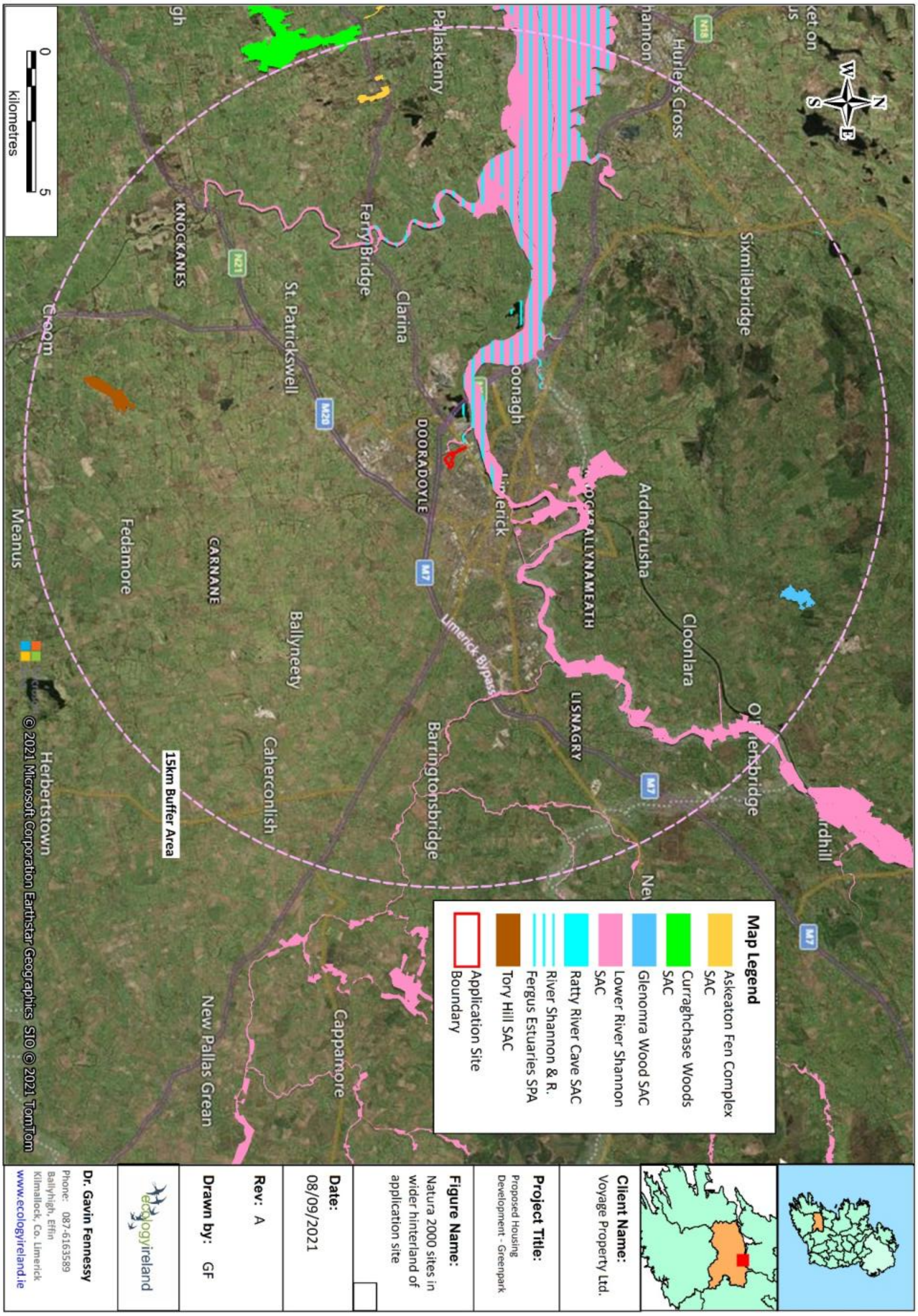


Figure 8.6: Natura 2000 sites within 15km of the application site boundary.

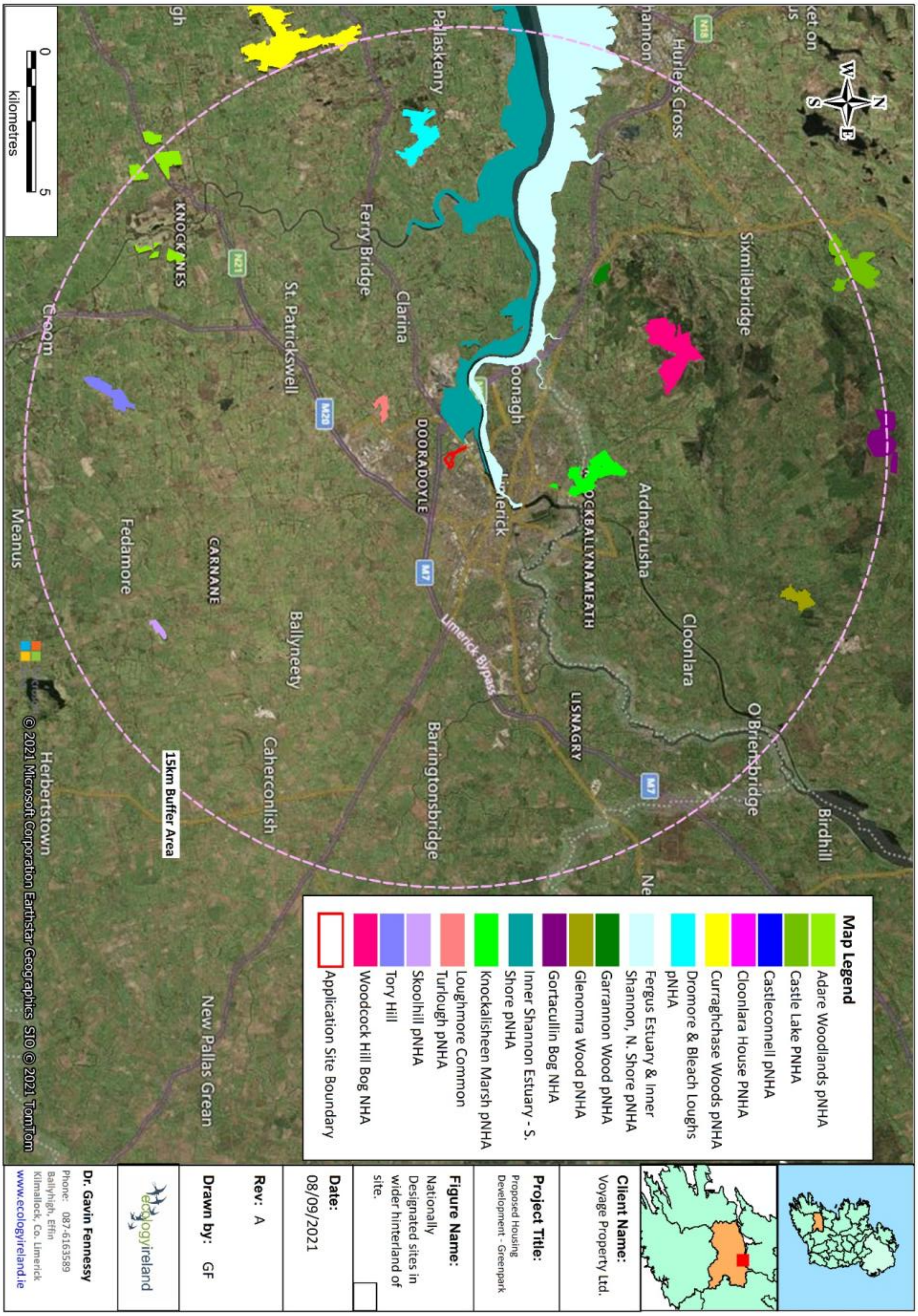


Figure 8.7: Nationally designated sites (NHA's & pNHA's) within 15km of the application site boundary.

8.3.2 Habitats and Botanical

8.3.2.1 Desktop Study- Habitats & Botanical

Three red listed near threatened species (Wyse-Jackson *et al*., 2016 have historically been recorded within the 2km grid squares that overlap the study site, these are Triangular club rush, Opposite leaved pond weed and Least Bur-reed. Triangular Club-rush has a restricted distribution to tidal stretches of the River Shannon and its tributaries and has been recorded growing on the Ballynaclogh River. It is protected under the Wildlife Acts (1976 and 2000) and is listed on the Flora Protection order 2015. Opposite-leaved Pondweed is typically associated in Ireland with tidal stretches of rivers or disturbed watercourses. It is protected under the Wildlife Acts (1976 and 2000) and is listed on the Flora Protection Order 2015 (NPWS, 2012b). Opposite-leaved Pondweed and Triangular Club-rush are classified as sub-types of the Annex I habitat Water courses of plain to montane levels with the *Ranunculion fluitanis* and *Calltricho-Batrachion* vegetation (3260) which is a qualifying feature of the Lower River Shannon SAC. Within the wider 10km grid square three further Flora Protection order species have historically occurred, Penny Royal, Meadow Barley and Autumn Crocus. None of these species were recorded during the terrestrial element of the habitat and botanical survey in 2020 however Opposite leaved pond weed was recorded during the Aquatic survey along the Ballynaclogh River. In previous surveys which took place in 2004 a number of rare plant species were identified in the area to the east of Ballynaclogh River between an artificial drain and the embankment which was approaching the EU Habitats Directive Annex I habitat Type *Molinia Meadows* (6410) however since this time this area has been developed into the existing Greyhound Racecourse track and the habitat on which they were found is no longer present having been covered over by the buildings and the car park for this development.

Table 8.3: Rare or protected plant species that have previously been recorded from the 2km grid squares R55S and R55M (after NBDC database) and 10km grid square R55 (after NPWS database).

Common Name	Scientific Name	Flora Protection Order 2015	Red Data Book Category (Wyse-Jackson *et al.*, 2016)	Grid Square
Triangular club rush	*Schoenoplectus triqueter*	Protected	Near threatened	2km Grid-R55M & R55S
Opposite leaved pond weed	*Groenlandia densa*	Protected	Near threatened	2km Grid-R55M & R55S
Least bur-reed	*Sparganium natans*	Not listed	Near threatened	2km Grid-R55S
Penny Royal	*Mentha pulegium*	Protected	Endangered	10km Grid-R55
Meadow barley	*Hordeum secalinum*	Protected	Vulnerable	10KM Grid-R55
Autumn crocus	*Colchicum autumnale*	Protected	Endangered	10KM Grid R55

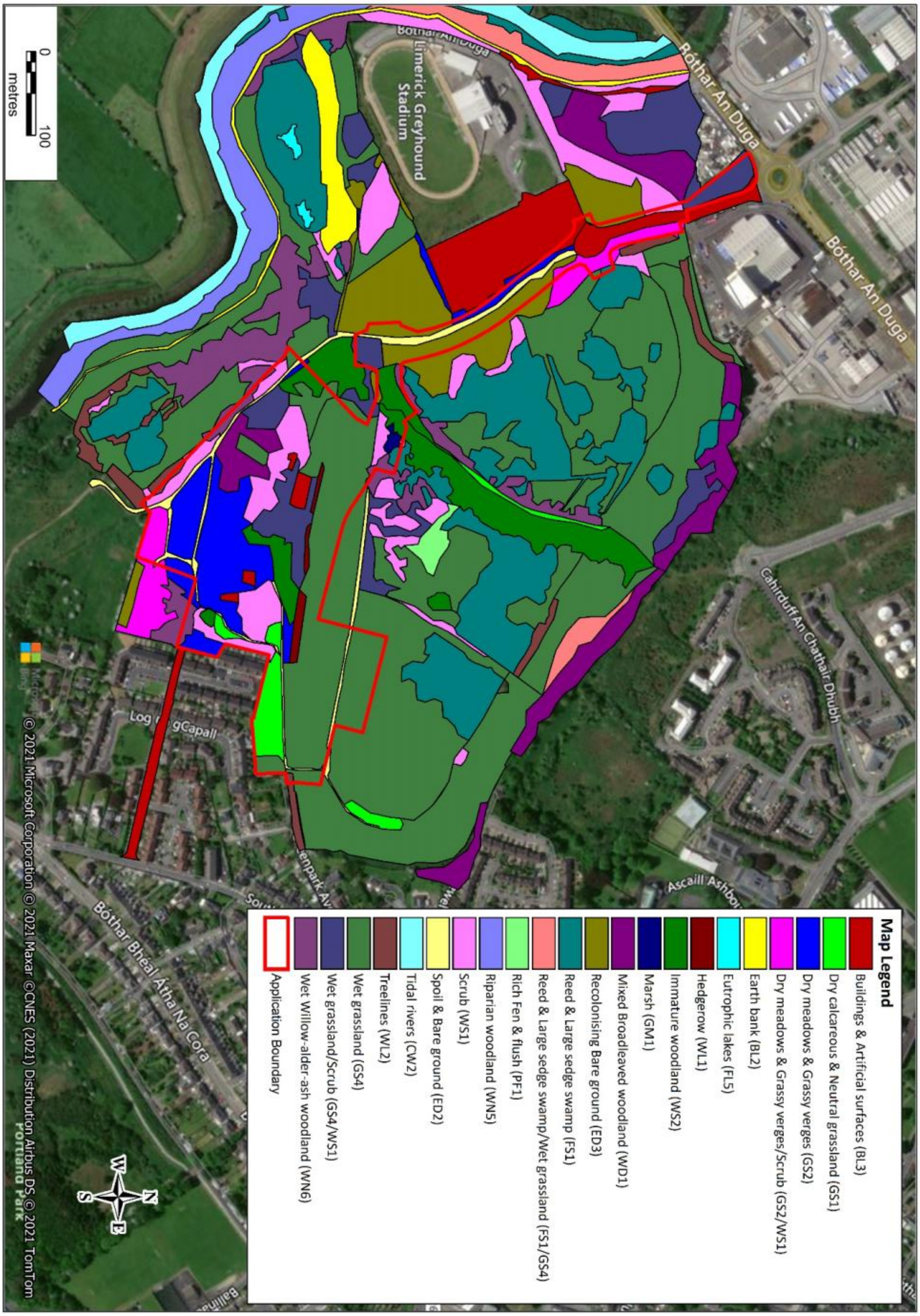


Figure 8.8: Habitat Map of the proposed development site in accordance with Fossitt (2000)

8.3.2.2 Existing Environment- Habitats and Botanical

The main habitats recorded within the proposed development site are listed in Table 8.3 and illustrated in Figure 8.8 Habitat map of the study area. The habitats within the study area reflect a landscape that has been the subject of considerable anthropogenic influence in the past having undergone reclamation, drainage and land improvement measures. While the anthropogenic influence remains quite evident, over time, the habitats onsite have gradually become more naturalised, vegetation has recolonised bare ground, tracks and demolished building areas, willow scrub (WS1) and immature woodland (WS2) are developing into more established semi-mature Wet willow-alder-ash woodland (WN6) dominated by willow species. The lands are not being actively managed apart from light grazing by a number of horses. What was former amenity grassland is now reverting to wet grassland (GS4) and swamp habitat (FS1 & FS2) owing to the underlying hydrological conditions based as it is in a natural flood plain where the water table is high. The wet grassland (GS4), Reed and large sedge swamps (FS1) and Tall herb swamps (FS2) are evaluated as being of **Local Importance (higher value)** given the specialist plants that grow in this habitat and the range of species (flora, invertebrate, bird, mammals) it can support. The grassland habitat is diversified somewhat by the underlying limestone bedrock and as a result Dry calcareous and neutral grassland (GS1) can be found in a number of areas across the site. Species richness is relatively high in these areas and specialist calcareous plant assemblages indicative of this grassland were present including Quaking Oat Grass (*Briza media*) and a number of orchid species including Common Spotted Orchid (*Dactylorhiza fuchsia*), Bee Orchid (*Ophrys apifera*) and Pyrimidal Orchid (*Anacamptis pyramidalis*). None of these orchid species are Flora Protection Order 2015 species. All of the orchids recorded in the study area are listed as species of Least Concern on the Vascular Plant Red List (after Wyse-Jackson et al., 2015). Other species recorded onsite indicative of the calcareous conditions included the Greater Knapweed (*Centaurea scabiosa*) which is currently categorised as near threatened in the vascular plant Red List (Wyse-Jackson *et al*., 2015). The areas of Dry calcareous and neutral grassland were evaluated as **Local Importance (Higher Value)**. The historical development of the site is reflected in habitats such as Spoil and bare ground (ED2), Buildings and Artificial surfaces (BL3) and Recolonising bare ground (ED3) where pioneer plant species have gradually recolonised these disturbed areas. The disturbed areas were also where non-native invasive plant species were concentrated within the study area. The Lower River Shannon SAC is a key ecological receptor which lies within the wider area; there is both habitat and hydrological connectivity between the Study area and this SAC. Ballynaclogh River a tributary of the River Shannon which forms part of the Lower River Shannon SAC runs along the western boundary of the study area (Figure 8.6). It is tidal at this point with a muddy substrate lined with monodominant stands of Common Reed (*Phragmites australis*) in the north west and Riparian woodland (WN5) to the south west. A number of Flora Protection Order (2015) species are known to occur along the Ballynaclogh River including Triangular Club-rush (*Schoenoplectus triqueter)* and Opposite Leaved Pondweed (*Groenlandia densa*), these were recorded during the aquatic ecology assessment and are referred to in Section 8.3.3. The Ballynaclogh River was evaluated as being of **International Importance** as it forms part of the EU designated site, the Lower River Shannon SAC. A large man-made earth embankment (BL2) runs between the Ballynaclogh River and the Study Area, this was built in the past as part of historical arterial drainage scheme works. Drains running in the north of the study area and from the lagoon (constructed wetland) run through this earth embankment and discharge into the Ballinaclogh River. The Earth bank forms a natural barrier between the proposed development and the Ballynaclogh River, it is evaluated as being of **International Importance** in light of the support function it provides to the adjacent habitats which form part of the Lower River Shannon SAC and it being itself partially located within the SAC.

Woodland habitat onsite is dominated by semi-mature willow species indicative of the underlying wetter hydrological conditions. Four main types of woodland were recorded Wet willow-alder-ash woodland (WN6), Riparian woodland (WN5), Mixed broadleaved woodland (WD1) and Scrub (WS1). None were evaluated as corresponding to Annex I habitat, the Riparian Habitat that runs along the Ballynaclogh River is evaluated as being of **International Importance** as it forms part of the Lower River Shannon SAC. All other woodland types were classified as being **of Local Importance with a lower to higher value**.

The conservation value of habitats in general across the site are evaluated of **Local Importance** and range from **lower to higher value**. Habitat of **International importance** only occurs within the EU Designated site, the Lower River Shannon SAC, which is lies on the western margins of the Study Area.

Table 8.3: List of the main habitats recorded within or directly adjacent to the proposed development site area during the 2020 Habitat and botanical Survey (Evaluation of conservation importance after NRA 2009 and Nairn & Fossitt 2004).

Fossit Code	Habitat Type	Habitat Evaluation
WN6	Wet willow-alder-ash woodland	Local Importance (Higher value)
WD1	Mixed Broadleaved Woodland	Local Importance (Higher value)
WSI	Scrub	Local Importance (Lower value)
WS2	Immature woodland	Local Importance (Lower value)
WL1	Hedgerows	Local Importance (Higher value)
WL2	Treelines	Local Importance (Higher value)
GS4	Wet Grassland	Local Importance (Higher value)
GS2	Dry meadows and grassy verges	Local Importance (Higher value)
GS1	Dry calcareous and neutral grassland	Local Importance (Higher value)
GM1	Marsh	Local Importance (Higher value)
FS1	Reed and large sedge swamp	Local Importance (Higher value)
FW4	Drainage Ditches	Local Importance (Lower value)
ED2	Spoil and bare ground	Local Importance (Lower value)
ED3	Recolonising bare ground	Local Importance (Lower value)
BL3	Buildings and artificial surfaces	Negligible value

8.3.2.2.1 Wet grassland (GS4)

Despite its former status as an amenity grassland and the installation of an extensive network of drainage channels within the study area the dominant grassland type is wet grassland (GS4), reflective of the location of this site on the Ballynaclough River (River Shannon) floodplain and local hydrological conditions which result in periodic inundation and waterlogging of soils onsite. Wet grassland habitat occurs on wet or waterlogged mineral or organic soils that are poorly drained or, in some cases, subjected to seasonal or periodic flooding (Fossitt, 2000). The range of species recorded within the wet grassland habitat varied depending on the degree of moisture present and extent of drainage installed nearby.

A large proportion of the proposed development site is composed of Wet grassland habitat (GS4) covering almost half of the development footprint area. Wet grassland species composition within the proposed development site boundary included frequent Yorkshire fog *Holcus lanatus* , False Oat Grass *Arrhenatherum elatius*, Creeping bent *Agrostis stolonifera*, Creeping Buttercup *Ranunculus repens*, Red Fescue *Festuca rubra*, Creeping thistle *Cirsium arvense*, Common mouse-ear *Cerastium fontanum* , Ribwort plantain *Plantago lanceolata*, Ragwort *Senecio jacobea*, with occasional Silverweed *Potentilla anserina* , Sweet vernal grass *Anthoxanthum odoratum*, Curly Dock *Rumex crispus* , Broad leaved Dock *Rumex obtusifolius*, Hard Rush *Juncus inflexus*, Meadow Buttercup *Ranunculus acris* , Hedge Bindweed *Calystegia sepium*, Great Willowherb *Epilobium hirsutum*, Greater Birds foot trefoil *Lotus pedunculatus* and Meadow Vetchling *Lathyrus pratensis*. Species such as Purple Loosestrife *Lythrum salicaria*, Common Fleabane *Pulicaria dysenterica*, Meadowsweet *Filipendula ulmaria*, Alexander, *Smyrnium olusatrum,* Hogweed *Heracleum sphondylium*, Bog stitchwort *Stellaria alsine*, were occasionally recorded in the wet grassland habitat closer to drainage ditches or in damper settings along with rare occurrence of Canary reed grass *Phalaris arundinacea*.

Evaluation: The areas of Wet grassland (GS4) habitat which are located within the Study area are evaluated as being of **Local Importance (Higher Value).**

Plate 8.1: Wet grassland (GS4) being grazed by local horses.

8.3.2.2.2 Reed and large sedge swamp (FS1)

Reed and large sedge swamp(FS1) habitat was recorded in large patches dominated by Lesser Pond Sedge *Carex acutiformis* within and adjacent to the proposed development site along the north eastern boundary forming an intimate association with wet grassland (GS4). The Lesser Pond Sedge was abundant forming dense stands with little else other than occasional or sometimes abundant patches of Canary Reed Grass, frequent Hedge Bindweed, occasional Water Horsetail *Equisetum fluviatile*, Purple Loosestrife, Meadow Vetchling and Hoary Willowherb *Epilobium parviflorum* . The wetter areas of the Reed and large sedge swamp (FS1) habitat was generally more species poor and included Bullrush *Typha latifolia*, species richness increased at the edges of this habitat type and also in drier areas which graded into wet grassland. In drier areas creeping thistle, bramble and nettle grew frequently amongst the dense stands of Lesser Pond Sedge. Other species present in this habitat included the occasional Yellow Flag Iris *Iris pseudacorus* and Meadow Foxtail *Alopecurus pratensis* and Common Fleabane. There are no linkages between Reed and large sedge swamp (FS1) habitat and Annex I habitat. Tall herb swamp (FS2) habitat can correspond to the Annex I Habitat 'Hydrophilus tall herb fringe communities of plains and of the montane to alpine levels (6430)'. However within this Study Area broadleaved herb component of the Reed and large sedge swamp habitat did not occur in sufficient proportion relative to the reed and large sedge/grass component to merit classification as Tall herb and Swamps (FS2).

Evaluation: The areas of reed and large sedge swamp habitat which are located within the Study area are evaluated as being of **Local Importance (Higher Value)**.

Plate 8.2: Areas of Reed and large sedge swamp (FS1) dominated by Lesser Pond Sedge

8.3.2.2.3 Dry meadows and grassy verges (GS2)

Dry meadows and grassy verges (GS2) are semi natural grassland which undergo little or no management (rarely fertilised or grazed) and which produce grasslands with a high proportion of tall course and tussocky grasses (Fossitt, 2000). This habitat type occurred largely in the south of the proposed development site in areas which had previously been cleared and along the margins of tracks. Species composition included abundant False-Oat Grass, frequent Yorkshire Fog, Nettle *Urtica dioica*, Creeping thistle, Bramble *Rubus fructicosus*, Creeping Bent, White clover *Trifolium repens* and Red Clover *Trifolium pratense* and occasional Cocksfoot Grass *Dactylis glomerata*, Common Knapweed *Centaurea nigra*, Common Vetch *Vicia sativa ssp. segetalis*, Annual meadow grass Poa annua, Creeping cinquefoil *Potentilla reptans*, Curly Dock, Wild Carrot *Daucus carota*, Colts foot *Tussilago farfara,* Oxeye daisy *Leucanthemum vulgare,* Black medick *Medicago lupulina.* Greater Knapweed *Centaurea scabiosa* which is currently categorised as near threatened in the vascular plant Red List (Wyse-Jackson *et al*., 2015) was recorded in this grassland habitat.

Evaluation: The areas of Dry meadows and grassy verges (GS2) habitat were located within areas that have undergone disturbance in the past and are now revegetated e.g. along margins of tracks but are evaluated as being of **Local Importance (Higher Value)** due to the range of species supported by this habitat type.

8.3.2.2.4 Dry calcareous and neutral grassland (GS1)

Dry calcareous and neutral grassland (GS1) is a semi improved or unimproved dry grassland that may be either calcareous or neutral, but not acid and is associated with low intensity agriculture typically occurring on free-draining mineral soils (Fossitt, 2000). The distribution of this habitat onsite was relatively limited in extent largely confined to three areas;

- an area running along the eastern residential estate boundary wall;
- along an earthen bank that runs along the south eastern perimeter of the former racecourse and;
- in the centre of the site along the rough trackway that divides the former racecourse.

Species richness was relatively high in these areas and species composition was indicative of calcareous or neutral grassland communities.

In the area running along the eastern residential estate boundary wall two large patches of Common Spotted Orchid were recorded (c. 30 flowering spikes) these are normally associated with calcareous or neutral soils. The number of broadleaved species was relatively high here and grass/sedge species were present but did not dominate. Species composition included frequent abundance of Common Knapweed and Common Birds Foot Trefoil *Lotus corniculatus*, Common Spotted Orchid *Dactylorhiza fuchsii* and Cats Ear *Hypochaeris radicata* and occasional Self-heal *Prunella vulgaris*, Sweet Vernal Grass, Creeping Cinquefoil, Meadow Vetchling, Ribwort Plantain, Yorkshire Fog, False Oat Grass, Black Medick, Red Clover, Bramble and Glaucous Sedge *Carex flacca*. Ladies Mantle *Alchemilla* spp., Bush Vetch *Vicia sepium*, Oxeye Daisy and Common Mouse Ear occurred rarely in this habitat. A number of ant hills (3 no.) were also observed near the Common Spotted orchid patches indicating that this habitat has not been disturbed for some time.

The second area of Dry calcareous and neutral grassland (GS2) is raised earthen bank along the south eastern perimeter of the former racecourse which had exposed rock in places and soils were shallow. This bank supported species which were strongly indicative of underlying calcareous soil conditions such as the frequently occurring Quaking grass *Briza media* and rarely occurring Pyramidal Orchids *Anacamptis pyramidalis*. Other species present included frequent Yorkshire Fog Grass and Oxeye Daisy and occasional Wild Carrot, Red Clover, White Clover, Meadow buttercup and the Common Spotted Orchid.

The third area of Dry calcareous and neutral grassland (GS1) occurred along the margins of the track that runs through the centre of the former racecourse. A section of this track lies within the proposed development site boundary and this habitat was notable for the presence of a number of Bee Orchids *Ophrys apifera* in flower; these plants occur mainly on dry, sandy, calcareous soil and are often associated with limestone pastures but can also occur on disturbed ground, roadside verges and quarries. While they are not protected in the Republic of Ireland the Bee Orchid is given special protection under the Wildlife (NI) Order, 1985 listed in Schedule 8, parts 1 and 2 and are of ecological interest due to the plant communities they can often co-exist with as well as being relatively rare locally. Other species that occurred here included frequent Red clover, Creeping Cinquefoil, Meadow Vetchling, Ribwort Plantain, Meadow buttercup, Grey Willow. Occasionally occurring species included Silverweed, Bush Vetch, Yorkshire Fog, Coltsfoot, Black Medick, Cats Ear, Common Birds Foot Trefoil, Self-Heal, Common Knapweed, Osier *Salix viminalis*, Ragwort and rarely occurring Common Spotted Orchid, Bee Orchid, Gorse *Ulex europaeus*, Oak Sapling *Quercus pedunculata*.

Evaluation: Dry calcareous and neutral grassland (GS1) can correspond with the priority EU Habitats Directive Annex I habitat 6210 Orchid-rich calcareous grassland*. The Annex I habitat 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) comprises species-rich plant communities found on shallow, well-drained calcareous substrates. It is considered a priority habitat only if it is an important orchid site (NPWS, 2019). With the exception of the relatively common *Dactylorhiza fuchsia* Common-spotted Orchid and *Dactylorhiza maculate* Heath spotted Orchid. 6210 habitat should be considered for the orchid-rich priority habitat *6210 if one or more of the following less common orchid species are present: *Anacamptis pyramidalis,Coeloglossum viride, Dactylorhiza fuchsia* v. *okellyi, Epipactis atrorubens, Gymnadenia conopsea, Listera ovata, Neotinea maculata, Ophrys apifera, Ophrys insectifera, Orchis mascula, Orchis morio, Platanthera bifolia, Platanthera chlorantha, Spiranthes spiralis*. The areas of Dry Calcareous grassland recorded did contain some of the Annex I Orchid indicator spcecies listed above including Bee Orchid *Ophrys apifera* and Pyramidal Orchid *Anacamptis pyramidalis* and therefore is approaching the description of the Annex I 6210 Priority grassland howver the habitat was limited in extent occurring in small patches. The largest area of Dry calcareous grassland (GS1) contained an abundance of Common Spotted Orchid however these are excluded as Annex I Priority habitat indicator species due to their relative abundance generally. In addition to supporting populations of rare orchids (e.g. *Gymnadenia conopsea, Ophrys apifera*) and being important for a range of pollinators, more permanent pastures of this type can be notable for their anthills. The area of Dry calcareous grassland (GS1) that runs along the eastern boundary wall contains a large abundance of Common Spotted Orchid and also had a number of anthills indicating this area has remained undisturbed for some time. The Dry calcareous and neutral grassland (GS1) onsite is evaluated as **Local Value (High Importance)** due to the specialist calcareous community of plants and rare Orchid species (e.g. Bee orchid, Pyramidal Orchid) that it supports and the relatively high species richness in these areas. Avoidance or minimisation of development in these areas of dry calcareous grassland (particularly those supporting rarer Orchid species) is advised if possible however if this is not practical specialist mitigation measures are proposed.

Plate 8.3: Bee Orchid and Plate 8.4a, 8.4b and 8.4c Common Spotted Orchid and Pyrimidal Orchid recorded in areas of Dry calcareous and neutral grassland (GS1) habitat.

8.3.2.2.5 Marsh (GM1)

Marsh habitat is found where soils are waterlogged or where the water table is close to ground level for most of the year (Fossitt, 2000). The area of Marsh (GM1) habitat within the greater Study Area was limited to a small area in the centre of the site where there is a natural depression in the local topography. A small proportion of this Marsh (GM1) habitat occurs within the proposed development site along the northern boundary. Species composition included a large proportion of broadleaved wetland species intermixed with stands of large sedge and grasses, the latter grasses and sedges not exceeding 50% proportion of overall plant cover. Common fleabane *Pulicaria dysenterica* was abundant in the marsh habitat along with frequently occurring Lesser pond Sedge, Water Horsetail, Greater Birds Foot Trefoil and Meadow vetchling. Occasional occurrence of False Oat Grass, Hard rush, Purple loostrife, Water Mint *Mentha aquatica* and *Carex flacca*. Marsh may contain pockets of the annexed habitat, 'hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430)'. A review of the Article 17 Annex I datasets did not show records for this Annex I habitat within the development site, the closest being c3.5km to the north west along Crompaun River (a tributary of the River Shannon). Annex I 'hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430) is known to occur in lowland flood plains along the unmanaged edges of slow moving rivers and the margins of lakes. While the species composition in particular the broadleaved component was well represented within the the Marsh habitat recorded onsite it is considered that it did not fully conform well to this Annex I habitat type due to the rekative abundance of large sedges such as Lesser pond sedge which was frequent in this habitat.

Evaluation: The area of Marsh (GM1) habitat which is located within the proposed development site is evaluated as being of **Local Importance (Higher Value).**

8.3.2.2.6 Drainage Ditches (FW4)

A network of man-made ditches have been installed around the perimeter of the former Limerick Racecourse track and throughout the wider Study Area. These drainage ditches were distributed as follows;

- Along the northern and north-eastern perimeter of the wider Study Area;
- Draining the undeveloped fields in the south of the Study Area;
- Around the perimeter and bisecting the former horse racecourse
- Smaller series of drains leading to the lagoon (constructed wetland).

The perimeter of the former racecourse is lined almost in its entirety by drainage ditches measuring approximately 1m wide and 0.5m deep, a network of similar sized drainage ditches also criss-cross the interior of the former racecourse. The drainage ditches within the proposed development site boundaries were largely over grown with vegetation and have not been maintained for some time. The drainage ditches contained some shallow water in places (in the central area) but in the main were largely dry. Species composition within the drain varied depending on water levels. Bullrush *Typha latifolia* was abundant in parts of the drain containing standing water, other species included occasional Fools water cress *Apium nodiflorum,* Soft rush *Juncus effusus*, Hard rush, and Lesser Pond Sedge. The sides of the drains were composed of herbaceous species including frequently occurring grasses False Oat grass, Yorkshire fog, occasional sedge Carex ovalis and Hard rush *Juncus inflexus* The broadleaved herb component included occasionally occurring Meadowsweet, Meadow vetchling, Nettle, Water horsetail, Marsh bedstraw *Galium palustre*, Great Willowherb *Epilobium hirsutum.* There was an occasional occurrence of semi mature trees which included Grey willow *Salix cinerea* and Whitethorn *Crataegus monogyna* . In drier parts of the drainage ditches bramble and False Oat grew abundantly within and along the sides of the drainage ditches along with frequently occurring Creeping thistle, Cleaver *Galium aparine*, Yorkshire fog, Cocksfoot, Creeping buttercup, Meadow buttercup and Ribwort plantain.

Evaluation: The Drainage ditch habitat (FW4) located within the proposed development site is evaluated as being of **Local Importance (Lower Value).**

8.3.2.2.7 Wet willow-alder-ash woodland (WN6)

Wet willow-alder-ash woodland (WN6) was recorded along the central track which runs through the former racecourse field, in the fields that run parallel to Ballynaclogh River and in scattered patches throughout the Study Area. The maturity of the Wet willow-alder-ash woodland (WN6) varied from a limited number of mature stands to the more commonly recorded semi-mature woodland type. This semi mature Wet willow alder ash woodland has developed over time from the immature willow stands and willow scrub that have colonised the site since active management of the lands have ceased. Within the proposed development site boundary Wet willow-alder-ash woodland (WN6) occurred in pockets near the south western boundary, in the southeast of the site and along the northern boundary. A mature stand of frequently occurring Grey willow *Salix cinerea*, White Willow, Ash and occasional Osier was recorded along the south western boundary adjacent to the access track. The understory consisted of dense and abundantly occurring bramble, nettle and creeping thistle.

Areas of semi mature Wet willow-alder-ash woodland (WN6) were composed of frequently occurring Grey Willow, occasional White Willow *Salix alba* and Osier *Salix viminalis* trees and rarely occurring Alder *Alnus glutinosa*. The subcanopy layer was composed of occasional White thorn and the ground flora consisted of frequent Yorkshire fog, Nettle and Creeping Buttercup and occasional Water Figwort *Scrophularia auriculata*, Lesser Pond Sedge and Water Horsetail. The Wet willow-alder-ash woodland habitat did not conform well to the description presented in Fossitt (2000) possibly due to the fact that ground conditions are not permanently waterlogged and at times drier conditions persist onsite. In addition, it did not correspond well to the priority Annex I habitat EU Habitats Directive, Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae).

Evaluation: The areas of wet willow-alder-ash woodland have been evaluated as being of **Local Importance (Higher Value).**

Plate 8.4: Wet willow alder ash woodland (WN6).

8.3.2.2.8 Mixed broadleaved woodland (WD1)

A limited amount of Mixed broadleaved woodland (WD1) habitat occurred along the southwestern boundary of the proposed development site. The canopy layer consisted of mature Sycamore *Acer pseudoplatanus* and White Willow trees which occurred frequently. The sub-canopy or shrub layer consisted of frequent White thorn under which the ground flora was dominated by a dense cover of abundantly occurring bramble and frequently occurring nettle and creeping thistle.

Evaluation: The area of Mixed Broadleaved woodland has been evaluated as being of **Local Importance (Higher Value).**

8.3.2.2.9 Hedgerow (WL1)

An area of hedgerow habitat (WL1) located in the centre of the proposed development site along the southern permimeter of the former race course track was composed of a linear stand of the ornamental shrub *Skimmia* spp which has matured and is now c 4m in height. The understory of the hedgerow was composed of abundantly occurring Ivy. Further south the hedgerow was composed of abundantly occurring Grey Willow and frequently occurring Osier. The understory consisted of abundant Ivy and frequent Creeping thistle, bramble, Nettle, False Oat grass and occasional Great willowherb and Yorkshire fog. Buddleia occurred rarely in this hedgerow.

Evaluation: The area of Hedgerow (WL1) has been evaluated as being of **Local Importance (Lower Value).**

8.3.2.2.10 Immature woodland (WS2)

Immature woodland (WS2) within the proposed development site mainly consisted of Willow tree species which have started to naturally colonise the site since management of the area has ceased. Grey Willow was the most abundantly recorded immature woodland tree species intermixed with frequent White Willow and occasional alder. Ground flora within the immature woodland was composed of herbaceous species including the frequent Yorkshire fog, False Oat grass and occasional Creeping bent, Cocksfoot grass, Red fescue, Crested dogstail *Cynosurus cristatus* and Sweet vernal grass. Broadleaved herbs were well represented particularly close to the margins of the woodland and in the immature woodland in the north of the proposed development site, species here typically included frequent Black medick, Red and White clover, Meadow buttercup, Creeping cinquefoil, meadow vetchling, Ribwort plantain, Coltsfoot, Oxeye daisy, Dandelion, Herb Robert *Geranium robertanium* and occasional Silverweed, Bush vetch, Selfheal, Wild carrot, Ragwort, Tormentil *Potentilla erecta*, Bartsia *Odontites vernus*, Common knapweed, Blackstonia *Blackstonia perfoliata*, Nettle. Rarely occurring species included Square stalked St. Johns Wort *Hypericum tetrapterum*, Eyebright *Euphrasia* spp. A number of orchid species were recorded along the margins of rough paths within the immature willow woodland including the Bee Orchid, Pyramidal Orchid and the Common Spotted Orchid. A number of Bee Orchids within this immature woodland habitat were recorded within the boundaries of the proposed development site (See Figure 8.8).

Evaluation: The Immature Woodland habitat has been evaluated as being of **Local Importance (Higher to Lower Value)** depending on the diversity of ground flora recorded with the higher value attributed to the immature woodland that currently supports a good diversity of plant species within the ground flora including some orchid species**.**

Plate 8.5: Immature woodland (WS2)

8.3.2.2.11 Scrub (WS1)

Scrub habitat (WS1) was recorded in areas where former recolonising bare ground and mounds from previous excavation works existed. Over time species such as abundantly occurring bramble and frequently occurring gorse, and young willow trees have colonised these areas other frequently occurring species in this scrub habitat included nettle, creeping thistle and False Oatgrass.

Evaluation: The area of Scrub (WS1)has been evaluated as being of **Local Importance (Lower Value).**

8.3.2.2.12 Spoil and bare ground (ED2)

Spoil and bare ground habitat (ED2) was present in the form of a network of unpaved site access tracks and in places heaps of spoil/rubble which had not been fully colonised by plant species. As the site has not undergone disturbance in recent times the areas of spoil and bare ground are starting to vegetate particularly along the centre of tracks and along the margins. Pioneer species often associated with disturbed ground were recorded here including frequent Black medick, Red and White clover, Coltsfoot, Dandelion, Selfheal, Annual meadow grass *Poa annua*, Ribwort plantain and occasional Hawksbeard, Mouse ear hawkweed, Greater plantain, Scarlet pimpernel *Anagallis arvensis,* Wild carrot, Groundsel, Common knapweed, Hard rush, Oxeye daisy, Red fescue, Creeping cinquefoil, Tufted vetch, Yarrow. Rarely occurring species included Fairy flax, Teasal, Field scabious, Lesser stitchwort and Square stalked St.Johns Wort.

Evaluation: The area of Spoil and bare ground (ED2)has been evaluated as being of **Local Importance (Lower Value).**

8.3.2.2.13 Recolonising bare ground (ED3)

Large areas of recolonising bare ground habitat (ED3) were present in the wider environment due to past site clearance and construction activities. Heaps of construction rubble and spoil have been left to revegetate and have led to a highly variable topography in places. Species colonising these areas included a large proportion of pioneer species and species associated with disturbed ground as well as some non-native invasive plant species e.g. Buddleia, Himalayan honeysuckle and Montbretia. False oat grass was abundant. Frequently occurring plants included Bramble, Large bindweed *Calystegia sylvatica*, Red and White Clover, Wild carrot, Selfheal, Black medick, Ribwort plantain, Crested dogs tail, Yorkshire fog, Coltsfoot, Birds foot trefoil, Hawksbeard, Creeping thistle, Nettle, Dandelion, Oxeye daisy. Occasionally occurring species included Teasal, Hoary willowherb *Epilobium parviflorum*, American willowherb *Epilobium ciliatum,* Silverweed, Herb Robert, Blackstonia, Nipplewort, Greater plantain, Common knapweed, Grey willow, Gorse, Hard rush, Birds foot trefoil, Creeping bent, Common century, Scarlet pimpernel, Ragwort, Fairy flax. Rarely occurring species included Common fleabane *Pulicaria dysenterica*, Eyebright and Square stalked St Johns Wort.

Evaluation: The area of Recolonising bare ground (ED3) has been evaluated as being of **Local Importance (Lower Value).**

8.3.2.2.14 Buildings and Artificial Surfaces (BL3)

Buildings and artificial surfaces habitat (BL3) was present on the main tarmacked entrance road and roundabout leading into the proposed development site from Dock Road. Very little was growing on the tarmac surface, along the margins species such as annual meadow grass, Lesser trefoil *Trifolium dubium*, Black medick and Groundsel *Senecio vulgaris* were recorded occasionally.

Evaluation: The area of Buildings and Artificial Surfaces (BL3)has been evaluated as being of **Local Importance (Lower Value).**

8.3.2.2.15 Wet grassland/Scrub (GS4/WS1)

A mosiac of Wet grassland/Scrub (GS4/WS1) habitat was recorded where lack of grazing and management has resulted in the colonisation of wet grassland habitat with a sparse distribution of young Grey and White willow saplings along with Bramble and Gorse. The ground flora was similar to the wider wet grassland habitat recorded onsite and included frequent Yorkshire fog, False Oat Grass, Creeping Buttercup, Red Fescue, Creeping thistle, Common mouse-ear, Ribwort plantain, Ragwort, with occasional Silverweed, Sweet vernal grass, Soft rush, Curly Dock, Broad leaved Dock, Ribwort plantain, Hard Rush and Meadow Buttercup.

Evaluation: The area of Wet grassland/Scrub (GS4/WS1)has been evaluated as being of **Local Importance (Lower Value).**

8.3.2.2.16 Dry meadows and grassy verges/Scrub (GS2/WS1)

A mosiac of Wet grassland/Scrub (GS4/WS1) habitat was recorded in the south west corner of the proposed development site where historically disturbed ground and mounds from previous excavation works have been recolonised by grassland and scrub species such as frequently occurring bramble, nettle, creeping thistle, False oat grass, and Cocks foot grass.

Evaluation: The area of Wet grassland/Scrub (GS4/WS1)has been evaluated as being of **Local Importance (Lower Value).**

8.3.2.2.17 Treelines (WS2)

A small section of a treeline occurred along the eastern boundary of the site, this was composed of frequent semi- mature sycamore, Grey willow and Whitethorn, occasional White willow and rare Pedunculate Oak and Osier. The base of the treeline was composed of frequent Bramble, Creeping thistle and False oat grass.

Evaluation: The area of Wet grassland/Scrub (GS4/WS1)has been evaluated as being of **Local Importance (Lower Value).**

8.3.2.3 Desktop Study- Non-native Invasive plant species

The NBDC[12] database and BSBI database for the R55S and R55M 2km grid squares overlapping the study site hold records for ten non-native invasive plant species including Canadian Waterweed *Elodea Canadensis*, Nutalls Water Weed Elodea nutallii, Japanese Knotweed *Fallopia japonica,* Winter heliotrope *Petasites fragrans,* Buddleia *Buddleja davidii*, Montbretia *Crocosmia × crocosmiiflora*, Himalayan Honeysuckle *Leycesteria formosa*, Sycamore *Acer pseudoplatanus*, Giant Hogweed *Heracleum mantegazzianum*, Field Penny-cress *Thlaspi arvense* and Travellers Joy *Clematis vitalba.* Four of these species, Japanese Knotweed, Giant hogweed, Nuttall waterweed and Canadian waterweed are categorised as High Impact invasive species (Kelly *et al*., 2013; NBDC dataset) and listed in the Third Schedule Part I under Regulations 49 and 50 of the European Communities (Birds and natural Habitats) Regulations 2011. The remaining species are medium risk and low risk.

Table 8.4: List of the non-native invasive plant species within the 2km grid squares overlapping the study site (R55S and R55M).

Common Name	Scientific Name	Listed in Third Schedule Part I * (Y/N)	Risk Rating (Kelly *et al*., 2013) and/or NBDC Risk rating
Japanese Knotweed	*Fallopia japonica*	Y	High
Himalayan honeysuckle	*Leycesteria formosa*	N	Medium
Nuttalls waterweed	*Elodea nuttallii*	Y	High
Canadian Waterweed	*Elodea canadensis*	Y	High
Travellers joy	*Clematis vitalba*	N	Medium
Field Penny-cress	*Thlaspi arvense*	N	Medium
Montbretia	*Crocosmia pottsii x aurea = C. x crocosmiiflora*	N	N/A
Winter heliotrope	*Petasites fragrans*	N	Low
Sycamore	*Acer pseudoplatanus*	N	Medium
Buddleia	*Buddleja davidii*	N	Medium
Giant Hogweed	*Heracleum mantegazzianum*	Y	High

8.3.2.4 Existing Environment- Non-native Invasive Species

No plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (i.e. species of which it is a legal offense to disperse, spread or otherwise cause to grow in any place) or classified as a 'risk of high impact invasive species' (Kelly et al. 2013) were recorded within the study site. In total five non-native invasive plant species were recorded during the 2020 habitat survey including;

- Himalayan honeysuckle (*Leycesteria 112ormosa*);
- Fuchsia (*Fuchsia magellanica*)
- Buddleia (*Buddleja davidii*)
- Travellers Joy (*Clematis vitalba*)
- Montbretia (*Crocosmia pottsii x aurea = C. x crocosmiiflora*)
- Sycamore (*Acer pseudoplatanus*)

[12] https://maps.biodiversityireland.ie/Map (accessed 09/10/2020)

Himalayan honeysuckle, Travellers Joy and Buddleia are classified as a 'risk of medium impact invasive species' (Kelly *et al.* 2013) but not listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011. Fuchsia and Montbretia are not as yet classified.

8.3.3 Aquatic Ecology

The following section summarises each aquatic survey site in terms of aquatic habitats, physical characteristics and overall value for fish, amphibians, macrophyte communities and macro-invertebrates. Physio-chemical water quality results are also summarised. Habitat codes are according to Fossitt (2000). Scientific names are provided at first mention only. An evaluation of the ecological importance of each survey site based on the aquatic surveys is provided below and summarised in Table 8.7.

8.3.3.1 Desktop review- Aquatic Ecology

A sensitive species data request for aquatic flora and fauna covering 10km grid squares containing and adjoining the proposed land redevelopment site (i.e. R55) revealed records for a number of protected (freshwater) aquatic species in the vicinity of the proposed land redevelopment site, as did data from the National Biodiversity Data Centre.

Records for two plant species listed under the Flora (Protection) Order 2015 were available for the wider study area. Triangular clubrush (*Schoenoplectus triqueter*), a rare and highly threatened vascular plant species in Britain and Ireland, restricted to tidal stretches of rivers (Preston, 2003), is widespread along Ballynaclogh River within the Lower River Shannon SAC (002165) (NPWS data; see Figure 3.1). No available records overlapped with the survey sites. Furthermore, opposite-leaved pondweed (*Groenlandia densa*), a sensitive macrophyte species associated with the tidal reaches of rivers and associated drainage channels, also listed under the Flora (Protection) Order 2015, is known from numerous locations along Ballynaclogh River in the vicinity of the study area (NPWS data; see Figure 3.1). Groenlandia densa is typically found on tidal mud along Ballynaclogh River (Ballynaclogh River) (Reynolds, 2013). No available records overlapped directly with the survey sites. Whilst two historical records for the mint species pennyroyal (*Mentha pulegium*) were available for grid square R55 (near Rossbrien), no other contemporary records for FPO aquatic plant species in the vicinity of the study area were available.

Numerous records for kingfisher (*Alcedo atthis*) were available from grid square R55, with multiple records within 2km grid square R55M in the vicinity of the study area at the bridge on Dock Road (NBDC data). No records overlapped with the Greenpark Racecourse study area. Records for common frog (*Rana temporaria*), smooth newt (*Lissotriton vulgaris*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*) and otter (*Lutra lutra*) were also available for grid square R55 although none overlapped with the study area (NPWS data, NBDC data).

Although records existed for giant hogweed (*Heracleum mantegazzianum*) and winter heliotrope (*Petasites fragrans*) within the Greenpark study area (NBDC data), no other non-native invasive plant records were available.

8.3.3.2 Existing Environment- Aquatic Ecology

8.3.3.2.1 Site 1A – unnamed drainage channel (along site boundary)

Site 1A was located on the largest drainage channel (FW4 habitat; Fossitt, 2000) within the study area. The artificial channel averaged 3m wide and 0.5m deep. The water was stagnant at the time of survey with over 90% cover of common duckweed (*Lemna minor*). The drainage ditch was contained in a deep U-shaped channel with 2-2.5m bankfull heights. The substrata comprised 100% silt, which was anoxic and invariably >0.5m in depth. The emergent macrophytes comprised locally frequent water horsetail (*Equisetum fluviatile*), blue water speedwell (*Veronica anagallis-aquatica*) and lesser water parsnip (*Berula erecta*). Submerged species included locally frequent common water starwort (*Callitriche stagnalis*) and occasional Canadian pondweed (*Elodea canadensi*s). The riparian zones comprised rank grassy embankments (GS2 habitat) of sweet vernal grass (*Anthoxanthum odoratum*), timothy grass (*Phleum pratense*), Yorkshire fog (*Holcus lanatus*), great willowherb (*Epilobium hirsutum*), field horsetail (*Equisetum arvense*), common figwort (*Scrophularia nodosa*), thistles (*Cirsium* spp.) and scattered grey willow (*Salix cinerea*). The drainage channel was bordered by industrial premises to the north (BL3) with storm water outfalls from hard surfaces scattered along the channel. Evidently, the water was heavily polluted due to stagnation and limited flows (foul odour present). The very high cover of common duckweed indicated heavy enrichment of the ditch.

Site 1A offered very poor fisheries habitat given its stagnant, heavily vegetated and heavily silted nature. The highly pollution-tolerant three-spined stickleback (*Gasterosteus aculeatus*) were present in high numbers (as inferred from sweep samples). Whilst some limited suitability existed for European eel, the channel was considered sub-optimal given the overall poor water quality and general fisheries habitat. The site was not of value for any other fish species.

The aquatic ecological evaluation of site 1A was of **local importance (lower value).**

Plate 8.6: Representative image of site 1A (facing downstream towards road culvert).

8.3.3.2.2 Site 1B – unnamed drainage channel (downstream of site boundary)

Site 1B was located downstream of site 1A outside of the site boundary and north of the Limerick Greyhound Stadium. Here, the drainage channel (FW4) averaged 2-3m wide and 0.3-0.6m deep, with localised deeper pool areas in association with various culverts. As with site 1A upstream, the water was stagnant at the time of survey with a very high surface cover of common duckweed. The drainage ditch was contained in a deep U-shaped channel with 2-2.5m bankfull heights which were bound in very dense bramble (*Rubus fruticosus* agg.) and grey willow-dominated scrub (i.e. high riparian shading). This typically precluded macrophyte growth but some common water starwort, Canadian pondweed, blue-water speedwell and common reed (*Phragmites australis*) was present in more open areas towards the Ballynaclogh River confluence (culvert). The substrata comprised 100% silt, which was anoxic and invariably >0.5m in depth. The drainage channel was bordered by dense scrub (WS1) on both banks with Limerick Greyhound Stadium to the south. The lower reaches of the drainage channel had some low tidal influence from Ballynaclogh River.

In terms of fisheries potential, site 1B offered poor fisheries habitat given its largely stagnant, heavily vegetated and heavily silted nature. The highly pollution-tolerant three-spined stickleback were present in high numbers (as inferred from sweep samples). Whilst some limited suitability existed for European eel, the channel was considered sub-optimal given the overall poor water quality and general fisheries habitat. Connectivity with Ballynaclogh River appeared limited in terms of fish accessibility (i.e. poorly accessible culverts).

The aquatic ecological evaluation of site 1B was of **local importance (lower value).**

Plate 8.7: Representative image of site 1B located at the culvert leading to Ballynaclogh River.

8.3.3.2.3 Site 2A – unnamed drainage channel

Site 2A was a U-shaped drainage channel (FW4) which followed an east-west direction to the northern extent of the site boundary. The ditch averaged 1.5m wide and contained some localised and very shallow standing water (0.05m deep max.) at the time of survey. The channel had a 1-2m bankfull height. The ditch had a 100% (anoxic) silt base, which was invariably >0.3m in depth. The macrophyte community was dominated by common reed. Common duckweed was highly abundant (>90% surface cover). The riparian areas were dominated by bramble scrub and great pond sedge (*Carex riparia*) with scattered hawthorn (*Crataegus monogyna*) and grey willow. Encroachment of soft rush (*Juncus effusus*) and other terrestrial species was frequent. Common frog and tadpoles were recorded in a pool at the western extent of the channel in May 2020 (however, site dried out thereafter). The water levels were too low during the site visit to collect physiochemical water data.

Given the capacity to support breeding common frog (at least seasonally), the aquatic ecological evaluation of site 2A was of **local importance (higher value).**

Plate 8.8: Representative image of site 2A (near western extent of channel).

8.3.3.2.4 Site 2B – unnamed drainage channel

Site 2B was a U-shaped drainage channel (FW4) which followed a southeast-northwest direction and adjoined site 2A. The ditch averaged 1-1.5m wide and contained some localised and very shallow standing water (0.05m deep max.) at the time of survey. The channel had a 1m bankfull height. The ditch had a 100% (anoxic) silt base, which was invariably >0.3-0.5m in depth. The macrophyte community was dominated by common reed, which was abundant both instream and along riparian areas. Common duckweed was abundant where standing water persisted (>90% surface cover). The riparian areas were dominated by bramble scrub and great pond sedge with scattered hawthorn and grey willow. The water levels were too low during the site visit to collect physiochemical water data.

Given the semi-dry nature of the site and general lack of fisheries habitat, the aquatic ecological evaluation of site 2B was of **local importance (lower value).**

Plate 8.9: Representative image of site 2B (near eastern extent of channel).

8.3.3.2.5 Site 2C – unnamed drainage channel

Site 2C was a U-shaped drainage channel (FW4) which followed a southeast-northwest direction and adjoined site 2A. The ditch averaged 1.5-2m wide and contained some localised and very shallow standing water (0.2m deep max.) at the time of survey. The channel had a 1-1.5m bankfull height. The ditch had a 100% (anoxic) silt base, which was invariably >0.5m in depth. The macrophyte community was dominated by common reed, which was abundant both instream and along riparian areas. Common duckweed was abundant where standing water persisted (>95% surface cover). The riparian areas were dominated by common reed and great pond sedge with scattered grey willow, hawthorn and bramble scrub. The water levels were too low during the site visit to collect physiochemical water data.

Given the semi-dry nature of the site and general lack of fisheries habitat, the aquatic ecological evaluation of site 2B was of **local importance (lower value).**

Plate 8.10: Representative image of site 2C.

8.3.3.2.6 Site 3 – unnamed drainage channel

Site 3 was a deep U-shaped drainage channel (FW4) which averaged 1-1.5m in width and followed an east-west direction along the northwestern boundary of the site. The ditch had 2.5m high bankfull height and was dry at the time of survey. However, the channel was evidently seasonal (i.e. contains water during wetter periods). The base of the channel (100% mud) supported great pond sedge and common reed. The riparian areas supported rank grasses, bramble, gorse (*Ulex europaeus),* thistle (*Cirsium* spp.), great willowherb with scattered hawthorn, osier (Salix viminalis), grey willow and occasional ash (*Fraxinus excelsior*). The water levels were too low during the site visit to collect physiochemical water data.

Given the semi-dry nature of the site and general lack of fisheries habitat, the aquatic ecological evaluation of site 3 was of **local importance (lower value).**

Plate 8.11: Representative image of site 3.

8.3.3.2.7 Site 4A – unnamed drainage channel

Site 4A was a deep U-shaped drainage channel (FW4) which averaged 1-1.5m in width and followed an east-west direction along the northwestern boundary of the site. The ditch was flanked by a regularly used public footpath to the south and had bankfull heights of 1m high and was evidently seasonal (i.e. contains water during wetter periods). The base of the channel supported localised reedmace (*Typha latifolia*), creeping bent grass (*Agrostis stolonifera*) and meadowsweet (*Filipendula ulmaria*). The riparian areas supported rank grasses, scattered hawthorn and grey willow.

Given the semi-dry nature of the site and general lack of fisheries habitat, the aquatic ecological evaluation of site 4A was of **local importance (lower value).**

Plate 8.12: Representative image of site 4A (100% dry channel).

8.3.3.2.8 Site 4B – unnamed drainage channel

Site 4B was a deep U-shaped drainage channel which averaged 2.5m wide and 0.2-0.3m deep. The stagnant channel connected sites 3 and 4A and followed a north-south direction. The channel featured bankfull heights of 2-2.2m. The substrata comprised 100% anoxic silt (black in colour). The macrophyte community was dominated by common reed and water horsetail, with occasional water mint (*Mentha aquatica*) in marginal areas. The surface had a very high cover of common duckweed (>75% surface cover). The riparian areas comprised scattered hawthorn, bramble, nettle (*Urtica dioica*), thistle, meadowsweet, great willowherb and rank grasses (WS1 and GS2 habitats).

The channel supported three-spined stickleback but was not considered of fisheries value for other species. Common frog were recorded during the site visit.

Given the semi-dry nature of the site and general lack of fisheries habitat, the aquatic ecological evaluation of site 4B was of **local importance (higher value).**

Plate 8.13: Representative image of site 4B.

8.3.3.2.9 Site 4C – unnamed drainage channel

Site 4C was a U-shaped drainage channel which averaged 2.5m wide and followed an east-west direction (an offshoot of site 4B). The channel was 100% dry at the time of survey and featured bankfull heights of 2-2.2m. The ditch had a 100% wet mud base. The macrophyte community was dominated by common reed with locally frequent water horsetail and great pond sedge. The riparian areas were dominated by bramble scrub (WS1) and great pond sedge with scattered hawthorn and grey willow.

Given the seasonal, semi-dry nature of the site and lack of fisheries habitat, the aquatic ecological evaluation of site 4C was of **local importance (lower value).**

Plate 8.14: Representative image of site 4C.

8.3.3.2.10 Site 5 – unnamed drainage channel

Site 5 was a U-shaped drainage channel (FW4) which averaged 2m wide and contained stagnant water 0.1-0.3m deep. The site followed a north-south orientation and connected to Ballynaclogh River via a 1200mm culvert and headwall at the southern extent of the channel (i.e. near site 7A). To the north, the channel adjoined the attenuation pond/wetland at survey site 6. The channel had a deep silt base (with black anoxic silt) invariably >0.2m deep. The drainage channel had lush vegetation growth comprising frequent water horsetail and great pond sedge with localised water mint and blue water speedwell. Bulrush was occasional instream. Submerged and or floating macrophyte species were limited to *Callitriche* species (rare). Duckweed species were abundant (>75% surface cover) with both common duckweed (*Lemna minor*) and least duckweed (*Lemna minuta*) present. The riparian zone comprised alder (*Alnus glutinosa*) saplings, grey willow and osier with abundant nettle and bramble scrub. Common figwort, cleavers (*Galium aparine*), great willowherb, creeping buttercup (*Ranunculus repens*), meadow buttercup (*Ranunculus acris*), meadow vetchling (*Lathyrus pratensis*) and dog rose (*Rosa canina*) were also present.

The channel supported three-spined stickleback but was not considered of fisheries value for other species. Common frog (and tadpoles) were recorded during the site visit.

Given the presence of common frog, the aquatic ecological evaluation of site 5 was of **local importance (higher value).**

Plate 8.15: Representative image of site 5 (southern extent of channel).

83.3.2.11 Site 6 – wetland

Site 6 was a relatively large artificial wetland habitat (FL8; capacity c. 23,000m^3) colonised by extensive reed swamp habitat (FS1). Common reed dominated the basin. The littorals supported very localised stands of great pond sedge and bulrush with scattered grey willow saplings. A small area (0.05ha) of open water was present in the centre of the wetland, which supported a dense mat of least duckweed (no submergent species). Indeed, this species was highly abundant throughout both open and in the reed-shaded areas of standing water (80% surface coverage). Water horsetail and marsh bedstraw (*Galium palustre*) were occasional in the margins with water mint and blue water speedwell recorded as rare. No submerged or floating macrophytes were recorded (very high surface coverage). The water depth averaged 1-2m with the substrata comprising of 100% soft silt (anoxic) with high clay fractions. The wetland was bordered by a mosaic of dense scrub supporting bramble, nettle, gorse, dog rose and creeping thistle, with dry meadow and grassy verge habitat (GS2). This bordering habitat supported a diverse range of species including common knapweed (*Centaurea nigra*), cocksfoot (*Dactylis glomerata*), Yorkshire fog, meadow vetchling, hard rush (*Juncus inflexus*), field horsetail, curled dock (*Rumex crispus*), nettle, field bindweed (*Convolvulus arvensis*) great willowherb, false oat grass (*Arrhenatherum elatius*), tormentil (*Potentilla erecta*) and vetches (*Vicia* spp.) The south bank (including embankment alongside Ballynaclogh River) featured mature treelines of willow, osier, aspen (*Populus tremula*) and alder, with dense bramble-dominated scrub.

Whilst bird species such as sedge warbler (*Acrocephalus schoenobaenus*) and reed bunting (*Emberiza schoeniclus*) were common, mallard duck (*Anas platyrhynchos*) was the only aquatic bird recorded during the site visit. Common frog and three-spined stickleback were present.

Given that open wetland habitats are very important biodiversity features and in the context of the local area the attenuation pond/ wetland and associated species assemblages can be considered of **local importance (higher value).**

Plate 8.16: Representative image of site 6, facing south showing extensive reed swamp habitat.

8.3.3.2.12 Site 7A – Ballynaclogh River, N18 road bridge

Site 7A on Ballynaclogh River (aka Ballinacurra Creek) represented a tidal channel (CW2), which averaged 14m during normal tidal range. The river was contained in a shallow V-shaped channel adjoining soft mudflat areas (LS4 habitat). Mature, earthen embankments were present along both banks. The tidal channel bed comprised deep silt and water between 1.0m and 4.0m deep, dependent on tidal stage. The channel mudflat margins comprised a gradation of muddy paludal transitional plant communities. Near the water's edge, carpets of *Callitriche* species sprawled on exposed mud that graded into zones of extensive fool's watercress (*Apium nodiflorum*) and redshank (*Persicaria maculosa*). Above this zone, frequent great pond sedge and hemlock water dropwort (*Oenanthe aquatica*) occurred with occasional curled dock, marsh ragwort (*Jacobaea aquatica*), great willowherb and the Flora (Protection) Order, 2015 species triangular clubrush (*Schoenoplectus triqueter*) (forming the along the higher tide mark). Occasional dense beds of common reed replaced this more herb rich zone. The riparian zones of the bank-tops were willow-dominated with osier, grey willow, aspen and more localised alder. In the understories on the tidal channel side, teasel (*Dipsacus fullonum*), meadowsweet, buttercups (*Ranunculus* spp.), common figwort, meadow grasses (*Poa* spp.), daisy (*Bellis perennis*), marsh horsetail (*Equisetum palustre*), wild angelica (*Angelica sylvestris*) and water forget-me-not (*Myosotis scorpioides*) were present amongst the broken, dead common reed stems. No opposite-leaved pondweed (*Groenlandia densa*), a macrophyte species protected under the Flora (Protection) Order, 2015 (S.I. No. 356/2015) and known from Ballynaclogh River, was recorded at the survey site. The species may however be visible during lower ride where it is known to be exposed on muddy banks of the low tide mark and it is considered highly likely that the species remains present at this location (i.e. downstream of the N18 Road Bridge).

The tidal channel was known to support a range of common fish species such as flounder (*Platichthys flesus*) and thick-lipped mullet (*Chelon labrosus*) (pers. obs.). The site also offered good European eel habitat.

Given that the site was located within the Lower River Shannon SAC (002165), the aquatic ecological evaluation of site 7A was of **International importance.**

Plate 8.17: Representative image of site 7A on Ballynaclogh River.

8.3.3.2.13 Site 7B – Ballynaclogh River, north of Limerick Greyhound Stadium

Located approx. 1.1km downstream from site 7A, Site 7B on Ballynaclogh River (aka Ballynaclogh River) represented a tidal channel (CW2), which averaged 15-16m during normal tidal range. The river was contained in a wide U-shaped channel adjoining soft mudflat areas (LS4 habitat). The tidal channel bed comprised deep silt and water between 1.0m and 4.0m deep, dependent on the tidal stage. The channel mudflat margins comprised steeper U-shaped bank than upstream at site 7A. The macrophyte community comprised hemlock water dropwort and fool's watercress, interspersed with beds of common reed. The exposed muddy littorals were dominated by Callitriche species with frequent curled dock. No opposite-leaved pondweed (*Groenlandia densa*), a macrophyte species protected under the Flora (Protection) Order, 2015 (S.I. No. 356/2015) and known from Ballynaclogh River, was recorded at the survey site.

The tidal channel is known to support a range of common fish species such as flounder and thick-lipped mullet (pers. obs.). The culvert headwall area (confluence with site 1B) was found to support abundant juvenile flounder at the time of survey (Plate 3.14). The site also offered good European eel habitat.

Given that the site was located within the Lower River Shannon SAC (002165), the aquatic ecological evaluation of site 7A was of **International importance.**

Plate 8.18: Representative image of site 7B on Ballynaclogh River.

Plate 8.19: Juvenile flounder and opossum shrimp (*Neomysis integer*) recorded via sweep netting at site 7B.

Plate 8.20: Abundant common frog tadpoles recorded in a pool at the western extent of site 2A in May 2020 before the site subsequently dried out.

8.3.3.3 Amphibians

Common frogs were recorded from several locations during the site visit, namely survey sites 2A, 4B, 5 and 6. Overall, those drainage channels containing standing/stagnant water provided better suitability for amphibians, with site 6 (wetland) providing the best amphibian habitat overall. Notably, common frog and tadpoles were recorded in a small stagnant pool at the western extent of drainage channel 2A during a preliminary site visit on Thursday 21st May 2020 (see Plate 3.15 above). However, a subsequent site visit revealed this location dried out with a total loss of tadpoles.

Sweep netting of aquatic survey sites in June 2020 did not reveal the presence of smooth newt (*Lissotriton vulgaris*), despite some suitability (e.g. site 6 wetland). The species may occur on the site but can have poorly detectable cryptic populations at sites where low population densities occur. In this respect if newt were widespread and the population densities were high they would have been detected during the aquatic site surveys. There were no available records for smooth newt which overlapped the study area (NBDC data, NPWS data).

8.3.3.4 Physiochemical water quality

A total of *n*=4 physiochemical water samples were collected and analysed from two drainage channels (site 1A & 5), one wetland site (site 6) and Ballynaclogh River (site 7B) within the footprint of the proposed land redevelopment site.

The physiochemical water quality recorded at *n*=4 sampling sites is summarised below in Table 8.5. Site 1A (drainage channel), site 5 (drainage channel) and site 6 (wetland) featured high alkalinity (≥228mg/l $CaCO_3$) and very high conductivity (≥660µS/cm). In light of a low salinity values (≤0.3ppt) at sites 1A and 6, such high conductivity readings would indicate a source of contamination/pollution. Indeed, measured levels of total ammonia at sites 1A and 5 were high (i.e. ≥0.126mg N/l) and the sites failed to meet 'good status' standards (i.e. ≤0.065 mg N/l) according to S.I. No. 77/2019 - European Union Environmental Objectives (Surface

Waters) (Amendment) Regulations 2019. Site 6 (wetland) was achieving 'good status' according to S.I. No. 77/2019 based on total ammonia levels. No standards for total ammonia are set out for transitional water bodies (e.g. Ballynaclogh River, site 7B).

Levels of Total Oxidised Nitrogen (TON) (nitrate + nitrite in combination) were high at site 1A and 5 (0.803 and 1.279mg N/l), respectively. In most instances the nitrite fraction comprises <1% of the total, so total oxidised nitrogen and nitrate are considered equivalent. The European Union Environmental Objectives (Surface Waters) (Amendment) Regulations 2019 (S.I. 77 of 2019) sets no specific boundary conditions for nitrate. However, EPA assessment of high-quality water sources has set boundary conditions of 0.8 mg/l NO_3-N (nitrate as nitrogen) for high quality waters and 1.8 mg/l NO_3-N for good quality waters. Thus, the drainage channels at sites 1A and 5 met good quality standards based on total oxidised nitrogen levels. The wetland at site 6 featured very low TON levels (0.013mg N/l). No standards for TON are set out for transitional water bodies (e.g. Ballynaclogh River, site 7B).

With regards nutrients, levels of molybdate reactive phosphate (MRP) (0.084mg P/l) and total phosphorus (0.168mg P/l) were particularly high at site 6 (wetland), thus indicating enrichment (Table 8.5). The wetland site failed to meet good status as required in the Surface Water Regulations (i.e. MRP levels ≤0.035mg P/l, total phosphorus ≤0.025mg P/). Ballynaclogh River achieved 'high status' (≤0.030mg P/l at 0-17ppt salinity) under S.I. No. 77/2019 according to MRP levels (i.e. 0.029mg P/l at site 7B).

The chlorophyll a level of site 6 (25.3µg/l) indicated the wetland site was moderately eutrophic (according to OECD, 1982) and, therefore, the risk of deoxygenation and level of enrichment was considered higher.

Dissolved oxygen levels were low across all four sampling sites (Table 8.5) but were particularly low at sites 1A and 6 (≤3.2mg O_2/l, ≤6.5%). The low levels recorded are likely due to poor water flows and lack of wind action given the recessed nature of watercourses and or steep banks, as well as the proliferation of reed lines in the wetland sheltering the waterbody. This would prevent aeration by wind breaking surface tension and increasing the area for oxygen diffusion into the waterbodies.

Table 8.5: Summary of physio-chemical water quality results for Greenpark Racecourse, July 2020. (*parameter measured using handheld meters on site)

Parameter	Site 1A – drainage channel	Site 5 – drainage channel	Site 6 - wetland	Site 7B – Ballynaclogh River
pH	7.59	8.06	7.57	8.24
Alkalinity (mg $CaCO_3$/l)	273	198	228	194
Salinity (ppt)	0.3	2.1	0.20	0.9
*** Conductivity (µS/cm)**	796	>3999 (meter maxed out)	660	>3999 (meter maxed out)
Total Ammonia (mg N/l)	0.126	0.249	0.056	0.362
Total Oxidised Nitrogen (mg N/l)	1.279	0.803	0.013	0.916
MRP (mg P/l)	0.020	0.029	0.084	0.029
Total Phosphorus (mg P/l)	--	--	0.168	--
*** Dissolved oxygen (mg O_2/l) (% saturation)**	3.2 (6.5%)	5.5 (11.6%)	2.4 (5.1%)	5.7 (12.2%)
BOD (mg O_2/l)	1.6	1.9	2.3	1.9
COD (mg O_2/l)	25.3	32.6	21.5	49.2
Suspended solids (mg /l)	70.4	106.0	4.6	406.0
Chlorophyll a (µg/l)	--	--	25.3	--

8.3.3.5 Macro-invertebrates

Macro-invertebrate samples were collected and analysed from two drainage channel sites (sites 1A & 5), one wetland site (site 6) and one transitional site (site 7B). A total of *n*=18 species across *n*=17 families were recorded in the sweep samples. The absence of dragonflies and damselflies (Odonata) and a lack of higher diversity of cased-caddis and or beetle species indicate poor water quality overall in the freshwater survey sites. A summary of results is presented in Table 8.6.

Site 1A supported the greatest species diversity (10) of the samples analysed, with the site being dominated by pollution-tolerant species such as *Asellus aquaticus* (hog louse), *Radix balthica* (wandering snail) and *Chironomus* sp. Site 5 was also dominated by *Asellus aquaticus* and *Chironomus* sp. in addition to *Gammarus pulex* (freshwater shrimp). Snail species such as the grazing and filter-feeding *Bithynia tentaculata* and *Valvata cristata* (both present in site 1A) are indicative of more enriched conditions, and their capacity to filter feed allows them to be opportunistic of such environments. No species of higher conservation value than 'least concern' on national Red lists were recorded from sites 1A or 5 (Table 8.6).

The wetland at site 6 was again dominated by *Asellus aquaticus* and *Chironomus* sp. larvae, with low numbers of Dytiscidae, Planorbidae and Limnephilidae and Planariidae. The cased-caddis species *Limnephilus marmoratus* is common in lake and pond habitats with prolific plant growth.

The transitional site 7B, located on Ballynaclogh River, supported a very low macro-invertebrate species diversity dominated by *Neomysis integer* (opossum shrimp) and *Potamopyrgus antipodarum* (Jenkins' spire snail). *Neomysis integer* is a dominant mysid shrimp in the upper reaches of estuaries but it uncommon in fully marine habitats.

In summary, no macro-invertebrate species of higher conservation concern than 'least concern' on National Red lists were recorded from the Greenpark Racecourse survey sites (Table 8.6).

Table 8.6: Summary of the macro-invertebrates recorded from samples from Greenpark Racecourse, June 2020.

Group	Family	Species	Site 1A	Site 5	Site 6	Site 7B	Irish Red list
Amphipoda	Gammaridae	*Gammarus pulex*		24			
Annelida	Naididae (Tubificidae)	*Naididae (Tubificidae)*	17				
Annelida	Hirudinea	*Glossiphonia complanata*		1			
Coleoptera	Dytiscidae	*Dytiscidae larva*		1	2		
Coleoptera	Hydrophilidae	*Helophorus aequalis*		1			Least concern
Coleoptera	Dytiscidae	*Hydroporus tessellatus*			1		Least concern
Diptera	Chironomidae	*Chironomus* sp.	25	75	46		
Isopoda	Asellidae	*Asellus aquaticus*	144	54	29		
Malacostraca	Mysidae	*Neomysis integer*				69	
Mollusca	Bithyniidae	*Bithynia tentaculata*	11				
Mollusca	Lymnaeidae	*Radix balthica*	63			2	
Mollusca	Physidae	*Physa fontinalis*	5				
Mollusca	Planorbidae	*Planorbis planorbis*			8		
Mollusca	Sphaeriidae	*Pisidium* sp.	1				
Mollusca	Tateidae	*Potamopyrgus antipodarum*				45	
Mollusca	Valvatidae	*Valvata cristata*	9				
Trichoptera	Limnephilidae	*Limnephilus marmoratus*			11		
Tricladida	Planariidae	*Polycelis nigra*	5		8		
Taxon richness			**10**	**6**	**7**	**3**	

8.3.3.6 Aquatic ecological evaluation

An evaluation of each aquatic survey site was based on the results of the aquatic surveys (Table 8.7). The majority of (drainage channel) survey sites were considered of **local importance (lower value)** due to their inherently low (or lack of) fisheries value and poor-quality aquatic habitats. The majority of the drainage channel sites were evidently seasonal (e.g. sites 2B, 2C, 3, 4A, 4B, 4C). Survey sites 2A, 4B and 5 were considered of **local importance (higher value)** given the presence of common frog and as they evidently acted as breeding areas due to tadpole presence. Site 6 (wetland) was also considered as being **(local importance (higher value)** given that it supported high local biodiversity.

Both aquatic survey sites on Ballynaclogh River (7A and 7B) were of **International importance** given the sites were located within the Lower River Shannon SAC (002165). Furthermore, the channel is known to support a range of transitional fish species including European eel (critically endangered; Pike et al., 2020), as well as Annex II otter and the Flora (Protection) Order, 2015 plant species triangular club rush and opposite leaved-pondweed.

Table 8.7: Evaluation summary of the survey sites (according to NRA, 2009 guidelines)

Site no.	Watercourse	Evaluation of importance	Rationale summary
1A	Drainage channel	Local Importance (lower value)	Low aquatic value (stagnant drainage ditch)
1B	Drainage channel	Local Importance (lower value)	Low aquatic value (stagnant drainage ditch)
2A	Drainage channel	**Local Importance (higher value)**	Common frog present (breeding site)
2B	Drainage channel	Local Importance (lower value)	Low aquatic value (stagnant drainage ditch)
2C	Drainage channel	Local Importance (lower value)	Low aquatic value (stagnant drainage ditch)
3	Drainage channel	Local Importance (lower value)	100% dry at time of survey (no aquatic value)
4A	Drainage channel	Local Importance (lower value)	100% dry at time of survey (no aquatic value)
4B	Drainage channel	**Local Importance (higher value)**	Common frog present
4C	Drainage channel	Local Importance (lower value)	100% dry at time of survey (no aquatic value)
5	Drainage channel	**Local Importance (higher value)**	Common frog present
6	Wetland	**Local Importance (higher value)**	Wetland habitat of high local importance given it supported high local biodiversity
7A	Ballynaclogh River	**International importance**	Within Lower River Shannon SAC (002165)
7B	Ballynaclogh River	**International importance**	Within Lower River Shannon SAC (002165)

8.3.4 Birds- Baseline Environment

8.3.4.1 Desktop Study- Birds

The NBDC dataset for the birds recorded in the overlapping 1km Grid Squares (R5555 & R5655) and 2km Grid Squares (R55M & R55S) reflects the nature and range of habitats present (Table 8.8). Terrestrial and aquatic species are well represented. Similarly, previous planning applications at this site provide a good historical source of data on the occurrence of certain species in the area (e.g. CSR, EIS 2006). Given the relatively unmanaged nature of the Greenpark race course site in the past two decades there has been scrub and woodland encroachment and the nature of the habitats present are likely to reflect this pattern of change.

Table 8.8 summarises the bird species that have been recorded historically in the two hectads that overlap the proposed development site. The table also shows the current Birds of Conservation Concern status (BoCCI; Gilbert *et al*. 2021) of each of these species. In total 75 species have been recorded in this area, 13 of these are Red-listed (Birds of High Conservation Concern): Curlew, *Numenius arquata*, Dunlin, *Calidris alpina*, Goldeneye, *Bucephala clangula*, Grey Wagtail, *Motacilla cinerea*, Kestrel, *Falco tinnunculus*, Lapwing, *Vanellus vanellus*, Meadow Pipit, *Anthus pratensis*, Pochard, *Aythya farina*, Redshank, *Tringa totanus*, Redwing, *Turdus iliacus*, Snipe, *Gallinago gallinago*, Stock Dove, *Columba oenas* and Swift, *Apus apus*. A further 23 of the species recorded are Amber-listed or of moderate conservation concern. The species recorded in these hectads reflect the proximity to the riparian habitats, with a good number of waterbirds represented.

The development site itself is not located directly adjacent to any watercourses and is dominated by habitats that would be generally unattractive for these species.

Table 8.8: Birds recorded in the two hectads (R55M, R55S) that overlap the proposed development site. The current BoCCI status is shown, along with the criteria used in determining the BoCCI status. Red-listed (^) and Amber-listed (*) species are highlighted.

Common Name	Scientific Name	BOCCI 4: 2020-2026 criteria	Season
Blackbird	*Turdus merula*	-	-
Blackcap	*Sylvia atricapilla*	-	-
Black-headed Gull*	*Chroicocephalus ridibundus*	BDMr1, BDMr2, BL	B/W
Blue Tit	*Cyanistes caeruleus*	-	-
Bohemian Waxwing	*Bombycilla garrulus*	-	-
Brambling*	*Fringilla montifringilla*	Spec 3	W
Chaffinch	*Fringilla coelebs*	-	-
Chiffchaff	*Phylloscopus collybita*	-	-
Coal Tit	*Periparus ater*	-	-
Collared Dove	*Streptopelia decaocto*	-	-
Common Sandpiper*	*Actitis hypoleucos*	Spec 3, BDMp2	B
Coot*	*Fulica atra*	Spec 3, WDMP1, BDMr2, WL	B/W

Common Name	Scientific Name	BOCCI 4: 2020-2026 criteria	Season
Cormorant*	*Phalacrocorax carbo*	BL	B/W
Cuckoo	*Cuculus canorus*	-	-
Curlew^	*Numenius arquata*	BDp1, BDp2, WDp2, BDr1, BDr2, Spec 1	B/W
Dunlin^	*Calidris alpina*	BDp1, BDp2, WDp1, WDp2, BDr1	B/W
Dunnock	*Prunella modularis*	-	-
Fieldfare	*Turdus pilaris*	-	-
Goldcrest*	*Regulus regulus*	Spec 2	B
Goldeneye^	*Bucephala clangula*	WDP1, WL	W
Goldfinch	*Carduelis carduelis*	-	-
Grasshopper Warbler	*Locustella naevia*	-	-
Great Crested Grebe*	*Podiceps cristatus*	WDMp1, WL	B/W
Great Tit	*Parus major*	-	-
Greenfinch*	*Carduelis chloris*	BDMp1	B
Greenshank	*Tringa nebularia*	-	-
Grey Heron	*Ardea cinerea*	-	-
Grey Wagtail^	*Motacilla cinerea*	BDp1 (RL); BDMr1, BDMp2 (AL)	B
Greylag Goose*	*Anser anser*		W
Herring Gull*	*Larus argentatus*	Spec 2, BDMp1, BDMp2	B/W
Hooded Crow	*Corvus cornix*	-	-
House Sparrow*	*Passer domesticus*	Spec 3	B
Jack Snipe	*Lymnocryptes minimus*	-	-
Jackdaw	*Corvus monedula*	-	-
Kestrel^	*Falco tinnunculus*	BDp1 (RL), Spec 3 (AL)	B
Kingfisher*	*Alcedo atthis*	-	-
Lapwing^	*Vanellus vanellus*	-	-
Lesser Redpoll	*Carduelis cabaret*	-	-
Linnet*	*Carduelis cannabina*	Spec 2	B
Little Egret	*Egretta garzetta*	-	-
Little Grebe	*Tachybaptus ruficollis*	-	-
Long-tailed Tit	*Aegithalos caudatus*	-	-
Magpie	*Pica pica*	-	-
Mallard*	*Anas platyrhynchos*	BDMp1	B/W
Meadow Pipit^	*Anthus pratensis*	Spec 1	B
Mistle Thrush	*Turdus viscivorus*	-	-
Moorhen	*Gallinula chloropus*	-	-

Common Name	Scientific Name	BOCCI 4: 2020-2026 criteria	Season
Mute Swan*	*Cygnus olor*	WI	B/W
Pheasant	*Phasianus colchicus*	-	-
Pied Wagtail	*Motacilla alba*	-	-
Pochard^	*Aythya ferina*	VU, Spec 1, WDp1	B/W
Redshank^	*Tringa totanus*	BDp1, BDp2	B/W
Redwing^	*Turdus iliacus*	Spec 1	W
Reed Bunting	*Emberiza schoeniclus*	-	-
Robin	*Erithacus rubecula*	-	-
Rook	*Corvus frugilegus*	-	-
Sand Martin*	*Riparia riparia*	Spec 3	B
Sedge Warbler	*Acrocephalus schoenobaenus*	-	-
Siskin	*Carduelis spinus*	-	-
Skylark*	*Alauda arvensis*	Spec 3	B
Snipe^	*Gallinago gallinago*	BDp1, BDp2 (RL), Spec 3 (AL)	B/W
Song Thrush	*Turdus philomelos*	-	-
Sparrowhawk	*Accipiter nisus*	-	-
Spotted Flycatcher*	*Muscicapa striata*	Spec 2	B
Starling*	*Sturnus vulgaris*	Spec 3	B
Stock Dove^	*Columba oenas*	BDp1	B
Stonechat	*Saxicola torquata*	-	-
Swallow*	*Hirundo rustica*	Spec 3	B
Swift^	*Apus apus*	BDp1 (RL); BDMr1, BDMr2, Spec 3 (AL)	B
Teal*	*Anas crecca*	BDMr2	B/W
Treecreeper	*Certhia familiaris*	-	-
Tufted Duck*	*Aythya fuligula*	Spec 3, WDMp1, WL	B/W
Willow Warbler*	*Phylloscopus trochilus*	Spec 3	B
Woodpigeon	*Columba palumbus*	-	-
Wren	*Troglodytes troglodytes*	-	-

BoCCI Status Key

Key	Criteria
Red List	
IUCN CE E V	Global Conservation Status Critically Endangered Endangered Vulnerable
BDp1, BDp2	High breeding population decline (>50% over 25yrs (since 1998) or since 1980 respectively)
WDp1, WDp2	High non-breeding population decline (>50% over 20 yrs or 30 yrs respectively)
BDr1, BDr2	High breeding range decline (>70% over 20 yrs or 40 yrs respectively)

Key	Criteria
HD	Historical Decline - declined severely in historic past (since 1800) but has not subsequently recovered
Spec 1	Species of global conservation concern
Amber List	
BDMp1, BDMp2	Moderate breeding population decline (25-49% over 25yrs or since 1980 respectively)
WDMp1, WDMp2	Moderate non-breeding population decline (25-49% over 20 yrs or 30 yrs respectively)
BDMr1, BDMr2	Moderate breeding range decline (35-69% over 20 yrs or 40 yrs respectively)
BR	Breeding rarity (<100 pairs in Ireland)
BL, WL	Localised breeding or wintering populations (>50% of irish pop concentrated in 10 or fewer sites)
BI, WI	International Importance during breeding or non-breeding season (irish pop represents >20% European pop)
Spec 2	European conservation status is unfavourable (global pop is concentrated in Europe)
Spec 3	European conservation status is unfavourable (global pop is concentrated outside Europe)

8.3.4.2 Existing Environment- Birds

Breeding surveys were carried out in the summer of 2020 with more intensive winter season surveys conducted across the entire overwintering period (October 2020-March 2021; Appendix 8.1).

A total of 41 bird species were recorded during the breeding transect surveys in summer 2020 (Table 8.9). Of these species, seven were present within 100m of each of the five survey transects: Chaffinch, *Fringilla coelebs*, Chiffchaff, *Phylloscopus collybita*, Meadow Pipit, Robin, *Erithacus rubecula*, Swallow, *Hirundo rustica*, Willow Warbler, *Phylloscopus trochilus* and Wren, *Troglodytes troglodytes*. Several of the waterbirds were only recorded in flight over the wider study area e.g. Cormorant, *Phalocrocorax carbo* and Herring Gull, *Larus argentatus*.

The breeding season surveys recorded birds typical of woodland and farmland e.g. Robin, Chaffinch and Wren and also migrant flycatchers such as Swallow, Sand Martin and Swift. Birds of open and semi-improved/wet-grassland were also well represented in the bird community at the site e.g. Linnet, Reed Bunting and Stonechat. Certain species, notably Feral Pigeon, were particularly associated with the Roche's Feeds facility north of the proposed development site.

Two Red-listed species were recorded during the breeding season transect survey Meadow Pipit and Swift. Meadow Pipit is a relatively common and widespread species but it is also a species that has undergone recent declines in global population. Swift has been added to the Red-list in the most recent BoCCI iteration. It is suggested that an observed steady decline in numbers is linked to the loss of many traditional nest cavities in buildings which have been renovated or demolished (Gilbert *et al*. 2021). There is no breeding habitat for Swifts within the Greenpark site. Meadow Pipits are ground-nesting species that prefer open grassland/heath and bog.

A total of 8 additional bird species were recorded as casual observations during the course of other surveys at the site (Table 8.9). These additional records included three further Red-listed species, Grey Wagtail, Kestrel and Snipe (Table 8.9). Kestrel are suspected to have bred in trees at the north of the study area, outside of the proposed development site. There were a number of sightings of Buzzards within the study area, particularly in the post-breeding period. Three juvenile Buzzards were observed together in flight to the south of the Greyhound Stadium on July 20th 2020.

The same transects that were used for the breeding season walkovers were again surveyed to record the usage of the site and adjoining areas by wintering birds throughout the winter of 2020/2021. These transects were surveyed on three occasions during the winter period (Appendix 8.1). A total of 40 bird species were recorded on transect during the winter period, a very similar level of diversity to that recorded during the breeding season (Table 8.9). Of these, only Jay, *Garrulus glandarius*, was not recorded within 100m of any of the survey transects. Transect 1 which is entirely within the proposed housing development site had the least bird species diversity during the winter months with 20 species recorded. Only 16 bird species were recorded within 100m of Transect 1. This transect was the least diverse transect in the winter period. The species with the highest recorded abundance on Transect 1 was Starling (12 individuals).

Another four species were recorded in the winter period as causal observations during other survey visits: Cormorant, *Phalocrocorax carbo*, House Sparrow, *Passer domesticus*, Grey Wagtail and Little Egret, *Egretta garzetta* (Table 8.9). Cormormant and Little Egret were occasionally observed overflying the site, in the case of Little Egret these sightings were exclusively close to the Ballynaclogh River. Single Cormorants were observed overflying the former race course, although not in the vicinity to the proposed development on several occasions. Grey Wagtail was observed close to the lagoon (constructed wetland) near the Ballynaclogh River on two occasions, in October 2020 and February 2021. House Sparrows were observed on several visits, associated with domestic gardens and bird feeders to the southeast of the proposed housing development and on two occasions close to the rear of Roche's Feeds Yard.

The breeding and wintering bird assemblages recorded are typical of the garden, parkland and scrub-type habitats present in the area. There were relatively few waterbirds recorded in the area.

A monthly daytime and night-time walkover of the site during the winter period confirmed that the proposed development site and all of the adjoining land within the applicant's ownership does not appear to be used to any appreciable extent by the SCI species of the River Shannon & River Fergus Estuaries SPA. In fact, there was no sightings of any concentrations of waterbirds made on site during these intensive surveys. The night-time thermal imagery study recorded low numbers of Snipe and in February 2021 a pair of Mallard, *Anas platyrhynchos*, using the wetter, more low-lying parts of the study area. The proposed development area was walked each month and the thermal imager was useful in recording common species at roost in the trees and bushes. Again, with the exception of low numbers of Snipe, there were no waterbirds present during any of these winter walkovers.

Table 8.9: Birds species recorded within 100m (x) or over 100m (P) from each of the breeding bird survey transects (summer 2020). 'P' indicates that the species was only recorded beyond 100m from the observer. Red-listed (^) and Amber-listed (*) species are highlighted.

Common Name	Scientific Name	BOCCI 4: 2020-2026 criteria	Season	T1	T2	T3	T4	T5
Blackbird	*Turdus merula*	-	-	x	P	x	x	x
Blackcap	*Syvia atriacapilla*	-	-			x	x	x
Blue Tit	*Cyanistes caeruleus*	-	-				x	x
Bullfinch	*Pyrrhula pyrrhula*	-	-	x			x	x
Chaffinch	*Fringilla coelebs*	-	-	x	x	x	x	x
Chiffchaff	*Phylloscopus collybita*	-	-	x	x	x	x	x
Coal Tit	*Periparus ater*	-	-		x			x
Cormorant*	*Phalocrocorax carbo*	BL	B/W					P
Dunnock	*Prunella modularis*	-	-	x		x	x	
Feral Pigeon	*Columba l. livia*	-	-			x		x
Goldcrest*	*Regulus regulus*	Spec 2	B			x	x	x
Goldfinch	*Carduelis carduelis*	-	-	x		x	x	x
Great Tit	*Parus major*	-	-	x				x
Greenfinch*	*Carduelis chloris*	BDMp1	B			x	x	x
Herring Gull*	*Larus argentatus*	Spec 2, BDMp1, BDMp2	B/W	P	P			x
Hooded Crow	*Corvis cornix*	-	-	x				x
Jackdaw	*Corvus monedula*	-	-					x
Jay	*Garrulus glandarius*	-	-			x		
Lesser Black-backed Gull*	*Larus fuscus*	BL	B/W	x				x
Lesser Redpoll	*Carduelis cabaret*	-	-	x		x	x	x
Linnet*	*Carduelis cannabina*	Spec 2	B				x	
Long-tailed Tit	*Aegithalos caudatus*	-	-			x		
Magpie	*Pica pica*	-	-	x	x		x	P
Meadow Pipit^	*Anthus pratensis*	Spec 1	B	x	x	x	x	x
Pheasant	*Phasianus colchicus*	-	-					x
Raven	*Corvus corax*	-	-	x	x	x		x
Reed Bunting	*Emberiza schoeniclus*	-	-	x		x	x	x
Robin	*Erithacus rubecula*	-	-	x	x	x	x	x
Rook	*Corvus frugilegus*	-	-	x		x	P	x

Common Name	Scientific Name	BOCCI 4: 2020-2026 criteria	Season	T1	T2	T3	T4	T5
Sand Martin*	*Riparia riparia*	Spec 3	B				x	x
Sedge Warbler	*Acrocephalus schoenobaenus*	-	-	x		x		x
Siskin	*Carduelis spinus*	-	-					x
Song Thrush	*Turdus philomelos*	-	-	x		x	P	x
Starling*	*Sturnus vulgaris*	Spec 3	B	x				
Stonechat	*Saxicola torquata*	-	-			x		x
Swallow*	*Hirundo rustica*	Spec 3	B	x	x	x	x	x
Swift^	*Apus apus*	BDp1 (RL); BDMr1, BDMr2, Spec 3 (AL)	B	x			x	x
Whitethroat	*Sylvia communis*	-	-		x			
Willow Warbler	*Phylloscopus trochilus*	-	-	x	x	x	x	x
Woodpigeon	*Colimba palumbus*	-	-	x		x	x	x
Wren	*Troglodytes trogloytes*	-	-	x	x	x	x	x

* Red-list species ^Amber-listed species

Table 8.10: Additional bird species recorded as casual records in the area from summer 2020 through winter 2020/2021. Red-listed (^) and Amber-listed (*) species are highlighted.

Common Name	Scientific Name	BOCCI 2021 criteria	Season
Black-headed Gull*	*Chroicocephalus ridibundus*	BDMr1, BDMr2, BL	B/W
Buzzard	*Buteo buteo*	-	-
Collared Dove	*Streptopelia decaocto*	-	-
Grey Heron	*Ardea cinerea*	-	-
Grey Wagtail^	*Motacilla cinerea*	BDp1 (RL); BDMr1, BDMp2 (AL)	B
Kestrel^	*Falco tinnunculus*	BDp1 (RL), Spec 3 (AL)	B
Skylark*	*Alauda arvensis*	Spec 3	B
Snipe^	*Gallinago gallinago*	BDp1, BDp2 (RL), Spec 3 (AL)	B/W

Plate 8.21: Young pheasant, crossing drainage ditch, recorded on Wildlife Camera.

Table 8.11: Winter bird survey transects results (October 2020-March 2021). Peak counts for each species and each transect are shown. 'P' indicates that the species was only recorded beyond 100m from the observer. Red-listed (^) and Amber-listed (*) species are highlighted.

Species	Scientific Name	BOCCI 4: 2020-2026 criteria	Season	T1	T2	T3	T4	T5
Blackbird	*Turdus merula*	-		2	2	4	5	3
Black-headed Gull*	*Chroicocephalus ridibundus*	BDMr1, BDMr2, BL	B/W				1	3
Blue Tit	*Cyanistes caeruleus*	-		2	4	4		2
Bullfinch	*Pyrrhula pyrrhula*	-			2			
Buzzard	*Buteo buteo*	-		P	2	P		1
Chaffinch	*Fringilla coelebs*	-		4	4	6	3	5
Coal Tit	*Periparus ater*	-				1	2	1
Collared Dove	*Streptopelia decaocto*	-		P		2		
Cormorant*	*Phalocrocorax carbo*	BL	B/W				1	
Dunnock	*Prunella modularis*	-		1	1	2	1	
Feral Pigeon	*Columba l. livia*	-			2		4	45
Fieldfare	*Turdus pilaris*	-			4	7		
Goldcrest*	*Regulus regulus*	Spec 2	B			2		1
Goldfinch	*Carduelis carduelis*	-		4	6	2	4	10

Species	Scientific Name	BOCCI 4: 2020-2026 criteria	Season	T1	T2	T3	T4	T5
Great Tit	*Parus major*	-		1	2	2	P	1
Grey Heron	*Ardea cinerea*	-					2	1
Hooded Crow	*Corvis cornix*	-		P	3	P	2	2
Jackdaw	*Corvus monedula*	-		1	P	P	3	2
Jay	*Garrulus glandarius*	-						P
Kestrel^	*Falco tinnunculus*	BDp1 (RL), Spec 3 (AL)	B				1	1
Lesser Redpoll	*Carduelis cabaret*	-				2		2
Linnet*	*Carduelis cannabina*	Spec 2	B				2	2
Long-tailed Tit	*Aegithalos caudatus*	-		1		2		
Magpie	*Pica pica*	-		3	3	2	1	5
Mallard*	*Anas platyrhynchos*	BDMp1	B/W			2	2	2
Meadow Pipit^	*Anthus pratensis*	Spec 1	B			1	1	1
Mistle Thrush	*Turdus viscivorus*	-			1		1	
Moorhen	*Gallinula chloropus*	-					1	
Pheasant	*Phasianus colchicus*	-			P	1	P	P
Pied Wagtail	*Motacilla alba yarrellii*	-		1				1
Raven	*Corvus corax*	-			2		4	P
Redwing^	*Turdus iliacus*	Spec 1	W	2	12	2		8
Robin	*Erithacus rubecula*	-		1	2	2	2	1
Rook	*Corvus frugilegus*	-		3	5	2	7	9
Siskin	*Carduelis spinus*	-				1		
Snipe^	*Gallinago gallinago*	BDp1, BDp2 (RL), Spec 3 (AL)	B/W			P	1	1
Song Thrush	*Turdus philomelos*	-		P	1		1	1
Starling*	*Sturnus vulgaris*	Spec 3	B	12	77	6	3	6
Woodpigeon	*Colimba palumbus*	-		4	13	P	4	5
Wren	*Troglodytes trogloytes*	-		2	4	3	2	3

8.3.5 Mammals- Baseline Environment

8.3.5.1 Desktop Study- Mammals

An initial desktop review for available data on mammal (non-volant) species for the study site was completed through consulting online databases to identify species of conservation interest (*e.g.* rare, protected) previously recorded for the relevant national grid squares.

There was a paucity of mammal sightings or signs recorded in the area in surveys that informed the 2006 EIS (CSR 2006) which accompanied a previous planning application at this site. Similarly, there are relatively few historical records of terrestrial mammals from the area recorded in the NBDC database. Other than records of Fox, *Vulpes vulpes*, Mink, *Mustela vison* and Greater White-toothed Shrew, *Crocidura russula*, there is a single aged (1982) record of the presence of Otter on the Ballynaclogh River from the two hectads that overlap the proposed development site.

8.3.5.2 Existing Environment- Mammals

The mammal (non-volant) assessment was undertaken by dedicated walkovers in July and August 2020, followed up by regular deployment of trail cameras and supplementary walkovers through until March 2021 (Appendix 8.1).

The field element of the assessment involved a walkover of the study site, where direct and/or indirect observations were noted (*e.g*. breeding sites, droppings, prints) in accordance with standard guidelines (*e.g.* Hundt 2012, JNCC 2004, Sutherland 1996). The embankments along the edge of the Ballynaclogh were walked to record evidence of the presence of Otter. The winter walkover surveys including thermal imagery surveys were also useful for recording nocturnal mammal activity in the area. There were several sightings of Fox, Wood Mouse as well as foraging bats made during the monthly surveys from October 2020-March 2021.

In addition to the walkover, digital wildlife cameras (Camera-traps) which take photographs and/or video when triggered by heat or motion, were also deployed (at 14 locations in the study area) to record mammal activity within the study site. The location where the cameras were deployed is shown in Figure 8.2. Evidence of mammal activity observed during other aspects of the biodiversity field studies but outside of the dedicated mammal walkover were also noted as casual species.

The conservation status of mammals was assessed with reference to the following: the Irish Wildlife Acts (1976 - 2012); the Red List of Terrestrial Mammals (Marnell *et al.* 2009); the EU Habitats Directive.

A total of 9 mammal species (excluding livestock and domestic pets) were recorded on the wildlife cameras deployed at the site (Table 8.12). Of these several had not previously been recorded in the 2km Grid Squares in which the study area is located (including Red Squirrel, Pine Marten and Stoat). The most frequent and widespread of the non-volant mammals recorded during each period of deployment at the site was Fox, closely followed Wood Mouse. None of the species recorded is of conservation concern in Ireland.

Evidence of the presence of three further mammal species was noted during the walkovers at the site. An Irish Hare (*Lepus timidus hibernicus*) was recorded near the entrance gate into the site in August 2020. In addition, Otter (*Lutra lutra*) spraints and signs were recorded at several points from the banks of the Ballynaclogh both upstream and downstream of the N18 bridge. The Ballynaclogh downstream of the bridge was walked in July 2020 and no holts were observed. Otters have a 'Least Concern' conservation status in Ireland but are considered Near Threatened in Europe and globally (Marnell *et al*. 2019). A single Rabbit, *Oryctolagus cuniculus* was observed north of the proposed development site on February 5th 2021.

No breeding sites, or burrows for any protected mammal species were recorded during the walkovers in the vicinity of the proposed development site.

Table 8.12: Mammal species identified on the wildlife camera record 2020-2021.

Common Name	Scientific Name	Conservation Status
Fox	*Vulpes vulpes*	Least Concern
Mink	*Mustela vison*	n/a
Hedgehog	*Erinaceus europaeus*	Least Concern
Wood Mouse	*Apodemus sylvaticus*	Least Concern
Rat	*Rattus norvegicus*	n/a
Greater White-toothed Shrew	*Crocidura russula*	Invasive; n/a
Stoat	*Mustela erminea*	Least Concern
Red Squirrel	*Sciurus vulgaris*	Least Concern
Pine Marten	*Martes martes*	Least Concern

Plate 8.22: Fox was the most frequent and widely recorded mammal species on the wildlife cameras

Plate 8.23: Wildlife camera deployed on tree overlooking drainage ditch.

8..5.3 Desktop Study- Bats

There are nine confirmed resident bat species in Ireland; Soprano Pipistrelle *Pipistrellus pygmaeus*, Common Pipistrelle *Pipistrellus pipistrellus*, Nathusius' Pipistrelle *Pipistrellus nathusii*, Leisler's Bat *Nyctalus leisleri*, Brown Long-eared Bat *Plecotus auritus*, Lesser Horseshoe Bat *Rhinolophus hipposideros* and three myotid species; Daubenton's Bat *Myotis daubentonii*, Natterer's Bat *Myotis nattereri*, and Whiskered Bat *Myotis mystacinus*.

All bat species in Ireland and their breeding/resting places are legally protected under European (EU Habitats Directive) and national law (Irish Wildlife Act 1976; and as amended). Under these laws, it is an offence to hunt or interfere with or destroy their breeding or resting places (roosts of all kinds), unless under statutory license issued by the National Parks and Wildlife Service.

Bats use different types of roosts during different times of the year and phases of their life cycle (see Hundt, 2012). For example, in early summer, pregnant females gather together to form maternity roosts where they give birth to pups and suckle them until they are weaned by late summer. The pups are flightless for a few weeks and are completely reliant on their mothers' milk. In winter when insect food becomes scarce due to low temperatures, bats seek out winter hibernation roosts where they enter into a torpor, reducing their metabolic requirements, and thus surviving through the period of low food availability. They are vulnerable to disturbance in winter roosts, as waking up causes them to burn fat reserves that must last until spring. Bats also make use of roosts other than their daytime roost. During night-time foraging bouts, they may take temporary shelter from inclement weather or process and digest insect prey in what are called 'night roosts'. These often tend to be close to key foraging areas (e.g. Knight & Jones, 2009).

Furthermore, each bat species tends to have its own particular roost requirements and preferences. For example, Lesser Horseshoe Bats cannot use their limbs to crawl into crevices like other species, and they must instead fly directly into a roost through an opening of sufficient size and hang by their specially adapted feet from a suitable perch. For this reason, this species will not use bat roost boxes as other Irish bat species will.

The bat landscape suitability index for the area is high (43.67) with the landscape deemed particularly suitable for Leisler's Bat (65) and Common Pipistrelle (64). There are historic records of the presence of four bat taxa from the two 2km Grid Squares that encompass the entirety of the lands under the applicants ownership at this site: Leisler's Bat, Daubenton's Bat, Soprano Pipistrelle and Pipistrelle species (probably Common/Soprano Pipistrelle). Older records of Pipistrelle sp. date from a time before it was known that Common (45kHz) and Soprano (55kHz) Pipistrelle were separate species.

Much of the naturally revegetated scrub in the study area would have little to no potential for roosting bats. In contrast, stonewalls and mature trees around the boundaries of the study area would have some potential for roosting bats. There is considerable light-spill onto the study area from surrounding suburban areas and facilities e.g. Greyhound Stadium. There are some darker areas in the area, generally the more heavily wooded section of the former race course.

The lack of buildings on the Greenpark site greatly limits the potential for roosting bats. However, given the extent of scrub and grassland it was anticipated that a good diversity and number of foraging bats would be recorded at the site.

8.3.5.4 Existing Environment- Bats

The long-term deployment of passive bat detectors at the site collected a large amount of data on the bat usage of the proposed development site and adjoining lands. Passive bat detectors are triggered by the high-frequency bat calls and record vocalisations onto a removable memory card. The detectors record all activity detected from sunset to sunrise and these calls are then analysed to identify the species present. The locations where the bat detectors were deployed is shown in Figure 8.2 and the deployment schedule is summarised in Appendix 8.1. Multi-season data was recorded for the site.

In addition to the deployment of passive detectors, active bat detectors (Wildlife Acoustics Touch Pro 2) were used during the October and March night-time bird survey walkovers in order to collect some additional casual records. This also allowed any bats seen on the thermal imager to be positively identified.

A total of 16 separate deployments resulted in over 30,000 separate bat registrations ('triggers') for analysis. A total of 6 bat species were confirmed to be present in the study area: Common Pipistrelle, Soprano Pipistrelle, Leisler's Bat, Daubenton's Bat, Brown Long-eared Bat and Lesser Horseshoe Bat. The summary of the analysis from the 16 deployments is shown in Table 8.13. The current conservation status of these species is shown in Table 8.13.

Of the species identified, only Common Pipistrelle was recorded on all of the passive detector deployments. Common Pipistrelle was by some distance the most abundant species in the calls recorded from the site. Table 8.13 summarises the proportion of the overall registrations identified from the site accounted for by each taxon. Overall, over 99.5% of the bat calls detected at the study area were accounted for by three species: Common Pipistrelle (72.4%), Leisler's Bat (16.7%) and Soprano Pipistrelle (10.4%).

The most notable finding from the bat surveys was the confirmation of Lesser Horseshoe Bats from the study area. None were recorded from within the proposed housing development boundary and overall only 16 of over 30,000 registrations were Lesser Horseshoe Bat.

The Lesser Horseshoe Bat (Plate 8.24) has a limited distribution in Ireland and is almost entirely concentrated in six Atlantic coast counties of Cork, Kerry, Limerick, Clare, Galway and Mayo (Roche *et al*. 2015). Ireland and Wales are home to some of the largest remaining populations of the species in Europe. It was once a widespread and abundant species but is currently one of the rarest bats in north-west Europe (Bontadina *et al*., 2008). It declined severely throughout much of its range between the 1950s and the 1980s and became locally extinct in the lowlands of Switzerland (*loc cit*.), and in parts of Britain (Schofield & McAney, 2008). It was thought to have gone extinct in the Netherlands and Luxembourg and is critically endangered in Germany (Hutson *et al.*, 2001). Due to declines in the European population, the Lesser Horseshoe Bat receives the highest level of protection under Irish and European legislation as an *Annex II* species of the EU Habitats Directive. It is the only Annex II bat species in Ireland, and large roosting sites, usually with >100 individuals in summer maternity roosts or >50 individuals in winter hibernation roosts, require the Irish government to designate a Special Area of Conservation (SAC) for its protection (Roche *et al*., 2015). There are no SACs for this species within 15km of Kilkerin Battery.

With particular relevance to this area, the Lesser Horseshoe Bat population in Ireland is fragmented and concern has been raised about a potential 'Limerick gap' in distribution. It was feared that the species could be on the road to local extinction without concerted efforts to protect and enhance roosting opportunities and improve habitat connectivity to link up the remaining colonies (see Roche *et al*. 2015). There are no records of Lesser Horseshoe Bats from the western city environs in Limerick (NBDC). There have been a number of isolated records of Lesser Horseshoe Bats from an undisclosed location in grid square (R5857) in recent years, but there are no published records of roost or regular foraging sites for the species in Limerick city.

It is certain, that the species has been under-recorded. Ecology Ireland has discovered a number of roost sites throughout Limerick, Clare and Cork and confirmed wider distribution of the species than previously known in recent years. The availability of passive detectors that can be deployed at sites for long periods unattended has certainly helped confirm the presence of less common species that could easily be missed by more traditional survey methods. Ecology Ireland has confirmed feeding and roosting sites for Lesser Horseshoe Bats at other sites in Limerick city in recent months (G. Fennessy 147er sobs.). The emerging evidence confirms that Lesser Horseshoe Bats are occurring in area where they were believed to be absent. The presence of Lesser Horseshoe Bats in an urban area may suggest that the species is somewhat more tolerant of night-time lighting than currently understood. It also indicates that the conservation outlook for the species may be altogether more positive for the species if the population is more widespread and less geographically isolated than was previously known.

The very small number of records identified of Lesser Horseshoe Bats in the area were spread across several seasons. There was no regular occurrence in the area and while the finding is of interest it does not indicate that the site is of any special importance for the species. The limited number of records may relate to an individual or small number of individuals commuting through the site or said individuals at the edge of their typical foraging range. The recent confirmation of Lesser Horseshoe Bats elsewhere in the city (G. Fennessy; confidential location) also provides a possible locus for bats foraging widely in Limerick city.

Plate 8.24: Lesser Horseshoe Bat, is Ireland's most protected bat species (Photo courtesy Jessicajil, Creative Commons).

Soprano Pipistrelle, Common Pipistrelle, Leisler's Bat, Daubenton's Bat and Brown Long-eared Bat are all relatively widespread and common nationally, and their populations are considered to be stable (Marnell *et al*., 2009). While Leisler's Bat is currently regarded as 'Near Threatened', this is mainly due to the fact that Ireland is a world stronghold for the species' population, as it is quite a rare species in Britain and elsewhere in the world (Marnell *et al*., 2009). Soprano Pipistrelle, Common Pipistrelle, and Leisler's Bat are the most common bat species recorded in Ireland, and Daubenton's Bat is the most common of the three confirmed resident Myotid species in Ireland (Marnell *et al*., 2009). Table 8.13 summarises the bat species recorded at the site in 2019 along with their current conservation status.

Table 8.13: Summary analysis for each of the 16 passive detector deployments in the study area from June 2020 to March 2021. The number of 'triggers' for each taxa list is shown.

Item	Lat	Long	Common Pipistrelle	Soprano Pipistrelle	40/50kHz Pip.	Leisler's Bat	Daubenton's Bat	Myotis sp.	Brown Long-eared Bat	Lesser Horseshoe Bat
1	52.64744	-8.65802	971	94		21	2	1		2
2	52.64744	-8.65802	455	108	3	9	13	1		
3	52.64959	-8.6522	219	557		35				1
4	52.64971	-8.55459	118	17		15				
5	52.64628	-8.65466				3				8
6	52.64814	-8.6503	4616		7	899	3	1	6	
7	52.65157	-8.65256	2883		2	521		2		
8	52.64902	-8.64593	1987	367	21	601		3	12	
9	52.64814	-8.6503	1009	19	10	27				
10	52.64968	-8.65546	56	16		8				
11	52.64585	-8.65165	721	104	5	18				
12	52.64942	-8.64714	1378	572	19	1292				1
13	52.65109	-8.6573	1345	231		886		4	7	
14	52.65171	-8.65249	3085	917	4	490			5	4
15	52.65078	-8.6561	74	8						
16	52.6497	-8.65035	2903	136		197				

Table 8.14: The proportion of the bat registrations from the Greenpark site accounted for by each taxon.

Taxa Confirmed	Overall % of total Registrations
Common Pipistrelle	72.41
Soprano Pipistrelle	10.44
Leisler's Bat	16.67
Unid. Pipistrelle	0.24
Daubenton's Bat	0.06
Myotis sp.	0.00
Brown Long-eared Bat	0.10
Lesser Horseshoe Bat	0.05

Table 8.15: Summary of bat species recorded on site and their conservation status.

Common Name	**Conservation Status**
Soprano Pipistrelle *Pipistrellus pygmaeus*	Least Concern* Protected species under Annex IV of EU Habitats Directive and the Irish Wildlife Acts.
Common Pipistrelle *Pipistrellus pipistrellus*	Least Concern* Protected species under Annex IV of EU Habitats Directive and the Irish Wildlife Acts.
Leisler's Bat *Nyctalus leisleri*	**Near Threatened*** Protected species under Annex IV of EU Habitats Directive and the Irish Wildlife Acts.
Daubenton's Bat *Myotis daubentonii*	Least Concern* Protected species under Annex IV of EU Habitats Directive and the Irish Wildlife Acts.
Brown Long-eared Bat *Plecotus auritus*	Least Concern* Protected species under Annex IV of EU Habitats Directive and the Irish Wildlife Acts.
Lesser Horseshoe Bat *Rhinolophus hipposideros*	Least Concern* Protected species under **Annex II** of EU Habitats Directive and the Irish Wildlife Acts.

** After Marnell et al. 2009.*

8.3.6 Other taxa- Baseline Environment

8.3.6.1 Desktop Study- Other taxa

NBDC records for the 2km grid squares which overlap the Application Site hold records for a number of other taxa. Table 8.16 lists the species from the NBDC records and describes their conservation status.

A small number of additional taxa considered 'near threatened' or 'endangered' have been recorded in the hectads in which the development site is located (Table 8.16; NBDC). This include Dingy Skipper Butterfly, *Erynnis tages*. This butterfly is a dowdy brown moth-like species that is locally common in the mid-west of Ireland (pers obs.) but is much less so in the remainder of the country. Gooden's Nomad Bee, *Nomada goodeniana*, is a large wasp-like kleptoparasite that is believed now to have been under-recorded and according the NBDC is likely to have its future conservation status improved (www.biodiversityireland.ie). The other two 'near threatened' bumblebee species are widely recorded and still relatively numerous despite having endured significant declines in population and range over recent decades. Swollen Spire Snail, Mercuria sp. is a mollusc of brackish waters. It is a species with restricted distribution but in Ireland it is still fairly common in its Shannon Estuary sites (http://www.habitas.org.uk/molluscireland/species.asp?ID=116).

Table 8.16: Other 'near threatened' and 'endangered' taxa recorded in the hectads in which the proposed development site is located.

Species	Hectad Found	Conservation Status
Dingy Skipper (*Erynnis tages*)	R55M	Threatened Species: Near threatened
Gooden's Nomad Bee (*Nomada goodeniana*)	R55M	Threatened Species: Endangered
Large Red Tailed Bumble Bee (*Bombus* (*Melanobombus) lapidarius*)	R55M & R55S	Threatened Species: Near threatened
Moss Carder-bee (Bombus (*Thoracombus*) *muscorum*)	R55M & R55S	Threatened Species: Near threatened
Swollen Spire Snail (*Mercuria* cf. *similis*)	R55M	Threatened Species: Endangered

8.3.6.2 Existing Environment-Other taxa

Field surveys during 2020 recorded a range of invertebrates and frequent observations of Common Frog, *Rana temporaria*. Frogs are an internationally important species and are protected under the Habitats Directive (92/43/EEC) and the Irish Wildlife Act (1976, as amended). The other taxa noted during the terrestrial ecology walkovers are presented in Table 8.16. There are also historical records of Common Lizard (*Zootoca vivipara*) from this area.

Table 8.17: Other taxa recorded as casual records during the terrestrial ecology surveys, 2020.

Other Taxa	Scientific Name
Common Blue	*Polyommatus icarus*
Meadow Brown	*Maniola jurtina*
Small Tortoiseshell	*Aglais urticae*
Speckled Wood	*Pararge aegeria*
Ringlet	*Aphantopus hyperantus*
Peacock	*Aglais io*
Red Admiral	*Vanessa atalanta*
Painted lady	*Vanessa cardui*
Orange Tip	*Anthocharis cardamines*
Emperor Dragonfly	*Anax imperator*
Brown Hawker	*Aeshna grandis*
Four-spotted chaser	*Libellula quadrimaculata*
White-tailed bumblebee	*Bombus lucorum*
Common carder bee	*Bombus pascuorum*
Common Frog	*Rana temporaria*

8.4 Potential Effects of the Proposed Project

The likelihood of environmental impacts arising due to the development is assessed in relation to the construction and operational phases. The elements of construction and operation and the potential impacts on biodiversity have been identified for assessment.

8.4.1 Construction Phase

8.4.1.1 Designated Sites- Construction Phase Impacts

The proposed development is not located within or adjacent to a Natura 2000 site or nationally designated NHA or pNHA thereby ruling out any direct habitat loss at the conservation sites in question. The proposed development is however located close to and is hydrologically connected to a number of designated sites including;

(i) Lower River Shannon SAC – c. 60m distance,
(ii) River Shannon & River Fergus Estuaries SPA – c. 130m distance,
(iii) Inner Shannon Est. - South Shore pNHA- c. 120m distance,
(iv) Fergus Est. & Inner Shannon - North Shore pNHA- c. 590m distance.

There is therefore potential for these sites to be indirectly affected in the event of water pollution, in the absence of mitigation. Furthermore the species which form the qualifying interests of the nearby designated sites (e.g. otter, wintering waterbirds) could suffer disturbance/displacement impacts as a result of noise/visual cues associated with the construction and/or operational phase of the proposed development.

The following potential impacts during the construction phase are considered in relation to the qualifying features of the Lower River Shannon SAC, the River Shannon & River Fergus Estuaries SPA, the Inner Shannon Est. - South Shore pNHA and the Fergus Est. & Inner Shannon - North Shore pNHA;

(i) Potential construction phase surface-water run-off impacts;
(ii) Potential disturbance/displacement impacts during construction on species of qualifying interest.

The above potential impacts which will be considered further in the NIS which accompanies this planning application.

8.4.1.1.1 Indirect Hydrological Impacts- Construction Phase

Indirect habitat loss or deterioration of designated sites within the surrounding area could occur from the effects of run-off or discharge into the aquatic environment through impacts such as increased siltation, nutrient release and/or contamination. This requires connectivity between the site and the designated site in question through watercourses and/or drainage ditches.

The ground conditions at the site mean that the main pathway for contamination is via surface water pathways which are particularly important for phosphate export which is the key limiting nutrient in transitional water bodies. The drainage network onsite connects the proposed development site directly to the Ballynaclogh River which forms part of the Lower River Shannon SAC and the River Shannon, the River Fergus Estuaries SPA, the Inner Shannon Est. - South Shore pNHA and the Fergus Est. & Inner Shannon - North Shore pNHA. There is therefore a direct hydrological connection between the SHD and these designated sites. A potential impact-receptor pathway therefore exists between these designated sites and the proposed development site. The potential construction phase surface-water run-off impacts in relation to designated sites are considered below.

8.4.1.1.2 Surface water run-off: Construction Phase

The construction phase of the development will involve the site preparation (e.g. vegetation clearance and earthworks). The construction phase works have the potential to result in run-off/sediment in the event of prolonged heavy rain where excavated areas and spoil heaps are unprotected. Similarly, the operation and refuelling of machinery during construction has the potential to result in leaks of hydrocarbons. Wastes will be generated at the site during the construction phase (particularly during the demolition of the existing structure) and these also have the potential to contaminate ground and surface water. However, a detailed planning phase Construction Environmental Management Plan (CEMP; GDG 2021) and Construction phase Waste Management Plan (CWMP; GDG 2021) have been prepared to accompany this application and the mitigation measures contained therein comprehensively address these risks. Silt management measures are described in the CEMP which are standard measures designed to control sediment run-off (silt screens etc.). Good site practices such as bunded storage of potential pollutants, nominated locations for refuelling, plant servicing and concrete mixing etc, use of hydrocarbon interceptors will effectively eliminate the likelihood of any significant construction phase impacts on hydrologically connected designated sites.

8.4.1.1.3 Disturbance Displacement

Consideration needs to be given to the potential for disturbance/displacement impacts of fauna that are listed as qualifying interests of designated sites through noise and/or visual cues arising from the proposed development. The SHD boundary is located c. 60m from the Lower River Shannon SAC and c. 130m east of the River Shannon & River Fergus Estuaries SPA and 120 m and 590m respectively from the Inner Shannon Est. - South Shore pNHA and Fergus Est. & Inner Shannon - North Shore pNHA. The SPA and pNHA's are designated for a range of qualifying wintering waterbird species that could suffer disturbance/displacement impacts as a result of noise/visual cues associated with the construction phase of the proposed development. Such disturbance/displacement impacts can also include artificial light spillage during the construction and operational phases. Therefore, disturbance/displacement impacts on waterbird species are potentially relevant here. The main development site is bordered to the north and east by residential and commercial developments, the site slopes generally from east to west, the lower levels of the site are within the embankment protected flood plain of the Ballynaclogh River. The SHD development area is situated on the southern or lower half of the site and is screened to a large degree from the Ballynclogh River and the designated sites by an existing flood embankment approximately 3m high.

There will be no requirement for construction works within the Ballynaclogh River or the nearby designated sites. Ballynaclogh River itself runs through commercially developed lands and adjacent to public roads including the busy N69 Dock Road, the waterbirds occurring here are likely to be already habituated to a range of anthropogenic noise sources. Given that the development site is situated in a relatively built up area with moderate levels of existing noise disturbance, where the main development site is screened from the estuary by the 3m high embankment, the proposed development is not expected to cause any significant disturbance/displacement impacts on the local waterbird population in general including the SPA and pNHA's qualifying interest species. Furthermore, the project will not result in artificial light spillage to the designated sites as the proposed lighting scheme will be confined to the main development area, which is screened from the estuary by the existing flood embankment. The lighting scheme to be employed during the construction phase of the development will be designed to minimise light spillage from the site. Construction work will generally be confined to daylight hours and lighting will generally not be required for the construction phase. There will however be occasions where the provision of portable lighting will be required (works on roadways and power floating floors as examples). Where possible and without jeopardising site safety, lights will be pointed down at a 45-degree angle and away from sensitive receptors. The site compound will have external lights for safety and security. These lights will be pointed down at a 45-degree angle and fitted with motion sensors to reduce unnecessary lighting and will be located away from sensitive receptors where possible. Taking the above into consideration, no significant disturbance/displacement impacts on qualifying bird interests of the SPA are anticipated as a result of the proposed development works and operations.

Lower River Shannon SAC is designated for the habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive (See Table 8.2 for list of qualifying interests). The primary conservation interests relate to habitats, botanical species and aquatic based faunal species (e.g. Lamprey, Salmon, Freshwater Pearl Mussel) and not terrestrial based faunal species that may be vulnerable to disturbance by activities associated with the site. One possible exception to this is Otter, which has a terrestrial element to its ecology as well as its primary association with aquatic ecosystems. However, research indicates that Otters can be tolerant of human related disturbance (e.g. Bailey and Rochford 2006, Sleeman *et al.* 2006 and Sleeman & Moore 2005). There were no signs of Otter (spraints, prints etc.) noted within or adjacent to the proposed development site during the site survey work. While the site is located c. 60m east of the Ballynclogh River it is effectively screened from the proposed development site by the nearby 3m high flood embankment that runs along the eastern back of the Ballynaclogh River. This embankment effectively helps screen the potential impacts to Otter and other bird and mammal species that forage and commute along this watercourse. The lagoon area and associated drainage network may provide habitat along which otters and other bird and mammal species may forage or transit. However many of the onsite drains were very shallow and/or dry and are not thought to be of significant value as aquatic habitat. In relation to the lagoon (constructed wetland) habitat the proposed development has been setback from this to avoid any potential disturbance impact on species that use this habitat.

Given that the proposed development is located in close proximity to the Ballynaclogh River, it is possible that Otters are present within the vicinity, at least occasionally. However, given the lack of high quality aquatic habitat and the habitats primarily comprising of recolonising bare ground, rank grassland habitat (GS4 & GS1) with evidence of succession to scrub, it is unlikely the proposed site itself would support this species.

While there would be increased noise emissions during the construction phase of the development, these would not be considered to pose a significant risk owing to the transient nature of works and the measures being put in place to control construction related noise including;

- Proper maintenance of plant, to minimise the noise produced by on site operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers
- Compressors and generators 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.
- Location of plant shall consider the likely noise propagation to nearby sensitive receptors.

With regards to linkages to SAC habitats, the site does not contain any habitat which would have potential links to Old Oak Woodlands [91A0] or Alluvial Forests [91E0]. The woodland that was recorded onsite was Wet willow alder ash woodland (WN6), Immature woodland (WS2) and Mixed broadleaved woodland (WD1). None of these woodland types were considered to correspond to Annex I habitats. The area of marsh habitat recorded onsite was not considered to correspond to the Annex I Hydrophilous Tall Herb Communities [6430].

While it is noted that the Lower River Shannon SAC is located approximately 60m from the southern boundary of the site, no aquatic habitats of note are present within the development site itself. Therefore, there would be no direct impacts upon designated aquatic species, due to works being outside of any potential habitat for these species.

As already stated many of the conservation interests of the Lower River Shannon SAC do not occur in the vicinity of the development e.g. the population of the Freshwater Pearl Mussel is located upstream of the site. The greatest risk to the faunal qualifying interests occurring nearby and in particular downstream of the development would be through a pollution/run-off event and disturbance through lighting and noise. Given that there are existing on-site drains connecting the proposed development area with the Ballynaclogh River (and thus the Lower River Shannon SAC) there is a potential impact-receptor pathway through construction stage run off between the proposed development site and the Lower River Shannon SAC and River River Shannon & River Fergus Estuaries SPA.
There is therefore a potential impact-receptor pathway through construction stage surface water run-off between the study site and the nearby designated sites and therefore there is potential for disturbance or displacement to occur associated with a degradation of the aquatic habitats of these qualifying interests.

8.4.1.2 Habitats & Botanical- Construction Phase Impacts

No habitats listed under Annex I of the EU Habitats Directive were present within the proposed development site boundaries. Also, no botanical species protected under the Flora (Protection) Order 2015 or listed in the EU Habitats Directive were recorded during the terrestrial habitat survey. One species red-listed in Ireland was recorded within the study site the Greater Knapweed (*Centaurea scabiosa*) which is currently categorised as near threatened in the vascular plant Red List (Wyse-Jackson *et al*., 2015). A number of Flora Protection Order (2015) species are known to occur along the Ballynaclogh River including Triangular Club-rush (*Schoenoplectus triqueter)* and Opposite Leaved Pondweed (*Groenlandia densa*), these were recorded along the Ballynaclogh River during the aquatic ecology assessment but are not located within the SHD site boundaries. A number of orchid species including Common Spotted Orchid (*Dactylorhiza fuchsia*), Bee Orchid (*Ophrys apifera*) and Pyrimidal Orchid (*Anacamptis pyramidalis*) were recorded within and close to the proposed development site. None of these orchid species are Flora Protection Order 2015 species. All of the orchids recorded in the study area are listed as species of Least Concern on the Vascular Plant Red List (after Wyse-Jackson et al., 2015). However they are regarded as features of ecological interest of some conservation value due to their relatively rare occurrence in the surrounding environment and therefore mitigation measures have been prescribed for these species.

The habitats within the proposed development site range from **local importance lower value** to **local importance higher value**. Wet grassland (GS4), Dry meadows and grassy verges (GS2) are the primary habitats that will be directly impacted by the proposed development footprint, which are categorised as habitat of **Local Importance (Higher value)**. Other areas of semi-natural habitat which will be impacted by the proposed development include a Scrub (WS1), Mixed broad leaved woodland (WD1), Wet willow alder ash woodland (WN6) and Dry calcareous and neutral grassland (GS1), Marsh (GM1), Reed and large sedge swamp (FS1). There will be a **permanent loss** of these semi natural habitats.

8.4.1.2.1 Construction Phase Impacts

The construction impacts will entail the clearance and loss of vegetation due to the construction of the proposed 371 no. apartment and dwelling houses, creche and associated development works including roads, footpaths, wastewater network, surface water network, water supply infrastructure, public lighting, landscaping and amenity areas. This will result in a **permanent irreversible loss of habitats** of existing semi natural habitats which are of Local

importance lower to higher ecological value. A Landscaping Plan (Murray & Associates 2021) has been developed which includes the planting of 620 new trees within the development and the open spaces and at the margins of the main access route. Additionally, there will be 2170m^2 of native woodland and shrub planting specified within the residential areas, and a further 1300m^2 of native tree and shrub planting to the access road area (totalling 3,470m^2), further bolstering the green infrastructure network.
Some of the chosen species will include; Oak (Quercus robur), Rowan (Sorbus aucuparia), Pine (Pinus sylvestris), Whitebeam (Sorbus aria), Willow (Salix spp), Alder (Alnus glutinosa), Birch (Betula pendula) which will be planted in the open spaces of the development. Hornbeam (Carpinus betulus), Tilia cordata 'Greenspire', Platanus orientalis 'Minaret' will be planted along the link roads. On the local roads Alder (Alnus glutinosa), Birch (Betula pubescens) and Rowan (Sorbus aucuparia) will be planted. Hazel (Corylus avellana), Cherry (Prunus avium), Pyrus 'Chanticleer', Crab Apple (Malus sylvestris) and Silver Birch (Betula pendula) will be planted in small residential streets and home zones.

Such landscaping proposals will add to the biodiversity of the remaining green spaces within the proposed development. In the absence of any mitigation to protect existing trees during the construction phase, there is potential for retained scattered trees and treelines in the lands to be damaged by construction activity. This would arise from damage to roots of trees if they remain unprotected and are within the proposed construction corridors. Additionally, there is potential for machinery strike to damage tree limbs. In a worst-case scenario, the damage inflicted on the scattered trees and treeline habitats would result in their degradation and removal from the lands. The effect of this would be permanent and could be significant at the local geographic scale.

8.4.1.2.2 Invasive Plant Species

No plant species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (i.e. species of which it is a legal offense to disperse, spread or otherwise cause to grow in any place) or classified as a 'risk of high impact invasive species' (Kelly *et al*. 2013) were recorded within the study site. In total five non-native invasive plant species were recorded during the 2020 habitat survey including;

- Himalayan honeysuckle (*Leycesteria formosa*);
- Fuchsia (*Fuchsia magellanica*)
- Buddleia (*Buddleja davidii*)
- Travellers Joy (*Clematis vitalba*)
- Montbretia (*Crocosmia pottsii x aurea = C. x crocosmiiflora*)
- Sycamore (*Acer pseudoplatanus*)

Himalayan honeysuckle, Travellers Joy and Buddleia are classified as a 'risk of medium impact invasive species' (Kelly *et al.* 2013) but not listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011. Fuchsia and Montbretia are not as yet classified.

Construction works within the proposed works areas can potentially disturb stands of invasive plants and/or soils contaminated with invasive plant material. In addition to lands within the proposed works areas, there is an identified risk of invasive plant species being spread onto neighbouring lands and onto public roads and other locations. Construction works could therefore result in the spread of invasive plant species both in-situ and ex-situ. The most common ways that these species can be spread are:

- Site and vegetation clearance, mowing, hedge-cutting or other landscaping activities;
- Spread of seeds or plant fragments during the movement or transport of soil;
- Spread of seeds or plant fragments through the local surface water and drainage network;
- Contamination of vehicles or equipment with seeds or plant fragments which are then transported to other areas;
- Importation of soil from off-site sources contaminated with invasive species plant material.

A watercourse can act as a potential impact-receptor pathway allowing the transit of invasive species resulting in the indirect habitat loss/damage to downstream habitats in the wider area including designated nature conservation sites that are present e.g. Lower River Shannon SAC. These impacts are deemed not to be relevant given that these terrestrial species are not adapted to growth in the aquatic environment associated with the Lower River Shannon SAC and the Shannon and River Fergus Estuary SPA. Depending on the timescale for the construction of the proposed scheme it may be possible to eradicate some species prior to the onset of construction on the site via an advance treatment contract. However if control programmes have not been achieved before construction begins, then site hygiene measures will need to be put in place to ensure that the further spread of invasive species is avoided.
The potential disturbance to the invasive plant species during development and landscaping activities has been addressed by the following controls;

(i) Prior to the development works and landscaping activity begins a survey by an appropriately experienced ecologist will be carried out to establish the full extents of the invasive plant species within the proposed development site boundary;
(ii) In accordance with the TII guidance this survey will produce accurate 1:5,000 scale mapping for the precise location of invasive species.
(iii) The pre-construction surveys will be undertaken by suitable ecologists with competence in identifying the species concerned having regard to any seasonal constraint.
(iv) Areas of invasive species will be fenced off and signage installed where no works will take place within this area until such time as they can be eradicated/managed;
(v) The invasive species will be appropriately managed (aiming for eradication) prior to any vegetation clearance works occurring where these species were identified.
(vi) The Contractor's will prepare an Invasive Alien Species (IAS) Management Plan for the works. The Plan must be clearly communicated to all site staff and must be adhered to if it is to be implemented successfully.

The best available methods of control and eradication make reference to the NRA Guidelines (2010) and Fennell *et al*. (2018). It is recommended that a suitably experienced contractor is employed to undertake the invasive species eradication programme at the site. A number of approaches are available for the control of invasive plant species consisting of chemical control, physical control or a combination of both. For example, manual control may only work for small, new infestations such as young Buddleia shrubs, but a combination of manual and chemical control may be required to ensure the complete eradication of more established shrubs. The specialist contractor will advise/finalise the best approach based on their knowledge of the species in question.

These measures will ensure that the spread of invasive species and resultant negative impacts will be avoided and the overall impact from invasive species is therefore considered **neutral.**

8.4.1.3 Aquatic Ecology- Construction Phase Impacts

Ballynaclogh River, which borders the proposed development site to the west, provides valuable habitat for a range of key aquatic ecological receptors such as fish (e.g. flounder, mullet species, European eel), macro-invertebrates, waterfowl and Annex II otter). Whilst not recorded at survey sites 7A or 7B, the Flora Protection Order (FPO) species opposite-leaved pondweed (*Groenlandia densa*) is widespread along Ballynaclogh River upstream and downstream of the study area (NPWS data, Figure 8.5). The FPO species triangular clubrush (*Schoenoplectus triqueter*) was present along Ballynaclogh River at both sites 7A and 7B, supporting the known distribution of the species along the channel (NPWS data, Figure 8.5). Therefore, any land redevelopment works should be cognisant of this protected and sensitive species regarding potential impacts, particularly to existing site hydrology and water quality.

The following section describes the potential impacts on aquatic ecology arising from the construction phase. These are the potential impacts that could arise in the absence of appropriate environmental controls, monitoring and ecological mitigation measures. Overall given the scale and nature of the works, the magnitude of the impact associated with construction works is considered to be large adverse. The significance of the environmental effect is therefore severe / significant in the absence of mitigation based on the high sensitivity of the receiving environment.

8.4.1.3.1 Input of silt

As well as directly affecting fish through their gills, silt has the long term impact of settling on the riverbed smothering coarse patches of sediment with fine particles, this depletes oxygen levels within the sediment by reducing through-flow within the sediment and causing direct mortality of eggs and early life stages of various fish. The deterioration of the riverbed in this manner has a detrimental effect on the macroinvertebrate assemblage, which also has a knock-on effect on fish. The likelihood of influx to the watercourse increases dramatically with rain, particularly heavy rain. Slope, ground porosity and vegetated cover are also significant factors governing the input of sediment to a watercourse. Silt contamination has the potential therefore for significant negative impact.

8.4.1.3.2 Input of nutrients

Excessive nutrients drive up productivity within a watercourse. Excessive plant and algal growth is caused by input of the plant nutrients nitrogen and phosphorus. In the presence of excessive growth of organic matter ambient dissolved oxygen (DO) levels fall whilst the biochemical oxygen demand (BOD) rises (a measurement of the rate of oxygen usage by aerobic organisms). The preceding sentences are a brief overview of nutrient input, however in reality it is a complex science of parameters, drivers, knock-on effects and feedback systems that combine and deplete the oxygen levels in the watercourse. This can have a significant negative impact on fish life, as well as many species of invertebrates, often changing the species assemblage of the ecosystem itself.

8.4.1.3.3 Input of cement

The introduction of cement to an aquatic environment can change the chemistry of the water (particularly pH and dissolved oxygen) as well as adding suspended solids, and as such has the potential to cause significant negative impacts on the stream. The significance and duration of the chemical effect is dependent on parameters such as quantity spilled, dilution rates, speed of remediation etc., however a bad event could lead to a very significant medium-term impact. Concrete spills can cause fish kills, can be detrimental to the macroinvertebrate community, and the resultant reduction in water quality and its bio-indicators is in violation of the Water Framework Directive (2000/60/EC).

8.4.1.3.4 Input of hydrocarbons and other chemicals

Spillage of hydrocarbons and other chemicals into the aquatic environment, depending on its character and magnitude, has the potential to cause significant negative impacts of varying extents and durations. The spill can cause biotic mortality in a number/combination of ways, through physiochemical reactions (pH, DO, COD etc) or through direct toxicity.

8.4.1.3.5 Hydromorphological changes

Hydromorphological changes can result from direct mechanical disturbance of the river, or significant changes within the catchment. Examples of direct mechanical disturbance include re-alignment of the channel, disturbance of connectivity to the flood plain, river crossings etc. Examples of significant changes within the catchment include large scale poorly designed drainage systems, drainage of wetlands, replacement of the vegetated surface with less permeable surfaces; all of which can change the magnitude of flood events, and hence the erosion-deposition regime within the main channel.

8.4.1.3.6 Treefelling

The red line planning application area comprises 10.5 hectares, with the substantive develolment within 7.9ha. The two main issues pertaining to watercourses during tree felling are potential sediment release and potential nutrient release. Sediment is released mainly due to a combination of the sudden removal of canopy combined with the tracking of heavy machinery over unvegetated/exposed ground. Nutrients are released as a result of decomposing brash in combination with nutrients released from changes in soil structure and stability.

8.4.1.3.7 Increased traffic on existing roads

A network of unpaved access tracks exist currently within the site boundary. The increased passage of machinery on these earthen/gravel tracks, particularly heavy machinery, can cause release of sediment into watercourses. There are a number of processes through which this can happen including wear and break-down of surface gravels, degradation of roads due to a combination of weight and vibration, damage to roadside drainage, and importation of sediment on wheels and tracks. This also has the potential to input hydrocarbons to watercourses.

8.4.1.3.8 Earthworks

There will be significant earthworks onsite during the construction of the proposed development. Excavation, storage and movement of soil, sub-soil and potentially rock, infilling and raising of areas will be carried out for 371 residential apartments and houses, a crèche and all associated infrastructure. This has the potential to introduce silt, hydrocarbons and other chemicals into watercourses, as well as inducing hydromorphological change in watercourses.

8.4.1.3.9 Dewatering and pouring of foundations

Onsite deep excavations may potentially need to be dewatered due to water table issues or heavy rain. This water is usually laden with suspended solids and the suction associated with the pumping usually increases the level of suspended solids further. The pouring of foundations will involve concrete onsite. This is brought in bulk in concrete trucks, the CEMP (GDG, 2021) outlines how the washing out of concrete delivery vehicles shall either be carried out on return to the batching plant (preferred option) or in designated wash out areas on site. The latter method in particular has the potential to introduce silt and cement to aquatic environments.

8.4.1.3.10 Chemical spillage

The operation and maintenance of the machinery onsite involves the use of hydrocarbon derivatives such as diesel, hydraulic fluid (including brake fluid) and various lubricants. Common causes for spillage include burst hosepipes, leaking tanks, spillage during refill/maintenance, incidents at the holding tanks. There are a wide range of other chemicals on a building site that could be included for discussion here such as wood preservative, various solvents, chemical filled porta-loos etc.

8.4.1.3.11 Road stream crossings

The installation of a roads and infrastructure has the potential to impact watercourses. The magnitude of the impact can vary from slight to significant, depending on a variety of parameters such as flow rate, dilution rate, amount of material which was incident on the watercourse, chemical characteristics of the material incident on the watercourse. The duration of the impact is usually short as the impact would only occur during the construction stage and a small or medium size watercourse crossing usually commences and finishes within the one or two day period. Depending on the method used to cross the watercourse, it has the potential to input silt, chemicals or cement to the watercourse, or it may have the potential to impart hydrological changes on the watercourse.

8.4.1.4 Birds- Construction Phase Impacts

The clearance of vegetation to facilitate the construction of the proposed housing development will most likely lead to a short-term localised reduction in the bird species diversity present in the immediate area. The species most likely to be directly impacted are the species associated with the scrub/woodland/garden type habitats present. In the absence of mitigation the loss of this habitat could lead to a loss of nesting birds as well as the habitats that are attractive to these species.

Vegetation clearance will reduce the amount of cover, feeding, roosting and nesting habitat for many of species recorded in this area during the breeding and winter season surveys. The impacts are likely to be highly localised and many of the birds will disperse into similar habitats in the wider area. Several of the species recorded were either flycatching above (e.g. Swallow, Swift) or commuting across the proposed development site and these species are unlikely to be adversely impacted to any extent. The range of species present in the area in the breeding and winter season was fairly typical of the range of habitats present. There was no usage of the development site and adjoining areas by the SCI species.

The construction activity and movement of personnel and machinery will cause some localised disturbance for birds occurring within and in adjoining habitats. Birds, like many mammals, habituate to regular activity and many of the resident species are already likely to be relatively tolerant of anthropogenic sources of disturbance (light, noise, traffic). However, rapid percussive noise can still cause a startle response and high-noise levels can impact on the ability of songbirds to communicate with conspecifics (e.g. Zollinger, 2017).

Construction activity may also have localised and temporary positive impacts for certain species. Species such Corvids and Gulls may be attracted into sites with ongoing earthworks by easy foraging opportunities. Similarly, certain species are attracted into newly seeded areas e.g. Woodpigeon. Improperly stored edible and putrescible wastes have the potential to attract in scavenging species.

Run-off, or pollution of watercourses could impact on the birds dependent on the downstream riparian habitats including the River Shannon & River Fergus Estuaries SPA. The potential impacts on the Natura 2000 sites are considered in detail in the accompanying NIS.

8.4.1.5 Mammals- Construction Phase Impacts

8.4.1.5.1 Non-Volant mammals

The proposed housing development is located at a site which is of lower local importance for most fauna overall. However, the context of the site, sizeable green space within a suburban area and location close to the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA increases the potential importance of the site area for a range of species.

Within the proposed development site there was no burrows of protected mammal species recorded. The diversity and relative abundance of non-volant mammals in the area was fairly typical for a site of this size in this part of Ireland.

The construction phase will require the clearance of some vegetation, mostly immature woodland (WS2) and Scrub (WS2) that has developed on the grassland at the former race course. The clearance of vegetation has the potential to disturb and displace some non-volant mammal species. Vegetation clearance also has the potential to directly impact mammals that may be present (include mortalities). It can also result in a localised loss of foraging, resting and breeding habitat for certain species.

During the construction phase of the development, there is likely to be a certain amount of disturbance to fauna occurring on/near the site and along access route, however this will be temporary in duration, and localised. Secure fencing that does not permit the passage of mammals through the construction site may increase the risk of severance of commuting routes. Similarly, night-time illumination of the site compounds etc. may cause localised disturbance for the local mammal species.

Construction traffic and movement of machinery and personnel will occur during daylight hours with some marginal increase in collision risk for mammals commuting through the site. Deep excavations and pooled water associated with the construction phase have the potential to entrap non-volant mammals. Works and associated activities arising from construction of the proposed development may lead to a disturbance of fauna through displacement at and close to the study site in general. However, the site located in a suburban built environment and as such fauna may already be relatively tolerant of human disturbance.

In the event that some mammals are displaced through disturbance or direct loss of habitat it is probable that many of the affected or disturbed individuals may move into adjoining lands. Given the relatively small footprint of the development any displacement or disturbance that may occur is likely to be highly localised, both temporally and spatially. It is considered that the small permanent loss of conifer plantation is unlikely to impact negatively on the wider diversity or abundance of non-volant mammals in this area. However, the construction activity has the potential to introduce sources of disturbance and/or attraction (e.g. edible wastes) for certain mammal species that in the absence of mitigation could alter the mammal community present.

A major run-off or pollution event could have a negative impact on the local mammal fauna through mortality and/or loss of habitat. Mammals associated with aquatic habitats (e.g. Otter) in the wider area could potentially be subject to negative impact through activities associated with the project, such as siltation, run-off and fuel spills. The proposed development site is not directly adjacent to the sensitive riparian corridors and is set away from watercourses.

In the absence of adequate mitigation it is likely that there would be slight negative short-term impacts on the local non-volant mammals arising from the proposed development.

8.4.1.5.2 Volant mammals (Bats)

Many of the potential impacts described for non-volant mammals also apply when considering bats. The proposed SHD site does not have any significant roost potential for bats but there is a relatively high diversity of bats represented in the overall Greenpark area.

The removal of vegetation has the potential to reduce the local foraging resource for bats. It could also lead to the removal of trees that now, or in the future, could have some potential for roosting bats. However, it is considered unlikely based on the field surveys and the nature and age of the woody vegetation to be cleared, that there is any bat roost in the area that will be cleared to facilitate the construction.

For some fauna (*i.e.* active at dusk/night/early dawn), in particular bats, disturbance displacement can also arise as a result of artificial lighting, where most bat species are negatively affected by artificial light in general (see Bat Conservation Ireland 2010, Stone 2013). Construction phase lighting has the potential to negatively impact the local bat species and may increase the chances of severance of commuting and foraging routes. Construction phase lighting has the potential to attract certain bat species and displace others and floodlighting can be a significant source of disturbance for all nocturnal mammal species. However, this impact will be temporary in nature and localised to areas around the site compound. Night-time lighting will be limited in extent (both static lighting, and vehicle headlights) as standard construction works will be carried out mostly during daylight hours.

Construction related run-off or degradation of aquatic habitats through hydrological links could potentially lead to a deterioration of the feeding resource for bats associated with aquatic habitats in the wider area. However, the design of the proposed development has ensured that there will be no construction activity within 50m of watercourses, except for the works associated with the improvement to the access track and the undergrounding of the cable route.

The removal of vegetation may also result in fragmentation of commuting routes and greater light-spill to areas formerly screened by vegetation. All of these potential impacts could adversely impact on the species diversity and pattern of usage of the site and adjoining areas by bats.

8.4.1.6 Other Taxa- Construction Phase Impacts

Common Frog which was recorded within the Application Site Boundary is listed on Annex V of the EU Habitats Directive, and is also legally protected by the Irish Wildlife Acts (1976 – 2012).The construction phase could lead to disturbance or loss of other species present such as Common Frog and Common Lizard. Frogs in particular occur widely at the site and probably breed in pools, drains etc. across the site. Track widening and construction could potentially reduce the amount of suitable breeding habitat for Frogs at the site. The design of the proposed development has sought to reduce the potential impact upon Frogs by applying a 50m buffer between the proposed development works and watercourses.

The Common Frog is recorded as being widespread on the site and the potential loss or disturbance of a small area of potential habitat for the species as a result of the development will have an insignificant impact on the local breeding frog population as a whole. This is due to the widespread availability of alternative suitable habitat in the area and also due to the high abundance, adaptability and favourable conservation status of this species (as explained below).

According to the recent National Frog Survey of Ireland 2010/2011, frogs are probably one of the most numerous vertebrates in Ireland, with an estimated breeding population in the Republic of Ireland of 165 million (95% Confidence Intervals: 104M - 310M frogs; Reid *et al.*, 2013). The national survey found that frogs were widespread and their distribution did not significantly differ between 1993-2006 and 2007-2011. Accordingly, the National Conservation Assessment for Common Frog was assessed as Favourable or ‘good’ (Green) (Reid *et al.*, 2013). A major contributing factor to the favourable conservation status of frogs in Ireland is the widespread availability of drainage ditches, which were found to be extensively utilised by frogs (86% of all breeding frogs occurred in this habitat) (Reid *et al.*, 2013). Furthermore, the National Frog Survey of Ireland found that frog occurrence and density were unaffected by levels of disturbance or water quality (pollution). Thus, there were no perceived impacts or threats that significantly affected frog occurrence or density [50].

The results of recent research have shown that frogs are abundant and widespread in Ireland, with a stable population and favourable conservation status [50]. This species has been shown to be adaptable (utilising man-made drainage ditches) and relatively tolerant of disturbance

[50]. It is likely therefore, that potential localised disturbance associated with the construction phase, will be offset by the availability of settlement ponds and other drainage features associated with the proposed infrastructure.

Construction activities have the potential to impact upon aquatic habitats at and downstream of the site through hydrological links from the works areas. Potential impacts on aquatic habitats and species are considered in detail in Chapter 10 (Hydrology) and in Section 8.4.2.3 (Aquatic Ecology) of this chapter. The drainage design behind the Site Drainage Management Plan is "to keep clean water clean" and to maintain a separation between clean water and water draining from work areas that may contain silt. Clean water is kept clean by maintaining a development free buffer zone around natural water bodies and features; avoiding disturbance to natural water bodies, installing clean water drains or interceptor drains around infrastructure, reducing works in close proximity to man-made drainage features where possible. Management of drainage waters from work areas within the site that might carry silt or sediment, and nutrients, will be routed towards stilling ponds prior to controlled diffuse release over vegetated natural surfaces. As described above the Aquatic Ecology Assessment has concluded that the overall impact on aquatic habitats to be **neutral** overall.

To conclude, the construction phase could lead to the disturbance or loss of other taxa. However, this will be temporary in duration and affected taxa will be able to move into the wider area, given the presence of similar and other suitable habitats. Considering the above, potential impacts on other taxa from the proposed newdevelopment are considered **neutral**.

8.4.2 Potential Operational Phase Impacts

The potential operational phase ecological impacts are largely related to (i) Surface /storm water run-off, (ii) waste water/foul effluent management and (iii) disturbance/displacement to species (e.g. otter, wintering water birds) as a result of noise/visual cues associated with the operational phase of the proposed development. An Operational phase Waste Management Plan has been prepared (GDG, 2021) and accompanies the planning application. This describes the primary undertakings in relation to wastemanagement at the site post-construction.

8.4.2.1 Designated sites- Operational Phase Impacts

As outlined previously there is a potential impact-receptor pathway in relation to surface water and waste water discharge via a hydrological connection between the proposed development site and Lower River Shannon SAC, River Shannon and Fergus Estuary SPA, the Inner Shannon Est. - South Shore pNHA and the Fergus Est. & Inner Shannon - North Shore pNHA.

Furthermore due to the proximity of the proposed development site to the Lower River Shannon SAC, River Shannon and Fergus Estuary SPA and the Inner Shannon Est. - South Shore pNHA located less than 150m from the proposed development site the potential for disturbance/displacement impacts on the qualifying interests (otter, wintering water birds) of the designated sites are also considered relevant.
Therefore the following potential impacts on the Lower River Shannon SAC, River Shannon and Fergus Estuary SPA, the Inner Shannon Est. - South Shore pNHA and the Fergus Est. & Inner Shannon - North Shore pNHA will be considered below;

(i) Potential operational phase surface-water run-off impacts;
(ii) Potential operational stage waste water discharge impacts and;
(iii) Potential disturbance/displacement impacts on qualifying interest species of the aforementioned designated sites.

A NIS has also been completed for the proposed development and accompanies this application.

8.4.2.1.1 Surface-Water Run-Off: Operational Phase

During the operational phase, surface water run-off at the site will be collected by a new surface water sewer network in the proposed development, which will link to the existing lagoon (constructed wetland), and which ultimately discharges to Ballynaclogh River. There is therefore a potential impact-receptor pathway through operational stage surface water discharge between the study site and four overlapping designated sites associated with Lower River Shannon SAC, River Shannon and Fergus Estuary SPA, the Inner Shannon Est. - South Shore pNHA and the Fergus Est. & Inner Shannon - North Shore pNHA. Hydrological links are not considered relevant to any of the other designated sites within 15km of the proposed development site as they do not share an impact-receptor pathway with the proposed development site.

During the operational phase, there is potential for fuel or oil spillages and contaminants from vehicle engines. Run-off from these parking areas and roadways may therefore include residual hydrocarbon contaminants from fuel emission and tyres, sediment and trace contaminants like metals and organics and therefore presents a potential source of contamination that could have a pathway to surface waters through the storm water drainage system. The nature of these contaminants could have a toxic effect on the biology of the receiving waters affecting the ecological status and chemical status of the water body and thereby potentially impacting on the ability of the water body to achieve its downstream conservation objectives for the Natura 2000 and nationally designated sites.

Given the scale and nature of the work for the proposed development site, the magnitude of the impact associated with surface run-off contamination is considered to be *large adverse.* The significance of the environmental effect is therefore *significant* in the absence of mitigation based on the high sensitivity of the receiving environment.

8.4.2.1.1 Wastewater/Foul Effluent Discharge: Operational Phase

Inadequate or inappropriate urban wastewater infrastructure can result in significant pressures to surface water bodies particularly where misconnections (piping of sewerage directly to a storm water network or surface water body), can result in significant impacts to the biology and chemistry of the aquatic environment. It is also important to ensure the existing sewer network within an agglomeration has capacity to accept the additional hydraulic and pollutant loading from the proposed development and that adequate treatment is provided at the wastewater treatment system so as not to impact the receiving environment and downstream sensitive areas, particularly given the existing nutrient pressures in the receiving water bodes is the key driver for the less than good ecological status. Given the scale and nature of the work, the magnitude of the impact associated with inadequate or inappropriate foul water collection and treatment is considered to be major adverse. The significance of the environmental effect is therefore significant in the absence of mitigation based on the high sensitivity of the receiving environment.

Wastewater generated on-site particularly during the operational phase of the development will be piped and discharged to the existing Irish Water foul sewer. Irish water has provided agreement in principal for the connection of the development associated with the SHD to their assets and have confirmed that the Bunlicky WWTP has adequate capacity for the development. Provided the sewer network is installed using industry standard best practice, and routinely checked there is likely to be no impact from wastewater from the development and therefore no further mitigation required. Drainage pipelines will be inspected by CCTV at completion of the construction project and any damage will be repaired.

Given that the proposed development will discharge to the Bunlicky WWTP which is operating within its discharge standards and which has the capacity to accept the loading associated with the proposed development, no impacts on designated sites are expected as a result of waste water discharge from the proposed development and no mitigation measures are therefore required in relation to waste water discharge and designated sites

8.4.2.1.3 Disturbance displacement: Operational Phase

Consideration needs to be given to the potential for disturbance/displacement impacts of fauna that are listed as qualifying interests (e.g. otter, wintering waterbirds) of designated sites through noise and/or visual cues arising from the proposed development. The Lower River Shannon SAC, River Shannon and Fergus Estuary SPA, the Inner Shannon Est. - South Shore pNHA are located within 150m of the proposed development site. The closest designated site is the Lower River Shannon SAC approximately 60m away and the Ballynaclogh River which forms part of this SAC is >100m away from the proposed development site. Activities associated with the operation of the proposed development could potentially lead to increased disturbance (e.g. light and n oise) in the vicinity. However given the residential nature of the development and due to the fact that the Ballynaclogh River is effectively screened from the proposed development site by a large flood embankment (c3-4m high), it is not likely that Otter and other bird and mammal species that forage and commute along the riparian corridor will be significantly affected by the proposed development during the operational stage. While Otter spraints were recorded at several points from the banks of the Ballynaclogh both upstream and downstream of the N18 bridge no holts were observed and no Otter signs were recorded within the main development site, likely due to the low foraging value. Given the generally lower value aquatic habitats within the Greenpark site, otter potential is low with the exception of the lagoon (constructed wetland). With the mitigation proposed it is considered that potential for noise and light to impact upon protected species during the operational phase would not be significant.

8.4.2.2 Habitats and Botanical- Operational Phase Impacts

There will be no additional removal of habitat during the operational phase of the proposed development and as such there is no potential for loss of semi-natural habitat and flora arising from the operational phase. Potential impacts arising from the operation of the development in terms of habitat loss on semi-natural habitats/flora are considered neutral.

Riparian habitats and flora (including the FPO species *Groenlandia densa and Schoenoplectus triqueter)* associated with aquatic habitats in the wider locality could be negatively affected by the proposed development through indirect hydrological/water quality impacts such as nutrient release, siltation and/or contaminated run-off/hydrocarbon release arising from the study site development works footprint and site maintenance and site management activities during the operational phase. Detailed surface water management measures (See Chapter 10. Hydrology) have been incorporated into the proposed residential development design to minimise the potential for a significant effect on water quality, including downstream designated sites.

Taking the above into consideration, potential effects on habitats and flora at the site arising from the operational phase of the proposed development are considered neutral, with operational phase effects on habitats and flora associated with aquatic habitats in the wider area are also considered neutral once appropriate mitigation is applied to any site maintenance and management works during the operational phase of the development.

8.4.2.3 Aquatic Ecology- Operational Phase Impacts

8.4.2.3.1 Surface water run-off: Operational Phase

During the operational phase, surface water run-off at the site will be collected by a new attenuated surface water sewer network in the proposed development, which will link to the existing lagoon for attenuation, and which ultimately discharges to Ballynaclogh River. There is therefore a potential impact-receptor pathway through operational stage surface water discharge between the proposed development site and the aquatic environment. In the event of flooding during the operational stage, there is potential for storm water run-off to be impacted by pollutants arising within the car parking areas and roadways. This runoff has the potential to provide pathways for a wide range of contaminants arising from general operations to the aquatic environment. The main potential pollutants from surface water drainage or direct run-off are sediment, hydrocarbons, and trace contaminants including metals and organics. In the absence of mitigation the project has the potential to have significant negative impacts on the aquatic environment during the operation stage should a significant flood event occur or via surface water contamination.

8.4.2.3.2 Wastewater/Foul Effluent Discharge: Operational Phase

Inadequate or inappropriate urban wastewater infrastructure can result in significant pressures to surface water bodies particularly where misconnections (piping of sewerage directly to a storm water network or surface water body), can result in significant impacts to the biology and chemistry of the aquatic environment. It is also important to ensure the existing sewer network within an agglomeration has capacity to accept the additional hydraulic and pollutant loading from the development and that adequate treatment is provided at the wastewater treatment system so as not to impact the receiving environment and downstream sensitive areas, particularly given the existing nutrient pressures in the receiving water bodes is the key driver for the less than good ecological status.

Given the scale and nature of the work, the magnitude of the impact associated with inadequate or inappropriate foul water collection and treatment is considered to be *major adverse.* The significance of the environmental effect is therefore *significant* in the absence of mitigation based on the high sensitivity of the receiving environment. Wastewater generated on-site during the operational phase of the development will be piped and discharged to the existing Irish Water foul sewer. Irish water has provided agreement in principal for the connection of the development associated with the SHD to their assets and have confirmed that the Bunlicky WWTP has adequate capacity for the development. Provided the sewer network is installed using industry standard best practice, and routinely checked the potential impact is considered to be neutral from wastewater from the development and therefore no further mitigation required.

8.4.2.4 Birds- Operational Phase Impacts

There will be a permanent increase in modified habitat; buildings and artificial surfaces (BL3; of no appreciable ecological value), as a result of the proposed development. In the absence of appropriate environmental controls and landscaping the proposed housing development site could lead to a permanent local reduction in the diversity and abundance of bird species. It is likely that this impact would be localised and the extent of the reduction in species diversity would be related to the extent of vegetative cover provided as part of the development. Certain arboreal species would be much less likely to persist at the site if there was a lack of trees.

There will be ongoing human activity/vehicular disturbance during the operational phase of the proposed development which may lead to a slight increase in noise and night-time lighting levels at the site (due to the proposed increase in residential occupancy) and in the surrounding areas. However, the bird species confirmed present at the site are as already described, likely to be relatively tolerant of noise and other anthropogenic sources of disturbance or will relocate to nearby similar habitats.

Without the application of appropriate mitigation there is a likelihood of some slight local permanent loss of bird species diversity associated with the development.

8.4.2.5 Mammals- Operational Phase Impacts

8.4.2.5.1 Non-Volant Mammals- Operational Stage Impacts

There will be a permanent increase in modified habitat; buildings and artificial surfaces (BL3; of no appreciable ecological value), as a result of the proposed development. In the absence of appropriate environmental controls and landscaping the proposed housing development site could lead to a permanent local reduction in the diversity and abundance of non-volant mammal species. It is likely that this impact would be localised and the extent of the reduction in species diversity would be related to the extent of vegetative cover provided as part of the development. Certain arboreal species (e.g. Pine Marten and Red Squirrel) would be much less likely to persist at the site if there was a lack of trees.

There will be ongoing human activity/vehicular disturbance during the operational phase of the proposed development which may lead to a slight increase in noise and night-time lighting levels at the site (due to the proposed increase in residential occupancy) and in the surrounding areas. However, the non-volant species confirmed present at the site are as already described, likely to be relatively tolerant of noise and other anthropogenic sources of disturbance.

Without the application of appropriate mitigation there is a likelihood of some slight local permanent loss of non- volant mammal species diversity associated with the development.

8.4.2.5.2 Bats (Volant Mammals)- Operational Stage Impacts

In the absence of mitigation and sensitive landscaping there is some likelihood of permanent localised negative impacts on the diversity and abundance of bats at the proposed development sites. Similarly, lighting design can impact on the attractiveness of a site for bats and impact upon their commuting pathways.
Conversely, the buildings themselves may in time have some roost potential for locally occurring bats.

8.4.2.6 Other Taxa- Operational Phase Impacts

The operational phase is not likely to lead to significant impacts on other taxa (e.g. Lepidoptera, Odonata, amphibians and reptiles) that occur at or in the immediate vicinity of the site.

8.5 Mitigation Measures

From the outset an iterative process of Mitigation by Design was employed for the proposed housing development whereby independent ecological expertise was utilised at an early design stage in identifying the ecological constraints and designing the site layout to take account of these constraints. Ecology Ireland was retained at an early stage and fed into the scoping of surveys and preparation of draft Masterplan for the overall Greenpark site.

This mitigation by design approach greatly reduces the risks of adverse impacts arising from the development from the outset, on flora, fauna and their habitats. Any potential impacts will be minimised by implementing the following mitigation and enhancement measures, such that residual impacts will be **slight negative-neutral in magnitude** overall for the proposed SHD housing development.

A dedicated planning phase Construction and Environmental Management Plan has been prepared for the proposed development (GD Geo, 2021). The CEMP provides details of responsibilities and timeframes for the implementation of measures and management controls. All of the recommendations within the CEMP will be implemented fully with the oversight of a full-time Environmental Clerk of Works (ECoW). GDG (2021) has also prepared a Construction phase Waste Management Plan (CWMP) and Operational phase Waste Management Plan (OWMP) which outline the principal commitments to the management of wastes throughout the project.

These plans (e.g. the planning phase CEMP) will be developed further at the post-planning and construction stages, by the client and on the appointment of the main contractor to the project and once the detailed civil design is finalised.

The following mitigation measures relating to ecology will be implemented as part of the proposed development in order to minimise the potential impacts on the existing ecology as discussed above

8.5.1 Construction Phase

8.5.1.1 Designated Sites – Mitigation Measures

The following mitigation measures are specified in the NIS for the proposed development which accompanies this application and are relevant to designated sites in general.

8.5.1.1.1 Wastewater/Foul Effluent- Mitigation

The foul water drainage has been designed using Causeway Flow software in accordance with the “Recommendations for site development works for Housing Areas” design guide and Irish Water “Code of Practice for Wastewater Infrastructure” (see Appendix B of Punch Consulting Engineers, Engineering Report, 2021).

It is proposed that foul water from the proposed development shall discharge by gravity to the existing 225mm/300mm diameter foul sewer prior to discharging to the Limerick Main Drainage Network. It is noted that a self-cleansing velocity of 0.75 m/s will be achieved within the foul network design when flowing full as per Irish Water requirements.

A proposed residential development for 30 units was granted planning on Greenpark Avenue, planning number 17/1190. The development allowed for the foul network to discharge to the Limerick Main Drainage network within Greenpark. As part of the Greenpark housing development, it is proposed to provide a manhole at the site boundary to accommodate foul water flows from the Greenpark Avenue development. The proposed foul water drainage network has also been designed to allow for future residential and nursing home development projects within Greenpark.

Wastewater generated on-site particularly during the operational phase of the development will be piped and discharged to the existing Irish Water foul sewer. Irish water has provided agreement in principal for the connection of the development associated with the SHD to their assets and have confirmed that the Bunlicky WWTP has adequate capacity for the development. Provided the sewer network is installed using industry standard best practice, and routinely checked there is likely to be no impact from wastewater from the development and therefore no further mitigation required. Drainage pipelines will be inspected by CCTV at completion of the construction project and any damage will be repaired (B_1 in Table 21.1 contained in Chapter 21).

8.5.1.1.2 Surface water run-off- Mitigation

The development has incorporated a variety of Sustainable Drainage Systems (SuDS) techniques to counteract the potential increased runoff as a result of increased hardstanding. SuDS include attenuation by bypass separators on the storm water network, green roofed apartments, permeable paving of driveways and car parks, tree lined areas, infiltration trenches, swales as well as, grassed and open space landscape portions of the site (B_2 in Table 21.1).

A new surface water sewer network shall be provided for the proposed development which will be entirely separate from the foul water sewer network. Surface water run-off from roof areas and hardstanding areas are designed to be collected by a gravity pipe network. Surface water will be collected and discharged via a mixture of traditional and sustainable (SuDS) drainage to the existing 1350mm/1500mm diameter surface water sewer. Each unit will have its own independent connection to the surface water sewer network. All SuDS measures are to be implemented with reference to the UK Suds Manual and Limerick City & County Council water services department requirements (B_3 in Table 21.1).

The minimum diameter of the mainline surface water sewers is 225mm and minimum horizontal and vertical separation distances between the proposed drainage and other services are as per the Irish Water Code of Practice. It is proposed that surface water will discharge via attenuation tanks, a class 1 bypass separator and flow control device prior to discharging to the existing surface water network. The surface water drainage network has been analysed for the risk of flooding for a 1 in 5-year flood event, 1 in 30- year rainfall event and a 1 in 100-year rainfall event by means of simulating such events in the drainage model with no flooding occurring. An increase of 20% in rainfall has been included to account for climate change and 10% for urban creep. Please refer to Appendix D of Punch Consulting Engineers Engineering Report for the development for detailed calculations.

A proposed residential development for 30 units was granted planning on Greenpark Avenue, planning number 17/1190. The development allowed for the attenuated surface water network to discharge to the existing surface water network within Greenpark with a restricted discharge rate of 9l/s. As part of the Greenpark housing development, it is proposed to provide an attenuation tank to accommodate surface water flows from the Greenpark Avenue development. The attenuation tank has been designed for a 1 in 30- year rainfall event and a 1 in 100-year rainfall event with a 20% allowance for climate change.

It is proposed that the surface water sewer from Log na gCapall will be accommodated via a separate surface water sewer which will discharge to the existing 1350mm/1500mm diameter surface water sewer. The proposed surface water drainage network has also been designed to allow for future residential and nursing home development projects within Greenpark.

The SuDS proposals in place for the development site include; Green Roofs, Tree Pit Systems, Permeable Paving, Infiltration Trenches, Rain Gardens and Swales. These will contribute to reducing and restricting the discharge rate from the site. It is proposed to attenuate surface water from the proposed development with five attenuation tanks located in open spaces throughout the development. The proposed attenuation tanks have been designed to reduce the peak runoff from the site. The attenuation tank has been sized to cater for a 1:100 storm event with a 20% allowance for climate change and 10% for urban creep. Please refer to Appendix D of Punch Consulting Engineers Engineering Report for supporting calculations.

After attenuation in the lagoon (constructed wetland) water discharges via the existing outfall structure which has a 1050mm diameter Tideflex valve with thimble plate which allows discharge of water to the river at low tide but prevents backflow into the lagoon in times of high tide. This system will cater for the strategic housing development scheme. Provided the best-practice techniques illustrated in CIRIA's guidance document (C768 – Guidance on the Construction of SuDS) are followed, no further mitigation is required.

Adequately specified oil interceptors will be incorporated into the proposed drainage network for the parking areas and access roads (B_4 in Table 21.1).

8.5.1.1.2.1 Construction Phase Best Practice Measures

Mitigation measures will be implemented by the contractors who will construct the developments in accordance with the requirements listed within the planning phase Construction Waste Management Plan and Construction Environmental Management Plan (GDG, 2021) which accompany the planning application for the development. Furthermore, once appointed, the contractors will submit a detailed construction management plan based on the requirements of these submitted planning documents for approval by the Planning Authority. The mitigation measures implemented by the contractor will refer to the construction management procedures for best practice regarding the following recognised international guidelines (B_5 in Table 21.1):

- Good practice guidelines on the control of water pollution from construction sites developed by the Construction Industry Research and Information Association (CIRIA, 2001);
- Control of Water Pollution from construction sites, Guidance for consultants and contractors (C532);
- Environmental Good Practice on Site (3rd edition) (C692); and
- Guidelines on Protection of Fisheries During Construction Works and Adjacent to Waters (2016).

8.5.1.1.2.2 Suspended Sediment and Sedimentation

Preventing run-off is an effective method of preventing sediment pollution in the water environment. Therefore, adoption of appropriate erosion and sediment controls to manage run-off during construction is essential to prevent sediment pollution. Mitigation measures to address the potential impact from suspended solids will be carried out in accordance with a site specific CEMP in line with the undertakings provided in the planning phase CEMP (GDG, 2021). The measures will be employed prior to the commencement and during construction and will include such measures as (B_5 in Table 21.1):

- Where possible, significant earthworks operations should be limited to the summer months.
- Silt fencing will be installed around the perimeter of the site. The location of the silt fencing will be determined in the construction stage CEMP and will be subject to a detailed assessment of the area or phase to be developed. The purpose of the silt fencing is to prevent silt laden water leaving the site and entering neighbouring land with the potential to impact nearby watercourses. A typical silt fence detail is shown below in Plate 8.25. It will consist of a double layer of geotextile membrane fixed to wooden stakes approximately 600mm high. The membrane will be anchored into the ground to form a continuous barrier to silt laden water from the works site. Silt fences will be monitored via a silt inspection log (to be maintained by the Environmental Manager/ECoW) and periodically maintained during the construction period. Typical maintenance will consist of repairs to damaged sections of membrane and removal of a build-up of silt on the upslope side of the fence. Daily silt fence inspections are recommended as part of their operation ensuring that any necessary repairs can be expedited.

Plate 8.25: Silt Fencing (www.geosyn.co.uk).

- Drainage ditches will be installed to intercept surface water where there is a risk of significant water flow into excavations or on to adjoining lands. There will also be a requirement to periodically pump water from excavations. All collected and pumped water will have to be treated prior to discharge. The run-off will be directed through appropriately sized settlement ponds to remove suspended solids. All treated water will then be directed to an existing constructed wetland lagoon to the west of the site. The constructed wetland was designed in anticipation of the site being developed and was sized to receive and attenuate the operational surface water drainage. Discharge from the constructed wetland to the Ballynaclogh River is controlled by a penstock. The operational flow rates will be much greater, due to the increase in impermeable area. The constructed wetland will therefore be capable of dealing with runoff from the unpaved site during construction.
- Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the site compound. These agencies will be notified immediately in the event of a pollution incident.
- Any temporary storage of soil, hardcore, crushed concrete or similar material will be stored 50m from any surface water drains. All temporary storage areas should also have surface run-off controls in place to prevent migration of possible materials. There can be no direct pumping of silty water from the works directly to any watercourse. All water from excavations must be treated by infiltration over lands or via settlement areas, silt busters etc.

8.5.1.1.2.3 Flooding

- The site is protected from flooding by existing embankments along the Ballynaclogh River and River Shannon. The risk of flooding during the construction period is therefore limited to an embankment breach scenario and then only during the bulk earthworks operations. Once the earthworks are complete, the entire SHD site will be above the breach flood levels. An embankment breach is a catastrophic scenario with potential to cause widespread flooding, pollution and risk to life in the vicinity. The likelihood of flooding during the earthworks operations is extremely low. The following measures will be required (B_6 in Table 21.1):

- Stockpiles of soil shall be kept at the highest level possible within the site.
- Silt fencing and settlement ponds shall be placed at the highest level possible within the site. Silt fences shall be inspected as part of the daily inspection regime. Trapped silt shall be removed from silt fencing at regular intervals.
- Earthworks shall be left exposed for the minimum time possible. Earthworks formations shall be protected by a layer of imported granular fill.
- Landscaping and seeding of the perimeter embankments and retaining structures in accordance with the Landscaping Plan shall be carried out as early as possible.
- An Emergency Response plan shall be developed for the site and shall consider the following:
- Flood forecasting shall be used to determine the probability of the site being flooded.
- Emergency evacuation routes will be included in the plan to ensure that flooding does not threaten the safety of construction personnel and/or residents.
- Site compounds, fuel storage areas, generators and the like shall be sited as high as possible on the site.

<u>Control of cement run-off</u> (B_7 in Table 21.1)

- The washing out of concrete delivery vehicles is a potential source of pollution and shall be carried out in in designated wash out areas only. Wash-out areas on site will be located greater than 50m from any natural watercourse and properly designed with an impermeable liner to contain all cement laden water. No wash-out of ready-mix concrete vehicles shall be located within 10 metres of any temporary or permanent drainage features. Signage shall be erected to clearly identify the wash-out areas. Sufficient wash-out areas shall be provided to cater for all vehicles at peak delivery times.
- On-site batching of concrete is not envisaged, but ready to use mortar silos are often used for housing developments. These systems involve the delivery and storage of dry cement and aggregates in silos, water is added at the point of delivery to make mortar or plaster. The following controls shall be put in place for the on-site batching of concrete, mortar and render:
- The plant shall be maintained in good condition.
- Delivery of cement shall be means of a sealed system to prevent escape of cement.
- The plant shall be situated on a paved area at least 20m from any temporary or permanent drainage features.
- Emergency procedures shall be in place to deal with accidental spillages of cement or mortar.

8.5.1.1.2.4 Accidental Spills and ***Leaks*** (B_8 in Table 21.1)

- No bulk chemicals will be stored within the active construction areas. Temporary oil and fuel storage tanks may be kept in the material storage area in suitable containers and will be stored on appropriately bunded spill pallets as required. Any fuel and oil stored onsite shall be stored on bunded spill pallets approved under BS EN 1992-3:2006). All bunds will be impermeable and capable of retaining a volume of equal to or greater than 1.1 times (>110%) capacity of the containers stored on them. In the event of a spillage, excess oil or fuel will be collected in the bund.
- Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will be undertaken offsite where possible. Where this is not possible, filling and maintenance will take place in a designated material storage compound, which is located at least 10

metres from any temporary or permanent drainage features. Spill protection equipment such as absorbent mats, socks and sand will be available in clearly marked bins/silos and in construction vehicles to be used in the event of an accidental release during refuelling. Training will be given to site workers in how to manage a spill event.

The following mitigation measures will be taken at the construction site to prevent any spillages to ground of fuels during machinery activities and prevent any resulting soil and/or groundwater quality impacts (B_9 in Table 21.1):

- Refuelling will be undertaken off site where possible.
- Where mobile fuel bowsers are used the following measures will be taken:
- Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use.
- Any pump or valve will be fitted with a lock and will be secured when not in use.
- All bowsers to carry a spill kit and operatives must have spill response training; and
- Portable generators or similar fuel containing equipment will be placed on suitable drip trays.
- Weekly checks of spill kits will be carried out to ensure they are sufficiently stocked.

<u>Monitoring (B_27 in Table 21.1)</u>

- Daily checks will be carried out and recorded in a Surface Water Management Log to ensure surface water drains are not blocked by silt, or other items, and that all storage is located the required distance from surface water receptors. A daily log of inspections will be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not reoccur.

8.5.1.1.2.5 Concrete and Cement Pollution (B_10 in Table 21.1)

The impacts in relation to cement and concrete for the development are, for the most part (but not limited to) the installation of the concrete areas (to be poured in-situ) and construction works of buildings.

The principal risks are:
The use of concrete in close proximity to water bodies requires a great deal of care. Fresh concrete and cement are very alkaline and corrosive and can cause serious pollution in water bodies. It is essential to ensure that the use of wet concrete and cement in or close to any water course is carefully controlled so as to minimise the risk of any material entering the water, particularly from shuttered structures or the washing of equipment.

- A concrete washdown area will be provided on site for trucks to use after delivery of concrete or on return to the batching plant. This area will be adequately bunded to mitigate the risk of contaminated runoff discharge to the Limerick Dock water body. Concrete trucks are to be washed down within the concrete truck washdown area after delivery of concrete, prior to exiting the site. Washdown runoff will be appropriately treated prior to discharge;
- Wash-out areas on site will be properly designed with an impermeable line to contain all cement laden water. No wash-out of ready-mix concrete vehicles shall be located within 10 metres of any temporary or permanent drainage features. Signage shall be

erected to clearly identify the wash-out areas. Sufficient wash-out areas shall be provided to cater for all vehicles at peak delivery times;

- On-site batching of concrete is not envisaged, but ready to use mortar silos are often used for housing developments. These systems involve the delivery and storage of dry cement and aggregates in silos, water is added at the point of delivery to make mortar or plaster. The following controls shall be put in place for the on-site batching of concrete, mortar and render:

  - The plant shall be maintained in good condition.
  - Delivery of cement shall be means of a sealed system to prevent escape of cement.
  - The plant shall be situated on a paved area at least 20m from any temporary or permanent drainage features.
  - Emergency procedures shall be in place to deal with accidental spillages of cement or mortar.

In circumstances where the mitigation measures are employed during construction operations, the potential impact to receiving water environment will be reduced to *negligible* thus reducing the significance of environmental effect will be reduced to *imperceptible.*

8.5.1.1.2.6 General Construction Works

The risk of water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages/spillages of fuels, oils, other chemicals and waste water) will be controlled through good site management and the adherence to codes and practices which limit the risk to within acceptable levels. The following measures will be implemented during construction (B_11 in Table 21.1):

- Silt control measures (as outlined in the planning phase Construction Environmental Management Plan) in the working CEMP which will be developed and implemented by the contractor, will include detail in respect of every aspect of the works in order to minimise potential impacts and maximise potential benefits associated with the works;
- Management and auditing procedures, including tool box talks to personnel, will be put in place to ensure that any works which have the potential to impact on the aquatic environment are being carried out in accordance with the contactors environmental controls, which will be consistent with an approved CEMP and any planning conditions;
- Existing and proposed surface water drainage and discharge points will be mapped on the Drainage layout. These will be noted on construction site plans and protected accordingly to ensure water bodies are not impacted from sediment and other pollutants using measures to intercept the pathway for such pollutants;
- Welfare facilities (canteens, toilets etc.) will be available within the construction compound and this will remain in place for the construction of the proposed development. The offices and site amenities will initially need to have their own foul water collection until connections are made to the mains networks.

Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures (B_12 in Table 21.1):

- Vehicles delivering material with potential for dust emissions to an off-site location shall be enclosed or covered at all times to restrict the escape of dust;
- Any hard surface site roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only;
- A power washing facility or wheel cleaning facility will be installed near to the site compound for use by vehicles exiting the site when appropriate;
- Road sweepers will be employed to clean the site access route as required.

The incorporation of these mitigation measures during the construction phase means the potential impact to receiving water environment will be reduced to negligible thus reducing the significance of the environmental effect to imperceptible, based on the high sensitivity of the receiving environment.

The use of oils and chemicals on-site requires significant care and attention. The following procedures will be followed to reduce the potential risk from oils and chemicals (B_13 in Table 21.1):

- New metal gerry cans with proper pouring nozzles will be used to move fuel around the site for the purposes of refuelling items of small plant on site. Metal gerry cans and any other items of fuel containers will be stored in certified metal bunded cabinets.
- Drip trays will be used under items of small plant at all times. Any waste oils etc. contained in the drip trays or the bunded area will be emptied into a waste oil drum, which will be stored within the bund.
- Any gas bottles will be stored in a caged area at a secure location on the site. All will be properly secured at point of work.
- No bulk chemicals will be stored within the active construction areas. Temporary oil and fuel storage tanks may be kept in the material storage area in suitable containers and will be stored on appropriately bunded spill pallets as required. Any fuel and oil stored onsite shall be stored on bunded spill pallets approved under BS EN 1992-3:2006). All bunds will be impermeable and capable of retaining a volume of equal to or greater than 1.1 times (>10%) capacity of the containers stored on them. In the event of a filling spillage excess oil or fuel will be collected in the bund;
- Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will be undertaken offsite where possible. Where this is not possible, filling and maintenance will take place in a designated material storage compound, which is located at least 10 metres from any temporary or permanent drainage features. Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release. Training will be given to appropriate site workers in how to manage a spill event. A certified double skinned metal fuel tank will be situated in this secure bunded area on the construction site if applicable. This tank will be certified for lifting when full.
- Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release during refuelling. Training will be given to appropriate site workers in how to manage a spill event. A hazardous bin will also be available to contain any spent sand or soak pads.
- Contingency Planning: A project specific Pollution Incident Response Plan will be prepared by the contractor and will refer to PPG 21 Pollution Incident Response Planning. The contractor's Environmental Manager will be notified in a timely manner of all incidents where there has been a breach in agreed environmental management procedures. Suitable training will be provided by the contractor to relevant personnel

detailed within the Pollution Incident Response Plan to ensure that appropriate and timely actions is taken.

The following mitigation measures will be taken at the construction site in order to prevent any spillages to ground of fuels during machinery activities and prevent any resulting soil and/or groundwater quality impacts (B_14 in Table 21.1):

- Refuelling will be undertaken off site where possible;
- Where mobile fuel bowsers are used the following measures will be taken:
    - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use;
    - The pump or valve will be fitted with a lock and will be secured when not in use;
    - All bowsers to carry a spill kit and operatives must have spill response training; and
    - Portable generators or similar fuel containing equipment will be placed on suitable drip trays.

Provided these mitigation measures are employed during construction operations, the potential impact to receiving water environment will be reduced to *negligible* thus reducing the significance of environmental effect will be reduced to *imperceptible*.

8.5.1.1.3 Habitats and Botanical- Mitigation

8.5.1.1.3.1 General Mitigation Measures for Habitats and Flora (B_15 in Table 21.1)

- Given the proximity of the site to ecologically sensitive receptors and EU and Nationally designated sites, an Ecologist will be appointed to oversee the implementation of the ecological mitigation and management measures committed to in the EIAR and associated documents.

- No removal of habitats or movement of construction machinery will occur outside of the
development works area/footprint during the construction phase. Existing trees and hedgerows shall be retained where possible.

- The works area/footprint will be clearly marked out for associated site staff, ecologically sensitive habitat will be fenced off in accordance with the advice of an Ecologist .

- Flora protection order species and Red listed plant species are known to occur in the area e.g. opposite-leaved pondweed (*Groenlandia densa*), triangular clubrush (*Schoenoplectus triqueter*), Least Bur-reed (*Sparganium natans*), Penny Royal (*Mentha pulegium*), Meadow Barley (*Hordeum secalinum*) and Autumn Crocus (*Colchicum autumnale*), Greater knapweed (*Centaurea scabiosa*). Prior to construction the Ecologist will check suitable habitat within the development footprint where these protected or red listed plants were recorded or are likely to be found. In the event that these species are found during the pre-construction checks, efforts should be made to avoid impacting upon or the loss of these species. If this is not possible a translocation plan will be developed by the Ecologist to move the protected flora to a suitable location. A survey will be required to confirm the extent of the range of the protected species and where necessary a derogation license from the NPWS will be obtained to develop possible translocation or alternative habitat development plans in consultation with the NPWS .

- Other species recorded which are not red-listed or FPO species but of ecological interest include a number of wild orchid species- the Bee Orchid, Pyramidal Orchid and Common spotted orchid. To try to conserve the seed bank of these wild orchids, prior to construction the Ecologist will find a suitable location to transfer these plants to.

- The area of species rich Dry calcareous and neutral grassland (GS1) located in the east of the site supported an abundance of Common spotted orchid and a species rich calcareous plant community. Prior to site clearance and under the supervision of an Ecologist this area shall be marked out, the topsoil in the area shall be removed carefully, kept intact and watered during the construction period to be reinstated and used in landscaping of the green areas or transferred to a suitable location to conserve the seedbank .

- The construction of the proposed development will be implemented in accordance with the
  Construction Environmental Management Plan (CEMP, GDG, 2021) for the proposed development to ensure environmental protection of the site in accordance with best practice controls (e.g. CIRIA 2015 & 2001; see GDG 2021) .

- The proposed Landscape Plan will be implemented in full. This includes the following:

  - There will also be 620 new trees planted within the development and the open spaces and at the margins of the main access route (Murray & Associates, 2021). Additionally, there will be 2170m^2 of native woodland and shrub planting specified within the residential areas, and a further 1300m^2 of native tree and shrub planting to the access road area (totalling 3,470m^2), further bolstering the green infrastructure network.
  - Some of the chosen species will include; Oak (*Quercus robur*), Rowan (*Sorbus aucuparia*), Pine (*Pinus sylvestris*), Whitebeam (*Sorbus aria*), Willow (*Salix* spp), Alder (*Alnus glutinosa*), Birch (*Betula pendula*) which will be planted in the open spaces of the development. Hornbeam (*Carpinus betulus*), *Tilia cordata* 'Greenspire', P*latanus orientalis* 'Minaret' will be planted along the link roads. On the local roads Alder (*Alnus glutinosa*), Birch (*Betula pubescens*) and Rowan (*Sorbus aucuparia*) will be planted. Hazel (*Corylus avellana*), Cherry (*Prunus avium*), *Pyrus* 'Chanticleer', Crab Apple (*Malus sylvestris*) and Silver Birch (*Betula pendula*) will be planted in small residential streets and home zones.

Provided these mitigation measures are employed during construction operations, the potential impact to habitats and botanical species are considered to be *Slight negative-neutral.*

8.5.1.1.3.2 Mitigation Measures for Invasive Plant Species (B_16 in Table 21.1)

Prior to the development works and landscaping activity begins a survey by an appropriately experienced ecologist will be carried out to establish the full extents of the invasive plant species within the proposed development site boundary. The Contractor's will prepare an

Invasive Alien Species (IAS) Management Plan for the works. The Plan must be clearly communicated to all site staff and must be adhered to if it is to be implemented successfully.

Any further invasive species identified during the preconstruction survey will also be managed in accordance with best practice . The control of some species may require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a qualified and experienced Contractor will be employed to carry out all work. It is advised that contractor refer to the following documents, which provides detailed recommendations for the control of invasive species and noxious weeds: Chapter 7 and Appendix 3 of the TII Publication *The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads* (NRA, 22010). Maintaining site hygiene at all times in an area where invasive non-native species are present is essential to prevent further spread. The following site hygiene measures shall be implemented onsite during the construction and/or for maintenance works during the operational stage where applicable :

- Fence off the infested areas prior to and during construction works where possible in order to avoid spreading seeds or plant fragments around or off the construction site.
- Clearly identify and mark out infested areas. Erect signs to inform Contractors of the risk.
- Avoid if possible using machinery with tracks in infested areas.
- Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within 50m of any watercourse or within a flood zone.
- If soil is imported to the site for landscaping, infilling or embankments, the contractor shall gain documentation from suppliers that it is free from invasive species.
- Ensure all site users are aware of measures to be taken and alert them to the presence of the Invasive Species Management Plan.
- Erection of adequate site hygiene signage in relation to the management of non-native invasive material as appropriate.

Provided these mitigation measures are employed during construction operations, the potential impact from non-native invasive species are considered to be *neutral.*

8.5.1.1.4 Aquatic Ecology- Mitigation measures

Ballynaclogh River (and the Lower River Shannon SAC), located >100m to the west, provides valuable habitat for a range of key aquatic ecological receptors such as fish (e.g. flounder, mullet species, European eel), macro-invertebrates, waterfowl and Annex II otter). Whilst not recorded at survey sites 7A or 7B, the Flora Protection Order (FPO) species opposite-leaved pondweed (*Groenlandia densa*) is widespread along Ballynaclogh River upstream and downstream of the study area. The FPO species triangular clubrush (*Schoenoplectus triqueter*) was present along Ballynaclogh River at both sites 7A and 7B, supporting the known distribution of the species along the channel. Therefore, any land redevelopment works should be cognisant of this protected and sensitive species regarding potential impacts, particularly to existing site hydrology and water quality.

The creation of a buffer zone around watercourses is one of the most important mitigations for the proposed development in terms of aquatic ecology. Many of the watercourses associated with the site are dry during certain seasons/weather. The 20m buffer recommended by IFI has been increased by a factor of 2.5 to become a 50m buffer zone (apart from at watercourse crossings) within which works will be limited and will require the erection of appropriate measures such as silt fencing. In terms of the Ballynaclogh River the footprint of the works will be in the order of 100m distance from this river, significantly decreasing the chances of impacts (B_17 in Table 21.1).

A further major mitigation to prevent the potential impacts to the ecology of watercourses, as outlined above, is the design and implementation of a highly functional site drainage system with integrated silt management and flow attenuation management. Punch Consulting Engineers have designed a bespoke drainage system taking into account parameters such as rainfall rates, gradient, area, etc. The plan of the site drainage system is illustrated in drawings PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0100 (1-4) and as outlined in the CEMP (GDG, 2021) which accompany this application. Additionally, a detailed breakdown of the mitigations accompanying this site drainage system is presented in Chapter 10: Hydrology (B_18 in Table 21.1).

A detailed surface water management plan for the proposed development is detailed in the Punch Engineering Planning Report (Punch Consulting Engineers, 2021) which accompanies this application . This plan provides details of how water quality will be protected during the construction of the proposed development (B_19 in Table 21.1). In addition to this, specific mitigation is provided in relation to water quality in Chapter 10: 'Hydrology' of this EIAR and as also outlined in section 8.5.1.1.2 of this chapter. In addition, the planning phase Construction Environmental Management Plan (CEMP) that is provided as part of this EIAR, provides the details of exactly how the measures will be implemented and who by during construction.

Provided these mitigation measures are employed during construction operations, the potential impact to habitats and botanical species are considered to be *Slight negative-neutral.*

8.5.1.1.5 Birds- Mitigation measures (B_20 in Table 21.1)

- Construction operations will take place during the hours of daylight for the most part to minimise disturbances to roosting birds or any active crepuscular/nocturnal bird species.
- A Toolbox Talk will be prepared and incorporated as part of the construction phase site induction. A wildlife register will be maintained by the environmental site staff during the construction phase. Site staff will be encouraged to report any wildlife sightings of note made during the construction phase and this information will be logged by the environmental site staff. The site manager will continue to maintain a wildlife register throughout the operational phase.
- The construction footprint will not be lit at night (with the exception of low-level switchable safety lighting). All lighting systems will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness.
- All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled at prescribed locations and all waste materials will be disposed of to licensed facilities.
- Mitigation measures outlined in EIAR and CEMP will be implemented to minimise and prevent the potential indirect impacts outlined above on aquatic and Annex I habitats and associated bird species in the surrounding area. For instance, detailed measures

are specified to reduce the risk of sediment run-off during construction (e.g. silt fences) .

- All vegetation clearance will be completed outside of the bird breeding season (1st March to 31st August). Any vegetation clearance required during the bird breeding season will only proceed following checks of the areas in question by a suitably qualified ecologist. All clearance works during the bird breeding season will be subject to supervision by the ECoW who will have 'stop works' authority in the event that there is any perceived risk to nesting birds .
- A minimum of 20 bird nest boxes will be erected on lands in the ownership of the applicant at Greenpark. These will include a Barn Owl box, a selection of woodcrete or recycled plastic nest boxes and 5 Swift bricks which will be integrated into the buildings on-site. The ECoW will advise and supervise the selection and installation of these nest boxes.

Post Construction Bird Monitoring Protocol (B_28 in Table 21.1)

- All edible and putrescible wastes will be stored and disposed of in an appropriate manner .
- The bird nest boxes will be monitored and maintained annually by a suitably qualified person for the first five years post construction .

8.5.1.1.6 Bats and Non-Volant Mammals- Mitigation measures (B_21 in Table 21.1)

- A pre-construction mammal survey will be carried out immediately before the commencement of vegetation clearance. This will include a passive bat survey to establish baseline bat activity in advance of the construction phase. There are no known protected mammal breeding sites which will be directly impacted by the proposed development .
- The ECoW will supervise/check areas where tree-felling and vegetation removal will occur prior to and during construction. This will ensure that any site specific issues in relation to wildlife will be highlighted and appropriate mitigation measures (e.g., NRA guidelines) are applied as appropriate (B_35 in Table 1).
- Construction operations will take place during the hours of daylight to minimise disturbances to nocturnal mammal species. Prevention of damaging run-off to watercourses (as outlined in the EIAR & CEMP) will be effective in minimising potential adverse impacts on Otters that occur widely in the hinterland of the proposed development .
- All lighting systems will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness .
- All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled according to the CEMP .
- Any sightings of mammals on-site will be logged on the wildlife register which will be maintained by the EcoW. This includes any fatalities recorded during construction or in the operational phase .
- A total of 20 bat boxes (woodcrete or similar) will be erected, during the construction period, under the supervision of a suitably qualified ecologist to increase the available roosts in the area and to enhance local biodiversity. The boxes will be erected on lands

in the ownership of the applicant. The location for the bat boxes will be selected by a suitably qualified ecologist and erected under the supervision of the EcoW.

8.5.1.1.7 Other Taxa- Mitigation measures (B_22 in Table 21.1)

The proposed mitigation measures (Chapter 9, Geology & Soils, Chapter 10 Hydrology) will ensure run-off and drainage are controlled and/or maintained there is no potential for significant water run-off impacts or indirect habitat loss or deterioration of the surrounding habitats as a result of construction works for the proposed housing development. The potential for run-off of sediment and nutrients to the aquatic environment and the potential impact on aquatic ecology is assessed in detail in Section 8.4.1.3 (Construction Phase impacts) and 8.4.2.3 (Operational Phase impacts) of this chapter and Chapter 10 Hydrology .

Areas where spoil is to be stored temporarily, or permanently, should be checked in advance for the presence of Frogs (and spawn). Any areas with pooled surface water, should be checked in advance for the presence of Frogs (and spawn). If protected species are present, the environmental staff will translocate these, if possible (under licence if applicable). The same measure should be applied for any drains or areas of standing water forded by construction machinery. These areas will be checked on an ongoing basis by the EcoW and any areas with breeding frogs, spawn or tadpoles will be mapped and if possible fenced off temporarily to allow Frogs to metamorphose. If such areas cannot be avoided by site traffic the environmental staff will translocate the frogs (adults/young) under licence if applicable .

If other taxa such as other species of Lepidoptera, Common Lizard etc. are recorded within or adjacent to the site these sightings will be logged on a wildlife register .

8.5.2 Operational Phase

8.5.2.1 Designated Sites- Mitigation

The following mitigation measures will be integrated as part of the proposed development regarding environmental protection of the designated sites identified to have source-impact receptor pathways in relation to potential operational phase surface water discharge impacts and waste water/foul effluent discharges .

8.5.2.1.1 Wastewater Mitigation- Operational Phase

Wastewater generated on-site particularly during the operational phase of the development will be piped and discharged to the existing Irish Water foul sewer and to Bunlicky WWTP. Agreement to discharge to the existing foul network and downstream WWTP will be secured with Irish Water and will ensure the wastewater discharge authorisation for the existing agglomeration will not be adversely affected. Foul Water will therefore be taken forward for appropriate treatment prior to discharge to the receiving environment. Both the surface water and foul system are to be entirely separate developments . Where the mitigation measures listed above are employed, the potential impact to receiving water environment will be reduced to *negligible* thus reducing the significance of environmental effect will be reduced to *Imperceptible* (B_23 in Table 21.1).

8.5.2.1.2 Surface Water- Mitigation- Operational Phase

The development has incorporated a variety of Sustainable Drainage Systems (SuDS) techniques to counteract the potential increased runoff as a result of increased hardstanding (including attenuation tanks). SuDS measures supplemented by bypass separators on the piped storm water network, will include green roofs, permeable paving of driveways and car parks, tree lined areas, tree pits, infiltration trenches, swales as well as, grassed and open space landscape portions of the site.

The surface water drainage design is described in detail in the Punch Consulting Engineers Engineering Report (2021) and summarised in Section 8.5.1.1.2 above. Provided the best-practice techniques as illustrated in CIRIA's guidance document (C768 – Guidance on the Construction of SuDS) are followed, no further mitigation is required.

8.5.2.1.3 Storm Water Run-off- Mitigation- Operational Phase

During the operational phase in the event of flooding, there is potential for storm water run-off to be impacted by pollutants arising within the car parking areas and roadways. This runoff has the potential to provide pathways for a wide range of contaminants arising from general operations to the aquatic environment. The main potential pollutants from surface water drainage or direct run-off are sediment, hydrocarbons, and trace contaminants including metals and organics.

The existing lagoon and pervious pavements have proposed dual purpose and whilst they are flow attenuation features they also mitigate against potential water quality issues associated with storm water run-off.

The entirety of the surface water drainage is designed to attenuate run-off from the operational site. Gravity pipe networks will collect runoff from hardstanding areas and roof areas (grass roofs will be used in certain buildings e.g. apartment blocks), while parking areas will be constructed with pervious asphalt. All surface water drainage from hard standing areas will ultimately drain to the lagoon via suitable sized class 1 bypass interceptors.

8.5.2.1.4 Disturbance/Displacement- Mitigation- Operational Phase (B_24 in Table 21.1)

To mitigate the potential negative impact of lighting on the surrounding habitats, design mitigation will ensure lighting will be minimised during both the construction and operational stages as follows ;

- Only be on when needed
- Only light the area that needs it
- Be no brighter than necessary
- Minimize blue light emissions
- Be fully shielded (pointing downward)

In this regard the proposed lighting scheme for the operational phase of the development is outlined as follows; Any new lighting required as part of the project will be of as low a wattage as possible and will be directed away from natural habitats and the Ballynaclogh River area. Illumination should be "cowled" or designed to ensure that the pool of light falls only on the footpath and not on the surrounding natural habitats. All light fittings will be LED, have asymmetrical projection i.e. directional, and with colour temperature of 2700K (warm spectrum preferred by bats). The radiation will be above 500nm to avoid the blue or UV light, most disturbing to bats. The lights will be positioned facing away from woodlands, rivers, hedgerows and other natural habitats. The lighting will be as per the following relevant guidelines and standards:

- Bats & Lighting Guidance Notes for Planners, engineers, architects and developers (Bat conservation Ireland, December 2010);
- BS 5489 Code of practice for the design of road lighting;
- IS EN 13201 Road Lighting requirements;
- CIBSE Lighting Guide 6 Illuminating the Outdoor Environment; and

The lights will be dimmable with individual photocells fitted to each light fitting, which will allow the lights to switch on automatically at dusk at a low output and slowly dim up to their full output as the natural light decreases. This will minimize light spill for mammals at dusk which is their peak time for feeding when they exit roosts/setts/holts for foraging. The lighting will also be controlled by occupancy/motion sensors so that it will remain at a low output if there was no pedestrian traffic or mammal activity nearby. This will also mitigate light overspill into the nearby existing residential properties.

With respect to disturbance displacement impact from noise, the development site is situated within the context of the existing urban environment and is located c. 100m from the Ballynaclogh River a large earthen embankment between the development site and the river therefore the area is effectively screened from the nearby SAC and SPA greatly reducing the potential for disturbance associated with localised increases in light and noise during the operational phase.

Given the existing nearby urban context, the habitat characteristics (local ecological importance) and the topography which effectively screen the proposed development area, and its location with regard to the key species and habitats, the risk of any significant disturbance to protected species is deemed to be low.

Where the mitigation measures listed above are employed, the potential impact to receiving water environment will be reduced to *negligible* thus reducing the significance of environmental effect will be reduced to *Imperceptible.*

8.5.2.2 Habitats & Botanical- Mitigation (B_25 in Table 21.1)

Regular inspections will be carried out by site staff to ensure that the drainage regime is adequately maintained to protect the future stability of the surrounding high value habitats and botanical species as a whole.

A Biodiversity Management Plan for semi-natural habitats (e.g. native woodland, hedgerow/treeline, pollinator friendly meadows and grassland) is recommended to be developed for the operational phase site as this would ensure that such habitats become established and are managed to promote maximum gain for biodiversity over the operational lifetime of the proposed development. The future landscape/biodiversity and habitat management plan will be finalised under the advice of a suitably qualified/experienced ecologist that may also include monitoring/supervision of the management plan when implemented.

Measures detailed in the Landscape Plan to plant predominantly native tress species and plant in accordance with the All Ireland Pollinator Plan will be fully implemented. This includes monitoring of the revegetation process over the first two years post construction.

8.5.2.3 Aquatic Ecology- Mitigation

Specific mitigation for the operational phase is provided for surface water management and waste water management as it relates to water quality in Chapter 10: 'Hydrology' of this EIAR and as also outlined in section 8.5.1.1.2 of this chapter. The following measures will be put in place to ensure the protection of surface waters from contamination (B_26 in Table 21.1):

- A hydrocarbon bypass interceptor will be installed as part of the surface water drainage network.
- The storm drainage calculations shall ensure that the proposed storm drainage networks are
  appropriately sized to serve the new development as proposed;
- A cleaning and maintenance schedule will be implemented for the proposed storm drainage system during the operation phase. Each gully will be fitted with silt traps to be emptied as part of the silt management and maintenance schedule;
- The proposed storm network will be inspected following construction to ensure that no cross connection between the proposed foul and storm network exists;
- The storm drainage system will be cleaned appropriately and inspected prior to being fully commissioned i.e. before being allowed to discharge to receiving waters.
- Water sampling of the receiving waters upstream and downstream of the proposed outfall will be undertaken before construction commences and for a period of 6 months following the completion of the development to ensure that the proposed water quality controls (both for the construction and operational phases) are appropriate and operating satisfactorily.

8.5.2.4 Birds- Mitigation

Post Construction Bird Monitoring Protocol (B_28 in Table 21.1)

- All edible and putrescible wastes will be stored and disposed of in an appropriate manner.
- The bird nest boxes will be monitored and maintained annually by a suitably qualified person for the first five years post construction

8.5.2.5 Bats and Non-Volant Mammals- Mitigation (B_29 in Table 21.1)

Post Construction Mammal Monitoring Protocol

- All edible and putrescible wastes will be stored and disposed of in an appropriate manner.
- The bat boxes will be monitored and maintained annually by a suitably qualified person for the first five years post construction.

8.5.2.6 Other taxa- Mitigation

Mitigation measures outlined in Chapter 4: Land, Soils & Geology, Chapter 8 Biodiversity and Chapter 10 Hydrology and Hydrogeology of this EIAR will be implemented to minimise and prevent the potential indirect impacts outlined above on aquatic and terrestrial habitats and other faunal species at the site and in the surrounding area.

8.6 Residual Effects

This ecological assessment has found that the proposed development site is not located within any designated site. The habitats recorded onsite have been evaluated as being of **Local importance (lower to higher value)**. With the implementation of the mitigation measures outlined in the EIS it is concluded that the residual impacts will **slight negative-neutral**. The mitigation measures described in the EIAR and in the planning phase CEMP along with the specific commitments presented herein are intended to minimise the impact of the development, from the construction of the housing development, through the occupation and maturation of the residential scheme. Ongoing monitoring and implementation of the monitoring measures described in the EIAR will ensure the preservation and future stability of the surrounding high value habitats as a whole.

8.7 Monitoring

8.7.1 Construction Phase

An Ecological Clerk of Works will be appointed by the developer for the duration of the works so as to ensure compliance of ecological mitigation measures as detailed in the various planning documentation. The appointment will ensure that all ecological mitigation measures as outlined in the EIS are implemented during the construction period according to best practices (B_30 in Table 21.1).

8.7.2 Operational Phase

All edible and putrescible wastes will be stored and disposed of in an appropriate manner.
The bird nest boxes will be monitored and maintained annually by a suitably qualified person for the first five years post construction

All edible and putrescible wastes will be stored and disposed of in an appropriate manner.
The bat boxes will be monitored and maintained annually by a suitably qualified person for the first five years post construction.

8.8 Reinstatement

Landscaped areas and SuDS measures will be completed at the same time as each phase. Landscaped areas will be finished with reclaimed topsoil, while seeding and planting will be implemented in accordance with the landscape plan for the site. The SuDS measures are to implemented with reference to the UK Suds Manual and Limerick City and County Council water services department requirements. These areas will decrease the impact of the SHD on the receiving aquatic environments.

The area of species rich Dry calcareous and neutral grassland (GS1) located in the east of the site supported an abundance of Common spotted orchid and a species rich calcareous plant community. Prior to site clearance and under the supervision of an Ecologist this area shall be marked out, the topsoil in the area shall be removed carefully, kept intact and watered and transferred to a suitable location as quickly as possible under the direct supervision of the Site Ecologist to conserve the orchid species and underlying seedbank.

8.9 Interactions

The water environment and impact on water quality has the potential to impact on water dependent habitats and species in the water bodies affected and therefore there is a strong interaction with biodiversity. The protection of the water environment will help to ensure that biodiversity is not significantly impacted by the implementation of the SHD.

Geology and soils also has a strong interaction with the Biodiversity with the interaction of surface and sub surface water important to the generation of run-off and the mitigation of same. Given the nature of the soils and location of the development on a flood plain, surface and near surface water pathways will be dominant and this will be considered during the detailed mitigation strategy for the development of the SHD.

8.10 Cumulative Effects

A number of permitted developments in the wider area were identified and the potential for any significant cumulative and in combination effects on the receiving environment were considered. A selection of these projects are summarised in Table 8.18 below. A nursing home development is also proposed on lands under the ownership of the applicant at the former race course (LCCC 21/1222) with a planning application recently lodged to Limerick City and County Council. This project has therefore also been considered in relation to potential cumulative effects throughout the EIAR. Ecology Ireland also prepared the EcIA and NIS in relation to the planning application for the proposed Nursing Home development.

Table 8.18: Selection of permitted/live projects proximate to proposed housing development at Greenpark

Project Description & Planning Reference
LCCC Reg. Ref. 18/656 – Permitted 22/08/2018 – **Located at Corcanree, Dock Road, Limerick** – *The construction of an extension to the existing process mill to the rear of existing building, associated fire fighting water storage tank and associated site works.*
LCCC Reg. Ref. 21/1222 – *A planning application has recently been made by the current Applicant for a proposed Nursing Home development on an adjoining part of the former racecourse lands. The proposed nursing home will be accessed via Log na gCapall. The development will be 4 storeys in height with a total gross floor area of c.5,237 sq m, consisting of 123 no. rooms, comprising 126 no. bedspaces (120 no. single rooms and 3 no. double rooms) and ancillary facilities, including 777 sq m of day space. The development will also consist of soft and hard landscaping. The application was accompanied by an EcIA and NIS prepared by Ecology Ireland Ltd.*
LCCC Reg. Ref. 17/1190 (ABP PL91.302015) – Permitted 05/11/2018. *The development will consist of the construction of 11 detached houses and 20 semi-detached houses and ancillary development on a site area of 1.6 hectares at Greenpark, Co. Limerick.*
LCCC Reg. Ref. 18/758 – Permitted 19/12/2018 – **Located at Corcanree Business Park, Dock Road, Limerick** – *The construction of a new warehouse and all associated site works.*
LCCC Reg. Ref. 18/1044 -Permitted 09/04/2019 – **Located Units 1-5 Castlemungret Estate, Skehacregguan, Mungret, Co. Limerick** – *(a) demolish existing industrial unit 1 (150sqm), (b) construction of replacement industrial unit 1 (185sqm), (c) amalgamate units 1,2,3 & 4 into one industrial unit for use by Conway Engineering Company Ltd, (d) change of use of a portion of units 3 & 4 to ancillary offices (158 sqm), I alterations to elevations of units 3 & 4 (to include new windows and doors and surface finish changes), (f) construction of a single storey link between units 2 & 3 to facilitate the amalgamation of units, (g) construct a new interal corridor to unit 5 including new single door on the elevation of this unit, (h) signage, (i) car parking and (j) all associated site works.*

Project Description & Planning Reference
LCCC Reg. Ref. 19/935 – Permitted 08/11/2019 – **Located at Alandale Orchard, Limerick** – *The installation of a 0.50m x 0.87m x 1.62m (LxWxH) above ground enclosure, to house a new natural gas District Regulating Installation with all ancillary services and associated sit works to replace the existing below ground natural gas regulating unit.*
LCCC Reg. Ref. 19/1012 – Permitted 05/12/2019 – **Located at Ted Russell Dock, Dock Road, Limerick** – *(1) conservation, restoration and new works to Bannatyne Mill, a Protected Structure; and (2) change of use of Bannatyne Mill from a grain store to commercial office use. The proposed works include: (a) provision of 3 no. projecting glass windows on the northern, southern and eastern elevations; (b) internal modifications including limited removal of fixtures and fittings; (c) provision of associated signage; (d) demolition and removal of the redundant electrical room at the west end of the building; I demolition of the existing ESB substation at the east end of the building and replacement with a new ESB substation removed from the building; (f) provision of external plant; (g) widening of the existing eastern access; (h) removal of section of boundary wall to Dock Road; (I) provision of on-site car and bicycle parking; and (j) all associated site development works. Bannatyne Mill is a Protected Structure RPS Ref. 255 and is listed on the NIAH (National Inventory of Architectural Heritage) Schedule Ref. No. 21516002*
LCCC Reg. Ref. 19/1297 – Permitted 21/02/2020 – **Located at BOC Gases Ireland Ltd., Dock Road, Limerick** – *The installation of a free-standing sign and associated site works.*
LCCC Reg. Ref. 20/580 – Permitted 27/11/2020 – **Located at Dock Road, Limerick** – *The construction of a single storey Warehouse/Distribution Centre and staff carpark on a derelict site, utilising existing entry access off Dock Road and providing new entry/exit access via Ashbourne Business Park service road and all ancillary site works. An Appropriate Assessment Screening Report/Natura Impact Statement will be submitted to the Planning Authority with this application.*

Project Description & Planning Reference
LCCC Reg. Ref. 20/723 – Permitted 27/10/2020 – **Located at Dock Road, Limerick** – *Proposed development on a brownfield, light industrial zoned site at Dock Road, Limerick. Retention permission is sought for 20 no. containers on site(no.'s 1-20) and the use of such containers for self storage purposes, and the provision of boundary fencing and an electric gate controlling access in to the site. Planning permission is sought for 18 no. containers on site(no.'s 21-39) and the use of such containers for self storage purposes, 8 no. on site car parking spaces, completion of boundary fencing and provision of signage. Access to the site is via a right of way which utilises the existing commercial site access that served the former Heiton Buckley Providers operation on site.*

A planned nursing home development (LCCC 21/1222) is also proposed on lands under the ownership of the applicant at the former race course and therefore has been considered in relation to potential cumulative effects throughout the EIAR. In general, the projects and plans are subject to their own assessments and planning processes. Many of the applications reviewed were for other residential or 192ndustrial developments that will need to ensure that they will not in themselves or in combination with other plans or projects have the potential to adversely impact upon the receiving environment and in particular the nearby designated Natura 2000 sites. For instance, this will also involve an assessment of the adequacy and capacity of the services (e.g. Waste-water treatment) upon which such developments will rely.

Potential cumulative effects in relation to other developments include construction related surface-water run-off, where qualifying interests associated with the nearby Natura 2000 sites could be subject to cumulative impact through hydrological or water quality impacts such as increased siltation, nutrient release and contaminated run-off arising from other developments. All of these projects have been considered on their own and in relation to the potential for any cumulative or in combination impacts arising from any combination of these projects proceeding in the future.

Taking the above into consideration, along with the proposed environmental management and controls integrated into the project design here and for other projects planned or proposed in the area cumulative and in-combination effects relating to other developments are not considered to be relevant in this case.

8.11 'Do-Nothing' Effect

In the "do nothing scenario" the proposed development site will continue to become more naturalised supporting the expansion of semi-natural habitats such as Marsh and Large reed and sedge swamp habitat. The dominant habitat, Wet Grassland, if unmanaged will tend towards rank grassland and maturing scrub with eventually lead to succession to Wet willow alder ash type woodland habitat (assuming there is no or little grazing or management).

Appendix 8.1

Survey Schedule – Ecological Field Surveys

Table 8.1.1: Deployment and collection dates for passive bat detectors at the Greenpark study area

Item	Lat	Long	Deployment Dates
1	52.64744	-8.65802	05 February to 14 March 2021
2	52.64744	-8.65802	16 December 2020 to 19 January 2021
3	52.64959	-8.6522	26 November to 30 December 2020
4	52.64971	-8.55459	26 November to 29 December 2020
5	52.64628	-8.65466	01 July to 21 July 2020
6	52.64814	-8.6503	20 July to 23 August 2020
7	52.65157	-8.65256	20 July to 17 August 2020
8	52.64902	-8.64593	28 August to 22 September 2020
9	52.64814	-8.6503	05 February to 15 March 2021
10	52.64968	-8.65546	26 November to 30 December 2020
11	52.64585	-8.65165	05 February to 14 March 2021
12	52.64942	-8.64714	19 June to 14 July 2020
13	52.65109	-8.6573	19 June to 20 July 2020
14	52.65171	-8.65249	28 August to 22 September 2020
15	52.65078	-8.6561	16 December to 28 December (mic dislodged)
16	52.6497	-8.65035	19 June to 15 July 2020

Table 8.1.2: Ecological walkover surveys, summer 2020 (incl. deployment and collection of trail cameras and bat detectors).

Date	Tasks
21 May 2020	Initial walkover, set out of transects, casual recording
19 June 2020	Transect survey, Mammal walkover, deployment of trail cameras
01 July 2020	Deployment of bat detectors
20 July 2020	Transect surveys, mammal survey walkover, habitat mapping, deployment of trail cameras and bat detectors
28 August 2020	Habitat mapping and botanical survey, mammal surveys, collection and deployment of trail cameras and bat detectors

Table 8.1.3: Winter bird survey schedule (including collection/deployment of cameras and detectors)

Date	Surveys undertaken	Additional Notes
02/10/2020	Winter bird transects, Night-time thermal image survey and walkover to record usage of wider site by wintering birds	Collection of cameras/detectors
25/11/2020	Night-time thermal image survey and walkover to record usage of wider site by wintering birds	
16/12/2020	Winter bird transects, Night-time thermal image survey and walkover to record usage of wider site by wintering birds. Deployment of trail cameras and bat detectors.	Deployment of trail cameras and bat detectors
19/01/2021	Night-time thermal image survey and walkover to record usage of wider site by wintering birds	
05/02/2021	Winter bird transects, Night-time thermal image survey and walkover to record usage of wider site by wintering birds.	Deployment/collection of cameras and detectors and changing cards and batteries
11/03/2021	Night-time thermal image survey and walkover to record usage of wider site by wintering birds	Collection of cameras/detectors

Table 8.1.4: Aquatic ecology surveys

Date	Surveys undertaken
21/05/2020	Aquatic ecology surveys as described in EIAR
08/06/2020	Aquatic ecology surveys as described in EIAR

9.0 LANDS, SOILS, GEOLOGY & HYDROGEOLOGY

9.1 Introduction

Gavin and Doherty Geosolutions Ltd. (GDG) has been engaged by Voyage Property Limited to assess the impact on the land, soil and geological environment of the proposed SHD at lands at the former Greenpark Racecourse, Dock Road, Limerick City. The proposed SHD will include the construction of residential units, a creche, and public open space, with associated roads, parking, etc, as described in Chapter 5 of this EIAR.

This assessment has been undertaken in accordance with the Environmental Protection Agency's (EPA) Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (2017).

This chapter provides a baseline assessment of the environmental setting of the proposed development in terms of land, soils, geology and hydrogeology and discusses the potential impacts that the construction and operation of the proposed development will have. Where required, appropriate mitigation measures to limit any identified significant impacts to soils, geology and hydrogeology are recommended and an assessment of residual impacts and significance of effects provided.

The objectives of the assessment are to:

- Produce a baseline study of the existing terrestrial environment (land, soil, geology and hydrogeology) in the area of the proposed development;
- Identify likely significant effects of the proposed development on land, soil, geology and hydrogeology during the construction phase and operational phase of each aspect of the development;
- Identify mitigation measures to avoid, remediate or reduce significant negative effects and,
- Assess significant residual effects and cumulative effects of each aspect of the proposed project cumulatively and in-combination with other developments.

9.1.1 Statement of Authority

Dan Hopkins (BSc (Hons) Geology) is a Senior Engineering Geologist with eight years post graduate experience.

9.1.2 Legislative Context

This chapter has been prepared having regard to the following policy documents:

- Planning and Development Acts 2000 to 2019 and the Planning and Development Regulations 2001 to 2019 including as amended by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law ;
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017:
- Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive); and,

- The Heritage Act 1995, as amended

9.1.3 Relevant Guidelines

This chapter has been prepared having regard to the following guideline documents:

- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (National Roads Authority (NRA), 2008);
- Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (Institute of Geologists of Ireland (IGI), 2013);
- Revised Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Draft (EPA, 2017); and,
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018).

9.2 Methodology

The methodology used to produce this chapter included the following steps:

- A review of relevant legislation and guidance;
- A review of project scoping documents and consultation responses from relevant parties;
- A desk study of existing information available for the site information and mapping available publicly via online portals;
- An intrusive investigation;
- An assessment of potential effects;
- An identification of measures to avoid and mitigate likely significant adverse effects; and
- An evaluation of residual effects.

The assessment covers a study area of 500m radius, measured from the centreline of the proposed development in accordance with the NRA Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, 2008.

9.2.1 Consultation

As part of the study, consultation was made with the following parties:

- Geological Survey Ireland (GSI); and
- EPA.

9.2.2 Desk Study, Walkover and Intrusive Investigation

A desk study was undertaken in order to collate and review background information for the site. The desk study involved the following:

- A review of previous site reports;

- Examination of the GSI datasets pertaining to soils, geological, hydrogeological, geohazard and mineral/aggregate mapping, historic ground investigations, well data and geological heritage; and
- Examination of Environmental Protection Agency (EPA) datasets on land, soil and waste mapping.
- A site walkover was carried out as part of the trial pitting investigation in June 2020 by a GDG engineer.
- The intrusive investigations consisted of:
    - Window sample boreholes and dynamic probes for the purpose of identifying ground make-up (IGSL, March/April 2021).
    - Trial pits for the purpose of identifying ground make-up and approximate depth to bedrock (GDG, June 2020)

Trial pit locations and logs are located in Appendix I.

9.2.3 Impact Assessment Methodology

The methods used for assessment of effects is based on a combination of the “Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes” published by the National Road Authority in 2008 and the “Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)” published by the EPA (2017).

The importance or sensitivity of lands, soils, geology and hydrogeology in the study area will be determined using the criteria set out in Table 9-1.

The magnitude of impacts will be determined using the criteria set out in Table 9-2.

Table 9.1: Criteria for Rating Importance of Soils and Geology Attributes (NRA, 2008)

Importance	Criteria	Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale*.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying route is significant on a local scale*.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and/or highly fertility soils. Groundwater: Regionally important potable water source supplying >2500 homes, groundwater vulnerability is

Importance	Criteria	Example
		classified as high; principal aquifer providing a regionally or locally important resource or supporting site protected under wildlife legislation
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying route is moderate on a local scale*	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral resource. Groundwater: Local potable water source supplying >50 homes, moderate classification of groundwater vulnerability; secondary aquifer providing water for agricultural or industrial use with limited connection to surface water
Low	Attribute has a low quality, significance or value on a local scale Degree or extent of soil contamination is minor on a local scale Volume of peat and/or soft organic soil underlying route is small on a local scale*	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition Wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral resource. Groundwater: Local potable water source supplying <50 homes, deep secondary aquifer with poor water quality not providing baseflow to rivers

* Relative to the total volume of inert soil disposed of and/or recovered

For the purposes of this assessment it is considered that Regionally Important ® Aquifers are Principal Aquifers; Locally Important (L) Aquifers are Secondary Aquifers and Poor (P) Aquifers are Unproductive Strata. Different classifications exist for each of the aquifer types, as listed below:

Regionally Important ® Aquifers:

- Karstified bedrock (Rk) where Rkc represents an aquifer dominated by conduit flow and Rkd represents an aquifer dominated by diffuse flow.

- Fissured bedrock (Rf).
- Extensive sand and gravel (Rg).
- Locally Important (L) Aquifers
- Bedrock which is generally moderately productive (Lm).
- Bedrock which is moderately productive only in local zones (Ll).
- Sand & gravel (Lg).
- Locally important karstified bedrock (Lk).

Poor (P) Aquifers:

- Bedrock which is generally unproductive except for local zones (Pl).
- Bedrock which is generally unproductive (Pu)

Table 9.2: Criteria for Rating Magnitude of Impacts (Adapted from NRA, 2008)

Magnitude of Impacts	Criteria
Large Adverse / High	Results in loss of attribute and/or quality and integrity of attribute
Moderate Adverse / Medium	Results in impact on integrity of attribute or loss of part of attribute
Small Adverse / Low	Results in minor impact on integrity of attribute or loss of small part of attribute
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity

The effects will be described in terms of their quality, significance and duration. The quality of effects will be described in accordance with the draft EIAR guidelines (EPA, 2017) as one of the following:

- Positive Effects – A change which improves the quality of the environment.
- Neutral Effects – No effect or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
- Negative/adverse Effects – A change which reduces the quality of the environment.

The significance of effects is described in accordance with the draft guidelines (EPA, 2017). Each effect will be designated one of the following definitions of significance:

- Imperceptible – An effect capable of measurement but without significant consequences
- Not significant – An effect which causes noticeable changes in the character of the environment but without significant consequences.
- Slight Effects – An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
- Moderate Effects – An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
- Significant Effects – 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 most of a sensitive aspect of the environment
- Profound Effects – An effect which obliterates sensitive characteristics.

The significance of the effect will be determined using the chart in Figure 9-1 by considering the magnitude of the impact and the significance of the attribute/environments. The chart is taken from (Figure 3.5) the draft EIAR guidelines (EPA, 2017).

The duration of effects will also be described as one of the following definitions in accordance with the draft guidelines (EPA, 2017):

- Momentary Effects – Effects lasting from seconds to minutes
- Brief Effects – Effects lasting less than a day
- Temporary Effects – Effects lasting less than a year
- Short-term Effects – Effects lasting one to seven years
- Medium-term Effects – Effects lasting seven to fifteen years.
- Long-term Effects – Effects lasting fifteen to sixty years
- Permanent Effects – Effects lasting over sixty years
- Reversible Effects – Effects that can be undone, for example through remediation or restoration

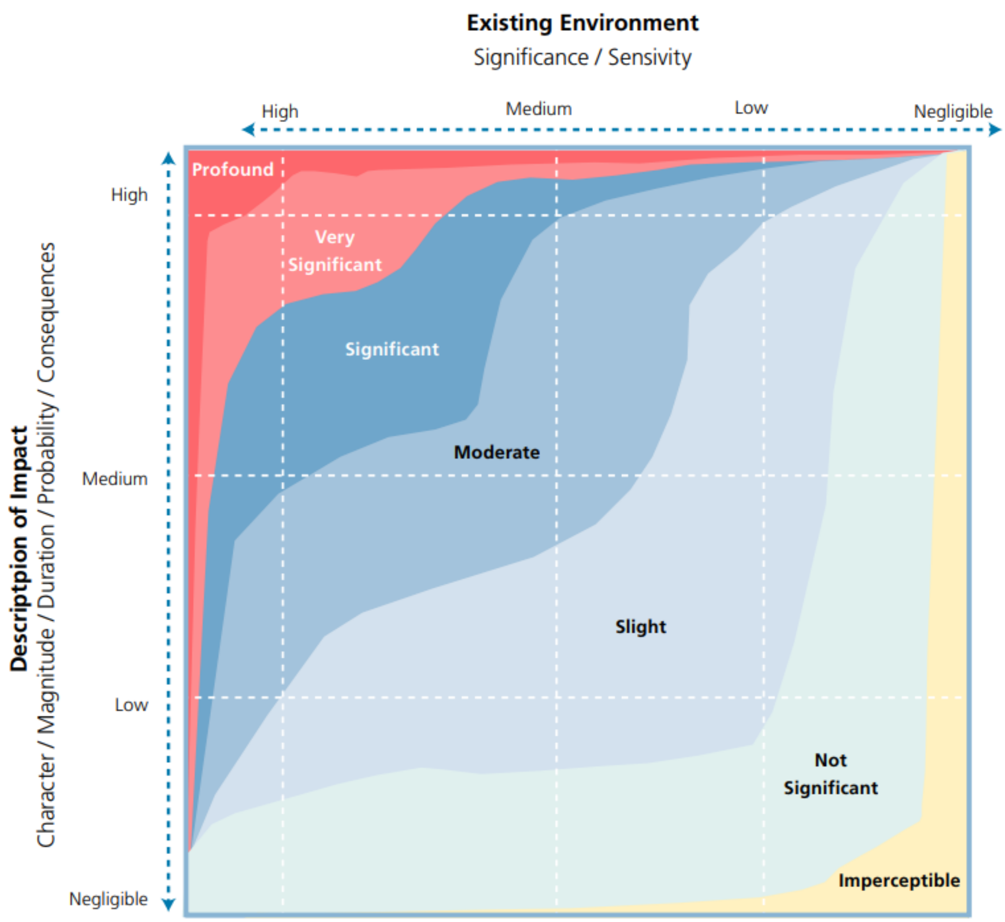


Figure 9.1: Chart showing typical classifications of the significance of effects

9.3 Study Area

The site area currently comprises an area of undulating scrub land immediately to the west of an existing residential development and approximately 280m south east of Limerick Greyhound Stadium. The M20 motorway is situated to the south of the site, orientated roughly east-west. The site is located at the former Limerick Racecourse and will be accessed via the N69 Dock Road to the northwest of the site. The site is bounded to the east by existing housing estates at Log na gCapall and Greenpark Avenue.

The site slopes generally from east to west, existing levels vary between 2.5m OD and 10m OD approximately.

9.4 Receiving Environment

The baseline conditions consider the existing site area as an unused area to the east of Limerick Greyhound Stadium immediately to the west of an existing residential development. The site was previously developed, the Limerick racecourse was located on the site. The site is now unused and overgrown.

The most notable features local to the study area is the Ballynaclogh River which is a tributary of the River Shannon and is located approximately 150m from the western and southwestern edges of the site. The site area is surrounded by residential/business buildings and leisure area.

9.4.1 Sources of Information

The sources of information used in this chapter are detailed below:

- Existing reports:
  - Greenpark Ground Model Report (GDG, 2020)
- Base mapping:
  - Digital globe 2011-2013 ortho-photography (DigiGlobe, 2013)
- GSI datasets (GSI, 2021):
  - Bedrock geology;
  - Quaternary;
  - Groundwater;
  - Geotechnical;
  - Landslides; and
  - Geological heritage.
- EPA datasets (EPA, 2021):
  - Soil Information System (SIS) National soils.
  - Corine land cover 2018; and
- Intrusive investigation data:
  - Dynamic probes, Window samples and boreholes (IGSL, 2021); and
  - Trial pits logs (GDG, 2020).

9.4.2 Topography and Geomorphology

OSi and Digital Globe background mapping was inspected to determine the site topography and geomorphology. The proposed development is located in an area defined by urban soils, tills and estuarine sediments.

The site slopes generally from east to west, existing levels vary between 2.5m OD and 10m OD approximately.

9.4.3 Lands

The land is currently unused and is overgrown, it is located within the southern extent of the former Limerick Racecourse. There is an access road located in the northwest of the site which currently serves the adjacent Limerick Greyhound Stadium and associated parking facilities.

The Corine land cover 2018 dataset is a map of the national land cover of Ireland. This classifies the land within the site as a combination of artificial non-agricultural vegetated areas, and inland wetland and marshes. Land in the vicinity of the site is classified as discontinuous urban fabric.

9.4.4 Soils and Subsoils

The GSI Quaternary Sediments map provides subsoil mapping for the site. The subsoil underlying the site is described as consisting of urban soils in the northern and central portions with estuarine silts and clays at the southern border of the site area. Peat was not identified in the GSI online geotechnical viewer.

Tills derived from limestones and embankment fills were also noted in the general area surrounding the site and were noted to be overlying estuarine silts and clays in the southern section of the site during trial pit investigations.

There is one ground investigation recorded on the GSI database which intersects the north western site boundary. This relates to the Roche's Feed industrial facility, but no geotechnical report is provided.

9.4.4.1 Landslides

The GSI geohazard mapping provides a regional landslide susceptibility map of Ireland that considers where the landslides occur and what causes them (slope, soil type and the impact of the flow of water in an area). According to this, the site susceptibility classification is detailed as low on flatter ground.

9.4.5 Bedrock

The GSI 100k Bedrock Geology map indicates that the entire site area is underlain by Visean Limestones, described as undifferentiated limestones of Carboniferous age.

The geological mapping does not show any faults or structural features within the site or its vicinity.

9.4.5.1 Depth to bedrock

The quaternary sediments map published by GSI records no presence of Bedrock outcrop or subcrop (Rck) at the site. This is corroborated by the ground investigations conducted on-site which did not verify the depth of bedrock.

The groundwater vulnerability map indicates ‘Low’ vulnerability, and therefore we can infer superficial deposit thicknesses of greater than 10m.

9.4.5.2 Karst

Limestone bedrock is particularly vulnerable to the occurrence of karst features. The GSI online Karst Features map has no karstic features recorded on the site, it identifies two karst features approximately 3.3km to the south-east of the site area.

9.4.6 Hydrogeology

The hydrogeology of the area has been described by the Geological Survey of Ireland as complex and very variable. The Limestone bedrock is generally considered to be indurated and hence dominated by fissure permeability (e.g. joints and faults). Such permeability is likely to be low except where coarse, clean Limestones where present, have been karstified, dolomitised or are highly fractured.

The Lower Carboniferous rocks that underlie the region have been classified by the Geological Survey of Ireland as “Locally Important Aquifer, bedrock which is moderately productive only in local zones”. These locally productive zones are due to the presence of more permeable strata that are encountered in different parts of the outcrop area due to substantial faults, fractures or fissures. The limited groundwater movement within the rock tends to be restricted to the weathered horizons or to non-extensive fractured zones. These zones tend to have a limited hydraulic continuity, low storage capacity and low potential yield.

The Quaternary drift is considered the principal medium for groundwater movement in the area. The infiltration capacity of the clay deposits would be limited due to their low permeability and hence groundwater movement is likely to be confined to the fluvio-glacial sand and gravel deposits that overlie the clays. The potential importance of the Quaternary drift deposits as a groundwater resource is a function of their permeability, thickness and extent. The low permeable fine grained glacial clays represent aquitards that limit infiltration and restrict recharge to bedrock aquifers when sufficiently thick. The overlying fluvio-glacial till deposits represent material with a significantly higher permeability. Consequently these deposits have a high potential recharge and storage capacity.

9.4.6.1 Groundwater vulnerability

The site falls within an area of low groundwater vulnerability.

9.4.6.2 Groundwater abstractions

The GSI map viewer identified one groundwater abstraction well located 0.24km east of the site.

9.4.6.3 Site specific Hydrogeology regime and groundwater flow

The intrusive ground investigations undertaken in 2020 and 2021 identified that groundwater is generally absent within the soils and subsoils across the site. One groundwater strike was noted during drilling of BH03. A slow ingress of groundwater was noted at 1.5m below ground level (bgl) within a strata described as; Firm grey sandy SILT/CLAY with occasional gravel.

Follow on groundwater level monitoring was undertaken in BH01, BH02 and BH03 on three occasions. BH01 and BH02 were consistently dry on all three occasions. Groundwater within BH03 was monitored at a level of 1.65m, 1.80m and 1.93m bgl on the 14th January 2021, 2nd April 2021 and 19th April 2021 respectively.

As groundwater was only present within one borehole, it is not possible to calculate groundwater flow direction. It is noted however that BH03 is located within the closest proximity to the Ballynaclogh River and the likely direction of groundwater flow would be towards this river. However, as noted previously, groundwater is generally absent within the soils and subsoils across the site and the contribution of shallow groundwater to the baseflow of the river is likely to be minimal.

9.4.7 Geological Heritage

According to the GSI geological heritage mapping and their responses to consultation, there are no geological Natural Heritage Areas (NHA) or County Geological Sites (CGS) in the vicinity of the proposed development site.

The closest mapped geological heritage sites of interest are two unaudited sites (Mungret Quarry and Carrigogunnell), located approximately 3km and 5km southwest of the site respectively.

9.4.8 Geological Resources

The GSI's Aggregate Potential Mapping (APM) provides a ranking for the potential of a site to provide crushed rock aggregate. The mapping indicates that the site has moderate crushed rock aggregate potential. The site is currently undesignated for granular aggregate potential and no granular deposits are recorded within subsoils.

Due to the high thicknesses of superficial deposits (greater than 10m), it is unlikely that the site would be subject to interest for future crushed rock aggregate excavation.

The APM also shows the inventory of active and historical quarries and pits in Ireland, as known in 2014. There is a small former brickfields pit located approximately 250m to the west of the site, north of the current Greyhound Racetrack.

9.4.9 Contamination

The EPA waste mapping database provides the locations of current waste facilities (including licensed, applied, surrendered, rejected). The mapping indicates the presence of a waste licence (WS-0259-01) within the western section of the site boundary. The licence was applied for in 2009 and withdrawn in 2014. It related to the infilling for development purposes of parts of the overall site, including the Greyhound Stadium. There is no evidence that any infilling was carried out within the SHD boundary.

There are no waste facilities within the vicinity of the Site.

The trial pit investigation undertaken by GDG in 2020 noted some made ground resulting from previous site use as a racecourse.

9.4.10 Summary of Baseline Conditions

Upon completion of a detailed evaluation of the site baseline conditions in terms of lands, soils, and geology, there are some sensitive or important aspects of the environment as follows:

- The Ballynaclogh River which is a tributary of River Shannon and is located approximately 150m from the western and southwestern edges of the site. The overland flow of waters on site will drain towards this watercourse. It is considered to have a medium quality or value on a local scale, corresponding to a Medium sensitivity/importance ranking.

All the other aspects of the lands, soils, geology and hydrogeology are considered to have a Low importance or sensitivity ranking.

9.5 Characteristics of the Proposed Development

The proposed development is described in full in Chapter 5. Drawings of the development can be found within the planning documents, an outline of the latest development plan is reproduced below in Figure 9-3.

Figure 9.3: Proposed Development (Reddy Architects)

The minimum finished floor level of all units will be 5.3m OD. Bulk earthworks are therefore required to raise the lower portion of the site, fill from the higher levels will be used where possible to achieve an earthworks balance on the site.

Excavation of soil and subsoil will be required for the proposed development in preparation for the construction of building foundations and in the preparation of a suitable sub-formation for road construction, trenching for foul and drainage water infrastructure and other services.

9.6 Potential Effects of the Development

The potential effects of the development will be discussed in terms of the two main stages of the project life-cycle: construction stage and operational stage. Only effects relating to the aspects of the environment highlighted as being of Medium or High sensitivity or importance will be discussed, namely, peat stability, crushed rock aggregate potential and bedrock aquifer. They will be discussed and evaluated in terms of their character, magnitude, duration, probability and consequence.

9.6.1 Do Nothing Scenario

The use of the proposed development site as undeveloped open land, formerly used as a racetrack would continue. As the area currently comprises overgrown scrub land vegetation, this would continue to grow and become further overgrown as a result of the Do-Nothing scenario.

The potential impacts are imperceptible.

9.6.2 Potential Effects and Mitigation Measures – Construction Stage

The opportunity to mitigate any effect is greatest within the design period.

The cut and fill earthworks have been designed to make use of the in-situ soils at the site as opposed to importing material to achieve a level development that is above the required flood level throughout.

Designated material storage areas have been included in the design to provide designated areas for appropriate storage of excavated materials.

However, there are some risks that cannot be mitigated through design and need to be managed during construction.

9.6.2.1 Subsoil and Bedrock Excavation (Cut and Fill)

An earthworks campaign to consisting of 47389m^3 of cut and 46953m^3 of fill is required. Cut in-situ material will be excavated from the central and eastern site areas and relocated to fill lower elevation areas, in the southern and northern site areas. The earthworks campaign is required to allow for site levelling, for the installation of foundations for the access roads, carpark and buildings, and service trenching.

This will result in a permanent relocation of soil, subsoil and rock across the site. The bedrock at the site can be classified as of "Low" importance, and the soil and subsoil deposits at the site could be classified as of "Low" importance as neither are unique and are abundant in the wider landscape.

Mechanism: Extraction/excavation. Cut and fill earthworks

Receptor: Land, topsoil, subsoil and bedrock.

Pre-Mitigation Potential Effect: Negative, slight/moderate, direct, likely, permanent impact on soil, subsoil and bedrock.

Mitigation Measures:

- All excavated (existing) overburden material will be reused on site as fill material to increase site levels in lower elevation areas **(LS_1; Table 21.1 contained in Chapter 21)**;
- Topsoil will be stripped and stored on site prior to reuse in areas of soft landscaping as part of the development (LS_2; Table 21.1); and,

Residual Effect Assessment: Due to the shallow nature of the excavations, the design measure to reuse excavated materials onsite and the 'low' value of the soil and rock resource the magnitude of the effect is considered to be a negative, direct, slight, likely, permanent impact on topsoil, subsoils and bedrock.

9.6.2.2 Contamination of Soil by Leakages and Spillages and Alteration of Soil Geochemistry

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk. The accumulation of spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects on the geological and water environment.

Mechanism: Leakage and Spillage.

Receptor: Topsoil, subsoil and bedrock.

Pre-Mitigation Potential Effect: Negative, direct, slight, short term, unlikely, permanent impact on soil, subsoil and bedrock.

Mitigation Measures:

- All plant and machinery will be serviced before being mobilised to site (LS_3 in Table 21.1);
- No plant maintenance will be completed on site, any broken down plant will be removed from site to be fixed (LS_4; Table 21.1);
- Refuelling will be completed in a controlled manner using drip trays at all times (LS_5; Table 21.1);
- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas away from open water (LS_6; Table 21.1);

- No bulk chemicals will be stored within the active construction areas (LS_7 in Table 21.1);
- Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will be undertaken offsite where possible. Where this is not possible, filling and maintenance will take place in a designated material storage compound, which is located at least 10 metres from any temporary or permanent drainage features (LS_8 in Table 21.1);
- Fuel containers will be stored within a secondary containment system, e.g. bunds for static tanks or a drip tray for mobile stores (LS_9 in Table 21.1);
- Containers and bunding for storage of hydrocarbons and other chemicals will have a holding capacity of 110% of the volume to be stored (LS_10 in Table 21.1);
- Ancillary equipment such as hoses and pipes will be contained within the bund (LS_11 in Table 21.1);
- Taps, nozzles or valves will be fitted with a lock system (LS_12 in Table 21.1);
- Fuel and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage (LS_13 in Table 21.1);
- Drip-trays will be used for fixed or mobile plant such as pumps and generators in order to retain oil leaks and spills (LS_14 in Table 21.1);
- Only designated trained operators will be authorised to refuel plant on site (LS_15 in Table 21.1);
- Procedures and contingency plans will be set up to deal with emergency accidents or spills (LS_16 in Table 21.1); and,
- An emergency spill kit with oil boom, absorbers etc. will be kept on-site for use in the event of an accidental spill. A specific team of staff will be trained in the use of spill containment (LS_17 in Table 21.1).

Highest standards of site management will be maintained, and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the site and surrounding environment during construction. A named person will be given the task of overseeing the pollution prevention measures agreed for the site to ensure that they are operating safely and effectively as well as having responsibility for the implementation of Emergency Procedures for spill control measures (LS_18 in Table 21.1).

Residual Effect Assessment: The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. The measures identified above to mitigate the risk of spills and leaks, will be applied during the construction phase. The residual effect is assessed as – Negative, imperceptible, direct, short-term, low probability effect on topsoil, subsoils and bedrock.

9.6.2.3 Soil and Subsoil Compaction

Unintended soil and subsoil compaction is due to inadvertent construction traffic on the development site. Soil compaction leads to bulk density of the soil increasing and the total porosity decreasing which can pose a risk to site drainage due to the lower level of ground permeability on the site. The soils and subsoils on site are thin and have minimal effect on the drainage regime at the site.

Mechanism: Excavation / handling / storage.

Receptor: Land, topsoil, subsoil.

Pre-Mitigation Potential Effect: Negative, direct, imperceptible, likely impact on topsoil and subsoils.

Mitigation Measures: The in-situ soils and subsoils underlying the development area will be subject to a certain amount of compaction, but this will be unavoidable. Any infill material/landscaping that is required will be placed and levelled in appropriate lift thicknesses to ensure the material is not over compacted thereby retaining its drainage properties (LS_19 in Table 21.1).

Residual Effect Assessment: Negative, slight, direct, likely impact on topsoil and subsoils.

9.6.2.4 Geological Effect on Local Designated Sites

Mechanism: Excavation / handling / storage of soil/subsoils.

Receptor: Land, topsoil, subsoil and associated designated sites.

Potential Effect: None, no direct excavation or development of any local designated sites are proposed. No indirect impacts on Designated Sites are anticipated.

Residual Effect: None.

9.6.2.5 Cut and Fill impact on groundwater

Mechanism: Extraction/excavation. Cut and fill earthworks.
Receptor: Groundwater (noted to be generally absent within soils and subsoils).

Potential Effect: None. No significant dewatering will be required.

Residual Effect: None

9.6.3 Potential Effects and Mitigation Measures – Operational Stage

Due to the nature of the proposed residential development, no impacts on soils, geology and hydrogeology are anticipated during the operational phase. The operational stage of the residential development consists of the typical activities in a residential area and will not involve further significant disturbance to the topsoil, subsoils and geology of the area.

No cumulative impacts on the land, soils, geology and hydrogeology environment are envisaged during the operational stage.

9.6.4 Assessment of Potential Effects on Human Health (Interaction)

Potential health effects arise mainly through the potential for soil and ground contamination. Residential developments are not a recognized source of significant potential pollution and so the potential for effects during the construction and operational phases are not of concern.

Hydrocarbons will be used onsite during construction through the use of site plant. However, the volumes will be small in the context of the scale of the project and will be handled and stored in accordance with industry best practice guidelines/methodologies and mitigation measures. The potential residual impacts associated with soil or ground contamination and subsequent health effects are imperceptible.

9.7 Residual Effects

Overall, the development of the project will have a not-significant negative effect on the lands, soil geological and groundwater environment, through the application of identified mitigation measures and appropriate management throughout the construction of the residential development.

9.8 Interactions

Land, soils, geology and hydrogeology has an interaction with hydrology and biodiversity. The earthworks for the site has the potential to impact on the surface water quality, by silt generated from runoff or chemicals/oils from construction vehicles carrying out the works. The proposed mitigation measures will ensure protection of surface water quality.

9.9 Cumulative Effects

The following projects are considered to assess the cumulative effects of the development:

- A proposed nursing home development at the south- eastern boundary of the site, planning ref LCCC Reg. Ref. 21/1222.
- A proposed housing development at the north-eastern boundary of the site, LCCC Reg. Ref. 17/1190 (ABP-302015-18) consisting of 30 residential units.

The potential cumulative effects of the proposed development in combination with the adjacent proposed developments have been considered during the construction and operational phase.

The potential cumulative effects of the proposed development in combination with the adjacent proposed developments have been considered in terms of impacts on land, soil, geological and groundwater environments. There will be some cut and fill earthworks associated with the nursing home to create a suitable level for development. However, the scale of the proposed earthworks at the adjacent developments is small in comparison with those of the SHD, so the potential cumulative effects are considered not significant.

With the implementation of mitigation measures for the proposed development as outlined above, no significant cumulative impacts on land, soils, geology and groundwater environments are anticipated during the construction or operation phases of the proposed development in combination with other developments. Potential cumulative impact will be permanent, not significant, and neutral.

9.10 Conclusion

The earthworks required at the site to mitigate against flood risk will result in a permanent relocation and removal of subsoil and bedrock across the site. Due to the nature of the site topography and geology it will be possible to reuse all cut material as fill which minimises the need to remove all excavated materials.

The works will be carried out in accordance with mitigation measures referred to in this chapter in addition to those proposed in the Construction and Environment Management Plan (CEMP) (GDG, 2021)

Overall, the development of the project will have a not-significant negative long-term effect on the land, soil, geological and groundwater environment, through the application of identified mitigation measures and appropriate management throughout the life cycle of the development.

No significant cumulative impacts on land, soil, geology and hydrogeology will occur due to the proposed development.

9.11 References

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10.0 HYDROLOGY – SURFACE WATER

10.1 Introduction

This chapter assesses the potential impact of the development of the proposed Strategic Housing Development (SHD), on receiving water quality environment and Water Framework Directive (WFD) compliance. Existing water quality in the vicinity of the project is established based on available water quality information and WFD monitoring programmes. The likely significant effects on water quality of the implementation of the SHD are assessed and measures to reduce, avoid and prevent these likely significant effects are proposed, where they are necessary.

This assessment is based on the SHD and design principles detailed in Chapter 5 and has been prepared at a strategic level to identify potential water quality issues that may arise from the development and presents mitigation measures that will be implemented to address the potential impacts.

Separately to the SHD, a planned nursing home development will also be undertaken within the Greenpark lands. This planned development has been considered within the overall cumulative impact assessment for the SHD.

10.2 Methodology

Baseline water quality within the receiving environment has been established through review of national monitoring data used to establish water quality status in the context of the EU Water Framework Directive (WFD) and supporting environmental standards.

An assessment has then been made of the components of the development that have the potential to have a significant impact on water quality using criteria for rating significance and magnitude set out in the National Roads Authority (NRA) publication “Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes” (NRA, 2008).

The significance of impact on surface water quality likely to occur during the construction and operation phases of the development are determined using a predominantly qualitative methodology. The assessment is a consideration of a combination of receptor sensitivity (**Table 10-1: C**) and the potential magnitude of the impact on the water environment (**Table 10-2**), in order to determine significance (**Table 10-3**). The approach to assessing the significance of impacts comprises assigning each impact to one of the four categories of magnitude as outlined in **Table 10-2** enables different components to be assessed based upon the same scale.

The significance determination and assessment of the potential likely environmental effects of each component of the project has been made based on the matrix presented in **Table 10-3** and in **Table 10-4**. To conclude the assessment, mitigation measures are proposed to reduce, avoid and prevent these likely significant effects, where appropriate. This enables a “with mitigation” assessment to be made of any residual impact as a result of the construction and operational phases of the project and/or in combination with other existing or approved projects in the vicinity of the development.

Table 10.1: Criteria for Rating Receptor Sensitivity (NRA, 2008)

Value (Sensitivity)	Typical Descriptors
Extremely High	***Attribute has a high quality or value on an international scale.*** Examples: Examples: River, Wetland or surface water body ecosystem protected by EU legislation. I.e. designated under the Habitats, Birds, Shellfish, Bathing Water or Freshwater Fish, Drinking Water or Nitrate Directives.
Very High	***Attribute has a high quality or value on a regional or national scale.*** Examples: River, Wetland or surface water body ecosystem protected by national legislation (NHA status), Regional important potable water source supplying >2500 homes, nationally important amenity site for wide range of leisure activities, Quality Class A (Biotic Index Q4, Q5), Flood plain protecting more than 50 residential or commercial properties from flooding.
High	***Attribute has a high quality or value on a local scale.*** Examples: Salmon fishery, locally important potable water source supplying >1000 homes, Quality Class B (Biotic Index Q3-4), Flood plain protecting 5 to 50 residential or commercial properties from flooding, Locally important amenity site for wide range of leisure activities.
Medium	***Attribute has a medium quality or value on a local scale.*** Examples: Coarse fishery, Local potable water source supplying >50 homes, Quality Class C (Biotic Index Q3, Q2-3), Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	***Attribute has a low quality or value on a local scale.*** Examples: Locally important amenity site for small range of leisure activities, Local potable water source supplying <50 homes, Quality Class D (Biotic Index Q2, Q1), Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 10.2: Criteria for Rating the Magnitude of Impact (NRA, 2008)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	Loss or extensive change to a water body or water dependent habitat.
		Increase in predicted peak flood level >100mm.
		Extensive loss of fishery
		Extensive reduction in amenity value
		Potential high risk of pollution to water body from routine run-off
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Increase in predicted peak flood level >50mm
		Partial loss of fishery
		Potential medium risk of pollution to water body from routine run-off
		Partial reduction in amenity value
Minor Adverse	Results in minor impact on integrity of attribute	Increase in predicted peak flood level >10mm
		Minor loss of fishery

Magnitude of Impact	Criteria	Typical Examples
	or loss of small part of attribute	Potential low risk of pollution to water body from routine run-off
		Slight reduction in amenity value
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level. Negligible loss of amenity value. Negligible loss of fishery

Table 10.2: Criteria for Rating the Significance of Environmental Impacts (NRA 2008)

Importance of Attribute	Magnitude of Impact			
	Negligible	**Minor**	**Moderate**	**Large**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Severe / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

Table 10.3: Defining Impact Significance (NRA, 2008)

	Attribute Importance				
	Extremely High	**Very High**	**High**	**Medium**	**Low**
Profound	Any permanent impact on attribute	Permanent impact on significant proportion of attribute			
Significant	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute		
Moderate	Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute	
Slight		Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute	Permanent impact on significant proportion of attribute

Imperceptible			Temporary impact on small proportion of attribute	Temporary impact on significant proportion of attribute	Permanent impact on small proportion of attribute

10.3 Baseline Environment

A desk-based assessment of surface water quality in the vicinity of the project application area was conducted. The sources of the water quality information include:

- Water Framework Directive water body status information arising from the Water Framework Directive monitoring programme. Water Quality in Ireland Report 2010-2015 (2017) supported by water quality information available on the EPAs online Water Framework Directive Application (www.catchments.ie);
- Protected areas datasets including:
  - information on Nutrient Sensitive Areas as outlined in the EPA's most recent Urban Waste Water Treatment Report (2017); and
  - the existing Register of Protected Areas (under Article 6 of the Water Framework Directive) for water dependent habitats and species in the SAC and SPA networks held by the EPA.
- Water Quality in Ireland – An Indicators Report (2018);

For the purposes of monitoring and assessing the quality of surface waters, all rivers, lakes, coastal inter-basins, estuaries, and coastal waters (within 1 nautical mile of the shoreline) have been divided into management units called "water bodies". Under the Water Framework Directive (WFD) condition of each water body must be reported to the European Commission in the form of ecological status and chemical status. Ground water bodies are similarly delineated with status identified.

Surface water bodies are grouped into sub-catchments for the purposes of water management, of which there are 583 nationally, which are further grouped into catchment management units of which there are 46 based on the hydrometric areas used by public authorities. As illustrated in **Figure 10.1** the development is located within Ballynaclogh_SC_010 sub catchment and the Shannon Estuary South sub-catchment. The Limerick Dock (IE_SH_060_0900) transitional water body runsparallel to the proposed development and incorporates the tidal reaches of the Ballynaclogh River.The Ballynaclogh_010 (IE_SH_24B040800) river water body is upstream of the Limerick Dock transitional water body.

Figure 10.2 shows the project in the context of the wider surface water body environment. These river and transitional water bodies ultimately discharge into the Upper Shannon Estuary (IE_SH_060_0800).

The project lies within the 'Limerick City Southwest' groundwater body (SH-G-141). This water body has achieved 'good' status during the 2013-2018 WFD monitoring cycle. Although, the 2010-2015 monitoring programme recorded 'poor' status as a result of impact of groundwater on surface water ecological status which were attributed to nutrient pressures from agriculture (EPA, www.catchments.ie). All the waterbodies are grouped into the Ballynaclogh_SC_010 sub-catchment (24_10), are within the Shannon Estuary South Catchment (Hydrometric Area 24) in the Irish River Basin District.

The soils, geology and hydrogeology section discusses the potential impact relating to groundwater which concludes that the overall hydrogeology impact from construction and operation of the development is considered to be Neutral.

10.3.1 Water Framework Directive Water Body Status

Directive 2000/60/EC establishing a framework for community action in the field of water policy (the Water Framework Directive), and its transposing regulations, establishes a legal framework for the protection, improvement and sustainable management of rivers, lakes, transitional waters (estuaries), coastal waters (to a distance of one nautical mile) and groundwater.

The fundamental objectives of the WFD are to maintain "high status" of surface waters where it exists, prevent deterioration in the existing status of waters, and achieve at least "good status" in relation to all waters by the end of the current river basin management cycle (2021) unless a water body is subject to an extended deadline under Article 4(7) of the Directive. A water body must achieve both good 'ecological status' and good 'chemical status' before it can be considered to be at good overall status. An assessment of the risks to the achievement of these objectives for water bodies has been undertaken by the EPA through the extensive characterisation of water bodies and the key pressures acting upon them. This characterisation process allows the development of a programme of measures to aid the achievement of the WFD objectives.

A Programme of Measures (POMs) outlines the steps that will be taken to meet WFD objectives as applicable to each water body. This Programme is contained within an overarching River Basin Management Plan (RBMP). These measures will require implementation at strategic level but also at regional and local level through the establishment of Regional Integrated Catchment Management Programmes. Whilst none of the water bodies within the project area have been included amongst those 190 prioritised areas for action in the current River Basin Management Plan for Ireland 2018 – 2021 (DHPLG, 2018), it is noted that measures required to ensure compliance with existing legislation will be implemented during this river basin management cycle.

Environmental Quality Standards (EQSs) for classifying surface water status are established in the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (SI No. 272 of 2009), as amended. These regulations set standards for biological quality elements, physico-chemical conditions supporting biological elements (including general conditions and specific pollutants), priority substances and priority hazardous substances.

As shown in **Figure 10.3** the 'ecological status' of a water body is established according to compliance with the EQSs for biological quality elements, physico-chemical conditions supporting biological elements and relevant pollutants and hydromorphological quality elements. The ‘chemical status’ of a water body is established according to compliance with the EQSs for priority substances and priority hazardous substances.

In addition to achieving good ecological and chemical status, a water body must achieve compliance with standards and objectives specified for protected areas, which include areas designated by the Bathing Water Directive; the Urban Waste Water Treatment Directive; the Shellfish Waters Directive; the Habitats Directive and the Birds Directive. Waters bodies that are compliant with WFD standards, but that contain protected areas that are non-compliant with protected area standards are downgraded to ‘less than good’ status.

Based on monitoring information and data from 2013 to 2018, the current WFD status classification of river water bodies potentially affected by the SHD is illustrated in **Figure 10.4**.

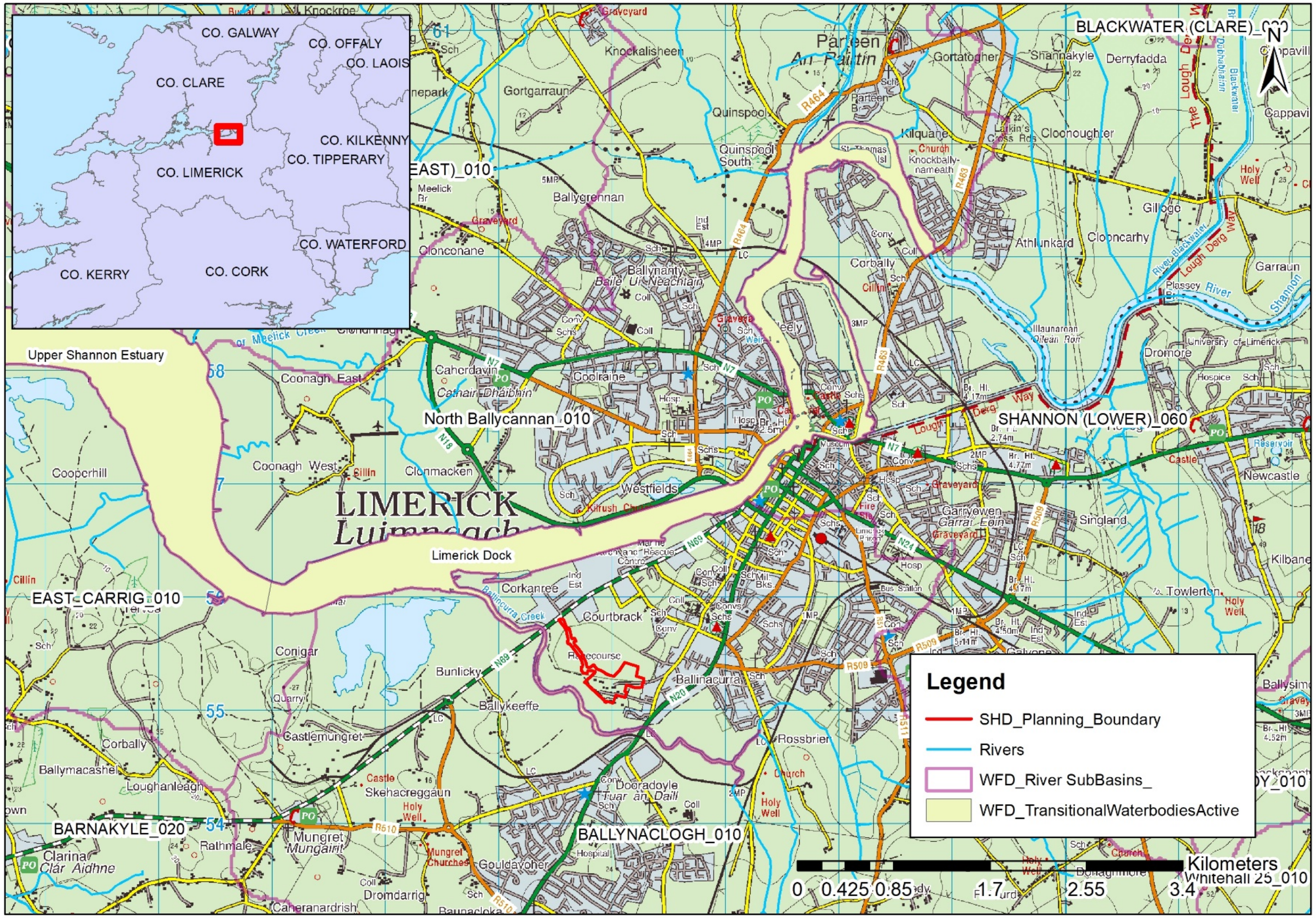

Figure 10.1: Site Location in the Context of the Water Framework Directive River Sub Basins

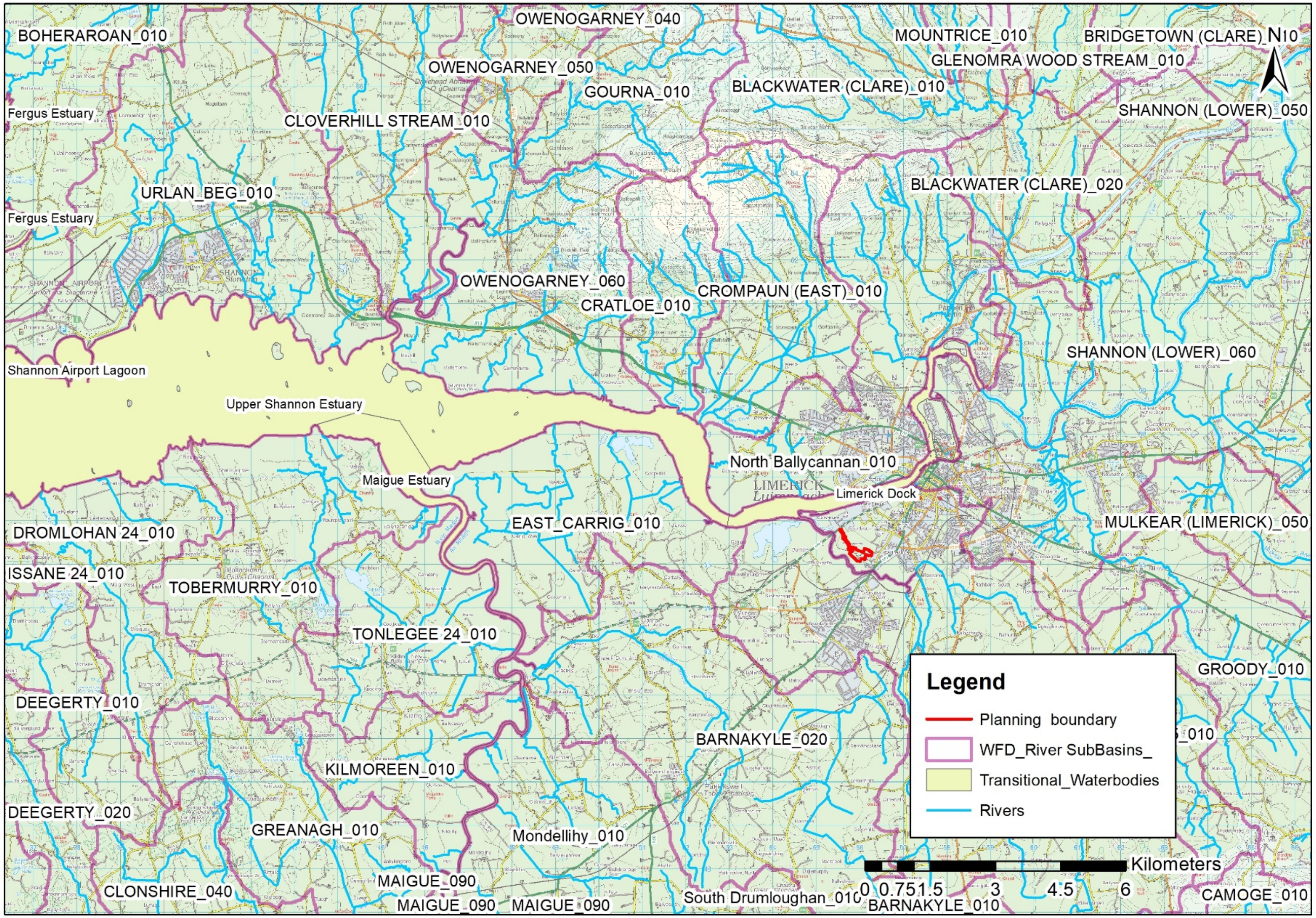

Figure 10.2: Site Location in the Context of the Wider Surface Water Environment

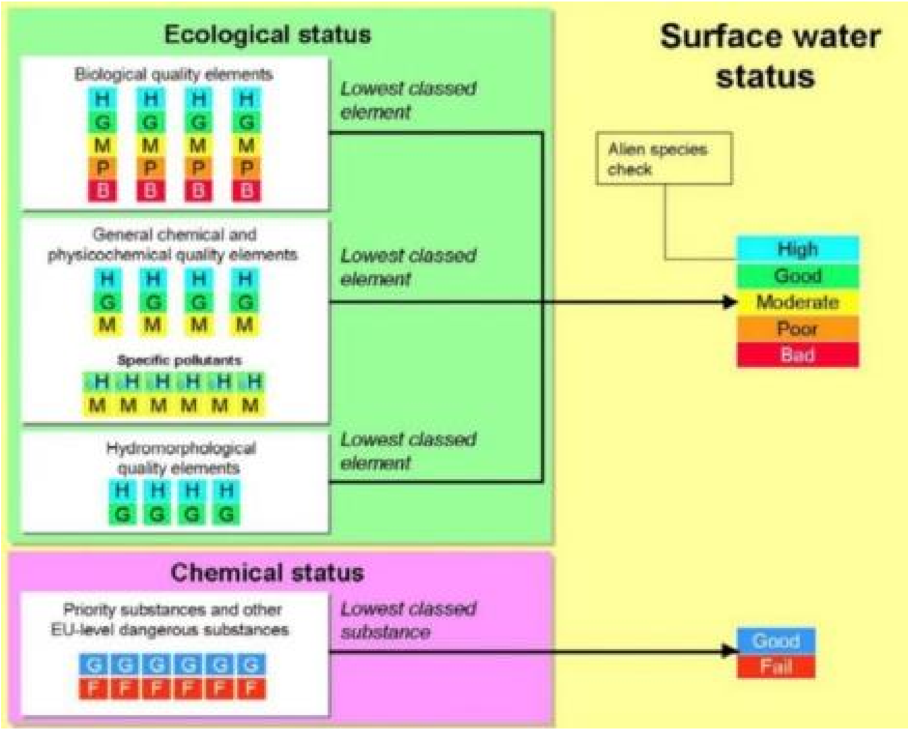

Figure 10.3: Elements of the Water Framework Directive Status

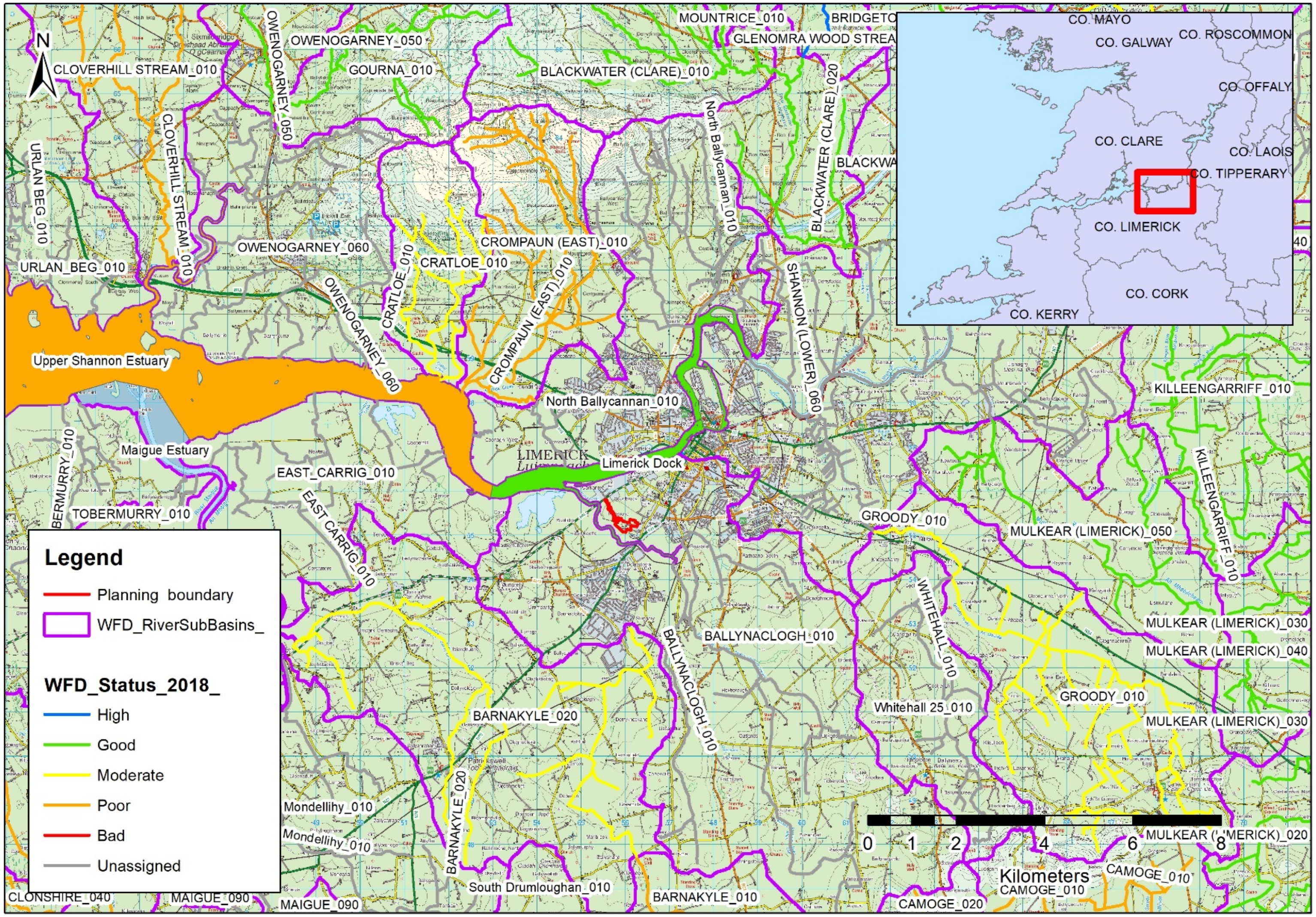

Figure 10.4: Water Framework Directive Water Body Status – Reported 2017

The WFD status classification between 2007 and 2018 is shown in **Table 10-5** for each of these water bodies. In summary the Limerick Dock was classified as "good", while the Ballynaclogh_010 has not been assigned a status whilst the downstream Upper Shannon Estuary has most recently been reported as "poor" status.

Table 10.4: WFD Status (2007-2018)

WFD Status 2007-2018	***Limerick Dock***	***Ballynaclogh_010***	***Upper Shannon Estuary***
	SH_060_0900	***SH_24B040800***	***SH_060_0800***
Overall WFD Water Quality Status (2007-2009)	Good	Unassigned	Good
Overall WFD Water Quality Status (2010-2012 – Interim)	Moderate	Unassigned	Moderate
Overall WFD Water Quality Status (2010-2015)	Moderate	Unassigned	Poor
Overall WFD Water Quality Status (2013-2018)	Good	Unassigned	Poor

A further breakdown of the ecological and chemical elements for the 2013-2018 WFD cycles is shown in **Table 10-6**. The Limerick Dock water body is currently at both "good" Ecological Status but was at "moderate" status in the 2010-2015 monitoring cycle. There has therefore been an improvement in biological quality elements from "moderate" to "good" due to an improvement in fish status. The Ballynaclogh_010 has yet been unassigned a status. The Upper Shannon Estuary has gradually declined from "good" status in the 2007-2009 monitoring cycle to the "moderate" in the 2010-2012 monitoring programme and more recently has deteriorated to "poor" due to unacceptable conditions for angiosperms (sea grasses) which are impacted by nutrient pressures in the upstream catchment.

This assessment of likely significant effects on water quality has been undertaken having regard to the necessity to comply with the WFD and in doing so ensuring that the project does not prevent the achievement of the WFD objectives for these water bodies in subsequent RBMP cycles. The water quality assessment therefore demonstrate that the SHD project will not cause deterioration in the status of these affected water bodies or prevent the improvement in status, where necessary, under the environmental objectives of the WFD.

Table 10.5: WFD Status Breakdown (2013-2018)

WFD Status 2013-2018			***Limerick Dock***	***Ballynaclogh_010***	***Upper Shannon Estuary***
			SH_060_0900	***SH_24B040800***	***SH_060_0800***
Ecological Status	*Biological Status*	*Phytoplankton Status*	*High*	*Not Available*	*High*
		Angiosperm Status	*Not Available*	*Not Available*	*Poor*
		Invertebrate Status	*Not Available*	*Not Available*	*Good*
		Fish Status	*Good*	*Not Available*	*Good*
	Supporting Chemistry Conditions	*Oxygenation Conditions*	*High*	*Not Available*	*High*
		Nutrients Condition	*High*	*Not Available*	*Good*
		Phosphorus conditions	*High*	*Not Available*	*Not Available*
		Relevant Pollutants	*Pass*	*Not Available*	*Pass*
	Hydromorphological Quality Element	*Hydrology, Morphology, Continuity*	*Not Available*	*Not Available*	*Good*
	Ecological Status (2013 – 2018)		**Good**	*Not Available*	**Poor**
Chemical Status	*Priority substances and other EU-level dangerous substances*		*Not Available*	*Not Available*	*Not Available*
	Chemical Status (2013 – 2018)		*Good*	*Not Available*	*Good*
Overall WFD Quality Status 2013 – 2018			***Good***	*Not Available*	***Poor***

10.3.2 Protected Areas

A significant proportion of the area of the Shannon Estuary South catchment is protected under existing EU legislation requiring special protection due to the sensitivity to pollution or particular environmental importance. All of the areas requiring special protection in the Irish River Basin District have been identified by EPA, mapped and listed in a national register of protected areas (required under Article 6 of the WFD Directive). The register of protected areas includes:

- areas designated for the abstraction of water for human consumption (Drinking Water Protected Areas);
- areas designated for the protection of economically significant aquatic species, i.e. Freshwater Fish and Shellfish;
- bodies of water designated as recreational waters, including areas designated as bathing waters;
- nutrient-sensitive areas, including areas identified as Nitrate Vulnerable Zones under the Nitrates Directive or areas designated as sensitive under Urban Waste Water Treatment Directive; as well as
- areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection including relevant Natura 2000 sites (Special Protection Areas (SPAs); and candidate Special Areas of Conservation (cSACs).

These protected areas have their own monitoring and assessment requirements to determine their condition. They are often assessed for additional pollutants or requirements relevant to their designation.

10.3.2.1 Nutrient Sensitive Waters

The Urban Waste Water Treatment Regulations 2001, as amended (which transpose the Urban Wastewater Treatment Directive (91/271/EEC) into Irish law and update the Environmental Protection Agency Act, 1992 (Urban Waste Water Treatment) Regulations 1994, as amended) list nutrient sensitive waters in the Third Schedule. There are no nutrient sensitive areas in the sub catchment.

10.3.2.2 Natura 2000 Protected Areas

Natura 2000 is a European network of important ecological sites. The EU Habitats Directive (92/43/EEC) places an obligation on Member States of the EU to establish the Natura 2000 network. The network is made up of Special Protection Areas (SPAs), established under the EU Birds Directive (79/409/EEC), and cSACs, established under the Habitats Directive itself.

As illustrated in **Figure 10.5** the project activities within the SHD area will not be within any Natura 2000 site (i.e. SPA or cSAC). The development of the development will therefore not have a direct impact on any Natura 2000 sites. However, there is the potential for water dependent protected areas downstream of the proposed development to be indirectly affected in the event of water pollution, in the absence of mitigation.
One of the main purposes of the water quality assessment is to ascertain whether the development will cause significant effects on the ecological status of the water bodies affected having regard to the environmental objectives for the water bodies, including conservation objectives for qualifying features of the downstream Natura 2000 network. It should also be noted that potential effects on Natura 2000 or “European” sites will be considered extensively in the appropriate assessment process which will be undertaken during the development consenting stage of the development.

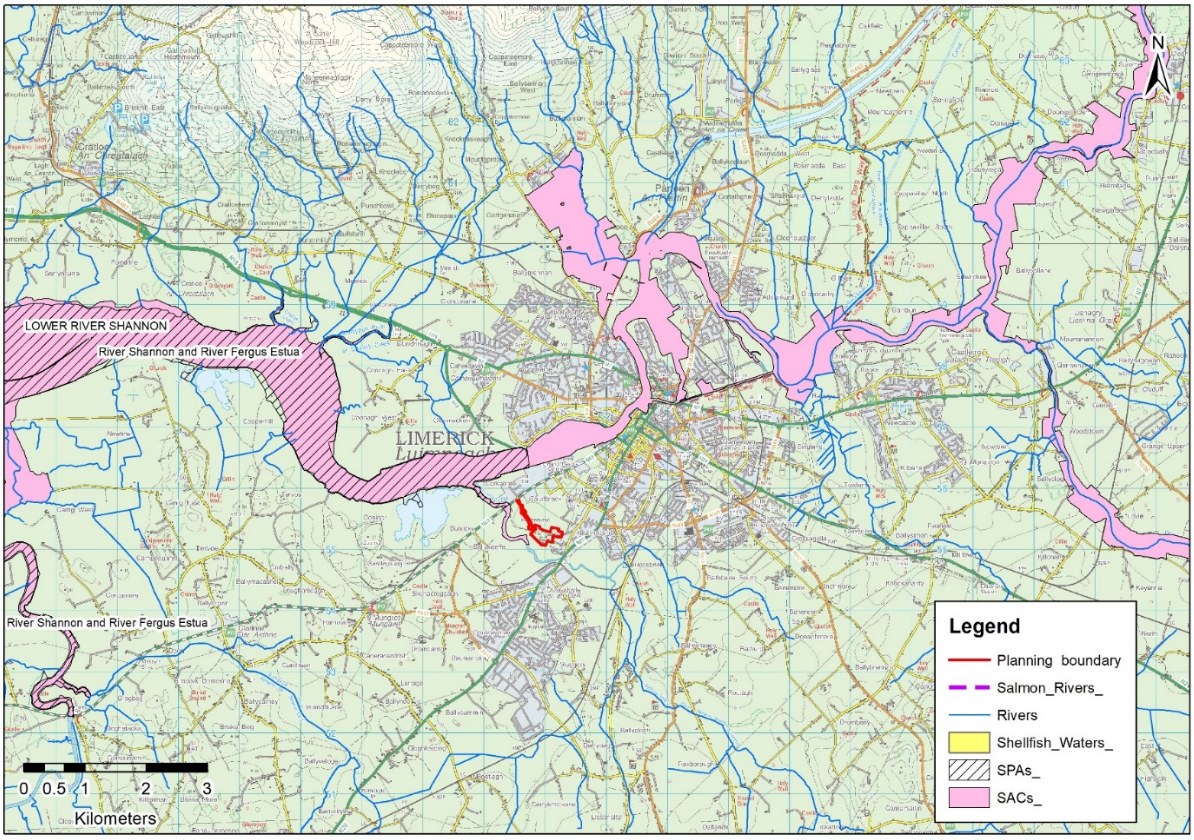

Figure 10.5: Natura 2000 Designated Sites*10.3.2.3 Bathing Waters*

The Bathing Water Directive (2006/7/EC) came into force in March 2006, and was transposed into Irish law by the Bathing Water Quality Regulations, 2008, as amended. The previous 1976 Directive was repealed with effect from 31 December 2014. Since 2014, the annual water quality classification (rating) of a beach or lake has been based on water quality results covering a four-year period rather than a single previous season's data. Water quality at beaches and lakes is classified as Excellent; Good, Sufficient or Poor (**Table 10-7**). This approach is common across all EU Member States and there is a requirement to ensure that bathing waters are of 'Sufficient' standard or better. Any 'Poor' bathing water requires a programme of adequate management measures to be implemented. A minimum of 16 samples are required for formal annual assessment.

Table 10.6: Annual Assessment Criteria for Bathing Waters

Parameter	Excellent	Good	Sufficient
E. coli (Freshwater) cfu/100 ml	500*	1000*	900**
E. coli (Coastal) cfu/100 ml	250*	500*	500**
Intestinal enterococci (freshwater) cfu/100 ml	200*	400*	330**
Intestinal enterococci (Coastal) cfu/100 ml	100*	200*	185**

*based on 95-percentile value **based on 90-percentile value

There are no designated bathing waters in the catchment but the bathing areas further downstream are located at Cappagh Pier Kilrush and Ballybunnion North and South. Bathing waters are significantly downstream, with the closest, Kilrush, over 50km downstream. Most recently, Cappagh Pier Kilrush has been classified as Excellent; Ballybunnion North as Good and Ballybunnion South as Excellent. Ballybunnion North has deteriorated from Excellent to Good in the 2019 monitoring period and remained unchanged in 2020. The remaining sites showed no change over this interval.

10.3.3 EPA Water Quality in 2019: An indicators Report

In 2020 the EPA published the Water Quality in 2019, An Indicators Report. The intention of the report is to keep decision makers and the public informed by providing timely, scientifically sound information on water quality using a series of water quality indicators. Of the sixteen indicators three relate to transitional and coastal water bodies located in close proximity to the project;

- Indicator 6 – Nitrogen in Estuaries and Coastal Waters,
- Indicator 7 – Phosphorus in Estuaries and Coastal Waters.

In this water quality assessment consideration has been given to potential effects of the development on these environmental indicators.

10.3.3.1 Indicator 10 – Nitrogen in Estuaries and Coastal Waters

In terms of coastal systems, nitrogen is primarily considered the limiting nutrient and therefore controls plant and algae growth. Nitrogen in the form of dissolved inorganic nitrogen in winter months is generally at its highest as a result of the absence of abundant algal or plant growth.

Thresholds have been determined for dissolved inorganic nitrogen in coastal and transitional water bodies for specific salinities, while coastal water bodies have an environmental quality standard. Human pollution sources are responsible for elevated nitrogen levels observed from levels of dissolved inorganic nitrogen above the thresholds.

The Indicators Report showed both Limerick Dock and the Upper Shannon Estuary to be exceeding the levels of dissolved inorganic nitrogen less than 50% of the time during the 2017-2019 monitoring. The trends in DIN concetrations indicated that levels were stable and neither increasing nor decreasing during the monitoring. During the 2013-2018 monitoring period, upward trends have been recorded for both water bodies, however, neither are environmentally significant. The development will produce foul water, a potential source of additional N loading to the estuary, however the foul water will be treated in the Castletroy WWTP which has adequate capacity to ensure that the existing emission limit values from the WWTP will not be exceeded.

Table 10.7: Summary of Dissolved Inorganic Nitrogen (as N) mg/l concentrations at Limerick Dock and the Upper Shannon Estuary sections during 2017-2020 (Monitoring stations Coonagh Point d/s LMD, u/s LMD Limerick Docks, u/s Foynes and d/s Pallaskenry STP).

Dissolved Inorganic Nitrogen (as N) mg/l	Limerick Dock	Upper Shannon Estuary
Min	0.24	0.16
Max	1.6	1.61
Mean	0.94	0.65
5%ile	0.47	0.20
95%ile	1.5	1.44

10.3.3.2 Indicator 11 – Phosphorus in Estuaries and Coastal Waters

In terms of lower salinity estuarine systems, phosphorus is the limiting nutrient. Excessive concentrations can cause eutrophication of the water body. Due to the absence of algal or plant growth during winter months, phosphorus concentrations are generally are at their highest.

Coastal waters have defined thresholds for specific salinities and estuarine waters have an environmental quality standard for phosphorus levels. Levels above these thresholds can be an indication of human related pollution.

The Indicators Report shows the Upper Shannon Estuary and Limerick Dock to both be in exceedance of phosphorus levels <50% of the time, stable trends were associated with the water bodies. The 2013-2018 data shows upwards trends associated with both water bodies, although neither are environmentally significant.

Phosphate is essential for plant growth but excessive levels can be detrimental to river ecological health and lead to eutrophication. The primary sources of phosphate in freshwater systems are sewage/industrial discharges and both diffuse or point sources from agricultural land. The development will produce foul water, a potential source of additional P loading to the estuary, however the foul water will be treated in the Limerick WWTP which has adequate capacity to ensure that the existing emission limit values from the WWTP will not be exceeded.

Table 10.8: Summary of Total Phosphorus (as P) mg/l concentrations at the Limerick Dock and the Upper Shannon Estuary sections during 2017-20 (Monitoring stations Coonagh Point d/s LMD, u/s LMD Limerick Docks, u/s Pallaskenry, u/s Foynes and d/s Pallaskenry, Carraig Bank Buoy, Tradee (Bunratty Buoy, Scarlet Buoy, Ardbane Buoy, Tervoe Buoy / Courtbrack Buoy and Cooper's Buoy).

Total Phosphorus (as P) mg/l	Limerick Dock	Upper Shannon Estuary
Min	0.01	0.01
Max	0.17	0.06
Mean	0.04	0.03
5%ile	0.01	0.01
95%ile	0.1	0.04

10.3.4 Site Characterisation

The Pollutant Impact Potential (PIP) mapping produced by the EPA ranks areas within water bodies from 1 (highest) to 7 (lowest) in respect to the potential impact from pollutants. In terms of PIP, the SHD site was rated a PIP category of 7 for nitrate pollution to groundwater and surface waters. However, the PIP for phosphate to surface waters the site is ranked 2 (second highest).

10.3.5 Summary of Existing Water Quality

A review of available national monitoring information for the water bodies in the immediate vicinity of the application boundary has concluded:

- The overall WFD Surface Water Quality status between 2013-2018 is:
  - Limerick Dock – Good Status
  - Ballynaclogh_010 – Unassigned Status
  - Upper Shannon Estuary – Poor Status
  - Limerick City Southwest groundwater body – Good Status
- Downstream of the SHD area, there are a number of protected areas under Article 6 of the WFD Directive, i.e., Natura 2000 sites and bathing water although the nearest bathing water is over 50 km from the site;
- Nutrient levels in the receiving water bodies are the main driver for the unsatisfactory water quality;
- The ground conditions at the site mean that the main pathway for contamination is via surface water pathways which are particularly important for phosphate export which is the key limiting nutrient in transitional water bodies.

10.4 Potential Effects of the Proposed Project

The likelihood of environmental impacts arising due to the development is assessed in relation to the construction and operational phases. The elements of construction and operation and the potential impacts on water quality have been identified for assessment.

The SHD has the potential to directly impact upon the Limerick Dock water body given the location of the works. The potential to indirectly impact upon the downstream Upper Shannon Estuary water body and sensitive areas further downstream has also been considered.

The significance of any environmental effect is rated based on the magnitude of the impact and the importance of the attribute. Based on this criteria the receiving environment is considered to be of high importance due to the fact that the water bodies are within the Shannon Estuary South catchment and provide a hydrological link to the important downstream protected areas, particularly the Natura 2000 sites.

In summary and for the purposes of this impact assessment the following components of works have been considered:

- Surface Water Drainage
- Foul Water Drainage for the entire development
- Construction of 371 residential units, a creche and all relevant infrastructure including parking areas, access, drainage, internal roads, pedestrian and cycle routes, services provisions, landscaping and boundary treatment and all associated site development and excavation works.

10.4.1 Construction Phase

Based on the nature of the components of works proposed for the development, temporary impacts on water quality have the potential to occur during the construction phase of the works. The following have been considered in this assessment:
Increased suspended sediment levels due to the accidental release of sediment to the water column during:

- Construction of buildings & structures;
- Cut and fill operations;
- Suspended sediment, including all soils, sands and rubble is the single main pollutant to the aquatic environment generated at construction sites and largely arises from the erosion of exposed soils and sediments by surface water runoff. Both temporary and permanent impacts on surface waters may occur during construction. Pollution from mobilised suspended solids (silt) is the prime concern. Suspended sediment due to run off from stripped construction areas, stockpiled earth and the dewatering of excavations can have a severe negative impact on water quality. Once suspended sediment load enters a river it can result in long-term changes that cause chronic harm. Sediment can cause river hydromorphological changes, which in turn change the dynamics of the river in the future and can negatively impact on the supporting hydromorphological conditions and ecological status resulting in an increased risk to the environmental objectives of a water body.

- Accidental release of highly alkaline contaminants from concrete and cement during the construction of hardstand areas, etc. The construction works associated with the development will involve the use of cement and concrete for some of the hard standing areas and construction of buildings. During the construction phases, there is the potential for impact on the water quality and a toxic effect on the biological elements resulting in a possible further deterioration in the ecological status or compromise the improvement in ecological status through the implementation of the programme of measures included in the River Basin Management Plan; and
- General water quality impacts associated with works machinery, infrastructure and on-land operations including the temporary storage of construction materials, oils, fuels and chemicals.

10.4.2 Operational Phase

The operational phase impacts associated with the project represent general water quality issues associated with surface and foul water drainage. General water quality impacts associated with runoff from parking areas and other hard standing areas that will be directed towards storm water network via gullies and channels. This surface water drainage network will direct attenuated water to the existing lagoon for attenuation and some level of treatment prior to discharge via the existing outfall to the tidal reaches of the Ballynaclogh River.

It is therefore imperative to ensure that mitigation proposed during the operational phase of the development in relation to drainage and flood relief are adhered to. There will be limited direct impact to Limerick Dock water body itself that would result in significant changes to the hydromorphological regime of the river and provided the attenuation lagoon has adequate capacity there will be a beneficial impact associated with the operational phase through the attenuation of contaminants and therefore water quality.

- **Storm water Run-off Contamination:**
  The operational phase of the SHD will involve the use of vehicles to the residential units and offices. During the operational phase, there is potential for fuel or oil spillages and contaminants from vehicle engines. Run-off from these parking areas and roadways may be impacted with residual hydrocarbon contaminants from fuel emission and tyres, sediment and trace contaminants like metals and organics and therefore represent a potential source of contamination that could have a pathway to surface waters through the storm water drainage system. The nature of these contaminants could have a toxic effect on the biology of the receiving waters affecting the ecological status and chemical status of the water body and thereby potentially impacting on the ability of the water body to achieve it environmental objectives and downstream conservation objectives for the Natura 2000 sites.

- **Foul Sewerage:**
  Inadequate or inappropriate urban wastewater infrastructure can result in significant pressures to surface water bodies particularly where misconnections (piping of sewerage directly to a storm water network or surface water body), can result in significant impacts to the biology and chemistry of the aquatic environment. It is also important to ensure the existing sewer network within an agglomeration has capacity to accept the additional hydraulic and pollutant loading from the development and that adequate treatment is provided at the wastewater treatment system so as not to

impact the receiving environment and downstream sensitive areas, particularly given that existing nutrient pressures are the key driver for the receiving water bodies failing to achieve their environmental objectives, i.e. the classification of 'less than good' ecological status.

10.4.2 Impact Matrix (Absence of Mitigation)

The potential impacts outlined in Sections 10.4.1 and 10.4.2 above are rated based on the impact level criteria in Section 10.2 to indicate their potential severity (profound, significant, moderate, slight and imperceptible) in the absence of any mitigation. The assessment reflects the activities and pollutants listed above and the different considerations for construction and operational phases of the project.

Table 10.9: Potential Impact Rating Matrix (in the absence of mitigation)

Significance of Environmental Impact	
CONSTRUCTION PHASE	
Suspended sediments / sedimentation	Severe / Significant
Concrete and cement pollution	Severe / Significant
Impacts associated with general construction works	Severe / Significant
OPERATIONAL PHASE	
Storm Water Run-off	Moderate / Slight
Foul Water	Significant

10.4.4 Description of Likely Significant Impacts

10.4.4.1 Construction Phase Impacts

10..4.1.1 Sediment Loading

The works associated with the SHD involves extensive earth works throughout with the construction of boundary treatments, swales, road ways and landscaped areas. Suspended sediment, including all soils, sands and rubble is the single main pollutant to the aquatic environment generated at construction sites and largely arises from the erosion of exposed soils and sediments by surface water runoff. Both temporary and permanent impacts on surface waters may occur during construction. Pollution from mobilised suspended solids (silt) is the prime concern. Suspended sediment due to run off from stripped construction areas (including swales), stockpiled earth and the dewatering of swale excavations can have a severe negative impact on water quality. This is particularly true in sloping areas with underlying clay following topsoil stripping. In areas of moderate to high rainfall, the potential problems are clearly exacerbated. If allowed to enter surface watercourses this run off can give rise to high suspended solids and detrimental impacts, in particular to fisheries and aquatic invertebrates which can impact the ecological status of a water body. Suspended solids may have an effect on:

- Sediment movement through rivers and its settlement onto the river bed causing formerly clean gravels to become clogged with fine sediment.
- The survival of fish eggs in gravel beds or spawning grounds as a result of deoxygenation caused by silt deposition;
- The survival of plants and algae by smothering;
- The survival of young fish and aquatic invertebrates such as mayfly larvae (Calopteryz sp.) through gill damage from sediment particles and;
- Amenity value through impaired visual appearance.

Once suspended sediment load enters a river it can result in long-term changes that cause chronic harm. Sediment can cause river hydromorphological changes, which in turn change the dynamics of the river in the future and can negatively impact on the supporting hydromorphological conditions of the water bodies ecological status resulting in an increased risk of deterioration in status.

Both bed and suspended materials, and subsequent changes in channel form associated with changes in sediment supply, may affect benthic invertebrates in many ways at various stages in their life cycle. The direct kill is only the first stage in the damage that silt causes to a benthic invertebrate population. Sediment that infiltrates the river bed decreases oxygen supply in interstitial areas, and destroys habitat for juvenile stages of the many benthic invertebrate life cycles. This can impact on the ecological status of a water body by changing the nature of the invertebrate community to more tolerant species that would not be indicative of the reference conditions expected for an Irish water body typology.

The sediment subsequently provides a medium for macrophyte growth. Macrophytes can smother the river substrate and habitat further, and can trap more sediment which exacerbates the problem in the long term. Silt infiltration of river bed gravels can also have a negative effect on fish species which can further impact on the biological elements of the WFD ecological status classification and could prevent the achievement of the environmental objectives for the water body.

Given the scale and nature of the works, the magnitude of the impact associated with sediment loading is considered to be large adverse. The significance of the environmental effect is therefore severe / significant in the absence of mitigation based on the high sensitivity of the receiving environment.

10.4.4.1.2 Concrete and Cement Pollution

The construction works associated with the development will include concrete footpaths and construction of reinforced concrete (RC) raft foundations. During the construction phase, there is the potential for accidental spillage of cement materials or during the setting of concrete which could have a significant adverse impact on water quality and a toxic effect on the biological elements resulting in a possible further deterioration in the ecological status or compromise the improvement in ecological status through the implementation of the programme of measures included in the River Basin Management Plan.

Given the scale and nature of the works, the magnitude of the impact associated with concrete and cement pollution is considered to be *large adverse.* The significance of the environmental effect is therefore *severe / significan*t in the absence of mitigation based on the high sensitivity of the receiving environment.

10.4.4.1.3 General Construction Works

The construction works will involve the use of plant and machinery, as well as the associated temporary storage of construction materials, oils, fuels and chemicals. During the construction phase, there is the potential for accidental spillage or release of construction materials (e.g. diesel, oil, chemicals) which could have a significant adverse impact on water quality and a toxic effect on the biological elements resulting in a possible further deterioration in the ecological status or compromise the improvement in ecological status through the implementation of the programme of measures included in the River Basin Management Plan.

Given the scale and nature of the works, the magnitude of the impact associated with general construction is considered to be large adverse. The significance of the environmental effect is therefore severe / significant in the absence of mitigation based on the high sensitivity of the receiving environment.

10.4.4.2 Operational Phase Impacts

Although the proposed SHD has been designed to incorporate flood mitigation and flood water retention/detention into its design, potential water quality impacts associated with the operational phase of the proposed development can be exacerbated due to poor design and implementation of these measures. It is therefore imperative to ensure that mitigation proposed during the operational phase of the developments in relation to drainage and flood relief are adhered to. There should be limited direct impact to Limerick Dock water body itself that would result in significant changes to the hydromorphological regime of the river particularly as the storm water will discharge through as existing outfall at greenfield rates. Furthermore, the attenuation tanks and lagoon will have a beneficial impact associated with the operational phase through the further attenuation of contaminants.

10.4.4.2.1 Storm water Run-off Contamination

The operational phase of the SHD will involve the use of vehicles to the residential units and crèche. During the operational phase, there is potential for fuel or oil spillages and contaminants from vehicle engines. Run-off from these parking areas and roadways may be impacted with residual hydrocarbon contaminants from fuel emission and tyres, sediment and trace contaminants like metals and organics and therefore represent a potential source of contamination that could have a pathway to surface waters through the storm water drainage system. The nature of these contaminants could have a toxic effect on the biology of the receiving waters affecting the ecological status and chemical status of the water body and thereby potentially impacting on the ability of the water body to achieve it environmental objectives and downstream conservation objectives for the Natura 2000 sites.

Given the scale and nature of the work across the SHD development, the magnitude of the impact associated with surface run-off contamination is considered to be *large adverse.* The significance of the environmental effect is therefore *significant* in the absence of mitigation based on the high sensitivity of the receiving environment.

10.4.4.2.2 Foul Sewerage

Inadequate or inappropriate urban wastewater infrastructure can result in significant pressures to surface water bodies particularly where misconnections (piping of sewerage directly to a storm water network or surface water body), can result in significant impacts to the biology and chemistry of the aquatic environment. It is also important to ensure the existing sewer network within an agglomeration has capacity to accept the additional hydraulic and pollutant loading from the SHD development and that adequate treatment is provided at the wastewater treatment system so as not to impact the receiving environment and downstream sensitive areas, particularly given the existing nutrient pressures in the receiving water bodes is the key driver for the less than good ecological status.

Given the scale and nature of the work, the magnitude of the impact associated with inadequate or inappropriate foul water collection and treatment is considered to be *major adverse.* The significance of the environmental effect is therefore *significant* in the absence of mitigation based on the high sensitivity of the receiving environment.

10.5 Mitigation Measures

In the absence of mitigation, the construction of some elements of the project has the potential to have Significant Adverse impacts on the aquatic environment.

Similarly, with no mitigation the project has the potential to have Moderate adverse impacts on the aquatic environment during the operation stage should a significant flood event occur. With these considerations in mind, detailed mitigation has been incorporated into the engineering design of the project to minimise its potential impact on the water environment. The risk to water quality posed by this project during construction and operation will be dependent on the quality of drainage and treatment of site run-off before discharge to the river. Therefore, it is pertinent to ensure that procedures are put in place for the control and minimisation of surface water and suspended solids movement, it is also important that measures are taken to ensure existing drainage pathways are kept free from construction sediment and pollutants through the use of effective barriers to pollutant export and best practice techniques to control these pressures at source. Section 10.5.2 and Section 10.5.3 details the mitigation measure that will be employed on site during the project construction and operational flood prevention phases.

10.5.1 Mitigation Incorporated into the Drainage Design

10.5.1.1 Wastewater

Wastewater generated on-site particularly during the operational phase of the development will be piped and discharged to the existing Irish Water foul sewer (H_1 in Table 21.1 contained in Chapter 21). Irish water has provided agreement in principal for the connection of the development associated with the SHD to their assets and have confirmed that the Limerick WWTP has adequate capacity for the development. Provided the sewer network is installed using industry standard best practice, and routinely checked there is likely to be no impact from wastewater from the development and therefore no further mitigation required. Drainage pipelines will be inspected by CCTV at completion of the construction project and any damage will be repaired (H_2 in Table 21.1).

10.5.1.2 Surface Water

The development has incorporated a variety of Sustainable Drainage Systems (SuDS) techniques to counteract the potential increased runoff as a result of increased hardstanding (H_3 in Table 21.1). SuDS include green roofed apartments and creche, permeable paving of driveways and visitor car parks, tree lined areas, infiltration trenches, rain gardens, swales as well as, grassed and open space landscape portions of the site. It is proposed that surface water will discharge via attenuation tanks, a class 1 bypass separator and flow control device prior to discharging to the receiving environment.

There are five proposed Ecocell Pluvial Cube (or approved equivalent) attenuation tanks located in open spaces throughout the proposed development. These tanks have been designed to reduce the peak runoff from the site to ensure the storm water from the site does not increase flood risk and additionally, further enhance silt removal from surface waters via their integrated silt traps (H_4 in Table 21.1).

To determine the performance of the proposed SuDS to be applied, the design criteria for the Simple Index approach for the Total SuDS mitigation index (for each contaminant type) ≥ pollution hazard index (for each contaminant type), as per the CIRIA SuDS manual, was used. In all cases, the mitigation index is greater than the pollution index for each contaminant type, and as such the proposed SuDS are deemed appropriate.

The development has an existing lagoon, which is capable of servicing an area of 39 hectares which includes the circa 10.5 ha of the total SHD application site. Based on a total contributing catchment area of 39.19ha, the lagoon would require a design capacity of 21,000m^3 for a 100 year Return Period with a 10% allowance for climate change. The built capacity of the existing lagoon is approximately 23,000m^3 based on the topographical survey. Therefore, the existing lagoon has sufficient capacity to attenuate flows from the SHD and adjoining lands. After attenuation in the lagoon, water discharges via the existing outfall structure which has a 1050mm diameter Tideflex valve with thimble plate. This allows the water to discharge to the river at low tide while preventing backflow into the lagoon at high tide. This system will cater for the strategic housing development scheme (H_5 in Table 21.1).

Adequately specified oil interceptors will be incorporated into the proposed drainage network for the parking areas and access roads (H_6 in Table 21.1).

10.5.2 Construction Phase Mitigation Measures

10.5.2.1 Construction Phase Best Practice Measures

Mitigation measures will be implemented by the contractors who will construct the developments in accordance with the requirements listed within the Construction Environmental Management Plan which will be submitted as part of the planning applications for the development (H_7 in Table 21.1). Furthermore, once appointed, the contractors will submit a detailed Construction Management Plan based on the requirements of these submitted planning documents for approval by the Planning Authority (H_8 in Table 21.1). The mitigation measures implemented by the contractor will refer to the construction management procedures for best practice regarding the following recognised international guidelines (H_9 in Table 21.1):

- Good practice guidelines on the control of water pollution from construction sites developed by the Construction Industry Research and Information Association (CIRIA, 2001);
- Control of Water Pollution from construction sites, Guidance for consultants and contractors (C532);
- Environmental Good Practice on Site (3rd edition) (C692); and
- Guidelines on Protection of Fisheries During Construction Works and Adjacent to Waters (2016).

10.5.2.2 Suspended Sediment and Sedimentation

Preventing run-off is an effective method of preventing sediment pollution in the water environment. Therefore, adoption of appropriate erosion and sediment controls to manage run-off during construction is essential to prevent sediment pollution.

Mitigation measures to address the potential impact from suspended solids will be carried out in accordance with a site specific CEMP (H_10 in Table 21.1). The measures will be employed prior to the commencement and during construction and will include such measures as:

- Drainage and measures to control run-off will be employed to manage sediments prior to any works to be undertaken at the site, i.e., arrangements for the treatment of dirty groundwater ingress from any excavations will be in place in advance of the dewatering to ensure it can be adequately managed on site;
- If possible, earthworks operations should be limited to the summer months.
- The site shall be surveyed to identify all existing drainage features and waterbodies.
- Silt fencing will be installed around the perimeter of the site. The location of the silt fencing will be determined in the construction stage CEMP and will be subject to a detailed assessment of the area or phase to be developed. The purpose of the silt fencing is to prevent silt laden water leaving the site and entering neighbouring land with the potential to impact nearby watercourses. It will consist of a geotextile membrane fixed to wooden stakes approximately 600mm high. The membrane will be anchored into the ground to form a continuous barrier to silt laden water from the works site. Silt fences will be monitored and periodically maintained during the construction period. Typical maintenance will consist of repairs to damaged sections membrane and removal of a build up of silt on the upslope side of the fence;
- Drainage ditches may be cut to intercept surface water where there is a risk of significant water flow into excavations or on to adjoining lands. There will also be a requirement to periodically pump water from excavations. All collected and pumped water will have to be treated prior to discharge. The run-off will be directed through appropriately sized settlement ponds to remove suspended solids. All treated water will then be directed to an existing lagoon to the west of the site. The lagoon was constructed in anticipation of the site being developed and was sized to receive and attenuate the operational surface water drainage. The operational flow rates will be much greater, due to the increase in impermeable area. The lagoon will therefore be capable of dealing with runoff from the unpaved site during construction;

- Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the site compound. These agencies will be notified immediately in the event of a pollution incident;
- Site personnel will be trained in the importance of preventing pollution and the mitigation measures described here to ensure same;
- The site manager will be responsible for the implementation of these measures. They will be inspected on at least a daily basis for the duration of the works, and a record of these inspections will be maintained;
- Any temporary storage of soil, hardcore, crushed concrete or similar material will be stored as far as possible from any surface water drains. There can be no direct pumping of silty water from the works directly to any watercourse. All water from excavations must be treated by infiltration over lands or via settlement areas, silt busters etc;
- There is a possibility that more severe flooding could occur during the construction period, emergency measures are therefore be required. The following control measures will be required:
- Silt fencing shall be placed above the 10-year flood level, and where that is not possible at the highest level possible within the site. Trapped silt shall be removed from silt fencing at regular intervals.
- Settlement ponds shall be placed above the 10-year flood level.
- Stockpiles of soil shall be kept out of the 10-year flood plain. This will not be possible at the northern extent of the site, additional measures will be incorporated at this location.
- Earthworks shall be exposed for the minimum time possible. Earthworks formations shall be protected by a layer of imported granular left fill.
- Landscaping and seeding of the perimeter embankments and retaining structures shall be carried out as early as possible.
- An Emergency Response plan shall be developed for the site to mitigate against stockpiles or exposed earth that are at risk from flood waters.

Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures (H_11 in Table 21.1):

- Vehicles delivering material with potential for dust emissions to an off-site location shall be enclosed or covered at all times to restrict the escape of dust;
- Any hard surface site roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only;
- A power washing facility or wheel cleaning facility will be installed near to the site compound for use by vehicles exiting the site when appropriate;
- Road sweepers will be employed to clean the site access route as required.

The incorporation of these mitigation measures during the construction phase means the potential impact to receiving water environment will be reduced to negligible thus reducing the significance of the environmental effect to imperceptible, based on the high sensitivity of the receiving environment.

10.5.2.3 Concrete and Cement Pollution

The impacts in relation to cement and concrete for the development are, for the most part (but not limited to) the installation of the concrete areas (to be poured in-situ) and construction works of buildings. The principal risks are:
The use of concrete in close proximity to water bodies requires a great deal of care. Fresh concrete and cement are very alkaline and corrosive and can cause serious pollution in water bodies. It is essential to ensure that the use of wet concrete and cement in or close to any water course is carefully controlled so as to minimise the risk of any material entering the water, particularly from shuttered structures or the washing of equipment. (H_12 in Table 21.1). The following measures will be undertaken to mitigate against possible pollution:

- A concrete washdown area will be provided on site for trucks to use after delivery of concrete or on return to the batching plant. This area will be adequately bunded to mitigate the risk of contaminated runoff discharge to the Limerick Dock water body. Concrete trucks are to be washed down within the concrete truck washdown area after delivery of concrete, prior to exiting the site. Washdown runoff will be appropriately treated prior to discharge;
- Wash-out areas on site will be properly designed with an impermeable line to contain all cement laden water. No wash-out of ready-mix concrete vehicles shall be located within 10 metres of any temporary or permanent drainage features. Signage shall be erected to clearly identify the wash-out areas. Sufficient wash-out areas shall be provided to cater for all vehicles at peak delivery times;
- On-site batching of concrete is not envisaged, but ready to use mortar silos are often used for housing developments. These systems involve the delivery and storage of dry cement and aggregates in silos, water is added at the point of delivery to make mortar or plaster. The following controls shall be put in place for the on-site batching of concrete, mortar and render:
- The plant shall be maintained in good condition.
- Delivery of cement shall be means of a sealed system to prevent escape of cement.
- The plant shall be situated on a paved area at least 20m from any temporary or permanent drainage features.
- Emergency procedures shall be in place to deal with accidental spillages of cement or mortar.

In circumstances where the mitigation measures are employed during construction operations, the potential impact to receiving water environment will be reduced to *negligible* thus reducing the significance of environmental effect to *imperceptible.*

10.5.2.4 General Construction Works

The risk of water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages/spillages of fuels, oils, other chemicals and waste water) will be controlled through good site management and the adherence to codes and practices which limit the risk to within acceptable levels. The following measures will be implemented during construction (H_13 in Table 21.1):

- A detailed works specific Construction Environmental Management Plan will be prepared during the planning submission and will be developed and implemented by the contractor and will include detail in respect of every aspect of the works in order to minimise potential impacts and maximise potential benefits associated with the works;

- Management and auditing procedures, including tool box talks to personnel, will be put in place to ensure that any works which have the potential to impact on the aquatic environment are being carried out in accordance with the contactors environmental controls, which will be consistent with an approved CEMP and any planning conditions;
- Existing and proposed surface water drainage and discharge points will be mapped on the Drainage layout. These will be noted on construction site plans and protected accordingly to ensure water bodies are not impacted from sediment and other pollutants using measures to intercept the pathway for such pollutants;
- Welfare facilities (canteens, toilets etc.) will be available within the construction compound and this will remain in place for the construction of the proposed development. The offices and site amenities will initially need to have their own foul water collection until connections are made to the mains networks.

The use of oils and chemicals on-site requires significant care and attention. The following procedures will be followed to reduce the potential risk from oils and chemicals (H_14 in Table 21.1):

- New metal 240erry cans with proper pouring nozzles will be used to move fuel around the site for the purposes of refuelling items of small plant on site. Metal 240erry cans and any other items of fuel containers will be stored in certified metal bunded cabinets.
- Drip trays will be used under items of small plant at all times. Any waste oils etc. contained in the drip trays or the bunded area will be emptied into a waste oil drum, which will be stored within the bund.
- Any gas bottles will be stored in a caged area at a secure location on the site. All will be properly secured at point of work.
- No bulk chemicals will be stored within the active construction areas. Temporary oil and fuel storage tanks may be kept in the material storage area in suitable containers and will be stored on appropriately bunded spill pallets as required. Any fuel and oil stored onsite shall be stored on bunded spill pallets approved under BS EN 1992-3:2006). All bunds will be impermeable and capable of retaining a volume of equal to or greater than 1.1 times (>10%) capacity of the containers stored on them. In the event of a filling spillage excess oil or fuel will be collected in the bund;
- Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will be undertaken offsite where possible. Where this is not possible, filling and maintenance will take place in a designated material storage compound, which is located at least 10 metres from any temporary or permanent drainage features. Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release. Training will be given to appropriate site workers in how to manage a spill event. A certified double skinned metal fuel tank will be situated in this secure bunded area on the construction site if applicable. This tank will be certified for lifting when full.
- Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release during refuelling. Training will be given to appropriate site workers in how to manage a spill event. A hazardous bin will also be available to contain any spent sand or soak pads.
- Contingency Planning: A project specific Pollution Incident Response Plan will be prepared by the contractor and will refer to PPG 21 Pollution Incident Response

Planning. The contractor's Environmental Manager will be notified in a timely manner of all incidents where there has been a breach in agreed environmental management procedures. Suitable training will be provided by the contractor to relevant personnel detailed within the Pollution Incident Response Plan to ensure that appropriate and timely actions is taken.

The following mitigation measures will be taken at the construction site in order to prevent any spillages to ground of fuels during machinery activities and prevent any resulting soil and/or groundwater quality impacts (H_15 in Table 21.1):

- Refuelling will be undertaken off site where possible;
- Where mobile fuel bowsers are used the following measures will be taken:
    - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use;
    - The pump or valve will be fitted with a lock and will be secured when not in use;
    - All bowsers to carry a spill kit and operatives must have spill response training; and
    - Portable generators or similar fuel containing equipment will be placed on suitable drip trays.

Provided these mitigation measures are employed during construction operations, the potential impact to receiving water environment will be reduced to *negligible* thus reducing the significance of environmental effect will be reduced to *imperceptible*.

10.5.3 Operational Phase

10.5.3.1 Wastewater

Wastewater generated on-site particularly during the operational phase of the development will be piped and discharged to the existing Irish Water foul sewer. Agreement to discharge to the existing foul network and downstream WWTP will be secured with Irish Water and will ensure the wastewater discharge authorisation for the existing agglomeration will not be adversely affected (H_16 in Table 21.1).

10.5.3.2 Surface Water

The development has incorporated a variety of Sustainable Drainage Systems (SuDS) techniques to counteract the potential increased runoff as a result of increased hardstanding (H_3 in Table 1). SuDS, supplemented by bypass separators on the piped storm water network, will include green roofed apartments and crèche, permeable paving of driveways and car parks, tree lined areas, infiltration trenches, attenuation tanks, swales as well as, grassed and open space landscape portions of the site. The development site has an existing lagoon, which is capable of servicing an area of 39 hectares, while the total application site of the SHD is circa 10.5ha. After attenuation in the lagoon it discharges the storm water runoff from the proposed development via the existing storm water outlet. This system will cater for the strategic housing development scheme (H_5 in Table 21.1).

Provided the best-practice techniques illustrated in CIRIA's guidance document (C768 – Guidance on the Construction of SuDS) are followed, no further mitigation is required.

10.5.3.2.1 Storm Water Run-off

During the operational phase in the event of flooding, there is potential for storm water run-off to be impacted by pollutants arising within the car parking areas and roadways. This runoff has the potential to provide pathways for a wide range of contaminants arising from general operations to the aquatic environment. The main potential pollutants from surface water drainage or direct run-off are sediment, hydrocarbons, and trace contaminants including metals and organics.

The existing lagoon and pervious pavements have proposed dual purpose and whilst they are flow attenuation features they also mitigate against potential water quality issues associated with storm water run-off.

The entirety of the surface water drainage is to discharge to the proposed attenuation. Gravity pipe networks will collect runoff from hardstanding areas and roof areas (although grass roofs will be used where feasible in certain buildings e.g. apartment blocks), while parking areas will be constructed with pervious asphalt. All surface water drainage from hard standing areas will ultimately drain to the lagoon via suitable sized class 1 bypass interceptors (H_17 in Table 1).

Where the mitigation measures listed above are employed, the potential impact to receiving water environment will be reduced to *negligible* thus reducing the significance of environmental effect will be reduced to *Imperceptible.*

10.5.3.2.2 Foul Sewerage

The foul sewerage from the development will be collected in the existing Irish Water foul water sewer. Foul Water will therefore be collected into the existing system and will be taken forward for appropriate treatment prior to discharge to the receiving environment (H_18 in Table 21.1).

Both the surface water and foul system are to be entirely separate developments (H_19 in Table 21.1).

Where the mitigation measures listed above are employed, the potential impact to receiving water environment will be reduced to *negligible* thus reducing the significance of environmental effect will be reduced to *Imperceptible.*

10.6 Residual Effects

Where the appropriate mitigation measures are fully implemented during the construction and operational phases of the SHD as outlined in the previous section, the impact of the project on the water quality in the area will be *imperceptible* as indicated in **Table 10-11.**

Accordingly, the development will not have a significant effect on the water quality of the receiving waters.

It can therefore be concluded that the proposed works are compliant with the requirements and environmental objectives of the EU Water Framework Directive and the other relevant water quality objectives for these water bodies.

Table 10.10: Residual Impacts (with mitigation)

Significance of Environmental Impact	
CONSTRUCTION PHASE	
Suspended sediments / sedimentation	Imperceptible
Concrete and cement pollution	Imperceptible
Impacts associated with general construction works	Imperceptible
OPERATIONAL PHASE	
Storm Water Run-off	Imperceptible
Foul Water	Imperceptible

10.7 Monitoring

10.7.1 Construction Phase

The CEMP includes emergency response procedures to mitigate against contamination to water systems, in particular in relation to oil spillage, uncontrolled silt discharge and sewage spill (H_20 in Table 21.1). The CEMP will also have procedures for monitoring the performance and effectiveness of mitigation measures employed during construction to ensure they are operating as intended and are providing the necessary protection to the receiving environment.

Weekly checks will be carried out to ensure surface water drains are not blocked by silt, or other items, and that all storage is located at least 10m from surface water receptors. A regular log of inspections will be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not reoccur.

10.7.2 Operational Phase

A number of elements of the development require frequent inspection and cleaning as a maintenance requirement. Visual inspections are required at different times for each element, whether bi-monthly, over 3, 4 or 6 monthly periods or following a storm event. Cleaning for the drainage elements are undertaken annually or every two years, while grass cutting for SuDS elements are required monthly during growing seasons or as needed for the tree pit systems (H_21 in Table 21.1).

Further information is available in Appendix F Maintenance Plan of the Punch Consulting Engineers Greenpark Housing Development Engineering Planning Report regarding routine maintenance of storm water infrastructure and SuDS within the development.

10.8 Reinstatement

Landscaped areas and SuDS will be completed at the same time as each phase. Landscaped areas will be finished with reclaimed topsoil, while seeding and planting will be implemented in accordance with the landscape plan for the site. The SuDS measures are to implemented with reference to the UK Suds Manual and Limerick City and County Council water services department requirements. These areas will decrease the impact of the SHD on the receiving aquatic environments.

10.9 Interactions

The water environment and impact on water quality has the potential to impact on water dependent habitats and species in the water bodies affected and therefore there is a strong interaction with biodiversity. The protection of the water environment will help to ensure that biodiversity is not significantly impacted by the implementation of the SHD.

Geology and soils also has a strong interaction with the water quality with the interaction of surface and sub surface water important to the generation of run-off and the mitigation of same. Section 9 Land, Soils, Geology and Hydrogeology notes the significant impacts of contamination of the geological and water environment via leak and/or spills of fuels and lubriants. Given the nature of the soils and location of the development surface and near surface pathways will be dominant and this will be considered during the detailed mitigation strategy for the development of the SHD.

10.19 Cumulative Effects

The SHD which encompasses a total site area of 10.5 ha, involves the construction of 371 residential units comprising 157 houses, 76 duplex units, 138 apartments and a childcare facility (550m^2). Additionally, the development will include all relevant infrastructure including parking areas, access, drainage, internal roads, pedestrian and cycle routes, services provisions, landscaping and boundary treatment and all associated site development and excavation works. A planned nursing home development LCCC Reg. Ref. 21/1222 and a permitted application for 30 residential dwellings (Reg. Ref. 17/1190 ABP-302015-18) are also proposed on lands at the former Greenpark Racecourse and therefore have been considered in respect to cumulative effects on water quality impacts. The mitigation provided in this chapter as well as mitigation incorporated into the design of the SHD will ensure that any negative impact to water quality is not significant. Therefore, this development will not contribute, directly or cumulatively to a significant deterioration in water quality.

10.11 ‘Do-Nothing’ Effect

In terms of the 'do-nothing' effect it is assumed that the site would remain undeveloped and that there would be no change in the current drainage, hydrological pathways or water quality of the Ballynaclogh River and ultimately to Limerick Dock transitional water body downstream.

As demonstrated by this assessment and assuming all mitigation and monitoring recommended is implemented the water quality and conditions of downstream water bodies will also remain unaffected.

10.12 Difficulties Encountered in Compiling the Chapter

No significant difficulties were encountered in compiling this chapter.

11.0 AIR QUALITY AND CLIMATE

11.1 Introduction

This section of the EIAR has been prepared by RSK Environment Limited to identify and assess the potential air quality and climate impacts associated with the proposed strategic housing development (SHD) at Greenpark Racecourse, Limerick City.

This chapter has been prepared by Christina Higgins, a senior air quality consultant at RSK Environment Limited. She is a Chartered Environmentalist (CEnv), a full member of the Institute of Environmental Science (MIEnvSc), a full member of the Institute for Air Quality Management (MIAQM) and an associate member of the Royal Society of Chemistry (AMRSC) and holds a PhD in Chemistry from the University of Bristol. Christina has seven years' experience as a project manager for air quality consultancy, modelling and monitoring, including EIAR and development planning applications. The contents of this chapter have been reviewed by Dr Srinivas Srimath, a full member of the Institute of Air Quality Management and a Chartered Environmentalist with over 29 years' experience of engineering and environmental projects relating to infrastructure development, pollution prevention and control, and air quality assessments.

The significance of impacts has been assessed in accordance with the Environmental Protection Agency (EPA) Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017.

With regard to the quality of the impact, ratings may have positive, neutral or negative applications. The significance of an impact on the receiving environment is described in the range between imperceptible and profound. The duration of impacts as described in the EPA Guidelines are presented on a scale between momentary and permanent.

11.2 Methodology

This air quality assessment has been prepared in the context of extensive European, national and local policy on the subject of air quality. A full review of this policy is given in Appendix 11.1.

The assessment addresses impacts during both the construction and operational phases of the proposed development. The approach taken for assessing the potential air quality impacts of the proposed development may be summarised as follows:

- characterisation of baseline local air quality;
- qualitative impact assessment of construction phase of the development;
- impact assessment of air quality impacts of the proposed development whilst it is operational; and
- recommendation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised.

As per guidance and best practice examples, climate change comprises two distinct areas:

- Climate Change Mitigation – an assessment of likely significant effects upon climate change resulting from the project and their mitigation, including an estimate of greenhouse gas (GHG) emissions; and
- Climate Change Adaptation – an assessment of likely significant effects of climate change upon the project, including its vulnerability and the need for any adaptation measures to ensure project resilience to projected climate change scenarios.

The terms “carbon”, “carbon dioxide (CO_2)” and “GHG” are used interchangeably in this chapter depending on the terminology of referenced documents, etc.

The life cycle of the project considers construction, operation and demolition. These are assessed throughout the chapter.

11.2.1 Construction Phase

Dust and particulate matter (PM) generated during the construction phase may have the potential for an adverse impact on local air quality, and therefore this was assessed in accordance with the Institute of Air Quality Management (IAQM) construction dust guidance (IAQM, 2016).

In order to assess the potential impacts, construction activities are divided into four types:

- demolition;
- earthworks;
- construction; and
- trackout (defined as the transport of dust and dirt from the construction / demolition sites onto public road network, where it may be deposited and then re-suspended by vehicles using the network).

The first step is to screen the requirement for an assessment. An assessment is required where there are human and/or ecological receptors within certain distances of the site.

There are human receptors within 350m of the boundary of the site and within 50m of the trackout route; therefore, construction dust may have the potential to cause an adverse impact in the local area. There are designated ecological receptors within 50 m of the trackout route; therefore, construction dust may have the potential to cause an adverse impact on ecological receptors.

A qualitative construction impact assessment has been conducted to assess the risk of dust impacts and determine appropriate mitigation to adequately control the risk. The level of mitigation recommended for each activity is then determined, being commensurate with the identified risk (high, medium or low risk). Mitigation is recommended for all these three risk categories as per the IAQM construction dust guidance. ‘Negligible’ is also a defined risk category, but mitigation is not required for the ‘negligible’ risk category. The IAQM construction dust guidance does not recommend assigning the significance of construction activities without mitigation. However, in EIAR terms (and for consistency in wording and terminology for the assessment of impact significance), high, medium, low and negligible (risk) will result in a significant, moderate and slight significance levels, as shown in Table 11.1.

Table 11.11: Classification of significant air quality effects (construction phase)

Risk (IAQM)	Significance (EPA)
High	Significant, Very Significant, Profound
Medium	Moderate
Low	Slight
Negligible	Not significant

The full construction dust assessment methodology is presented in Appendix 11.2.

11.2.2 Operational Phase

LA 105 of the Design Manual for Roads and Bridges (DMRB) was published by Highways England in November 2019 and sets out the requirements for assessing and reporting the effects of highway projects on air quality. The DMRB, on which the Transport Infrastructure Ireland (TII) 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 air quality assessment:

- Road alignment change of 5m or more;
- Daily traffic flow changes of 1,000 Annual Average Daily Traffic (AADT) or more;
- Heavy Duty Vehicle (HDV) flow changes of 200 AADT or more;
- Daily average speed changes of 10 km/h or more;
- Peak hour speed changes of 20 km/h or more.

The TII guidance also states that a detailed modelling assessment will be required 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 junction, hills, etc.).

For routes which pass within 2km of a designated area of conservation (Irish or European), TII requires consultation with an Ecologist. 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.

Table 11.2 provides information for judgement of significance of air quality effects of a project as per the DMRB for nitrogen dioxide (NO_2) and PM_{10}. For consistency in wording and terminology for the assessment of impact significance, the equivalent EIAR terms are also presented.

Table 11.12: Classification of significant air quality effects (operational phase)

Magnitude of change in annual mean NO_2 or PM_{10} (μg/m^3)	Magnitude (DMRB)	Significance (EPA)
>4 (>10%)	Large	Major adverse/beneficial
>2 (>5%)	Medium	Moderate adverse/beneficial
>0.4 (>1%)	Small	Minor adverse/beneficial
<0.4 (<1%)	Negligible	Negligible

Operational phase cumulative effects were assessed by the inclusion of assumed committed development traffic flows in both the 'Do Minimum' (DM) and 'Do Something' (DS) traffic data scenarios.

11.2.3 Climate

LA 114 Climate of the DMRB was published in 2019. The following scoping criteria are used to determine whether a detailed climate assessment is required. If any of the road links impacted by the proposed development meet or exceed the below criteria, then further assessment is required.

- A change of more than 10% in AADT.
- A change of more than 10% to the number of heavy-duty vehicles.
- A change in daily average speed of more than 20 km/hr.

Climate Change Mitigation

Climate mitigation assesses likely GHG emissions from the construction and operation of the proposed development, and the measures taken to mitigate these emissions. Determining the significance of climate change effects is complex given the local scale at which GHG emissions occur relative to the cumulative and global nature of climate change. This assessment estimates the development GHG emissions and compares these with the national (Irish) target. The magnitude and significance of GHG emissions are determined using the EPA and Institute of Environmental Management & Assessment (IEMA) guidance and professional judgement.

Magnitude and Significance of Effect

Table 11.3 provides information for judgement of significance of GHG effects of a project. For consistency in wording and terminology for the assessment of impact significance, the equivalent EIAR terms are also presented.

Table 11.13: Classification of significant GHG effects

GHG magnitude of change relative to budget	Magnitude	Significance (EPA)
>10%	Large	Major adverse/beneficial
3-10%	Medium	Moderate adverse/beneficial
1-3%	Small	Minor adverse/beneficial
<1%	Negligible	Negligible

Duration of Effect

Carbon dioxide equivalent (CO_2eq) is a measure used to compare the emissions from various GHGs based on the amount of CO_2 that would have the same global warming potential (GWP), when measured over a specified timescale (generally 100 years). Given this timescale and the findings of the IPCC Special Report: Global Warming of 1.5°C report that some impacts of climate change may be long-lasting or irreversible, the duration of effect is assumed to be long term and permanent.

Climate Change Adaptation

Climate change adaptation considers potential impacts to the construction and operation phases of the development from future changes to local climatic conditions that are projected to result from climate change. Measures to mitigate these effects are also discussed.

11.3 Baseline Environment

11.3.1 Air Quality

Existing or baseline air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources.

The principal air quality pollutants relevant to this assessment are considered to be NO_2, PM_{10} and $PM_{2.5}$, generally regarded as the three most significant air pollutants released by vehicular combustion processes, or subsequently generated by vehicle emissions in the atmosphere through chemical reactions. These pollutants are generally considered to have the greatest potential to result in human health impacts, and are the substances of most concern in terms of existing levels in the area, as discussed below.

A desk-based study has been undertaken using data obtained from the EPA website. The Mungret monitoring site is approximately 1.8km to the south-west of the development site. The site monitors PM_{10} and $PM_{2.5}$ but was only was operational from July 2020. The People's Park background monitoring site is approximately 2km to the north-east of the site. The NO_2, PM_{10} and $PM_{2.5}$ monitoring data recorded at People's Park for 2020 are presented in Table 11.4.

Table 11.14: Annual Mean Measured Pollutant Concentrations at the People's Park Monitoring Site (Source: http://airquality.ie)

People's Park	2020 (µg/m³)
NO_2	10.1
PM_{10}	12.8
$PM_{2.5}$	8.6

Monitoring data from NO_2 diffusion tubes located in Limerick are available for 2018 and 2019 (from https://www.epa.ie/air/quality/diffusiontuberesults/). The closest diffusion tube to the site is on Dock Road. The NO_2 concentration monitored in 2019 was 24.2 µg/m³.

No exceedances of the relevant air quality standards (AQSs) was recorded at the sites in proximity to the site. Furthermore, no exceedance of the NO_2 annual mean AQS was recorded at any of the diffusion tubes sites in Limerick in 2019.Therefore, exceedances of the relevant AQSs at the site is not expected.

It is noted that the Irish Cement Limited works is approximately 2km to the west of the development. In 2017 an application was submitted for a "10 year permission for development to allow for the replacement of fossil fuels through the introduction of lower carbon alternative fuels and to allow for the use of alternative raw materials in their Limerick Cement Factory". The air quality assessment submitted as part of the EIA (planning application 16345) concluded that *"the predicted ground level concentrations of relevant pollutants in addition to background concentrations are in compliance with air quality standards"*. A review of the air quality assessment was carried out by AWN Consulting (Review of The Air Quality, Climate And Health Impacts Of The Irish Cement IE Licence Review Ref P0029-05 and Planning Application Ref 16/345, dated 19 December 2016). This review concluded that *"AWN Consulting's assessment of the air quality modelling assessment is that in general it is valid and can be considered a valid estimate of predicted conditions for both the existing and proposed scenario at the worst case ground level".* Therefore, further consideration of the impact of the existing cement works is not considered necessary.

The National Parks and Wildlife Services website (https://www.npws.ie/) indicates that the River Shannon and River Fergus Estuaries Special Protection Area (SPA), Lower River Shannon Special Area of Conservation (SAC) and the Inner Shannon Estuary Proposed Natural Heritage Area are within 50 m of potential routes along which trackout could arise.

11.3.2 Climate

Anthropogenic emissions of greenhouse gases in Ireland included in the European Union's Effort Sharing Decision "EU 2020 Strategy" (Decision 406/2009/EC) are outlined in the most recent review by the EPA which details emissions from 1990 up to 2019 (it should be noted that at the time of writing the 1990-2019 review was still provisional and not yet final). Agriculture was the largest contributor of CO_2 emissions in 2019 at 35.3%. The second largest contributor was the transport sector accounting for 20.3%. Ireland had total GHG emissions of 59.90 Mt CO_2eq in 2019.

2019 is the seventh year where compliance with the EU 2020 Strategy is assessed. The Decision (Decision 406/2009/EC) sets 2020 targets for sectors outside of the Emissions Trading Scheme (known as ESD emissions) and annual limits. Ireland had total GHG ESD emissions of 45.71 Mt CO_2eq in 2019. This is 6.98 Mt CO_2eq higher than Ireland's annual target for emissions in 2019.

In terms of 2030 reduction targets the EU Effort Sharing Regulation (Regulation (EU) 2018/842) requires that Ireland reduce its non-Emissions Trading Scheme emissions by 30% on 2005 levels by 2030.

Ireland's GHG Emissions Projections 2019-2040 Report, published by the EPA in 2020, provides an assessment of Ireland's total projected GHG emissions which includes an assessment of progress towards achieving its emission reduction targets out to 2020 and 2030 set under the

EU Effort Sharing Decision (Decision No 406/2009/EU) and Effort Sharing Regulation (Regulation (EU) 2018/842).

The EPA produced two scenarios in preparing these GHG emissions projections: a "With Existing Measures" scenario and a "With Additional Measures" scenario. The emissions projections and specifically the With Additional Measures scenario include the impact of new climate mitigation policies and measures that are in Ireland's Climate Action Plan which was published in 2019.

Compared to the With Existing Measures scenario, the With Additional Measures scenario (which includes the impact of the 2019 Climate Action Plan) will deliver an emission savings of approximately 78.8 Mt CO_2eq over the period 2021-2030. An average reduction in emissions of 2.9% per year is projected over this period.

Baseline Climate Conditions

The closest meteorological station to the development site is Shannon Airport. Table 11.5 presents the average observed climate data for this site 1981 – 2010 available on the Met Eireann website (https://www.met.ie/climate/30-year-averages).

Table 11.15: Baseline Climatic Conditions

Month	Max. temp. (°C)	Min. temp. (°C)	Days of air frost (days)	Daily Sunshine (hours)	Rainfall (mm)	Days of rainfall ≥1 mm (days)	Monthly mean wind speed (knots)
January	8.8	3.2	5.3	1.6	102.3	16	10.3
February	9.2	3.2	5.1	2.3	76.2	12	10.2
March	11.1	4.5	2.1	3.2	78.7	14	10
April	13.3	5.7	0.7	5.1	59.2	11	9
May	16	8.2	0	5.8	64.8	12	8.9
June	18.3	10.9	0	5.2	69.8	11	8.5
July	19.8	12.9	0	4.5	65.9	12	8.5
August	19.6	12.7	0	4.5	82	13	8.2
September	17.7	10.8	0	3.9	75.6	12	8.4
October	14.3	8.2	0.5	2.9	104.9	16	9.2
November	11.1	5.5	2.3	2	94.1	15	9.1
December	9	3.6	4.8	1.4	104	15	9.4
Annual	14	7.4	20.8	3.5	977.6	159	9.1

Future Climate Baseline

Potential future baseline conditions are presented in EPA report number 339, published in 2020, High-resolution Climate Projections for Ireland – A Multi-model Ensemble Approach. The report states that mid-century mean annual temperatures are projected to increase by 1.3-1.6°C (under the pessimistic scenario) and heatwave events are expected to increase by the middle of the century. The coldest 5% of daily minimum temperatures are projected to rise by 1–2.4°C. The frequencies of heavy precipitation events is projected to increase over the year as a whole and in the winter and autumn months, with “likely” projected increases of 5–19%. The number of extended dry periods (defined as at least 5 consecutive days for which the daily precipitation is less than 1 mm) is also projected to increase substantially by the middle of the century over the full year and for all seasons except spring. The projected increases in dry periods are largest for summer.

Sensitive Receptors

The UK Climate Change Risk Assessment provides guidance on potentially sensitive receptors. Table 11.6 sets out a summary of climate change risks and opportunities relevant to the proposed development.

Table 11.16: Climate Change Risk Assessment

Climate Change Effect	Risk	Opportunity	Receptor(s)
Increase in winter mean temperature	Risk to species and habitats from changing climate space	New species colonisation and increased climate space	Habitats and species
		Improved health and wellbeing during construction	Construction employees and equipment
		Reduced energy use and GHG emissions	Energy infrastructure and climatic system
Increased summer mean and daily maximum temperature	Changing climate space	New species colonisation and increased climate space	Habitats and species
	Increased energy demand from additional cooling in buildings	-	Energy infrastructure and climatic system
	Overheating impacting health and wellbeing	-	Building occupants
	Ground movement due to ground movement and differential settlement	-	Buildings and infrastructure
Decrease in summer rainfall	Water restrictions	-	Habitats and species
	Fresh water supplies	-	Building operations
	Ground movement and differential settlement	-	Building infrastructure
Increase in winter rainfall	Increased flood risk	-	Building infrastructure and building occupants
	Ground movement and differential settlement	-	Building infrastructure

11.4 Potential Effects of the Proposed Project

11.4.1 Construction Phase

11.4.1.1 Potential Dust Emission Magnitude

With reference to the IAQM construction dust guidance outlined in Appendix 11.2, the estimation of dust emissions magnitudes (before mitigation) for demolition, earthworks, construction and trackout activities are presented in Table 11.7.

Table 11.17: Summary of Dust Emissions Magnitudes (Before Mitigation)

Activity	IAQM Criteria	Dust Emission Magnitude
Demolition	Foundations only to be demolished Onsite crushing and screening proposed Height of demolition activities is <10m Potentially dusty material (concrete demolition) Timing of works in unknown	Small
Earthworks	Total site area where earthworks may occur is >10,000m^2 Soil type is tills and some made ground The number of heavy earth moving vehicles active at any one time is estimated to be >10 The height of bunds on site will be <4m The total material to be moved is estimated to be 20,000-100,00 tonnes Preference for earthworks to occur in summer (i.e. dry months)	Large
Construction	Total building volume will be >100,000m^3 On-site concrete batching and sandblasting are not proposed Construction materials are expected to be potentially dusty	Large
Trackout	Number of heavy vehicles per day out of the site is estimated to be 10-50 Estimated that vehicle may travel on unpaved roads <50m The surface type of the site has the potential to be dusty	Medium

11.4.1.2 Sensitivity of the Area

With reference to the IAQM construction dust guidance outlined in Appendix 11.2, the estimation of dust emissions magnitudes (before mitigation) for demolition, earthworks, construction and trackout activities are presented in Table 11.8.

As per the IAQM construction dust guidance, the sensitivity of the area takes into account a number of factors, including:

- The sensitivity of individual receptors in the area;

- The proximity and number of those receptors;
- For the human health assessment, the local background annual mean PM_{10} concentration; and
- Site specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

Consideration is given to human and ecological receptors from the impact of the construction site boundary and routes along which HDVs may facilitate trackout. RSK anticipate that construction traffic will travel along Dock Road.

Table 11.8 presents the determined sensitivity of the area with the factors itemised which have helped to define this.

Construction activities are relevant up to 350m from the proposed development site boundary whereas trackout activities are only considered relevant up to 50m from the edge of the road up to 200 m from the site exit (for medium sites), as per the IAQM construction dust guidance.

The National Parks and Wildlife Services website (https://www.npws.ie/protected-sites) was used to identify sensitive ecological receptors near the proposed development site. Designated ecological receptors were identified within 50 m of the trackout route – the River Shannon and River Fergus Estuaries SPA and Lower River SAC. The ecologists for the project were consulted and stated that the ecologically designated sites were unlikely to be dust sensitive. Therefore, the ecologically designated sites have been assigned low sensitivity.

Human receptors were identified within 350m of the proposed development site boundary by making reference to online publicly available satellite imagery.

Table 11.18: Sensitivity of the area

Potential Impact		**Demolition**	**Earthworks**	**Construction**	**Trackout**
Dust soiling	Receptor sensitivity	High	High	High	High
	Number of receptors	10-100	10-100	10-100	10-100
	Distance from the source	<20m	<20m	<20m	<20m
	Overall Sensitivity of the Area	**High**	**High**	**High**	**High**
Human health	Receptor sensitivity	High	High	High	High
	Number of receptors	10-100	10-100	10-100	10-100
	Distance from the source	<24µg/m³	<24µg/m³	<24µg/m³	<24µg/m³
	Overall Sensitivity of the Area	**Low**	**Low**	**Low**	**Low**
Ecological	Receptor sensitivity	Low	Low	Low	Low
	Distance from the source	No statutory designated sites have been identified within 50m of the application site boundary. Vegetation/local plant community within and surrounding the site (i.e. <20m).			SPA and SAC <20m
	Overall Sensitivity of the Area	**Low**	**Low**	**Low**	**Low**

11.4.1.3 Risk of Impacts

The dust emission magnitude summarised in Table 11.7 has been combined with the sensitivity of the area in Table 11.8 to determine the risk of impacts of construction activities before mitigation. These have been evaluated based on risk categories of each activity in Appendix 11.2.

The risk of dust impacts from construction activities is identified as ranging between negligible and high risk, as is shown in Table 11.9. Mitigation measures to reduce construction phase impacts are defined based on this assessment in Section 11.5.1.

Table 11.19: Summary of Dust Risk from Construction Activities

Potential Impact	Dust Risk Impact			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust soiling	Medium risk	High risk	High risk	Medium risk
Human health	Negligible risk	Low risk	Low risk	Low risk
Ecological	Negligible risk	Low risk	Low risk	Low risk

11.4.1.4 Exhaust Emissions from Plant and Vehicles

The estimated number of employee trips and construction vehicle movements generated by the proposed development is low compared to vehicular trips generated by the proposed development during the operational phase. The number of HDV movements associated with the application site has been estimated to be 10-50 HDV movements per day during the busiest phase of the construction period. Therefore, the short-term increase in HDVs and employee trips moving to and from site is considered not significant.
The operation of site equipment and machinery will result in emissions to atmosphere of exhaust gases, but with suitable controls and site management such emissions are considered short-term and not significant (as per Defra's Local Air Quality Management Technical Guidance).

11.4.2 Operational Phase

As per Section 11.3.1, exceedances of the relevant AQSs is not expected at the proposed development site.

The transport consultants for the scheme, PUNCH Consulting Engineers Limited, provided the traffic data which is likely to be generated by the proposed development on the local road network (see Appendix 11.3).

The proposed development is predicted to generate a maximum of 3,000 AADT along Dock Road. None of the other roads assessed in the Traffic and Transportation Statement exceed any of the TII/DMRB criteria.

Using the DMRB Screening Method tool (see input and output in Appendix 12.4), predicted pollution concentrations were predicted at one receptor location along Dock Road. Background concentrations at the site were assumed to be similar to the People's Park monitoring site. Table 11.10 and Table 11.11 present the results of the screening DM and DS scenarios.

Table 11.20: Predicted NO_2 and PM_{10} concentrations – SHD only

Receptor	NO_2				PM_{10}			
	DM (µg/m³)	DS (µg/m³)	Change (µg/m³)	Magnitude	DM (µg/m³)	DS (µg/m³)	Change (µg/m³)	Magnitude
Dock Road	24.33	25.06	0.73	Small	16.69	16.91	0.21	Negligible

Table 11.21: Predicted NO_2 and PM_{10} concentrations – Masterplan

Receptor	NO_2				PM_{10}			
	DM (µg/m³)	DS (µg/m³)	Change (µg/m³)	Magnitude	DM (µg/m³)	DS (µg/m³)	Change (µg/m³)	Magnitude
Dock Road	24.33	25.83	1.50	Small	16.69	17.13	0.44	Small

As per Table 11.2, these changes correspond to small and negligible changes in concentration and are considered minor adverse and not significant, respectively. As concentrations at the site as well below the relevant AQSs, a detailed air quality modelling assessment is not considered to be required.

Air Quality Impact on Ecological Sites

The DMRB states that only sites that are sensitive to nitrogen deposition should be included in the assessment and that it is not necessary to include sites for example that have been designated as a geological feature or water course. Therefore, assessment of the identified designated sites is not considered necessary.

11.4.3 Potential Climate Impacts

11.4.3.1 Construction Phase

GHG emissions will be generated during the construction of the development from various activities, such as during the combustion of fossil fuels by construction plant and vehicles, the generation of consumed mains electricity, the manufacturing of construction materials and the transport to / from site of workers, materials and wastes.

For both the construction and operational stage when considering mitigation and residual effects, IEMA recommends use of the GHG Mitigation Hierarchy which provides a structure for mitigating GHG emissions, as follows:

- Avoid – Investigate and deploy options to eliminate GHG emissions.
- Reduce – Ensure that construction and operational activities will deliver efficient use of energy and resources.
- Substitute – Commit to deploying renewables and low carbon materials, methods and technologies in place of more carbon intensive sources.
- Compensate – Develop a strategy to compensate for residual or unavoidable emissions.

In 2017 RICS published 'Whole life carbon assessment for the built environment' guidance which provides a benchmark factor for estimating average building construction site GHG emissions where more specific information is not available (as typically the case at this planning stage prior to detailed design). As presented in Table 11.12, this factor (1,400 kgCO_2eq per £100k project value) has been applied to the project value ((€9,072,695 or approximately £7,750,000) to estimate total construction site GHG emissions as 108.5 tCO_2eq.

Table 11.22: Estimated Construction Site GHG Emissions

Parameter	Value
Estimate project value	£7,750,000
RICS construction emissions factor	1,400 kgCO_2eq/£100k
Estimated construction site emissions	108.5 tCO_2eq

In 2014 RICS published 'Methodology to calculate embodied carbon of materials' guidance which provides benchmark estimates of embodied carbon associated with construction materials for different buildings types. The benchmark for 'detached, single family home' and 'low rise apartment (3-5 storeys)' is 550 kgCO_2eq/sqm. As presented in Table 11.13, this benchmark has been applied to the estimated development floor area (36,879m^2) to estimate the embodied carbon associated with the development as 20,283.5.0 tCO_2eq.

Table 11.23: Estimated Embodied Carbon

Parameter	Value
Estimated development floor area	36,879m^2
RICS embodied carbon factors	550 kgCO_2eq/sqm - detached, single family home 550 kgCO_2eq/sqm - low rise apartment (3-5 storey)
Estimated embodied carbon	20,283.5 tCO_2eq

Table 11.14 presents the total estimated construction phase GHG emissions, comprising the site GHG emissions and embodied carbon emissions as set out above.

Table 11.24: Total and Annual Construction Phase GHG Emissions

Parameter	Value
Total Construction Phase GHG Emissions	20,392.0 tCO_2eq
Average Annual Construction Phase GHG Emissions	4,078.4 tCO_2eq

The construction period is likely to be approximately 5 years. Therefore, the estimated average annual construction phase GHG emissions are 4,078.4 tCO_2e. This is 0.011% of Ireland's 2020 target (37,651 kt CO_2eq) and 0.012% of the 2030 target (32,860 kt CO_2eq) and therefore, construction phase GHG emissions are considered negligible and negligible significance. As per the DMRB climate guidance, further assessment of the construction phase climate impacts is not required.

11.4.3.2 Operational Phase

The operation of the development will produce GHG emissions from the generation of mains electricity to heat and power the dwellings. An estimate of the development's annual energy demands has been provided as 5,639,200 kWh (15,200 kWh per unit). The emission factor for CO_2 per unit of energy for electricity (2019) is 324.5 gCO_2/kWh (https://www.seai.ie/data-andinsights/seai-statistics/conversion-factors/). This factor has been applied to the development annual energy demand as presented in Table 11.15. The proposed development will increase CO_2 emissions by 0.0049% of Ireland's EU 2020 emissions target for CO_2 (37,651 kt/annum) and 0.0056% of the 2030 target (32,860 kt/annum). Therefore, the impact of the proposed development on national GHG emissions is not significant in terms of Ireland’s obligations under the EU 2020 target.

Table 11.25: Estimated Operational Phase GHG Emissions from Energy

Parameter	Value
Annual energy demand for 287 units	5,639,200 kWh
GHG Emissions	1,829.9 tCO_2eq

The impact of the proposed development traffic emissions of CO_2 were also assessed using the DMRB screening model (see Table 11.16). The results show that the impact of the proposed development will be to increase CO_2 emissions by ≤0.001% of Ireland's EU 2020 and 2030 emissions targets for CO_2. Therefore, the impact of the proposed development on national GHG emissions is not significant in terms of Ireland’s obligations under the EU 2020 target.

Table 11.26: Predicted CO_2 concentrations – SHD only

CO_2			
DM (tonnes/annum)	**DS (tonnes/annum)**	**Change (tonnes/annum)**	**Magnitude and significance**
1,159	1,324	165	0.0004% (2020 target, negligible, not significant) 0.0005% (2030 target, negligible, not significant)
Ireland’s 2020 emissions target			37,651 kilotonnes/annum
Ireland’s 2030 emissions target			32,860 kilotonnes/annum

Table 11.27: Predicted CO_2 concentrations - Masterplan

CO_2			
DM (tonnes/annum)	**DS (tonnes/annum)**	**Change (tonnes/annum)**	**Magnitude and significance**
1,159	1,515	356	0.0009% (2020 target, negligible, not significant) 0.001% (2030 target, negligible, not significant)
Ireland’s 2020 emissions target			37,651 kilotonnes/annum
Ireland’s 2030 emissions target			32,860 kilotonnes/annum

GHG emissions will also be generated as a result of other operational activities such as mains water consumption, wastewater treatment and the transport and treatment of waste, emissions from such sources are likely to be small compared to emissions from energy consumption. Therefore, these other activities are excluded from the assessment.

Potential Climate Impacts

The following relate to climate change mitigation and adaptation:

- Increased temperatures could have a beneficial effect during winter construction by improving working conditions, construction efficiency and reducing health and safety risks associated with snow and ice;
- Increased summer temperatures may have negative effects during the construction phase posing potential health and safety risks associated with heat exposure and dehydration;
- Decreased summer rainfall may impact water supplies;
- Increased temperatures may have a beneficial effect during the development's operational phase by reducing space heating demand and associated GHG emissions;
- Increased/altered rainfall leading to increased flooding risk;
- Increased GHG emissions from construction and operational phase plant and vehicles.

Climate change can result in increased or altered rainfall leading to increased flooding risk. A site-specific Flood Risk Assessment has been undertaken as part of the planning application and measures have been incorporated into the design of the proposed development to account for potential flooding impacts as a result of climate change.

The likely overall magnitude of the changes on climate is negative, not significant and long-term.

11.5 Mitigation Measures

11.5.1 Construction Phase

11.5.1.1 Exhaust Emissions from Plant and Vehicles

The traffic effects of the proposed development during the construction phase will be limited to a relatively short period and will be along traffic routes employed by haulage/construction vehicles and workers. Any effects on air quality will be temporary i.e. during the construction period only and can be suitably controlled by the employment of mitigation measures and appropriate to the development project, including a construction logistics plan, and are therefore unlikely to materially impact on local air quality (AC_1 in Table 21.1 contained in Chapter 21.).

Any emissions from non-road mobile machinery (NRMM) can be reduced by ensuring that any plant used on-site comply with the NO_x, particulate matter and carbon monoxide emissions standards specified in the EU Directive 97/68/EC and subsequent amendments as a minimum, where they have net power of between 37kW and 560kW . The emissions standards vary depending on the net power the engine produces (AC_2 in Table 21.1). The Construction Environmental Management Plan will include these emissions controls

11.5.1.2 Fugitive Dust Emissions

The traffic effects of the proposed development during the construction phase will be limited to a relatively short period and will be along traffic routes employed by haulage/construction vehicles and workers. Any effects on air quality will be temporary i.e. during the construction period only and can be suitably controlled by the employment of mitigation measures (described below) and appropriate to the development project, including a construction logistics plan, and are therefore unlikely to materially impact on local air quality.

The dust emitting activities outlined in Section 11.4.1 can be effectively controlled by appropriate dust control measures (described below) and any adverse effects can be greatly reduced or eliminated.

Prior to commencement of construction activities, it is anticipated that an agreement on the scope of a Dust Management Plan for the construction phase will be reached with the local authority to ensure that the potential for adverse environmental effects on local receptors is minimised. The Dust Management Plan should include inter alia, measures for controlling dust and general pollution from site construction operations, and include details of any monitoring scheme, if appropriate. Controls should be applied throughout the construction period to ensure that emissions are mitigated.

The dust risk categories identified have been used to define appropriate, site-specific mitigation methods. Site-specific mitigation measures are divided into general measures, applicable to all sites and measures specific to earthworks, construction and trackout. Depending on the level of risk assigned to each site, different mitigation is assigned. The method of assigning mitigation measures as detailed in the IAQM construction dust guidance has been used.

In this case, the 'high risk' site mitigation measures have been applied, as determined by the dust risk assessment in Section 11.4.1. For those mitigation measures that are general, the lowest risk assessed has been applied. Two categories of mitigation measure are described in the IAQM construction dust guidance – 'highly recommended' and 'desirable', which are indicated according to the dust risk level identified in Table 11.9.

The mitigation measures describe below will be used to control potential fugitive emissions from the construction project. Therefore, the measures listed below, whether cited as 'highly recommended' or 'desirable' in the IAQM construction dust guidance, will be applied on/ around site.

Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Display the name and contact details of people accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information (AC_3 in Table 21.1).

Dust Management

- Develop and implement a Dust Management Plan, which may include measures to control other emissions, to be approved by the Local Authority. The level of detail will depend on the risk and should include at a minimum the highly recommended measures. The desirable measures should be included as appropriate for the site. The Construction Environmental Management Plan may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/ or visual inspections (AC_21.1 in Table 1).

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off site and the action taken to resolve the situation in the log book.
- Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes (AC_5 in Table 21.1).

Monitoring

- Undertake regular on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary.
- Carry out regular site inspections to monitor compliance with the dust management plan, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- If required, agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations and duration (including baseline monitoring) with the local authority (AC_20 in Table 21.1).

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.

- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping (AC_6 in Table 21.1).

Operating Vehicles/Machinery and Sustainable Travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas.
- Produce a construction logistics plan to manage the sustainable delivery of goods and materials.
- Implement a travel plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing) (AC_7 in Table 21.1).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods (AC_8 in Table 1).

Waste Management

- No bonfires or burning of waste material (AC_9 in Table 1).

Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate to cover with topsoil, as soon as practicable (AC_10 in Table 21.1)

Specific to Construction

- Avoid scabbling (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust (AC_11 in Table 21.1).

Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site.
- Avoid any dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Install hard surfaced haul route, which are regularly cleaned and damped down with fixed or mobile sprinkler systems, or mobile water bowsers.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits (AC_12 in Table 21.1).

11.5.2 Operational Phase

It is considered unlikely that the development would introduce additional sensitive receptors into an area of known poor air quality and the development is not anticipated to have a significant impact on local air quality. Nevertheless, it is recommended that mitigation measures should be included to minimise the impact of the development on the air quality. These measures could include:

- The preparation of a travel plan to encourage sustainable transport (public transport, cycling and walking) (AC_13 in Table 21.1);
- Provision for alternative fuels, such as electric vehicle charge points (AC_14 in Table 21.1);
- Use of renewable energy sources such as photovoltaics, where possible (AC_15 in Table 21.1).

Climate

- As above, the provision for alternative fuels and encouragement of sustainable modes of transport will reduce operational phase GHG emissions;
- The Construction Environment Management Plan sets out measures to mitigate the potential impacts of climate change during construction. Such as measures related to increased flood risk, overheating risks to construction employees and equipment, potential for water shortages and dust mitigation (AC_16 in Table 21.1);
- The potential for increased risk of flooding due to climate change is mitigated through a range of mitigation which require the consideration of climate change (AC_17 in Table 21.1); and

- The proposed development is designed to protect site habitats and species from climate change and enhance biodiversity (AC_18 in Table 21.1) (Chapter 8).

11.6 Residual Effects

11.6.1 Construction Phase

All construction effects were assessed to be not significant provided that appropriate dust control and construction phase mitigation measures are applied as listed in Section 11.5.1. During the construction phase, potential climate change effects are considered likely to be appropriately mitigated and not significant. Residual effects are therefore also not significant with suitable mitigation measures in place. The anticipated residual impact from the construction phase of the development is summarised as follows.

The anticipated residual impact from the construction phase of the development is summarised as follows.

Table 11.28: Construction Phase Residual Impacts

Quality	Significance	Duration
Air quality		
Negative	Not significant	Short-term
Climate change		
Negative	Not significant	Short-term

11.6.2 Operational Phase

The development is not anticipated to have a significant impact on local air quality, and the residual impacts of the development on air quality whilst it is in operation are likely to be acceptable. During the operational phase, potential climate change effects are considered likely to be not significant. Standard or best practice measures have been recommended nonetheless to minimise the impact of the development on the air quality.

The anticipated residual impact from the operational phase of the development is summarised as follows.

Table 11.29: Operational Phase Residual Impacts

Quality	Significance	Duration
Air quality		
Negative	Not significant to minor adverse	Permanent
Climate change		
Negative	Not significant	Permanent

11.7 Monitoring

The appointed contractor will be required to monitor levels of dust during critical construction periods at nearby sensitive locations and/or development site boundaries (AC_19 in Table 21.1) No additional monitoring is proposed for the operational phase of the proposed development.

11.8 Reinstatement

Not applicable.

11.9 Interactions

Interactions could arise at the closest sensitive receptors to the proposed development between Material Assets Roads and Traffic (Chapter 16) and Human Health (Chapter 7). These effects are possible in both the construction and operational phases because of possible dust soiling and possible exposure to air quality pollutants.

11.10 Cumulative Effects

11.10.1 Construction Phase

The phasing/commencement of any other permitted developments in the locality could potentially result in the scenario where a number of other construction sites are in operation at the same time as the proposed development. However, all permitted developments are expected to agree and follow site specific Construction Environmental Management Plans or Dust Management Plans and Construction Traffic Management Plans that will adequately control emissions from construction. Therefore, cumulative construction phase effects are considered not significant.

11.10.2 Operational Phase

Potential cumulative development traffic data were included in this assessment in the 'Do Minimum' scenarios (see Appendix 11.3 Table A11.10). As per construction phase impacts, any other permitted developments are expected to follow best practice mitigation measures to minimise emissions to air. Therefore, significant GHG emissions and exceedance of the relevant AQSs is considered unlikely and cumulative operational phase effects are considered not significant.

11.11 'Do-Nothing' Effect

There will be no significant change to air quality or climate/GHG emissions with or without the proposed development in place.

11.12 Difficulties Encountered in Compiling the Chapter

- No site-specific air quality monitoring was carried out and it was assumed that the monitoring data available from the EPA website was representative of the site.
- AM and PM peak traffic data were converted to AADT by the transport specialists. However, it was noted that AADT estimations from short periods have a disputable confidence interval.

Appendix 11.1

Air Quality and Climate Change Standards

The Air Quality Framework Directive (1996) established a framework under which the European Commission (EC) could set limit or target values for specified pollutants. The directive identified several pollutants for which limit or target values have been, or will be set in, subsequent 'daughter directives'. The framework and daughter directives were consolidated by Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe, which retains the existing air quality standards and introduces new objectives for fine particulates ($PM_{2.5}$).

The air quality standards (AQSs) in Europe are set in EU directives, the Clean Air for Europe (CAFE) Directive was published in 2008. The CAFE directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011.

The relevant standards for Europe to protect human health are summarised in Table A11.1.

Table A11.1: Air Quality Standards Relevant to the Proposed Development

Substance	Averaging period	Exceedances allowed per year	Ground level concentration limit (µg/m^3)
Nitrogen dioxide (NO_2)	1 calendar year	-	40
	1 hour	18	200
Fine particles (PM_{10})	1 calendar year	-	40
	24 hours	35	50
Fine particles ($PM_{2.5}$)	1 year	N/A	20

Local Air Quality Management Review and Assessment Technical Guidance published by the Department for Environment, Food and Rural Affairs (Defra) advises that an exceedance of the 1 hour mean NO_2 objective is unlikely to occur where the annual mean concentration is below 60µg/m^3, where road transport is the main source of pollution. This concentration has been used to screen whether the hourly mean objective is likely to be achieved.

Gothenburg Protocol

In 1999, Ireland signed the Gothenburg Protocol to the 1979 UN Convention on Long Range Transboundary Air Pollution. European Commission Directive 2001/81/EC and the National Emissions Ceiling Directive (NECD), prescribes the same emissions limits as the 1999 Gothenburg Protocol. A National Programme for the progressive reduction of emissions of four transboundary pollutants, nitrogen oxides (NO_x), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and ammonia (NH_3), has been in place since April 2005. 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. 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 some new national emission reduction commitments which will be applicable from 2020 and 2030 for SO_2, NO_x, non-methane volatile organic compounds (NMVOC), NH_3, and methane (CH_4). Irelands reduction targets are shown in Table A11.2.

Table A11.2: The reduction targets for Ireland, shown as a percentage reduction from 2005 levels, for four transboundary pollutants (SO_2, NO_x, VOCs, NH_3) and $PM_{2.5}$

Pollutant	Percentage reduction below 2005 level	
	2020-2029	2030
SO_2	65%	83%
NO_x	49%	75%
VOC	25%	32%
NH_3	1%	7%
$PM_{2.5}$	18%	53%

Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002. For the purpose 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 2008-2012.

Ireland is also committed to the Paris Agreement, which aims to limit global temperature increase to no more the 2°C above pre-industrial levels, and the "2030 Climate and Energy Policy framework" agreed by the EU, which endorsed a binding EU target of at least a 40% reduction in greenhouse gas emissions by 2030 compared to 1990.

The Government published the Climate Action Plan 2019 (Government of Ireland, 2019). This Plan is "committed to achieving a net zero carbon energy systems objective for Irish society and in the process, create a resilient, vibrant and sustainable country". This Plan sets out policies and measures aimed to help Ireland achieve its decarbonisation goals.

The Government published a draft of the Climate Action and Low Carbon Development Bill in 2021. If ratified, this legislation would put Ireland in a similar position as countries such as the UK and France where legislation to reach net zero GHG emissions by 2050 is in place.

Appendix 11.2

Construction Dust Assessment Methodology

To assess the potential impacts, construction activities are divided into demolition, earthworks, construction and trackout. The descriptors included in this section are based upon the IAQM construction dust guidance. The assessment follows the steps recommended in the guidance.

Step 1 and Step 2 methods from the IAQM construction dust guidance are described in this Appendix to assign dust risk categories for each of the construction activities.

Step 1: Screen the requirement for assessment

The first step is to screen out the requirement for a construction dust assessment, this is usually a somewhat conservative level of screening. An assessment is usually required where there is:

- a ‘human receptor’ within:
  - 350m of the boundary of the site; or
  - 50m of the route used by construction vehicles on the public highway, up to 500m from the site entrance(s).
- an ‘ecological receptor’:
  - 50m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

Step 2A: Defining the Potential Dust Emission Magnitude

Demolition

The dust emission magnitude category for demolition is varied for each site in terms of timing, building type, duration and scale. Examples of the potential dust emission classes are provided in the guidance as follows:

- Large: Total building volume >50,000 m^3, potentially dusty construction material, on-site crushing and screening, demolition activities > 20m above ground level;
- Medium: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10m – 20m above ground level; and
- Small: Total building volume <20,000 m^3, construction material with low potential for dust release, demolition activities < 10m above ground, demolition during wetter months.

Earthworks

The dust emission magnitude category for earthworks is varied for each site in terms of timing, geology, topography and duration. Examples of the potential dust emission classes are provided in the guidance as follows:

- Large: Total site area >10,000 m^2, potentially dusty soil type (e.g. clay), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000 tonnes;
- Medium: Total site area 2,500 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8m in height, total material moved 20,000 – 100,000 tonnes; and
- Small: Total site area < 2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <10,000 tonnes, earthworks during wetter months.

Construction

The dust emission magnitude category for construction is varied for each site in terms of timing, building type, duration, and scale. Examples of the potential dust emissions classes are provided in the guidance as follows:

- Large: Total building volume > 100,000 m^3, piling, on site concrete batching;
- Medium: Total building volume 25,000 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching; and
- Small: Total building volume < 25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout

Factors which determine the dust emission magnitude class of trackout activities are vehicle size, vehicle speed, vehicle number, geology and duration. Examples of the potential dust emissions classes are provided in the guidance as follows:

- Large: > 50 HDV (> 3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100m;
- Medium: 10 – 50 HDV (> 3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 – 100m; and
- Small: < 10 HDV (> 3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length < 50m.

Step 2B: Defining the Sensitivity of the Area

The sensitivity of the area is defined for dust soiling, human health and ecosystems. The sensitivity of the area takes into account the following factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Site-specific factors, such as whether here are natural shelters such as trees, to reduce the risk of wind-blown dust.

Table A11.3 has been used to define the sensitivity of different types of receptors to dust soiling, health effects and ecological effects.

Based on the sensitivities assigned of the different types of receptors surrounding the site and numbers of receptors within certain distances of the site, a sensitivity classification for the area can be defined for each. Tables A11.4 to A11.6 indicate the method used to determine the sensitivity of the area for dust soiling, human health and ecological impacts, respectively.

For trackout, as per the guidance, it is only considered necessary to consider trackout impacts up to 50m from the edge of the road.

Table A11.3: Sensitivity of the Area Surrounding the Site

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
High	• Users can reasonably expect an enjoyment of a high level of amenity. • The appearance, aesthetics or value of their property would be diminished by soiling. • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • Examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.	• Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day) • Examples include residential properties, hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• Locations with an international or national designation and the designated features may be affected by dust soiling. • Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. • Examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
Medium	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home. • The appearance, aesthetics or value of their property could be diminished by soiling. • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. • Examples include parks and places of work.	• Locations where the people exposed are workers and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown. • Locations with a national designation where the features may be affected by dust deposition. • Example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.
Low	• The enjoyment of amenity would not reasonably be expected. • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling. • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • Examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	• Locations where human exposure is transient. • Indicative examples include public footpaths, playing fields, parks and shopping streets.	• Locations with a local designation where the features may be affected by dust deposition. • Example is a local Nature Reserve with dust sensitive features.

Table A11.4: Sensitivity of the area to dust soiling effects on people and property

Receptor Sensitivity	Number of Receptors	Distances from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table A11.5: Sensitivity of the area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distances from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 μg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 μg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 μg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 μg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium*	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

* The IAQM guidance recommends a further breakdown of 'medium risk' categories, although these are less conservative and have therefore not been utilised in this assessment.

Table A11.6: Sensitivity of the area to Ecological Impacts

Receptor Sensitivity	Distances from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C: Defining the Risk of Impacts
The final step is to use both the dust emission magnitude classification with the sensitivity of the area, to determine a potential risk of impacts for each construction activity, before the application of mitigation. Tables A11.7 to A11.9 indicate the method used to assign the level of risk for each construction activity.

Table A11.7: Risk of Dust Impacts from Demolition

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A11.8: Risk of Dust Impacts from Earthworks/Construction

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table A11.9: Risk of Dust Impacts from Trackout

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Appendix 11.3

Traffic Data

Table A11.10: Traffic Data

Link	AADT*			
	Baseline 2019	**Do Minimum 2024**	**Do Something 2024 SHD only**	**Do Something 2024 Masterplan**
Dock Road**	25,500	27,300	31,200	35,700
Greenpark Avenue	5,100	5,500	5,800	Data not provided
Log na gCapall	5,600	5,950	6,150***	Data not provided

*No change to HDV flows is expected as a result of the proposed development
**Only link where DMRB criterion exceeded
** Do Something – Nursing home only

Appendix 11.4

DMRB Screening

Table A11.11: Example DMRB Screening input for baseline 2019

Link	Distance from link centre to receptor (m)	Baseline 2019	Annual average speed (km/h)	Road type	Total %LDV	Total %HDV
Dock Road	5	25,500	50	A	100	0

As per TII guidance, the DMRB screening results were verified using the Dock Road diffusion tube (24.2 µg/m^3 NO_2 in 2019). Modelled versus monitored NO_2 at the site is presented in Table A11.12, showing that the percentage difference between the two was greater than 25%. Following air quality guidance, verification is recommended and was carried out as detailed below.

Table A11.12: Modelled versus Monitored NO_2 Concentrations

Site	Background NO_2	Monitored total NO_2	Modelled total NO_2	% Difference [(modelled – monitored)/monitored] x100
Dock Road	10.1	24.2	13.4	-44.6

Modelled versus measured road NO_x at the diffusion tube site are shown in Table A11.13.

Table A11.13: Modelled versus Monitored NO_x/NO_2

Site	Monitored Total NO_2	Background NO_2	Monitored Road Contribution NO_x	Modelled road Contribution NO_x	Ratio of Modelled and Measured Road NO_x
Dock Road	24.2	10.1	26.6	8.8	3.0

A factor of **3.0** was obtained and was applied to the modelled road-NO_x component predicted at the receptor. The verified annual average modelled road contribution NO_x concentrations have then been converted into annual average road NO_2 by using the Defra NO_x to NO_2 spreadsheet (v8.1) (using Armagh, Banbridge and Craigavon as per TII guidance); a comparison of monitored and model adjusted NO_2 is presented in Table A11.14.

Table A11.14: Modelled versus Monitored NO_2 Concentrations

Site	Background NO_2	Monitored total NO_2	Modelled total NO_2 after adjustment	% Difference [(modelled – monitored)/monitored] x100
Dock Road	10.1	24.2	26.6	0

The same factor was applied to the modelled PM_{10} concentrations. NO_2 and PM_{10} results are shown in Table A11.15 and A11.16.

Table A11.15: DMRB results – SHD only

Receptor	NO_2 (µg/m^3)			PM_{10} (µg/m^3)		
	DM	DS	Change	DM	DS	Change
Dock Road	24.33	25.06	0.73	16.69	16.91	0.21

Table A11.16: DMRB results - Masterplan

Receptor	NO_2 (µg/m^3)			PM_{10} (µg/m^3)		
	DM	DS Masterplan	Change	DM	DS Masterplan	Change
Dock Road	24.33	25.83	1.50	16.69	17.13	0.44

12.0 NOISE AND VIBRATION

12.1 Introduction

This section of the EIAR has been prepared by RSK Group to identify and assess the potential noise and vibration impacts associated with the proposed strategic housing development (SHD) at the former Greenpark Racecourse, Limerick City.

This chapter has been prepared by James Mangan and Aarron Hamilton, of RSK Ireland Ltd.

James is Associate Director with RSK Ireland Ltd. and has been working in the field of Acoustics since 2001, he is a corporate member of the Institute of Acoustics (MIOA) and has completed the IOA Diploma in Acoustics and Noise Control from UWE (Bristol). He has extensive knowledge in aspects of environmental noise monitoring, analysis, impact assessment and reporting and has prepared environmental impact assessments reports for various major developments. James is the current Chairman of the Irish Branch of the Institute of Acoustics.

Aarron has a Master's in Music and Media Technologies from Trinity College Dublin; with a special focus on Room Acoustics, Studio Acoustics, Absorption and Diffusion. Aarron is now Acoustic Technician for RSK Ireland Ltd. focusing on building acoustics, environmental noise surveys, associated data analysis and impact assessment. Aarron has worked on numerous projects in the public and private sectors, including EIA, construction noise and vibration monitoring, complaint investigation and sound insulation testing projects. He has knowledge and experience using and interpreting international guidance and legislation for acoustics.

This chapter includes a description of the receiving ambient noise climate in the vicinity of the subject site, an assessment of the potential noise and vibration impact associated with the proposed development during both the short-term construction phase and the long-term operational phase on its surrounding environment. The assessment of direct, indirect and cumulative noise and vibration impacts on the surrounding environment have been considered as part of the assessment.

During the construction phase, the range of activities with potential to generate noise and vibration emissions to off-site sensitive receptors will include site preparation works, construction of the proposed development and erection of any temporary buildings/compounds that may be required.

During the operational phase, the potential sources of noise are those associated with additional vehicular traffic on public roads, car parking and any proposed new building services plant items to be provided. The potential inward noise impact of the nearby N18 road on the proposed dwellings has also been considered in this chapter.

The significance of impacts has been assessed in accordance with the EPA Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017.

With regard to the quality of the impact, ratings may have positive, neutral or negative applications. The significance of an impact on the receiving environment is described in the

range between imperceptible and profound. The duration of impacts as described in the EPA Guidelines are presented on a scale between momentary and permanent.
Noise and vibration emissions from the development will vary in terms of quality, duration and magnitude. The following sections analyse the expected construction and operational phase noise and vibration impacts both in terms of the proposed assessment criteria (refer Section 12.2.1 and 12.2.2) and the expected impacts in terms of the significant effects.

12.2 Methodology

A review of relevant standards and guidelines has been conducted to set noise and vibration criteria for the developments' construction and operational phases;

- Baseline noise monitoring has been undertaken to characterise the receiving noise environment;
- Predictive calculations have estimated the likely noise emissions during the construction phase at nearest sensitive locations (referred to as NSL's from hereon, outlined in ref. Figure 12.1);
- Predictive calculations have assessed potential impacts associated with the developments' operation at NSL's surrounding the development;
- The potential impact of noise/vibration from the nearby N18 road has been considered with regard to the future amenity of the proposed residential dwelling's occupants, and;
- A schedule of mitigation measures has been proposed to reduce potential impacts relating to noise and vibration to and from the proposed development.

Relevant noise & vibration criteria for the developments' construction and operational phases, along with the methodology for conducting baseline noise surveys, have been outlined below.

12.2.1 Construction Phase

12.2.1.1 Noise

The closest neighbouring NSL's to the proposed development are the residential dwellings primarily to the east of the site. The distance between the construction site and nearby NSL's varies, the closest distance between the site and neighbouring dwelling will be approximately 20 metres but generally construction works will occur between 20 and 200 metres from existing dwellings, depending on the location where specific works are occurring.

There are no statutory limits with respect to construction noise in Ireland, additionally, limits for construction noise are not outlined in Limerick City & County Council's (LCCC) *Noise Action Plan 2018 to 2023* (NAP). In the absence of relevant national or local guidelines, reference is made to the "National Protocol for Dealing with Noise Complaints for Local Authorities" NIECE 2016, which states:

> *"At the time of writing the most relevant standards to the majority of complaints include"…*

> *"BS 5228-1:2009+A1:2014* Code of practice for noise and vibration control on construction and open sites."

BS 5228:2009+A1:2014 is considered to represent the *industry standard* methodology for the assessment of construction noise and describes two methods for deriving noise significance thresholds for construction sites.

BS 5228:2009+A1:2014 (Appendix E.1) describes a method for identifying *'Potential significance based upon noise change'*. Following this methodology, BS 5228:2009+A1:2014 designates a noise sensitive location (NSL) into a specific category based on pre-existing ambient noise levels and then sets a threshold noise value that, if exceeded, indicates a significant construction noise impact.

Table 12.1 presents the threshold values for significant noise impacts for weekday daytime and Saturday morning activity.

Table 12.1: BS5228 Construction Noise Thresholds for Significant Effects

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

A. Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
B. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
C. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
D. 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

Annex E.2 of BS 5228-1:2009+A1:2014 also provides the following comments in relation to *'Potential significance based on fixed noise limits'*:

BS 5228:2009+A1:2014 (Appendix E.2) also prescribes Potential significance based on fixed noise limits, which are sometimes adopted for projects of significant size, and are quoted below.

> *"Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut. The noise can be measured with a simple sound level meter, as we hear it, in A-weighted decibels (dB(A))– see note below. Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the site boundary should not exceed:*
>
> - *70 decibels (dBA) in rural, suburban and urban areas away from main road traffic and industrial noise;*
> - *75 decibels (dBA) in urban areas near main roads in heavy industrial areas.*

These limits are for daytime working outside living rooms and offices. In noise-sensitive situations, for example, near hospitals and educational establishments – and when working outside the normal hours say between 19.00 and 22.00 hours – the allowable noise levels from building sites will be less: such as the reduced values given in the contract specification or as advised by the Environmental Health Officer (a reduction of 10 dB(A) may often be appropriate). Noisy work likely to cause annoyance locally should not be permitted between 22.00 hours and 07.00 hours."

Taking account of the measured ambient noise levels and BS5228 significance thresholds, the recommended noise limits for construction activity are as follows:

- Monday to Friday 07.00 – 19.00 65 dB $L_{Aeq,12hrs}$
- Saturday 07.00 – 13.00 65 dB $L_{Aeq,6hrs}$

It is assumed that construction works will take place during normal working hours only. In exceptional circumstances, and subject to agreement with LCCC, extended hours of operation may be applied for, in such instances an assessment of potential noise impacts shall be carried out in advance of works taking place, and submitted to LCCC, as part of the extended hours request.

12.2.1.2 Vibration

Following the same approach, BS 5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites. Vibration* recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak component particle velocity (in frequency range of predominant pulse) of 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above.

The standard also notes that below 12.5 mm/s PPV the risk of damage tends to zero. The recommended construction vibration criteria are presented in Table 12.2.

Table 12.2: Vibration Criteria During Construction Phase

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:-		
Less than 15Hz	15 to 40Hz	40Hz and above
15 mm/s	20 mm/s	50 mm/s

12.2.2 Operational Phase

12.2.2.1 Noise (Outward)

Plant Noise Levels

Reference is made to British Standard BS4142:2014+A1: 2019: '*Methods for Rating and Assessing Industrial and Commercial Sound*' (BS 4142) in setting criteria for any new mechanical plant items. This standard outlines methods for analysing building services plant sound emissions to residential receptors. BS 4142 is widely considered the 'industry standard' methodology for the assessment of industrial noise in Ireland.

BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature, using outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling upon which the sound is incident.

The BS 4142 assessment methodology compares the measured external background sound level (in the absence of plant items) to the rating sound level, of the plant items, when operational. Where sound emissions are found to be tonal, impulsive, intermittent or to have other sound characteristics that are readily distinctive against the residual acoustic environment, BS4142:2014 advises that penalties be applied to the specific level to arrive at the rating level.

Based upon measured day and night-time background sound levels on the site, appropriate plant noise criteria to nearby dwellings are as follows:

- Daytime (07:00 to 23:00hrs) 45 dB $L_{Aeq,1hr}$
- Night-time (23:00 to 07:00hrs) 40 dB $L_{Aeq,15\text{-}min}$

Plant noise emissions should not contain any characteristics that would warrant any acoustic feature penalties under the BS 4142:2014 assessment procedure.

Additional Road Traffic on Public Roads

The potential noise impact associated with the proposed development introducing additional traffic onto the existing road networks has been considered. Table 12.3 states the likely impact associated with any particular change in traffic noise level (Source DMRB, 2012).

Table 12.3: DMRB impact associated with change in traffic noise level (long term)

Noise Change (dB $L_{A10,18hr}$)	Magnitude of Impact
0	No Change
0.1 - 2.9	Negligible
3 - 4.9	Minor
5 - 9.9	Moderate
10+	Major

Table 12.3 has presented the DMRB (2012) likely impacts associated with long-term change in traffic noise level, the corresponding significance of impact presented in the 'EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017 is presented in Table 12.4 for consistency in wording and terminology for the assessment of impact significance.

Table 12.4: DMRB impact associated with change in traffic noise level (Updated)

Noise Change (dB $L_{A10,18hr}$)	Magnitude of Impact (DMRB, 2012)	Impact Guidelines on the Information to be contained in EIAR (EPA)
0	No Change	Imperceptible
0.1 - 2.9	Negligible	Not Significant
3 – 4.9	Minor	Slight
5 – 9.9	Moderate	Moderate
10+	Major	Significant, Very Significant, Profound

Other Noise Sources

For any other non-traffic or plant related sources appropriate guidance on internal noise levels for dwellings is contained within BS 8233: 2014*: Guidance on Sound Insulation and Noise Reduction for Buildings*. This British Standard sets out recommended noise limits for indoor ambient noise levels in dwellings as summarised in Table 12.5.

Table 12.5: Recommended Indoor Ambient Noise Levels from BS 8233: 2014

Typical Situation	Daytime $L_{Aeq,16hr}$ (07:00 to 23:00hrs)	Night-time $L_{Aeq, 8hr}$ (23:00 to 07:00hrs)
Living / Dining Rooms	35 / 40	n/a
Bedrooms	35	30

External limits can be derived from the internal criteria in Table 12.5 by factoring the noise reduction afforded by a partially open window. BS8233:2014 states a typical 15dB attenuation. Using this correction value across a partially open window, the following external noise levels would result in appropriate internal noise levels within nearby NSL's.

- Daytime / Evening (07:00 to 23:00 hours) 50 - 55dB $L_{Aeq,1hr}$
- Night-time (23:00 to 07:00 hours) 45dB $L_{Aeq,15min}$

12.2.2.2 Noise (Inward)

In a scenario where new residential development is proposed in an area with an existing level of environmental noise, there is currently no clear national guidance on methodology to assess the suitability of the site for development on noise grounds. The EPA has suggested that in the interim that Action Planning Authorities should examine the planning policy guidance notes issued in England titled, *ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise*, May 2017. Numerous local authorities, including LCCC, have adopted ProPG, and the LCCC NAP states the following in this regard:

"Limerick City and County Council will adopt a strategic approach to managing environmental noise from major roads, within its functional area, and will aim to:

- *identify appropriate mitigation measures to reduce noise levels where they are potentially harmful;*
- *prevent additional members of the community being exposed to undesirable noise levels through robust planning policies based on the principles of good acoustic design in line with Professional Practice Guidance on Planning & Noise (2017) and based on the guidance and recommendations of the World Health Organisation;*
- *protect areas which are considered to be desirably quiet or which offer a sense of tranquillity through a process of identification and validation followed by formal designation of "Quiet Areas"."*

ProPG outlines a systematic risk based two stage approach for evaluating noise exposure on prospective sites for residential development. The two primary stages of the approach can be summarised as follows:

Stage 1 - Comprises a high-level initial noise risk assessment of the proposed site considering either measured and or predicted noise levels, and;

Stage 2 – Involves a full detailed appraisal of the proposed development covering four "key elements" that include:

- Element 1 - Good Acoustic Design Process;
- Element 2 - Noise Level Guidelines;
- Element 3 - External Amenity Area Noise Assessment, and;
- Element 4 - Other Relevant Issues.

ProPG is intended to outline the methodology and findings of the assessments, so as the planning authority can make an informed decision on the permission. ProPG outlines the following possible recommendations in relation to the findings:

A. Planning consent may be granted without any need for noise conditions;
B. Planning consent may be granted subject to the inclusion of suitable noise conditions;
C. Planning consent should be refused on noise grounds in order to avoid significant adverse effects ("avoid"); or,
D. Planning consent should be refused on noise grounds in order to prevent unacceptable adverse effects ("prevent").

The initial noise risk assessment is intended to provide an early indication of any acoustic issues that may be encountered. It calls for the categorisation of the site as a negligible, low, medium or high risk based on the pre-existing noise environment. Figure 12.1 presents the basis of the initial noise risk assessment, it provides appropriate risk categories for a range of continuous noise levels either measured and/or predicted on site.

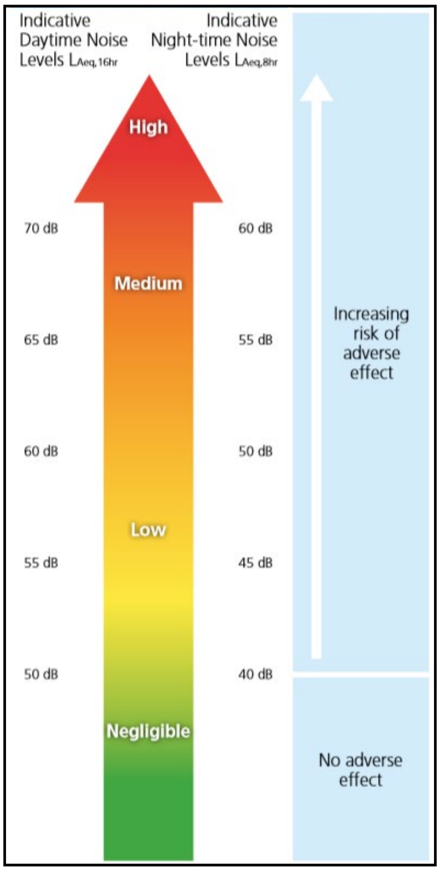

Figure 12.1: ProPG Stage 1 - Noise Risk Assessment Categories

Paragraph 2.9 of ProPG states that:

"The noise risk assessment may be based on measurements or prediction (or a combination of both) as appropriate and should aim to describe noise levels over a "typical worst case" 24 hour day either now or in the foreseeable future."

For the purposes of this EIAR inward noise impact assessment, a Stage 1 noise risk assessment of the proposed site has been conducted, based on measured noise level data and with comparison to the categories outlined in Figure 12.1.

12.2.2.3 Vibration

No significant sources of vibration are expected to arise during the operational phase of the development. Operational vibration has therefore not been addressed further in this chapter.

12.3 Baseline Environment

12.3.1 Baseline Noise Survey

An environmental noise survey has been conducted in general accordance with ISO 1996-2:2017 *"Acoustics -- Description, measurement and assessment of environmental noise -- Part 2: Determination of sound pressure levels"*.

12.3.1.1 Monitoring Locations

Location N1 was chosen to represent noise levels at the proposed façade that is closest to the nearby Greyhound Racing track and Roches Feeds. Locations N2 – N4 were chosen because of their proximity to nearby noise sensitive locations (i.e. nearby dwellings) and also their proximity to nearby roads such as the N18. The selected measurement locations are shown in Figures 12.2 to 12.6.

Figure 12.2: Proposed Site Plan showing approximate baseline noise measurement position N1 – N4

Figure 12.3: Photograph showing baseline noise measurement position N1

Figure 12.4: Photograph showing baseline noise measurement position N2

Figure 12.5: Photograph showing baseline noise measurement position N3

Figure 12.6: Photograph showing baseline noise measurement position N4

12.3.1.2 Survey Periods

Noise measurements were conducted at Location N1 between 14:59hrs on 01 March 2021 to 16:02hrs on 9 March 2021. The weather during the survey period was generally dry and calm.

12.3.1.3 Instrumentation

Measurements were made using a B&K 2250 Light Sound Level Meter B&K Environmental Monitoring Kit. Sample periods were 15-minute log periods. The instrumentation was calibrated using a B&K calibrator. Calibration certificates are available on request.

12.3.1.4 Measurement Parameters

The noise survey results are presented in decibels (dB), using the following parameters:

$L_{Aeq,T}$ is the equivalent continuous sound level and is used to describe a fluctuating sound as a single value over the sample period (T).

$L_{AFmax,T}$ The maximum A-weighted sound pressure level occurring within a specified time period (T). Measured using the "Fast" time weighting.

$L_{AF10,T}$ Refers to those A-weighted noise levels in the top 10 percentile of the sampling interval; it is the level which is exceeded for 10% of the measurement period (T). It is used to determine the intermittent high noise level features of locally generated noise and usually gives an indicator of the level of road traffic. Measured using the "Fast" time weighting.

$L_{AF90,T}$ Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval (T). It is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to describe a background level without contribution from intermittent sources. Measured using the "Fast" time weighting.

All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

12.3.1.5 Baseline Noise Survey Results

Location N1

Table 12.6 presents a summary of the average daytime (i.e. 07:00 to 23:00) and night-time (i.e. 23:00 to 07:00hrs) noise levels measured at Location N1.

Table 12.6: Summary of Measured Baseline Noise Levels at Location N1

Day / Date	Period	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
		L_{Aeq} [13]	L_{Amax} [14]	L_{A10} [15]	L_{A90} [16]
Mon 1 March 2021	Day / Evening	56	101	50	47
Mon/Tue 1 - 2 March 2021	Night-time	45	59	45	43
Tue 2 March 2021	Day / Evening	48	74	49	46
Tue/Wed 2 - 3 March 2021	Night-time	44	58	45	42
Wed 3 March 2021	Day / Evening	46	72	47	44
Wed/Thu 3 - 4 March 2021	Night-time	42	64	43	41
Thu 4 March 2021	Day / Evening	46	72	47	44
Thu/Fri 4 - 5 March 2021	Night-time	46	65	46	44
Fri 5 March 2021	Day / Evening	51	66	51	48
Fri/Sat 5 - 6 March 2021	Night-time	44	61	46	42
Sat 6 March 2021	Day / Evening	49	78	50	45
Sat/Sun 6 - 7 March 2021	Night-time	39	61	41	36
Sun 7 March 2021	Day / Evening	54	106	44	38
Sun/Mon 7 – 8 March 2021	Night-Time	43	71	42	36
Mon 8 March	Day / Evening	54	87	54	49

Figure 12.7 shows a graphical representation of the measured baseline noise levels over the survey period.

[13] Represents the logarithmic average of the 15-minute noise measurements over the sample period.
[14] Represents the highest measured L_{AFmax} noise measurement over the sample period.
[15] Represents the arithmetic average of the 15-minute noise measurements over the sample period.
[16] Represents the arithmetic average of the 15-minute noise measurements over the sample period.

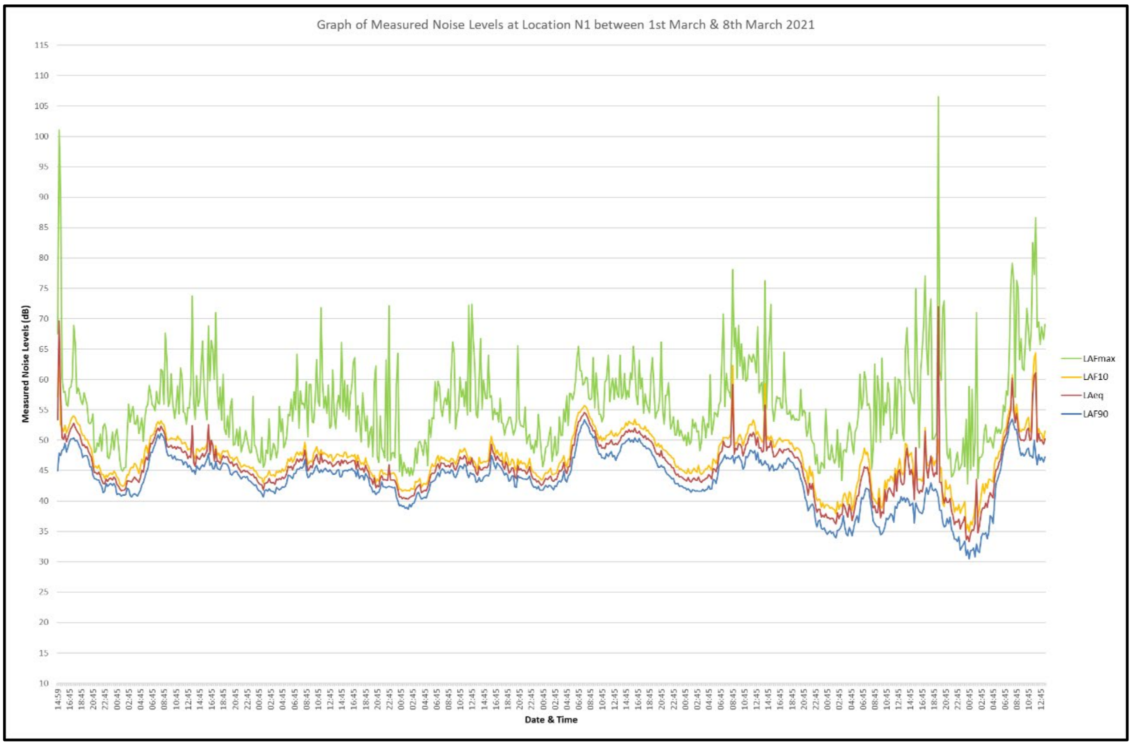

Figure 12.7: Graph of baseline noise measurements at N1

During the survey period, the dominant intermittent noise source was distant road traffic, activity in the nearby greyhound stadium, horses travelling throughout the site, the nearby factory operations and birdsong. Other sources of intermittent noise included occasional distant aircraft and occasional slight wind generated noise on nearby foliage.

Location N2

Table 12.7 presents a summary of the attended daytime noise levels measured at Location N2.

Table 12.7: Summary of Measured Baseline Noise Levels at Location N2

Start Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
	$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A10,15min}$	$L_{A90,15min}$
12:19	48	56	50	46
13:09	47	60	49	45
13:58	50	73	51	46

During the noise survey, the dominant noise sources were noted to be from distant road traffic, birdsong and distant construction noise. Ambient noise levels were measured in the range 48 to 50dB $L_{Aeq,15min}$. The background noise was measured in the range 45 to 46dB $L_{A90,15min}$.

Location N3

Table 12.8 presents a summary of the attended daytime noise levels measured at Location N3.

Table 12.8: Summary of Measured Baseline Noise Levels at Location N3

Start Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
	$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A10,15min}$	$L_{A90,15min}$
12:30	56	82	55	50
13:20	53	70	55	50
14:07	53	71	55	50

During the noise survey, the dominant noise sources were noted to be from distant road traffic, birdsong and distant construction noise. Ambient noise levels were measured in the range 53 to 56dB $L_{Aeq,15min}$. The background noise was 50 dB $L_{A90,15min}$.

Location N4

Table 12.9 presents a summary of the attended daytime noise levels measured at Location N4.

Table 12.9: Summary of Measured Baseline Noise Levels at Location N4

Start Time	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)			
	$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A10,15min}$	$L_{A90,15min}$
13:32	47	59	49	44
12:48	47	59	49	44
14:21	47	54	48	44

During the noise survey, the dominant noise sources were noted to be from distant road traffic, birdsong and distant construction noise. Ambient noise levels were measured at 47 dB $L_{Aeq,15min}$. The background noise level was measured at 44dB $L_{A90,15min}$.

Due to the Covid 19 Pandemic, traffic flows throughout Ireland have reduced and this will have influenced baseline noise level data collected in March 2021. As such, EPA noise mapping will be used, in combination with a review of available and historic TII traffic count data for nearby traffic counters, in order to estimate the effect, in dB, of these reduced traffic flows. The estimated reduction will be calculated and the baseline data will be corrected in order to correct for any potential impacts.

12.4 Potential Effects of the Proposed Project

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

- Construction Phase, and;
- Operational Phase.

12.4.1 Construction Phase

During the construction phase the main site activities will include site clearance, ground excavation works and provision of infrastructure, construction of the residential buildings, road construction and landscaping. Potential impacts during the construction phase will be short term.

BS 5228-1:2009+A1:2014 provides catalogue of source noise levels for various construction plant, machinery and activity, along with a clear methodology and procedure for the prediction of noise from construction to sensitive receptors. This allows for an indicative assessment of the likely impacts of construction activity to nearby dwellings.

Table 12.10 presents construction plant items that are considered to be typical for a site of this nature, along with the BS5228-1 reference noise emission values at the nominal distance of 10 metres.

Table 12.10: Typical Construction Plant Items and BS5228-1 Reference Noise Emission Values

Phase	Item of Plant (BS 5228-1 Ref.)	Construction Noise Level at Reference Distance (10m) dB $L_{Aeq,1hr}$
Site Preparation	Wheeled Loader Lorry (C2 28)	74
	Diesel Generator (C4.76)	61
	Track Excavator (C2 22)	72
	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
Foundations	Tracked Excavator (C3.24)	74
	Concrete Pump (C3.25)	78
	Compressor (C3 19)	75
	Poker Vibrator (C4 33)	78
General Construction	Tower Crane (C4.48)	76
	Articulated lorry (C12.10)	77
	Hand tools	81
	Pneumatic Circular Saw (D7.79)	75
	Internal fit – out	70
Landscaping	Dozer (C2.13)	78
	Dump Truck (C4.2)	78
	Surfacing (D8.25)	68

The nearest third-party noise sensitive locations to the proposed construction works are the properties to the east of the site boundary.

The closest works area is approximately 20m from the nearest properties with the remainder of works taking place across the site at varying distances. In order to assess a worst-case scenario, construction noise levels at distances of 20m, 30m and 100m have been used although a prediction to 10m distance is also provided as a reference in Table 12.10.

The calculations also assume that the equipment will operate for 66% of a typical 12-hour working day and that a standard site hoarding, typically 2.4m height will be provided around the perimeter of the construction site for the duration of works. Table 12.11 summarises the construction noise predictions.

Table 12.11: Typical Construction Noise Predictions at Various Distances

Construction Phase	Predicted Construction Noise Level dB $L_{Aeq,12hr}$ at 20m	Predicted Construction Noise Level dB $L_{Aeq,12hr}$ at 30m	Predicted Construction Noise Level dB $L_{Aeq,12hr}$ at 100m
Site Preparation	67	63	50
Foundations	67	63	51
General Construction	69	65	52
Landscaping	66	62	49

With consideration of the site location, the likely construction phase activities, the distances from these works to nearby dwellings and the proposed construction noise criteria (i.e. 65 dB $L_{Aeq,T}$) it is expected that potentially significant noise impacts will be encountered when works are occurring approximately 20 metres or closer to neighbouring dwellings.

Works associated with the site preparation and formulation of building foundations, are likely to be the most significant noise sources, although other general construction works occurring close to the site boundary adjoining neighbouring dwellings also has the potential to generate significant short-term noise impacts.

Noise mitigation measures will therefore be necessary in order to reduce impacts as far as is reasonably practicable. The use of best practicable means (BMP) to control emissions can constitute a ground of defence against charges that a nuisance is being caused. Typical mitigation measures that should be considered are presented in the relevant sections of this document.

Vibration

With consideration of the distance from site boundaries to nearby sensitive receptors, and proposed general methods of construction, it is projected that vibration emissions to nearby receptors will be not significant. Vibration mitigation measures are, however, presented in the relevant sections of this document in order to ensure that construction vibration emissions are adequately controlled.

12.4.2 Operational Phase – Outward Noise Impact

Operational phase outward noise impacts will be long-term and will typically consist of:

- noise from new building services plant;
- increased noise due to additional vehicular traffic on public roads, and;
- car parking on site.

12.4.2.1 Mechanical Services Plant Noise

Any new proposed building services plant shall be designed and specified such that cumulative noise emissions do not exceed the following criteria, at the external façade of existing and/or proposed new noise sensitive locations:

- Daytime/Evening (07:00 to 23:00 hours): 50 dB $L_{Aeq,1hr}$
- Night (23:00 to 07:00 hours): 40 dB $L_{Aeq,15min}$

Plant noise emissions should not contain any characteristics that would warrant any acoustic feature penalties under the BS 4142:2014 assessment procedure.

Adherence to the noise criteria outlined above will ensure that impacts are low, when assessed in accordance with British Standard BS4142:2014+A1: 2019: '*Methods for Rating and Assessing Industrial and Commercial Sound*'.

12.4.2.2 Additional Road Traffic Noise on Public Roads

A traffic impact assessment has been prepared as part of this EIAR. Information provided by the traffic consultant (Julie Tiernan, Technical Director at Punch Consulting Engineers) was provided to RSK and this information has been used to determine the predicted change in noise levels in the vicinity of the adjacent road network along which traffic will travel to and from the site. Traffic data for the following scenarios has been reviewed in preparing this assessment:

- Existing Traffic 2017/2019 (Surveyed Year);
- Future Traffic 2024/2025 (Opening Year of Greenpark Site), and;
- Future Traffic 2039/2040 (Opening Year + 15 Years).

AADT flow data has been used to assess the potential change in noise levels along the adjacent roads between the base year and the scenarios incorporating future site traffic. Changes in road traffic noise on the local road network have been considered using prediction guidance contained within *Calculation of Road Traffic Noise* (CRTN) issued by the Department of Transport in 1988. The future traffic flow data takes account of the proposed development. Tables 12.12 to 12.15 summarise the calculated change in road traffic noise level for the assessment years.

Table 12.12: Assessment of Change in Traffic Noise Levels on Roads Surrounding the Site (AADT: Do Nothing 2024 vs Do Something - Masterplan 2024): Source: Punch Consulting Engineers

Link	AADT Traffic Flows		Predicted Change in noise Level, dB (L_{A10})
	Do Nothing (2024)	Do Something (2024 – Masterplan)	
Dock Road (2024)	27,300	35,700	+1.2

Table 12.13: Assessment of Change in Traffic Noise Levels on Roads Surrounding the Site (AADT: Do Nothing 2039 vs Do Something - Masterplan 2039) Source: Punch Consulting Engineers

Link	AADT Traffic Flows		Predicted Change in noise Level, dB (L_{A10})
	Do Nothing (2039)	Do Something (2039 – Masterplan)	
Dock Road (2039)	29,700	38,000	+1.1

Table 12.14: Assessment of Change in Traffic Noise Levels on Roads Surrounding the Site (AADT: Do Nothing vs Do Something – SHD Only: 2025 & 2040) Source: Punch Consulting Engineers

Link	AADT Traffic Flows		Predicted Change in noise Level, dB (L_{A10})
	Do Nothing	Do Something (SHD Only)	
Greenpark Avenue (2025)	5,500	5,800	+0.2
Greenpark Avenue (2040)	5,900	6,200	+0.2

Table 12.15: Assessment of Change in Traffic Noise Levels on Roads Surrounding the Site (AADT: Do Nothing vs Do Something (Nursing Home Only 2040 & 2039) Source: Punch Consulting Engineers

Link	AADT Traffic Flows		Predicted Change in noise Level, dB (L_{A10})
	Do Nothing	Do Something (Nursing Home Only)	
Log na gCapall (2024)	6,450	6,650	+0.1
Log na gCapall (2039)	5,950	6,150	+0.1

The calculated increase in noise level on the majority of roads is less than 2dB, referring to Table 12.4 confirms that this calculated change in noise level is 'Negligible' and the associated impact is 'Not Significant'.

12.4.2.3 Car Parking on Site

In this instance the majority of car parking will be provided by means of driveway parking at each dwelling. The nature of the car parking facilities will ensure that the impact at noise-sensitive residences both within the development and in the surrounding areas is negligible (increase in noise level less than 3dB). Referring to the magnitude of impacts as described in Table 12.4, it is considered that the change in noise level due to car parking provided by the proposed development will be 'Negligible' and the associated impact will be 'Not Significant'.

12.4.3 Operational Phase – Inward Noise Impact

A Stage 1 noise risk assessment of the proposed site has been conducted in accordance with the guidance outlined in *ProPG Planning and Noise: Professional Practice Guidance on Planning and Noise*, May 2017. The ProPG methodology has been followed in order to provide a risk-based assessment of the suitability of the proposed site for residential development.

Over the course of the baseline noise survey period (1-8 March 2021), the measured noise levels have been compared to the ProPG Noise Risk Assessment Categories (as presented in Figure 12.1).

Table 12.16 presents a summary of the measured daytime (i.e. 07:00 to 23:00) and night-time (i.e. 23:00 to 07:00hrs) noise levels and the associated ProPG Noise Risk Assessment Categories for each period, based upon the data collected at Location N1.

Table 12.16: Summary of ProPG Noise Risk Assessment Categories

Day / Date	Period	Measured Noise Levels (dB $L_{Aeq,T}$)	ProPG Noise Risk Assessment Category (Ref. Figure 12.1)
Mon 1 March 2021	Day / Evening	56	Low Risk
Mon/Tue 1 - 2 March 2021	Night-time	45	Low Risk
Tue 2 March 2021	Day / Evening	48	Low Risk
Tue/Wed 2 - 3 March 2021	Night-time	44	Low Risk
Wed 3 March 2021	Day / Evening	46	Low Risk
Wed/Thu 3 - 4 March 2021	Night-time	42	Low Risk
Thu 4 March 2021	Day / Evening	46	Low Risk
Thu/Fri 4 - 5 March 2021	Night-time	46	Low Risk
Fri 5 March 2021	Day / Evening	51	Low Risk
Fri/Sat 5 - 6 March 2021	Night-time	44	Low Risk
Sat 6 March 2021	Day / Evening	49	Low Risk
Sat/Sun 6 - 7 March 2021	Night-time	39	Low Risk
Sun 7 March 2021	Day / Evening	54	Low Risk
Sun/Mon 7 – 8 March 2021	Night-time	43	Low Risk
Mon 8 March	Day / Evening	54	Low Risk

ProPG also states that a site should not be considered a negligible risk if more than 10 L_{AFmax} events exceed 60 dB during the night period and the site should be considered a high risk if the L_{AFmax} events exceed 80 dB more than 20 times a night.

Figure 12.8 presents the night-time L_{AFmax} values measured over the course of the baseline survey. Reference to the measured values confirms that the site can be categorized Low Risk in terms of maximum night-time noise level events.

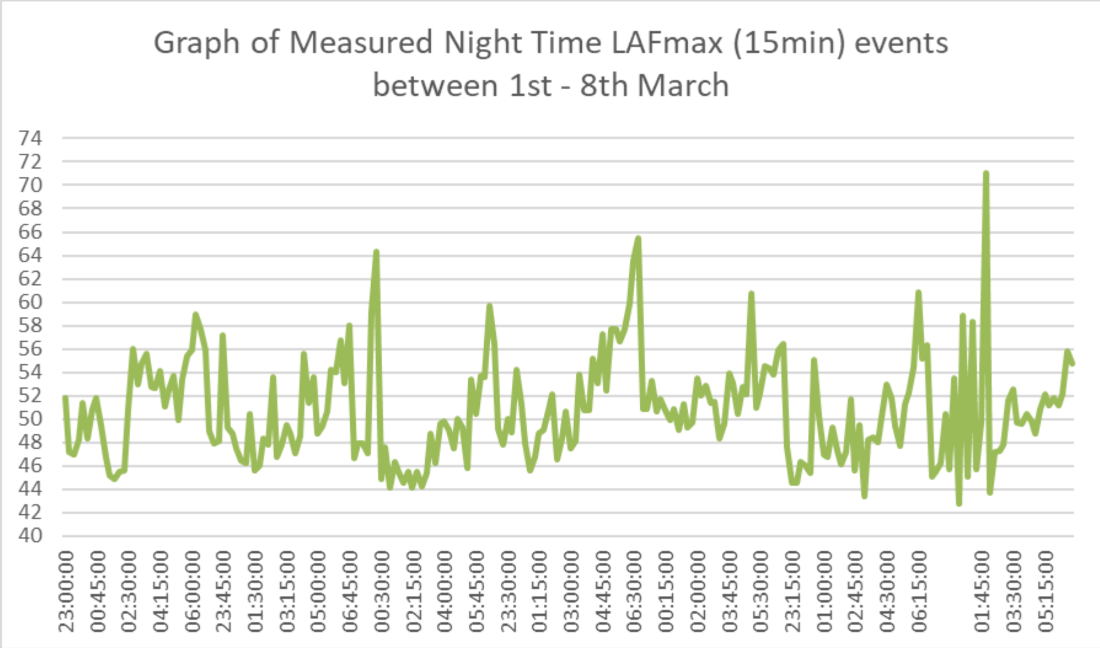

Figure 12.8: Graph of Measured night-time L_{AFmax} values

The above designations are based on the long-term data collected at Location N1. Upon review of the associated sound level difference between the monitoring locations N1 and the monitoring locations N2 to N4, it is expected that similar noise risk designations will be encountered across the extent of the site.

Considering the noise levels presented, the site noise risk assessment has concluded that the site lies within the low noise risk categories. ProPG states the following with respect to low risks areas:

> *"At low noise levels, the site is likely to be acceptable from a noise perspective provided that a good acoustic design process is followed and is demonstrated in an ADS which confirms how the adverse impacts of noise will be mitigated and minimised in the finished development."*

An Acoustic Design Statement (ADS) will be prepared at the detailed design stage of the project outlining in detail the Acoustic Design Process that will ensure compliance with the relevant design guidelines for internal and external amenity areas.

Upon review of nearby TII traffic counters, it is calculated that traffic noise levels along the nearby roads[17] were 2 to 3dB lower than would be encountered pre and post pandemic. The application of these corrections to baseline data would not alter the above conclusion i.e. that *"the site noise risk assessment has concluded that the site lies within the low noise risk categories"*.

[17] M07 Between Jn29 M07/N24 Ballysimon and Jn30 M07/M18/20 Rossbrien, Rossbrien, Co. Limerick, M07 Between Jn29 M07/N24 Ballysimon and Jn30 M07/M18/20 Rossbrien, Rossbrien, Co. Limerick and N18 Between Jn4 Cratloemoyle and Jn5 Cratloe, Cratloe, Co Clare.

12.5 Mitigation Measures

12.5.1 Construction Phase

With regard to construction activities, best practice control measures for noise and vibration from construction sites are found within BS 5228:2009+A1:2014 '*Code of Practice for Noise and Vibration Control on Construction and Open Sites Parts 1 and 2*'. Whist construction noise and vibration impacts are calculated to be within the criteria set out in this document for the majority of the time, the contractor will ensure that all necessary noise and vibration control measures will be used, in order to ensure impacts to nearby residential noise sensitive locations are not significant.

The following mitigation measures are required during the construction of the proposed development:

- Use of a site hoarding, minimum 2.4m height to be erected around the perimeter of the construction site for the duration of works where the distance of works is 30m or less to nearby noise sensitive locations (N_1 in Table 21.1 contained in Chapter 21);

- Limiting the hours of construction to the following (N_2 in Table 21.1):

  Monday to Friday 07.00 – 19.00
  Saturday 07.00 – 13.00

  In exceptional circumstances, and subject to agreement with LCCC, extended hours of operation may be applied for. In such instances an assessment of potential noise impacts shall be carried out in advance of works taking place, and submitted to LCCC, as part of the extended hours request.

- Monitoring levels of noise and vibration during critical periods and at sensitive locations (N_3 in Table 21.1);

- Maintaining site access roads even so as to mitigate the potential for vibration from lorries (N_4 in Table 21.1);

- Selection of plant with low inherent potential for generation of noise and/ or vibration (N_5 in Table 21.1);

- Erection of barriers as necessary around items such as generators or high duty compressors (N_6 in Table 21.1);

- Situate any noisy plant as far away from sensitive properties as is reasonably practicable and the use of vibration isolated support structures where necessary (N_7 in Table 21.1)

- Establishing channels of communication between the contractor/developer, Local Authority and residents (N_8 in Table 21.1), and;

- Appointing a site representative responsible for matters relating to noise and vibration (N_9 in Table 21.1).

12.5.2 Operational Phase

Outward Impact

Noise from new building services plant (N_10 in Table 21.1)

Any proposed new plant shall be designed and specified such that noise emissions do not exceed the following criteria, at the external façade of existing and/or proposed new noise sensitive locations:

- Daytime (07:00 to 23:00 hours) 50dB $L_{Aeq,1hr}$, and;
- Night (23:00 to 07:00 hours) 40dB $L_{Aeq,15min}$.

Where necessary noise mitigation measures shall be installed in order to ensure that the above plant noise limits are not exceeded, such measures may include attenuators to the atmosphere side of supply/extract fans, acoustic barrier screens to chillers/condensers and, where required, acoustic louvres to plantrooms.

Increased noise due to additional vehicular traffic on public roads

During the operational phase of the development, noise mitigation measures with respect to the traffic from the development are not deemed necessary.

Car parking on site

During the operational phase of the development, noise mitigation measures with respect to car parking on site are not deemed necessary.

Inward Impact

Baseline noise surveys have established that the site falls within the low noise risk category, a low noise risk designation indicates that significant noise mitigation measures are not required to control noise ingress into the site.

Based on the noise levels measured on site, a reasonable façade sound insulation performance specification for dwellings, subject to Acoustic Design Statement review, will result in compliance with internal noise level guidelines in the proposed dwellings (N_11 in Table 21.1).

12.6 Residual Effects

12.6.1 Construction Phase

During the construction phase of the project there will be some negative impact on nearby noise sensitive locations due to noise/vibration emissions from construction activity. The implementation of suitable control measures will ensure that the impact is minimized. The residual impact from construction is as follows.

Table 12.17: Construction Phase Residual Noise/Vibration Impacts

Quality	Significance	Duration
Negative	Moderate	Short-term

12.6.1.1 Construction Phase Noise and Human Health

In terms of the noise exposure of construction workers, the Safety, Health and Welfare at Work (General Application) Regulations 2007 (Statutory Instrument No. 299 of 2007) provides guidance in terms of allowable workplace noise exposure levels for employees. The Regulations specify two noise Action Levels at which the employer is legally obliged to reduce the risk of exposure to noise. The appointed contractor will be required to comply with the Regulations and provide appropriate noise exposure mitigation measures where necessary.

The noise exposure level to off-site receptors during the construction phase will be below the lower Action Level and therefore the risk of noise exposure resulting in hearing damage to off-site receptors is not significant.

In terms of construction noise emissions to nearby off-site receptors, provided that noise emissions are controlled to comply with the recommended significance thresholds, as outlined in previous sections, and considering the short-term nature of the works, the potential health impacts associated with construction noise is not significant.

12.6.2 Operational Phase

The anticipated residual impact from the operational phase of the development is summarised as follows.

Table 12.18: Operational Phase Residual Noise/Vibration Impacts

Quality	Significance	Duration
Neutral	Not Significant	Permanent

12.6.2.1 Operational Phase Noise and Human Health

Provided that operational phase outward noise emissions are controlled to comply with the recommended criteria, the potential health impacts associated with operational phase site noise emissions are not significant.

The ProPG Stage 1 Initial Noise Risk Assessment of road traffic on the proposed dwellings has categorized the site as “Low Risk”. The potential health impact of noise from the existing transportation network on the dwelling occupants is therefore not significant.

12.6.3 Worst Case Impact

Should a significant impact occur as a result of either construction or operational phase noise or vibration, the likely outcome would be a loss of amenity resulting in nuisance.
However, based upon the assessments conducted, the worst-case impacts are expected to be **Moderate** for the construction phase, and **Not Significant** for the operational phase.

12.7 Monitoring

12.7.1 Construction Phase

The appointed contractor will be required to monitor levels of noise and vibration during critical construction periods at nearby sensitive locations and/or development site boundaries (N_12 in Table 21.1).

12.7.2 Operational Phase

No additional monitoring is proposed for the operational phase of the proposed development

12.8 Reinstatement

Not applicable.

12.9 Interactions

Noise and vibration interacts with Roads and Traffic and information provided in Chapter 16 (Material Assets – Roads & Traffic) has been used in preparing this EIAR Noise & Vibration Chapter.

12.10 Cumulative Effects

12.10.1 Construction Phase

The phasing/commencement of any other permitted developments in the locality could potentially result in the scenario where a number of other construction sites are in operation at the same time as the proposed development. In particular, it is possible that the proposed development Reg. Ref. 17/1190 ABP-302015-18 , and the proposed nursing home LCCC Reg. Ref. 21/1222 could be under construction at the same time as this proposed development. The location of these proposed development sites in relation to each other and to nearby noise sensitive locations, means that there is minimal risk of cumulative construction noise emissions resulting in an exceedance of the relevant criteria. The same conclusion is likely to be reached in the event that there are other nearby construction sites active at the same time as the sites discussed above.

12.10.2 Operational Phase

The location of the proposed development site in relation to nearby noise sensitive locations and the distance from the proposed development site in relation to other nearby lands means that there is minimal risk of cumulative operational phase noise emissions resulting in an exceedance of the relevant criteria. No additional mitigation measures are therefore required.

12.11 'Do-Nothing' Effect

The existing noise climate will remain unchanged on site and at nearby noise sensitive locations.

12.12 Difficulties Encountered in Compiling the Chapter

Due to the Covid 19 Pandemic, traffic flows were sightly reduced and this may have influenced the baseline noise level data that was collected in March 2021. As such, EPA noise mapping was utilized, in combination with a review of available and historic TII traffic count data for nearby traffic counters, in order to estimate the effect of these reduced traffic flows. Any variation in baseline data was corrected in order to correct for any potential impacts.

There were no other difficulties encountered in the preparation of this document.

13.0 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

13.1 Introduction

Murray and Associates were engaged to complete a Landscape and Visual Impact Assessment for the proposed residential developments, and associated infrastructural works, on lands located within the Greenpark Area of Limerick City.

The report was completed by Jim Bloxam (MLArch, MILI), a Senior Associate Landscape Architect. He holds a master's degree in Landscape Architecture from University College Dublin and is a full corporate member of The Irish Landscape Institute.

The landscape and visual impact assessment of the proposed development is a means of appraising the affect the proposed development would have on the receiving environment in terms of quality of landscape – both physically and visually. The assessment aims to indicate the layout and design of the proposed development which would present the least overall landscape and visual impact.

13.2 Methodology

The assessment has operated in a stepwise refinement method with the identification of effects forming the basis for design of the proposed scheme. Therefore, the methodology has informed and assisted in the design of the proposed development as opposed to being an assessment of a predetermined development. For the purposes of impact assessment, however, the landscape planting will be described under the mitigation measures section and effects with and without this mitigation will be considered as part of the study.

The methodology employed in the landscape and visual impact assessment is as follows:

- Desktop survey of detailed maps, aerial photography and other information relevant to the study area, including the Limerick County Council Development Plan (2010-2016).
- Site survey and photographic survey to determine landscape character of the general study area and specific landscape of the site.
- Assessment of the potential significant impacts of the proposed scheme utilising the plan and elevation drawings of the scheme to determine the main impacting features and the degree to which these elements would be visible in relation to observations made during the field survey. In determining visibility, the views to the proposed development site are considered based on the heights, finishes, design and other visual characteristics of the proposed structures and setting.
- The proposal of a scheme of mitigation measures. These will be defined as measures which will be generally implemented and specific landscape measures which would be site-specific and address particular landscape or visual issues identified.
- An evaluation of the impacts of the scheme with and without amelioration. For the purposes of assessment, the predicted visual effects of the scheme are assumed at 10 years following the completion of the proposed development. This is to allow a professional judgement on visual effects that is based on early mature tree sizes.

Landscape impacts are defined as changes in the fabric, character and quality of the landscape as a result of the development. This includes direct effects on landscape receptors and greater effects that can alter the wider distinctiveness of the landscape. Landscape receptors are the physical or natural resource, special interest or viewer group that will experience an effect. The sensitivity (of a landscape receptor) is the vulnerability to change. The extents of the landscape effects have been assessed by professional evaluation using the terminology defined as per **Tables 13.1, 13.2, 13.3, 13.4, 13.5** and **13.6.**

The terminology is based on the criteria set down in the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, published by the EPA (Draft, August 2017) and with additional guidance from *Guidelines for Landscape and Visual Impact Assessment* (3rd Edition, by The Landscape Institute / Institute of Environmental Assessment published by Routledge, 2013). This chapter also has regard to the *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning & Local Government, 2018),* and *Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact*

Table 13.1: The extent of Landscape Effect

Imperceptible Effects	An effect capable of measurement but without noticeable consequences. There are no noticeable changes to landscape context, character or features.
Not Significant	An effect which causes noticeable changes in the character of the landscape but without noticeable consequences. There are no appreciable changes to landscape context, character or features.
Slight Effects	An effect which causes noticeable changes in the character of the landscape without affecting its sensitivities. There are minor changes over a small proportion of the area or moderate changes in a localised area or changes that are reparable over time.
Moderate Effects	An effect that alters the character of the landscape in a manner that is consistent with existing and emerging trends. There are minor changes over some of the area (up to 30%) or moderate changes in a localised area.
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the landscape. There are notable changes in landscape characteristics over a substantial area (30-50%) or an intensive change over a more limited area
Very Significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment. There are notable changes in landscape characteristics over a substantial area (50-70%) or a very intensive change over a more limited area.
Profound Effects	An effect which obliterates sensitive characteristics. There are notable changes in landscape characteristics over an extensive area (70-100%) or a very intensive change over a more limited area.

Visual effects relate solely to changes in available views of the landscape and the effects of those changes on people viewing the landscape. They include the direct effect on views of the development, the potential reaction of viewers, their location and number and the effect on visual amenity. The intensity of the visual effects is assessed by professional evaluation using the terminology defined as per **Tables 13.2 – 13.6** below:

Table 13.2: The extent of Visual Effect

Imperceptible Effects	There are no changes to views in the visual landscape.
Not Significant	An effect which causes noticeable changes in the character of the visual environment but without noticeable consequences. The proposal is adequately screened due to the existing landform, vegetation or constructed features.
Slight Effects	An effect which causes noticeable changes in the character of the visual environment without affecting its sensitivities. The affected view forms only a small element in the overall visual composition, or changes the view in a marginal manner.
Moderate Effects	An effect that alters the character of the visual environment in a manner that is consistent with existing and emerging trends. The proposal affects an appreciable segment of the overall visual composition, or there is an intrusion in the foreground of a view.
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the visual environment. The proposal affects a large proportion of the overall visual composition, or views are so affected that they form a new element in the physical landscape.
Very Significant Effects	An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the visual environment. The proposal affects the majority of the overall visual composition, or views are so affected that they form a new element in the physical landscape.
Profound Effects	An effect which obliterates sensitive characteristics. The view is entirely altered, obscured or affected.

Table 13.3: The Quality of the Landscape & Visual Effect

Neutral Effect	Neither detracts from nor enhances the landscape of the receiving environment or view
Positive Effect	Improves or enhances the landscape of the receiving environment or a particular view
Negative Effect	Detracts from the quality of the landscape or view

Table 13.4: The Duration of the Landscape & Visual Effects

Momentary	Effects lasting from seconds to minutes
Brief	Effects lasting less than a day
Temporary	Effects lasting one year or less
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

Please note: "Momentary" and "Brief" Effects as defined in the Draft EPA Guidelines (August 2017) are not considered relevant to landscape & visual assessment as effects of such short duration are extremely unlikely to generate appreciable effects.

Table 13.5: The Extent and Context of Effects

Extent	Describes the size of the area, the number of sites and the proportion of a population affected by an effect
Context	Describes whether the extent, duration or frequency conforms or contrasts with established conditions

Table 13.6: The Probability of Effects

Likely Effects	Effects that can be reasonably expected to occur if all mitigation measures are properly implemented.
Unlikely Effects	Effects that can be reasonably expected not to occur if all mitigation measures are properly implemented.

The landscape and visual assessment methodology will be utilised in conjunction with a professional evaluation of the proposed development to determine the likely significant effects of the project and the degree of effect.

The term 'study area' as used in this report refers to the site itself and its wider landscape context in the study of the physical landscape and landscape character. This may extend for approximately 1km in all directions from the site in order to achieve an understanding of the overall landscape. In terms of the visual assessment, the study of visual amenity may extend outside the study area, from areas where views of the site are available, but the majority of visual effects for a development of this nature would be most significant within 100m.

The assessment has operated in a stepwise refinement method with the identification of effects forming the basis for the design of the proposed scheme. Therefore, the methodology has informed and assisted in the design of the proposed development as opposed to being an assessment of a predetermined development.

The significance of effects can be measured as a function of the magnitude of change (i.e. the degree of change from the baseline) and the sensitivity of the receptor. **Table 13.7** below acts as a guide for the assessor in combining these assessment criteria. It is important to note that the assessor's professional judgement, common sense and experience are also factors in ascribing rational judgements for the significance of effects.

Table 13.7: Level of Impact resulting from a combination of Sensitivity Rating & Magnitude of Change

	Magnitude of Change				
Sensitivity	Very High	High	Medium	Low	No appreciable change
Very High (IV)	Profound	Very Significant	Significant	Moderate	Slight
High (III)	Very Significant	Significant	Significant	Moderate	Slight
Medium (II)	Significant	Significant	Moderate	Slight	Not Significant
Low (I)	Moderate	Moderate	Slight	Not Significant	Imperceptible
No sensitivity	Slight	Slight	Not Significant	Imperceptible	Imperceptible

13.3 Significance & Sensitivity of the Local Landscape and Visual Amenities

In landscape and visual assessments, one of the key factors is the sensitivity of a landscape to change, where the proposed development will inevitably result in adding a new element to the landscape. The publication *Guidelines for Landscape and Visual Impact Assessment* (2013) defines sensitivity as: *"A term applied to specific receptors, combining judgments of the susceptibility of the receptor to the specific type of change or development proposed and the value related to that receptor."*

Sensitivity refers to the inherent sensitivity to change of the landscape resource, as well as the visual sensitivity in terms of views, visibility, number and nature of viewers and scope to mitigate visual impact.

During the initial research and evaluation, a typology was developed based on the fieldwork and research into the site. These categories will help to identify the sensitivity of the existing receptors.

For the purpose of the evaluation, four baseline evaluation categories shall be used with respect to sensitivity:

- Very high (IV) – most important, most sensitive area;
- High (III);
- Medium (II); and
- Low (I) – least sensitive area.

The baseline evaluations shall be based on: -

- Legally-defined protected categories (e.g. European-protected sites, national monuments);
- Specific designations (such as those in Development Plans);
- Particularly sensitive and protection-worthy areas identified through the analysis of existing available data and site surveys.

The baseline evaluation conditions are listed in the following **Tables 13.8** and **13.9.**

Table 13.8: Baseline Evaluation – Sensitivity of Landscape Receptor*

Landscape Receptor	Category
Designated Landscapes (SPA, cSAC, pNHA, etc.) National / Regional / District Parks / Public Amenity Areas Riparian landscapes Significant trees (Tree Preservation Order or Co. Dev. Plan designation) 'Champion' trees (Tree Council of Ireland designation) Areas of Scenic Beauty as described in CDP Historic Designed Landscape associated with listed building (e.g. Demesne) with intact, mature landscape	IV (Very High)
Local Parks / Amenity facilities e.g. walking routes Townscape / Streetscape (good quality, e.g. Architectural Conservation Areas) Landscape features with significant merit – walls, structures, entrances, mature tree-lined avenues, etc. Deciduous woodland Rural Landscape of high quality with distinctive features or field patterns Traditional Stone Walls	III (High)
Rural Landscape (typical field patterns, hedgerows) Trees / Hedgerows (not designated) Coniferous woodland	II (Medium)
Infrastructural / Unmanaged landscape Waste ground	I (Low)
A low-quality landscape, e.g. Industrial landscape, etc.	Not sensitive

** Developed by Murray and Associates for the proposed development with reference to fieldwork and research, and with reference to Transport Infrastructure Ireland Publication no. PE-ENV-01101, published December 2020: Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Specified Infrastructure Projects - Overarching Technical Document (specifically Table 5 Rating of Landscape Significance / Sensitivity - example evaluation criteria for baseline categorisation of landscape / townscape / seascape significance and sensitivity)*

Table 13.9: Baseline Evaluations – Sensitivity of Visual Receptors **

Visual Receptor	Category
Listed Views/Viewshed in Relevant Planning Documents Views from Key Public Urban Spaces and Parks, Good quality / extensive views from listed buildings or spaces, within 50m	IV (Very High)
Local receptors within 100m of the site (residential properties, nursing homes, residential care units, schools, cemeteries, tourist accommodation, tourist facilities, parks) with direct views of the development Publicly accessible viewpoints identified in the study with high-quality views or within a high-quality visual environment.	III (High)
Local receptors within 100m of the site with oblique or compromised views of the development, or more than 100m from the site with existing high-quality views, or from a primary pedestrian route. Existing views from elevated viewpoints, within 1.5 km	II (Medium)
Local Receptors with oblique/limited views from over 100m People travelling through the area.	I (Low)
People working in the area.	Not sensitive

*** Developed by Murray and Associates for the proposed development with reference to fieldwork and research, and with reference to Transport Infrastructure Ireland Publication no. PE-ENV-01101, published December 2020: Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Specified Infrastructure Projects - Overarching Technical Document (specifically Table 6 Rating of Visual Significance/Sensitivity - example evaluation criteria for baseline categorisation of visual significance and sensitivity)*

13.4 Baseline Environment

Immediate Site Characteristics:

The site is located within the planning boundaries of the Limerick City Development Plan (2010-2016). The subject site is located to the south of the Dock Road, to the east of the existing Greyhound Stadium. Under the land-use zoning objectives the subject lands are defined as 'R2' – 'Residential'., as are lands to the immediate north. Lands to the north-west are zoned 'C6' - Mixed/general commercial/industrial/enterprise uses.

There are residential land uses in the wider contextual area. Lands to the north and west are established residential areas, with a mixture of older one-off housing and newer apartment developments.

The closest dwellings are located in the Log Na gCapall residential development, immediately adjacent to the southeast, at approximately 25 metres from the site.

Other dwellings lie further to the, east, north-east and north. These dwellings range from some 60m to the east to over 500 metres further north.

The site is currently accessed via the road leading to the existing existing Greyhound Stadium, and then by a small vehicular track leading south-east.

Other features of note include The Ballynaclogh River, situated to the south-west, and the large arterial route of the N18.
The site itself forms part of the old Greenpark Racecourse, closed in circa 1999, and is currently unmanaged grassland with colonising stands of vegetation. A large portion of the southern area of the site sits on the demolished racecourse grandstand and ancillary buildings. The northern portion of the site sits over the old grass racetrack. Within the site some copses of immature vegetation have appeared since 2006 when the grandstand and ancillary buildings were demolished, and the Log Na gCapall development was extended to the west.

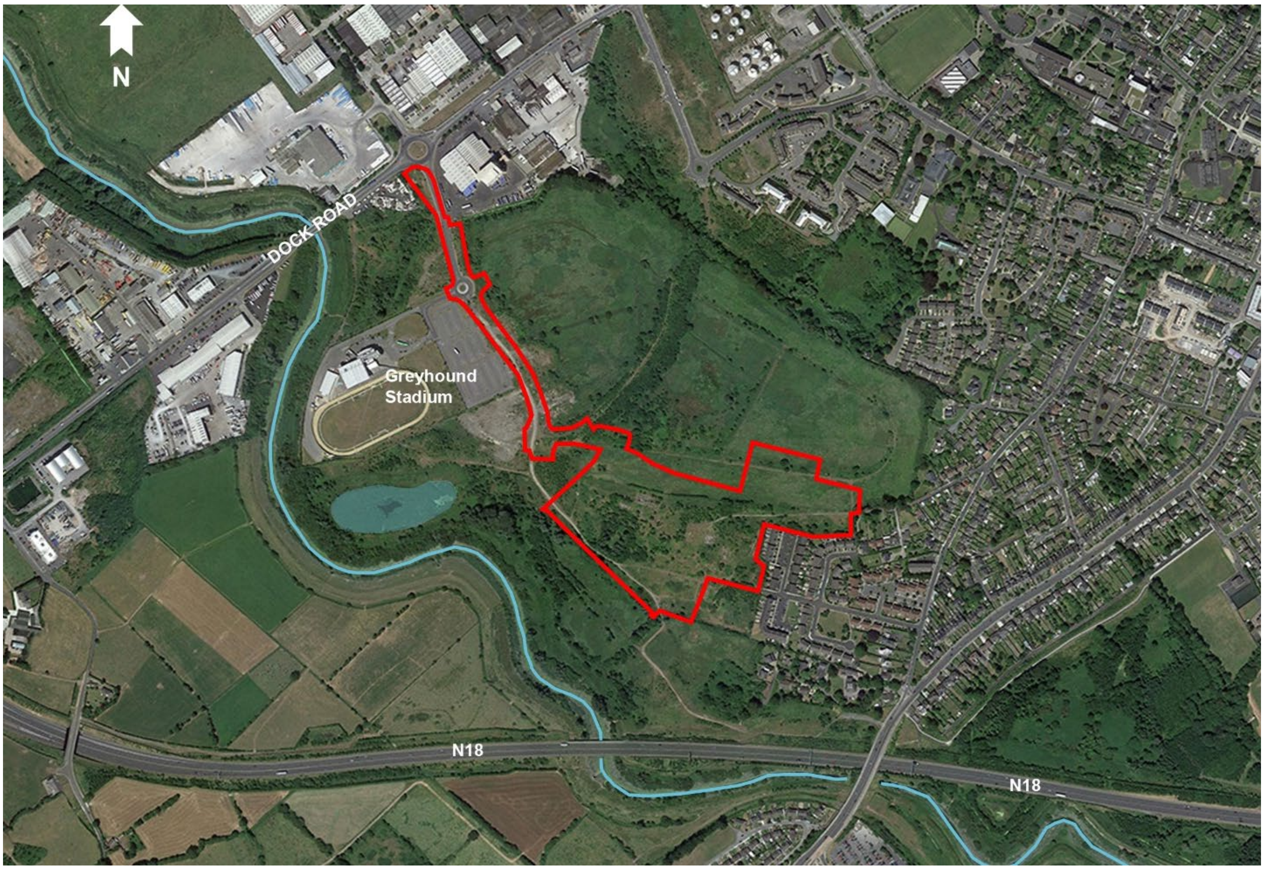

Figure 13.1: Site Location Map

Broader Site Characteristics:

Limerick City lies some 2km to the north-east; the land uses between the city and the site are composed of a variety of typical edge of city uses, including commercial, residential, office and retail. Generally, the majority of land uses are residential estates in this area.

The Shannon River is approximately 1.1km to the north-west. The land between the site and the Shannon is mainly commercial and light industrial developments to the north of the Dock Road.
To the west lie agricultural lands and the cement factory at a distance of approximately 2km.

Some 300 metres to the south, the landscape is bisected by the N18. Beyond this lies further agricultural lands and the Crescent shopping centre, surrounded by low-density suburban housing.

13.5 Sensitivity of Landscape

In landscape terms this site is categorised as being within the Limerick City Council Administrative Area and is not included in any other Landscape Character Assessment designations. There are no protected views or prospects and no Tree Preservation Orders within the site. Furthermore, the site is zoned for development within the Development Plan.

Within the site the ecological assessment has identified some habitats as being of Local Importance (ranging from a lower to a higher value).

There are no Natura 2000 Protected Areas or nationally designated NHA or pNHA within the site.

However, the Lower Shannon SAC (002165), running along the Ballynaclogh River, is some 60 metres to the south-west of the site. The River Shannon and River Fergus Estuaries SPA is approximately 130 metres to the north-west of the site, while the Inner Shannon Est. - South Shore pNHA is 110m distance and the Fergus Est. & Inner Shannon - North Shore pNHA is some 590m distance.

The adjacency of the Lower Shannon SAC and the on-site habitats of Local Importance have an impact on the sensitivity of the landscape within the site, which would generally be considered medium. This assessment is tempered by the residential zoning designation as per the limerick City and County Development Plan. This would be characterised as areas with the capacity to generally accommodate a wide range of uses without significant adverse effects on the appearance or character of the area.

13.6 Visual Sensitivity

Visual receptors have greater potential sensitivity to change in the landscape. This sensitivity is reduced by the following existing factors:

- The distances from the site to some of the visual receptors is relatively large and therefore the sensitivity is accordingly diminished.
- Most views from residential dwellings appear to be from 1st floor windows. This results in lower sensitivity as these rooms are potentially un-occupied during daylight hours. However, some duplex units within the Log Na gCapall development are adjacent to the site, whose first floor windows are generally living areas. The sensitivity of these dwellings would be considered to be medium.
- There are visual barriers for many of the receptors, including fencing, existing hedgerows/trees, tree planting, etc.

Sensitivity of views is also mitigated by the residential zoning designation of the lands. Sensitivity of visual receptors is therefore considered to be mainly low. Sensitivity is occasionally moderate/significant for residential receptors that are adjacent to the proposed site with direct views of the proposed development.

13.7 Potential Viewpoints

Viewpoints in LVIA

1) Dwellings to proposed entrance from Dock Road (530m)
2) Apartments adjacent to Alandale Square (440m)
3) Apartments to south of Alandale Hall (500m)
4) Dwellings to Castlewell estate (260m)
5) Dwellings to Greenpark Gardens (160m)
6) Dwellings to South Circular Road (150m)
7) Dwellings to Greenpark Avenue (60m)
8) Dwelling to north of Log Na gCapall estate (45m)
9) Dwellings to west of Log Na gCapell estate - 2 (85m)
10) Dwellings to west of Log Na gCapell estate - 1 (25m)
11) Dwellings to west of Ballinacurra Close (150m)
12) Road users of N18 (270-700m)

Figure 13.2: Potential Viewpoints Location Map

The following viewpoints have aggregated separate visual receptors into distinct groups with similar sensitivity and geographic location. The distances stated are approximate and are to the nearest point of the proposed site.

(VP1) Dwellings to proposed entrance from Dock Road (530m): These single storey dwellings are c. 530 metres from the site. Significant shelter belt planting of trees and vegetation associated screening towards the site, resulting in limited/oblique, low sensitivity views from this location.

(VP2) Apartments adjacent to Alandale Square (440m)
and
(VP3) Apartments to south of Alandale Hall (500m)
Several dwellings within a relatively new development comprising of 3 – 4 storey apartments. The dwellings have mature hedgerows to the boundary of each property and hedgerows to the west of the lane. Direct views to the site occur from the outside edge of the dwellings facing south. Views to the site look over the existing field system comprised of open grassland with colonising vegetation. A row of existing mature Monterey Cypress running east/west gives an element of screening into the site. Due to the distance from the proposed site and the interceding tree vegetation, limited and low sensitivity views exist.

(VP4) Dwellings to Castlewell estate (260m)
These several two storey dwellings are at 260 metres from the site. Views to the site are mainly from upper windows and look over the existing field system compromised of open grassland with a tree belt on the boundary of the estate. Due to the distance and interceding vegetation, limited and low sensitivity views exist through the hedgerows and trees towards the existing site.

(VP5) Dwellings to Greenpark Gardens (160m)
These dwellings are c. 160 metres from the site. Mature garden trees and hedgerows in the property boundaries screen the views to the west. Views are generally oblique towards the site and have a backdrop of the existing Log Na gCapall development, therefore, these views are generally considered to be low to medium sensitivity.

(VP6) Dwellings to South Circular Road (150m): These two-storey dwellings face onto the South Circular Road and are c. 60 metres from the proposed site. Views to the site are from the rear of the properties. Low/medium sensitivity due to interceding vegetation with adjacency to the site.

(VP7) Dwellings to Greenpark Avenue (60m): A row of single storey dwellings with dense vegetative cover to the north, c. 60 metres from the site. Limited and low to moderate sensitivity views exist through to the site, from the periphery of the private amenity space.

(VP8) Dwelling to north of Log Na gCapall estate (25m):
The rear upper floors of these two storey dwellings face directly onto the proposed development. Main views from living areas will be partially screened by property boundaries. Due to the proximity of the development, there are moderate/high sensitivity views towards the site.

(VP9) Dwellings to west of Log Na gCapall estate - 2 (85m): Situated c. 85 metres from the site. These 3 storey duplex units have direct views from rear upper storey windows. Due to the proximity of the site the visual sensitivity is considered to be medium/high.

(VP10) Dwellings to west of Log Na gCapall estate - 1 (45m):
These dwellings are c.35 from any proposed development and abut the site boundary at approximately 7.5m. Views to the site are from upper rear windows. Moderate/high sensitivity views exist towards the site due to the proximity.
To note, for viewpoints 8, 9 and 10, the proposed development is somewhat lower than the existing Log Na gCapall development which will have an impact on the assessment.

(VP11) Dwellings to west of Ballinacurra Close (150m) These two residential dwellings are c.150 metres from the site. Oblique north-western views are present towards the site, mainly from first floor windows. Ground floor views would mainly be obscured by boundary treatments and garden vegetation, resulting in low sensitivity views from this location.

(VP12) Road users of N18 (270-700m): Existing vegetation associated with the roadway screens the site from the road to some degree. The site is further screened to the east of the Ballynaclogh River with roadside fencing. The sensitivity of these views is considered low due to the passing nature of the views from vehicles at speed and due to the current zoning designation of the surrounding lands.

13.5 Potential Effects of the Proposed Project

The potential impacts are the impacts that the development could have without consideration of landscape mitigation or amelioration – i.e. without landscape works. For the sake of clarity these shall be considered under the following headings: Landscape Impacts and Visual Impacts.

These impacts are considered under the following headings:

- short-term impacts (construction phase up to five years);
- short-term impacts (operation phase up to seven years);
- medium-term impacts (operation phase, seven to fifteen years) and
- long-term impacts (operation phase up to fifteen years to sixty years).

These effects have been compiled to identify any areas where the proposed development may be injurious to the scenic and visual character of the area and represent the potential impact rather than the eventual long-term effect. For this section, it is assumed that no specific landscape works are carried out with the construction of the development and that the open spaces are as existing i.e. grassed areas. This enables recognition of potential, rather than actual, impacts which facilitates the identification of suitable landscape mitigation measures.

Construction Phase

Landscape:

This landscape will undergo a change from that of an area of agricultural fields to a large construction site. This results in a very significant magnitude of change in the landscape.

There will be significantly negative impacts on the landscape associated with the construction works of this development. This will be due to the site clearance and the building processes required to erect the proposed development and associated works.

Visual:

Visual impacts during construction will affect all sensitive receptors identified in section 13.7 above and listed in **Table 13.10** below. This is due to construction activities, vehicles, structures, etc.

Table 13.10: Summary of Construction Phase Likely Significant Effects without Mitigation

View	Quality	Significance	Magnitude	Probability	Duration	Sensitivity
VP1	Negative	Not Significant	Low	Likely	Short-Term	Low
VP2	Negative	Not Significant	Low	Likely	Short-Term	Low
VP3	Negative	Not Significant	Low	Likely	Short-Term	Low
VP4	Negative	Not Significant	Low	Likely	Short-Term	Low
VP5	Negative	Not Significant	Low	Likely	Short-Term	Low
VP6	Negative	Not Significant	Low	Likely	Short-Term	Low
VP7	Negative	Not Significant	Low	Likely	Short-Term	Low/Moderate
VP8	Negative	Significant	Medium	Likely	Short-Term	Moderate/High
VP9	Negative	Moderate	Medium	Likely	Short-Term	Moderate/high
VP10	Negative	Significant	Medium	Likely	Short-Term	Moderate/High
VP11	Negative	Slight	Low	Likely	Short-Term	Low
VP12	Negative	Not Significant	Low	Likely	Short-Term	Low

Operational Phase

Landscape:

Short-term landscape impacts after the construction works (up to seven years)

Following construction, the main landscape impacts of the proposed development are associated with the change in land use from agricultural lands of medium sensitivity to a more intensified, residential use, as specified in the Limerick City and County Council zoning designation. This is considered to be a moderately negative impact, as the existing landscape is of medium sensitivity.

This short-term impact is likely to persist into the medium and long term in the absence of mitigation measures.

Visual:

This section should be read in conjunction with the photomontages prepared by Digital Dimensions and included under separate cover.

(VP1) Dwellings to proposed entrance from Dock Road (530m): These single storey dwellings are c. 530 metres from the site. Significant shelter belt planting of trees and vegetation associated screening towards the site. Due to the distance from the site and the interceding vegetation, the proposed development will have an imperceptibly negative effect on views.

(VP2) Apartments adjacent to Alandale Square (440m)
and
(VP3) Apartments to south of Alandale Hall (500m)

Several dwellings within a relatively new development comprising of 3 – 4 storey apartments and. The dwellings have mature hedgerows to the boundary of each property and hedgerows to the west of the lane. Direct views to the site occur from the outside edge of the dwellings facing south. Views to the site look over the existing field system comprised of open grassland with colonising vegetation. A row of existing mature Monterey Cypress running east/west gives an element of screening into the site. Due to the distance from the proposed site and the interceding tree vegetation, not significantly negative effects will occur on views.

(VP4) Dwellings to Castlewell estate (260m) These several two storey dwellings are at 260 metres from the site. Views to the site are mainly from upper windows and look over the existing field system compromised of open grassland with a tree belt on the boundary of the estate. Due to the distance from the site, interceding vegetation and boundaries, and the oblique nature of the views, the proposed development will have a not significantly negative effect on views.

(VP5) Dwellings to Greenpark Gardens (160m): These dwellings are c. 160 metres from the site. Mature garden trees and hedgerows in the property boundaries partially screen the views to the west. Views are generally oblique towards the site and have a backdrop of the existing Log Na gCapall development within the views. Therefore, the proposed development will have a slightly to not significantly negative effect on views.

(VP6) Dwellings to South Circular Road (150m): These two-storey dwellings face onto the South Circular Road and are c. 150 metres from the proposed site. Views to the site are from the upper floors to the rear of the properties. Interceding boundaries and vegetation means that the proposed development will have a not significantly negative effect on views towards the site.

(VP7) Dwellings to Greenpark Avenue (60-90m): A row of single storey dwellings with dense vegetative cover to the north, c. 60-90 metres from the site. Views to the proposed development are oblique and from upper storey windows. Interceding boundaries and vegetation also contribute towards screening. For this reason, the proposed development will have a not significantly negative effect on views.

(To note, for viewpoints 8, 9 and 10, the proposed development is somewhat lower than the existing Log Na gCapall development which has a mitigating effect on the assessment.)

(VP8) Dwellings to north of Log Na gCapall estate (25m):
The rear upper floors of these two storey dwellings face directly onto the proposed development. Main views from living areas will be partially screened by property boundaries. Due to the proximity of the development, the proposed development will have a moderately negative effect on view.

(VP9) Dwellings to west of Log Na gCapall estate - 2 (85m): Situated c. 85 metres from the site. These 3 storey duplex units have oblique views from rear windows. Due to the oblique nature of the views and the distance from the proposed development, the effect on views will be moderately negative.

(VP10) Dwellings to west of Log Na gCapall estate - 1 (45m):
These dwellings are c.35 metres from any proposed development and abut the site boundary at approximately 7.5m. The living areas of the duplex units face directly onto the proposed development. Due to this proximity the effect on views of the development these duplex units will be significantly negative. The proposed development will have a moderately negative effect on views from the dwellings at ground level will be due to existing boundaries to these properties.

(VP11) Dwellings to west of Ballinacurra Close (150m) These two residential dwellings are c.150 metres from the site. Oblique north-western views are present towards the site, mainly from first floor windows. Ground floor views would mainly be obscured by boundary treatments and garden vegetation. For these reasons the proposed development will have a slightly negative effect on views.

(VP12) Road users of N18 (270-700m): Existing vegetation associated with the roadway screens the site from the road to some degree. The site is further screened to the east of the Ballynaclogh River with roadside fencing. The sensitivity of these views is considered low due to the passing nature of the views from vehicles at speed and due to the current zoning designation of the surrounding lands. Therefore, the proposed development will have a not significantly negative effect on views.

13.6 Mitigation Measures

The following recommendations are put forward to mitigate against the negative impacts mentioned above and to reinforce the positive impacts of the proposed development. Mitigation measures are proposed and considered only on the lands of the subject site.

Construction Phase

During the construction phase, site hoarding will be erected to restrict views of the site during construction. Hours of construction activity will also be restricted in accordance with local authority guidance. Tree protection measures will be installed to the existing trees and hedges identified on site (LV_1 in Table 21.1 contained in Chapter 21).

Operational Phase

The primary proposed ameliorative, remedial or reductive measures can be seen on Murray and Associates Drawing No. 1835_PL_P_01 and are as follows:

- Planting of native trees and shrubs on raised berms to the proposed roadway leading from Dock Road. This treatment will screen the traffic and associated roadway elements from the potential viewpoints, creating an attractive immediate buffer to the visual environment. softening and screening the development over time (LV_2 in Table 21.1).
- Native trees, shrubs and wildflowers will be used where possible throughout the development, particularly in the buffer spaces surrounding the development site. Where native planting is not specified, planting has reference to the All-Ireland Pollinator Plan (LV_3 in Table 21.1).

- Where possible, screening of proposed structures with tree lines and woodland planting is proposed (LV_4 in Table 21.1).
- Mitigation measures are shown on the submitted landscape drawings. At time of planting, the proposed standard trees in the landscaped buffer zones will be at least 3.0m in height. The trees will reach a mature height of at least 7 to 15 metres, dependant on species within the medium term (LV_5 in Table 21.1).

13.7 Residual Effects

Construction Phase

Anticipated residual effects will be as per **Table 13.10** due to the short-term nature of the construction process and the proposed height of the structure.

Operational Phase – Landscape

Short-term landscape impacts after the construction works (up to seven years)

Following construction, the main landscape impacts of the proposed development are associated with the change in land use from agricultural lands of low sensitivity to a more intensified, residential use, as specified in the Limerick City and County Council zoning designation. This is considered to be a moderately negative impact, as the existing landscape is of medium sensitivity.

Medium-term landscape impacts (seven to twenty years)

As the existing planting matures on site there will be a slight positive impact upon the subject site. However, the potential cumulative effect of future development of the lands at Greenpark by others, in line with the permitted development to the north-east and future development of lands to the north and south, would result in further development on existing agricultural land. This could result in a significantly negative impact, due to potential loss of trees and associated hedgerows and their associated landscape value.

*Long-term landscape impacts (over twenty years***)**

Maturing trees and hedgerows will further integrate the proposed development into the existing landscape, resulting in a long term slightly negative impact on the landscape.

Operational Phase - Visual

Due to the distance from the proposed development and interceding existing vegetation and boundary treatments, negative effects on views will not be significant for receptors 2, 3, 4, 5, 6 and 7.

Receptor 8 is the closest to the proposed development. The proposed development is at a lower level (approximately 1.2m to 1.7m) than the existing dwellings in Log Na gCapall, but is still visible. Views cannot be mitigated in this location due to the proposed dwellings rear

gardens being directly adjacent to the site boundary. Therefore, this view will continue to experience moderately negative effects on their views due to the proximity of the site.
The duplex units within the Receptor 10 view will experience a change from significantly negative to moderately negative effects on their views due to the screening belt of semi-mature trees proposed within the site directly at the boundary with the existing development. The proposed development will have a slightly negative effect on views from the dwellings at ground level. This is due to existing boundaries to these properties.

The duplex units within the Receptor 9 view will experience change from moderately negative to slightly negative effects on their views. This is due to the proposed tree planting within the adjacent open space adding an element of screening to the development.

The receptors at Viewpoint 11 will benefit from proposed screening within the open space of the proposed development. This gives a change from a slightly negative to a not significantly negative residual effect on views towards the site.

The view of the receptors at Viewpoint 1, at the Dock Road entrance, will change from not significantly negative to imperceptibly negative, due to the inclusion of a raised berm with planting and dense woodland that will screen their views

Table 13.11: Summary of Operational Phase Likely Significant Effects with Mitigation

View	Quality	Significance	Magnitude	Probability	Duration	Sensitivity
VP1	Negative	Imperceptible	Low	Likely	Long-Term	Low
VP2	Negative	Not Significant	Low	Likely	Long-Term	Low
VP3	Negative	Not Significant	Low	Likely	Long-Term	Low
VP4	Negative	Not Significant	Low	Likely	Long-Term	Low
VP5	Negative	Not Significant	Low	Likely	Long-Term	Low
VP6	Negative	Not Significant	Low	Likely	Long-Term	Low
VP7	Negative	Not Significant	Low	Likely	Long-Term	Low/Moderate
VP8	Negative	Moderate	Medium	Likely	Long-Term	Moderate/High
VP9	Negative	Moderate	Medium	Likely	Long-Term	Moderate/high
VP10	Negative	Moderate	Medium	Likely	Long-Term	Moderate/High
VP11	Negative	Slight	Low	Likely	Long-Term	Low
VP12	Negative	Not Significant	Low	Likely	Long-Term	Low

13.8 Monitoring

Construction Phase

Landscape tender drawings and specifications will be produced to ensure that the landscape work is implemented in accordance with best practice. This document will include tree work procedures, soil handling, planting and maintenance. The contract works will be supervised by a suitably qualified landscape architect (LV_6 in Table 21.1).

The planting works will be undertaken in the planting season after completion of the main civil engineering and building work (LV_7 in Table 21.1).

Operational Phase

This will consist of weed control, replacement planting, pruning etc. All landscape works will be in an establishment phase for the initial three years from planting. A landscape management plan accompanies the planning application. Prior to completion of the landscape works, a competent landscape contractor should be engaged and a detailed maintenance plan, scope of operation and methodology be in place (LV_8 in Table 21.1).

13.9 Interactions

The assessment of the landscape impacts associated with the proposed development has several interactions with other parameters of the assessment. In summary, these are as follows:

- Population and Human Health
- Biodiversity

The interactions of landscape with these parameters were as follows:

- Population and Human Health

The landscape and visual impact associated with human beings focuses on the effects to dwellings. The proposed development generates visual effects; the effects and associated amelioration and mitigation of these effects is discussed in the impact sections of the report at 13.6 and 13.7.

- Biodiversity

The long-term effects of the proposed development will have a positive effect on the tree cover associated with the development and the inclusion of native species of shrub planting.

13.10 Cumulative Effects

There are two current projects immediately adjacent to the site that will have likely significant effects on views. There is a current proposal in the process of planning for a nursing home to the immediate south of the site adjacent to viewpoint 9 (LCCC Reg. Ref. 21/1222), and a recently permitted residential scheme of 30 no. units to the north-east of the proposed development (*Reg. Ref. 17/1190 ABP-302015-18*).

Further development proposals may occur in line with the zoning designations within the Greenpark lands as per the current Limerick City and County Council Development Plan.

Any further development within the vicinity of the proposed lands could have the possibility of impacting on the same sensitive receptors as identified above. This could lead to potential impacts of a slightly higher level of significance on the identified receptors when assessed cumulatively. These future developments will have further impact on the named receptors above that cannot, at this stage, be fully quantified. The most likely of these potential impacts will be loss of vegetation and an impact on views.

13.11 'Do-Nothing' Effect

The do-nothing impact refers to the non-implementation of the proposed development. The primary effect of this would be that the impacts and effects identified would not directly occur. In this regard the following issues are relevant.

The current land use of the subject site is not a land use which is likely to persist in the longer term due to the current zoning within the Development Plan. This envisages a considerable development for the land in the proposed development area.

In the event that the development does not proceed it is likely that the subject site would be developed in the future for some residential and open space use in line with its zoning. If the site is left in its current state, the management, or lack thereof, will be likely to continue in its current manner and hence a neutral impact will persist on the existing landscape.

14.0 CULTURAL HERITAGE, ARCHAEOLOGY AND ARCHITECTURAL

14.1 Introduction

This chapter provides an assessment of the proposed development and its impact on the receiving cultural heritage, archaeological, and architectural environment. Its primary aim is to assess the likely impact that the proposed development will have on this environment, and to provide suitable mitigation measures to safeguard any monuments, features and finds which may be of cultural heritage merit within the subject site or in its immediate vicinity. For the purposes of this assessment the proposed development was inspected by Frank Coyne of Aegis Archaeology Limited on 8 April 2021. Frank Coyne, Aegis Archaeology Limited prepared this chapter and an Archaeological, Architectural and Cultural Heritage Impact Assessment.

14.2 Methodology

For the purpose of setting the proposed development within its wider archaeological and architecture and cultural heritage landscape, and to assess the potential impact arising from same, a desktop assessment of available archaeological, historical and cartographic sources was undertaken which was supplemented by a field inspection. The desktop study employed a range of archival and documentary sources; the principal sources consulted being as follows:

- National Monuments, Preservation Orders and Register of Historic Monuments for Limerick City;
- The Record of Monuments and Places (RMP);
- The Sites and Monuments Record (SMR);
- Topographical files of the National Museum of Ireland;
- Catalogue of Limerick Municipal Museum;
- Limerick City Development Plan 2010–2016 (as extended);
- The Record of Protected Structures for Limerick City;
- The Architectural Conservation Areas for Limerick City;
- National Inventory of Architectural Heritage;
- Ordnance survey mapping, current and historic;
- Ordnance survey aerial photography, current and historic;
- Griffith's Valuation;
- Excavations database (1970–2021); and,
- Other published and unpublished sources.

A detailed field inspection was undertaken in order to identify any unrecorded cultural heritage remains within the receiving environment. Regard has been given to the planned nursing home development (LCCC Reg. Ref. 21/1222) from an accumulative perspective (see section 14.10 below) and to the grant of permission for adjacent development Ref. 17/1190 ABP-302015-18. No other archaeological investigations such as geophysical survey or archaeological test trenching were undertaken. The entire study methodology is guided by a legislative framework, standards and guidance that governs how aspects of archaeological, cultural and architectural heritage are protected. A list is provided in the Archaeological Architectural and Cultural Heritage Assessment enclosed with this planning application, (annexes 1,2, and 3 of that report).

14.3 Baseline Environment

The paper study which forms part of the assessment was carried prior to the field inspection on 8 April 2021. All available historical and archaeological documentation was consulted: the sites and monuments record; the record of monuments and places; early mapping for the subject site including heritage maps; a variety of published historical and archaeological accounts (listed in reference section); city development plan and record of protected structures; and other relevant sources. The description of the known history and archaeology of the subject site is provided in a separate Archaeological, Architectural and Cultural Heritage Impact Assessment. The National Museum of Ireland Files were consulted for findspots and artefacts recorded in the townlands around the subject site. Nothing of relevance was returned during that consultation.

The subject site is mainly located in the townland of Ballincurra (Hart), in the barony of Pubblebrien and in the civil parish of St Michael (https://www.logainm.ie/30589.aspx). The northernmost portion which comprises the access road from the Dock Road is located in the adjacent townland of Corkanree. It lies well outside of the zone of archaeological potential for the historic town of Limerick.

Human occupation on the island of Ireland can be currently traced back some ten thousand years. Archaeological sites survive today as upstanding structures, earthwork monuments or subsurface remains. Landscape change in Ireland has accelerated in the second half of the twentieth century and into the twenty-first century, and many archaeological sites have been levelled by activities associated with modern development, agriculture, industry, housing developments and infrastructural improvements. This has culminated in the current visible archaeological landscape, which is not fully representative of the full span of human activity. In the case of the subject site, the archaeological environment of the land has been considered. There are no known archaeological monuments or historic structures within the subject site or in its immediate vicinity. The closest recorded archaeological monument, which is also listed on the National Inventory of Architectural Heritage (NIAH) is over 200m to the southwest of the subject site's boundary. One previous archaeological investigation was undertaken on the subject site. This was the archaeological monitoring of a 16m wide wayleave for the Limerick Main Drainage Scheme. Nothing of an archaeological nature was discovered during this monitoring.

The field inspection which forms part of the assessment was carried on 8 April 2021. The weather was dry though overcast and visibility was good. The site topography is low lying level land which has been previously disturbed by topsoil stripping and spoil deposition in its southern portion. A full description of the subject site recorded during the field inspection is provided in a separate Archaeological, Architectural and Cultural Heritage Impact Assessment. No previously unrecorded features of cultural heritage, archaeological or architectural merit were encountered during the field inspection.

14.4 Potential Effects of the Proposed Project

The impact assessment and significance of impacts during both construction and operational phase has been assessed within the proposed development. The potential impacts are outlined below under construction and operational phases and the taking account of the 'do-nothing' impact. All impacts unless otherwise stated within the assessment are considered to be permanent in duration, using the NRA scale as outlined in their guidance documentation. Predicted impacts have been considered in turn. Mitigation measures are devised in order to avoid, reduce or remedy significant adverse effects. In general, **mitigation by avoidance** is the preferred method of mitigation (known as 'preservation in situ'). Consideration must be given to all impacts, and alternatives must be considered at the earliest stage of the EIS/ ER process. This type of mitigation may include minor realignments of project development in order to avoid heritage assets. Where this is demonstrably not possible (Dúchas 1999a, 24) **mitigation by reduction or design** may be followed. This is a common strategy for dealing with effects that cannot be avoided and it seeks to limit the exposure to the heritage asset by record or excavation. For example, the recording of buildings of architectural heritage interest or where an archaeological site or monument cannot be avoided, the excavation of deposits and features will ensure that it is accurately recorded, archived and documented for public reference (known as 'preservation by record'). **Mitigation by remedy** is a strategy used for dealing with *residual impacts* which cannot be prevented from entering the cultural heritage environment and causing adverse effects. Remedy serves to improve adverse conditions which exist by carrying out further works which seek to restore the environment to an approximation of its previous condition or to a new equilibrium. An example of mitigation by remedy would be reinstating buildings, walls or features and/or finding engineering and architectural design solutions that reduce the level of impact at any given heritage asset. Mitigation by remedy can include recording, repairing, restoring, or offsetting (Eirgrid 2015, 74-75).

14.4.1 Construction Phase

All impacts, unless otherwise stated are considered likely to be long term and of permanent duration. Overall, the proposed development is not predicted to have an impact on the archaeological, architectural or cultural heritage, and there are no known features of cultural heritage interest within the development footprint. Nothing of a cultural heritage, archaeological or historic architectural nature was located as upstanding during the walkover inspection.

Cultural heritage features, archaeological monuments and historic architecture that are known outside the entire development footprint have been deemed to be sufficiently distant and impacts are predicted to be neutral.

14.4.1.1 Archaeological Heritage

It is possible that the construction phase on the subject site has a low potential to impact (destroy or partially destroy) on previously unrecorded archaeological features of merit that may lay subsurface. Please note that Statutory instrument (SI) 249 of 2012 (European Union (Environmental Impact Assessment of Proposed Demolition of National Monuments) Regulations 2012) has created an obligation for an EIA to be undertaken where the Minister's approval is sought under the National Monuments Acts for works that would result in the demolition of a National Monument (Eirgrid 2015, 81).

14.4.1.2 Cultural Heritage

It is possible that the construction phase on the subject site has a very low potential to impact (destroy or partially destroy) on previously unrecorded cultural heritage features of merit that may lay subsurface.

14.4.1.3 Architectural Heritage

It is unlikely that the construction phase on the subject site has the potential to impact (destroy or partially destroy) on previously unrecorded architectural heritage features of merit that may lay subsurface.

14.4.2 Operational Phase

14.4.2.1 Archaeological Heritage

There are no operational archaeological heritage impacts predicted for the residential phase.

14.4.2.2 Cultural Heritage

There are no operational cultural heritage impacts predicted for the residential phase.

14.4.2.3 Architectural Heritage

There are no operational architectural heritage impacts predicted for the residential phase.

14.5 Mitigation Measures

14.5.1 Construction Phase

14.5.1.1 Archaeological Heritage

In order to mitigate any potential negative impact on the archaeological heritage which may lie subsurface on the subject site and due to the topsoil disturbance noted on the subject site during the EIA it is suggested that a test trenching assessment under licence (as per Dúchas 1999a, 25-29), be undertaken in the unfilled northern portion of the site (CHAA_1 in Table 21.1 contained in Chapter 21). This measure should be undertaken prior to commencement, immediately after grant of permission given the time it takes to complete this particular survey work.

The remainder of the subject site, due to previous disturbance, is suggested for archaeological monitoring of the ground works associated with construction (CHAA_2 in Table X).

14.5.1.2 Cultural Heritage

As no adverse impacts were identified, no mitigation measures are suggested.

14.5.1.3 Architectural Heritage

As no adverse impacts were identified, no mitigation measures are suggested.

14.5.2 Operational Phase

14.5.2.1 Archaeological Heritage

As no operational impacts have been predicted, there is no suggested mitigation required in this regard. All physical archaeological, architectural and cultural heritage impact issues will be resolved at the pre-construction or construction Phase of the proposed Project and therefore no potential impacts are envisioned at the Operational Phase of the proposed Project.

14.5.2.2 Cultural Heritage

As no operational impacts have been predicted, there is no suggested mitigation required in this regard. All physical archaeological, architectural and cultural heritage impact issues will be resolved at the pre-construction or construction Phase of the proposed Project and therefore no potential impacts are envisioned at the Operational Phase of the proposed Project.

14.5.2.3 Architectural Heritage

As no operational impacts have been predicted, there is no suggested mitigation required in this regard. All physical archaeological, architectural and cultural heritage impact issues will be resolved at the pre-construction or construction Phase of the proposed Project and therefore no potential impacts are envisioned at the Operational Phase of the proposed Project.

14.6 Residual Effects

No residual impacts are anticipated on any of the potential cultural, archaeological or architectural heritage provided that the suggested mitigation and monitoring is implemented. Monuments identified are well outside the area of proposed development and so will be preserved *in situ* and left in place. Such sites will be subject to natural processes, unless otherwise maintained. Therefore, there will be no significant effects on the receiving environment.

14.7 Monitoring

It is suggested that a programme of archaeological monitoring (i.e. a watching brief) be undertaken during topsoil/bulk earthworks removal and enabling works for services etc. at the construction phase (CHAA_2 in Table 21.1).

There will be no requirement for monitoring of cultural, archaeological or architectural heritage in any post-development phase.

14.8 Reinstatement

It is suggested that in the event of the proposed development proposal being discontinued and 'made good' no negative predicted impacts are anticipated on the cultural heritage, archaeological or architectural resource. There will be no requirement for reinstatement.

14.9 Interactions

No interactions were identified during this assessment process.

14.10 Cumulative Effects

Development within the area of influence of the subject site was considered. A nursing home development (LCCC Reg. Ref. 21/1222) is planned immediately to the southeast of the subject site, and planning permission has been granted for an adjacent development (Ref. 17/1190 ABP-302015-18). Due to the relative size of the adjacent sites and the fact that they do not contain any known archaeological monuments, known features of historic architecture or known cultural heritage features, no cumulative effects are anticipated in relation to cultural, archaeological or architectural heritage.

14.11 'Do-Nothing' Effect

Should no development take place, the site will remain as is and be used as it was at the time of writing. Cultural, archaeological and architectural heritage identified are well outside the area of proposed development and so if no development takes place will continue to be preserved *in situ* and left in place. Such sites will be subject to natural processes, unless otherwise maintained.

14.12 Difficulties Encountered in Compiling the Chapter

No difficulties or limitations were encountered in the compilation of this chapter.

15.0 MICROCLIMATE – DAYLIGHT AND SUNLIGHT

15.1 Introduction

ARC Architectural Consultants Ltd has been retained by the Applicant to prepare this Sunlight and Daylight Access Analysis of the proposed development on lands at the former Greenpark Racecourse, Limerick. This Chapter assesses the impact of the proposed development on sunlight and daylight access to lands outside the application site as part of the Environmental Impact Assessment Report. Sunlight and daylight access within the application site is assessed in the document entitled *Assessment of Sunlight & Daylight Access within the Proposed Development*, which is submitted separately as part of the application.

In assessing sunlight and daylight access analysis, Irish practitioners tend to refer to the relevant PJ Littlefair's 2011 revision of the 1991 publication *Site layout planning for daylight and sunlight: a guide to good practice* for the Building Research Establishment (the BRE Guide).

Section 1.7 of the BRE Guide provides: *"The guidance here is intended for use in the UK and Republic of Ireland"*. Its use in assessing impacts on sunlight and daylight access as part of the planning process is supported by national government planning policy including:

- The *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas*, which, at Section 7.2 states: *"Planning authorities should require that daylight and shadow projection diagrams be submitted in all such proposals. The recommendations of "Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice" (B.R.E. 1991)18 or B.S. 8206 "Lighting for Buildings, Part 2 1992: Code of Practice for Daylighting" should be followed in this regard."*

- The Sustainable Urban Housing: Design Standards for New Apartments Guidelines for Planning Authorities, which, at Section 6.6, states: *"Planning authorities should have regard to quantitative performance approaches to daylight provision outlined in guides like the BRE guide 'Site Layout Planning for Daylight and Sunlight' (2nd edition) or BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting' when undertaken by development proposers which offer the capability to satisfy minimum standards of daylight provision."*

The standards for daylight and sunlight access in buildings (and the methodologies for assessment of same) suggested in the BRE Guide have been referenced in preparing this chapter. The *BS 8206-2: 2008 – 'Lighting for Buildings – Part 2: Code of Practice for Daylighting'* was withdrawn in May 2019, while *BS EN 17037: Daylight in Buildings* was adopted in the United Kingdom in May 2019. Given this, this Chapter does not refer to BS 8206-2: 2018. In the interests of clarity, it should further be noted that this Chapter does not refer to *IS EN 17037: Daylight in Buildings* or *BS EN 17037: Daylight in Buildings* as the recommendations of those documents relate to the design of new buildings. Neither IS EN 17037 nor BS EN 17037 provide any guidance on the assessment of impacts on sunlight and daylight access within existing buildings.

[18] The *Guidelines for Planning Authorities on Sustainable Residential Development in Urban Areas* refer to the first edition of the BRE Guide as published in 1991. A second edition of the Guide was published in 2011.

The BRE Guide does not set out rigid standards or limits, but is preceded by the following very clear warning as to how the design advice contained therein should be used:

> *"The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design."* [Emphasis added.]

15.2 Baseline Environment

The application site includes a large area of undeveloped greenfield land at the former Greenpark Racecourse. The site is bounded on its eastern edge by existing residential development, including three storey blocks of duplex units and two storey semi-detached houses at Log Na gCapall and single storey detached houses at Greenpark Avenue.

Given the largely vacant character of the site and relatively large areas of greenfield / rural land surrounding the site, the shadow environment of the existing site and of its immediate surroundings is inconsistent with what would normally be expected in the inner suburbs of a city.

It is noted that planning permission has been granted for a development of 30 no. residential dwellings and associated development Greenpark Avenue, South Circular Road (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18) to the east / northeast of the application site, but that this development has yet to be constructed. It is further noted that an application has been made to Limerick City and County Council for a nursing home development on the adjoining site in the ownership of the Applicant to the east (LCC Reg. Ref. 21/1222).

15.3 Daylight Access Impact Analysis

Daylight is defined in *Site layout planning for daylight and sunlight: a guide to good practice* for the Building Research Establishment (the BRE Guide) as *"combined skylight and sunlight"*. For the purpose of this analysis, Section 15.3 assesses the impact of the construction of the proposed development on daylight reaching defined opes in existing buildings (e.g. windows or other openings in existing buildings, such as patio doors) when the weather is overcast.

The impact of the proposed development on rays of the sun reaching neighbouring lands is described in Section 15.4 below.

15.3.1 Methodology

The only Irish statutory guidance to provide advice on undertaking sunlight and daylight access impact analysis is set out in the *Advice Notes on Current Practice* prepared by the Environmental Protection Agency (2003), which accompany the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency (2002). While the EPA issued *Draft Guidelines on the Information to be*

Contained in Environmental Impact Assessment Reports in 2017, revised drafts of the accompanying *Advice Notes on Current Practice* have yet to be published.

These Advice notes state: *"Climate in an Environmental Impact Statement generally refers to the local climatological conditions or "microclimate" of an area, such as local wind flow, temperature, rainfall or solar radiation patterns ... it is important to identify receptors which may be particularly sensitive to climate change."* [Emphasis added.] Having regard to the Advice Notes, ARC undertook detailed quantitative analysis of those receptors particularly sensitive to changes in the daylight environment in order to provide an empirical basis for the conclusions outlined in this chapter.

In identifying receptors particularly sensitive to changes in the daylight environment, ARC considered two factors:

(i) *the use of receptors (i.e. buildings) surrounding the application site*: buildings in residential use (and, particularly, habitable rooms within residences) would be considered to be sensitive to changes in the daylight environment. Section 2.2.2 of the BRE Guide provides: *"The guidelines here are intended for use for rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed. The guidelines may also be applied to any existing non-domestic building where the occupants have a reasonable expectation of daylight; this would normally include schools, hospitals, hotels and hostels, small workshops and some offices"*;

(ii) *the location of receptors relative to the application site:* as set out in section 2.2.21 of the BRE Guide *"If any part of a new building or extension, measured in vertical section perpendicular to a main window wall of an existing building, from the centre of the lowest window, subtends to an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected."*

Given this, the receptors most sensitive to changes in the daylight environment as a result of the construction of development on the application site would be windows facing towards the proposal at low levels of accommodation in buildings in residential use in close proximity to the site (i.e. low level rooms at Log na gCapall and Greenpark Avenue). Therefore, ARC identified a representative sample of rooms and windows at Log na gCapall for detailed quantitative analysis. That representative sample of buildings includes worst case scenario receptors, including windows in existing buildings closest to proposed new structures and windows at lower levels of accommodation. The sample included buildings in closest proximity to proposed new structures. In the chosen residential buildings, a sample "lowest window" (e.g. a ground floor window) was chosen in each building for analysis, having regard to section 2.2.21 of the BRE Guide. Existing buildings were omitted from the sample where there was sufficient data within the sample to allow a reasonable inference to be made about the likely impact on that existing building (e.g. where the impact along the length of a terrace was likely to be similar, a sample of windows on that terrace was chosen; where the impact on an existing building closest to a new structure was included in the sample, windows in more distant buildings could be excluded from the sample). This sample is considered to include a worst case scenario (please see Figure 15.1 below).

Section 2.2.21 of the BRE Guide suggests that:

"If any part of a new building or extension, measured in a vertical section perpendicular to a main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25° to the horizontal, then the diffuse daylighting of the existing building may be adversely affected. This will be the case if ...

the VSC measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value..."

The BRE Guide defines VSC (Vertical Sky Component) as follows: *"Ratio of that part of illuminance, at a point on a given vertical plan, that is received directly from a CIE standard overcast sky, to illuminance on a horizontal plane due to an unobstructed hemisphere of this sky. The VSC does not include reflected light, either from the ground or from other buildings."*

A three dimensional digital model of the proposed development, the planned nursing home development on the adjoining site in the ownership of the Applicant to the east (LCC Reg. Ref. 21/1222); the permitted development at Greenpark Avenue, South Circular Road of 30 no. residential dwellings and associated development (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18) and and of existing buildings in the area was constructed by ARC Consultants based on drawings and three dimensional models supplied by the Design Team. Where survey data of surrounding context was not available, assumptions were made, with reference to on-site, satellite and aerial photography and to the online planning register, where relevant, in the creation of the three dimensional model. At paragraph H1.2, the BRE Guide states: *"It is generally more difficult to calculate the effects of trees on daylight because of their irregular shapes and because some light will generally penetrate through the tree crown. Where the effect of a new building on existing buildings nearby is being analysed, it is usual to ignore the effect of existing trees."* Given this, existing and proposed landscaping was not included in this model.

ARC assessed the Vertical Sky Component of each window at a point at the centre of each window. Having regard to the extreme variability in sky luminance over the course of any given day depending on weather conditions and the changing seasons, this daylight access analysis uses the Commission Internationale de l'Eclairage (CIE) Standard Overcast Sky Distribution model in its calculations, which is the standard sky most commonly used in daylight access analysis. This model assumes that sky luminance varies from horizon to zenith and is considered to correspond to an overcast day. As such, calculation of daylight levels in a room in circumstances where the sky luminance corresponds to the CIE Standard Overcast Sky Distribution could be considered to represent a worst case scenario.

Definition of Effects on Daylight Access

In assessing whether a predicted effect of the proposal on daylight access is likely to be "imperceptible", "not significant", "slight", "moderate", "significant", "very significant" or "profound" within the meaning of the EPA's *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, ARC referred to Appendix I of the BRE Guide sets out advice on environment impact assessment. It states:

I4 The assessment of impact will depend on a combination of factors, and there is no simple rule of thumb that can be applied.

I5 *Where the loss of skylight or sunlight fully meets the guidelines in this book, the impact is assessed as negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or a limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space.*

I6 *Where the loss of skylight or sunlight does not meet the guidelines in this book, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:*

- *only a small number of windows or limited area of open space are affected*
- *the loss of light is only marginally outside the guidelines*
- *an affected room has other source of skylight or sunlight*
- *the affected building or open space only has a low level requirement for skylight or sunlight*
- *there are particular reasons why an alternative, less stringent, guidelines should be applied (see Appendix F).*

I7 *Factors tending towards a major adverse impact include:*

- *a large number of windows or large area of open space are affected*
- *the loss of light is substantially outside the guidelines*
- *all the windows in a particular property are affected*
- *the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight, eg a living room in a dwelling or a children's playground.*

Having considered the factors outlined in Appendix I of the BRE Guide, ARC's assessment classifies the impact of the proposed development on daylight and sunlight access within existing buildings or open spaces with reference to the list of definitions set out at *Table 3.3: Descriptions of Effects* contained in the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency. The definitions from the EPA document are in italics, while some comment is also given below on what ARC considers these definitions might imply in the case of daylight access (e.g. having regard to Appendix I of the BRE Guide). Please note that, for the purpose of this chapter, the word "effect" is taken to have the same meaning as the word "impact".

- ***Imperceptible:*** *An effect capable of measurement but without significant consequences.* The definition implies that the development would cause a change in the daylight received at a location, capable of measurement, but not noticeable to the casual observer. If the development caused no change in daylight access, there could be no effect. Examples of "imperceptible" impacts on daylight access would include:

  (a) a scenario where the proposed development is predicted to reduce the Vertical Sky Component received by a sample window, but the sample window will continue to receive the relevant recommended level of

Vertical Sky Component after the construction of the proposed development; and

(b) a scenario where the proposed development is predicted to reduce the Vertical Sky Component to not less than 0.8 times its former value (i.e. the BRE Guide threshold for an adverse impact).

- ***Not Significant:*** *An effect which causes noticeable*[2] *changes in the character of the environment but without significant consequences* (the footnote "2" to the word *"noticeable"* is: *"for the purposes of planning consent procedures"*). The definition implies that the development would cause a change in the daylight received at a location, which is capable of measurement and capable of being noticed by an observer who is taking an active interest in the extent to which the proposal might affect daylight access.

- ***Slight:*** *An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.* For this definition to apply, the amount of daylight received at a location would be changed by the construction of the development to an extent that is both capable of measurement and is noticeable to a minor degree. However, the daylight environment within an existing building should remain largely unchanged. An example of a "slight" impact would be a scenario where, although the impact of the proposed development is not predicted to reduce the amount of daylight received by a sample window to less than 0.8 times its former value, the amount of light received by the sample window is predicted to fall below a key recommended level, whether that is the BRE Guide recommended target value or an alternative target value. A further example of a "slight" impact would be where, although the construction of the proposed development is predicted to reduce the amount of light received to a level below the BRE Guide threshold for an adverse impact, the predicted reduction is just outside that BRE Guide threshold (e.g. the amount of daylight received by a sample window falls to not less than 0.7 times its existing value*). A "slight" impact could also occur where there is a more considerable reduction in daylight by a sample window within an existing building, but only a small number of windows within that property are affected to that extent.

- ***Moderate:*** *An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.* In this case, a development must bring about a change in the daylight environment within an existing building; and this change must be consistent with a pattern of change that is already occurring or is likely to occur. A moderate effect would occur where other developments were bringing about changes in daylight access of similar extent in the area. A "moderate" impact might also be considered to occur where the level of daylight received by a sample window falls below the BRE Guide recommended level and to between 0.5 and 0.7 times its existing value, subject to consideration of other factors*.

- ***Significant:*** *An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.* The definition implies that the existence of the development would change the extent of daylight access in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a development resulting in a *"significant"* diminution of daylight access would reduce daylight to the extent that minimum standards for daylighting are not met and artificial lighting is required for part of the day. A "significant" impact could occur where the predicted reduction in daylight access is greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "significant" impact could occur where daylight access to the sample window falls to between 0.25 and 0.5 times its former value*.

- ***Very Significant:*** *An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.* The definition implies that the existence of the development would change the extent of daylight access to a considerable degree and in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a *"very significant"* effect would occur where a development would result in daylight received in a room falling well below the minimum standards for daylighting and where artificial lighting would be required in that room as the principal source of lighting all the time. A "very significant" impact could occur where the predicted reduction in daylight access is considerably greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "very significant" impact could occur where daylight access to the sample window falls to between 0.01 and 0.25 times its former value*.

- ***Profound:*** *An effect which obliterates sensitive characteristics.* Examples of development resulting in a *"profound"* effect on daylight access would include facilitating daylight access to a room in an existing building where the existing room has none (e.g. as a result of the demolition of a building) or by removal of all access to daylight within an existing building.

* Please note that, while this section sets out indicative quantitative ranges that could apply to each type of impact, this assessment considers a range of factors (such as relevant target values, the use of the affected building, the number of rooms affected within the building, etc) in classifying impacts.

In relation to daylight access, it is conceivable that a development could result in positive effects, but this implies that a development would involve a reduction of the size or scale of built form (e.g. such as the demolition of a building, which might result in an increase in daylight access). Though that is possible, it is usually unlikely as most development involves the construction of new obstructions to daylight access.

15.3.2 Potential Effects of the Proposed Project

15.3.2.1 Construction Phase

The potential impact of the construction phase of the proposed development on daylight access is likely to be, initially, lesser than the potential impact of the completed development. As the proposed development nears completion, the potential impact of the emerging development is likely to be similar in all material respects to that of the completed development. It is noted that temporary structures and machinery (e.g. hoarding, scaffolding, cranes, etc.) have the potential to result in changes in daylight access in buildings, although any additional impacts arising from temporary structures or machinery are likely to be temporary and minor.

15.3.2.2 Operational Phase

Section 2.1.1 of the BRE Guide provides that *"The quantity and quality of daylight inside a room will be impaired if obstructing buildings are large in relation to their distance away"*. Generally speaking, new development is most likely to affect daylight access in existing buildings in close proximity to the application site.

<u>Overview of the potential impact of the proposed development on daylight access to existing buildings outside the application site</u>

ARC's analysis indicates that the construction of the proposed development is likely to result in little or no change in daylight access within neighbouring existing buildings. The potential impact of the proposed development on daylight access within neighbouring existing residences surrounding the application site (e.g. on residential lands to the east of the site at Log Na gCapall and Greenpark Avenue) is, therefore, likely to range from none to "imperceptible" to "not significant".

Given that the potential for development to result in impacts on daylight access diminishes with distance, it is the finding of ARC's analysis the proposed development will have no undue adverse impact on daylight access within buildings in the wider area surrounding the application site.

<u>Detailed analysis of the potential impact of the proposed development on daylight access to existing buildings outside the application site</u>

This chapter assesses the impact of the proposed development to all potential receptors surrounding the application site - these impacts are described in the overview section above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on daylight access to a representative sample of sensitive receptors (i.e. rooms) in buildings in proximity to the application site (please see Figure 15.1 below).

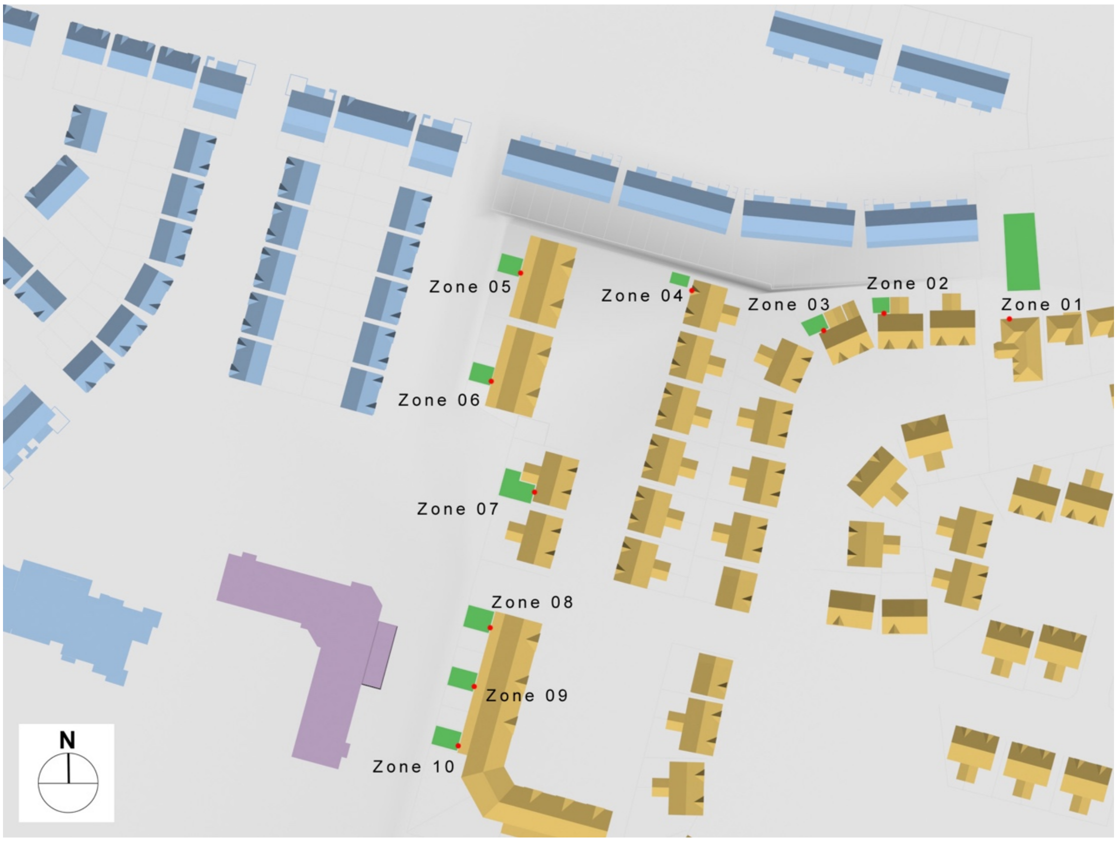

Figure 15.1: Indicative diagram showing location of sample windows (indicated with a red dot) assessed under this chapter. [Please note that, as it is yet to be constructed, the sample windows at Zones 13 and 14 were assessed under Section 15.3.3: Potential Cumulative Effects only].

As explained in Section 15.3.1 above, ARC measured daylight access to existing buildings before and after the construction of the proposed development with reference to Vertical Sky Component to identify whether the construction of the proposed development creates the potential for adverse impacts on daylight access. Section 2.2.21 of the BRE Guide suggests that: *"If any part of a new building or extension, measured in a vertical section perpendicular to a main window wall of an existing building, from the centre of the lowest window, subtends an angle of more than 25̊ to the horizontal, then the diffuse daylighting of the existing building may be adversely affected. This will be the case if ...the VSC measured at the centre of an existing main window is less than 27%, and less than 0.8 times its former value..."*.

The results of ARC's analysis are set out in Table 15.1 below, together with a short comment on each result.

Table 15.1: Potential impact of the proposed development on daylight access to sample windows* in existing buildings in proximity to the application site

<table>
<tr><th rowspan="2">Zone+</th><th rowspan="2">Location</th><th rowspan="2">Floor</th><th colspan="4">Vertical Sky Component</th></tr>
<tr><th>Existing</th><th>Proposed</th><th>Change
(times existing value of VSC)</th><th>Potential Impact</th></tr>
<tr><td rowspan="2">Zone 01</td><td>Greenpark Ave</td><td>Floor 00</td><td>39.00%</td><td>37.10%</td><td>0.95</td><td>Imperceptible</td></tr>
<tr><td colspan="6">The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as “imperceptible”.</td></tr>
<tr><td rowspan="2">Zone 02</td><td>Log Na gCapall</td><td>Floor 00</td><td>24.60%</td><td>21.40%</td><td>0.87</td><td>Imperceptible</td></tr>
<tr><td colspan="6">The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is not likely to fall to less than 0.8 times its former value, the potential impact of the proposed development on this window is assessed as “imperceptible”.</td></tr>
<tr><td rowspan="2">Zone 03</td><td>Log Na gCapall</td><td>Floor 00</td><td>22.80%</td><td>21.20%</td><td>0.93</td><td>Imperceptible</td></tr>
<tr><td colspan="6">The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is not likely to fall to less than 0.8 times its former value, the potential impact of the proposed development on this window is assessed as “imperceptible”.</td></tr>
<tr><td rowspan="2">Zone 04</td><td>Log Na gCapall</td><td>Floor 00</td><td>35.40%</td><td>34.50%</td><td>0.97</td><td>Imperceptible</td></tr>
<tr><td colspan="6">The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as “imperceptible”.</td></tr>
<tr><td rowspan="2">Zone 05</td><td>Log Na gCapall</td><td>Floor 00</td><td>33.90%</td><td>32.70%</td><td>0.96</td><td>Imperceptible</td></tr>
<tr><td colspan="6">The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as “imperceptible”.</td></tr>
<tr><td rowspan="2">Zone 06</td><td>Log Na gCapall</td><td>Floor 00</td><td>33.90%</td><td>32.90%</td><td>0.97</td><td>Imperceptible</td></tr>
<tr><td colspan="6">The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as “imperceptible”.</td></tr>
<tr><td>Zone 07</td><td>Log Na gCapall</td><td>Floor 00</td><td>32.10%</td><td>31.70%</td><td>0.99</td><td>Imperceptible</td></tr>
</table>

Zone+	Location	Floor	Vertical Sky Component			
			Existing	Proposed	Change (times existing value of VSC)	Potential Impact
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".					
Zone 08	Log Na gCapall	Floor 00	28.70%	28.40%	0.99	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".					
Zone 09	Log Na gCapall	Floor 00	28.60%	28.40%	0.99	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".					
Zone 10	Log Na gCapall	Floor 00	28.70%	28.50%	0.99	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential impact of the proposed development on this window is assessed as "imperceptible".					
Zone 11	Log Na gCapall	Floor 00	35.50%	35.40%	1.00	None
	ARC's analysis indicates that the proposed development is not likely to result in any change in Vertical Sky Component at this window.					
Zone 12	Log Na gCapall	Floor 00	37.60%	37.60%	1.00	None
	ARC's analysis indicates that the proposed development is not likely to result in any change in Vertical Sky Component at this window.					

* Survey information of all structures on private lands surrounding the application site was not available. Where insufficient survey information was available and window sizes / locations could not be informed by information available from the online planning register or from aerial photography, window sizes / locations were estimated by ARC.

\+ Please note that, as the development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 has yet to be constructed, the sample windows at Zones 13 and 14 were assessed under Section 15.3.3: Potential Cumulative Effects only. Please see table Table 15.2 below.

15.3.3 Potential Cumulative Effects

A review of the Limerick City and County Council online planning register identified the following developments which are planned or for which permission has been granted, which, in combination with the development now proposed, have the potential to result in material cumulative impacts on daylight access to the area surrounding the application site, within the meaning of *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide):

- The planned nursing home development on the adjoining site to the east (LCC Reg. Ref. 21/1222);
- The permitted development at Greenpark Avenue, South Circular Road of 30 no. residential dwellings and associated development (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18).

As part of this assessment, ARC has assessed the potential for the proposed development, in combination with these planned and permitted developments, to result in cumulative impacts on daylight access within existing buildings surrounding the application site.

15.3.3.1 Construction Phase

The potential cumulative impact of the construction phase of the proposed development, in combination with nearby planned and permitted developments, on daylight access within existing buildings is likely to be, initially, lesser than the cumulative impact of the completed developments. As the proposed and permitted developments near completion, the potential impact of the emerging developments is likely to be similar in all material respects to that of the completed developments. It is noted that temporary structures and machinery (e.g. hoarding, scaffolding, cranes, etc.) have the potential to result in changes in daylight access, although any additional impacts arising from temporary structures or machinery are likely to be temporary and minor.

15.3.3.2 Operational Phase

<u>Overview of the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on daylight access to existing buildings outside the application site</u>

ARC's analysis indicates that there is a potential for the proposed development, in combination with the planned nursing home development on the adjoining site (LCC Reg. Ref. 21/1222) and the permitted residential development at Greenpark Avenue (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18), to result in cumulative impacts on daylight access within existing buildings additional to those already described in Section 15.3.2 above.

The proposed development, in combination with these nearby planned and permitted developments, has the potential to result in a very minor increase in the potential reduction in daylight access in nearby existing buildings to the east and southeast indicated in Table 15.1 above. ARC's analysis found that, notwithstanding this, the overall cumulative impact of the proposed development, in combination with the planned nursing home development on the adjoining site, on daylight access within neighbouring existing buildings at Log Na gCapall is likely to fall in the range of "imperceptible" to "not significant".

This section also considers the potential impact of the proposed development, in combination with the planned nursing home development, on the permitted (but not yet constructed) residential development at Greenpark Avenue (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18). ARC's analysis indicated that, if it were assumed that the planned nursing home development and the residential development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 were constructed, the construction of the proposed development would result in little or no impact on daylight access to houses permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18. The impact of the proposed development, in combination with the planned nursing home development, on daylight access to the permitted (but not yet constructed) residential development at Greenpark Avenue would range from none to "imperceptible".

Given that the potential for development to result in impacts on daylight access diminishes with distance, it is the finding of ARC's analysis the proposed development will have no undue adverse impact on daylight access within buildings in the wider area surrounding the application site.

Detailed analysis of the potential cumulative impact of the proposed development, in combination with the planned nursing home development on the adjoining site, on daylight access within existing buildings outside the application site

This analysis assesses the impact of the proposed development on all potential receptors surrounding the application site - these impacts are described in the section above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development, in combination with the planned nursing home development on the adjoining site (LCC Reg. Ref. 21/1222) and the permitted residential development at Greenpark Avenue (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18), to result in impacts on daylight access to a representative sample of sensitive receptors (i.e. rooms) in buildings in proximity to the application site (please see Figure 15.1 above). The representative sample of buildings includes worst case scenario examples, such as those rooms in existing buildings closest to the proposed development and rooms at low levels of accommodation.

The results of ARC's analysis are set out in Table 15.2 below:

Table 15.2: Potential cumulative impact of the proposed development on daylight access to sample windows* in existing buildings in proximity to the application site

<table>
<tr><th rowspan="2">Zone</th><th rowspan="2">Floor</th><th colspan="5">Vertical Sky Component</th></tr>
<tr><th>Existing</th><th>Existing incl. Planned & Permitted</th><th>Cumulative Proposed</th><th>Change from Existing to Cumulative Proposed (times existing value of VSC)</th><th>Potential Overall Cumulative Impact</th></tr>
<tr><td rowspan="2">Zone 01</td><td>Floor 00</td><td>39.00%</td><td>38.60%</td><td>36.80%</td><td>0.94</td><td>Imperceptible</td></tr>
<tr><td colspan="6">The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".</td></tr>
<tr><td rowspan="2">Zone 02</td><td>Floor 00</td><td>24.60%</td><td>24.60%</td><td>21.40%</td><td>0.87</td><td>Imperceptible</td></tr>
<tr><td colspan="6">The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but</td></tr>
</table>

Zone	Floor	Vertical Sky Component				
		Existing	Existing incl. Planned & Permitted	Cumulative Proposed	Change from Existing to Cumulative Proposed (times existing value of VSC)	Potential Overall Cumulative Impact
	decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is not likely to fall to less than 0.8 times its former value, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".					
Zone 03	Floor 00	22.80%	22.80%	21.20%	0.93	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is not likely to fall to less than 0.8 times its former value, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".					
Zone 04	Floor 00	35.40%	35.40%	34.40%	0.97	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".					
Zone 05	Floor 00	33.90%	33.90%	32.60%	0.96	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".					
Zone 06	Floor 00	33.90%	33.80%	32.80%	0.97	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".					
Zone 07	Floor 00	32.10%	31.60%	31.40%	0.98	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% or falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".					
Zone 08	Floor 00	28.70%	26.90%	26.70%	0.93	Imperceptible to Not Significant

Zone	Floor	Vertical Sky Component				
		Existing	Existing incl. Planned & Permitted	Cumulative Proposed	Change from Existing to Cumulative Proposed (times existing value of VSC)	Potential Overall Cumulative Impact
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. While the BRE Guide would suggest that an impact of this extent is not likely to be noticeable, taking a conservative approach, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible" to "not significant" as the cumulative impact is likely to reduce Vertical Sky Component at the window from slightly above the recommended 27% Vertical Sky Component to just below it.					
Zone 09	Floor 00	28.60%	25.70%	25.60%	0.90	Imperceptible to Not Significant
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. While the BRE Guide would suggest that an impact of this extent is not likely to be noticeable, taking a conservative approach, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible" to "not significant" as the cumulative impact is likely to reduce Vertical Sky Component at the window from slightly above the recommended 27% Vertical Sky Component to just below it.					
Zone 10	Floor 00	28.70%	25.70%	25.70%	0.90	Imperceptible to Not Significant
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. While the BRE Guide would suggest that an impact of this extent is not likely to be noticeable, taking a conservative approach, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible" to "not significant" as the cumulative impact is likely to reduce Vertical Sky Component at the window from slightly above the recommended 27% Vertical Sky Component to just below it.					
Zone 11	Floor 00	35.50%	34.70%	34.60%	0.97	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".					
Zone 12	Floor 00	37.60%	37.40%	37.40%	0.99	Imperceptible
	The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component, the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on this window is assessed as "imperceptible".					
Zone 13	Floor 00	N/A	34.90%	33.50%	N/A	See below
	This sample window is in a building permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18, but <u>not yet constructed</u>. As the building is not yet constructed, this table does not include an assessment of the Vertical					

<table>
<tr><th rowspan="2">Zone</th><th rowspan="2">Floor</th><th colspan="5">Vertical Sky Component</th></tr>
<tr><th>Existing</th><th>Existing incl. Planned & Permitted</th><th>Cumulative Proposed</th><th>Change from Existing to Cumulative Proposed (times existing value of VSC)</th><th>Potential Overall Cumulative Impact</th></tr>
<tr><td></td><td colspan="6">Sky Component at this window under an existing scenario or an assessment of the cumulative impact of development on the existing scenario.

However, in the interests of completeness, it should be noted that, if it were assumed that the planned nursing home development and the residential development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 were constructed, the construction of the proposed development would reduce Vertical Sky Component at this window to 0.96 times its former value. The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component under a cumulative scenario, the potential impact of the proposed development, in combination with the planned nearby nursing home, on this window would be assessed as “imperceptible”.</td></tr>
<tr><td rowspan="2">Zone 14</td><td>Floor 00</td><td>N/A</td><td>34.50%</td><td>33.30%</td><td>N/A</td><td>See below</td></tr>
<tr><td colspan="6">This sample window is in a building permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18, but <u>not yet constructed</u>. As the building is not yet constructed, this table does not include an assessment of the Vertical Sky Component at this window under an existing scenario or an assessment of the cumulative impact of development on the existing scenario.

However, in the interests of completeness, it should be noted that, if it were assumed that the planned nursing home development and the residential development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 were constructed, the construction of the proposed development would reduce Vertical Sky Component at this window to 0.97 times its former value. The BRE Guide suggests that occupants of an existing building are not likely to notice an adverse reduction in daylight access where Vertical Sky Component remains above 27% <u>or</u> falls below 27% Vertical Sky Component but decreases to not less than 0.8 times its former value after the construction of a development. As the Vertical Sky Component at this window is likely to remain above 27% Vertical Sky Component under a cumulative scenario, the potential impact of the proposed development, in combination with the planned nearby nursing home, on this window would be assessed as “imperceptible”.</td></tr>
</table>

* Survey information of all structures on private lands surrounding the application site was not available. Where insufficient survey information was available and window sizes / locations could not be informed by information available from the online planning register or from aerial photography, window sizes / locations were estimated by ARC.

15.3.4 Mitigation Measures

<u>Construction Phase</u>

The subject application proposes the development of a large zoned site in a residential area. In these circumstances, scope for mitigation measures during the construction phase, which would preserve a sustainable level of density, is limited.

<u>Operational Phase</u>

The subject application proposes the development of a large zoned site in a residential area. In these circumstances, scope for mitigation measures during the operational phase, which would preserve a sustainable level of density, is limited. However, it is noted that the proposed development was carefully designed in the first instance to minimise the potential for impacts on daylight access within neighbouring existing buildings to arise (e.g. by ensuring adequate separation distances between existing and proposed structures relative to the height of proposed structures) (DS_1 in Table 21.1 contained in Chapter 21).

15.3.5 Residual Effects

Construction Phase
As no ameliorative, remedial or reductive measures are now proposed, the residual impact of the proposed development on daylight access is likely to be as described under Section 15.3.2 above.

Operational Phase
As no ameliorative, remedial or reductive measures are now proposed, the residual impact of the proposed development on daylight access is likely to be as described under Section 15.3.2 above. The residual impact of the proposed development on daylight access to the surrounding area is assessed as ranging from none to “imperceptible” to “not significant”.

Cumulative Impact
As no ameliorative, remedial or reductive measures are now proposed, the residual cumulative impact of the proposed development in combination with development already permitted on daylight access is likely to be as described under Section 15.3.3 above. The residual cumulative impact of the proposed development on daylight access to the surrounding area is assessed as ranging from none to “imperceptible” to “not significant”.

15.3.6 Interactions

As is always the case where a development will result in a change to the daylight environment within existing buildings, the impacts of the development on daylight access will result in interactions with climate, and population and human health.

15.3.7 ‘Do Nothing’ Effects

In a “do nothing” scenario, the existing daylight environment within neighbouring buildings will remain unchanged.

15.4 Sunlight Access Impact Analysis

Sunlight is not defined in *Site layout planning for daylight and sunlight: a guide to good practice* for the Building Research Establishment (the BRE Guide). The Commission Internationale de L’Éclairage / International Commission on Illumination defines sunlight as meaning the *“part of direct solar radiation capable of causing a visual sensation”* (Source: 17-29-103, *CIE S 017:2020 ILV: International Lighting Vocabulary*, 2nd edition).

For the purpose of this analysis, Section 15.4 assesses the impact of the construction of the proposed development on the rays of the sun reaching defined opes in existing buildings (e.g. windows or other openings in existing buildings, such as patio doors) and reaching neighbouring gardens or amenity spaces.

Section 15.3 above assesses the impact of the construction of the proposed development on daylight reaching defined opes in existing building (e.g. windows or other openings in existing buildings, such as patio doors) when the weather is overcast.

15.4.1 Methodology

The only Irish statutory guidance to provide advice on undertaking sunlight and daylight access impact analysis is set out in the *Advice Notes on Current Practice* prepared by the Environmental Protection Agency (2003), which accompany the *Guidelines on the Information to be Contained in Environmental Impact Statements* prepared by the Environmental Protection Agency (2002). While the EPA issued *Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* in 2017, revised drafts of the accompanying *Advice Notes on Current Practice* have yet to be published.

These Advice notes state: *"Climate in an Environmental Impact Statement generally refers to the local climatological conditions or "microclimate" of an area, such as local wind flow, temperature, rainfall or solar radiation patterns ... it is important to identify receptors which may be particularly sensitive to climate change."* [Emphasis added.] Having regard to the Advice Notes, ARC undertook detailed quantitative analysis of those receptors particularly sensitive to changes in the sunlight environment in order to provide an empirical basis for the conclusions outlined this chapter.

In identifying receptors particularly sensitive to changes in the shadow environment, ARC considered two factors:

(i) *the use of receptors (i.e. buildings or gardens) surrounding the application site*: buildings in residential use (and, particularly, habitable rooms within residences) and associated amenity spaces would be considered to be sensitive to changes in the shadow environment;
(ii) the location of receptors relative to the application site: for example, as set out in section 3.2.2 of the BRE Guide *"obstruction to sunlight may become an issue if some part of a new development is situated within 90° of due south of a main windows wall of an existing building"* and if *"in the section drawn perpendicular to this existing window wall, the new development subtends an angle greater than 25° to the horizontal measured from the centre of the lowest window to a main living room"* (Emphasis added).

Given this, the receptors most sensitive to changes in the sunlight environment as a result of the construction of development on the application site would be low level windows to the west, north and east of the proposal in buildings in residential use, which face within 90° of due south and which are in close proximity to the site. As lands to the north and west of the site are largely undeveloped, ARC identified a representative sample of windows in existing buildings and amenity spaces at Log Na gCapall and Greenpark Avenue to the east for detailed quantitative analysis. The sample included buildings in closest proximity to proposed new structures. In the chosen residential buildings, a sample "lowest window" (e.g. a ground floor window) was chosen in each building for analysis, having regard to section 3.2.2 of the BRE Guide. Existing buildings were omitted from the sample where there was sufficient data within the sample to allow a reasonable inference to be made about the likely impact on that existing building (e.g. where the impact along the length of a terrace was likely to be similar, a sample of windows on that terrace was chosen; where the impact on an existing building closest to a new structure was included in the sample, windows in more distant buildings could be excluded from the sample). This sample is considered to include a worst case scenario (please see Figure 15.2 below).

The BRE Guide does not outline a recommended level of sunlight access to be achieved by windows facing within 90° of due north. All windows in existing buildings at Log na gCapall and in existing buildings at Greenpark Avenue opposing the application site face within 90° of due north. The BRE Guide also does not describe a threshold for adverse impact on such windows. Notwithstanding this, in the interests of completeness, this chapter includes detailed quantitative analysis of the potential impact of the proposed development on sample north-facing windows in these existing north-facing buildings with reference to the tests outlined for windows facing within 90° of due south. The results of ARC's analysis are set out in Table 15.3 below.

Section 3.2.1 of the *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide) provides as follows in relation to the assessment of the impact of development on sunlight access to existing buildings.

> *"If a living room of an existing dwelling has a main window facing within 90° of due south, and any part of a new development subtends an angle of more than 25° to the horizontal measured from the centre of the window in a vertical section perpendicular to the window, then the sunlighting of the existing dwelling may be adversely affected. This will be the case if the centre of the window:*
>
> - *receives less than 25% of annual probable sunlight hours, or less than 5% of annual probable sunlight hours between 21 September and 21 March* *and*
> - *receives less than 0.8 times its former sunlight hours during either period* *and*
> - *has a reduction in sunlight received over the whole year greater than 4% of annual probable sunlight hours."*

Section 3.3 of the BRE Guide sets out design advice and recommendations for site layout planning to ensure good sunlight access to amenity spaces and to minimise the impact of new development on existing amenity spaces. The Guide suggests that, for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours sunlight on 21st March.

A three dimensional digital model of the proposed development; the planned nursing home development on the adjoining site in the ownership of the Applicant to the east (LCC Reg. Ref. 21/1222); the permitted development at Greenpark Avenue, South Circular Road of 30 no. residential dwellings and associated development (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18) and of existing buildings in the area was constructed by ARC Consultants based on drawings and three dimensional models supplied by the Design Team. Where survey data of surrounding context was not available, assumptions were made, with reference to on-site, satellite and aerial photography and to the online planning register, where relevant, in the creation of the three dimensional model.

Section 3.3.9 of the BRE Guide provides that the *"question of whether trees or fences should be included in the calculation depends upon the type of shade they produce. Normally trees and shrubs need not be included, and partly because the dappled shade of a tree is more pleasant than the deep shadow of a building (this applies especially to deciduous trees)."* Given this, existing and proposed landscaping was not included in the assessment model.

Using the digital model, shadows were cast by ARC at several times of the day at the summer and winter solstices, and at the equinox. An equinox occurs twice a year: the March or vernal equinox (typically in or around the 20th to 21st March) and the September or autumnal equinox (typically in or around the 21st to 23rd September). For the purposes of this analysis and with reference to the BRE Guide, shadows were cast at several times of the day on 21st March.

The results are presented in shadow study diagrams associated with this report. Three images have been prepared for each time period on each representative date as follows:

- Receiving Environment: this image shows the shadows cast by the existing buildings only. Existing buildings surrounding the application site are shown in light grey. The shadows cast are shown in a dark grey tone.
- Proposed Development: this image shows the shadows cast by the existing buildings together with the shadows cast by the proposed development. The existing buildings surrounding the site are shown in light grey, while the proposed development on the application site is shown in blue. The shadows cast are shown in a dark grey tone.
- Cumulative: this image shows the shadows cast by the existing buildings together with the shadows cast by the proposed development, the planned nursing home development on the adjoining site to the east (LCC Reg. Ref. 21/1222); and the permitted development at Greenpark Avenue, South Circular Road of 30 no. residential dwellings and associated development (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18). The existing buildings surrounding the site are shown in light grey, while the proposed development on the application site is shown in blue. The neighbouring planned and permitted developments are shown in purple. The shadows cast are shown in a dark grey tone.

In order to calculate sunlight access to rooms, ARC referenced the methodology outlined in Appendix A: Indicators to calculate access to skylight, sunlight and solar radiation of the BRE Guide. Using proprietary sunlight and daylight access analysis software, ARC analysed a sunpath diagram overlaid with a shading mask corresponding to the existing or proposed shadow environment (as appropriate) and the sunlight probability diagram for a latitude of 53° N (i.e. Limerick is at a latitude of 52.7° N) for a reference point (i.e. the centre point) of each sample study window. The sunlight availability indicator has 100 spots on it. Each of these represents 1% of annual probable sunlight hours (APSH). The percentage of APSH at the reference point is found by counting up all the unobstructed spots.

In order to calculate sunlight access to rear gardens, ARC used proprietary sunlight analysis software to calculate the proportion of sample gardens in sunlight at regular intervals on 21st March in circumstances where the existing environment remains unchanged, in circumstances where the proposed development is constructed, in circumstances where nearby planned and permitted developments are constructed, and in circumstances where the proposed development and nearby planned and permitted developments have been constructed. Please note that the area of the garden quoted in Tables 15.4 and 15.6 relates to the area analysed for the purpose of the assessment.

Definition of Effects on Sunlight Access

The assessment of the impact of the proposed development on sunlight access had regard to the *Guidelines on the Information to be Contained in Environmental Impact Assessment*

Reports prepared by the Environmental Protection Agency (Draft of 2017), and to Directive 2011/92/EU (as amended by Directive 2014/52/EU) on the assessment of the likely effects of certain public and private projects on the environment.

In assessing whether a predicted effect of the proposal on sunlight access is likely to be "imperceptible", "not significant", "slight", "moderate", "significant", "very significant" or "profound" within the meaning of the EPA's *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*, ARC referred to Appendix I of the BRE Guide sets out advice on environment impact assessment. It states:

> *I4 The assessment of impact will depend on a combination of factors, and there is no simple rule of thumb that can be applied.*
>
> *I5 Where the loss of skylight or sunlight fully meets the guidelines in this book, the impact is assessed as negligible or minor adverse. Where the loss of light is well within the guidelines, or only a small number of windows or a limited area of open space lose light (within the guidelines), a classification of negligible impact is more appropriate, especially if there is a particularly strong requirement for daylight and sunlight in the affected building or open space.*
>
> *I6 Where the loss of skylight or sunlight does not meet the guidelines in this book, the impact is assessed as minor, moderate or major adverse. Factors tending towards a minor adverse impact include:*
> - *only a small number of windows or limited area of open space are affected*
> - *the loss of light is only marginally outside the guidelines*
> - *an affected room has other source of skylight or sunlight*
> - *the affected building or open space only has a low level requirement for skylight or sunlight*
> - *there are particular reasons why an alternative, less stringent, guidelines should be applied (see Appendix F).*
>
> *I7 Factors tending towards a major adverse impact include:*
> - *a large number of windows or large area of open space are affected*
> - *the loss of light is substantially outside the guidelines*
> - *all the windows in a particular property are affected*
> - *the affected indoor or outdoor spaces have a particularly strong requirement for skylight or sunlight, eg a living room in a dwelling or a children's playground.*

Having considered the factors outlined in Appendix I of the BRE Guide, ARC's assessment classifies the impact of the proposed development on daylight and sunlight access within existing buildings or open spaces with reference to the list of definitions set out at *Table 3.3: Descriptions of Effects* contained in the *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* prepared by the Environmental Protection Agency. The definitions from the EPA document are in italics, while some comment is also given below on what ARC considers these definitions might imply in the case of daylight access (e.g. having regard to Appendix I of the BRE Guide). Please note that, for the purpose of this chapter, the word "effect" is taken to have the same meaning as the word "impact".

- ***Imperceptible:*** *An effect capable of measurement but without significant consequences.* The definition implies that the development would cause a change in the sunlight received at a location, capable of measurement, but not noticeable to the casual observer. If the development caused no change in sunlight access, there could be no effect. Examples of "imperceptible" impacts on sunlight access would include:

  (a) a scenario where the proposed development is predicted to reduce the amount of sunlight received by a sample window, but the sample window will continue to receive the relevant recommended level of Annual Probable Sunlight Hours after the construction of the proposed development; and
  (b) a scenario where the proposed development is predicted to reduce the Annual Probable Sunlight Hours received by a sample window to not less than 0.8 times its existing value (i.e. the BRE Guide threshold for an adverse impact). Similarly, where sunlight access to a sample garden is reduced, the impact of proposed development could be considered to be "imperceptible" or "not significant" where the sample garden continues to receive at least two hours of sunlight over half its area on 21st March, and, where the area of the garden capable of receiving sunlight on 21st March does not drop to less than 0.8 times its existing level after the construction of the proposed development.

- ***Not Significant:*** *An effect which causes noticeable[2] changes in the character of the environment but without significant consequences* (the footnote "2" to the word *"noticeable"* is: *"for the purposes of planning consent procedures"*). The definition implies that the development would cause a change in the sunlight received at a location, which is capable of measurement and capable of being noticed by an observer who is taking an active interest in the extent to which the proposal might affect sunlight access.

- ***Slight:*** *An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.* For this definition to apply, the amount of sunlight received at a location would be changed by shadows cast by the development to an extent that is both capable of measurement and is noticeable to a minor degree. However, the shadow environment of the surrounding environment should remain largely unchanged. An example of a "slight" impact would be a scenario where, although the impact of the proposed development is not predicted to reduce the amount of sunlight received by a sample window or garden to less than 0.8 times its former value, the amount of light received by the sample window or garden is predicted to fall below a key recommended level, whether that is the BRE Guide recommended target value or an alternative target value. A further example of a "slight" impact would be where, although the construction of the proposed development is predicted to reduce the amount of light received to a level below the BRE Guide threshold for an adverse impact, the predicted reduction is just outside that BRE Guide threshold (e.g. the amount of sunlight received by a sample window or garden falls to not less than 0.7 times its existing value*). A "slight" impact could also occur where there is a more considerable reduction in sunlight by a sample window within an existing building, but only a small number of windows within that property are affected to that extent.

- ***Moderate:*** *An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.* In this case, a development must bring about a change in the shadow environment of the area; and this change must be consistent with a pattern of change that is already occurring or is likely to occur. A moderate effect would occur where other developments were bringing about changes in sunlight access of similar extent in the area. A "moderate" impact might also be considered to occur where the level of sunlight access to a sample window or garden falls below the BRE Guide recommended level and to between 0.5 and 0.7 times its existing value, subject to consideration of other factors*.

- ***Significant:*** *An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.* The definition implies that the existence of the development would change the extent of sunlight access in a manner that is not *"consistent with existing and emerging baseline trends"*. For example, a development resulting in a *"significant"* diminution of sunlight access would overshadow a location to the extent that there is a significant change in the amount of direct sunlight received at that location. A "significant" impact could occur where the predicted reduction in sunlight access is greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "significant" impact could occur where sunlight access to the sample window or garden falls to between 0.25 and 0.5 times its former value*.

- ***Very Significant:*** *An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.* For example, a *"very significant"* reduction in sunlight access would occur where the development overshadows a location for most of the time that the location would have been in sunlight prior to the construction of the development and where overshadowing of that magnitude is not *"consistent with existing and emerging baseline trends"*. A "very significant" impact could occur where the predicted reduction in sunlight access is considerably greater than what is envisaged to occur if the application site were developed in line with existing and emerging baseline trends. Subject to consideration of other factors, a "very significant" impact could occur where sunlight access to the sample window or garden falls to between 0.01 and 0.25 times its former value*.

- ***Profound:*** *An effect which obliterates sensitive characteristics.* Examples of development resulting in a *"profound"* effect on sunlight access would include facilitating sunlight access at a location where that location has previously had none (e.g. facilitating sunlight access as a result of the demolition of a building) or by removal of all access to sunlight at a location.

* Please note that, while this section sets out indicative quantitative ranges that could apply to each type of impact, this assessment considers a range of factors (such as relevant target values, the use of the affected building, the number of rooms affected within the building, etc) in classifying impacts.

In relation to sunlight access, it is conceivable that there could be positive impacts, but this implies that a development would involve a reduction of the size or scale of built form (e.g. such as the demolition of a building, which might result in an increase in sunlight access). Though that is possible, it is usually unlikely as most development involves the construction of new obstructions to sunlight access.

The range of possible impacts listed above deal largely with the extent of impact; and the extent of the impact of a development is usually proportional to the extent to which that development is large in scale and/or height and its proximity to the location. This proportionality may be modified by the extent to which the development is seen as culturally or socially acceptable, and on the interaction between the proposed development, the character of the existing shadow environment and the land use pattern of the receiving environment.

15.4.2 Potential Effects of the Proposed Project

15.4.2.1 Construction Phase

The potential impact of the construction phase of the proposed development on sunlight access is likely to be, initially, lesser than the potential effect of the completed development. As the proposed development nears completion, the potential impact of the emerging development is likely to be similar in all material respects to that of the completed development. It is noted that temporary structures and machinery (e.g. hoarding, scaffolding, cranes, etc.) have the potential to result in changes in sunlight access in buildings and to open spaces, although any additional impacts arising from temporary structures or machinery are likely to be temporary and minor.

15.4.2.2 Operational Phase

The statistics of Met Eireann, the Irish Meteorological Service, indicate that the sunniest months in Ireland are May and June. During December, Shannon Airport (the station closest to the proposed development) receives a mean daily duration of 1.4 hours of sunlight out of a mean maximum daily duration of 7.1 hours sunlight each day (i.e., only 20% of potential sunlight hours). This can be compared with a mean daily duration of 5.8 hours of sunlight out of a mean maximum daily duration of 15.6 hours each day received at Shannon Airport during May (i.e., 37% of potential sunlight hours). Therefore, impacts caused by overshadowing are generally most noticeable during the summer months and least noticeable during the winter months. Due to the low angle of the sun in mid winter, the shadow environment in all urban and suburban areas is generally dense throughout winter.

In assessing the impact of a development on sunlight access, the comments of PJ Littlefair in *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide) should be taken into consideration. The BRE Guide states, at Section 3.3.13, that *"it must be borne in mind that nearly all structures will create areas of new shadow, and some degree of transient overshadowing of a space is to be expected."*

<u>Overview of the potential impact of shadows cast by the proposed development outside the application site</u>

Shadows cast by the proposed development have the potential to extend beyond the western boundary of the site during the mornings throughout the year. However, the extent of additional overshadowing of lands to the west is likely to be minor and, as lands to the west are undeveloped, the potential for material impacts to arise on the shadow environment are low. Similarly, shadows cast by the proposal have the potential to extend to undeveloped lands to the north at various times of the day around mid winter when the sun is low and to undeveloped lands to the south during the early mornings and late evenings around mid summer. The potential impact of shadows cast by the proposed development on sunlight access to lands to the west, north and south of the application site is assessed as ranging from none to “imperceptible” to “not significant”.

To the east, the proposed development has the potential to result in minor additional overshadowing of residential lands at Greenpark Avenue and Log Na gCapall during the afternoons and evenings throughout the year. The potential impact of shadows cast by the proposed development on sunlight access to lands to the east of the application site is assessed as ranging from none to “imperceptible” to “not significant”.

<u>Detailed analysis of the potential impact of shadows cast by the proposed development on existing buildings outside the application site</u>

This chapter assesses the impact of the proposed development to all potential receptors surrounding the application site - sunlight impacts are described in the section above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on sunlight access to a representative sample of sensitive receptors (i.e. windows) in buildings in proximity to the application site (please see Figure 15.2 below).

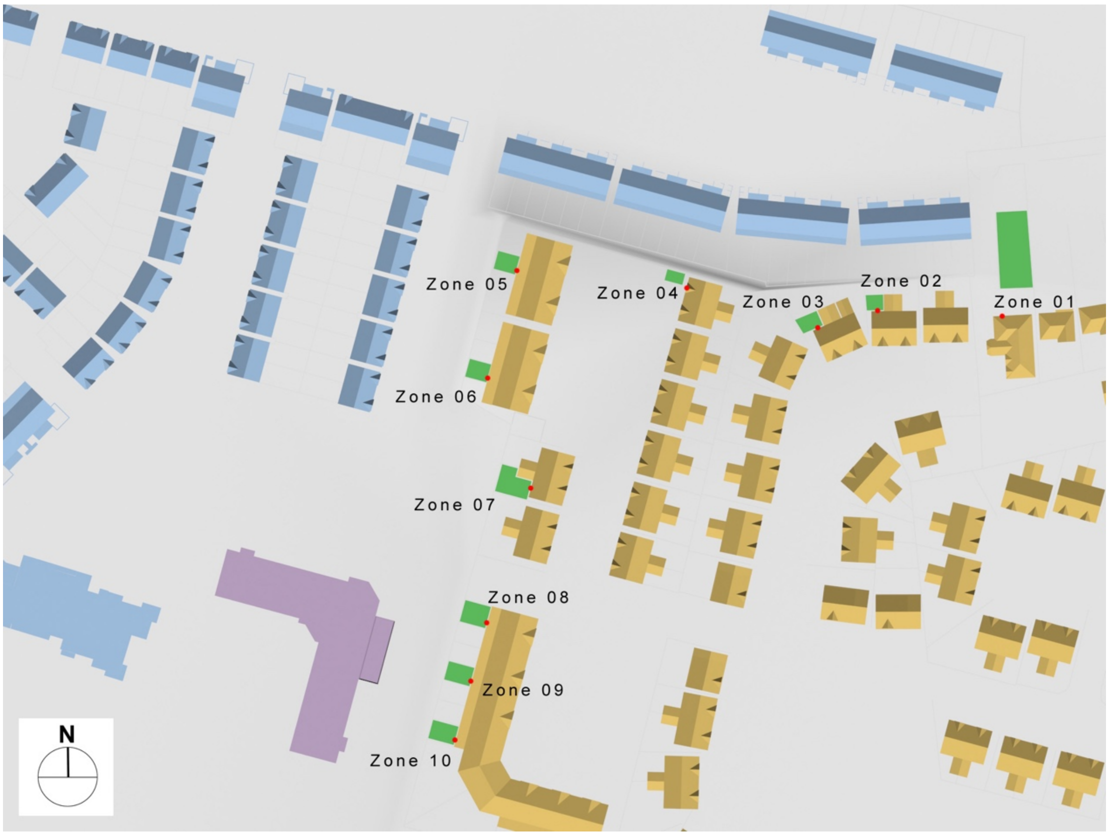

Figure 15.2: Indicative diagram showing location of sample windows (indicated with red dot) and gardens (indicated in green) assessed under this chapter. [Please note that, as it is yet to be constructed, the sample windows at Zones 13 and 14 were assessed under Section 15.4.3: Potential Cumulative Effects only].

As set out in Section 15.4.1, ARC had regard to the BRE Guide, which provides as follows in relation to the assessment of the impact of development on sunlight access to existing buildings*: “If the available sunlight hours are both less than the amount above [25% of annual probable sunlight hours, including at least 5% of annual probable sunlight hours in the winter* *months between 21 September and 21 March] and less than 0.8 times their former value, either over the whole year or just in the winter months (21 September to 21 March), then the occupants of the existing building will notice the loss of sunlight; if the overall annual loss is greater than 4% of APSH, the room may appear colder and less cheerful and pleasant."* This excerpt from the BRE Guide suggests that where the construction of a new development has the potential to reduce sunlight access values below the recommended annual level, to less than 0.8 times the former level of sunlight access or by more than 4% APSH during the relevant periods, the potential impact of that proposed development will not be noticed.

It should further be noted that the BRE Guide does not outline a recommended level of sunlight access to be achieved by windows facing within 90° of due north. The BRE Guide also does not describe a threshold for adverse impact on such windows. Notwithstanding this, as all principal facades of existing buildings facing towards the application site face within 90° of due north, this chapter includes detailed quantitative analysis of the potential impact of the proposed development on sunlight access to sample windows in houses at Log Na gCapall and Greenpark Avenue with reference to the tests outlined for windows facing within 90° of due south.

The results of ARC's analysis are outlined in Table 15.3 below.

Table 15.3: Potential impact of the proposed development on sunlight access to sample windows in existing buildings in proximity to the application site**

Zone+	Floor	Annual Probable Sunlight Hours						Potential Impact
		Existing			Proposed			
		Annual	Summer*	Winter*	Annual	Summer*	Winter*	
1	Floor 00	8%	8%	0%	8%	8%	0%	None
	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
2	Floor 00	3%	3%	0%	3%	3%	0%	None
	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
3	Floor 00	10%	10%	0%	10%	10%	0%	None
	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
4	Floor 00	37%	28%	10%	37%	28%	10%	None
	ARC's analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
5	Floor 00	35%	30%	5%	33%	28%	5%	Imperceptible
	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as this window will continue to receive more than 25% Annual Probable Sunlight Hours							

Zone+	Floor	Annual Probable Sunlight Hours						Potential Impact
		Existing			Proposed			
		Annual	Summer*	Winter*	Annual	Summer*	Winter*	
	(including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.							
6	Floor 00	36%	30%	6%	34%	28%	6%	Imperceptible
	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be “imperceptible” as this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development.							
7	Floor 00	38%	30%	8%	38%	30%	8%	None
	ARC’s analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
8	Floor 00	33%	29%	4%	33%	29%	4%	None
	ARC’s analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
9	Floor 00	34%	30%	4%	34%	30%	4%	None
	ARC’s analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
10	Floor 00	35%	30%	5%	35%	30%	5%	None
	ARC’s analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
11	Floor 00	16%	16%	0%	16%	16%	0%	None
	ARC’s analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							
12	Floor 00	39%	30%	9%	39%	30%	9%	None
	ARC’s analysis indicates that the proposed development is not likely to result in any change in sunlight access at this window.							

* For the purposes of this calculation, summer is taken to mean the period between March and September, and winter is considered to be the period between September and March.

** Survey information of all structures on private lands surrounding the application site was not available. Where insufficient survey information was available and window sizes / locations could not be informed by information available from the online planning register or from aerial photography, window sizes / locations were estimated by ARC.

+ Please note that, as the development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 has yet to be constructed, the sample windows at Zones 13 and 14 were assessed under Section 15.4.3: Potential Cumulative Effects only. Please see table Table 15.5 below.

Detailed analysis of the potential impact of shadows cast by the proposed development on gardens / amenity areas outside the application site

Insofar as amenity spaces / gardens are concerned, the BRE Guide provides that *"It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March. If as a result of new development an existing garden or amenity area does not meet the above, and the area which can receive two hours of sun on 21 March is less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable."* [Emphasis added.] This suggests that where a garden or amenity area can receive two hours of sun over half its area on 21 March notwithstanding the construction of a proposed development, loss of sunlight as a result of additional overshadowing is not likely to be noticed.

This analysis assesses the impact of the proposed development to all potential receptors surrounding the application site - these impacts are described above in the section above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on sunlight access to a representative sample of sensitive receptors (i.e. gardens) in proximity to the application site (please see Figure 15.2 above).

Table 15.4 sets out the likely proportion of these gardens in sunlight before and after the construction of the proposed development throughout the day on 21st March.

Table 15.4: Potential impact of the proposed development on sunlight access to sample neighbouring gardens

Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
Zone 01 Greenpark Avenue Rear Garden	10:00	76%	76%
	11:00	87%	87%
	12:00	97%	97%
	13:00	95%	95%
	14:00	84%	84%
	15:00	75%	75%
	16:00	57%	57%
	17:00	24%	21%
	18:00	0%	0%
Potential "imperceptible" impact on 21st March. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (224 sq m) during the late evening of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			
Zone 02 Log Na gCapall Rear Garden	10:00	0%	0%
	11:00	0%	0%

Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
	12:00	5%	5%
	13:00	17%	17%
	14:00	0%	0%
	15:00	0%	0%
	16:00	0%	0%
	17:00	0%	0%
	18:00	0%	0%
No potential change in sunlight access on 21st March. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (24 sq m) on 21st March.			
Zone 03 Log Na gCapall Rear Garden	10:00	0%	0%
	11:00	40%	40%
	12:00	38%	38%
	13:00	20%	20%
	14:00	0%	0%
	15:00	0%	0%
	16:00	1%	1%
	17:00	2%	2%
	18:00	0%	0%
No potential change in sunlight access on 21st March. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (32 sq m) on 21st March.			
Zone 04 Log Na gCapall Front Garden	10:00	0%	0%
	11:00	0%	0%
	12:00	55%	55%
	13:00	98%	98%
	14:00	100%	100%
	15:00	100%	100%
	16:00	100%	100%
	17:00	9%	9%

Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
	18:00	0%	0%
No potential change in sunlight access on 21st March. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (19 sq m) on 21st March.			
Zone 05 Log Na gCapall Rear Garden	10:00	0%	0%
	11:00	11%	11%
	12:00	43%	43%
	13:00	58%	58%
	14:00	56%	56%
	15:00	42%	42%
	16:00	32%	32%
	17:00	6%	6%
	18:00	19%	0%
Potential "imperceptible" to "not significant" impact on 21st March. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (37 sq m) during the late evening of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that the proportion of the garden capable of receiving at least two hours of sunshine on 21st March is unlikely to change as a result of shadows cast by the proposed development.			
Zone 06 Log Na gCapall Rear Garden	10:00	0%	0%
	11:00	12%	12%
	12:00	41%	41%
	13:00	56%	56%
	14:00	54%	54%
	15:00	39%	39%
	16:00	31%	31%
	17:00	8%	8%
	18:00	21%	0%
Potential "imperceptible" to "not significant" impact on 21st March. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (37 sq m) during the late evening of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that the proportion of the garden capable of receiving at least two hours of sunshine on 21st March is unlikely to change as a result of shadows cast by the proposed development.			
Zone 07 Log Na gCapall Rear Garden	10:00	0%	0%
	11:00	32%	32%

Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
	12:00	54%	54%
	13:00	65%	65%
	14:00	62%	62%
	15:00	53%	53%
	16:00	42%	42%
	17:00	13%	13%
	18:00	12%	3%
Potential "imperceptible" to "not significant" impact on 21st March. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (70 sq m) during the late evening of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			
Zone 08 Log Na gCapall Rear Garden	10:00	0%	0%
	11:00	20%	20%
	12:00	52%	52%
	13:00	63%	63%
	14:00	62%	62%
	15:00	50%	50%
	16:00	41%	41%
	17:00	19%	19%
	18:00	26%	0%
Potential "imperceptible" to "not significant" impact on 21st March. ARC's analysis indicates that the construction of the proposed development is likely to result in a minor change in sunlight access to this garden (53 sq m) during the late evening of 21st March, although this change is likely to be so minor that it will not be noticeable. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development.			
Zone 09 Log Na gCapall Rear Garden	10:00	0%	0%
	11:00	19%	19%
	12:00	48%	48%
	13:00	59%	59%
	14:00	54%	54%
	15:00	39%	39%

Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
	16:00	30%	30%
	17:00	13%	13%
	18:00	28%	28%
No potential change in sunlight access on 21st March. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (46 sq m) on 21st March.			
Zone 10 Log Na gCapall Rear Garden	10:00	0%	0%
	11:00	20%	20%
	12:00	55%	55%
	13:00	64%	64%
	14:00	59%	59%
	15:00	44%	44%
	16:00	38%	38%
	17:00	14%	14%
	18:00	28%	28%
No potential change in sunlight access on 21st March. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (46 sq m) on 21st March.			
Zone 11 Log Na gCapall Rear Garden	10:00	63%	63%
	11:00	63%	63%
	12:00	66%	66%
	13:00	69%	69%
	14:00	74%	74%
	15:00	72%	72%
	16:00	81%	81%
	17:00	66%	66%
	18:00	10%	10%
No potential change in sunlight access on 21st March. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (221 sq m) on 21st March.			
Zone 12 Log Na gCapall Rear Garden	10:00	25%	25%
	11:00	39%	39%

Zone	21st March Time	Existing Percentage area in sunlight	Proposed Percentage area in sunlight
	12:00	78%	78%
	13:00	96%	96%
	14:00	98%	98%
	15:00	92%	92%
	16:00	64%	64%
	17:00	8%	8%
	18:00	20%	20%
No potential change in sunlight access on 21st March. ARC's analysis indicates that the construction of the proposed development is unlikely to result in any change in sunlight access to this garden (93 sq m) on 21st March.			

15.4.3 Potential Cumulative Effects

A review of the Limerick City and County Council online planning register identified the following developments which are planned or for which permission has been granted, which, in combination with the development now proposed, have the potential to result in material cumulative impacts on sunlight access to the area surrounding the application site, within the meaning of *Site layout planning for daylight and sunlight: a guide to good practice* (the BRE Guide):

- The planned nursing home development on the adjoining site to the east (LCC Reg. Ref. 21/1222);
- The permitted development at Greenpark Avenue, South Circular Road of 30 no. residential dwellings and associated development (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18).

As part of this assessment, ARC has assessed the potential for the proposed development, in combination with these planned and permitted developments, to result in cumulative impacts on sunlight access to the area surrounding the application site.

15.4.3.1 Construction Phase

The potential cumulative impact of the construction phase of the proposed development, in combination with nearby planning and permitted developments, on sunlight access to the surrounding area is likely to be, initially, lesser than the cumulative impact of the completed developments. As the proposed and permitted developments near completion, the potential impact of the emerging developments is likely to be similar in all material respects to that of the completed developments. It is noted that temporary structures and machinery (e.g. hoarding, scaffolding, cranes, etc.) have the potential to result in changes in sunlight access, although any additional impacts arising from temporary structures or machinery are likely to be temporary and minor.

15.4.3.2 Operational Phase

Overview of the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on sunlight access to the surrounding area
ARC's analysis indicates that there is a potential for the proposed development, in combination with the planned nursing home development on the adjoining site (LCC Reg. Ref. 21/1222) and the permitted residential development at Greenpark Avenue (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18), to result in cumulative impacts on sunlight access to the area surrounding the application site additional to those already described in Section 15.4.2 above.

The proposed development, in combination with nearby planned and permitted developments, has the potential to result in a greater reduction in sunlight to nearby gardens at Log Na gCapall than is indicated in Table 15.4 above. ARC's analysis indicates that the cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on sunlight access to neighbouring residential lands is likely to fall in the range of "imperceptible" to "slight" under a worst case scenario.

This section also considers the potential impact of the proposed development, in combination with the planned nursing home development, on the permitted (but not yet constructed) residential development at Greenpark Avenue (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18). ARC's analysis indicated that, if it were assumed that the planned nursing home development and the residential development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 were constructed, the construction of the proposed development would result in little or no impact on sunlight access to houses permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18. The impact of the proposed development, in combination with the planned nursing home development, on sunlight access to the permitted (but not yet constructed) residential development at Greenpark Avenue would range from none to "imperceptible" to "slight" on those houses and gardens closest to the application site boundary.

Detailed analysis of the potential cumulative impact of the proposed development, in combination with nearby planned and permitted developments, on sunlight access within existing buildings outside the application site
This analysis assesses the potential cumulative impact of the proposed development, in combination with the planned nursing home development on the adjoining site (LCC Reg. Ref. 21/1222) and the permitted residential development at Greenpark Avenue (LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18), on all potential receptors surrounding the application site - these impacts are described in the section above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development, in combination with the planned nursing home development on the adjoining site, to result in impacts on sunlight access to a representative sample of sensitive receptors (i.e. rooms) in buildings in proximity to the application site (please see Figure 15.2 above). The representative sample of buildings includes worst case scenario examples, such as rooms at close proximity to the proposed development and rooms at low levels of accommodation.

The results of ARC's analysis are set out in Table 15.5 below:

Table 15.5: Potential cumulative impact of the proposed development on sunlight access to sample windows in existing buildings in proximity to the application site**

Zone	Floor	Annual Probable Sunlight Hours									Potential Cumulative Impact
		Existing			Existing incl. Permitted and Planned Developments			Cumulative Proposed			
		Annual	Summer*	Winter*	Annual	Summer*	Winter*	Annual	Summer*	Winter*	
01	Floor 00	8%	8%	0%	8%	8%	0%	8%	8%	0%	None
	ARC's analysis indicates that shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in any change in sunlight access at this window.										
02	Floor 00	3%	3%	0%	3%	3%	0%	3%	3%	0%	None
	ARC's analysis indicates that shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in any change in sunlight access at this window.										
03	Floor 00	10%	10%	0%	10%	10%	0%	10%	10%	0%	None
	ARC's analysis indicates that shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in any change in sunlight access at this window.										
04	Floor 00	37%	28%	10%	37%	28%	10%	37%	28%	10%	None
	ARC's analysis indicates that shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in any change in sunlight access at this window.										
05	Floor 00	35%	30%	5%	35%	30%	5%	33%	28%	5%	Imperceptible
	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest that shadows cast by the proposed development, in combination with nearby planned and permitted developments, on this window would result in an "imperceptible" cumulative impact as this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development as well as nearby planned and permitted developments.										
06	Floor 00	36%	30%	6%	36%	30%	6%	34%	28%	6%	Imperceptible
	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest that shadows cast by the proposed development, in combination with nearby planned and permitted developments, on this window would result in an "imperceptible" cumulative impact as this window will continue to receive more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development as well as nearby planned and permitted developments.										
07	Floor 00	38%	30%	8%	38%	30%	8%	38%	30%	8%	None
	ARC's analysis indicates that shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in any change in sunlight access at this window.										
08	Floor 00	33%	29%	4%	30%	26%	4%	30%	26%	4%	Imperceptible
	This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.8 times their former value after the construction of the proposed development. Specifically, ARC's analysis indicates that Annual Probable Sunlight Hours										

<table>
<tr><th rowspan="3">Zone</th><th rowspan="3">Floor</th><th colspan="9">Annual Probable Sunlight Hours</th><th rowspan="3">Potential Cumulative Impact</th></tr>
<tr><th colspan="3">Existing</th><th colspan="3">Existing incl. Permitted and Planned Developments</th><th colspan="3">Cumulative Proposed</th></tr>
<tr><th>Annual</th><th>Summer*</th><th>Winter*</th><th>Annual</th><th>Summer*</th><th>Winter*</th><th>Annual</th><th>Summer*</th><th>Winter*</th></tr>
<tr><td></td><td colspan="11">received by the window will fall to 0.91 times their existing value over the course of the year as a result of shadows cast by the proposed development, in combination with nearby planned and permitted developments. ARC's analysis further indicates that Annual Probable Sunlight Hours are not likely to change during the winter period.</td></tr>
<tr><td rowspan="2">09</td><td>Floor 00</td><td>34%</td><td>30%</td><td>4%</td><td>28%</td><td>24%</td><td>4%</td><td>28%</td><td>24%</td><td>4%</td><td>Imperceptible to Not Significant</td></tr>
<tr><td colspan="11">This window faces within 90° of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.83 times their former value after the construction of the proposed development. Specifically, ARC's analysis indicates that Annual Probable Sunlight Hours received by the window will fall to 0.91 times their existing value over the course of the year as a result of shadows cast by the proposed development, in combination with nearby planned and permitted developments. ARC's analysis further indicates that Annual Probable Sunlight Hours are not likely to change during the winter period. If noticeable, shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in "significant consequences" for the character of the sunlight environment. This impact is assessed as ranging from "imperceptible" to "not significant".</td></tr>
<tr><td rowspan="2">10</td><td>Floor 00</td><td>35%</td><td>30%</td><td>5%</td><td>29%</td><td>24%</td><td>5%</td><td>29%</td><td>24%</td><td>5%</td><td>Imperceptible to Not Significant</td></tr>
<tr><td colspan="11">This window faces within 90°of due north. However, applying the Section 3.2.1 criteria for windows facing within 90° of due south, the BRE Guide would suggest the impact of the proposed development on this window would be "imperceptible" as Annual Probable Sunlight Hours received by this window are not likely fall to less than 0.83 times their former value after the construction of the proposed development. Specifically, ARC's analysis indicates that Annual Probable Sunlight Hours received by the window will fall to 0.91 times their existing value over the course of the year as a result of shadows cast by the proposed development, in combination with nearby planned and permitted developments. ARC's analysis further indicates that Annual Probable Sunlight Hours are not likely to change during the winter period. If noticeable, shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in "significant consequences" for the character of the sunlight environment. This impact is assessed as ranging from "imperceptible" to "not significant".</td></tr>
<tr><td rowspan="2">11</td><td>Floor 00</td><td>16%</td><td>16%</td><td>0%</td><td>16%</td><td>16%</td><td>0%</td><td>16%</td><td>16%</td><td>0%</td><td>None</td></tr>
<tr><td colspan="11">ARC's analysis indicates that shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in any change in sunlight access at this window.</td></tr>
<tr><td rowspan="2">12</td><td>Floor 00</td><td>39%</td><td>30%</td><td>9%</td><td>39%</td><td>30%</td><td>9%</td><td>39%</td><td>30%</td><td>9%</td><td>None</td></tr>
<tr><td colspan="11">ARC's analysis indicates that shadows cast by the proposed development, in combination with nearby planned and permitted developments, are not likely to result in any change in sunlight access at this window.</td></tr>
<tr><td rowspan="2">13</td><td>Floor 00</td><td colspan="3">N/A</td><td>83%</td><td>59%</td><td>25%</td><td>77%</td><td>53%</td><td>24%</td><td>See below</td></tr>
<tr><td colspan="11">This sample window is in a building permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18, but <u>not yet constructed</u>. As the building is not yet constructed, this table does not include an assessment of the Annual Probable Sunlight Hours at this window under an existing scenario or an assessment of the cumulative impact of development on the existing scenario.

However, in the interests of completeness, it should be noted that, if it were assumed that the planned nursing home development and the residential development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 were constructed, the construction of the proposed development, planned and permitted developments would result in an "imperceptible" impact on sunlight access as this window will continue to receive very considerably more than 25% Annual</td></tr>
</table>

Zone	Floor	Annual Probable Sunlight Hours									Potential Cumulative Impact
		Existing			Existing incl. Permitted and Planned Developments			Cumulative Proposed			
		Annual	Summer*	Winter*	Annual	Summer*	Winter*	Annual	Summer*	Winter*	
	Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development as well as nearby planned and permitted developments.										
14	Floor 00	N/A			83%	59%	25%	82%	59%	24%	See below
	This sample window is in a building permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18, but <u>not yet constructed</u>. As the building is not yet constructed, this table does not include an assessment of the Annual Probable Sunlight Hours at this window under an existing scenario or an assessment of the cumulative impact of development on the existing scenario. However, in the interests of completeness, it should be noted that, if it were assumed that the planned nursing home development and the residential development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 were constructed, the construction of the proposed development, planned and permitted developments would result in an "imperceptible" impact on sunlight access as this window will continue to receive very considerably more than 25% Annual Probable Sunlight Hours (including 5% Annual Probable Sunlight Hours during the winter period) after the construction of the proposed development as well as nearby planned and permitted developments.										

* For the purposes of this calculation, summer is taken to mean the period between March and September, and winter is considered to be the period between September and March.

** Survey information of all structures on private lands surrounding the application site was not available. Where insufficient survey information was available and window sizes / locations could not be informed by information available from the online planning register or from aerial photography, window sizes / locations were estimated by ARC.

<u>Detailed analysis of the potential cumulative impact of the proposed development, in combination with the planned nursing home development on the adjoining site, on sunlight access to gardens / amenity areas outside the application site</u>

This analysis assesses the impact of the proposed development to all potential receptors surrounding the application site - these impacts are described above in the section above. However, by way of example in order to illustrate briefly the findings outlined in the overview section, ARC conducted detailed analysis of the potential for the proposed development to result in impacts on sunlight access to a representative sample of sensitive receptors (i.e. gardens) in proximity to the application site (please see Figure 15.2 above).

Table 15.6 sets out the likely proportion of these gardens in sunlight before and after the construction of the proposed development throughout the day on 21st March.

Table 15.6: Potential cumulative impact of the proposed development, in combination with the planned nursing home development on the adjoining site, on sunlight access to sample neighbouring gardens

Zone	Time	Percentage area in sunlight – 21st March		
		Existing	Existing incl. Planned Nursing Home Development	Cumulative Proposed
Zone 01 Greenpark Avenue Rear Garden	10:00	76%	76%	76%
	11:00	87%	87%	87%
	12:00	97%	97%	97%
	13:00	95%	95%	95%
	14:00	84%	84%	84%
	15:00	75%	75%	75%
	16:00	57%	57%	57%
	17:00	24%	24%	21%
	18:00	0%	0%	0%
Potential "imperceptible" cumulative impact on 21st March. ARC's analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (224 sq m).				
Zone 02 Log Na gCapall Rear Garden	10:00	0%	0%	0%
	11:00	0%	0%	0%
	12:00	5%	5%	5%
	13:00	17%	17%	17%
	14:00	0%	0%	0%
	15:00	0%	0%	0%
	16:00	0%	0%	0%
	17:00	0%	0%	0%
	18:00	0%	0%	0%
No potential change in sunlight access on 21st March. ARC's analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (24 sq m).				
Zone 03 Log Na gCapall Rear Garden	10:00	0%	0%	0%
	11:00	40%	40%	40%
	12:00	38%	38%	38%
	13:00	20%	20%	20%

Zone	Time	Percentage area in sunlight – 21st March		
		Existing	Existing incl. Planned Nursing Home Development	Cumulative Proposed
	14:00	0%	0%	0%
	15:00	0%	0%	0%
	16:00	1%	1%	1%
	17:00	2%	2%	2%
	18:00	0%	0%	0%
No potential change in sunlight access on 21st March. ARC's analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (32 sq m).				
Zone 04 Log Na gCapall Front Garden	10:00	0%	0%	0%
	11:00	0%	0%	0%
	12:00	55%	55%	55%
	13:00	98%	98%	98%
	14:00	100%	100%	100%
	15:00	100%	100%	100%
	16:00	100%	100%	100%
	17:00	9%	9%	9%
	18:00	0%	0%	0%
No potential change in sunlight access on 21st March. ARC's analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (19 sq m).				
Zone 05 Log Na gCapall Rear Garden	10:00	0%	0%	0%
	11:00	11%	11%	11%
	12:00	43%	43%	43%
	13:00	58%	58%	58%
	14:00	56%	56%	56%
	15:00	42%	42%	42%
	16:00	32%	32%	32%
	17:00	6%	6%	6%
	18:00	19%	19%	0%

Zone	Time	Percentage area in sunlight – 21st March		
		Existing	Existing incl. Planned Nursing Home Development	Cumulative Proposed
Potential "imperceptible" to "not significant" cumulative impact on 21st March. ARC's analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (37 sq m).				
Zone 06 Log Na gCapall Rear Garden	10:00	0%	0%	0%
	11:00	12%	12%	12%
	12:00	41%	41%	41%
	13:00	56%	56%	56%
	14:00	54%	54%	54%
	15:00	39%	39%	39%
	16:00	31%	31%	31%
	17:00	8%	8%	8%
	18:00	21%	21%	0%
Potential "imperceptible" to "not significant" cumulative impact on 21st March. ARC's analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (37 sq m).				
Zone 07 Log Na gCapall Rear Garden	10:00	0%	0%	0%
	11:00	32%	32%	32%
	12:00	54%	54%	54%
	13:00	65%	65%	65%
	14:00	62%	62%	62%
	15:00	53%	53%	53%
	16:00	42%	42%	42%
	17:00	13%	13%	13%
	18:00	12%	12%	3%
Potential "imperceptible" to "not significant" cumulative impact on 21st March. ARC's analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (70 sq m).				
Zone 08 Log Na gCapall Rear Garden	10:00	0%	0%	0%
	11:00	20%	20%	20%
	12:00	52%	52%	52%
	13:00	63%	63%	63%

Zone	Time	Percentage area in sunlight – 21st March		
		Existing	Existing incl. Planned Nursing Home Development	Cumulative Proposed
	14:00	62%	62%	62%
	15:00	50%	50%	50%
	16:00	41%	41%	41%
	17:00	19%	0%	0%
	18:00	26%	0%	0%
Potential "imperceptible" to "slight" cumulative impact on 21st March. ARC's analysis indicates that the construction of the proposed development, in combination with nearby planned and permitted developments, is likely to result in a reduction in sunlight access to this garden (53 sq m) during the late evening of 21st March. ARC's analysis indicates that at least half of the garden will continue to receive at least two hours of sunlight on 21st March after the construction of the proposed development and nearby planned and permitted developments.				
Zone 09 Log Na gCapall Rear Garden	10:00	0%	0%	0%
	11:00	19%	19%	19%
	12:00	48%	48%	48%
	13:00	59%	59%	59%
	14:00	54%	54%	54%
	15:00	39%	39%	39%
	16:00	30%	30%	30%
	17:00	13%	0%	0%
	18:00	28%	0%	0%
Potential "imperceptible" to "slight" cumulative impact on 21st March. ARC's analysis indicates that the construction of the planned nursing home development on the adjoining site is likely to result in a reduction in sunlight access to this garden (46 sq m) during the late evening of 21st March. ARC's analysis indicates that the proportion of the garden capable of receiving at least two hours of sunshine on 21st March is unlikely to change as a result of shadows cast by the proposed development and nearby planned and permitted developments.				
Zone 10 Log Na gCapall Rear Garden	10:00	0%	0%	0%
	11:00	20%	20%	20%
	12:00	55%	55%	55%
	13:00	64%	64%	64%
	14:00	59%	59%	59%
	15:00	44%	44%	44%
	16:00	38%	38%	38%
	17:00	14%	8%	8%

<table>
<tr><th rowspan="2">Zone</th><th rowspan="2">Time</th><th colspan="3">Percentage area in sunlight – 21st March</th></tr>
<tr><th>Existing</th><th>Existing incl. Planned Nursing Home Development</th><th>Cumulative Proposed</th></tr>
<tr><td></td><td>18:00</td><td>28%</td><td>0%</td><td>0%</td></tr>
<tr><td colspan="5">Potential “imperceptible” to “slight” cumulative impact on 21st March.
ARC’s analysis indicates that the construction of the planned nursing home development on the adjoining site is likely to result in a reduction in sunlight access to this garden (46 sq m) during the late evening of 21st March. ARC’s analysis indicates that the proportion of the garden capable of receiving at least two hours of sunshine on 21st March is unlikely to change as a result of shadows cast by the proposed development and nearby planned and permitted developments.</td></tr>
<tr><td rowspan="9">Zone 11
Log Na gCapall
Rear Garden</td><td>10:00</td><td>63%</td><td>63%</td><td>63%</td></tr>
<tr><td>11:00</td><td>63%</td><td>63%</td><td>63%</td></tr>
<tr><td>12:00</td><td>66%</td><td>66%</td><td>66%</td></tr>
<tr><td>13:00</td><td>69%</td><td>69%</td><td>69%</td></tr>
<tr><td>14:00</td><td>74%</td><td>74%</td><td>74%</td></tr>
<tr><td>15:00</td><td>72%</td><td>72%</td><td>72%</td></tr>
<tr><td>16:00</td><td>81%</td><td>81%</td><td>81%</td></tr>
<tr><td>17:00</td><td>66%</td><td>66%</td><td>66%</td></tr>
<tr><td>18:00</td><td>10%</td><td>10%</td><td>10%</td></tr>
<tr><td colspan="5">No potential change in sunlight access on 21st March.
ARC’s analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (221 sq m).</td></tr>
<tr><td rowspan="9">Zone 12
Log Na gCapall
Rear Garden</td><td>10:00</td><td>25%</td><td>25%</td><td>25%</td></tr>
<tr><td>11:00</td><td>39%</td><td>39%</td><td>39%</td></tr>
<tr><td>12:00</td><td>78%</td><td>78%</td><td>78%</td></tr>
<tr><td>13:00</td><td>96%</td><td>96%</td><td>96%</td></tr>
<tr><td>14:00</td><td>98%</td><td>98%</td><td>98%</td></tr>
<tr><td>15:00</td><td>92%</td><td>92%</td><td>92%</td></tr>
<tr><td>16:00</td><td>64%</td><td>64%</td><td>64%</td></tr>
<tr><td>17:00</td><td>8%</td><td>8%</td><td>8%</td></tr>
<tr><td>18:00</td><td>20%</td><td>20%</td><td>20%</td></tr>
<tr><td colspan="5">No potential change in sunlight access on 21st March.
ARC’s analysis indicates no potential for the proposed development, in combination with nearby planned and permitted developments, to result in additional cumulative impacts on this garden (93 sq m).</td></tr>
<tr><td rowspan="2">Zone 13</td><td>10:00</td><td rowspan="2">N/A</td><td>29%</td><td>29%</td></tr>
<tr><td>11:00</td><td>41%</td><td>41%</td></tr>
</table>

<table>
<tr><th rowspan="2">Zone</th><th rowspan="2">Time</th><th colspan="3">Percentage area in sunlight – 21st March</th></tr>
<tr><th>Existing</th><th>Existing incl. Planned Nursing Home Development</th><th>Cumulative Proposed</th></tr>
<tr><td rowspan="7">Permitted but not yet constructed development at Greenpark Avenue Rear Garden</td><td>12:00</td><td rowspan="7"></td><td>55%</td><td>55%</td></tr>
<tr><td>13:00</td><td>54%</td><td>54%</td></tr>
<tr><td>14:00</td><td>43%</td><td>43%</td></tr>
<tr><td>15:00</td><td>39%</td><td>38%</td></tr>
<tr><td>16:00</td><td>41%</td><td>40%</td></tr>
<tr><td>17:00</td><td>36%</td><td>16%</td></tr>
<tr><td>18:00</td><td>6%</td><td>0%</td></tr>
<tr><td colspan="5">This sample garden is in a development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18, but <u>not yet constructed</u>. As the development is not yet constructed, this table does not include an assessment of sunlight access to the garden on 21st March under an existing scenario or an assessment of the cumulative impact of development on the existing scenario.

However, in the interests of completeness, it should be noted that, if it were assumed that the planned nursing home development and the residential development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 were constructed, the construction of the proposed development, planned and permitted developments would result in an “imperceptible” to “slight” impact on sunlight access to this garden (171 sq m) during the late evening of 21st March. ARC’s analysis indicates that the proportion of the permitted garden capable of receiving at least two hours of sunshine on 21st March is unlikely to change as a result of shadows cast by the proposed development and nearby planned and permitted developments.</td></tr>
<tr><td rowspan="9">Zone 14
Permitted but not yet constructed development at Greenpark Avenue Rear Garden</td><td>10:00</td><td rowspan="9">N/A</td><td>62%</td><td>62%</td></tr>
<tr><td>11:00</td><td>70%</td><td>70%</td></tr>
<tr><td>12:00</td><td>80%</td><td>80%</td></tr>
<tr><td>13:00</td><td>80%</td><td>80%</td></tr>
<tr><td>14:00</td><td>75%</td><td>75%</td></tr>
<tr><td>15:00</td><td>63%</td><td>63%</td></tr>
<tr><td>16:00</td><td>54%</td><td>54%</td></tr>
<tr><td>17:00</td><td>12%</td><td>12%</td></tr>
<tr><td>18:00</td><td>12%</td><td>0%</td></tr>
</table>

<table>
<tr><th rowspan="2">Zone</th><th rowspan="2">Time</th><th colspan="3">Percentage area in sunlight – 21st March</th></tr>
<tr><th>Existing</th><th>Existing incl. Planned Nursing Home Development</th><th>Cumulative Proposed</th></tr>
<tr><td colspan="5">This sample garden is in a development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18, but <u>not yet constructed</u>. As the development is not yet constructed, this table does not include an assessment of sunlight access to the garden on 21st March under an existing scenario or an assessment of the cumulative impact of development on the existing scenario.

However, in the interests of completeness, it should be noted that, if it were assumed that the planned nursing home development and the residential development permitted under LCC Reg. Ref. 17/1190; ABP Ref. ABP-302015-18 were constructed, the construction of the proposed development, planned and permitted developments would result in an "imperceptible" to "not significant" impact on sunlight access to this garden (63 sq m) during the late evening of 21st March. ARC's analysis indicates that the proportion of the permitted garden capable of receiving at least two hours of sunshine on 21st March is unlikely to change as a result of shadows cast by the proposed development and planned nearby and permitted developments.</td></tr>
</table>

15.4.4 Mitigation Measures

Construction Phase

The subject application proposes the development of a large zoned site in a residential area. In these circumstances, scope for mitigation measures during the construction phase, which would preserve a sustainable level of density, is limited.

Operational Phase

The subject application proposes the development of a large zoned site in a residential area. In these circumstances, scope for mitigation measures during the operational phase, which would preserve a sustainable level of density, is limited. However, it is noted that the proposed development was carefully designed in the first instance to minimise the potential for impacts on sunlight access to neighbouring lands to arise (e.g. by ensuring adequate separation distances between existing and proposed structures relative to the height of proposed structures) (DS_2 in Table 21.1).

15.4.5 Residual Effects

Construction Phase

As no ameliorative, remedial or reductive measures are now proposed, the residual impact of the proposed development on sunlight access is likely to be as described under Section 15.4.2 above.

Operational Phase

As no ameliorative, remedial or reductive measures are now proposed, the residual impact of the proposed development on sunlight access is likely to be as described under Section 15.4.2 above. The residual impact of the proposed development on sunlight access to the surrounding area is assessed as ranging from none to "imperceptible" to "not significant".

Cumulative Impact

As no ameliorative, remedial or reductive measures are now proposed, the residual cumulative impact of the proposed development in combination with development already permitted on sunlight access is likely to be as described under Section 15.4.3 above. The residual cumulative impact of the proposed development on sunlight access to the surrounding area is assessed as ranging from none to “imperceptible” to “slight”.

15.4.6 Interactions

As is always the case where a development will result in a change to the sunlight environment of an area, the impacts of the development on sunlight access will result in interactions with population and human health and landscape.

15.4.7 ‘Do Nothing’ Effects

In a “do nothing” scenario, the existing sunlight environment within neighbouring buildings and open spaces will remain unchanged.

15.5 Monitoring

Monitoring of avoidance, remedial and mitigation measures is not relevant to the assessment of impacts on daylight and sunlight access in the case of the subject application.

15.6 Reinstatement

Reinstatement is not relevant to the assessment of impacts of the proposed development on daylight and sunlight access in the case of the subject application. It is intended that the proposed development will be permanent.

15.7 Difficulties Encountered in Compiling the Chapter

It was considered neither possible nor practical for the Design Team to gain unfettered access to every parcel of private property within the study area surrounding the application site in order to carry out measured building survey. Therefore, while ARC has confidence that the three dimensional model used in the assessment of the impact of the proposal on daylight access achieves a high degree of accuracy, it should be noted that some level of assumption was necessary in completing the model.

It was considered neither possible nor practical to carry out detailed quantitative analysis of the potential impact of the construction phase of the proposed development as insufficient detail was available regarding what structures or objects related to the construction (e.g. hoarding, machinery, etc) capable of resulting in an obstruction of sunlight or daylight access would be on the site or exactly where those structures or objects would be on the site. Even if this information was available, any such detailed quantitative analysis would represent only a snapshot in time.

As noted above, in assessing sunlight and daylight access, Irish practitioners tend to refer to PJ Littlefair’s 2011 revision of the 1991 publication *Site layout planning for daylight and sunlight: a guide to good practice* for the Building Research Establishment (the BRE Guide). However, it is noted that the BRE Guide does not set out rigid standards or limits and is preceded by the following very clear warning as to how the design advice contained therein should be used: *"The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design."* [Emphasis added.]

15.8 References

- British Standards Institution (2008) BS8206: Part 2: 2008 Lighting for Buildings: Part 2 – Code of Practice for Daylight. Milton Keynes, BSI.
- B.S. EN 17037:2018: *Daylight in Buildings.*
- Council Directive 14/52/EU (amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment) (Official Journal No. L 124/1, 25.4.2014)
- Environmental Protection Agency. 2002. *Guidelines on the Information to be Contained in Environmental Impact Statements.* Wexford: Environmental Protection Agency.
- Environmental Protection Agency. 2003. *Advice Notes on Current Practice*. Wexford: Environmental Protection Agency.
- Environmental Protection Agency. 2015. *Advice note for Preparing Environmental Impact Statements DRAFT*. Wexford: Environmental Protection Agency.
- Environmental Protection Agency. 2017. *Guidelines on information to be contained in Environmental Impact Assessment Reports DRAFT*. Wexford: Environmental Protection Agency.
- I.S. EN 17037:2018: *Daylight in Buildings.*
- Littlefair, PJ. 1991. *Site Layout Planning for Daylight and Sunlight: A Good Practice Guide*. Watford: Building Research Establishment.
- Littlefair, PJ. 2011. *Site Layout Planning for Daylight and Sunlight: A Good Practice Guide*. Watford: Building Research Establishment.

16.0 MATERIAL ASSETS - ROADS AND TRAFFIC

16.1 Introduction

This chapter comprises an assessment of the likely effects of the proposed SHD development on the surrounding road network which may be impacted as a result of the project.

This chapter was prepared by Julie Tiernan BE(Civil) (Hons) MSc CEng MIEI of PUNCH Consulting Engineers.

16.2 Methodology

The assessment is based on the Traffic and Transport Assessment and the following documents:

- TII's Traffic and Transport Guidelines PE-PDV-02045 (May 2014)
- Limerick City Council Development Plan 2010 – 2016

Site visits were made at various dates to review the character and issues associated with the surrounding road network.

The scope of the TTA was discussed and agreed with Limerick City and Council Engineering representatives. Traffic surveys were used from 2017, 2018 and 2019 to established baseline traffic flows on the existing road network. The impact of the proposed development was assessed by comparing the baseline traffic flows extended to the Design Year of 2039 compared with the proposed development added up to the Design Year. TRL traffic modelling package Junctions 9 was used to analyse the traffic impact.

As the proposed development is part of an overall masterplan development within the Applicant's land holding, LCCC requested that the masterplan development traffic impact was also assessed. This included calculations for a nursing home portion of the masterplan which will be accessed separately to the proposed residential units.

16.3 Baseline Environment

16.3.1 Site Location

The proposed residential development is located in Greenpark, approximately 2 km to the southwest of Limerick City. The main access to the site is via a link road off the Limerick Greyhound Roundabout. The Greyhound Roundabout further links north to Greenpark Roundabout.

The proposed residential development is Phase 1 of an overall Masterplan for Greenpark. The masterplan development will include additional residential units, office accommodation, neighbourhood centre, a café, a nursing home and open space.

The overall Greenpark site is bordered to the east by a number of established residential estates, to the north-west by the N69 Dock road and the Dock Road Industrial Estate, to the north-east by a number of residences, while the Ballynaclogh River runs close to the southern perimeter of the subject lands. The proposed development (Phase 1) site is bordered to the east by Log Na gCapall residential estate and Greenpark Avenue and to the South East by Vance's Land, to the north by the former Greenpark Racecourse and to the west by Greenpark Lagoon and the Ballynaclogh River.

16.3.2 Existing Cycling and Pedestrian Facilities

The proposed SHD development is well served by pedestrian linkages surrounding the site, including opportunities to connect via the Dock Road, Allandale and the existing residential developments located to the east.

Designated cycling facilities are limited in the vicinity of the proposed development.

There are no cycling facilities on the Dock Road. Currently there are discussions ongoing between Limerick City and County Council (LCCC) and the National Transport Authority (NTA) in relation to the upgrade of the Dock Road to have enhanced public transportation/ alternative modal facilities including priority bus corridors and dedicated cycle lanes.

16.3.3 Public Transport

The proposed SHD development is well served by transport infrastructure, including a range of public transportation modes.

The location of the site provides for ease of access to the city centre via the Dock Road and South Circular Road (pedestrian/cyclist access only) via Log na gCapall housing estate and Greenpark Avenue. The M20, N18 and N69 can all be accessed by private car from the site. Colbert Station Train and Bus Station is located approximately 2km to the north east of the site and offers daily services to Dublin, Cork, Galway and numerous cities and towns throughout Ireland. There are a number of bus stops on Ballinacurra Road which are served by the 301, 304, 304A and 304X routes connecting Limerick city centre and environs.

16.3.4 Proposed Transport Infrastructure

Currently there are discussions ongoing between Limerick City and County Council (LCCC) and the National Transport Authority (NTA) in relation to the upgrade of the Dock Road to have enhanced public transportation/ alternative modal facilities including priority bus corridors and dedicated cycle lanes.

As part of the constraints assessment for the Limerick Northern Distribution Road (LNDR) a traffic study was undertaken by Roughan O'Donovan to provide forecasted values for the junctions surrounding Limerick City and the potential associated reduction in traffic in the city. With the opening of the LNDR, it is envisaged that a portion of the traffic utilising the Dock Road will decrease in the AM and PM peaks as more viable routes become available in the city. The impact of the LNDR on Greenpark Roundabout capacity will be further explored once further information is available from LCCC.

The proposed residential development has taken consideration of the Draft Limerick/ Shannon Transport Strategy 2040. There will be a bus route via the Dock Road which will help alleviate traffic as people accessing the city will be able to use public buses rather than cars.

16.4 Potential Effects of the Proposed Project

16.4.1 Construction Phase

Construction traffic travelling to the site will use the existing Greenpark Roundabout off the Dock Road for access. Overall, there will be a negative short-term not significant impact to local traffic during the construction phase.

The traffic volume associated with the construction phase site is not considered to be excessive and will be spread out over the duration of the construction of the development. It is anticipated that 10-50 HGVs will access the site per day during the busiest period of construction. As the construction works are off-line and due to the designated access point which allows delivery vehicles to pull off into the site, there will be no significant disruption to the traffic flows on the Dock Road as a result of the construction of the development. It is not envisaged that any diversions will be required. Existing public footpaths are unlikely to be impacted by the project as all works are proposed within the site boundaries.

16.4.2 Operational Phase

At operational phase, there is likely to be a slight long-term neutral impact on the surrounding roads as a result of the proposed development.

The existing Greenpark Roundabout is already at theoretical capacity in the Opening Year 2022 (RFC=92%) with no additional development traffic. With the additional development traffic added in the Design Year of 2039 the existing roundabout will not experience much more overloading than with the current traffic volume growth as experienced and tracked by the TII in the Limerick area. Therefore, the impact of the development is described as slight long-term neutral impact.

16.5 Mitigation Measures

16.5.1 Construction Phase

The following mitigation measures are proposed for the construction phase of the proposed SHD development with reference to Material Assets: Roads and Traffic:

MA:RT_1 To address the Construction Phase impacts raised, the appointed Contractor shall prepare a Construction Transport Management Plan prior to the commencement of development. All deliveries shall be provided with instructions/directions on accessing the site from the Dock Road, and deliveries shall be scheduled outside of peak commuting hours.

Construction operations on site and deliveries to the site will be in accordance with the Construction and Environmental Management Plan (CEMP).

The preparation of the CTMP will entail an assessment of existing nearby employment, educational, recreational and commercial facilities to establish the peak times for vehicles, cyclists and pedestrians. This information would be used to develop the optimum start/finish/delivery times to minimise impact on these existing facilities.

The CTMP issued at construction stage would identify haulage routes and restrictions as appropriate in discussion with the Local Authority. There will also be a requirement for comprehensive measures as part of the construction management.

MA:RT_2 To address the Construction Phase impacts raised, the construction vehicle movements will be minimised through:

a) Consolidation of delivery loads to/from the site and manage large deliveries on site to occur outside of peak traffic periods;
b) Use of precast/prefabricated materials where possible;
c) 'Cut' material generated by the construction works will be re-used on site where possible, through various accommodation works;
d) Adequate storage space on site will be provided;
e) A strategy will be developed to minimize construction material quantities as much as possible;
f) Construction staff vehicle movements will also be minimized by promoting the use of public transport, shared use of vehicles, cycling and walking.

With the implementation of these mitigation measures during the construction phase, the severity of the impact of the proposed development on the roads and traffic will be minimised.

16.5.2 Operational Phase

The following mitigation measures are proposed for the operational phase of the proposed SHD development with reference to Material Assets: Roads and Traffic:

MA:RT_3 The design and construction of the built services in accordance with the relevant guidelines and codes of practice will mitigate any potential impacts during the operational phase of the development.

16.6 Residual Effects

16.6.1 Construction Phase

There will be no residual impacts on the surrounding roads and traffic during the construction phase.

16.6.2 Operational Phase

Residual impacts on the surrounding roads and traffic during the operational phase is considered to be slight long-term neutral impact. The volumes of traffic generated from the currently proposed development will have a slight effect on the road network traffic volumes and can be considered within the norms for urban developments.

16.7 Monitoring

16.7.1 Construction Phase

The contractor will be obliged to appoint a traffic liaison officer/traffic manager who will be involved in preparing the CTMP and to monitor the performance of the CTMP (MA:RT_4 in Table 21.1). The traffic liaison officer will be available to receive complaints, comments and queries about the traffic generated by the construction site and traffic issues associated with the site. Regular meetings will be held on-site to which with all relevant stakeholders will be invited. The traffic liaison officer/traffic manager will liaise with:

- Limerick City and County Council including Elected Members
- An Garda Siochana
- Irish Rail
- Bus Eireann
- Other relevant statutory bodies
- Members of the community
- Adjacent contractors

The traffic liaison officer/traffic manager will be sufficiently senior in position and will be responsible for dealing with any complaints and remedying any non-compliance and developing solutions to prevent re-occurrence.

16.7.2 Operational Phase

There will be no monitoring requirements of the roads and traffic in the operational phase of the development.

16.8 Interactions

AADTs for the surrounding road network have been provided for the Noise/Air/Climate Chapters for the Do Nothing and Do Something Scenarios up to the Design Year of 2039.

16.9 Cumulative Effects

As the proposed development is part of an overall masterplan development within the Applicant's land holding, LCCC requested that the masterplan development traffic impact was also assessed. This included calculations for a nursing home portion of the masterplan which will be accessed separately to the proposed residential units via Log na gCapall housing estate.

Additionally, LCCC Reg. Ref. 17/1190; ABP ref. 302015-18 granted permission for the construction of 30 no. residential dwellings. The impact of this development was also assessed.

The proposed development is not likely to result in significant adverse impacts on roads and traffic either alone or in combination with the existing planned or likely future projects.

16.10 'Do-Nothing' Effect

If the proposed development does not proceed there would be no additional demand or loading on the existing road network other than the naturally growing baseline traffic figures.

16.11 Difficulties Encountered in Compiling the Chapter

No significant difficulties were encountered in completing this chapter.

17.0 MATERIAL ASSETS – WASTE MANAGEMENT

17.1 Introduction

Gavin and Doherty Geosolutions Ltd. (GDG) has been engaged by Voyage Property Limited to prepare the Material Assets (Waste Management) Chapter for the proposed SHD at lands at the former Greenpark Racecourse, Dock Road, Limerick City. The proposed SHD will include the construction of residential units, a creche, and public open space, with associated roads, parking, etc, as described in Chapter 5 of this EIAR.

This assessment has been undertaken in accordance with the Environmental Protection Agency's (EPA) Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (2017).

The objectives of the assessment are to:

- Produce a baseline study of the existing environment in the area of the proposed development.
- Identify likely significant effects of the proposed development on waste management during the construction phase and operational phase of each aspect of the development.
- Identify mitigation measures to avoid, remediate or reduce significant negative effects.
- Assess significant residual effects and cumulative effects of each aspect of the proposed project cumulatively and in-combination with other developments.

17.2 Methodology

A Construction Waste Management Plan (CWMP) and Operational Waste Management Plan (OWMP) are provided in the appendices to this report. These plans set out in detail the strategy for waste management during the construction and operation of the development. The overarching methodology for waste management will be in line with circular economy principles. The European Commission adopted the Circular Economy Action Plan in 2020.

The aim of a circular economy is to manage the use of material resources more efficiently by ensuring resources are retained in the economic cycle for as long as possible and minimisation of waste generation and, where the generation of waste is unavoidable, the principles of the Waste Hierarchy will be followed, refer to Figure 17-1 below.

Figure 17.1: Waster Hierarchy (Source southernwasteregion.ie)

17.3 Legislation and Guidance

The EU legislation that defines the legislative context for this development is the Waste Framework Directive (2008/98/EC) which has been incorporated into Irish waste legislation through the Waste Management Act 1996 (as amended). In addition, the following legislation will also apply to this development:

- Environmental Protection Act, 1992
- Litter Pollution Act, 1997
- Planning and Development Act, 2020

As outlined in the *Duty of Care* of the *Waste Management Act* (1996), the waste producer is considered to be responsible for waste from the time of generation through to its legal disposal. This is not typically practical when considering the end site user of the proposed development, therefore waste contractors are to be employed to physically transfer waste from where it is produced to the final disposal site.

As control of the waste is removed from the producer at such an early stage, it is therefore extremely important that effective management of the waste occurs prior to transfer off site. This responsibility therefore falls to the building contractors, residents, tenants, or facilities management company. It is also their responsibility to employ suitably permitted/licenced contractors to transfer the waste off-site, in accordance with all legal requirements. This includes the requirement that the waste contractor should handle, transport and reuse/recover/recycle/dispose of waste in a matter than ensures that no adverse environmental impacts occur as a result of any of these activities.

Contractors transporting the waste should hold a collection permit, as issued by the National Waste Collection Permit Office.

Waste receiving facilities must also be appropriate licenced or permitted. The receiving facility must hold an appropriate Certificate of Registration (COR) or waste permit granted by LCC under the *Waste Management (Facility Permit & Registration) Regulations 2007,* or a waste or Industrial Emissions Directive (IED) licence granted by the EPA.

In addition to the aforementioned legislation, the *Limerick City and County Council (Segregation, Storage and Presentation of Household and Commercial Waste) Bye-Laws* (2019) should be adhered to. The document outlines bye-laws related to:

- Obligation to participate in a waste collection service.
- Maintenance and management of waste containers.
- Location for container storage.
- Use of waste containers on collection day.
- Waste presentation times and container removal.
- Prohibited waste types.
- Segregation of household waste and contamination prevention.
- Additional provisions for householders not availing of a kerbside collection service.
- Provisions affecting multi-user buildings, apartment blocks, etc.
- Interference with orderly waste collection.
- Additional provisions for commercial waste.
- Enforcement provisions / fix payment notices.

Schedule 1 of the bye-laws presents a list of acceptable recyclable kerbside wastes, which comprises:

- Paper wastes
- Aluminium cans
- Steel cans
- Cardboard
- Plastic pots, trays and tubs
- Plastic bottles (PET 1)
- Plastic bottles (HDPE2)

The Irish government policy document: A Resource Opportunity – Waste Management Policy in Ireland 52 was published in 2012 highlights environmental and economic benefits of improved waste management, particularly in relation to waste prevention.

Construction phase waste management is generally carried out in accordance with the Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects 53 published in 2006 and Construction and Demolition Waste Management: A handbook for Contractors and Site Managers 54 is also referred to and has been used in the creation of this chapter and associated method statements.

Where necessary, additional guidance has been taken from industry guidelines, British Standards and other relevant studies and reports.

17.4 Baseline (Waste) Environment

The site is currently undeveloped and consists of overgrown grassland and vegetation. There is therefore no waste currently generated from the site.

17.5 Summary of Operational Waste Aspects

The proposed development is expected to generate construction waste. It is also expected that some limited demolition waste from buried foundations may also be generated, which has been considered as part of this assessment.

The construction process and potential waste generation is considered in two phases:

1. Earthworks operations
2. Construction Phase.

17.5.1 Earthworks operations

17.5.1.1 Topsoil strip and bulk earthworks

There will be significant earthworks operations to raise parts of the site above the required flood level. The potential impact of the earthworks operations has been eliminated by designing the site levels to ensure there is an overall earthworks balance within the site. There will be therefore no requirement to remove soil from the site, unless it is identified as unsuitable for use due to contamination or other factor being identified, the process for managing this incidence is discussed as part of the Mitigation Measures, Section 17.6.

17.5.1.2 Existing foundations

Although the site is predominantly greenfield, historic structures were present in some areas of the site and the earthworks operations are therefore expected to include the removal of existing concrete foundations that will be incorporated into the material balance for the site. Existing foundations will only be excavated and processed if they are located within areas of bulk excavation. No off-site disposal of these materials is expected unless they are identified as unsuitable for re-use.

17.5.2 Construction phase

The proposed development is designed to minimise the generation of excess materials requiring disposal offsite and where required the construction will minimise any off-site disposal where practicable.

However, the management of construction waste streams will be necessary, as discussed below.

17.5.2.1 Unexpected, unsuitable soils management

In order to minimise the requirement to dispose of materials off-site, a watching brief and contamination discovery procedure will be adopted by the contractor prior to works commencing.

Where potentially contaminated or otherwise unsuitable material is encountered, it will be segregated, tested and assessed to confirm suitability for re-use or where this is not determined then the soils will be classified the HazWasteOnline (or similar) for waste disposal purposes in accordance with the European Communities (EC) Council Decision 2003/33/EC.

17.5.2.2 Building construction

General Construction and Demolition (C&D) waste will be generated during the construction process. The requirements for dealing with C&D wastes are detailed in the CWMP.

During construction, it is usual for waste to be produced from surplus materials, including but not limited to:

- Cladding (off-cuts or damaged)
- Metal formwork
- Timber
- Concrete/Cement
- Tiles
- Bricks
- Waste from packaging (cardboard, plastic, timber) and oversupply of materials.

The estimated construction waste amounts are presented in Table 17.1, these are estimates based on other construction activities and are for information purposes at this time. The contractor will be expected to confirm anticipated waste generation and recovery rates as part of construction planning.

Table 17.1: Construction Waste Reuse, Recycling and Disposal Rates Estimates

Waste Types	Tonnes	Reuse		Recycle/Recovery		Disposal	
		%	Tonnes	%	Tonnes	%	Tonnes
Soil and stones	32,897	100%	32,897	-	-	-	-
Concrete, brick, tiles and similar (estimated at 0.5t per unit)	180.5			100%	180.5		
Mixed C&D waste (estimated at 0.25t per unit)	90					100%	90
Metals (estimated at 0.1t per unit)	36			100%	36		
Timber (estimated at 0.05t per unit)	18			100%	18		
Other (estimated at 0.1t per unit)	36			50%	18	50%	18

A CWMP has been prepared for the proposed works which provides the protocols expected to be implemented for the management of waste generated during construction, and this document should be referred to as part of this document.

17.5.3 General waste

There will be a significant number of operatives on the site during construction. Relatively small volumes of domestic type waste will therefore be generated. The CWMP outlines how this waste will managed.

17.5.4 Fuel and oil spills

Accidental spillages have the potential to generate volumes of contaminated liquid and soils. Procedures are included in the CWMP for dealing with the wastes arising from accidental spillages.

17.5.5 Operational Phase

Operational Waste Streams relate to waste expected to be generated on occupation of the site post development. The proposed development will give rise to a variety of domestic waste streams , including:

- Paper and Cardboard
- Plastic, Glass, Timber and Metal
- Compostable food waste and other biodegradable/deleterious wastes
- Waste batteries (non-hazardous)
- Waste Electrical and Electronic Equipment (WEEE) (non-hazardous)
- Empty toner or printer ink cartridges; and
- Mixed, non-recyclables

17.6 Mitigation Measures

All waste materials will be managed in accordance with regional and national legislation as outlined in this section and only licensed waste carriers and disposal sites will be used during this work and will include the following management practices, summarised from the CWMP:

17.6.1 Earthworks Operations

To minimise the potential requirement for removal of waste soils or other material generated from earthworks operations, including the processing of buried structures, the following protocols will be used:

- Excavated subsoil and topsoil, or processed buried structures, will be carefully stored in segregated piles on site for subsequent reuse, or treatment/disposal, although the latter is considered unlikely to be required (W_1 in Table 21.1 contained in Chapter 21).
- Where hazardous wastes are identified, these will be removed and kept separate from other waste materials to avoid cross contamination and stored in such a way to prevent impact on the surrounding environment, prior to disposal to suitably licenced recycling or disposal facilities (W_2 in Table 21.1).

- The management of all stockpiled materials will include appropriate testing and assessments, where necessary, to confirm suitability for re-use (W_3 in Table 21.1).

17.6.2 Construction Phase

Waste generation during construction is expected to produce wastes requiring off-site disposal. The waste streams have been identified in Section 17.5.2 and mitigation measures to limit waste generation are presented below (W_4 in Table 21.1):

- The contractor will be required to ensure that oversupply of materials is kept to a minimum and that opportunities for reuse of suitable materials is maximised.
- If the material is deemed to be a waste, removal and reuse/recycling/recovery/disposal of the material will be carried out in accordance with all associated regulations and guidelines, presented in Section 17.3 above.
- The contractor shall ensure that materials are ordered so that the quantity delivered, the timing of the delivery and the storage is not conducive to the creation of unnecessary waste.
- Concrete waste will be segregated and stockpiled prior to being crushed ready for reuse.
- Surplus concrete, waste masonry and wood arisings will be collected for separation and recovery at a remote facility.
- Packaging will be segregated and returned to the supplier for reuse if possible or transfer to a recycling facility.
- Other C&D waste materials will either be segregated or included with other mixed C&D waste materials, for subsequent separation and recovery or disposal at a remote facility.

17.6.3 Operational Phase

It is expected that normal waste management processes will be employed post development. These will be managed in line with the Limerick City and County Council waste collection and management practices, including the collection of recyclables and compostable wastes from residential properties as part of kerbside collections (W_5 in Table 21.1).

17.7 Residual Effects

17.7.1 Construction Phase

To ensure compliance with waste management legislation and best practice, the construction phases will follow the construction waste management plan. Where practicable all recoverable wastes will either be re-used on-site during construction or sent off-site for processing and re-use. All non-recoverable wastes will be sent off-site to a suitably licensed facility.

Provided the mitigation measures outlined are followed, the residual effect of the construction phase on the environment will be slight adverse and short term.

17.7.2 Operational Phase

On the basis that kerbside collections for residential properties includes for the segregation and collection of recyclable and compostable materials it is anticipated that the residual effect of operational waste will be low to moderate adverse and permanent, where permanent relates to the continued generation of domestic waste that is unlikely to be removed entirely.

17.8 Monitoring

Monitoring requirements for waste management during the construction phase will be included in the Construction and Environmental Management Plan. This includes the requirement to collect data on volumes, percentage recovered and disposal statistics including the retention of waste disposal tickets or other tracking information.

17.9 Cumulative Effects

The following projects are considered to assess the cumulative effects of the development:

- A proposed nursing home development at the south- eastern boundary of the site, planning ref LCCC Reg. Ref. 21/1222.
- A proposed housing development at the north-eastern boundary of the site, LCCC Reg. Ref. 17/1190 (ABP-302015-18) consisting of 30 residential units.

The potential cumulative effects of the proposed development in combination with the adjacent proposed developments have been considered in terms of impacts on waste during the construction and operational phase.

17.9.1 Construction Phase

The construction period for the SHD may or may not overlap with the other developments. The cumulative effect of the SHD and the other developments will result in an increase in waste generation during the construction phase. As the construction process is a finite operation, the cumulative effects of the construction phase on waste generation will cease on completion of the works. The overall cumulative impact of the construction works is estimated as moderate, given the likely generation of some waste during works, and short term.

17.9.2 Operational Phase

The developments will continue to generate waste throughout their operational lives, in this case it could be considered that any residential development may be considered to have a moderate and long-term cumulative waste impact. With the implementation of adequate waste segregation and kerbside collections it is expected that the cumulative impacts can be reduced to low to moderate long term.

The operators of the nursing home will engage specialist waste contractors to collect and manage all wastes including non-hazardous and special/hazardous wastes that may include clinical wastes. On the basis that wastes will be carefully segregated by the operators, the impacts will be low to moderate, but it is expected that due to the nature of some wastes routes for disposal may include more landfilling and possible incineration.

17.10 'Do-Nothing' Effect

In the event that the project does not get developed i.e. the "do nothing" scenario, then the waste impacts described in this Chapter will not arise. In that scenario the site will remain undeveloped with the potential to attract ongoing illegal dumping

17.11 Interactions

The management of waste during the construction phase in accordance with the Construction & Demolition Waste Management Plan (C&D WMP) will meet the requirements of regional and national waste legislation and promote the management of waste in line with the priorities of the waste hierarchy. Therefore, the effect of waste generation in both earthwork and construction phases in terms of waste management will be low to moderate and short term.

During the operational phase, the management of domestic wastes generated is expected to ensure waste segregation occurs at source in each residential unit to facilitate the diversion of waste away from landfill and maximise re-use and recycling.

As communal waste storage areas will be designed to provide clean, safe and mobility impaired accessible facilities that will be regularly managed, the impact of waste arising from the proposed development is likely to be low, short-term, and imperceptible with respect to human health.

17.12 Conclusions

The construction phases described above are not expected to generate significant waste that cannot be re-used on-site or otherwise recycled. In general, the potential for disposal of soils cannot be discounted, however the development is designed to minimise this requirement.

Other wastes that may be generated on-site during construction will be managed in line with the Construction Waste Management Plan, this is based on the waste management hierarchy and where possible any wastes will be recycled or recovered on-site or processed off-site by a specialist company, to be determined.

Overall, the construction phase of works is not expected to have any significant waste generation with a low to moderate and short-term impact determined for construction.

The use of the site post development, will generate domestic refuse, managed as part of kerbside collections. The waste management objectives of LCCC include for the segregation and recycling or composting of materials and in this regard, while the effects will be cumulative and long term, the impacts will be low to moderate on the basis of good waste management practices and kerbside collections.

18.0 MATERIAL ASSETS – BUILT SERVICES

18.1 Introduction

This chapter comprises an assessment of the likely effects of the proposed SHD development on the built services and infrastructure present in the environment which may be impacted as a result of the project.

This chapter was prepared by Donal Gallery BEng MIEI of PUNCH Consulting Engineers and Norman Woods BEng of Woods PS Building Services Engineers.

18.2 Methodology

The potential impact of this development in relation to material assets built services was assessed in accordance with EPA Guidelines (2002) and Advice Notes (2003) and their respective draft updates in 2015 and 2017.

Economic assets of natural origin, which include biodiversity, land & soil and water, are addressed elsewhere in this EIAR, in particular Chapter 8, 9 and 10 respectively. Cultural Assets of a Physical Type and Cultural Heritage of a Social Type are addressed in Chapter 14 of this EIAR.

A desktop study was carried out on existing material assets associated with the site of the proposed SHD development. Projections of resource use were undertaken for both the construction and operational phases of the proposed SHD development, and the impacts assessed. Mitigation measures are proposed where appropriate.

The applicant has issued a planning application for a nursing home within their land holding. We have had regard to this project to ensure that we have captured the in combination impact of the proposed SHD development and the planned nursing home development. This will be further discussed in the cumulative impact section below.

18.3 Baseline Environment

This section considers the key aspects relating to material assets of the proposed SHD development site and the surrounding area, namely urban settlements, ownership and access, traffic infrastructure, potable water supply, wastewater discharge, electricity supply, gas supply, telecoms and municipal waste.

The following aspects of the proposed SHD development will affect material assets within the vicinity of the proposed SHD development site:

- Urban Settlements (Refer to Chapter 7)
- Access (Refer to Chapter 16)
- Transport Infrastructure (Refer to Chapter 16)
- Municipal Waste (Refer to Chapter 12)
- Foul Water Disposal

- Surface Water Disposal
- Potable Water Supply
- Natural Gas Supply
- Electrical Supply
- Information and Communications Technology

18.3.1 Access

Vehicular access and egress to and from the proposed SHD development will be provided via a link road off the Limerick Greyhound Roundabout. The Greyhound Roundabout further links north to Greenpark Roundabout.

The Traffic and Transport Assessment (TTA) prepared by PUNCH Consulting Engineers which is submitted with this application addresses the impact of the subject site on the surrounding road network.

18.3.2 Transport Infrastructure

The proposed SHD development is well served by transport infrastructure, including a range of public transportation modes.

The location of the site provides for ease of access to the city centre via the Dock Road and South Circular Road (pedestrian/cyclist access only) via Log na gCapall housing estate. The M20, N18 and N69 can all be accessed by private car from the site. Colbert Station Train and Bus Station is located 2.8km to the north east of the site and offers daily services to Dublin, Cork, Galway and numerous cities and towns throughout Ireland. There is a bus stop on Ballinacurra Road which is served by the 301, 304, 304A and 304X routes connecting Limerick city centre and environs.

The Traffic and Transport Assessment (TTA) prepared by PUNCH Consulting Engineers which is submitted with this application addresses the impact of the proposed SHD development on the surrounding road network.

18.3.3 Foul Water Disposal

Based on existing record drawings, surveys and site visits it was established that the following foul water drainage infrastructure is located within the Greenpark lands:

- Limerick Main Drainage 1500mm diameter pipe flowing south east to north west through the site. Refer to figure 3.1.
- 225mm/300mm diameter pipe flowing north east to south west for approximately 315m before flowing south east to north west through the site and discharging to the Limerick Main Drainage network upstream of Greenpark Roundabout.

Figure 18.1 and PUNCH planning drawings show the existing drainage on site and in the surrounding area.

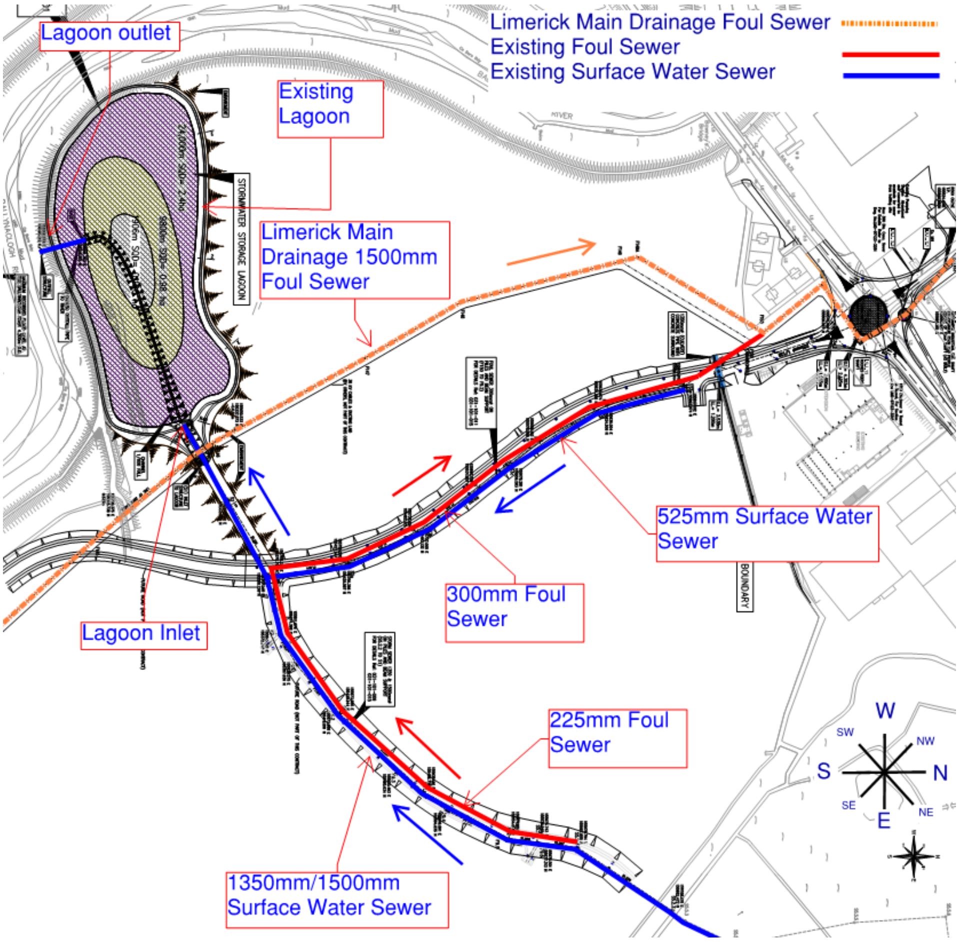

Figure 18.1: Existing foul water infrastructure surrounding the site

18.3.4 Surface Water Disposal

Based on existing record drawings, surveys and site visits it was established that the following surface water drainage infrastructure is located within Greenpark lands:

- 1350mm/1500mm diameter pipe flowing north east to south west from the boundary of the Alandale Development to the existing lagoon. This pipe was designed to receive surface water from Greenpark, Mary immaculate College, Oil Storage Depot, Fitzhaven, Convent and Alandale lands.
- 525mm diameter pipe flowing north west to south east from the Limerick Greyhound Stadium roundabout to the existing lagoon. This pipe was designed to receive surface water from Greenpark lands.
- 300mm diameter pipe from Log na gCapall which discharges to an existing surface water drain within Greenpark
- An existing lagoon which was designed to receive surface water from the lands noted in table 18-1 and figure 18.2. The existing lagoon consists of:
    - Inlet structure to the lagoon
    - Penstock structure - the penstock structure controls the flow of the water from the lagoon to the outfall structure in the Ballynaclough River.

- Outfall structure - the outfall structure is constructed of reinforced concrete and contains a 1050mm diameter Tideflex valve with thimble plate which allows discharge of water to the river at low tide but prevents backflow into the lagoon in times of high tide.

Table 18.1: Lagoon Contributing Areas

Regional SuDS (Lagoon) Contributing Areas	
Greenpark	14.561ha
Mary Immaculate College	2.91 ha
Oil Storage Depot	2.38 ha
Fitzhaven	3.7 ha
Convent	2.42 ha
Alandale	9.81 ha
Other	3.404 ha
Total Impermeable Area	**39.19 ha**

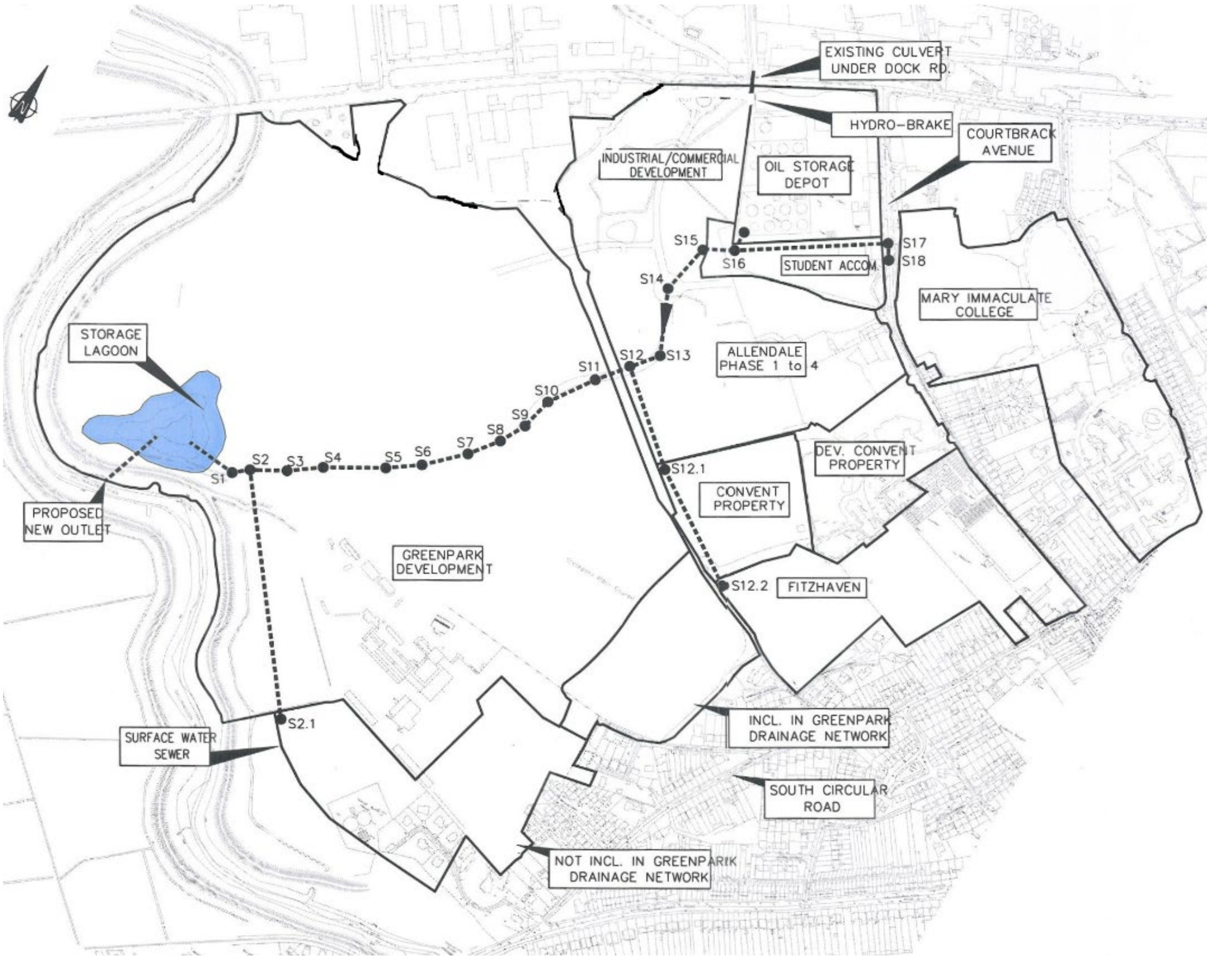

Figure 18.2: Lagoon Contributing Areas - Map

Figure 18.1 and PUNCH planning drawings shows the existing drainage on site and in the surrounding area.

18.3.5 Potable Water Supply

Based on existing record drawings, surveys and site visits it was established that the following watermain infrastructure is located within the Greenpark lands:

- 600mm diameter pipe flowing south east to north west through the site.
- 300mm diameter pipe flowing south east to north west from the Dock Road Roundabout for approximately 220m.

Figures 18.2, 18.3 and PUNCH planning drawings show the existing watermain infrastructure on site and in the surrounding area.

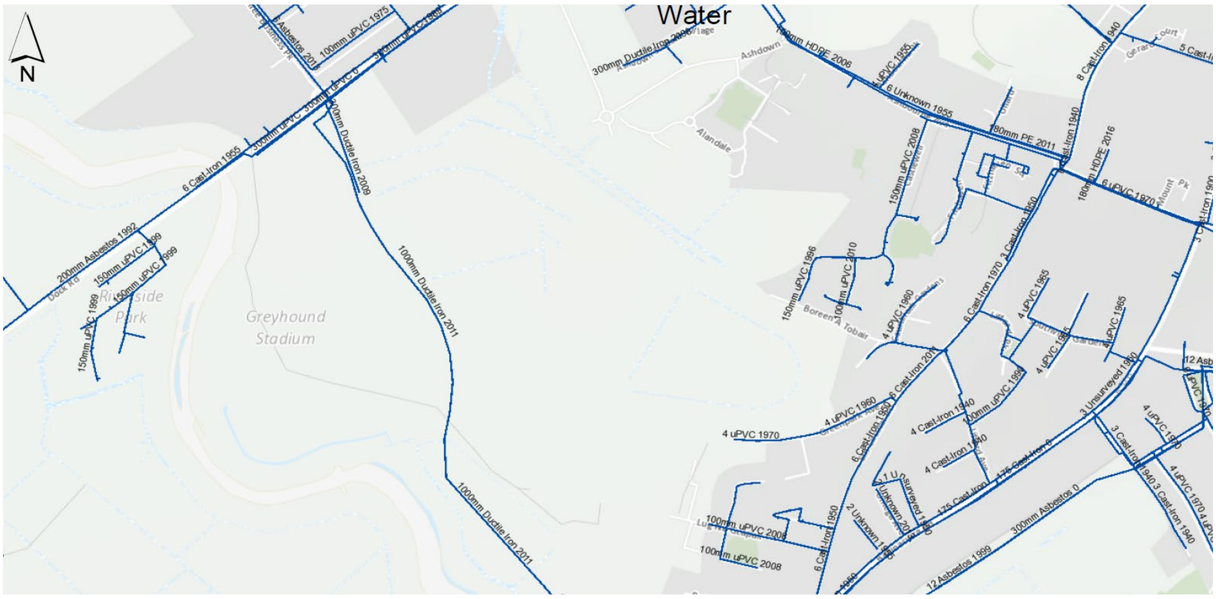

Figure 18.2: Existing Watermains infrastructure surrounding the site

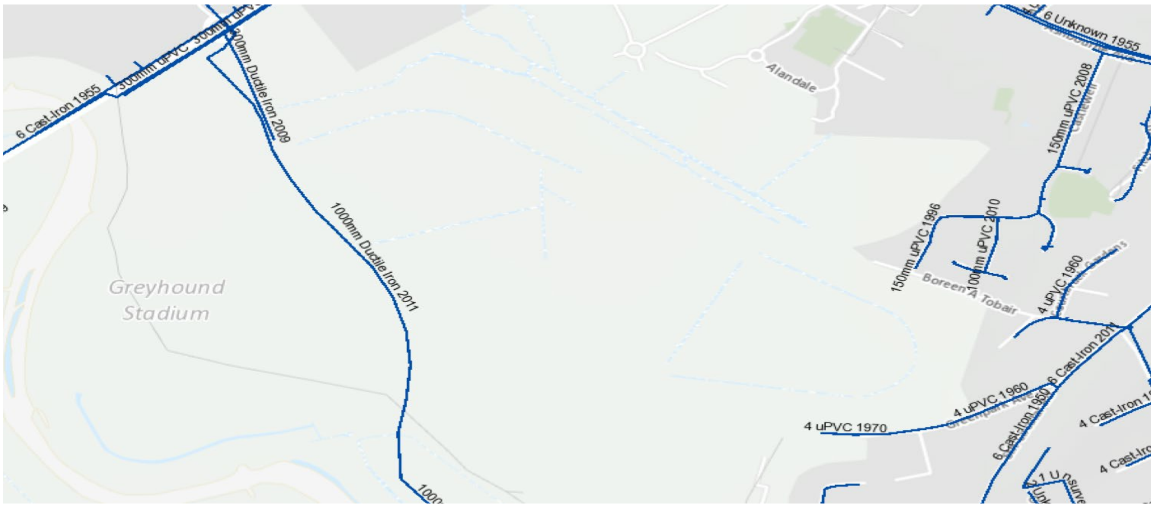

Figure 18.3: Existing Watermains infrastructure surrounding the site

18.3.6 Natural Gas Supply

The SHD consists of apartments, domestic houses, duplexes & creche, in line with building regulations TGD Part L the heating and hot water strategy is to use Heatpump technology which requires electrical supply. There is <u>no requirement</u> for Natural Gas to service these properties.

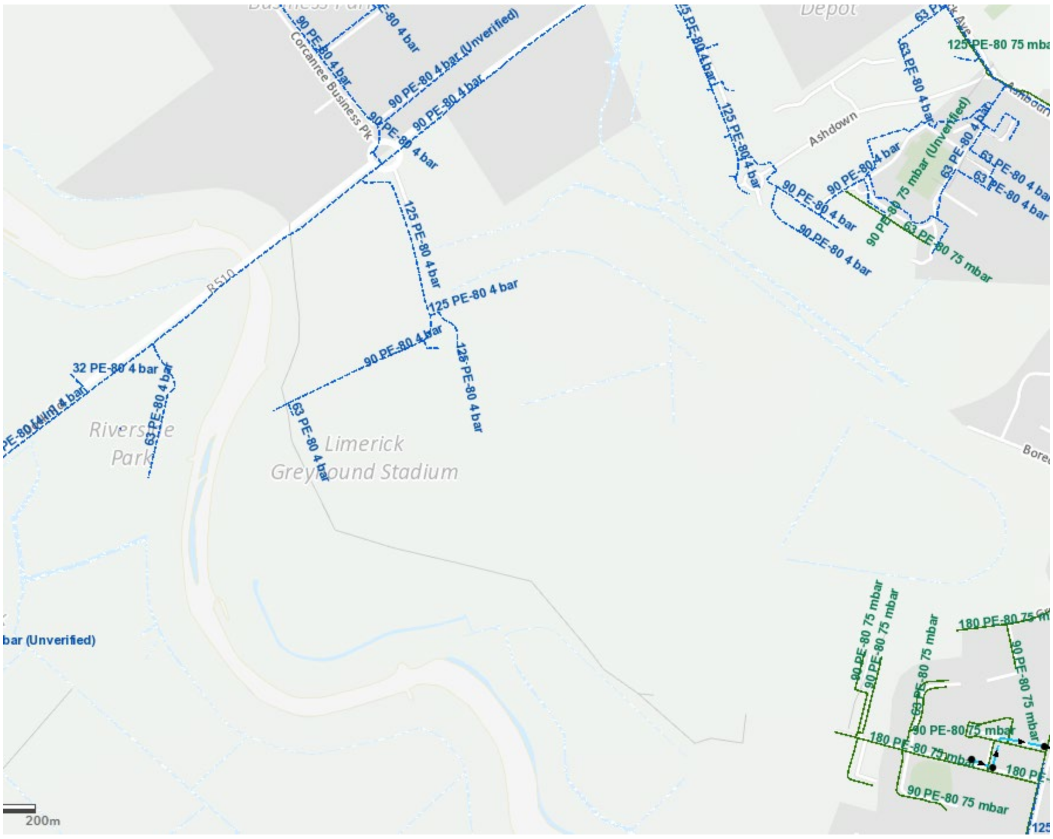

Figure 18.4: Existing Gas Networks infrastructure surrounding the site

18.3.7 Electrical Supply

ESB have HV lines traversing the site & MV Lines in close proximity which will be used to facilitate several cabinet Kiosk type MV/LV substations.

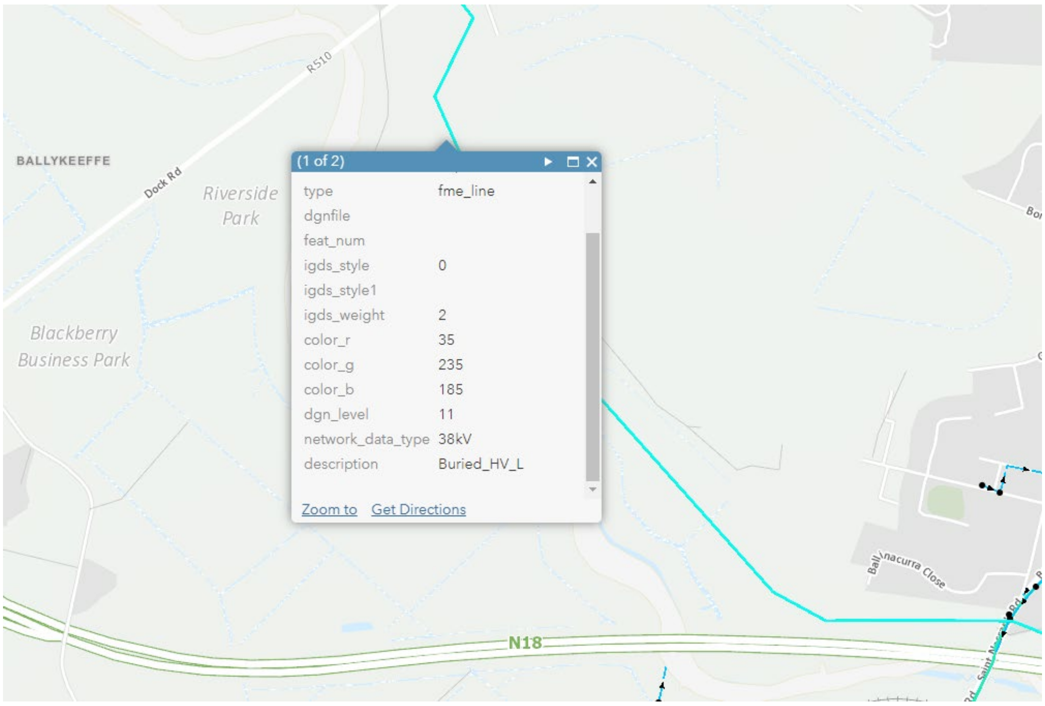

Figure 18.5: High Voltage Lines on Site

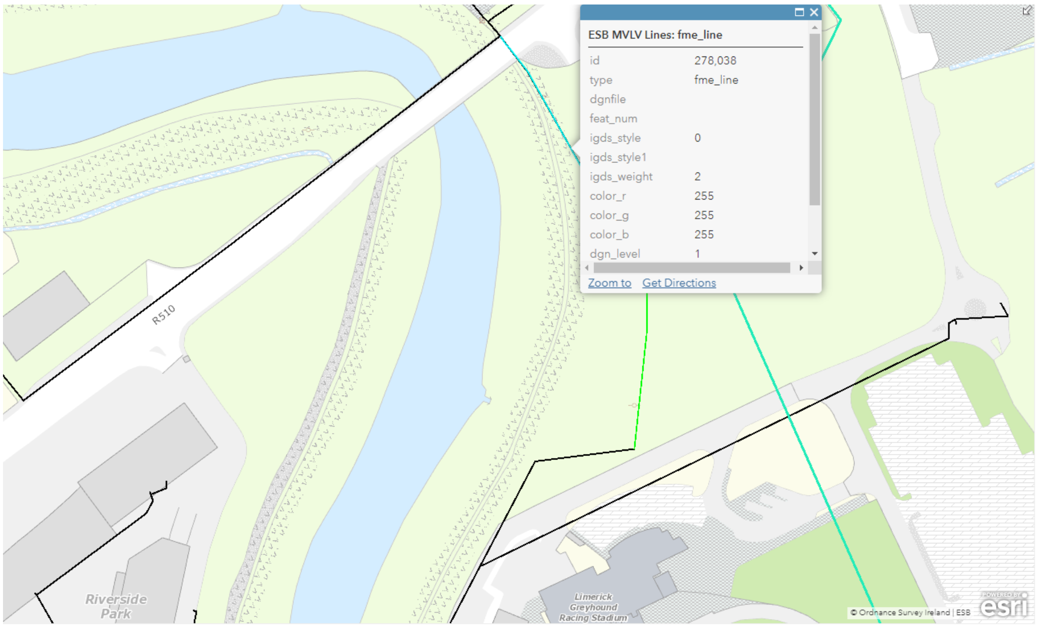

Figure 18.6: MV & LV Lines on site

18.3.8 Information and Communications Technology

There is currently EIR ducts servicing the Greyhound Stadium, these will be extended into the site to provide telecoms & broadband services to each home user.

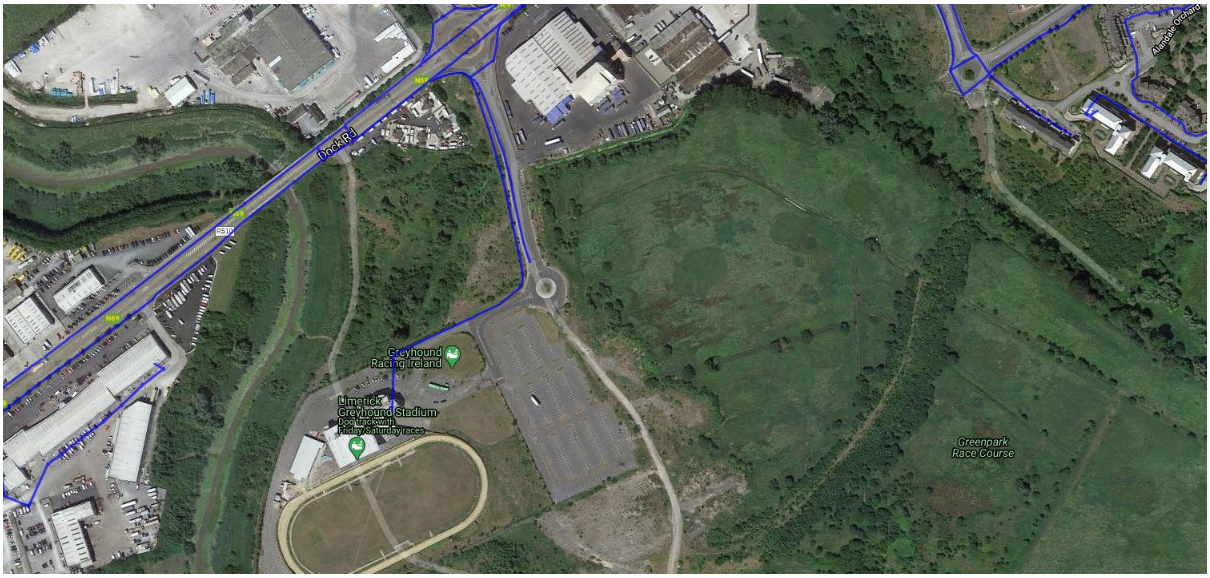

Figure 18.7: EIR Duct Network Lines on site

18.4 Characteristics of Proposed SHD development

The proposed SHD development is described in Chapter 5. The following elements are relevant to the assessment of effects in this Chapter:

- Foul Water disposal
- Surface Water disposal
- Potable Water Supply
- Electrical Supply
- Information and Communications Technology

18.4.1 Foul Water Disposal

It is proposed that foul water from the proposed SHD development shall discharge by gravity to the existing 225mm diameter foul sewer prior to discharging to the Limerick Main Drainage Network.

A proposed residential development for 30 units was granted planning on Greenpark Avenue (planning number 17/1190 - ABP-302015-18. The development allowed for the foul network to discharge to the existing foul sewer within Greenpark. As part of the SHD development, it is proposed to provide a manhole at the site boundary to accommodate foul water flows from the Greenpark Avenue development.

It is also proposed to provide a manhole at the site boundary to accommodate foul water flows from the proposed Nursing Home development (planning reference 21/1222).

18.4.2 Surface Water Disposal

A new surface water sewer network shall be provided for the proposed SHD development which will be entirely separate from the foul water sewer network. Surface water run-off from roof areas and hardstanding areas are designed to be collected by a gravity pipe network. Surface water will be collected and discharged via a mixture of traditional and Sustainable urban Drainage System (SuDS) to the existing lagoon via existing 1350mm/1500mm diameter surface water sewer. Each unit will have its own independent connection to the surface water sewer network.

It is proposed that surface water will discharge via attenuation tanks, a class 1 bypass separator and flow control device prior to discharging to the existing surface water network at a rate of 4l/s/ha.

A proposed residential development for 30 units was granted planning on Greenpark Avenue, planning number 17/1190 (ABP-302015-18). The development allowed for attenuated surface water network to discharge to the existing surface water network within Greenpark with a restricted discharge rate of 9l/s. As part of the SHD housing development, it is proposed to provide a manhole at the site boundary which will discharge to an attenuation tank to accommodate surface water flows from the Greenpark Avenue development.

It is also proposed to provide a manhole at the site boundary to accommodate attenuated surface foul water flows from the proposed Nursing Home development (planning reference 21/1222)

It is proposed that the surface water sewer from Log na gCapall will be accommodated via a separate surface water sewer which will discharge to the existing 1350mm/1500mm diameter surface water sewer.

18.4.3 Potable Water Supply

It is proposed to provide a 250mm diameter watermain, 180mm diameter watermain and 125mm diameter watermain branch lines for the development. A connection will be made to the existing 600mm diameter watermain.

18.4.4 Natural Gas Supply

The existing gas infrastructure to the Greyhound Stadium will be retained, new infrastructure is not intended for this project.

As the design intention in compliance with TGD Part L (NZEB) is to utilise Air to Water Heat-pumps for heating and hot water generation there is no requirement for natural gas connection.

18.4.5 Electrical Supply

There will be a separate Kiosk substation (Image below) per 150 units, the LV network will be distributed via underground ducting and ESB Mini pillars.

Figure 18.8: Sample ESB Kiosk Sub Station

18.4.6 Information and Communications Technology

A full duct infrastructure to facilitate EIR FTTH (Fibre To The Home) 10Gigabit Broadband will be provided so each unit will have access to the national broadband plan. This infra structure will ensure EIR can provide current and next generation broadband to each home.

18.5 Potential Effects of the Proposed Project

18.5.1 Construction Phase

Access

The details of the deliveries and access to the construction site will be decided on prior to construction commencing and will be subject to agreement with the Planning Authority as part of the Contactor's CEMP, including traffic management. Deliveries and access to the construction site are likely to have a negative, slight, short-term impact on road users of the local road network.

Please refer to the CEMP by Gavin and Doherty Geosolutions for access and traffic management required to be implemented by the contractor during the construction the stage.

Transport Infrastructure

Please refer to chapter 16, Material Assets Transportation for details of transport infrastructure impacts.

Foul Water Disposal

The proposal will involve providing a connection to the existing foul water infrastructure. The connection will be made before the development is occupied. The impact is likely to be neutral, imperceptible and temporary.

Surface Water Disposal

The proposal will involve providing a connection to the existing surface water infrastructure, a connection to the existing surface water sewer from Log na gCapall, a proposed manhole at the site boundary to accommodate attenuated surface water flows from the proposed nursing home (planning reference 21/1222) and a proposed manhole at the site boundary to accommodate a future surface water sewer from the proposed residential development on Greenpark Avenue, planning number 17/1190 (ABP-302015-18). The connections will be made before the development is occupied. The impact is likely to be neutral, imperceptible and temporary.

Potable Water Supply
The proposal will involve providing a new connection to the existing potable water supply network. There is potential for some short-term impacts by way of disruption in water supply due to these works to facilitate connecting the development to the existing public water supply network. This could lead to disruption in water supply to nearby residences and buildings for short periods. The potential impact on the local public water supply network is likely to be negative, not significant and temporary.

Natural Gas Supply
As there is no requirement for Gas this will not impact the site. The impact is likely to be not significant.

Electrical Supply
We have engaged the ESB and they have advised that there is capacity in both the HV & LV network to facilitate the project. The impact is likely to be neutral, imperceptible, and temporary.

Information and Communications Technology
EIR Duct network is to be extended along roadway to service the SHD. The impact is likely to be neutral, imperceptible and temporary.

18.5.2 Operational Phase

Access and Transport Infrastructure
The traffic and transport impact of the proposed SHD development is assessed in Chapter 16, supported by the Traffic and Transportation Assessment report prepared by PUNCH Consulting Engineers which is submitted with this planning application.

Foul Water Disposal
The impact of the proposed SHD development on the public foul sewerage system is likely to be an increase in the quantity of wastewater discharging to the Bunlicky Waste Water Treatment Plant, Dock Road, Limerick.

A pre-connection application enquiry (Customer Reference No. CDS20006611) was issued to Irish Water in October 2020 and a response was received in December 2020 stating that "subject to a valid connection agreement being put in place, your proposed connection to Irish Water network(s) can be facilitated."

The potential impact of the proposed SHD development on the public foul sewerage system is likely to be negative, slight and long term.

Surface Water Disposal

It is proposed that surface water will discharge to an existing lagoon via surface water sewers, attenuation tank, class 1 bypass separator and flow control device that were designed to receive unattenuated surface water from the proposed SHD development.

The potential impact of the proposed SHD development on the surface water network is likely to be neutral.

Potable Water Supply
The impact of the proposed SHD development on the public water supply is likely to be an increase in demand on the existing supply.

A pre-connection application enquiry (Customer Reference No. CDS20006611) was issued to Irish Water in October 2020 and a response was received in December 2020 stating that "subject to a valid connection agreement being put in place, your proposed connection to Irish Water network(s) can be facilitated."

The potential impact of the proposed SHD development on the public water supply network is likely to be negative, slight and long term.

Natural Gas Supply
As there is no requirement for Gas this will not impact the site. The impact is non existent.

Electrical Supply
The impact of the proposed SHD development on the electricity supply is likely to be an increase in demand on the existing supply.

We have engaged Dan Clancy of the ESB and he has advised that there is capacity in both the HV & LV network to facilitate the project.

The potential impact of the proposed SHD development on the electricity network is likely to be neutral.

Information and Communications Technology
EIR Duct network is to be extended along roadway to service the SHD. The potential impact of the proposed SHD development on the electricity network is likely to be neutral.

18.6 Mitigation Measures

18.6.1 Construction Phase

The following mitigation measures are proposed for the construction phase of the proposed SHD development with reference to Material Assets: built Services:

MA:BS_1 The proposed SHD development should comply with the provisions of the Construction Waste Management Plan with respect to construction waste.

MA:BS_2 A Construction and Environmental Management Plan, including traffic management, should be implemented by the contractor for the construction stage to protect local amenities and the integrity and operation of the local road network during the construction phase.

MA:BS_3 Provision of Utilities should be carried out in accordance with the recommendations of the relevant statutory bodies (ESB, Gas Networks Ireland, Irish Water, EIR, Limerick City and County Council etc.).

MA:BS_4 All proposed connections to existing services should be constructed at off-peak times to minimise disruption to neighbouring properties.

MA:BS_5 Water metering should be included to record consumption to ensure there are no leaks as a result of the project.

18.6.2 Operational Phase

The following mitigation measures are proposed for the operational phase of the proposed SHD development with reference to Material Assets: Built Services:

MA:BS_6 The design and construction of the built services in accordance with the relevant guidelines and codes of practice will mitigate any potential impacts during the operational phase of the development.

18.7 Residual Effects

It is predicted that there will be no significant effect on the receiving environment from a built services perspective once the appropriate mitigation and monitoring measures are implemented throughout the construction and operational duration of the development.

18.7.1 Construction Phase

Residual impacts on the built services during the construction phase is considered to be temporary, occasional in nature and not significant, where a service is unavoidably disrupted to facilitate the construction phase.

18.7.2 Operational Phase

Residual impacts on built services during the operational phase given the new infrastructure is considered to be long term with a positive impact to all end users once the appropriate mitigation and monitoring measures are implemented.

18.8 Monitoring

18.8.1 Construction Phase

The following monitoring measures are proposed:-

MA:BS_7 Water consumption will be monitored for the development during construction through the use of water meters. This will ensure that any potential leaks as a result of construction are addressed promptly.

MA:BS_8 All water mains to be pressure tested and cleaned in accordance with the Irish Water code of practice prior to connecting to the existing potable water supply network. This will ensure that the watermain is leak free, clean and ready to receive water before the development is operational.

MA:BS_9 All foul sewers to be pressure tested and cleaned in accordance with the Irish Water code of practice prior to connecting to the existing foul sewer network. This will ensure that the foul sewer is leak free, clean and ready to receive foul effluent before the development is operational.

MA:BS_10 All surface water sewers to be pressure tested and cleaned prior to connecting to the existing surface water network. This will ensure that the surface water sewer is leak free, clean and ready to receive surface water before the development is operational.

18.8.2 Operational Phase

The following monitoring measures are proposed:-

MA:BS_11 Any monitoring of the built services required during the operational phase of the proposed project will be outlined in the operational and maintenance manual. This will ensure that the built services are operating as designed and any maintenance that is required is undertaken.

18.9 Interactions

There are no identified interactions with other chapters.

18.10 Cumulative Effects

18.10.1 Construction Phase

A number of projects are proposed for the surrounding area as detailed in section 3.5. It is unlikely that the developments noted in section 3.5 including the planned nursing home and the proposed residential development on Greenpark Avenue would give rise to significant impacts on material assets built services during the construction stages of those projects. Any impacts are likely to be temporary in nature.

Construction impacts will include providing a connection to the existing foul water infrastructure, surface water infrastructure, watermain and ESB infrastructure the impact of which is likely to be neutral, imperceptible and temporary.

The individual and combined effects as discussed above when considered holistically are likely to have a negative, not significant and temporary impact on local material assets, built services as long as mitigation measures outlined are put in place.

18.10.2 Operational Phase

A number of projects are proposed for the surrounding area as detailed in section 3.5. It is unlikely that the developments noted in section 3.5 including the planned nursing home and the proposed residential development on Greenpark Avenue would give rise to significant impact on material assets built services during the operational stages of those projects.

The individual and combined effects as discussed above when considered holistically are likely to have negative, slight, long term impact on material assets, built services as long as mitigation measures outlined are put in place.

18.11 'Do-Nothing' Effect

In order to provide a qualitative and equitable assessment of the proposed SHD development, this section considers the proposed SHD development in the context of the likely impacts upon the receiving environment should the proposed SHD development not take place.

If the proposed SHD development does not proceed there would be no additional demand or loading on material assets, built services.

18.12 Difficulties Encountered in Compiling the Chapter

No significant difficulties were encountered in completing this chapter.

19.0 SUMMARY OF PRINCIPAL INTERACTIONS OF EFFECTS

19.1 Introduction

Schedule 6 Item 2(d) of the Planning and Development Regulations, 2001 as amended requires that projects are examined with regard to the inter-relationship of aspects referred to in Item 2(d) of Schedule 6.

The matrix incorporated in Table 19.1 inter-relates the various Chapters of the EIAR to the various impact headings referred to in Schedule 6 Item 2(d) of the Planning and Development Regulations, 2001, As Amended. This matrix does not represent a form of relative assessment of impacts, but merely identifies and amalgamates areas of principal interaction.

19.2 Description of Potential Interactions

19.2.1 Population and Human Health

All environmental factors interact with Population and Human Health (Chapter 7). The key areas of interactions are:

- Land, Soils, Geology and Hydrogeology
- Air and Climate
- Noise and Vibration
- Landscape and Visual
- Daylight and Sunlight
- Waste

There are no significant adverse effects for Population and Human Health.

19.3.2 Biodiversity

The water environment and impact on water quality has the potential to impact on water dependent habitats and species in the water bodies affected and therefore there is a strong interaction with biodiversity. The key areas of interaction are considered to be:

- Hydrology
- Land, Soils, Geology and Hydrogeology
- Landscape and Visual

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

19.3.3 Land, Soils, Geology and Hydrogeology

The earthworks for the site has the potential to impact on the surface water quality, by silt generated from runoff or chemicals/oils from construction vehicles carrying out the works.

Potential health effects arise mainly through the potential for soil and ground contamination. Residential developments are not a recognized source of significant potential pollution and so the potential for effects during the construction and operational phases are not of concern.

The key areas of interaction are:

- Biodiversity
- Hydrology
- Population and Human Health

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

19.3.4 Hydrology (Surface Water)

The water environment and impact on water quality has the potential to impact on water dependent habitats and species in the water bodies affected and therefore there is a strong interaction with biodiversity. The protection of the water environment will help to ensure that biodiversity is not significantly impacted by the implementation of the SHD.

Geology and soils also have a strong interaction with the water quality with the interaction of surface and sub surface water important to the generation of run-off and the mitigation of same. The key areas of interaction are therefore considered to be:

- Biodiversity
- Land, Soils, Geology and Hydrogeology

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

19.3.5 Air Quality and Climate

Both the construction and operational phases of the proposed project have the potential to result in dust soiling and possible exposure to air quality pollutants. The key areas of interaction are therefore:

- Population and Human Health
- Biodiversity
- Roads and Traffic

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

19.3.6 Noise and Vibration

Noise and vibration interacts with human health, especially during the construction phase of the project there will be some negative impact on nearby noise sensitive locations due to noise/vibration emissions from construction activity. In terms of construction noise emissions to nearby off-site receptors, provided that noise emissions are controlled to comply with the recommended significance thresholds, as outlined in previous sections, and considering the short-term nature of the works, the potential health impacts associated with construction noise is not significant.

There is also interaction between noise and additional traffic arising from the development, both during the operational phase.

The key areas of interaction are therefore considered to be:

- Population and Human Health
- Roads and Traffic

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

19.3.7 Landscape and Visual

The long-term effects of the proposed development will have a positive effect on the tree cover associated with the development and the inclusion of native species of shrub planting.

The proposed project generates visual effects. The landscape and visual impact associated with human beings focuses on the effects to dwellings.

The key areas of interaction are therefore considered to be:

- Population and Human Health
- Biodiversity

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

19.3.8 Cultural Heritage, Archaeology and Architectural

No interactions are identified in respect of Cultural Heritage, Archaeology and Architectural.

19.3.9 Microclimate – Daylight/ Sunlight

The proposed project will result in a change to the sunlight environment of an area. It is therefore considered that impacts upon sunlight access will result in interactions with the following factors:

- Population and Human Health
- Landscape and Visual

It is noted that an interaction with Daylight and Sunlight is not explicitly identified within the Landscape and Visual Chapter. The author of that Chapter is of the professional opinion that as there are no significant changes arising from the proposed project in respect of daylight and sunlight there is no material interaction between the two Chapters.

On the basis that there are no significant adverse effects expected in this regard, the potential interaction between Daylight and Sunlight and Landscape and Visual is not considered to change the overall conclusions of this EIAR.

19.3.10 Material Assets - Roads and Traffic

The changes to traffic in the surrounding area during both the construction and operational phase of the development is considered to interact with air quality and noise related impacts. The key areas of interaction are therefore considered to be:

- Air Quality and Climate
- Noise and Vibration

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

19.3.11 Material Assets – Waste Management

The construction and operational phases of the proposed project will generate waste which has the potential to interact with human health. The key areas of interaction are therefore considered to be:

- Population and Human Health

Subject to adherence to the proposed mitigation measures, no significant adverse impacts are anticipated.

19.3.12 Material Assets – Built Services

No interactions are identified in respect of Built Services.

19.2 Summary Interactions Table

Table 19.1 provides a summary of the interactions between potential environmental effects that have been identified in this EIAR.

Table 19.1: Matrix of Interactions Between Environmental Factors

Interactions Between Environmental Factors												
	Population & Human Health	Biodiversity	Land, Soils, Geology and Hydrogeology	Hydrology	Air Quality/ Climate	Noise & Vibration	Landscape & Visual	Cultural Heritage, Archaeology and Architectural	Daylight and Sunlight	Roads and Traffic	Waste	Built Services
Population & Human Health			✓		✓	✓	✓		✓		✓	
Biodiversity			✓	✓			✓					
Land, Soils, Geology and Hydrogeology				✓								
Hydrology												
Air Quality/ Climate										✓		
Noise & Vibration										✓		
Landscape & Visual									✓			
Cultural Heritage, Archaeology and Architectural												
Daylight and Sunlight												
Roads and Traffic												
Waste												
Built Services												

20.0 CUMULATIVE IMPACTS

20.1 Introduction

This Chapter has regard to the potential cumulative impact upon the environment arising from the proposed project, in combination with other developments (committed or planned projects) in the surrounding area.

Cumulative impact is defined by the EU Guidelines as:

> *"Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. For example:*
>
> - *Incremental noise from a number of separate developments;*
> - *Combined effect of individual impacts, e.g. noise, dust and visual, from one development on a particular receptor; and*
> - *Several developments with insignificant impacts individually but which together have a cumulative effect."*

20.2 Committed Development

In terms of committed development, a search of Limerick City and County Council and An Bord Pleanála's websites has been conducted. The following development with planning permission has been identified for the purposes of this cumulative assessment: LCCC Reg. Ref. 17/1190; ABP ref. 302015-18. The description of development is as follows:

> *"The construction of a housing development of 31 no. residential dwellings consisting of 11 no. detached dwelling, 20 no. semi detached dwellings with ancillary roads and infrastructure. Permission is also sought for the upgrade of Greenpark Avenue consisting of the installation of speed ramps, the realignment of the junction of Greenpark Avenue with the South Circular Road and the installation of a table top at the junction of Greenpark Avenue and South Circular Road with speed ramps at each approach…"*

It is noteworthy that planning condition no. 2 requires the omission of house no. 25 and therefore, the permitted scheme comprises 30 no. houses.

Each environmental issue assessed within this EIAR has been considered in respect to the cumulative impact of the proposed project with the above referenced development.

20.3 Planned Development

In terms of planned development, an application for a proposed nursing home development has been submitted to LCCC by the Applicant in respect of the land in the south eastern corner of the wider former Greenpark Racecourse lands (LCCC Reg. Ref. 21/1222). The land is within the ownership of the Applicant for the current SHD application and forms part of the site wide Masterplan for the lands.

This application has been considered as part of cumulative assessment. The description of development is as follows:

> *"Voyage Property Limited intend to apply for permission for development for a nursing home at this site of c.1.3 ha, in the south-eastern part of the former Greenpark Racecourse, Dock Road, Limerick. The site is principally bound by existing undeveloped lands to the north, south and west and the adjoining Log na gCapall Housing Estate to the east. The proposed nursing home will be accessed via Log na gCapall, via an existing access point.*
>
> *The development will be 4 storeys in height with a total gross floor area of c.5,237 sq m, consisting of 123 no. rooms, comprising 126 no. bedspaces (120 no. single rooms and 3 no. double rooms) and ancillary facilities, including 777 sq m of day space.*
>
> *The development will also consist of soft and hard landscaping including 2,954 sq m of open space; 32 no. surface car parking spaces (including 3 no. electric parking spaces); bicycle parking; internal roads and pathways; boundary treatment including sloped embankments; SUDS measures including green roof; piped infrastructural services and connections; plant; revised tie-in arrangements to Log na gCapall (including road widening); waste management provision; public lighting; earthworks; and all site development and excavation works above and below ground."*

Each environmental issue assessed within this EIAR has been considered in respect to the cumulative impact of the proposed project with the above referenced development.

20.4 Conclusions

Having regard to the above, this EIAR considers the total impact associated with the proposed project, in combination with committed and planned development within the area surrounding the site.

Each chapter that covers an environmental aspect has specific regard to any potential cumulative impacts arising from the proposed project in combination with the above identified projects. It is considered that no significant cumulative impacts are likely to arise.

21.0 SCHEDULE OF ENVIRONMENTAL COMMITMENTS/ MITIGATION MEASURES

21.1 Introduction

This Chapter provides a consolidated list of all of the environmental commitments/ mitigation measures that have been recommended by the various specialists throughout the Chapters of this EIAR.

The mitigation and monitoring measures have been recommended on that basis that they are considered necessary to protect the environment during both the construction and operational phases of the proposed project.

21.2 Summary Tables

Table 21.1: Schedule of Proposed Environmental Commitments		
Mitigation No.	**Description of Mitigation/Environmental Commitment**	**Phase**
	Biodiversity	
B_1	Provided the sewer network is installed using industry standard best practice, and routinely checked there is likely to be no impact from wastewater from the development and therefore no further mitigation required. Drainage pipelines will be inspected by CCTV at completion of the construction project and any damage will be repaired.	Construction
B_2	The development has incorporated a variety of Sustainable Drainage Systems (SuDS) techniques to counteract the potential increased runoff as a result of increased hardstanding. SuDS include attenuation by bypass separators on the storm water network, green roofed apartments, permeable paving of driveways and car parks, tree lined areas, infiltration trenches, swales as well as, grassed and open space landscape portions of the site.	Construction
B_3	A new surface water sewer network shall be provided for the proposed development which will be entirely separate from the foul water sewer network. Surface water run-off from roof areas and hardstanding areas are designed to be collected by a gravity pipe network. Surface water will be collected and discharged via a mixture of traditional and sustainable (SuDS) drainage to the existing 1350mm/1500mm diameter surface water sewer. Each unit will have its own independent connection to the surface water sewer network. All SuDS measures are to be implemented with reference to the UK Suds Manual and	Construction

	Limerick City & County Council water services department requirements.	
B_4	Adequately specified oil interceptors will be incorporated into the proposed drainage network for the parking areas and access roads.	Construction
B_5	Mitigation measures will be implemented by the contractors who will construct the developments in accordance with the requirements listed within the planning phase Construction Waste Management Plan and Construction Environmental Management Plan (GDG, 2021) which accompany the planning application for the development. Furthermore, once appointed, the contractors will submit a detailed construction management plan based on the requirements of these submitted planning documents for approval by the Planning Authority. The mitigation measures implemented by the contractor will refer to the construction management procedures for best practice regarding the following recognised international guidelines: • Good practice guidelines on the control of water pollution from construction sites developed by the Construction Industry Research and Information Association (CIRIA, 2001); • Control of Water Pollution from construction sites, Guidance for consultants and contractors (C532); • Environmental Good Practice on Site (3rd edition) (C692); and • Guidelines on Protection of Fisheries During Construction Works and Adjacent to Waters (2016). • Drainage ditches will be installed to intercept surface water where there is a risk of significant water flow into excavations or on to adjoining lands. There will also be a requirement to periodically pump water from excavations. All collected and pumped water will have to be treated prior to discharge. The run-off will be directed through appropriately sized settlement ponds to remove suspended solids. All treated water will then be directed to an existing	Construction

	constructed wetland lagoon to the west of the site. The constructed wetland was designed in anticipation of the site being developed and was sized to receive and attenuate the operational surface water drainage. Discharge from the constructed wetland to the Ballynaclogh River is controlled by a penstock. The operational flow rates will be much greater, due to the increase in impermeable area. The constructed wetland will therefore be capable of dealing with runoff from the unpaved site during construction. • Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the site compound. These agencies will be notified immediately in the event of a pollution incident. • Any temporary storage of soil, hardcore, crushed concrete or similar material will be stored 50m from any surface water drains. All temporary storage areas should also have surface run-off controls in place to prevent migration of possible materials. There can be no direct pumping of silty water from the works directly to any watercourse. All water from excavations must be treated by infiltration over lands or via settlement areas, silt busters etc.	
B_6	In relation to flooding, the following measures will be required: • Stockpiles of soil shall be kept at the highest level possible within the site. • Silt fencing and settlement ponds shall be placed at the highest level possible within the site. Silt fences shall be inspected as part of the daily inspection regime. Trapped silt shall be removed from silt fencing at regular intervals.	Construction

	• Earthworks shall be left exposed for the minimum time possible. Earthworks formations shall be protected by a layer of imported granular fill. • Landscaping and seeding of the perimeter embankments and retaining structures in accordance with the Landscaping Plan shall be carried out as early as possible. • An Emergency Response plan shall be developed for the site and shall consider the following: a) Flood forecasting shall be used to determine the probability of the site being flooded. b) Emergency evacuation routes will be included in the plan to ensure that flooding does not threaten the safety of construction personnel and/or residents. c) Site compounds, fuel storage areas, generators and the like shall be sited as high as possible on the site.	
B_7	In relation to the control of cement run-off, the following measures will be required: • The washing out of concrete delivery vehicles is a potential source of pollution and shall be carried out in in designated wash out areas only. Wash-out areas on site will be located greater than 50m from any natural watercourse and properly designed with an impermeable liner to contain all cement laden water. No wash-out of ready-mix concrete vehicles shall be located within 10 metres of any temporary or permanent drainage features. Signage shall be erected to clearly identify the wash-out areas. Sufficient wash-out areas shall be provided to cater for all vehicles at peak delivery times. • On-site batching of concrete is not envisaged, but ready to use mortar silos are often used for housing developments. These systems involve the delivery and storage of dry cement and aggregates in silos, water is added at the point of delivery to make mortar or plaster. The following controls shall be put in place for the on-site batching of concrete, mortar and render: • The plant shall be maintained in good condition. • Delivery of cement shall be means of a sealed system to prevent escape of cement.	Construction

	• The plant shall be situated on a paved area at least 20m from any temporary or permanent drainage features. • Emergency procedures shall be in place to deal with accidental spillages of cement or mortar.	
B_8	In relation to accidental spills and leaks, the following measures will be required: • No bulk chemicals will be stored within the active construction areas. Temporary oil and fuel storage tanks may be kept in the material storage area in suitable containers and will be stored on appropriately bunded spill pallets as required. Any fuel and oil stored onsite shall be stored on bunded spill pallets approved under BS EN 1992-3:2006). All bunds will be impermeable and capable of retaining a volume of equal to or greater than 1.1 times (>110%) capacity of the containers stored on them. In the event of a spillage, excess oil or fuel will be collected in the bund. • Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will be undertaken offsite where possible. Where this is not possible, filling and maintenance will take place in a designated material storage compound, which is located at least 10 metres from any temporary or permanent drainage features. Spill protection equipment such as absorbent mats, socks and sand will be available in clearly marked bins/silos and in construction vehicles to be used in the event of an accidental release during refuelling. Training will be given to site workers in how to manage a spill event.	Construction
B_9	The following mitigation measures will be taken at the construction site to prevent any spillages to ground of fuels during machinery activities and prevent any resulting soil and/or groundwater quality impacts: • Refuelling will be undertaken off site where possible. • Where mobile fuel bowsers are used the following measures will be taken: • Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use.	Construction

	• Any pump or valve will be fitted with a lock and will be secured when not in use. • All bowsers to carry a spill kit and operatives must have spill response training; and • Portable generators or similar fuel containing equipment will be placed on suitable drip trays. • Weekly checks of spill kits will be carried out to ensure they are sufficiently stocked.	
B_10	In relation to concrete and cement pollution, the following measures are required: • A concrete washdown area will be provided on site for trucks to use after delivery of concrete or on return to the batching plant. This area will be adequately bunded to mitigate the risk of contaminated runoff discharge to the Limerick Dock water body. Concrete trucks are to be washed down within the concrete truck washdown area after delivery of concrete, prior to exiting the site. Washdown runoff will be appropriately treated prior to discharge; • Wash-out areas on site will be properly designed with an impermeable line to contain all cement laden water. No wash-out of ready-mix concrete vehicles shall be located within 10 metres of any temporary or permanent drainage features. Signage shall be erected to clearly identify the wash-out areas. Sufficient wash-out areas shall be provided to cater for all vehicles at peak delivery times; • On-site batching of concrete is not envisaged, but ready to use mortar silos are often used for housing developments. These systems involve the delivery and storage of dry cement and aggregates in silos, water is added at the point of delivery to make mortar or plaster. The following controls shall be put in place for the on-site batching of concrete, mortar and render: - The plant shall be maintained in good condition. - Delivery of cement shall be means of a sealed system to prevent escape of cement. - The plant shall be situated on a paved area at least 20m from any temporary or permanent drainage features.	Construction

	- Emergency procedures shall be in place to deal with accidental spillages of cement or mortar.	
B_11	The risk of water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages/spillages of fuels, oils, other chemicals and waste water) will be controlled through good site management and the adherence to codes and practices which limit the risk to within acceptable levels. The following measures will be implemented during construction: • Silt control measures (as outlined in the planning phase Construction Environmental Management Plan) in the working CEMP which will be developed and implemented by the contractor, will include detail in respect of every aspect of the works in order to minimise potential impacts and maximise potential benefits associated with the works; • Management and auditing procedures, including tool box talks to personnel, will be put in place to ensure that any works which have the potential to impact on the aquatic environment are being carried out in accordance with the contactors environmental controls, which will be consistent with an approved CEMP and any planning conditions; • Existing and proposed surface water drainage and discharge points will be mapped on the Drainage layout. These will be noted on construction site plans and protected accordingly to ensure water bodies are not impacted from sediment and other pollutants using measures to intercept the pathway for such pollutants; • Welfare facilities (canteens, toilets etc.) will be available within the construction compound and this will remain in place for the construction of the proposed development. The offices and site amenities will initially need to have their own foul water collection until connections are made to the mains networks.	Construction
B_12	Spillage and blow-off of debris, aggregates and fine material onto public roads will be reduced to a minimum by employing the following measures:	Construction

	• Vehicles delivering material with potential for dust emissions to an off-site location shall be enclosed or covered at all times to restrict the escape of dust; • Any hard surface site roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only; • A power washing facility or wheel cleaning facility will be installed near to the site compound for use by vehicles exiting the site when appropriate; • Road sweepers will be employed to clean the site access route as required	
B_13	The use of oils and chemicals on-site requires significant care and attention. The following procedures will be followed to reduce the potential risk from oils and chemicals (B_13 in Table 21.1): • New metal gerry cans with proper pouring nozzles will be used to move fuel around the site for the purposes of refuelling items of small plant on site. Metal gerry cans and any other items of fuel containers will be stored in certified metal bunded cabinets. • Drip trays will be used under items of small plant at all times. Any waste oils etc. contained in the drip trays or the bunded area will be emptied into a waste oil drum, which will be stored within the bund. • Any gas bottles will be stored in a caged area at a secure location on the site. All will be properly secured at point of work. • No bulk chemicals will be stored within the active construction areas. Temporary oil and fuel storage tanks may be kept in the material storage area in suitable containers and will be stored on appropriately bunded spill pallets as required. Any fuel and oil stored onsite shall be stored on bunded spill pallets approved under BS EN 1992-3:2006). All bunds will be impermeable and capable of retaining a volume of equal to or greater than 1.1 times (>10%) capacity of the containers stored on them. In the event of a filling spillage excess oil or fuel will be collected in the bund;	Construction

	• Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will be undertaken offsite where possible. Where this is not possible, filling and maintenance will take place in a designated material storage compound, which is located at least 10 metres from any temporary or permanent drainage features. Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release. Training will be given to appropriate site workers in how to manage a spill event. A certified double skinned metal fuel tank will be situated in this secure bunded area on the construction site if applicable. This tank will be certified for lifting when full. • Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release during refuelling. Training will be given to appropriate site workers in how to manage a spill event. A hazardous bin will also be available to contain any spent sand or soak pads. • Contingency Planning: A project specific Pollution Incident Response Plan will be prepared by the contractor and will refer to PPG 21 Pollution Incident Response Planning. The contractor's Environmental Manager will be notified in a timely manner of all incidents where there has been a breach in agreed environmental management procedures. Suitable training will be provided by the contractor to relevant personnel detailed within the Pollution Incident Response Plan to ensure that appropriate and timely actions is taken.	
B_14	The following mitigation measures will be taken at the construction site in order to prevent any spillages to ground	Construction

	of fuels during machinery activities and prevent any resulting soil and/or groundwater quality impacts: • Refuelling will be undertaken off site where possible; • Where mobile fuel bowsers are used the following measures will be taken: ○ Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use; ○ The pump or valve will be fitted with a lock and will be secured when not in use; ○ All bowsers to carry a spill kit and operatives must have spill response training; and ○ Portable generators or similar fuel containing equipment will be placed on suitable drip trays.	
B_15	General mitigation measures for habitats and flora: • Given the proximity of the site to ecologically sensitive receptors and EU and Nationally designated sites, an Ecologist will be appointed to oversee the implementation of the ecological mitigation and management measures committed to in the EIAR and associated documents. • No removal of habitats or movement of construction machinery will occur outside of the development works area/footprint during the construction phase. Existing trees and hedgerows shall be retained where possible. • The works area/footprint will be clearly marked out for associated site staff, ecologically sensitive habitat will be fenced off in accordance with the advice of an Ecologist . • Flora protection order species and Red listed plant species are known to occur in the area e.g. opposite-leaved pondweed (*Groenlandia densa*), triangular clubrush (*Schoenoplectus triqueter*), Least Bur-reed	Construction

	(*Sparganium natans*), Penny Royal (*Mentha pulegium*), Meadow Barley (*Hordeum secalinum*) and Autumn Crocus (*Colchicum autumnale*), Greater knapweed (*Centaurea scabiosa*). Prior to construction the Ecologist will check suitable habitat within the development footprint where these protected or red listed plants were recorded or are likely to be found. In the event that these species are found during the pre-construction checks, efforts should be made to avoid impacting upon or the loss of these species. If this is not possible a translocation plan will be developed by the Ecologist to move the protected flora to a suitable location. A survey will be required to confirm the extent of the range of the protected species and where necessary a derogation license from the NPWS will be obtained to develop possible translocation or alternative habitat development plans in consultation with the NPWS . • Other species recorded which are not red-listed or FPO species but of ecological interest include a number of wild orchid species- the Bee Orchid, Pyramidal Orchid and Common spotted orchid. To try to conserve the seed bank of these wild orchids, prior to construction the Ecologist will find a suitable location to transfer these plants to. • The area of species rich Dry calcareous and neutral grassland (GS1) located in the east of the site supported an abundance of Common spotted orchid and a species rich calcareous plant community. Prior to site clearance and under the supervision of an Ecologist this area shall be marked out, the topsoil in the area shall be removed carefully, kept intact and watered during the construction period to be reinstated and used in landscaping of the green areas or transferred to a suitable location to conserve the seedbank . • The construction of the proposed development will be implemented in accordance with the Construction Environmental Management Plan (CEMP, GDG, 2021) for the proposed development to ensure environmental protection of the site in	

	accordance with best practice controls (e.g. CIRIA 2015 & 2001; see GDG 2021) . • The proposed Landscape Plan will be implemented in full. This includes the following: o There will also be 620 new trees planted within the development and the open spaces and at the margins of the main access route (Murray & Associates, 2021). Additionally, there will be 2170m^2 of native woodland and shrub planting specified within the residential areas, and a further 1300m^2 of native tree and shrub planting to the access road area (totalling 3,470m^2), further bolstering the green infrastructure network. o Some of the chosen species will include; Oak (*Quercus robur*), Rowan (*Sorbus aucuparia*), Pine (*Pinus sylvestris*), Whitebeam (*Sorbus aria*), Willow (*Salix* spp), Alder (*Alnus glutinosa*), Birch (*Betula pendula*) which will be planted in the open spaces of the development. Hornbeam (*Carpinus betulus*), *Tilia cordata* 'Greenspire', P*latanus orientalis* 'Minaret' will be planted along the link roads. On the local roads Alder (*Alnus glutinosa*), Birch (*Betula pubescens*) and Rowan (*Sorbus aucuparia*) will be planted. Hazel (*Corylus avellana*), Cherry (*Prunus avium*), *Pyrus* 'Chanticleer', Crab Apple (*Malus sylvestris*) and Silver Birch (*Betula pendula*) will be planted in small residential streets and home zones.	
B_16	Prior to the development works and landscaping activity begins a survey by an appropriately experienced ecologist will be carried out to establish the full extents of the invasive plant species within the proposed development site boundary. The Contractor's will prepare an Invasive Alien Species (IAS) Management Plan for the works. The Plan must be clearly communicated to all site staff and must be adhered to if it is to be implemented successfully. Any further invasive species identified during the preconstruction survey will also be managed in accordance	Construction

	with best practice . The control of some species may require the use of herbicides, which can pose a risk to human health, to non-target plants or to wildlife. In order to ensure the safety of herbicide applicators and of other public users of the site, a qualified and experienced Contractor will be employed to carry out all work. It is advised that contractor refer to the following documents, which provides detailed recommendations for the control of invasive species and noxious weeds: Chapter 7 and Appendix 3 of the TII Publication *The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads* (NRA, 22010). Maintaining site hygiene at all times in an area where invasive non-native species are present is essential to prevent further spread. The following site hygiene measures shall be implemented onsite during the construction and/or for maintenance works during the operational stage where applicable : • Fence off the infested areas prior to and during construction works where possible in order to avoid spreading seeds or plant fragments around or off the construction site. • Clearly identify and mark out infested areas. Erect signs to inform Contractors of the risk. • Avoid if possible using machinery with tracks in infested areas. • Clearly identify and mark out areas where contaminated soil is to be stockpiled on site and cannot be within 50m of any watercourse or within a flood zone. • If soil is imported to the site for landscaping, infilling or embankments, the contractor shall gain documentation from suppliers that it is free from invasive species. • Ensure all site users are aware of measures to be taken and alert them to the presence of the Invasive Species Management Plan. • Erection of adequate site hygiene signage in relation to the management of non-native invasive material as appropriate.	
B_17	The creation of a buffer zone around watercourses is one of the most important mitigations for the proposed development in terms of aquatic ecology. Many of the	Construction

	watercourses associated with the site are dry during certain seasons/weather. The 20m buffer recommended by IFI has been increased by a factor of 2.5 to become a 50m buffer zone (apart from at watercourse crossings) within which works will be limited and will require the erection of appropriate measures such as silt fencing. In terms of the Ballynaclogh River the footprint of the works will be in the order of 100m distance from this river, significantly decreasing the chances of impacts.	
B_18	A further major mitigation to prevent the potential impacts to the ecology of watercourses, as outlined above, is the design and implementation of a highly functional site drainage system with integrated silt management and flow attenuation management. Punch Consulting Engineers have designed a bespoke drainage system taking into account parameters such as rainfall rates, gradient, area, etc. The plan of the site drainage system is illustrated in drawings PUNCH Drawings 191325-PUNCH-XX-XX-DR-C-0100 (1-4) and as outlined in the CEMP (GDG, 2021) which accompany this application. Additionally, a detailed breakdown of the mitigations accompanying this site drainage system is presented in Chapter 10: Hydrology.	Construction
B_19	A detailed surface water management plan for the proposed development is detailed in the Punch Engineering Planning Report (Punch Consulting Engineers, 2021) which accompanies this application. This plan provides details of how water quality will be protected during the construction of the proposed development.	Construction
B_20	In relation to birds, the following measures are required: • Construction operations will take place during the hours of daylight for the most part to minimise disturbances to roosting birds or any active crepuscular/nocturnal bird species . • A Toolbox Talk will be prepared and incorporated as part of the construction phase site induction. A wildlife register will be maintained by the environmental site staff during the construction phase. Site staff will be encouraged to report any wildlife sightings of note made during the construction phase and this information will be logged by the environmental site staff. The site	Construction

	manager will continue to maintain a wildlife register throughout the operational phase. • The construction footprint will not be lit at night (with the exception of low-level switchable safety lighting). All lighting systems will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness. • All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled at prescribed locations and all waste materials will be disposed of to licensed facilities. • Mitigation measures outlined in EIAR and CEMP will be implemented to minimise and prevent the potential indirect impacts outlined above on aquatic and Annex I habitats and associated bird species in the surrounding area. For instance, detailed measures are specified to reduce the risk of sediment run-off during construction (e.g. silt fences). • All vegetation clearance will be completed outside of the bird breeding season (1st March to 31st August). Any vegetation clearance required during the bird breeding season will only proceed following checks of the areas in question by a suitably qualified ecologist. All clearance works during the bird breeding season will be subject to supervision by the ECoW who will have 'stop works' authority in the event that there is any perceived risk to nesting birds. • A minimum of 20 bird nest boxes will be erected on lands in the ownership of the applicant at Greenpark. These will include a Barn Owl box, a selection of woodcrete or recycled plastic nest boxes and 5 Swift bricks which will be integrated into the buildings on-site. The ECoW will advise and supervise the selection and installation of these nest boxes.	
B_21	In relation to bats and non-volant mammals, the following measures are required:	Construction

	• A pre-construction mammal survey will be carried out immediately before the commencement of vegetation clearance. This will include a passive bat survey to establish baseline bat activity in advance of the construction phase. There are no known protected mammal breeding sites which will be directly impacted by the proposed development . • The ECoW will supervise/check areas where tree-felling and vegetation removal will occur prior to and during construction. This will ensure that any site specific issues in relation to wildlife will be highlighted and appropriate mitigation measures (e.g., NRA guidelines) are applied as appropriate (B_35 in Table 1). • Construction operations will take place during the hours of daylight to minimise disturbances to nocturnal mammal species. Prevention of damaging run-off to watercourses (as outlined in the EIAR & CEMP) will be effective in minimising potential adverse impacts on Otters that occur widely in the hinterland of the proposed development. • All lighting systems will be designed to minimise nuisance through light spillage. Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness. • All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled according to the CEMP. • Any sightings of mammals on-site will be logged on the wildlife register which will be maintained by the ECoW. This includes any fatalities recorded during construction or in the operational phase. • A total of 20 bat boxes (woodcrete or similar) will be erected, during the construction period, under the supervision of a suitably qualified ecologist to increase the available roosts in the area and to enhance local biodiversity. The boxes will be erected on lands in the ownership of the applicant. The location for the bat boxes will be selected by a suitably qualified ecologist and erected under the supervision of the ECoW.	

B_22	In relation to other taxa, the following measures are required: Areas where spoil is to be stored temporarily, or permanently, should be checked in advance for the presence of Frogs (and spawn). Any areas with pooled surface water, should be checked in advance for the presence of Frogs (and spawn). If protected species are present, the environmental staff will translocate these, if possible (under licence if applicable). The same measure should be applied for any drains or areas of standing water forded by construction machinery. These areas will be checked on an ongoing basis by the ECoW and any areas with breeding frogs, spawn or tadpoles will be mapped and if possible fenced off temporarily to allow Frogs to metamorphose. If such areas cannot be avoided by site traffic the environmental staff will translocate the frogs (adults/young) under licence if applicable . If other taxa such as other species of Lepidoptera, Common Lizard etc. are recorded within or adjacent to the site these sightings will be logged on a wildlife register .	Construction
B_23	Wastewater generated on-site particularly during the operational phase of the development will be piped and discharged to the existing Irish Water foul sewer and to Bunlicky WWTP. Agreement to discharge to the existing foul network and downstream WWTP will be secured with Irish Water and will ensure the wastewater discharge authorisation for the existing agglomeration will not be adversely affected. Foul Water will therefore be taken forward for appropriate treatment prior to discharge to the receiving environment. Both the surface water and foul system are to be entirely separate developments.	Operational
B_24	To mitigate the potential negative impact of lighting on the surrounding habitats, design mitigation will ensure lighting will be minimised during both the construction and operational stages as follows; • Only be on when needed • Only light the area that needs it • Be no brighter than necessary • Minimize blue light emissions • Be fully shielded (pointing downward)	

	In this regard the proposed lighting scheme for the operational phase of the development is outlined as follows; Any new lighting required as part of the project will be of as low a wattage as possible and will be directed away from natural habitats and the Ballynaclogh River area. Illumination should be "cowled" or designed to ensure that the pool of light falls only on the footpath and not on the surrounding natural habitats. All light fittings will be LED, have asymmetrical projection i.e. directional, and with colour temperature of 2700K (warm spectrum preferred by bats). The radiation will be above 500nm to avoid the blue or UV light, most disturbing to bats. The lights will be positioned facing away from woodlands, rivers, hedgerows and other natural habitats. The lighting will be as per the following relevant guidelines and standards: • Bats & Lighting Guidance Notes for Planners, engineers, architects and developers (Bat conservation Ireland, December 2010); • BS 5489 Code of practice for the design of road lighting; • IS EN 13201 Road Lighting requirements; • CIBSE Lighting Guide 6 Illuminating the Outdoor Environment; and The lights will be dimmable with individual photocells fitted to each light fitting, which will allow the lights to switch on automatically at dusk at a low output and slowly dim up to their full output as the natural light decreases. This will minimize light spill for mammals at dusk which is their peak time for feeding when they exit roosts/setts/holts for foraging. The lighting will also be controlled by occupancy/motion sensors so that it will remain at a low output if there was no pedestrian traffic or mammal activity nearby. This will also mitigate light overspill into the nearby existing residential properties.	
B_25	Regular inspections will be carried out by site staff to ensure that the drainage regime is adequately maintained to protect the future stability of the surrounding high value habitats and botanical species as a whole.	

	A Biodiversity Management Plan for semi-natural habitats (e.g. native woodland, hedgerow/treeline, pollinator friendly meadows and grassland) is recommended to be developed for the operational phase site as this would ensure that such habitats become established and are managed to promote maximum gain for biodiversity over the operational lifetime of the proposed development. The future landscape/biodiversity and habitat management plan will be finalised under the advice of a suitably qualified/experienced ecologist that may also include monitoring/supervision of the management plan when implemented . Measures detailed in the Landscape Plan to plant predominantly native tress species and plant in accordance with the All Ireland Pollinator Plan will be fully implemented. This includes monitoring of the revegetation process over the first two years post construction.	
B_26	The following measures will be put in place to ensure the protection of surface waters from contamination: • A hydrocarbon bypass interceptor will be installed as part of the surface water drainage network. • The storm drainage calculations shall ensure that the proposed storm drainage networks are appropriately sized to serve the new development as proposed; • A cleaning and maintenance schedule will be implemented for the proposed storm drainage system during the operation phase. Each gully will be fitted with silt traps to be emptied as part of the silt management and maintenance schedule; • The proposed storm network will be inspected following construction to ensure that no cross connection between the proposed foul and storm network exists; • The storm drainage system will be cleaned appropriately and inspected prior to being fully commissioned i.e. before being allowed to discharge to receiving waters. • Water sampling of the receiving waters upstream and downstream of the proposed outfall will be undertaken before construction commences and for a period of 6 months following the completion of the	

	development to ensure that the proposed water quality controls (both for the construction and operational phases) are appropriate and operating satisfactorily.	
Monitoring		
B_27	Daily checks will be carried out and recorded in a Surface Water Management Log to ensure surface water drains are not blocked by silt, or other items, and that all storage is located the required distance from surface water receptors. A daily log of inspections will be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not reoccur.	Construction
B_28	• All edible and putrescible wastes will be stored and disposed of in an appropriate manner. • The bird nest boxes will be monitored and maintained annually by a suitably qualified person for the first five years post construction.	Operational
B_29	• All edible and putrescible wastes will be stored and disposed of in an appropriate manner. • The bat boxes will be monitored and maintained annually by a suitably qualified person for the first five years post construction.	Operational
B_30	An Ecological Clerk of Works will be appointed by the developer for the duration of the works so as to ensure compliance of ecological mitigation measures as detailed in the various planning documentation. The appointment will ensure that all ecological mitigation measures as outlined in the EIS are implemented during the construction period according to best practices	Construction

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase
Land, Soils, Geology and Hydrogeology (Chapter 9)		
Mitigation		
LS_1	All excavated (existing) overburden material will be reused on site as fill material to increase site levels in lower elevation areas	Construction
LS_2	Topsoil will be stripped and stored on site prior to reuse in areas of soft landscaping as part of the development	Construction
LS_3	All plant and machinery will be serviced before being mobilised to site to avoid soil contamination.	Construction

LS_4	No plant maintenance will be completed on site, any broken down plant will be removed from site to be fixed to avoid soil contamination.	Construction
LS_5	Refuelling will be completed in a controlled manner using drip trays at all times.	Construction
LS_6	Mobile bowsers, tanks and drums will be stored in secure, impermeable storage areas away from open water	Construction
LS_7	No bulk chemicals will be stored within the active construction areas	Construction
LS_8	Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will be undertaken offsite where possible. Where this is not possible, filling and maintenance will take place in a designated material storage compound, which is located at least 10 metres from any temporary or permanent drainage features	Construction
LS_9	Fuel containers will be stored within a secondary containment system, e.g. bunds for static tanks or a drip tray for mobile stores.	Construction
LS_10	Containers and bunding for storage of hydrocarbons and other chemicals will have a holding capacity of 110% of the volume to be stored.	Construction
LS_11	Ancillary equipment such as hoses and pipes will be contained within the bund.	Construction
LS_12	Taps, nozzles or valves will be fitted with a lock system.	Construction
LS_13	Fuel and chemical stores including tanks and drums will be regularly inspected for leaks and signs of damage.	Construction
LS_14	Drip-trays will be used for fixed or mobile plant such as pumps and generators in order to retain oil leaks and spills.	Construction
LS_15	Only designated trained operators will be authorised to refuel plant on site.	Construction
LS_16	Procedures and contingency plans will be set up to deal with emergency accidents or spills.	Construction
LS_17	An emergency spill kit with oil boom, absorbers etc. will be kept on-site for use in the event of an accidental spill. A specific team of staff will be trained in the use of spill containment.	Construction
LS_18	Highest standards of site management will be maintained, and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the site and surrounding environment during construction. A named person will be given the task of overseeing the pollution prevention measures agreed for the site to ensure that they are operating safely and effectively as well as having responsibility for the implementation of Emergency Procedures for spill control measures.	Construction
LS_19	Any infill material/landscaping that is required will be placed and levelled in appropriate lift thicknesses to ensure the material is not over compacted thereby retaining it drainage properties.	Construction

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase
Hydrology (Chapter 10)		
Mitigation		
H_1	Wastewater generated on-site particularly during the operational phase of the development will be piped and discharged to the existing Irish Water foul sewer	Construction
H_2	Drainage pipelines will be inspected by CCTV at completion of the construction project and any damage will be repaired.	Construction
H_3	The development has incorporated a variety of Sustainable Drainage Systems (SuDS) techniques to counteract the potential increased runoff as a result of increased hardstanding. (SuDS include attenuation by bypass separators on the storm water network, green roofed apartments and creche, permeable paving of driveways and visitor car parks, tree lined areas, infiltration trenches, swales as well as, grassed and open space landscape portions of the site). Provided the best-practice techniques illustrated in CIRIA's guidance document (C768 – Guidance on the Construction of SuDS) are followed, no further mitigation is required.	Operational
H_4	There are five proposed Ecocell Pluvial Cube (or approved equivalent) attenuation tanks located in open spaces throughout the proposed development. These tanks have been designed to reduce the peak runoff from the site to ensure the storm water from the site does not increase flood risk and additionally, further enhance silt removal from surface waters via their integrated silt traps	Operational
H_5	The development has an existing lagoon, which is capable of servicing an area of 39 hectares which includes the circa 10.5 ha of the total SHD application site. Based on a total contributing catchment area of 39.19ha, the lagoon would require a design capacity of 21,000m^3 for a 100 year Return Period with a 10% allowance for climate change. The built capacity of the existing lagoon is approximately 23,000m^3 based on the topographical survey. Therefore, the existing lagoon has sufficient capacity to attenuate flows from the SHD and adjoining lands. After attenuation in the lagoon, water discharges via the existing outfall structure which has a 1050mm diameter Tideflex valve with thimble plate. This allows the water to discharge to the river at low tide while preventing backflow into the lagoon at high tide. This system will cater for the strategic housing development scheme	Operational
H_6	Adequately specified oil interceptors will be incorporated into the proposed drainage network for the parking areas and access roads.	Operational

H_7	Construction Phase best practice measures will be implemented by the contractors who will construct the development in accordance with the requirements of the Construction Environmental Management Plan.	Construction
H_8	Once appointed, the contractors will submit a detailed Construction Management Plan, based on the requirements of the submitted planning application documents, for the approval of the Planning Authority.	Prior to Commencement Construction
H_9	The mitigation measures implemented by the contractor will refer to the construction management procedures for best practice regarding the following recognised international guidelines: • Good practice guidelines on the control of water pollution from construction sites developed by the Construction Industry Research and Information Association (CIRIA, 2001); • Control of Water Pollution from construction sites, Guidance for consultants and contractors (C532); • Environmental Good Practice on Site (3rd edition) (C692); and • Guidelines on Protection of Fisheries During Construction Works and Adjacent to Waters (2016).	Construction
H_10	Erosion and sediment controls to manage run-off during construction will be carried out in accordance with the site-specific Construction Environmental Management Plan, which shall include the following measures: • Drainage and measures to control run-off will be employed to manage sediments prior to any works to be undertaken at the site, i.e., arrangements for the treatment of dirty groundwater ingress from any excavations will be in place in advance of the dewatering to ensure it can be adequately managed on site; • If possible, earthworks operations should be limited to the summer months. • The site shall be surveyed to identify all existing drainage features and waterbodies. • Silt fencing will be installed around the perimeter of the site. The location of the silt fencing will be determined in the construction stage CEMP and will be subject to a detailed assessment of the area or phase to be developed. The purpose of the silt fencing is to prevent silt laden water leaving the site and entering neighbouring land with the potential to impact nearby watercourses. It will consist of a geotextile membrane fixed to wooden	Prior to Commencement (Construction)

		stakes approximately 600mm high. The membrane will be anchored into the ground to form a continuous barrier to silt laden water from the works site. Silt fences will be monitored and periodically maintained during the construction period. Typical maintenance will consist of repairs to damaged sections membrane and removal of a build up of silt on the upslope side of the fence; • Drainage ditches may be cut to intercept surface water where there is a risk of significant water flow into excavations or on to adjoining lands. There will also be a requirement to periodically pump water from excavations. All collected and pumped water will have to be treated prior to discharge. The run-off will be directed through appropriately sized settlement ponds to remove suspended solids. All treated water will then be directed to an existing lagoon to the west of the site. The lagoon was constructed in anticipation of the site being developed and was sized to receive and attenuate the operational surface water drainage. The operational flow rates will be much greater, due to the increase in impermeable area. The lagoon will therefore be capable of dealing with runoff from the unpaved site during construction; • Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the site compound. These agencies will be notified immediately in the event of a pollution incident; • Site personnel will be trained in the importance of preventing pollution and the mitigation measures described here to ensure same; • The site manager will be responsible for the implementation of these measures. They will be inspected on at least a daily basis for the duration of the works, and a record of these inspections will be maintained; • Any temporary storage of soil, hardcore, crushed concrete or similar material will be stored as far as possible from any surface water drains. There can be no direct pumping of silty water from the works directly to any watercourse. All water from excavations must be treated by infiltration over lands or via settlement areas, silt busters etc;	

	• There is a possibility that more severe flooding could occur during the construction period, emergency measures are therefore be required. The following control measures will be required: • Silt fencing shall be placed above the 10-year flood level, and where that is not possible at the highest level possible within the site. Trapped silt shall be removed from silt fencing at regular intervals. • Settlement ponds shall be placed above the 10-year flood level. • Stockpiles of soil shall be kept out of the 10-year flood plain. This will not be possible at the northern extent of the site, additional measures will be incorporated at this location. • Earthworks shall be exposed for the minimum time possible. Earthworks formations shall be protected by a layer of imported granular left fill. • Landscaping and seeding of the perimeter embankments and retaining structures shall be carried out as early as possible. • An Emergency Response plan shall be developed for the site	
H_11	Spillage and blow-off of debris, aggregates and final material onto public roads will be reduced to a minimum by the following mitigation measures: • Vehicles delivering material with potential for dust emissions to an off-site location shall be enclosed or covered at all times to restrict the escape of dust; • Any hard surface site roads will be swept to remove mud and aggregate materials from their surface while any unsurfaced roads shall be restricted to essential site traffic only; • A power washing facility or wheel cleaning facility will be installed near to the site compound for use by vehicles exiting the site when appropriate; • Road sweepers will be employed to clean the site access route as required.	Construction
H_12	The use of wet concrete and cement will be carefully controlled to minimise the risk of any material entering the	Construction

	water, particularly from shuttered structures or the washing of equipment by the following mitigation measures: • A concrete washdown area will be provided on site for trucks to use after delivery of concrete or on return to the batching plant. This area will be adequately bunded to mitigate the risk of contaminated runoff discharge to the Limerick Dock water body. Concrete trucks are to be washed down within the concrete truck washdown area after delivery of concrete, prior to exiting the site. Washdown runoff will be appropriately treated prior to discharge; • Wash-out areas on site will be properly designed with an impermeable line to contain all cement laden water. No wash-out of ready-mix concrete vehicles shall be located within 10 metres of any temporary or permanent drainage features. Signage shall be erected to clearly identify the wash-out areas. Sufficient wash-out areas shall be provided to cater for all vehicles at peak delivery times; • On-site batching of concrete is not envisaged, but ready to use mortar silos are often used for housing developments. These systems involve the delivery and storage of dry cement and aggregates in silos, water is added at the point of delivery to make mortar or plaster. The following controls shall be put in place for the on-site batching of concrete, mortar and render: • The plant shall be maintained in good condition. • Delivery of cement shall be means of a sealed system to prevent escape of cement. • The plant shall be situated on a paved area at least 20m from any temporary or permanent drainage features. • Emergency procedures shall be in place to deal with accidental spillages of cement or mortar.	
H_13	The risk of water quality impacts associated with works machinery, infrastructure and on-land operations (for example leakages/spillages of fuels, oils, other chemicals and waste water) will be controlled through good site management and the adherence to codes and practices which limit the risk to within acceptable levels. The following measures will be implemented during construction:	Construction

	• A detailed works specific Sedimentation Plan, Construction Management Plan (CMP) and Construction Environmental Management Plan will be prepared during the planning submission and will be developed and implemented by the contractor and will include detail in respect of every aspect of the works in order to minimise potential impacts and maximise potential benefits associated with the works; • Management and auditing procedures, including tool box talks to personnel, will be put in place to ensure that any works which have the potential to impact on the aquatic environment are being carried out in accordance with the contactors environmental controls, which will be consistent with an approved CEMP and any planning conditions; • Existing and proposed surface water drainage and discharge points will be mapped on the Drainage layout. These will be noted on construction site plans and protected accordingly to ensure water bodies are not impacted from sediment and other pollutants using measures to intercept the pathway for such pollutants; • Welfare facilities (canteens, toilets etc.) will be available within the construction compound and this will remain in place for the construction of the proposed development. The offices and site amenities will initially need to have their own foul water collection until connections are made to the mains networks.	
H_14	The following procedures will be followed to reduce the potential risk from oils and chemicals: • New metal gerry cans with proper pouring nozzles will be used to move fuel around the site for the purposes of refuelling items of small plant on site. Metal gerry cans and any other items of fuel containers will be stored in certified metal bunded cabinets. • Drip trays will be used under items of small plant at all times. Any waste oils etc. contained in the drip trays or the bunded area will be	Construction

		emptied into a waste oil drum, which will be stored within the bund. • Any gas bottles will be stored in a caged area at a secure location on the site. All will be properly secured at point of work. • No bulk chemicals will be stored within the active construction areas. Temporary oil and fuel storage tanks may be kept in the material storage area in suitable containers and will be stored on appropriately bunded spill pallets as required. Any fuel and oil stored onsite shall be stored on bunded spill pallets approved under BS EN 1992-3:2006). All bunds will be impermeable and capable of retaining a volume of equal to or greater than 1.1 times (>10%) capacity of the containers stored on them. In the event of a filling spillage excess oil or fuel will be collected in the bund; • Refuelling of vehicles and the addition of hydraulic oils or lubricants to vehicles will be undertaken offsite where possible. Where this is not possible, filling and maintenance will take place in a designated material storage compound, which is located at least 10 metres from any temporary or permanent drainage features. Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release. Training will be given to appropriate site workers in how to manage a spill event. A certified double skinned metal fuel tank will be situated in this secure bunded area on the construction site if applicable. This tank will be certified for lifting when full. • Spill protection equipment such as absorbent mats, socks and sand will be available to be used in the event of an accidental release during refuelling. Training will be given to appropriate site workers in how to manage a spill event. A hazardous bin will also be available to contain any spent sand or soak pads. • Contingency Planning: A project specific Pollution Incident Response Plan will be prepared by the contractor and will refer to PPG 21 Pollution Incident Response Planning. The contractor's Environmental Manager will be notified in a timely manner of all incidents where there has been a breach in agreed	

	environmental management procedures. Suitable training will be provided by the contractor to relevant personnel detailed within the Pollution Incident Response Plan to ensure that appropriate and timely actions is taken.	
H_15	The following mitigation measures will be taken at the construction site in order to prevent any spillages to ground of fuels during machinery activities and prevent any resulting soil and/or groundwater quality impacts: • Refuelling will be undertaken off site where possible; • Where mobile fuel bowsers are used the following measures will be taken: ○ Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use; ○ The pump or valve will be fitted with a lock and will be secured when not in use; ○ All bowsers to carry a spill kit and operatives must have spill response training; and ○ Portable generators or similar fuel containing equipment will be placed on suitable drip trays.	Construction
H_16	Agreement to discharge to the existing foul network and downstream WWTP will be secured with Irish Water and will ensure the wastewater discharge authorisation for the existing agglomeration will not be adversely affected.	Operational
H_17	To reduce the potential impact to the receiving environment in the event of flooding arising from potential pollutants from surface water drainage or direct run-off, the following measures will be incorporated in the proposed development: • The existing lagoon and pervious pavements have proposed dual purpose and whilst they are flow attenuation features they also mitigate against potential water quality issues associated with storm water run-off. • The entirety of the surface water drainage is to discharge to the proposed attenuation. Gravity pipe networks will collect runoff from hardstanding areas and roof areas (although grass roofs will be used where feasible in certain buildings e.g. apartment blocks), while parking areas will be constructed with pervious asphalt. All surface water drainage from hard	Operational

	standing areas will ultimately drain to the lagoon via suitable sized class 1 bypass interceptors.	
H_18	The foul sewerage from the development will be collected in the existing Irish Water foul water sewer. Foul Water will therefore be collected into the existing system and will be taken forward for appropriate treatment prior to discharge to the receiving environment.	Operational
H_19	Both the surface water and foul system are to be entirely separate developments.	Operational
Monitoring		
H_20	Monitoring associated with the emergency response procedures to mitigate against contamination to water systems, in particular in relation to oil spillage, uncontrolled silt discharge and sewage spill contained within the CEMP.	Construction
H_21	The CEMP includes emergency response procedures to mitigate against contamination to water systems, in particular in relation to oil spillage, uncontrolled silt discharge and sewage spill. The CEMP will also have procedures for monitoring the performance and effectiveness of mitigation measures employed during construction to ensure they are operating as intended and are providing the necessary protection to the receiving environment. Weekly checks will be carried out to ensure surface water drains are not blocked by silt, or other items, and that all storage is located at least 10m from surface water receptors. A regular log of inspections will be maintained, and any significant blockage or spill incidents will be recorded for root cause investigation purposes and updating procedures to ensure incidents do not reoccur.	Construction
H_21	A number of elements of the development require frequent inspection and cleaning as a maintenance requirement. Visual inspections are required at different times for each element, whether bi-monthly, over 3, 4 or 6 monthly periods or following a storm event. Cleaning for the drainage elements are undertaken annually or every two years, while grass cutting for SuDS elements are required monthly during growing seasons or as needed for the tree pit systems.	Construction

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase

<table>
<tr><th colspan="3">Air Quality and Climate (Chapter 11)</th></tr>
<tr><th colspan="3">Mitigation</th></tr>
<tr><td>AC_1</td><td>Any effects on air quality will be temporary i.e. during the construction period only and can be suitably controlled by the employment of mitigation measures and appropriate to the development project, including a <u>construction logistics plan</u>, and are therefore unlikely to materially impact on local air quality.</td><td>Construction</td></tr>
<tr><td>AC_2</td><td>Any emissions from non-road mobile machinery (NRMM) can be reduced by ensuring that any plant used on-site comply with the NO_x, particulate matter and carbon monoxide emissions standards specified in the EU Directive 97/68/EC and subsequent amendments as a minimum, where they have net power of between 37kW and 560kW.</td><td>Construction</td></tr>
<tr><td>AC_3</td><td>Communications
• Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
• Display the name and contact details of people accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
• Display the head or regional office contact information.</td><td>Construction</td></tr>
<tr><td>AC_4</td><td>Dust Management
• Develop and implement a Dust Management Plan, which may include measures to control other emissions, to be approved by the Local Authority. The level of detail will depend on the risk and should include ats a minimum the highly recommended measures. The desirable measures should be included as appropriate for the site. The Construction Environmental Management Plan may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/ or visual inspections</td><td>Construction</td></tr>
<tr><td>AC_5</td><td>Site Management
• Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
• Make the complaints log available to the local authority when asked.
• Record any exceptional incidents that cause dust and/or air emissions, either on- or off site and the action taken to resolve the situation in the log book.
Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes</td><td>Construction</td></tr>
</table>

AC_6	**Preparing and maintaining the site** • Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. • Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site. • Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period. • Avoid site runoff of water or mud. • Keep site fencing, barriers and scaffolding clean using wet methods. • Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below. • Cover, seed or fence stockpiles to prevent wind whipping	Construction
AC_7	**Operating Vehicles/Machinery and Sustainable Travel** • Ensure all vehicles switch off engines when stationary - no idling vehicles. • Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable. • Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas. • Produce a construction logistics plan to manage the sustainable delivery of goods and materials. • Implement a travel plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	Construction
AC_8	**Operations** • Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems. • Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. • Use enclosed chutes and conveyors and covered skips. • Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate. • Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as	Construction

	reasonably practicable after the event using wet cleaning methods.	
AC_9	**Waste Management** • No bonfires or burning of waste material	Construction
AC_10	**Specific to Earthworks** • Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate to cover with topsoil, as soon as practicable.	Construction
AC_11	**Specific to Construction** • Avoid scabbling (roughening of concrete surfaces) if possible. • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place. • Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery. • For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust	Construction
AC_12	**Specific to Trackout** • Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. • Avoid any dry sweeping of large areas. • Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. • Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. • Record all inspections of haul routes and any subsequent action in a site log book. • Install hard surfaced haul route, which are regularly cleaned and damped down with fixed or mobile sprinkler systems, or mobile water bowsers. • Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). • Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	Construction

AC_13	The preparation of a travel plan to encourage sustainable transport (public transport, cycling and walking);	Operational
AC_14	Provision for alternative fuels, such as electric vehicle charge points, will reduce operational phase GHG emissions;	Operational
AC_15	Use of renewable energy sources such as photovoltaics, where possible.	Operational
AC_16	The Construction Environment Management Plan sets out measures to mitigate the potential impacts of climate change during construction. Such as measures related to increased flood risk, overheating risks to construction employees and equipment, potential for water shortages and dust mitigation;	Operational
AC_17	The potential for increased risk of flooding due to climate change is mitigated through a range of mitigation which require the consideration of climate change;	Operational
AC_18	The proposed development is designed to protect site habitats and species from climate change and enhance biodiversity	Operational
	Monitoring	
AC_19	The appointed contractor will be required to monitor levels of dust during critical construction periods at nearby sensitive locations and/or development site boundaries	Construction

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase
	Noise and Vibration (Chapter 12)	
	Mitigation	
N_1	Use of a site hoarding, minimum 2.4m height to be erected around the perimeter of the construction site for the duration of works where the distance of works is 30m or less to nearby noise sensitive locations.	Construction
N_2	Limiting the hours of construction to the following: *Monday to Friday 07.00 – 19.00* *Saturday 07.00 – 13.00* *In exceptional circumstances, and subject to agreement with LCCC, extended hours of operation may be applied for. In such instances an assessment of potential noise impacts shall be carried out in advance of works taking place, and submitted to LCCC, as part of the extended hours request.*	Construction

N_3	Monitoring levels of noise and vibration during critical periods and at sensitive locations.	Construction
N_4	Maintaining site access roads even so as to mitigate the potential for vibration from lorries;	Construction
N_5	Selection of plant with low inherent potential for generation of noise and/ or vibration;	Construction
N_6	Erection of barriers as necessary around items such as generators or high duty compressors;	Construction
N_7	Situate any noisy plant as far away from sensitive properties as is reasonably practicable and the use of vibration isolated support structures where necessary	Construction
N_8	Establishing channels of communication between the contractor/developer, Local Authority and residents	Construction
N_9	Appointing a site representative responsible for matters relating to noise and vibration.	Construction
N_10	Any proposed new plant shall be designed and specified such that noise emissions do not exceed the following criteria, at the external façade of existing and/or proposed new noise sensitive locations: • Daytime (07:00 to 23:00 hours) 50dB $L_{Aeq,1hr}$, and; • Night (23:00 to 07:00 hours) 40dB $L_{Aeq,15min}$. Where necessary noise mitigation measures shall be installed in order to ensure that the above plant noise limits are not exceeded. Such measures may include attenuators to the atmosphere side of supply/extract fans, acoustic barrier screens to chillers/condensers and, where required, acoustic louvres to plantrooms.	Operational
N_11	An Acoustic Design Statement shall be prepared at detailed design stage to set the façade sound insulation performance requirement for the development	Operational
Monitoring		
N_12	The appointed contractor will be required to monitor levels of noise and vibration during critical construction periods at nearby sensitive locations and/or development site boundaries.	Construction

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase
Landscape and Visual (Chapter 13)		
Mitigation		
LV_1	During the construction phase, site hoarding will be erected to restrict views of the site during construction. Hours of construction activity will also be restricted in accordance with local authority guidance. Tree protection measures	Construction

	will be installed to the existing trees and hedges identified on site.	
LV_2	Planting of native trees and shrubs on raised berms to the proposed roadway leading from Dock Road. This treatment will screen the traffic and associated roadway elements from the potential viewpoints, creating an attractive immediate buffer to the visual environment. softening and screening the development over time.	Operational
LV_3	Native trees, shrubs and wildflowers will be used where possible throughout the development, particularly in the buffer spaces surrounding the development site. Where native planting is not specified, planting has reference to the All-Ireland Pollinator Plan.	Operational
LV_4	Where possible, screening of proposed structures with tree lines and woodland planting is proposed.	Operational
LV_5	Mitigation measures are shown on the submitted landscape drawings. At time of planting, the proposed standard trees in the landscaped buffer zones will be at least 3.0m in height. The trees will reach a mature height of at least 7 to 15 metres, dependant on species within the medium term.	Operational
	Monitoring	
LV_6	Landscape tender drawings and specifications will be produced to ensure that the landscape work is implemented in accordance with best practice. This document will include tree work procedures, soil handling, planting and maintenance. The contract works will be supervised by a suitably qualified landscape architect.	Construction
LV_7	The planting works will be undertaken in the planting season after completion of the main civil engineering and building work.	Construction
LV_8	This will consist of weed control, replacement planting, pruning etc. All landscape works will be in an establishment phase for the initial three years from planting. A landscape management plan accompanies the planning application. Prior to completion of the landscape works, a competent landscape contractor should be engaged and a detailed maintenance plan, scope of operation and methodology be in place.	Operational

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase
	Cultural Heritage, Archaeology and Architectural (Chapter 14)	
	Mitigation	

CHAA_1	Test trenching assessment under licence (as per Dúchas 1999a, 25-29) be undertaken in the northern portion of the site in the area proposed for spoil deposition if topsoil stripping is required prior to the deposition of spoil.	Construction - Prior to Commencement
Monitoring		
CHAA_2	It is suggested that a programme of archaeological monitoring (i.e. a watching brief) be undertaken during topsoil removal and enabling works for services etc. at the construction phase.	Construction

Mitigation No.	Description of Mitigation/Environmental Commitment	Phase
Microclimate – Daylight/ Sunlight (Chapter 15)		
Mitigation		
DS_1	The proposed development was carefully designed in the first instance to minimise the potential for impacts on daylight access within neighbouring existing buildings to arise (e.g. by ensuring adequate separation distances between existing and proposed structures relative to the height of proposed structures).	Design/ embedded
DS_2	The proposed development was carefully designed in the first instance to minimise the potential for impacts on sunlight access to neighbouring lands to arise (e.g. by ensuring adequate separation distances between existing and proposed structures relative to the height of proposed structures)	Design/ embedded

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase
Material Assets – Roads and Traffic (Chapter 16)		
Mitigation		
MA:RT_1	To address the Construction Phase impacts raised, the appointed Contractor shall prepare a Construction Transport Management Plan prior to the commencement of development. All deliveries shall be provided with instructions/directions on accessing the site from the Dock Road, and deliveries shall be scheduled outside of peak commuting hours. Construction operations on site and deliveries to the site will be in accordance with the Construction and Environmental Management Plan (CEMP). The preparation of the CTMP will entail an assessment of existing nearby employment, educational, recreational and commercial facilities to establish the peak times for vehicles, cyclists and pedestrians. This information would be used to develop the optimum start/finish/delivery times to minimise impact on these existing facilities.	Construction - Prior to Commencement

	The CTMP issued at construction stage would identify haulage routes and restrictions as appropriate in discussion with the Local Authority. There will also be a requirement for comprehensive measures as part of the construction management.	
MA:RT_2	To address the Construction Phase impacts raised, the construction vehicle movements will be minimised through: a) Consolidation of delivery loads to/from the site and manage large deliveries on site to occur outside of peak traffic periods; b) Use of precast/prefabricated materials where possible; c) 'Cut' material generated by the construction works will be re-used on site where possible, through various accommodation works; d) Adequate storage space on site will be provided; e) A strategy will be developed to minimize construction material quantities as much as possible; f) Construction staff vehicle movements will also be minimized by promoting the use of public transport, shared use of vehicles, cycling and walking.	Construction
MA:RT_3	The design and construction of the built services in accordance with the relevant guidelines and codes of practice will mitigate any potential impacts during the operational phase of the development.	Operational
Monitoring		
MA:RT_4	Appointment of a traffic liaison officer/ traffic manager - The contractor will be obliged to appoint a traffic liaison officer/traffic manager who will be involved in preparing the CTMP and to monitor the performance of the CTMP.	Construction

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase
Material Assets – Waste Management (Chapter 17)		
Mitigation		
W_1	Excavated subsoil and topsoil, or processed buried structures, will be carefully stored in segregated piles on site for subsequent reuse, or treatment/disposal, although the latter is considered unlikely to be required.	Construction (Earthworks)
W_2	Where hazardous wastes are identified, these will be removed and kept separate from other waste materials to avoid cross contamination and stored in such a way to prevent impact on the surrounding environment, prior to disposal to suitably licenced recycling or disposal facilities.	Construction (Earthworks)

W_3	The management of all stockpiled materials will include appropriate testing and assessments, where necessary, to confirm suitability for re-use.	Construction (Earthworks)
W_4	Measures to limit waste generation: o The contractor will be required to ensure that oversupply of materials is kept to a minimum and that opportunities for reuse of suitable materials is maximised. o If the material is deemed to be a waste, removal and reuse/recycling/recovery/disposal of the material will be carried out in accordance with all associated regulations and guidelines, presented in Section 17.3 above. o The contractor shall ensure that materials are ordered so that the quantity delivered, the timing of the delivery and the storage is not conducive to the creation of unnecessary waste. o Concrete waste will be segregated and stockpiled prior to being crushed ready for reuse. o Surplus concrete waste masonry and wood arisings will be collected separation and recovery at a remote facility. o Packaging will be segregated and returned to the supplier for reuse if possible or transfer to a recycling facility. o Other C&D waste materials will either be segregated or included with other mixed C&D waste materials, for subsequent separation and recovery or disposal at a remote facility.	Construction
W_5	It is expected that normal waste management processes will be employed post development. These will be managed in line with the Limerick City and County Council waste collection and management practices, including the collection of recyclables and compostable wastes from residential properties as part of kerbside collections.	Operational

Mitigation/ Monitoring No.	Description of Mitigation/Environmental Commitment	Phase
Material Assets – Built Services (Chapter 18)		
Mitigation		
MA:BS_1	The proposed SHD development should comply with the provisions of the Construction Waste Management Plan with respect to construction waste.	Construction

MA:BS_2	A Construction and Environmental Management Plan, including traffic management, should be implemented by the contractor for the construction stage to protect local amenities and the integrity and operation of the local road network during the construction phase.	Construction
MA:BS_3	Provision of Utilities should be carried out in accordance with the recommendations of the relevant statutory bodies (ESB, Gas Networks Ireland, Irish Water, EIR, Limerick City and County Council etc.).	Construction
MA:BS_4	All proposed connections to existing services should be constructed at off-peak times to minimise disruption to neighbouring properties.	Construction
MA:BS_5	Water metering should be included to record consumption.	Construction
MA:BS_6	The design and construction of the built services in accordance with the relevant guidelines and codes of practice will mitigate any potential impacts during the operational phase of the development.	Operational
Monitoring		
MA:BS_7	Water consumption will be monitored for the development during construction through the use of water meters .	Construction
MA:BS_8	All water mains to be pressure tested and cleaned in accordance with the Irish Water code of practice prior to connecting to the existing potable water supply network.	Construction
MA:BS_9	All foul sewers to be pressure tested and cleaned in accordance with the Irish Water code of practice prior to connecting to the relocated Irish Water Ferrybank foul pumping station.	Construction
MA:BS_10	All surface water sewers to be pressure tested and cleaned prior to connecting to the existing surface water network.	Construction
MA:BS_11	Any monitoring of the built services required during the operational phase of the proposed project will be outlined in the operational and maintenance manual.	Operational