Comhairle Cathrach & Contae Luimnigh

Limerick City & County Council

LIMERICK CITY GREENWAY (UL TO NTP)

EIAR PART 2

Environmental Impact Assessment Report

July 2025

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1 INTRODUCTION

This Environmental Impact Assessment Report (EIAR) for the proposed Limerick City Greenway (UL to NTP) has been prepared by Ryan Hanley on behalf of Limerick City and County Council (LCCC) who propose to implement and maintain the project. The EIAR forms an integral part of the applications for consent of the Project, acting as a basis for public consultation and informed comment.

1.1 BRIEF DESCRIPTION OF THE PROPOSED DEVELOPMENT

The Limerick City Greenway (UL to NTP) Project will form an extension to the already constructed Limerick Smarter Travel, Route 2, which involved the upgrade of an existing pathway, 1.5km in length between University of Limerick and the Guinness Bridge along the bank of the River Shannon which connects directly into the city centre.

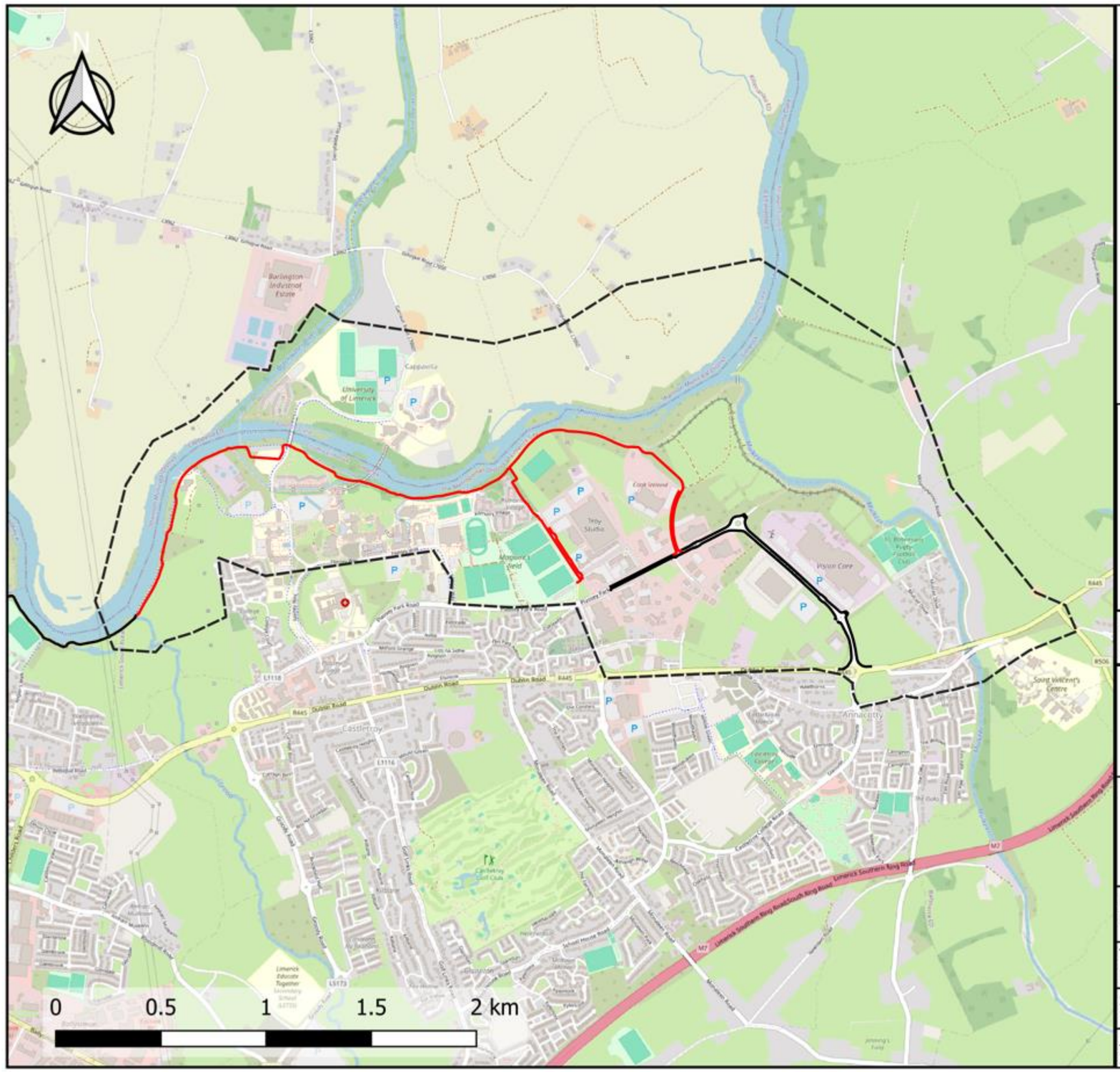
The proposed Greenway route will continue from the existing Limerick Smarter Travel, Route 2 west of the River Groody bridge and extend along an existing section of paved and gravel pathway along the River Shannon, providing for access to and from the University of Limerick (UL) and the National Technology Park (NTP) in Castletroy. The proposed Greenway will connect along University Road and McLaughlan Road to Plassey Park Road.

The proposed works are provided in detail in Chapter 4 of this report and Project drawings included in Appendix A.

1.2 STUDY AREA

The Study Area covers approximately 5.8 km^2 in the Counties of Limerick and Clare encompassing the main UL campus, the NTP, sections of the Dublin Road (R445) and northern banks of the Lower River Shannon, including the UL campus located in Cappavilla, Co. Clare (Figure 1.1).

The Study Area is situated within the Lower Shannon River Catchment, with two main water bodies present including the Lower River Shannon which traverses through the centre of the Study Area and Mulkear River to the east of the Study Area. A small section of the Blackwater (Clare) river is present to the north of the Study Area near the Cappavilla UL campus.



Map Legend

- Proposed Greenway Route
- Existing Active Travel Infrastructure Link
- Study Area
- Project Location

RYAN HANLEY

CLIENT

Comhairle Cathrach & Contae Luimnigh
Limerick City & County Council

PROJECT
Limerick City Greenway

TITLE
Proposed Route Layout

SCALE	DATE	DRAWN	CHECKED	APPROVED
1:25000	11/24	AC	PR	BL

JOB N.	Report Title	REVISION
2535	EIAR	0

Figure 1.1 Location of the Limerick City Greenway Study Area and the associated watercourses

1.3 Strategic Planning and Development Context

This section sets out current European Union (EU), national, regional and where relevant local policy and legislation related to flood management, its place within the planning and development system and how the Limerick City Greenway (UL to NTP) is considered in the context of this policy and legislation.

1.3.1 European Regulations

In June 2021, the European Parliament and Council agreed upon a new funding regulation for the 2021 - 2027 Multiannual Financial Framework (MFF). The new regulation, Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24th of June 2021 concerns two EU Structural Funds which are traditionally the primary sources of EU investments for cycle projects: the European Regional Development Fund (ERDF) and the Cohesion Fund (CF).

Investments under the ERDF should contribute to the development of a comprehensive high-speed digital infrastructure network, and to promoting pollution-free and sustainable multimodal mobility with a focus on public transport, shared mobility, walking and cycling, as a part of the transition to the net-zero carbon economy.

As outlined in Article 3 of this Regulation, policy objectives (PO) which benefit cycling as a mode of transport, include:

- Article 3, 1(b) (viii): PO 2 - promoting sustainable multimodal urban mobility, as part of transition to a net zero carbon economy;
- Article 3, 1(c): PO 3 - a more connected Europe by enhancing mobility;
- Article 3, 1(c) (ii): PO 3 - developing and enhancing sustainable, climate resilient, intelligent, and intermodal national, regional, and local mobility, including improved access to TEN-T (trans-European transport network) and cross-border mobility;

Furthermore, in relation to Annex I of the ERDF regulations it states "*dedicated cycling infrastructure supported*" as one of the output indicators (RCO 58) and the "*annual users of dedicated cycling infrastructure*" as a results indicator (RCO 64) for PO 2.

1.3.2 European Strategies

1.3.2.1 Sustainable and Smart Mobility Strategy

On the 9th of December 2020, the European Commission published its *Sustainable and Smart Mobility Strategy* with the intended outcome to achieve a 90% cut in emissions by 2050 through delivering a "*smart, competitive, safe, accessible and affordable transport system*" in order for the EU to achieve climate neutrality as outlined in the European Green Deal.

The Strategy is structured around three key objectives:

- Objective 1: Sustainable mobility – An irreversible shift to zero-emission mobility;
- Objective 2: Smart mobility - achieving seamless, safe and efficient connectivity; and
- Objective 3: Resilient mobility – a more resilient single European transport area: for inclusive connectivity.

The Strategy identifies a total of 82 initiatives in 10 key areas for action ("flagships"), one of which relates to cycling and cycling infrastructure:

Flagship 3 – Making interurban and urban mobility more sustainable and healthy

- "As set out in the 2030 climate target plan, increasing the modal shares of collective transport, walking and cycling, as well as automated, connected and multimodal mobility will significantly lower pollution and congestion from transport, especially in cities and improve the health and well-being of people".
- "Active transport modes, such as cycling, have seen growth with cities announcing over 2300 km of extra cycling infrastructure. This should be doubled in the next decade towards 5000 km in safe bike lanes".
- "Revising the Urban Mobility Package to promote and support these sustainable and healthy transport modes, the Commission will contribute to the improvement of the current European framework for urban mobility.
- "European policies and financial support should also reflect the importance of urban mobility…" including provisions for "…safe infrastructure for walking and cycling".

1.3.2.2 EU Cycling Strategy

In June 2017, the European Cyclists' Federation (ECF) published the EU Cycling Strategy: Recommendations for Delivering Green Growth and an Effective Mobility in 2030 aimed at increasing cycling and bringing substantial added value to EU policy goals and devised to inspire the EU Commission to develop their own EU Cycling Strategy.

Four objectives are central to this Strategy:

1. Grow cycle use by 50 % at an average across the EU;
2. Halve rates for killed and seriously injured cyclists (in km cycled);
3. Invest €3 billion in cycling in the period 2021 – 27, and €6 billion from 2028 –34.
4. At a qualitative level, it is strongly advised that cycling is treated as an equal partner in the mobility system.

It is important to note that this publication is not the EU Cycling Strategy itself but calls upon the EU's executive branch to include the development of an official EU Cycling Strategy in the Commission Work Programme 2018 or subsequent initiatives. The publication was submitted to the European Commission where it was positively received and to include the cycling strategy as part of the 2018 initiative on multimodality.

1.3.3 National Legislation, Policy and Guidelines

1.3.3.1 National Planning Framework

The National Planning Framework (NPF) is the Government's high-level strategic plan for shaping the future growth and development of Ireland to the year 2040. Various Policy Objectives are outlined within the Report which include:

- National Policy Objective 9 - which refers to the extent to which trips may be made by sustainable modes of travel, i.e. walking, cycling and the scale of planned investment in such;
- National Policy Objective 27 - Ensure the integration of safe and convenient alternatives to the car into the design of our communities, by prioritising walking and cycling accessibility; and

- National Policy Objective 64 - Improve air quality and help prevent people being exposed to unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport, walking and cycling as more favourable modes of transport.

The Policies will ensure the delivery of the National Strategic Objectives (NSO) as outlined in the National Development Plan (discussed below in Section 1.3.3.2) including:

- NSO1 Compact Growth - Ensure a transition to a more sustainable modes of travel including walking and cycling;
- NSO4 Sustainable Mobility - Develop a comprehensive network of safe cycling routes in metropolitan areas; and
- NS07 Enhanced Amenities and Heritage - Implementation of planning and transport strategies for urban areas with a major focus on improving walking and cycling routes.

1.3.3.2 National Development Plan 2021 - 2030

As part of Project Ireland 2040, the National Development Plan (NDP) sets out the Government's over-arching investment strategy and budget for the period 2021-2030. It is an ambitious plan that balances the significant demand for public investment across all sectors and regions of Ireland with a major focus on improving the delivery of infrastructure projects. Various National Strategic Outcomes (NSO) are noted within the NDP which target specific goals/objectives, some of which relate to cycling infrastructure.

It is noted within the Climate Action and Environment section of the NDP the need for "travelling by cleaner and greener transport" and a "shift away from the private car to greater use of active travel (walking and cycling) and public transport", which supports NSO4 Sustainable Mobility. Allocations provided under the NDP largely support the development, or protection and renewal, of infrastructure assets such as cycle-tracks. Encouraging people to adopt more sustainable mobility options, particularly cycling and walking, forms a major element of the NDP Review which gives effect to the Programme for Government commitment to focus investment in this area.

NSO2 Enhanced Regional Accessibility seeks to enhance intra-regional accessibility through improving transport links between key urban centres of population and their respective regions. The NDP sets out details of a new National Active Travel Programme which will complement the active travel investments in cities, towns and villages and deliver significant additional walking and cycling infrastructure around the country by 2025. Through the National Active Travel Programme, the government is firmly committed to encouraging the use of walking, cycling and other active travel methods. In 2021, the NTA allocated just over €240 million to active travel infrastructure projects. Over the next 10 years approximately €360 million per annum will be invested in walking and cycling infrastructure in cities, towns, and villages across the country. This investment will help support the delivery of significant levels of new and improved walking and cycling infrastructure.

The National Cycle Network Plan, published by the Department of Transport in 2023 has mapped existing cycling infrastructure in both urban and rural areas, including Greenways, and will serve to inform future planning and project delivery decisions in relation to walking and cycling infrastructure for the remainder of the decade.

1.3.3.3 The National Cycle Network Plan (2023)

Transport Infrastructure Ireland (TII) has worked with key stakeholders to develop a National Cycling Network Plan (NCN) on behalf of the Department of Transport which will be a valuable resource in relation to active travel connectivity around Ireland. The plan, published in 2023, links cities and towns of over 5,000 people with a safe, connected and inviting cycle network. One of the most ambitious and wide-reaching infrastructure plans in the history of the State, the proposed cycle network of approximately 3,500km will connect more than 200 settlements and 2.8m people. The NCN will link to destinations such as transport hubs, centres of education, centres of employment, leisure, and tourist destinations with the intention of facilitating greater cycling and walking amongst students, leisure users, tourists, and commuters alike. The NCN aligns with the NTA's CycleConnects programme of urban and county-level cycle networks, as well as other cycle routes and networks in various stages of development, including the EuroVelo routes, national and regional greenways, and the Strategic Plan for Greenways in Northern Ireland.

The NCN Plan objectives, presented below, were developed to deliver the vision of the NCN, ensure consistency with national and regional policy objectives and provide a framework for assessing network corridor options and the impact of the NCN.

- 1.1: Increase the number of cycle trips by improving the provision of safe and attractive cycle infrastructure.
- 1.2: Enhance and protect local environments and biodiversity (e.g., pollinator plans, green corridors).
- 2.1: Connect to strategic destinations outside of urban areas as appropriate (including centres of education, centres of employment, and leisure destinations).
- 2.2: Support the development of cycling and walking culture in Ireland.
- 3.1: Connect identified urban areas of 5,000+ population and those urban areas listed in the NTA's urban cycle network strategy.
- 3.2: Connect to strategic destinations outside of urban areas as appropriate (including transport hubs, centres of education, centres of employment and, tourist leisure destinations), as appropriate.
- 3.3: Integrate with existing and proposed cycle infrastructure (including greenways, safe routes to schools, the EuroVelo network, Interreg projects), as appropriate.
- 3.4: Integrate with existing and proposed cycle infrastructure in Northern Ireland, as appropriate.
- 4.1: Encourage use of off-road infrastructure, where appropriate.
- 4.2: Where efficient and effective, encourage routes that use 'quiet', low traffic volume roads.
- 4.3: Promote the design of cycle infrastructure that is fully accessible to all users, regardless of age or ability.
- 4.4: Promote the design of cycle infrastructure that meets safety requirements.
- 4.5: Promote the design of cycle infrastructure that provides a safe and secure environment for all users
- 5.1: Propose corridors to maximise the number of users.
- 5.2: Incorporate existing greenways, disused railways, canals, bypassed national roads, regional and local roads, long distance trails, as appropriate.
- 5.3: Maximise the use of publicly owned land, where possible.
- 5.4: Provide a framework to support the targeted investment in associated active travel projects.
- 5.5: Take lessons from best practice internationally in development of national cycle networks, particularly the UK and EU high-cycling countries.
- 5.6: Future-proof cycle route capacity, taking account of population growth and additional demand from modal shift.

1.3.3.4 The National Sustainable Mobility Policy (2022)

The National Sustainable Mobility Policy sets out a strategic framework to 2030 for active travel (walking and cycling) and public transport journeys to help Ireland meet its climate obligations. It is accompanied by an action plan to 2025 which contains actions to improve and expand sustainable mobility options across the country by providing safe, green, accessible, and efficient alternatives to car journeys. It also includes demand management and behavioural change measures to manage daily travel demand more efficiently and to reduce the journeys taken by private cars. The overall vision outlined in the Policy is "to connect people and places with sustainable mobility that is safe, green, accessible and efficient". To this end, the policy is guided by three key principles, which are underpinned by ten high-level goals.

- Principle: Safe and Green Mobility
  - 1. Improve mobility safety.
  - 2. Decarbonise public transport.
  - 3. Expand availability of sustainable mobility in metropolitan areas.
  - 4. Expand availability of sustainable mobility in regional and rural areas.
  - 5. Encourage people to choose sustainable mobility over the private car.
- Principle: People Focused Mobility
  - 6. Take a whole journey approach to mobility, promoting inclusive access for all.
  - 7. Design infrastructure according to Universal Design Principles and the Hierarchy of Road users model.
  - 8. Promote sustainable mobility through research and citizen engagement.
- Principle: Better Integrated Mobility
  - 9. Better integrate land use and transport planning at all levels.
  - 10. Promote smart and integrated mobility through innovative technologies and development of appropriate regulation.

1.3.4 Regional Policy

1.3.4.1 Regional Spatial and Economic Strategy for the Southern Region (2020)

The Regional Spatial and Economic Strategy for the Southern Region (RSES) was published in January 2020 by the Southern Regional Assembly. The RSES is a regional-level framework to ensure improved coordination in planning and development policy across local authority boundaries is underpinned by the National Planning Framework (NPF) and NDP and establishes a broad framework for the way in which our society, environment, economy, and the use of land should evolve.

Within the document reference is made towards "Priorities for the Limerick Shannon Metropolitan Area Transport Strategy" and outlines objectives such as:

- Development of a strategic metropolitan wide cycle network with several high-capacity flagship routes catering for a range of journey purposes.

1.3.5 Local Planning Policy

1.3.5.1 Limerick Development Plan 2022 - 2028

The Limerick Development Plan, which was issued in June 2021, came into effect in July 2022 and sets out a strategic vision intended to guide the sustainable future growth of Limerick to 2028. The Plan is underpinned

by a number of interlinked strategic objectives, three of which relate to the promotion of cycling as a greener means of transport within the county and the importance of connection to open spaces:

- Strategic Objective 2: Transition to an environmentally sustainable carbon neutral economy;
- Strategic Objective 6: Reduce car dependency and promote and facilitate sustainable modes of transport, prioritising walking and cycling; and
- Strategic Objective 8: Protect, enhance and connect areas of natural heritage, green infrastructure and open space.

Furthermore, the Core Strategy Policies outlined in the Plan, particularly "Policy CSP P2 Compact Growth" references the compact growth of Limerick City Metropolitan Area, towns and villages which can be served by walking and cycling networks, to ensure that development proceeds sustainably.

Within the Sustainable Mobility and Transport Section of the Plan, it is noted throughout that walking and cycling are the most sustainable forms of transport, assisting with climate change mitigation and important for promoting healthy communities. Reference is made towards the NPF and RSES ensuring that during the lifetime of the Draft Plan, the Council will strengthen the links between land use and transportation planning and will seek to promote sustainable transport, by providing attractive, inclusive, and connected walking and cycling networks. Policies outlined in the Sustainable Mobility and Transport Section include:

- Policy TR P2 Promotion of Sustainable Patterns of Transport Use - encourage more sustainable patterns of travel and greater use of sustainable forms of transport, including public transport, cycling and walking; and
- Policy TR P3 Sustainable Mobility and Regional Accessibility - It is a policy of the Council to support sustainable mobility, enhanced regional accessibility and connectivity within Limerick, in accordance with the National Strategic Outcomes of the NPF.

A key objective outlined in the Plan includes "Objective TR O14 Walking and Cycling Infrastructure" whereby it is the objective of the Council to improve and provide clear, safe and direct pedestrian linkages, cycle networks and to maintain and expand the pedestrian route network, infrastructure and where possible retrofit cycle and pedestrian routes into the existing urban road network. Additionally, "Objective TR O15 Limerick Cycle Network" states that it is an objective of the Council to implement in full the Cycle Network as outlined in the Limerick Shannon Metropolitan Area Transport Strategy.

The Council will continue the roll out of active travel initiatives across Limerick, including promoting and facilitating safe walking and cycling.

1.3.5.2 Limerick Shannon Metropolitan Area Transport Strategy 2040

The Limerick Shannon Metropolitan Area Transport Strategy (LSMATS) delivers a high-quality, accessible, integrated and more sustainable transport network that supports the role of the Limerick-Shannon Metropolitan Area as the major growth engine of the Mid-West Region. In order to achieve this, several principles are proposed including Principle 03 which sets to prioritise sustainable transport to reduce car dependency.

The LSMATS sets out the Strategy Outcomes which will include:

- Prioritised public transport, walking and cycling in urban areas across the Limerick-Shannon Metropolitan Area; and
- Reduced transport-related emissions through a provision of a cleaner, greener public transport fleet, a modal shift to walking and cycling.

Throughout the LSMA, the need for a prioritisation and expansion of walking and cycling to promote modal shift is highlighted. A key study, the Limerick Metropolitan Cycle Network Study, was referenced which has the vision of developing a consistent, clear, and continuous network of urban and suburban cycle networks throughout the Limerick Metropolitan Area. Objective CC1 is outlined which states the development of a Comprehensive Strategic Cycling Network and to:

- Deliver an integrated, fully connected high-quality cycle network linking all major origins and destinations within the LSMA;
- Develop an Inter-Urban network connecting Limerick City and Metropolitan town centres; and
- Maintain and enhance existing infrastructure to a high standard.

1.3.5.3 Limerick Metropolitan Cycle Network Study

In 2016, Limerick City and County Council in collaboration with the National Transport Authority (NTA) published the Limerick Metropolitan Cycle Network Study in order to direct and prioritise investment in cycle infrastructure. The vision of the Cycle Network Study was to develop a consistent, clear, and continuous network of urban and suburban cycle networks throughout the Limerick Metropolitan Area to ensure cycling becomes a realistic choice as a mode of transport.

Within this report five routes comprising an integrated network of cycle lanes and pedestrian links intended to give greater connectivity to the city centre are included:

- Route 1 – Corbally to Limerick City Centre;
- Route 2 – UL to City Centre along the River Shannon and Canal;
- Route 3 – UL, Castletroy and National Technology Park to City Centre;
- Route 4 – Southill, Ballysimon, Monaleen, and Castletroy to City Centre; and
- Route 5 – Southill and Roxoboro Shopping Centre to City Centre.

This Study highlights the requirements needed in achieving a modal shift to cycling and brings to focus initiatives to encourage a cultural change and acceptance of cycling as the norm in the Limerick Metropolitan Area.

1.4 Legislative Requirements for an Environmental Impact Assessment (EIA)

The European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment was amended by Directive 2014/52/EU (the "EIA Directive") which was transposed into Irish Law by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) (the "Irish EIA Regulations").

This EIAR complies with the EIA Directive and with the Irish EIA Regulations and will be made available for inspection by the public as part of the pre-planning consultation as required under Section 247 of the Planning and Development Act, 2000 (as amended). This EIAR will be submitted to An Bord Pleanála as part of the Project documentation. The Minister will then carry out an independent assessment of the environmental impacts of the Project to ensure the EIAR is in compliance with national and EU statutory requirements.

Article 5 of the EIA Directive provides where an EIA is required, the developer shall prepare and submit an EIAR. The information to be provided by the developer shall include at least:

(a) a description of the project comprising information on the site, design, size and other relevant features of the project;

(b) a description of the likely significant effects of the project on the environment;

(c) a description of the features of the project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;

(d) 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;

(e) a non-technical summary of the information referred to in points (a) to (d); and (f) any additional information specified in Annex IV relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected.

Ryan Hanley was engaged as environmental consultants on the proposed project and commissioned to prepare this EIAR in accordance with the requirements of the EIA Directive and the Irish EIA Regulations.

The EIAR provides information on the receiving environment and assesses the likely significant effects of the proposed project on it and proposes mitigation measures to avoid or reduce these effects. It then provides an assessment of the residual effects of the Project taking into account the implementation of mitigation. The function of this EIAR is to provide information to allow the competent authority to conduct the EIA of the proposed project.

All elements of the project have been assessed individually, and cumulatively together, and then in combination with other plans and projects as part of this EIAR.

Guidance

The Environmental Protection Agency (EPA) published its 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2022), which are intended to guide practitioners preparing an EIAR and the EIAR complies with these Guidelines.

In preparing this EIAR regard has also been taken of the provisions of the 'Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment', published by the Department of the Department of Housing, Planning and Local Government (DHPLG) in August 2018.

The European Commission also published a number of guidance documents in December 2017 in relation to Environmental Impact Assessment of Projects (Directive 2011/92/EU as amended by 2014/52/EU) including 'Guidance on Screening' and 'Guidance on the preparation of the Environmental Impact Assessment Report'. Ryan Hanley has prepared the EIAR with in accordance with these guidelines also.

1.5 PURPOSE AND SCOPE OF THE EIAR

The purpose of this EIAR is to enable the competent authority to carry out an assessment of the likely significant effects on the environment of the Limerick City Greenway (UL to NTP) before it is constructed. The EIAR describes the current state of the environment in the vicinity of the proposed development site in an effort to quantify the possible effects, if any, of the construction and operational stages, the recommended mitigation measures and any residual impacts of the proposed development on the environment. It then provides details of the alternatives considered and the full details of all elements and stages of the proposed development. Following this, the environmental impacts of the proposed development are assessed individually, and cumulatively together, and then in combination with other plans and projects. The requirements for the Greenway will continue for the foreseeable future, thus this EIAR does not consider

environmental effects associated with a decommissioning stage of the Project. The assessment process that led to the compilation of this document served to highlight any areas where mitigation measures may be necessary in order to protect the receiving environment from any significant negative effects as a result of the proposed development. Where necessary and appropriate, mitigation measures and prescribed and residual impacts are then assessed.

LCCC's objective is to pursue the most efficient and positive design of the proposed Greenway in order to enable the Project to be incorporated into the receiving environment insofar as possible and to plan for the identified effects so that measures are in place to ensure that any adverse impacts are avoided, reduced, or remedied as appropriate.

1.6 Structure and Content of the EIAR

1.6.1 General Structure

An EIA is a process of examining and assessing the environment in tandem with a proposed development to ensure that all potential environmental impacts are documented and taken into the consideration of the overall formulation of the proposed development inter alia through the design process. This process allows for the creation of a series of steps in the assessment of potential impacts on various elements of the environment. The overall structuring of this EIAR has regard to the information requirements of the Directives and Irish Statutory Regulations. The purpose of the EIAR is to introduce the proposed development, define its location and the extent of works, identify the key environmental issues and receptors in the vicinity, consider the potential impacts of the proposal on these receptors.

This EIAR uses the grouped structure method to describe the existing environment, the potential impacts of the proposed development therein, the proposed mitigation measures and the residual impacts that remain thereafter. An assessment of the alternative options considered along with background information relating to the proposed development, scoping and consultation undertaken and a description of the proposed development are presented in separate sections. The grouped format sections describe the impacts of the proposed development in terms of:

- Population and Human Health;
- Biodiversity;
- Land Use, Soils and Geology;
- Water (hydrology and hydrogeology);
- Air Quality & Climate/ Noise & Vibration;
- Landscape and Visual;
- Cultural Heritage;
- Material Assets (including traffic and transportation), and;
- In combination effects and Interactions of the Foregoing

Each of these factors shall be discussed under the headings "Description of Existing Environment", "Assessment Methodology", "Potential Impacts", "Mitigation" and "Residual Impacts". The EIAR also includes a non-technical summary, which is a condensed and easily comprehensible version of the EIAR document. The non-technical summary is laid out in a similar format to the main EIAR document and comprises a description of the proposed development followed by the existing environment, impacts and mitigation measures presented in the grouped format.

1.6.2 Description of Impacts

As stated in the '*Guidelines on the Information to be contained in Environmental Impact Statements*' (EPA, May 2022), an assessment of the likely significant effects of a proposed development is a statutory requirement of the EIA process. The statutory criteria for the presentation of the characteristics of potential impacts requires that potential significant impacts are described with reference to the extent, magnitude, complexity, probability, duration, frequency, reversibility and trans frontier nature (if applicable) of the impact.

The classification of impacts in this EIAR will follow the definitions provided in the Glossary of Impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports – '(EPA 2022).
- 'Advice Notes on Current Practice in the Preparation of Environmental Impact Statements' (EPA, 2003)
- 'Guidelines on the Information to be contained in Environmental Impact Statements' (EPA, 2002)
- Revised Guidelines on the Information to be contained in Environmental Impact Statements – Draft September 2015 '(EPA 2015)
- 'Advice Notes for Preparing Environmental Impact Statements – Draft September 2015' (EPA 2015).

This EIAR has also complied with the publication 'Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report' (European Commission, 2017).

Table 1.1 presents the glossary of impacts as published in the EPA guidance documents. Standard definitions are provided in this glossary, which permit the evaluation and classification of the quality, significance, extents, probability, duration, and type of impacts associated with a proposed development on the receiving environment. The use of pre-existing standardised terms for the classification of impacts ensures that the EIA employs a systematic approach, which can be replicated across all disciplines covered in the EIAR, as advised in '*Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA, 2022). The consistent application of terminology throughout the EIAR facilitates the assessment of the proposed development on the receiving environment.

Table 1.1 Effect Classification Terminology (EPA, 2022)

Impact Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative	A change which reduces the quality of the environment
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	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities

Impact Characteristic	Term	Description
	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
	Significant	An effect, which by its character, magnitude, duration, or intensity alters a sensitive aspect of the environment
	Very significant	An effect which, by its character, magnitude, duration, or intensity significantly alters most of a sensitive aspect of the environment
	Profound	An effect which obliterates sensitive characteristics
Extent & Context	Extent	Describe the size of the area, number of sites and the proportion of a population affected by an effect
	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions
Probability	Likely	Effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented
	Unlikely	Effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented
Duration and Frequency	Momentary	Effects lasting from seconds to minutes
	Brief	Effects lasting less than a day
	Temporary	Effects lasting less than a year
	Short-term	Effects lasting one to seven years
	Medium-term	Effects lasting seven to fifteen years
	Long-term	Effects lasting fifteen to sixty years
	Permanent	Effect lasting over sixty years
	Reversible	Effects that can be undone, for example through remediation or restoration
	Frequency	Describe how often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Type	Indirect	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway
	Cumulative	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.

Impact Characteristic	Term	Description
	Do Nothing	The environment as it would be in the future should the subject project not be carried out
	Worst Case	The effects arising from a project in the case where mitigation measures substantially fail
	Indeterminable	When the full consequences of a change in the environment cannot be described
	Irreversible	When the character, distinctiveness, diversity, or reproductive capacity of an environment is permanently lost
	Residual	Degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic	Where the resultant effect is of greater significance than the sum of its constituents

Each impact is described in terms of its quality, extent, duration, significance, and type, where possible. A 'Do-Nothing' impact is also predicted in respect of each environmental theme in the EIAR. Residual impacts are also presented following any impact for which mitigation measures are prescribed. The remaining impact types are presented as required or applicable throughout the EIAR.

1.7 PROJECT TEAM

1.7.1 Protect Team Responsibilities

This EIAR was prepared by Ryan Hanley with expert technical contributions provided by specialists. Ryan Hanley were also appointed as consultant engineers for the design of the Project. The companies and staff listed in Table 1.2 were responsible for completion of the EIAR of the proposed development. Further details regarding project team members are provided below.

Table 1.2 Project Team

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
Ryan Hanley, Galway Business Park, Upper Newcastle Rd., Dangan, Galway	Trevor Stafford	MSc Environmental Sustainability – Part Time (2021 – Present) Diploma in Project Management, DBS, 2010 BSc in Environmental Management, University of Wolverhampton, 2004 Diploma in Applied Freshwater and Marine Biology, GMIT 2003 Certificate in Aquaculture, GMIT 2002 MIEMA	Trevor has over 17 years' experience in Environmental Services sector including periods within both the Public and Private Sectors. Trevor is a Senior Ecologist and is responsible for the delivery of environmental and ecological assessments to support a range of proposed developments including greenways, active travel, water, wastewater, utilities and flood relief schemes. Trevor was responsible for production of Chapter 8 Water, and for overseeing other chapters.
	Henry Kenny	BSc (Hons) Environmental Science, National University of Ireland, Galway MSc. Environmental Engineering, Queen's University Belfast	Henry has over 16 years' experience in Environmental Services sector including periods within both the Public and Private Sectors. Henry is currently on Ryan Hanley project teams for Lifford FRS in Co. Donegal, Ballinasloe FRS in Co. Galway, Adare FRS and Athea FRS in Co. Limerick. Henry has extensive field experience in Site Investigation (SI) to inform environmental projects including geoenvironmental logs, soil and water

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
			sampling. Henry has also experience in baseline noise, vibration and odour monitoring on transport, industrial and commercial projects. Henry is competent in the preparation, input to and review of technical environmental reports such as AA Screenings, NIS, EIA documents and EIAR Chapters. Henry has been involved in the preparation and organization of recent Public Consultations Events for the Ballinasloe FRS and Adare FRS. He played a key role in the delivery of the Raphoe EIAR in January 2023 which included Appropriate Assessments (AA), an Invasive Species Management Plan (ISMP) and a Construction Environmental Management Plan (CEMP). Henry was responsible for production of Chapter 7 Land use, Soils, Geology, Chapter 9 Air Quality: Noise and Vibration, and for overseeing and review of other chapters.
	Paola Rodolfi	BSc Biology (Marine Vertebrate Biology) Stony Brook University, New York, USA MSc. Environmental Management, Instituto Tecnologico de Buenos Aires, Argentina	Paola has over 10 years of experience in environmental management, preparing EIAR, NIS and other related reports. For EIA reports she has contributed to produce various chapters (population and human health, air quality, climate – ghg emissions calculations for plans and projects) for various types of plans and projects (land and marine planning, renewables, WwTP). Her experience further includes carbon assessment calculations, sustainability reports and GIS analysis tools. Her professional training includes the use of LCA tools for whole life carbon assessments, climate change impacts and carbon costing for projects using GaBi, OneClick LCA, and vulnerability assessments through risk assessment templates and questionnaires, adaptation viewers and open data tools. In addition to the use of other carbon databases and tools such as ERIC (UKEA), TII Carbon Tool, ICE Database, GHG Protocol.

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
			Throughout her professional career, she participated in the UN REDD+ project to reduce emissions from deforestation and forest degradation. With Ryan Hanley, Paola has been involved in preparing Environmental Impact Assessment Reports, AA Screening reports, NIS, EIA Screening and Scoping reports for wastewater treatment plants, ICW, marine modelling works, and flood relief schemes. Paola was responsible for assisting in the production and review of Chapter 1 Introduction, Chapter 2 Alternatives, Chapter 5 Human Beings, Population and Human Health, Chapter 9 Air Quality: Noise and Vibration, Chapter 10 Climate, Chapter 12 Material Assets, Chapter 14 Interactions, and Chapter 15 Schedule of Mitigations.
	Breda Quinn	BSc (Hons) Science, Wildlife Biology Institute of Technology, Tralee, Co. Kerry (Now MTU)	Breda has five years' experience in the preparation of technical environmental reports such as Appropriate Assessment Screenings, Natura Impact Statements, EIA Screening and EclA's. Breda is also experienced in preparing and carrying out Winter Bird Surveys, Breeding Bird Surveys, Vantage Point Surveys, Invasive Species Surveys and Habitat Assessment Surveys. Breda was responsible for production of Chapter 6 Biodiversity, the Breeding Birds survey report, Winter Birds survey report, and the Invasive Species Management Plan (ISMP).

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
	Angela Wallace	B.A. (Hons) in Archaeology & English, NUIG M.Sc. Science of Archaeological Materials, UCL Member Institute of Archaeologists of Ireland 2000-present. Member Federation of Archaeological Managers & Employers (FAME) 2020-present.	Angela is a senior archaeologist with 25 years of experience in all aspects of archaeology relating to planning and development, assessment, evaluation, test-excavation, excavation, post-excavation, and report production. Her work to date has involved all aspects of Archaeology on both infrastructural projects and private developments from design to construction stages. Prior to working for Ryan-Hanley, Angela founded her own archaeological consultancy in 2008; Atlantic Archaeology which is based in Enniscrone, Co. Sligo. Her successful practice has and continues to deliver archaeological elements on many small and large-scale projects countrywide. Angela also has experience on various community heritage and outreach projects. She has built up experience in developing effective, positive and engaging public communication strategies for archaeological projects. Angela is licensed by the National Monuments Service to undertake archaeological monitoring, testing and direct excavations in the Republic of Ireland. Angela has held over 100 licences on various projects from 1999-present. Angela was responsible for the completion of Chapter 12 Cultural Heritage.

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
	Brendan Larkin	BA, BAI (Hons) Civil, Structural & Environmental Engineering, Trinity College Dublin (1998-2002) Masters of Business Administration (MBA, Distinction), Manchester Business School, The University of Manchester (2016) Chartered Engineer (CEng), Engineers Ireland (2011)	Brendan is Ryan Hanley's Lead Designer and Project Manager for the Limerick City Greenway (UL to NTP) project. Brendan has 21 years' experience in in the design, project management and construction stage supervision of water and wastewater engineering, greenways and cycle lanes, urban spaces, environmental and construction projects. Brendan was a contributor to Chapter 1 Introduction, Chapter 2 Alternatives, Chapter 3 Background, Chapter 4 Description, Chapter 13 Material Assets, and for overseeing production of the EIA report.
	Grace Kilbane	BSc (Hons) Science, National University of Ireland, Galway MSc (Hons) Ecological Management and Conservation Biology, Queen's University Belfast Associate Membership of the Chartered Institute of Ecology and Environmental Management (ACIEEM)	Grace has 4 years' experience in the preparation of technical environmental reports such as Appropriate Assessment Screenings, Natura Impact Statements, Environmental Impact Assessment documents and EIAR Chapters. Grace has been involved in the preparation of Constraints Reports, Public Consultations and other documents associated with the Environmental Impact Assessment process for several flood relief schemes including Lifford, The Neale and Ballinasloe. Grace was responsible for producing the EIA Scoping, early drafts of the AA Screening report, early drafts of various chapters in this EIA report, and the early draft of the Invasive Species Management Plan (ISMP).

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
	Dr. Kathryn Carney	BE (Hons), Bachelor of Engineering (Civil), National University of Ireland Galway PhD Civil Engineering, National University of Ireland Galway Member of Engineers Ireland MIEI	Kathryn is a civil engineer with 9 years' post graduate experience in the field of civil and environmental engineering and has been responsible for the preparation and review of EIS/ EIAR chapters for several flood relief schemes including the Raphoe (Donegal), River Deel (Crossmolina), Blackpool (Cork) and Bandon (Addendum). Kathryn was involved in writing early drafts of various chapters in this EIAR in conjunction with Grace Kilbane.
	Damien McAndrew	Honours Bachelor Degree in Environmental Science, ATU Sligo 2020	Damien is an Environmental Scientist with over 3 years' experience working in the area of ecology. Damien is a Member of Bat Conservation Ireland and has >30 nights bat survey experience in dusk emergence/dawn re-entry surveys, with a demonstrated history in working on bat-sensitive projects. This includes Appropriate Assessment, Ecological Impact Assessment, Ecological Clerk of Works, and derogation licence applications on multiple demolition/construction projects throughout Ireland, along with Preliminary Roost Assessments for bat suitability, and the preparation of Toolbox Talks for Operations Staff in the event of encountering a bat during works. Damien is familiar with a range of software for Irish bat species identification and behavioural analysis. Damien has a demonstrated history working on Environmental Assessments for public and private tenders which includes reporting for Appropriate Assessments, Local Area Plans, Strategic Environmental Assessments, Flood Risk Assessments, Ecological Impact Assessments, and Invasive Species Reporting.

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
			Damien carried out Bat Surveys for this project which are detailed in Chapter 6 Biodiversity.
	John Olney	BA (Hons) Archaeology and English, National University of Ireland Galway	John is Senior Archaeologist with over 18 years' experience in all aspects of field archaeology, assessment, survey, and report production. He has extensive experience of research through to excavation on both infrastructural projects and private developments. His work involves screening, scoping, and compiling Cultural Heritage chapters for EIAR, Archaeological Impact Assessment, Landscape & Visual Impact Assessment, Desk Based Assessments, and report writing to publication standards. He has extensive experience of Built Heritage Assessment and mitigation design across a range of projects. John was responsible for the early drafts of Chapter 12 Cultural Heritage and Chapter 13 Material Assets.
	Sarah Nolan	BSc. (Hons) Earth and Ocean Sciences, National University of Ireland, Galway MEngSc. Water, Waste and Environmental Engineering, University College Dublin	Sarah has 4 years' experience in the environmental sector including marine data management. Sarah also has experience in the production of Environmental Impact Assessment Reports (EIAR) for aquaculture sites in the west of Ireland. Within Ryan Hanley, Sarah has technical report writing experience in Appropriate Assessment (AA) Screening Reports, EIA Screening Reports, Construction Environmental Management Plans (CEMP). Sarah was responsible for contributing to Chapter 5 Human Beings, Population & Human Health, and Chapter 6 Biodiversity.

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
Cunnane Stratton Reynolds - Landscape Planning and Design. 3 Molesworth Place, Dublin 2, D02 EP97	Keith Mitchell	M.A Hons (Landscape Architecture) Member of the Irish Landscape Institute Chartered Membership of The Landscape Institute (UK) Director Landscape Architect at CRS	Keith Mitchell is a Chartered Landscape Architect who trained in Scotland & the USA. He has 20 years professional experience in Landscape & Urban Design. His extensive experience in the field of Environmental Impact Assessment has focused on 'Landscape and Visual Impact Assessment', which he has carried out for a wide variety of development types. In addition, Keith is also a qualified Arborist who regularly undertakes tree surveys for private and public sector clients. Keith carried out an arborist survey for this project and worked closely with Evelyn Sikora during the production of Chapter 11 Landscape and Visual Impact Assessment.
	Evelyn Sikora	BA Landscape Architecture, MA planning and Sustainable Development (UCC) Member of the Irish Landscape Institute (MILI). Senior Landscape Planner at CRS	Evelyn specialises in Landscape and Visual Assessment and has experience in a range of projects, including for Strategic Infrastructure projects, throughout Ireland. These include wind and solar farms, road schemes, flood relief projects, telecommunications and infrastructure, quarries, residential and commercial developments, in both rural and urban contexts. She also has experience in assessing landscape character as part of Landscape and Visual Assessment work, as well as experience in project management of Environmental Impact Assessment Reports. Evelyn produced Chapter 11 Landscape and Visual Impact Assessment in conjunction with Keith Mitchell.

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
Delichon Ecology	Eamonn Delaney	BSc, MSc, MCIEEM Cecol	Eamonn has 15 years consultancy experience based in Co. Galway. He is a Full and Chartered member of the Chartered Institute of Ecology and Environmental Management (CIEEM) specialising in ecological field survey work and assessment (avifauna, terrestrial mammals, flora, habitat survey and classification) and in the interpretation and implementation of Irish and EU legislation relating to wildlife, biodiversity, and environmental planning. He has extensive experience in the delivery of Appropriate Assessments, Ecological Impact Assessments and Environmental Impact Assessment biodiversity chapters for a range of project types including transport infrastructure, water infrastructure, renewable energy, recreation and amenity, residential and commercial development. Eamonn undertook winter and breeding bird surveys for this project and wrote the reports that were considered in Chapter 6 Biodiversity of this EIAR.
O'Donnell Environmental	Tom O'Donnell	BSc (Hons) MSc CEnv MCIEEM	Tom is a Chartered Environmentalist with over 15 years professional experience in Ireland, the UK, and New Zealand. His experience includes involvement from the Planning Process by undertaking ecological surveys and reporting such as Ecological Impact Assessment Reports (EclA), Appropriate Assessment Screening Reports, Natura Impact Statement Reports and the Biodiversity chapters of Environmental Impact Assessment Reports (EIAR). Tom undertook a bat survey for this project and delivered a bat survey report that was included in Chapter 6 Biodiversity of this EIAR.

Company	Principal Staff Involved in Project	Qualifications & Affiliations	EIAR Input and Biopic
APEM Ltd	Dr. Alex Seeney	PhD University of Stirling MSc Freshwater and Coastal Sciences, Queen Mary University of London	Principal Fisheries Scientist at APEM. Alex completed the first draft of Chapter 8 Water.
	Dr. Lauren Vickers	PhD Fisheries Science, University of Hull BSc Aquatic Zoology, University of Hull CEnv, MIFM	Associate Director (Fisheries Scientist) at APEM. Lauren contributed to the first draft of Chapter 8 Water.

1.8 PROJECT CONSTRAINTS

No specific constraints have been identified as limiting the assessment of likely significant impacts detailed in this EIAR. Where data limitations have been encountered these are described within the individual chapters.

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2. THE NEED FOR THE PROJECT AND ASSESSMENT OF ALTERNATIVES

2.1 INTRODUCTION

The proposed route of the Limerick City Greenway (UL to NTP) is located along the banks of the River Shannon from the bridge on the River Groody, running along the southern bank of the River Shannon, passing through University of Limerick, and along University Road and McLaughlan Road to Plassey Park Road. It is centred around the University of Limerick (UL) campus grounds and the National Technology Park (NTP) in Limerick.

The proposed Greenway is indicated in Figure 2.1. The proposed Limerick City Greenway (University of Limerick (UL) to National Technology Park (NTP)) will be 4.25km long and will consist of a 3.3km long and 3.0-4.0m wide shared path on existing paths or in green fields, and 0.9km of separated 1.8m wide footpaths and 1.8-2.0m wide cycle lanes alongside the eastern and western sides of University Road and McLaughlan Road. The proposed Greenway will extend between the River Goody bridge and Plassey Park Road. The area lies within the River Shannon Catchment.

The proposed Greenway will form an extension to the already constructed Limerick Smarter Travel (LST), Route 2, which involved an upgrade of an existing pathway, 1.5km in length between University of Limerick and the Guinness Bridge. This proposed Greenway will extend that route eastwards to improve the accessibility to the riverside and to increase the number of people using sustainable transport to commute between Limerick City, UL, and the NTP.

This chapter addresses alternatives while taking into consideration the legislative and guidance requirements, under the following headings:

- "Do Nothing" Alternative;
- Preferred route; and
- Alternative route options.

Each of these are addressed in the Section 2.4 in this chapter.

2.1.1 Physical Characteristics of Site and Surrounding Lands

The area for the proposed works is located in County Limerick, encompassing the northern banks of the Lower River Shannon, the UL campus, and the NTP.

The major settlement within the area is Castletroy. Castletroy is located within the eastern environs of Limerick City, approximately 3km from Limerick City Centre. The University and the National Technology Park (NTP) are also located in the Castletroy area.

The proposed works lie within an area of existing pathway for part of the route while the reminder lies within amenity and agricultural areas adjacent to the River Shannon, and along the existing University Road and McLaughlan Road. The surrounding area is a mixture of built land in the form of private dwellings, educational buildings, recreational, industrial areas and agricultural fields.

The proposed Greenway is directly adjacent to and within the Lower River Shannon SAC (002165). Approximately 4km downstream from where the proposed works will take place lies the River Shannon and River Fergus Estuaries SPA (004077). Further details regarding the designated areas are provided in Chapter 6 Biodiversity of this EIAR.

The Zone of Influence of the proposed works for the Greenway is specific to the type of environmental assessment being undertaken. The study area is centred around Castletroy, specifically the UL Campus and the NTP. Following a detailed and comprehensive consideration of options for alternative routes, the preferred route was selected based on potential impacts, mainly on biodiversity and water resulting from the proposed development, whereas other assessments included the visual envelope of the project and the impact on cultural heritage, landscape and visual environment, as well as on the population as beneficiary of the proposed Greenway.

Refer to Figure 2.1 for the Site Boundary.

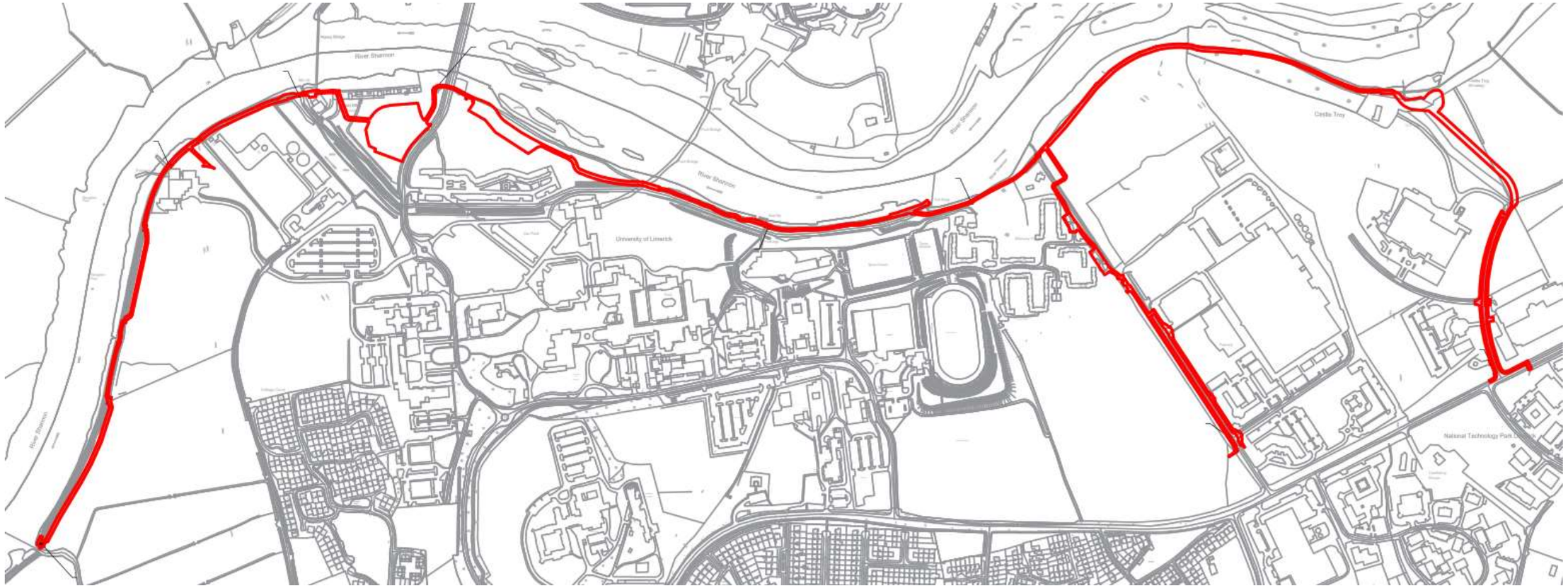

Figure 2.1: Site boundary

2.1.2 Limerick Smarter Travel Project

Limerick City was awarded the title of Ireland's first Smarter Travel Demonstration City in a national competition funded by the Department of Transport, Tourism and Sport (DTT&S) and co-funded by the European Regional Development Fund (ERDF) under the Southern & Eastern Regional Assembly (SERA) Operational Programme 2007-2013. The initiative was run between 2012 and 2016 in partnership with University of Limerick. €9 million was awarded for the project which saw a host of infrastructural and behavioural change measures being rolled out in the four project area hubs. The four hubs were:

- The City centre;
- Castletroy (including the University and the National Technology Park);
- Regeneration area of Southill (including a large inner-city community and an extensive employment centre, including light industry); and,
- Corbally (made up of a largely suburban community, separated from the city by two river crossings and restricted road capacity).

The main objective of the Limerick Smarter Travel (LST) Project was to connect four hubs in Limerick City and its suburbs by the development and promotion of sustainable modes of transport for those living, working, and studying in these areas, to provide direct, safe, and enjoyable walking and cycling routes. The Limerick City Greenway (UL to NTP) is part of the Castletroy hub in the LST initiative and will form an extension to the already constructed LST, Route 2.

2.2 Need for the Proposed Development

The proposed Greenway aligns with the objectives of European, national, regional, and local mobility strategies by becoming a corridor for non-motorised travels, integrating both environment and quality of life of the surrounding area by providing zero-emissions mobility paths as well as safe and efficient connectivity for Limerick City Metropolitan Area, its towns and villages.

The Greenway will be a part of LCCC's growing urban and suburban cycle networks and the proposed Castletroy Cycle Network as outlined in the Limerick Metropolitan Cycle Network Study (LMCNS), facilitating and maximising commuting, tourist, recreational and leisure trips. It will offer a choice for a more sustainable transport alternative while aiding social integration, economic growth, and environmental sustainability.

As part of a sustainable mobility scheme, the proposed Greenway can bring benefits to the community, health, and environment through:

- **Connectivity**, connecting main towns and villages via coherent and joined-up networks.
- **Health**, reducing air pollution and increase activity levels by encouraging modal shift away from traditional and less sustainable transportation.
- **Safety**, improving actual and perceived safety for those walking, wheeling, and cycling and create safe routes for travelling.
- **Reduced air pollution**, shifting to less car driven journeys and more walking, wheeling, cycling and public transport that are important in tackling air pollution and its negative health impacts.
- **Reducing carbon emissions**, helping reach net-zero carbon goals since changing to active travel can have significant lifecycle carbon emission benefits.

The proposed work aligns with strategic planning and development policies and encourages the development of safe and efficient movement and accessibility network that will cater for the needs of all users and to encourage priority for walking and cycling, delivering significant modal shift to more sustainable transport modes.

2.3 Project Design Process

The design process comprises a number of steps involving co-ordination of project engineering and environmental teams. The following steps have been completed in the design and assessment process:

- Preliminary Site Investigation;
- Preliminary Design;
- Constraints Study;
- Selection of Preferred Option;
- Appropriate Assessment Screening; and
- Environmental Impact Assessment.

The outcomes of the above assessments are discussed below and within the various relevant EIAR chapters in this document.

2.4 Consideration of Reasonable Alternatives

2.4.1 Overview

This section provides a comprehensive analysis of alternatives which have been considered for meeting the objective of becoming a connecting Greenway, that is technologically, socially, environmentally, and economically acceptable while becoming part of Ireland's growing national and regional cycle/greenway routes. This was undertaken in accordance with Annex IV of the EIA Directive as amended 2014/52/EU.

Annex IV (2) of the EIA Directive as amended by Directive 2014/52/EU states that the information provided in an Environmental Impact Assessment Report (EIAR) should include *"a description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects"*.

The primary obligation under Article 5(1)(d) of the EIA Directive is upon the developer to provide a description of the 'reasonable alternatives' considered in the course of the application process. In this regard, the Directive states as follows: *"(d) 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;*

This section of the EIAR contains a description of the reasonable alternatives that were considered for the proposed Greenway in terms of route options as well as site layout. This section also outlines the design considerations in relation to the Greenway, including all associated works such as the Greenway composition, along with the necessary drainage, bridges, platforms to facilitate the Greenway. It indicates the main reasons for selecting the chosen option with regards to its environmental impacts.

The presentation and consideration of various alternatives investigated by the project design team is an important requirement of the EIA process. The consideration of alternatives is an effective means of avoiding

environmental impacts. As set out in the '*Guidelines on The Information to be Contained in Environmental Impact Assessment Reports*' (Environmental Protection Agency, 2022): *"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."*

It is important to acknowledge that although the consideration of alternatives is an effective means of avoiding environmental impacts, there are the existence of other non-environmental factors to consider when considering alternatives. These include non-environmental factors and site-specific issues as outlined below.

Non-environmental Factors

EIA is confined to the potential significant environmental effects that influence consideration of alternatives. However, other non-environmental factors may have equal or overriding importance to the developer of a project, for example project economics, land availability, engineering feasibility, social considerations or planning considerations.

Site-specific Issues

The EPA guidelines state that the consideration of alternatives also needs to be set within the parameters of the availability of the land, i.e. the site may be the only suitable land available to the developer, or the need for the project to accommodate demands or opportunities that are site-specific. Such considerations should be on the basis of alternatives within a site, for example design and layout.

2.4.2 Guidance on Methodology

The EU Guidance Document (EU, 2017) on the preparation of EIAR outlines the requirements of the EIA Directive and states that, in order to address the assessment of reasonable alternatives, the Developer needs to provide the following:

- A description of the reasonable alternatives studied; and
- An indication of the main reasons for selecting the chosen option with regards to their environmental impacts.

There is limited European and National guidance on what constitutes a '*reasonable alternative*' however the EU Guidance Document (EU, 2017) states that reasonable alternatives "*must be relevant to the proposed project and its specific characteristics*".

The guidance also acknowledges that "the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative".

The current EPA Guidelines (EPA, 2022) state that "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 in deciding on the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required."

Consequently, taking into account the guidance and complying with the EIA Directive requirements, this chapter addresses alternatives from an Environmental perspective in the following sections.

2.4.3 Route Identification

Various route options were considered for the proposed Greenway taking into account a number of engineering and environmental measures:

- Existing infrastructure;
- Water courses and flooding;
- Ecology;
- Heritage;
- Flood Risk;
- Design Elements;
- Construction Constraints;
- Safety; and
- Cost estimates.

The existing paths in the study area are illustrated in Figure 2.2.

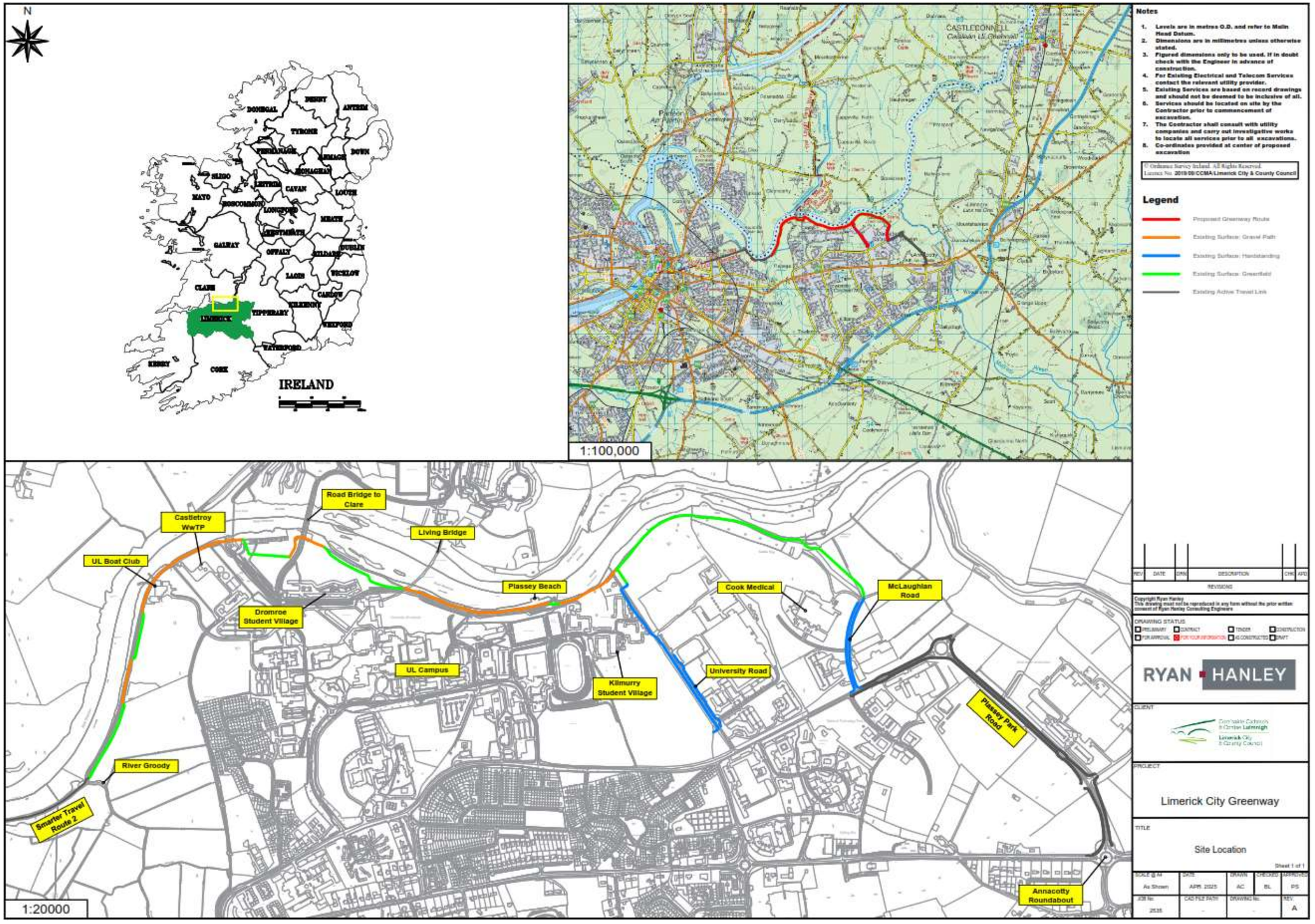

Figure 2.2: Existing paths and roads in UL and the NTP, and green fields

2.4.4 Alternatives

Three possible scenarios were considered when determining the design of Greenway; namely "Do Nothing" scenario, a preferred route, and alternative route options.

2.4.4.1 Do Nothing

The option assessment considered this solution unfavourable since even though if the works are not carried out there would be no negative impacts on the natural surroundings (biodiversity, soils, water, etc.), this would lead to a lack of fulfilment of the proposed objectives in the Limerick Smart Travel Project, slowing down the shift towards more sustainable travel modes.

If the proposed works are not implemented, the environmental, social and economic benefits resulting from the Greenway won't reach the beneficiary community that would make use of it, increasing impacts such as traffic congestion, air pollution, increased greenhouse gases emissions and reduced connectivity between the key hubs of Limerick City.

The "do-nothing" scenario was considered to represent an inappropriate and inefficient use of the path; particularly having regard to the opportunity to provide the much-needed connectivity for Limerick City Metropolitan Area.

2.4.4.2 Preferred Route

One of the primary objectives of this project is to improve comfort, safety and security for walkers and cyclists who travel between Limerick city, the University of Limerick, and the National Technology Park, and to encourage an increase in sustainable travel. This was the basis for the selection of the proposed route. Chainage references relate to the Preliminary Design Drawings.

The preferred proposed is described and illustrated in greater detail in Chapter 4 of this EIAr and a summary is provided in this section.

The proposed route commences west from the existing River Groody bridge at the confluence of the River Groody with the River Shannon (CH 0). The proposed Greenway route will run adjacent to an existing narrow walking track along the southern bank of the River Shannon. The proposed Greenway will rejoin this existing Active Travel path where it is 3.5m wide and will cross an existing bridge (CH 400). A new steel parapet will be installed above the low stone parapet on this existing bridge to replace the existing parapet which currently narrows the bridge.

The route will pass by the UL Boat Club and extend eastwards to an existing concrete bridge which will be replaced by a 4.8m long steel bridge (Bridge No. 1 @ CH 795). A new 9.6m long steel and concrete bridge will be constructed alongside an existing stone bridge (Bridge No. 2 @ CH 970). The existing bridge across the Plassey Mill race will be replaced with a new 5.4m long steel bridge (Bridge No. 3 @ CH 1000) and an amenity space is proposed adjacent to the Plassey Mill (CH 1010). Access for a future connection to the Blackbridge across the River Shannon to Co. Clare will be provided. The existing bridge across the overspill for the Plassey Mill race will be replaced with a new 5.1m long steel bridge (Bridge 4 @ CH 1050).

The route turns southeast and will continue behind a collection of fishing huts and crosses a section of mixed broadleaved woodland and amenity grassland (approx. CH 1050 – CH 1250). The proposed route will replace an existing gravel path going north towards Drumroe Village University Bridge and turn east to continue along the River Shannon past the Drumroe Student Village. The proposed Greenway route will

replace the existing gravel path, pass under the Living bridge (CH 1650), and meander between the River Shannon and the Plassey Mill race to avoid mature trees (wherever possible) until it reaches Plassey Beach.

A 12.8m long steel bridge is proposed to replace the existing concrete bridge at the mouth of the Plassey Mill race (CH-2200 – CH-2245). This new bridge will facilitate wheelchair users and cyclists to cross the Plassey Mill race whereas the existing bridge is narrow and has steps. There will be a new ramp for people to walk down, wheelchair users and buggies/children's scooters from the proposed Greenway to Plassey Beach providing an amenity that provides access to all. There will be new seating and planting areas provided at the beach.

The proposed Greenway route then passes north of Kilmurray Student Village and reaches a junction (CH 2250). The route south provides access to University Road and to Plassey Park road. The proposed Greenway runs south past the eastern boundary of the Kilmurray Student Village and crosses the entrances to Kilmurry Village and the UL Gaelic grounds. At this point the shared 3.5m wide greenway changes to separate cycle lanes and footpaths along the eastern and western sides of University Road and will connect to existing cycle lanes and footpaths on Plassey Park Road.

The proposed Greenway continues route east at (CH 2250) and traverses amenity grassland and scrub areas where there is an unpaved desire line before turning south (CH 3100) to traverse more grassland and scrub areas, then turns south to join connect to McLaughlan Road in the NTP at CH 3500. This section of the route is subject to extensive flooding because it lies within Flood Zone A, so drainage along and under the Greenway has been designed to ensure the path can be utilised as soon as possible after flooding events.

The proposed 3.5m wide shared greenway changes to separate cycle lanes and footpaths along the eastern and western sides of McLaughlan Road and will connect to existing cycle lanes and footpaths on Plassey Park Road. An existing raised table on Plassey Park Road close to the junction with McLaughlan Road will be converted to a 6m long Toucan crossing to prioritise crossings for pedestrians and cyclists.

The route includes new amenity spaces at the following locations:

- At the Plassey Mill (approx. CH 1010)
- Near Plassey Beach (approx. CH 2200)

CFRAM flood mapping and anecdotal evidence confirms part of the proposed route between CH 2500 – CH 3500 will be subject to low probability (1 in 1000 year), medium probability (1 in 100 year) and high probability (1 in 10 year) flooding events. This is also the only section of the route which lies within Flood Zone A.

There will be tree planning at the following locations:

- CH 770 east of UL Boat Club,
- CH 1200 behind the Fisherman cottages,
- CH 1400-1520 north of the UL campus,
- CH 2105-2175 at Plassey Beach, and,
- CH 3190-3450 east of Cook Medical campus,

2.4.4.3 Alternative Route Options

Alternative route options include the use of different links as substitutes to sections of the proposed route as described above. The number of alternative routes is severely limited because the River Shannon is to the north of the proposed Greenway, and the UL campus is to the south. There are existing roads and paths in the campus but not one that runs east to west to match the length of the existing riverside path between the River Groody Bridge and east of Kilmurry Student Village.

The following have been under consideration for inclusion as part of the Greenway.

Link A

At the Mill Race east of Plassey Mills the route would turn south-east towards the UL campus, running along the route of the Mill Race. As the route crosses the UL campus, it briefly crosses onto an existing tarred route before continuing through a greenfield site and passing beneath the Living Bridge. The route passes Plassey House and the UL hockey pitches before rejoining the riverbank track.

Link G

Link G would divert from the proposed route east of Troy Castle (approx. CH 3190) and continue along the banks of the River Shannon until it reached the confluence with the River Mulkear. It would turn towards the River Mulkear and continues along its western bank until it reached the UL Bohemians Rugby Football Club. It would continue round northern and western boundary of the rugby club sports fields and extend down Mulcair Drive.

Link C

Link C would divert from Link G alongside the River Mulkear and provide a direct access to Plassey Park Road. Link C would traverse a greenfield site before joining an unfinished section of road where the route would run along an existing footpath and grass verge.

Link E

Link E is an alternative to Link C. Link E would divert from Link G along the River Mulkear and provides a connection to Plassey Park Road. Link E would cross a greenfield site and connect to Plassey Park Road but it would run through a large multinational commercial campus (i.e., Johnson & Johnsons Vision Care).

Link F

Link F would start from Link G and run southwest to the Johnson & Johnsons Vision Care campus at the south-western boundary of the UL Bohemians Rugby Football Club. Link F would connect to Plassey Park Road.

The proposed greenway route and the alternate links are illustrated in Figure 2.3.

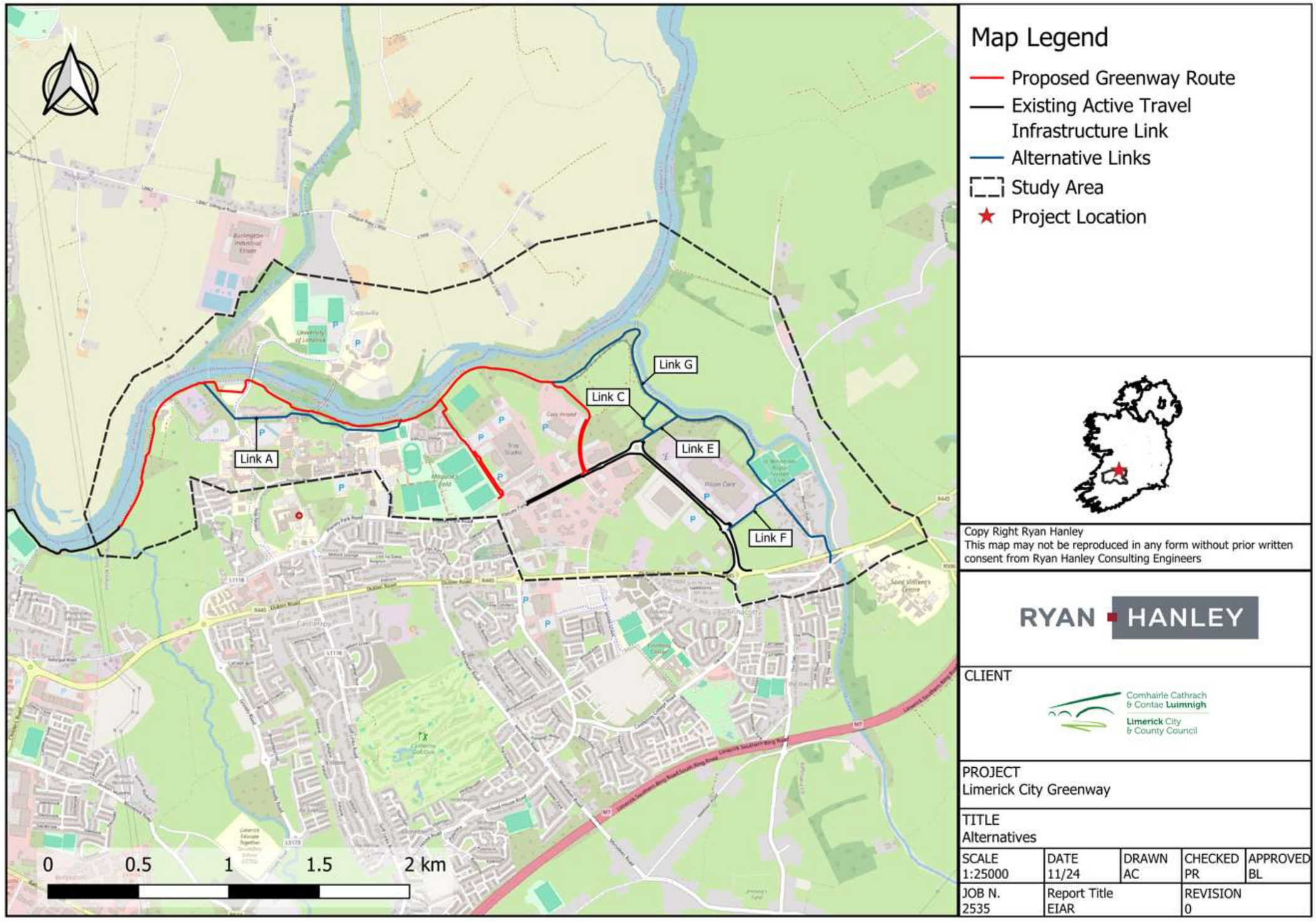

Figure 2.3: Route alternatives considered for the Greenway

2.4.5 Options Appraisal

The following table compares the proposed route against the alternative Links that were considered for the Greenway.

Table 2. 1 Summary of Options

	Preferred route	Alternative route comprised of Link A and Link G
General overview	The proposed route commences east of an existing bridge over the River Groody and runs along an existing gravel path alongside the River Shannon. East of Kilmurray Student Village in UL, the proposed greenway will be constructed on grassland. The proposed greenway will connect via University Road and McLaughlan Road to Plassey Park Road. The project will include new amenity spaces; public lighting, seating, bike racks, wayfinding signage, and information boards.	The alternative greenway route would start at the River Groody until it meets the Plassey Mill Race. Link A would follow the Mill Race through the UL campus and would rejoin the preferred route west of Plassey Beach. The alternative greenway route would follow the same path as the preferred route until the turn south to McLaughlan Road. Link G would continue east along the banks of the River Shannon and turn south-east at the confluence of the River Mulcair with the River Shannon. Link G would continue along the banks of the River Mulkear, through the UL Bohemians RFC club grounds, and along Mulcair Drive. Link C, Link E and Link F are not considered in this assessment because they provide connections between Plassey Park Road and Link G. They have also been excluded from the cost estimate provided in this table below.
Technical viability	This option is technically viable. Several potential access routes have been identified for construction purposes. Space limitations are not an issue to reach the extents of the Greenway. Site compounds will be placed at suitable locations along the construction site.	This option is technically viable but some of the links cannot be constructed due to land unavailability, flooding risk, and safety in relation to proposed construction or commercial activities.
Social acceptability	The preferred Greenway route is a benefit for the community, providing a means to achieve better physical and mental health. It would become an alternative transport mode for cyclists and pedestrians for various purposes such as work, study, tourism, leisure, and recreation.	The alternative route is a benefit for the community, providing a means to achieve better physical and mental health. It would become a transport mode for cyclists and pedestrians for various purposes such as work, study, tourism, leisure, and recreation.

	Preferred route	Alternative route comprised of Link A and Link G
	The proposed Greenway route will further improve connectivity between Limerick city and the suburbs. The preferred Greenway route runs along the River Shannon which would be a favored route by cyclists and pedestrians and links to existing paths along the route.	The alternative Greenway route will further improve connectivity between Limerick city and the suburbs The alternative Greenway Link A would run through the UL campus with busy roads, providing a safety risk for pedestrians and cyclists, not just for Greenway users but for students and staff in the UL Campus. The alternative Greenway Link G would run along the banks of the River Mulcair in Flood Risk Zone A which is predicted to flood at 1 in 10 yearly intervals which would close the route for periods until water levels subside. This may lead to negative social commentary.
Environmental viability	No significant impacts are anticipated, and mitigation measures to maintain drainage, provide biodiversity, and promote habitats will be put in place.	The alternative route has higher potential impact on key ecological receptors because it runs along the River Mulkear where more habitats and species would be disturbed than the preferred route.
Economic viability	The construction cost estimate for the preferred Greenway route excluding land acquisition is €10.5M.	The construction cost estimate for the alternative Greenway route excluding land acquisition is €14.5M. The difference is the addition of Link G.

2.4.5.1 Multi Criteria Analysis

Multi Criteria Analysis (MCA) assesses options against an explicit set of objectives. It creates a structured framework for comparing a set of defined options across diverse criteria so that these can be evaluated across a range of priorities and/or values. Using MCA, the proposed and alternative route options have been assessed against technical, social, environmental, and economic criteria. The qualitative analysis is based on a "traffic light" system, according to the criteria in Table 2.2.

Table 2.2 MCA qualitative criteria

Qualitative description	
Meets proposed objective. Potential impacts are low and considered compatible after the implementation of some mitigation measures	
Partially meets objective. Potential impacts can occur and are considered moderate. Needs implementation of proposed mitigation measures	

Does not meet objective. Potential impacts are likely to occur and affect the achievement of the proposed objective. Implementation of mitigation measures, and if applicable, compensation measures, are aimed for long-term recovery	

The MCA for the proposed and alternative route is summarised in Table 2.3. The assessment was undertaken on the basis of potential impacts and achievement of objectives in the absence of design and mitigation measures, which may overcome many of the potential effects identified.

A summary of the assessment is as follows:

- **Environmental**: the links for the alternative route has higher potential for environmental impact, especially Link G along the River Mulcair.
- **Technical:** the alternative route includes links that might result in higher risks during construction and operation of the proposed greenway, due to intersections with areas of higher traffic (Link A).
- **Economic:** the links for the alternative route have a higher surface interference with current utilities within the area (existing Link A, and future Link G areas in a commercial campus), therefore increasing the risk of damaging these infrastructures.
- **Social:** in promoting human health and safety, because of the higher traffic areas that the alternative links run into, the scoring for this aspect is lower than the preferred route.

Table 2.3 MCA Ranking

Parameters Criteria	Objective	Proposed route	Alternative route
Environmental	Minimise the risk for potential sources of environmental pollution		
	Support the objectives of the Habitats Directive		
	Avoid damage to the flora and fauna within the study area		
	Protect the landscape character and visual amenity within the path and its surroundings		
	Avoid damage to or loss of features of cultural heritage		
	Protect soil resources and function		
	Minimise detrimental impact of climate change on the environment resulting from GHG emissions		
Technical	Minimise health and safety risks associated with the construction, operation and use of the Greenway		

Parameters Criteria	Objective	Proposed route	Alternative route
	Ensure the options are aligned with planning objectives		
	Ensure the path options are adaptable to future risks		
Economic	Minimise economic risk		
	Minimise risk to current transport infrastructure		
	Minimise risk to current utility infrastructure		
Social	Promote human health and safety		
	Enhancement of quality of life for the community		
	Enhancement to amenity value of the area		
	Support strategic planning and development objectives towards sustainable transportation		

2.4.6 Mitigation Measures

The best practice design and mitigation measures set out in this EIAR will contribute to reducing any risks associated with the proposed development in this location and have been designed to break the pathway between the site and any identified environmental receptors. The mitigation methods proposed follow the principal of avoidance of impact where possible in the first instance, followed by minimisation of impacts where full avoidance is not possible. The mitigation methods proposed represent industry best practice. Alternative mitigation methods that are not best practice were not considered to be reasonable and were therefore not considered further in the EIAR.

2.4.7 Conclusions and Recommendations

The preferred option put forward in this report, has been selected for several reasons:

- **Safety of Users**: Although the route is within a flood zone, safe access to the route is expected to be maintained throughout the year. Additional safety measures may be required to manage access during flooding, such as the inclusion of lockable gates to prevent access to the route in Flood Risk Zone A located at the junction east of Kilmurray Student Village and where the cycle lane and footpath changes to a shared path at McLaughlan Road. These would prevent access to this section of the proposed Greenway during a flood event.
- **Increased use of Greenway**: The proposed Greenway would provide a more inclusive amenity by making the route more accessible abled and less-abled users between Limerick City, the University

of Limerick, and the National Technology Park. The increased level of connectivity achieved by the Greenway will likely increase the frequency of its use.

- **Enhancement to amenity value of the area**: The preferred route offers the opportunity to showcase a range of the existing views, wildlife and heritage in the area by developing paved areas equipped with amenity service including bicycle racks, benches, and information boards related to the area of interest.
- **Cost**: The cost estimate for construction of the preferred route is less than the cost estimate for the alternative route.
- **Access for Construction**: Access for construction can be achieved for the proposed route using sectional construction areas that are supplied from compounds. Each compound is accessible from public roads thereby providing separation between public side construction vehicles (e.g. delivery trucks) and works side vehicles (e.g. digger, dumper) in the sections.
- **Welfare for Construction**: The contractor will set up welfare facilities in each compound.

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3. BACKGROUND TO THE PROPOSED DEVELOPMENT

3.1. INTRODUCTION

The Limerick City Greenway (UL to NTP) forms part of a larger cycleway plan, the proposed Limerick Cycle Network as outlined in the Limerick Shannon Metropolitan Area Transport Strategy (LSMATS) 2040 and as Objective TR O9 in the Limerick Development Plan (LDP) 2022-2028.

The focus of the LSMATS is to promote cycling as a realistic choice as a mode of transport in the Limerick Metropolitan Area, making it an attractive location for cyclists of all ages and abilities by proposing the development of a consistent, clear, and continuous network of urban and suburban cycle networks throughout the area.

The Limerick City Greenway (UL to NTP) Project will connect at its western extent to the existing Limerick Smarter Travel, Route 2, which involved the upgrade of an existing pathway, 1.5km in length between University of Limerick and the Guinness Bridge along the bank of the River Shannon and connects directly into the city centre. It will also connect to cycle lanes and footpaths on Plassey Park Road.

Consultation is an important element of the design process. The objective of consultation is to ensure that the views and concerns of all stakeholders are taken into account and that information relevant to the project is made known and available during the design and planning process. These engagements have included broad general consultation at the Constraints Study stage and associated Public Information Events as well as circulation of questionnaires and specific rounds of consultation with landowners affected by the proposed project. This chapter outlines the consultations for this project to date.

3.2. PREFERRED ROUTE DEVELOPMENT

For a detailed description and more information about the preferred and alternative routes, please refer to Chapter 2 of this EIA report.

3.2.1. Preferred Primary Route and Links

The preferred Greenway route will extend from the River Groody bridge and extend along an existing paved and unpaved pathway along the southern bank of the River Shannon, providing for entrances and exits from the University of Limerick and the National Technology Park at Castletroy. It will continue along University Road and McLaughlan Road to Plassey Park Road.

3.2.2. Alternative Route Options

Alternative route options include the use of different links as substitutes to sections of the preferred primary route as described above. The following have been under consideration for inclusion as part of the Greenway.

- Link A - the route follows the Mill Race through the UL campus.
- Link G - diverts from the proposed route east of Troy Castle (approx. CH 3190) and continues along the banks of the River Shannon and the River Mulkear through UL Bohemians Rugby Football Club, along Mulcair Drive to Annacotty Village.
- Link C - diverts from Link G alongside the River Mulkear and provides access to the route from Plassey Park Road.
- Link E - an alternative to Link C.

- Link F - leaves Link G and turns towards Johnson & Johnsons Vision Care, at the southern boundary of the UL Bohemians Rugby Football Club then connects to Plassey Park Road.

3.2.3. Constraints Study and Report

A Constraints Study and Report were produced in November 2020. The constraints study examined the key environmental constraints within the study area upon which the construction and installation of a Greenway could have an impact. The purpose of the Constraints Study was to determine constraints that exist, which could affect the design of the path, delay the progress and could influence the cost of the Greenway. The report was based on consultation with statutory consultees, public information events, and collection of a range of environmental and related data and information. A summary of these consultations is provided below.

3.2.3.1. Stakeholder Consultation

Initial consultation in the form of an EIA Scoping document was issued in December 2020 to relevant stakeholders and consultees that the project team identified for this project including:

- Limerick City & County Council,
- University of Limerick,
- The IDA,
- Waterways Ireland;
- Inland Fisheries Ireland,
- Office of Public Works,
- Environmental Protection Agency;
- Dept. of Environment;
- Dept. of Housing, Local Government and Heritage; and,
- An Garda Siochana.

For ease of communications during the project, key stakeholders were assigned into a stakeholder matrix (refer to Figure 3.1) which assisted in differentiating the specific level and type of communications required. This process of assigning stakeholders into the quadrants and their subsequent level of engagement was reviewed during different stages in the project, i.e., Route selection and constraints identification, Initial consultation, Preliminary Design, Surveys, etc. A clear, defined communication pathway for both internal and external stakeholders ensures stakeholder dissatisfaction is minimised and any potential issues are dealt with as early as possible in each stage.

The Greenway traverses a high number of folios; so close liaison with the University of Limerick, the IDA (who represent numerous commercial companies including Johnson & Johnson Vision Care) was established and developed. Communication lines were maintained with local-residents and relevant bodies by way of project updates through the LCCC Project team. A favourable response to the proposals was provided from the stakeholders consulted and all observations, comments and opinions were integrated into the design process.

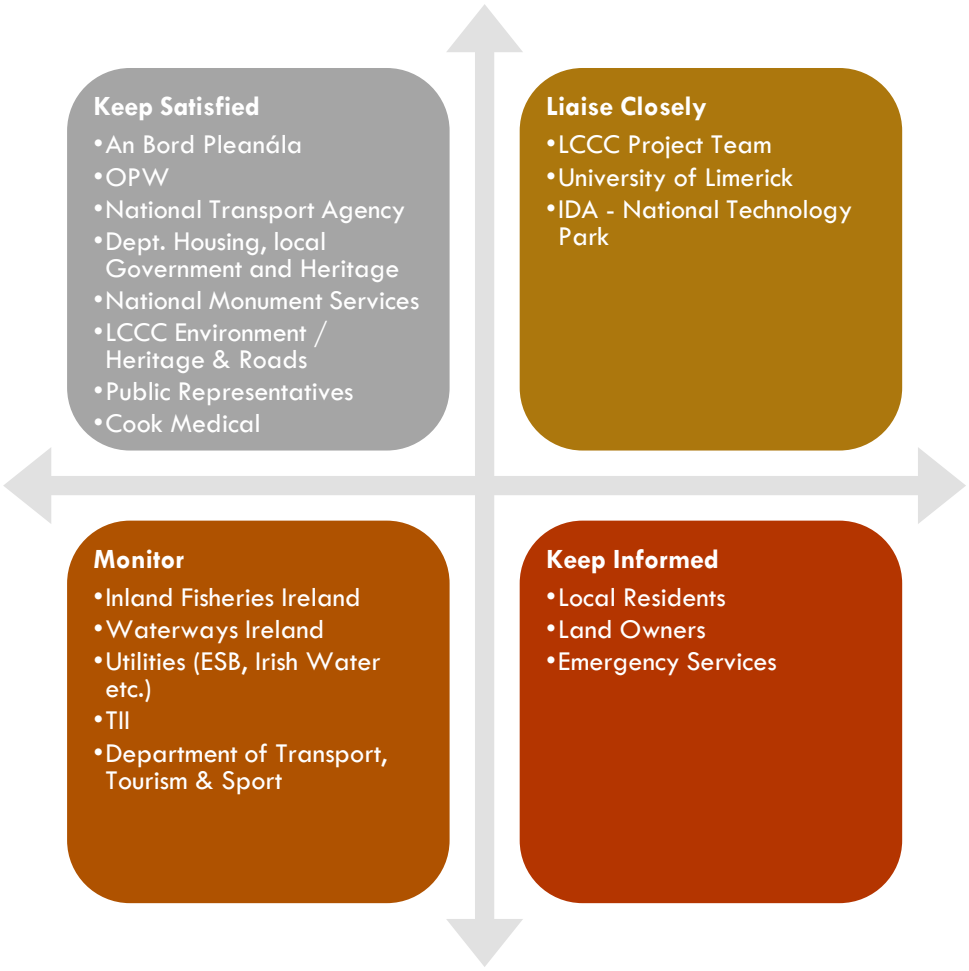

Figure 3.1 Consultation stakeholder matrix

3.2.3.2. Consultation with An Bord Pleanála

A pre-planning consultation meeting was held with An Bord Pleanála (the Planning Authority), and representatives of Limerick City and County Council (LCCC, the prospective applicant), and Ryan Hanley on 13th October 2022.

A second pre-planning consultation meeting was held with An Bord Pleanála on 11th November 2024.

3.2.3.3. Consultation with Elected Representatives

Presentations about the proposed design were provided to elected representatives on 21st July 2021 and 13th October 2022.

3.2.3.4. Public Information Day & Virtual Consultation Room

A public information event took place on 4th of August 2022 at the Kilmurry Village Hall in the University of Limerick campus. The project team's objectives for the Public Information Day was:

- To inform the public about the proposed Limerick City Greenway (UL to NTP);
- Inform the public of the process and answer questions; and
- Invite submissions on the design process.

A virtual consultation room was set up to allow community and public a chance access project material as well as to provide feedback and comments on the proposed design. Refer to Figure 3.2.

Figure 3.2 Limerick City Greenway Virtual Room

Figure 3.3 Limerick City Greenway Public Consultation event

3.2.3.5. Landowner Consultations

The proposed Greenway passes through public and private lands. The number of private properties that the proposed Greenway passes through has been kept to a minimum in order to minimise the number of land use agreements to be arranged to facilitate the works. Folios are registered to the following:

- Individual landowners;
- The University of Limerick (UL);
- Shannon Commercial Enterprises Designated Activity Company;
- The IDA (with lease agreements to companies including Johnson & Johnson Vision Care); and
- Limerick City and County Council (LCCC).

There are leaseholds and sublease-holds, owned by UL, a leasehold held by Holmes, O'Malley and Sexton Solicitors and sublease-hold held by Plassey Campus Centre Limited.

In advance of submission for planning for the proposed Greenway to An Bord Pleanála (APB), the design proposal was communicated to freeholders and tenants and when applicable, an agreement of no objection was received in writing from the freeholders and tenants regarding the proposed plans for the Limerick City Greenway (UL to NTP). Engagement with freeholders and tenants was carried out as early as possible, once the design was established, to ensure agreement is secured pre-planning and that feedback from stakeholders was collected and incorporated into the final detailed design.

Due to the non-invasive nature of the proposed Greenway and the amenity value it will add to the area, it is proposed that lands required for the proposed Greenway will be acquired by agreement, with land purchase if this cannot be achieved.

3.2.4. Public Information Sharing Event - Responses

The overall response was positive as the public were satisfied with the proposals presented. Concerns and suggestions offered by the public largely related to personal safety while using the route and to the appearance of the route.

Concerns and suggestions related to personal safety while using the route included the following:

- Provision of lighting along the route;
- Clearing back of overgrown vegetation;
- Provision of railing to prevent falls into the river;
- Security and/or policing of the route to reduce potential for anti-social behaviour;
- Restrict use of motorised vehicles and provision of a speed limit;
- The separation of and provisions for both cyclist and pedestrian;
- Clear signage; and
- Improved route surface.

Concerns and suggestions related to the appearance of the route included the following:

- Provision of benches;
- Provision of rubbish bins;
- Provision of a playground;
- Improve dog control;
- Provision of end of route facilities and destinations of interest;
- Clear back areas of overgrowth and trim trees to open up the view to the river;
- Maintain the routes "wilderness"; and
- Ensure flora and fauna is not disturbed.

3.2.5. Consultation Feedback: Consultation Feedback- Constraints Study Report

As part of the constraints study, information was gathered on engineering, socio-economic, environmental, cultural heritage and geotechnical constraints. Environmental constraints were investigated under the following headings:

- Population and Human Health
- Ecology
- Water
- Land use, Soils and Geology
- Archaeology, Architectural and Cultural Heritage
- Landscape & Visual
- Air, Noise and Climate
- Material Assets

Under each heading, the assessment methodology was first outlined followed by a description of the defined Study Area or 'receiving environment'. This allowed a full assessment of the potential constraints and a comprehensive consideration of options. Finally, a summary of the key constraints and implications for the proposed project was noted. The key constraints for each of the headings above were carefully considered in the early phases of the project to ensure that the design was developed in line with the constraints.

The Constraints Study, which was completed in late 2020, was the initial means of characterising the environment of the study area which would later inform the Scoping Report and the final EIAR. The scope of the Constraints Study was generally broad, looking at all environmental constraints. **Table 3.1** provides a summary of the key constraints identified in the Constraints Study Report.

Table 3-1: Summary of constraints for the Limerick City Greenway

Environmental Constraints	Summary of key constraints
Population and Human Health	The proposed project took into consideration the proposed zoning objectives set out in the Castletroy Local Area Plan 2019-2025 (which has been superseded by the Limerick Development Plan 2022-2028), and in particular not impact on areas zoned residential which are likely to be developed with housing to support the growing population in the area.
	In designing the proposed Greenway, the value (both cultural and economic) of any buildings (Residential, Retail, etc) likely to be adversely affected by the Greenway should be taken into account. In addition, adverse impacts on buildings or structures of conservation interest should be minimised or avoided where possible.
	The design of the Greenway should ensure that the public amenity value of the study area is not diminished. Impacts on the public amenity areas adjacent to the rivers such as riverside walks and in particular fishing access areas should be considered and minimised or mitigated.
	Significant effects on long term pollution in the area are not anticipated for the proposed project.
	The proposed project will likely improve tourism potential in the area and as such is not anticipated pose a constraint in this regard.
	The proposed project supports the policy of the council in relation to transport of reducing dependency on cars and promoting the development of the Smarter Travel Network within the area and as such is not anticipated to pose a constraint in this regard.
Ecology	The sensitivity of the waterbodies and designated sites within the study area has no significant detail. These will need to be addressed to ensure that the negative effects are minimised and mitigated.
	The design should take into consideration the breeding or resting locations for otter. When the detailed design of the proposed Greenway is selected, affected areas may require additional survey to determine the level of otter activity and if any breeding or resting places are present within and adjacent to the footprint of the works. Works could result in the damage or destruction of resting places and

Environmental Constraints	Summary of key constraints
	appropriate mitigation will be required to ensure no long-term adverse impacts on local otter populations. Appropriate licences may also be required from NPWS in relation to any works on or around otter breeding or resting places.
	The Greenway design should take into consideration the potential impacts from loss of riparian habitat which provides food, cover and shade and helps to stabilise riverbanks. Significant impacts on fish populations and macroinvertebrates populations could occur due to such loss of habitat.
	The mobilisation of high levels of silt from construction beside rivers can impact spawning habitats. Excessive siltation can cause eggs and fry to be smothered. Spawning salmonids and lamprey are likely to avoid traditional spawning areas due to excessive silt deposits.
	The riverine corridor and vegetated fringe of the study area watercourses provides suitable habitats for nesting birds and also within the river walls and may provide a number of cracks and crevices suitable for nesting birds. If possible, vegetation clearance associated with the works and any works to existing walls, should be conducted outside of the breeding bird season (March to August inclusive) to protect any nests that may be present. If this is not possible, working areas should first be searched by a suitably qualified ecologist for the presence of any nests. If found, the nests should not be disturbed until the chicks have fledged and the nest is deemed inactive. A possible ecological opportunity as part of these works will be to include nesting boxes.
	Trees along the River Shannon, and the old buildings and bridges provide potential roosting opportunities for bats, with the surrounding habitat providing good foraging and commuting routes. Options that require the removal of mature trees or works to riverine built structures with the potential to support roosting bats shall be assessed for bat potential. The optimum time to carry out bat surveys is May-August inclusive. If bats are found to be present the surveys will determine the species, numbers, access points and type of roost. If a hibernation roost or maternity roost is found, they shall not be disturbed during the hibernation or maternity periods.
	It must be ensured that there are no significant impacts on the Natura 2000 sites (SAC/SPA), namely the Lower River Shannon SAC and the River Shannon and River

Environmental Constraints	Summary of key constraints
	Fergus Estuaries SPA. The Shannon River is directly adjacent to the proposed works. There is potential to negatively affect the status of these designated sites.
	Himalayan balsam and Giant Hogweed are listed as invasive plants under the EC (Birds and Natural Habitats) Regulations 2011 (S.I. 477/2011). These regulations prohibit the introduction and dispersal of these species. Therefore, the works associated with the Greenway in areas where invasive species are present must use appropriate measures to ensure their containment. Appropriate measures should be taken to ensure that the spread of these invasive species is not initiated or extended by any proposed works. An Invasive Species Management Plan will be required for the treatment of Giant Hogweed and Himalayan balsam (and other invasive species) in a safe and environmentally acceptable manner.
Water	The design of the proposed Greenway should take into account the main objectives of the Water Framework Directive River Basin District Management Plan (RBDMP) by ensuring that any works proposed do not result in the deterioration of water quality of any watercourse in the study area and where possible contribute to the achievement of "good" status within the study area.
	The construction phase of the Greenway has the potential to impact on the water quality of the study area watercourses through: ▪ Release or run-off of suspended solids from site preparation or development of construction materials ▪ Accidental release of cement or contaminated materials from the site to watercourses ▪ Unintentional discharge of oil/diesel from the worksite to watercourses
	The design of the Greenway will include consideration of routes with minimum flood risk to ensure the Greenway can remain in use, where possible.
	The construction materials which will form part of the design will be chosen to minimise impact on flood storage volume of the River Shannon.
	A Construction Environmental Management Plan should be prepared before commencement of any construction works.

Environmental Constraints	Summary of key constraints
	The removal and disposal of any river/estuarine sediment should follow the guidelines for handling waste under the Waste Management Acts as amended. A strict chain of custody must accompany all excavated materials taken off site for disposal.
Soils and Geology	Permanent or temporary removal of soils/excavation of bedrock may be necessary during the construction of the Greenway which could potentially impact bedrock and alter drainage patterns. Ground conditions within the study area will be identified through geotechnical investigation during the next stage of the Greenway development.
	Significant effects on Geological Heritage are not anticipated for the proposed project.
	Significant effects on Economic Geology are not anticipated for the proposed project.
	There is potential risk of contamination of groundwater through spills or leaks from hazardous substances used on site during construction. Best site practice should be implemented on site and appropriate mitigation measures should be implemented where works are hydrologically connected to groundwater bodies.
Archaeology, Architectural and Cultural Heritage	Given the provisions of the National Monuments Acts, no disturbance to, or interference with, any known archaeological sites can take place without prior Notification, assessment and consultation with the National Monuments Service of the Department of Housing, Local Government & Heritage (DoHLGH). This should be conducted through the established consultation process via the Development Applications Unit (DAU) as part of planning.
	Refer to Chapter 12 in this EIA report provides details on archaeological sites/monuments within the study area. Each site/monument is assigned a Zone of Archaeological Potential (ZAP) within which works should not be undertaken without prior consent of the Minister of Housing, Local Government & Heritage.
	These sites include the Castletroy castle complex (RMP: LI006-017001- 017003) where works may directly impact the archaeological & visual integrity of the site.

Environmental Constraints	Summary of key constraints
	The riverine environment of the River Shannon within the study area has high archaeological potential and adjacent greenfield areas where works are proposed have potential for previously unrecorded sub-surface archaeology.
	Additionally, there are five Protected Structures within the study area. These include the Plassey Mills Complex, Plassey House and Castletroy. Refer to Chapter 12 in this EIA report.
	An Archaeological Impact Assessment should be carried out for the proposed Greenway. This may include a programme of advance archaeological testing and/or monitoring of Site Investigations as required
	An Architectural Heritage Impact Assessment of Plassey Mills complex should be carried out for the proposed Greenway
	All impacts on identified heritage – including areas to which local lore is connected – and their immediate environs, should be avoided where possible in the design of the proposed Greenway.
	Where avoidance by design is not possible then archaeological investigations may be required for identified areas of archaeological potential which would be directly impacted by the proposed Greenway.
	Advance investigations should be undertaken at design stage to facilitate mitigation design and allow adequate time to evaluate and record any archaeological features or deposits that may be encountered.
	Any ground disturbance works associated with the proposed project should be further assessed for archaeological potential. Appropriate mitigation should be determined during the design phase in consultation with the National Monuments Service (DoHLGH).
	All Protected Structures have statutory protection and design avoidance of these features and their settings should be employed where possible.
	Limerick City & County Council Heritage and Conservation offices should be consulted at an early stage of project development.

Environmental Constraints	Summary of key constraints
	The National Monuments Service of the Department of Housing, Local Government & Heritage should be consulted at an early stage of the Greenways development.
Landscape/ Air/Noise and Vibration/ Climate Change	The design of the Greenway will minimise disturbance on existing hedgerows, trees, stone walls in the area as they form defining features of the landscape character of the area and are under pressure from population growth.
	Where trees felling is required to facilitate the Greenway's construction, planting schemes should be included to compensate for the loss of existing trees in the area.
	The proposed Greenway offers a recreational facility suitable for the zone in which it is proposed (where other sporting facilities such as pitches cannot be developed). In developing the Greenway along the banks of the river it will be important to protect and enhance the existing landscape character of the area by preserving natural vegetation.
	The design of the Greenway will include the development of viewing points as part of the Greenway route which will improve the amenity value of the area.
	It is recommended that mitigation measures be put in place to reduce the impacts on air quality and the noise environment during the construction phase of the Greenway.
	It is recommended that the effects of vibration during the construction phase be considered in the design process.
	The design should take into consideration any noise/vibration sensitive receptors such as residence, schools and retirement homes located in proximity to the study area.
	Meteorological and climatological data should be consulted in the engineering design process.
	The potential impacts of Climate change should be assessed with regards to the prediction of flood risk and should be taken into account in the design of the proposed Greenway.

Environmental Constraints	Summary of key constraints
Material Assets	It is recommended that the existing and proposed location of overhead lines, watermains and underground services in the vicinity of any proposed Greenway be ascertained as part of the Engineering Study. It is recommended that Limerick City & County Council and other utility providers with services in the area be consulted regarding the location and priority of existing and proposed services.
	It is recommended that Limerick City & County Council, National Roads Authority and Transport Infrastructure Ireland (TII) be consulted in relation to any effects on traffic management on roads infrastructure in the vicinity of the study area in relation to the proposed cycleway. A Road Safety Audit should be carried out where the Greenway interface with roads.

3.2.1. Consultation with State Agencies – Responses

There have been favorable responses to the proposals from UL and the IDA who are the principal landowners along the proposed Greenway route. The project team has taken on board all previous comments made during the consultation process.

There has been very little response from state agencies/bodies except to acknowledge the project. The OPW has recommended Section 50 assessments be carried out for all proposed drains and culverts along the route and that assessment will be carried out in Q1 2025. LCCC is engaged in ongoing communications with the NTA because they are funding this project.

Table 3- 2: Stakeholder Register

Date	Stakeholder	Document	Response
13/05/2021	LCCC Heritage	EIA Scoping Report	Recommended to engage Archaeologist and Architectural Conservation officer
03/06/2021	LCCC Archaeologist	EIA Scoping Report	Met Sarah on site to discuss the proposed Greenway and took on board her recommendations
04/06/2021	LCCC Architectural Conservation	EIA Scoping Report	Met Tom on site and he recommended conservation of Bridge 2. Asked if Plassey Mills and Troy Castle could also be conserved as part of the project
18/06/2021	Waterways Ireland	Letter, Design drawings, and EIA Scoping Report	No response

18/06/2021	Office of Public Works	Letter, Design drawings, and EIA Scoping Report	No response
18/06/2021	National Parks & Wildlife Service	Letter, Design drawings, and EIA Scoping Report	No response
18/06/2021	Inland Fisheries Ireland	Letter, Design drawings, and EIA Scoping Report	No response
18/06/2021	An Garda Siochana	Letter, Design drawings, and EIA Scoping Report	No response
21/06/2021	IDA Castletroy	Letter and EIA Scoping Report	Multiple responses. Primarily concerned about route along Mulcair River behind J&J campus. Coordination with IDA flood defence engineers
21/06/2021	UL Facilities	Letter and EIA Scoping Report	Multiple. Met Ger Manning on site on two occasions and presented the project to his Facilities team.
11/08/2022	An Bord Pleanála	Cover Letter, Planning Report, Site Location plan, Design and Cross Sections drawings, 3d photomontages	Met with ABP in October 2022
19/10/2022	President of UL	Letter explaining the route through UL	No response
18/11/2022	ESB	Letter explaining the project and locations of proposed connections to the ESB network	No response
20/06/2024	Breda Ingle	Update for planning application ABP-314351-22	Provided a timeline to ABP for submission in Q3 2024
26/08/2024	Office of Public Works	Query about Section 50 requirement for culverts	Response received. Section 50 assessment required throughout.
07/01/2025	IDA Castletroy	Stakeholder letter and Location map	No response
07/01/2025	UL Facilities	Stakeholder letter and Location map	No response
07/01/2025	Failte Ireland	Stakeholder letter and Location map	No response
07/01/2025	Waterways Ireland	Stakeholder letter and Location map	No response
07/01/2025	Inland Fisheries Ireland	Stakeholder letter and Location map	No response
07/01/2025	Environmental Protection Agency	Stakeholder letter and Location map	No response
07/01/2025	Dept. of Environment	Stakeholder letter and Location map	No response
07/01/2025	Dept. of Housing, Local Government and Heritage	Stakeholder letter and Location map	No response
07/01/2025	ESB	Stakeholder letter and Location map	No response
07/01/2025	Eirgrid	Stakeholder letter and Location map	No response

07/01/2025	Uisce Eireann	Stakeholder letter and Location map	No response
07/01/2025	An Taisce	Stakeholder letter and Location map	No response
25/03/2025	An Bord Pleanála	LCG determination for EIA report	No response
25/03/2025	LCCC Ecologist	Stakeholder letter and Location map	No response
25/03/2025	LCCC Archaeologist	Stakeholder letter and Location map	No response
25/03/2025	LCCC Conservation Officer	Stakeholder letter and Location map	No response
29/04/2025	OPW	OPW letter and Map	No response
30/04/2025	An Bord Pleanála	Letter and 2nd pre-application consultation meeting minutes, request to close pre-consultation process	Response received on 20th May 2025. Pre-consultation process closed.
20/05/2025	NPWS (DAU)	Letter re Bats and Public lighting, Location map	No response
17/06/2025	Rosa Donovan (Fisherman cottages)	Rosa Donovan letter with flood relief text and relevant drawings	No response
17/06/2025	Inland Fisheries Ireland	Letter regarding proposed construction works at riverbanks	No response
July 2025	IDA Castletroy	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	UL Facilities	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Failte Ireland	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Waterways Ireland	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Inland Fisheries Ireland	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Environmental Protection Agency	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Dept. of Environment	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Dept. of Housing, Local Government and Heritage	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	ESB	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Eirgrid	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder

July 2025	Gas Networks Ireland	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Uisce Eireann	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	An Taisce	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Fire Service	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	HSE Ambulance	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	An Garda Siochana	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	UL Director of the Buildings and Estates department	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	OPW	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Clare County Council	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	TII	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	NTA	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Arts Council	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Heritage Council	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Southern Regional Assembly	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Department of Transport	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Dept. of Tourism, Culture, Arts, Gaeltacht, Sports and Media	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder
July 2025	Commissioner of Public Works in Ireland	Letter notifying Stakeholder that Planning Application has been issued to ACP	Not yet issued to Stakeholder

3.3. EIAR Scoping

Scoping is carried out in accordance with the 'Environmental Impact Assessment of Projects - Guidance on Scoping' (EPA, 2017), 'Advice Notes on Current Practice in the preparation of Environmental Impact Statements' (EPA, 2015), 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment' (DoHPLG, 2018) and "Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) (EPA, 2022). Scoping is the process of determining the content, depth and extent of topics to be covered in the environmental information to be submitted to a competent authority for projects that are subject to an Environmental Impact Assessment (EIA). This process is conducted by contacting the relevant authorities and Non-Governmental Organisations (NGOs) with interest in the specific aspects of the environment likely to be affected by the proposal. These organisations are invited to submit comments on the scope of the EIA and EIAR and the specific standards of information they require. Comprehensive and timely scoping helps ensure that the EIAR refers to all relevant aspects of the proposed development and its potential effects on the environment and provides initial feedback in the early stages of the project, when alterations are still easily incorporated into the design. In this way scoping not only informs the content and scope of the EIA, it also provides a feedback mechanism for the proposal design itself.

3.3.1. Informal Scoping Report

An EIA scoping report, introducing the proposed Limerick City Greenway (UL to NTP) by providing details of the projects preferred route, was prepared by Ryan Hanley and circulated in March 2021. A copy of the Scoping Report, along with the preliminary drawings for the Greenway, was issued to all relevant stakeholders that have been identified as likely concerned by the project. Refer to Table 3-2.

The information provided in the scoping report was based on information gathered during earlier stages of the project including the constraints and options stages, existing environmental databases, reports and mapping.

3.4. Cumulative Assessment

The EIA Directive and associated guidance documents requires that the description of likely significant effects of a project includes an assessment of cumulative impacts that may arise. The factors to be considered in relation to cumulative effects include, inter alia, population and human health, ecology and biodiversity, water, land use, soils, geology, archaeology, architecture, cultural heritage, landscape, visual, air, noise, climate and material assets as well as the interactions between these factors. Each chapter of this EIAR has included a cumulative impact assessment section, which provides a thorough assessment of the potential for cumulative effects resulting from each factor of this project.

3.5. In Combination Assessment

The potential impacts arising from the proposed Greenway when considered in combination with other relevant plans and projects has been carried out in each chapter, with the purpose of identifying what influence the proposed development will have on the surrounding environment when considered in combination with relevant permitted, proposed and constructed projects in the vicinity of the proposed site.

The material was gathered through a search of relevant online Planning Registers, reviews of relevant environmental documents, other phases of Greenway & cycle route projects, planning applications & drawings, and served to identify past and future projects, their activities and their potential environmental impacts.

In general, projects which have the potential for cumulative effects are referred to where relevant, in the individual chapters of this report. A summary of relevant plans and projects which have the potential to cause cumulative effects, and which are relevant to every chapter, are included in Table 3-3.

Table 3-3: Summary of relevant plans and projects

Plans and Projects	Description
Limerick Development Plan 2022-2028	The Limerick Development Plan 2022 – 2028 (LDP) envisages Limerick as the principal focus within the region, with the potential to generate and be the focus of significant employment and housing growth. The LDP is underpinned by a strategic vision intended to guide the sustainable future growth of Limerick. At the core of the vision is cohesive and sustainable communities, where cultural, natural and built environment is protected. The vision embraces inclusiveness and a high quality of life for all, through healthy place-making and social justice, including the ongoing development of the Regeneration Areas and disadvantaged communities. An integrated approach will align housing and public transport provision. Human and environment wellbeing including climate adaptation are at the core of the vision. The strategic vision of the LDP reads as follows: "By 2030, Limerick will become a green City region on the Shannon Estuary connected through people and places. This will be achieved through engagement, innovation and resilient urban development and self-sustaining rural communities" The following are the interlinked strategic objectives of the Plan: ▪ Grow Limerick's economy and create opportunity through maximising the potential for development through the promotion and enhancement of the competitive advantages of Limerick, including its strategic location, connectivity and accessibility to international markets, a skilled workforce and a high quality of life. ▪ Transition to an environmentally sustainable carbon neutral economy. ▪ Ensure new residential development is of the highest quality, enabling life cycle choices and physical, community, recreation and amenity infrastructure are provided in tandem, to create sustainable, healthy, inclusive and resilient communities.

Plans and Projects	Description
	▪ Protect the unique character of Limerick. Support and facilitate revitalisation and consolidation of the City, towns and villages, through public realm and place-making initiatives. Address vacancy and dereliction to create compact attractive, vibrant and safe environments in which to live, work, visit and invest. Ensure the highest quality of public realm and urban design principles are applied to all new developments, including the construction of landmark buildings in appropriate locations. ▪ Create a competitive environment in which to do business. Promote, support and enable sustainable and economic development, enterprise and employment generation. Focus in particular on areas which are accessible by public and sustainable modes of transport. Enable settlements and rural areas to become self-sustaining through innovation and diversification of the rural economy. ▪ Reduce car dependency and promote and facilitate sustainable modes of transport. Prioritise walking, cycling and public transport. Provide an appropriate level of road infrastructure, road capacity and traffic management, to support existing and future development and enhance connectivity. ▪ Protect, enhance and ensure the sustainable use of Limerick's key infrastructure, including water supplies and wastewater treatment facilities, energy supply including renewables, broadband and transportation. ▪ Protect, enhance and connect areas of natural heritage, green infrastructure and open space for the benefits of quality of life, biodiversity, protected species and habitats, while having the potential to facilitate climate change adaptation and flood risk measures. ▪ Protect, conserve and enhance the built and cultural heritage of Limerick, through promoting awareness, utilising relevant heritage legislation and ensuring good quality urban design principles are applied to all new developments. The principle that well planned and integrated development enhances the sustainability, attractiveness and quality of an area should be at the centre of any proposal.

Plans and Projects	Description
	▪ Support growth in the tourism sector in Limerick and capture key opportunities to grow the sector based around four key drivers – o Waterways, o Activities, o Heritage, o Arts and Culture, in an urban and a rural environment.
Limerick Shannon Metropolitan Area Transport Strategy (LSMATS)	This Strategy sets out the framework for the delivery of the transport system required to further the development of the Limerick Shannon Metropolitan Area as a hub of cultural and social development and regeneration; as the economic core for the Mid-West; as an environmentally sustainable and unified metropolitan unit; as a place where people of all ages can travel conveniently and safely; and a place that attracts people, jobs and activity from all over Ireland and beyond.
Limerick County Council planning register	The review of the Limerick County Council online planning register was undertaken and documented relevant general development planning applications within the study area, most of which relate to recent upgrades and improvements to manufacturing and healthcare facilities in the National Technology Park as well as some extension works on Mulcair drive; some of which are outlined below. These applications have also been taken account on describing the baseline environment and in the relevant assessments. Permission sought in 2018 for a ten-year planning permission for a multipurpose manufacturing building, warehouse and auxiliary infrastructure (Planning Ref: 181020) Permission sought in 2019 for first floor office area over existing production area at J&J facility. (Planning Ref: 2051782) Permission sought in 2019 for extension to main J&J building extending the main production area, replacement of existing tanks etc (Planning Ref: 157046) Permission sought in 2020 for extension to existing common room mezzanine at Millstream Building in UL (Planning Ref: 181263) Permission sought in 2020 for the construction of a new temporary pre-fabricated multi-sensory room and all associated ancillary site works at St. Vincent's School (Planning Ref: 2076)

Plans and Projects	Description
	Permission sought for a new site entrance from Plassey Road and parking (Planning Ref: 191027) Permission sought in 2021 for single story extensions to existing J & J building, construction of waste storage yard etc (Planning Ref: 211275) Permission sought by J&J in 2021 for removal of existing ditch, erection of fence, tree planting, landscape works, extension of walking amenity etc (Planning Ref: 2113902) Permission sought by J&J in 2021 for erection of fence & gate to the northern boundary of the Vision care site (Planning Ref: 211792) Permission sought by J&J in 2021 for a water recycling plant, storage tanks, access road, perimeter fence and ancillary site works (Planning Ref: 211793) Permission sought in 2022 for the repairs to the pontoon and gangway adjacent to UL boat house (Planning Ref: 22281) Permission sought in 2023 by the University of Limerick for the redevelopment of an existing sports pitch just east of Kilmurry Student Village (Planning Ref: 2360712) Permission sought by UÉ in 2023 for Castletroy WWTP upgrade (Planning Ref: 23316168) Permission sought by the IDA in 2025 for proposed surface water drainage and flood defences (Planning Ref: 25/60477)

3.6. REFERENCES

Department of Housing, Planning and Local Government (August 2018) Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment. DHPLG, Dublin.

Environmental Protection Agency (2017) Environmental Impact Assessment of Projects - Guidance on Scoping. EPA, Wexford.

Environmental Protection Agency (2015) Advice Notes on Current Practice in the preparation of Environmental Impact Statements. EPA, Wexford.

Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) (2022), EPA.

Limerick City and County Council, National Transport Authority (2019). Limerick Metropolitan Cycle Network Study.

Ryan Hanley (2020). Constraints Study Report.

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4 DESCRIPTION OF THE PROPOSED DEVELOPMENT

This chapter describes the construction activities and sequencing of works for the proposed Limerick City Greenway (UL to NTP) project and outlines the general mitigation measures which will be implemented to ensure the potential impacts of the construction activities on the environment are avoided, prevented and/or reduced.

Limerick City and County Council (LCCC) propose to develop and maintain the proposed Limerick City Greenway (UL to NTP) which commences west from the existing River Groody bridge and will run along the southern bank of the River Shannon on an existing paved and unpaved walking track before turning south to connect to University Road in the University of Limerick (UL) campus, and McLaughlan Road in the National Technology Park (NTP).

Refer to the Preliminary Design drawings in Appendix A for Chainages.

4.1 EXISTING GRAVEL PATH, GREEN FIELD, AND ROADS

The proposed Limerick City Greenway (UL to NTP) will be constructed alongside the southern bank of the River Shannon between the River Groody bridge and east of Cook Medical in the IDA park. There will be links perpendicular to the river between Kilmurray Student Village and University Road, and between Cook Medical/McLaughlan Road and Plassey Park Road.

Refer to the Preliminary Design drawings in Appendix A for Chainages.

CH000 – CH300

The proposed route commences west from the existing River Groody bridge (Figure 4-1) at the confluence of the River Groody with the River Shannon.

Figure 4-1: Existing Bridge at River Groody

The proposed Greenway route will divert from and run adjacent to an existing narrow walking track along the southern bank of the River Shannon. The existing narrow path has a wooden fence along its sides and there have been complaints to LCCC from the public regarding the width of the path, especially in relation to the speed of cyclists and scooter users. For this reason a new 3.5m wide path is proposed to be constructed between CH0-300.

Figure 4-2: Start of proposed greenway in green field with existing path alongside

CH300-CH430

The proposed greenway will cross the land drain and rejoin the existing path which will be resurfaced but the existing path will remain the same. The path will avoid a small forest of trees that were planted to compensate for habitat loss when the Living Bridge that connects the UL Campus that is located in Co. Limerick and in Co. Clare was constructed. The path will cross the existing bridge at CH400.

Figure 4-3: Existing bridge at CH400

CH430-CH615

The proposed greenway will divert away from the existing path and run through a green field. It will cross a land drain.

CH615-CH795

The proposed greenway will rejoin the existing path and run in front of the UL Boat Club building, and the UL slipway. The existing ESB covered will be raised to match the level of the proposed greenway (approx. 150mm higher than existing).

Figure 4-4: Existing path to be resurfaced

The proposed greenway will continue along the existing paved path until the surface changes from paved to gravel surface. It will connect to an existing shared surface leading to the UL campus.

Figure 4-5: Paved path connects to shared path leading to UL

Figure 4-6: Existing Project information sign for Limerick Smarter Travel Cycle Route 2

Figure 4-7: Existing direction sign outside the UL Boat Club and slipway in background

There is existing public lighting along the existing path between the River Groody bridge and the UL Boat House. Refer to the black column and lantern in Figure 4-8.

Figure 4-8: Examples of existing Public Lighting Column and Lantern along Limerick Smarter Travel Cycle Route 2

East of the paved path towards the UL campus, the existing path surface changes from tarmac to gravel.

Figure 4-9: Path surface changes from paved to gravel and narrows to approximately 1.5m width

CH795

The path will cross a bridge over a land drain (Named as Bridge 1 for the purposes of this project). There is a stone parapet on the River Shannon side of the bridge and a metal railing on the opposite side. There are wooden fences leading to the bridge on the eastern and western approaches.

Figure 4-10: Existing Bridge No 1

Figure 4-11: Existing bridge over land drain (Bridge 1)

Figure 4-12: Existing abutment wall (proposed to be decommissioned)

CH795-CH950

The proposed greenway will continue eastwards and pass along the existing gravel path north of the Castletroy wastewater treatment plant. There is a northern access into the plant with an existing route over a culverted land drain that will be included in the proposed greenway path.

Figure 4-13: View south to the northern access gate of Castletroy Wastewater Treatment Plant

Figure 4-14: View facing east outside the Castletroy wastewater treatment plant

There are existing concrete railings alongside the narrow gravel path. The proposed path will avoid two trees with a potential for a bat roost at CH850. No bat roosts have been identified in these trees, but the trees will remain.

CH950-CH980

The existing path continues to an existing narrow stone bridge (named as Bridge 2 in this project). The surface changes from gravel to paved.

There are existing stone abutments and a high stone wall at Bridge 2.

Figure 4-15: Existing path and stone bridge along Shannon River leading to Bridge 2

Figure 4-16: View of Bridge 2 from the exiting paved path

The existing stone parapet that is missing in Figure 4-17 has been reset into position by LCCC since the photo was taken.

Figure 4-17: View of Bridge 2 from bank of drain

Figure 4-18: View under Bridge 2 facing north to the River Shannon

Figure 4-19: : Existing railing between Bridge 2 and Bridge 3

CH1000

The existing path continues to a temporary steel truss bridge that has replaced a concrete deck over an existing stone bridge (named as Bridge 3 in this project). This bridge crosses the Plassey Mill Race where it flows into the River Shannon.

Figure 4-20: Existing temporary bridge across the Plassey mill race where it rejoins the River Shannon

Figure 4-21: Shallow water level in Plassey Mill Race and existing abutments of Bridge 3

CH1000-1040

The existing path continues past a rest area north of Plassey Mills (Figure 4-22).

Figure 4-22: Existing bench in front of Plassey Mill

The existing bridge between Co. Limerick and Co. Clare is to the north of this area (Figure 4-23). This bridge is known locally as the 'Black bridge'.

Figure 4-23: Black bridge

Figure 4-24: Blocked access to the Black bridge that links County Limerick and County Clare

There is an existing kissing gate on the path east of the rest area in front of Plassey Mills.

Figure 4-25: Existing gate on path at Plassey Mills (1 of 2)

Figure 4-26: Existing gate on path at Plassey Mills (2 of 2

CH1040

The existing path continues eastwards towards an existing bridge (named as Bridge 4 in this project) across the decommissioned overspill for the Plassey Mill Race.

Figure 4-27: Existing bridge (Bridge 4) over the decommissioned and dry Plassey Mill race overspill

Figure 4-28: Dry bed of overspill from Plassey Mill Race

CH1040-CH1330

The existing path continues north of the existing Fisherman cottages, but the proposed path will turn south-east and run behind the Fisherman Cottages as requested by the residents. This area is characterised by uneven poorly drained ground with thick undergrowth. The residents in the cottages have reported regular flooding in their properties so this project will construct a new flood defence system for the residents.

Figure 4-29: Thick vegetation with immature trees with Plassey Mills in the background

Figure 4-30: Heavy undergrowth to rear/south of Fisherman Cottages

Figure 4-31: Trees to south/rear of Fisherman Cottages (cottage partially visible)

Figure 4-32: Existing Bee Hives east of the Fisherman Cottages

Figure 4-33: Existing kissing gate at the Garrisson Wall to be retained on the gravel path that runs in front of the Fisherman cottages

There is an existing gravel path to the east of the Fisherman Cottages that connects to existing shared paths in the UL Campus.

Figure 4-34: Existing gravel path east of Fisherman Cottages

CH1330-CH1340

The proposed path will rejoin the existing path and will pass under an existing bridge between Co. Limerick and Co. Clare.

Figure 4-35:: Existing road bridge between the UL campus in Co. Limerick and Co. Clare

Figure 4-36: View of existing gravel path under road bridge that links UL campus between Co. Limerick and Co. Clare

CH1340-CH1410

East of the road bridge the existing path continues eastwards along the southern bank of the River Shannon and towards the existing Dromroe Student village in the UL Campus. The existing path runs through a designated Annex 1 habitat Alluvial woodland forest. UL Facilities has planted Oak trees between Dromroe Student village and the existing path at this location.

Figure 4-37: Existing gravel path along southern bank of the River Shannon

Figure 4-38: Extent of Annex 1 Alluvial Forest interactions with existing path and proposed Greenway route

CH1410-1730

To avoid the existing avenue of beech trees in the Annex 1 Alluvial Woodland forest alongside the riverside path, the proposed greenway route will divert to the south of the beech trees and north of the Oak trees towards a newly planted stand of birch trees. The existing gravel path will remain unaltered.

Figure 4-39: Existing Beach and newly planted Oak trees between the River Shannon and Dromroe Student village

Figure 4-40: Existing gravel path alongside river through an avenue of mature trees in the Annex 1 Alluvial forest

A 6.5m wide strip of immature Birch trees will be removed to provide space for the proposed greenway.

Figure 4-41: Existing immature trees to be removed

The existing path continues under the Living Bridge.

Figure 4-42: Living Bridge in UL campus

Figure 4-43: Existing gravel path under the Living Bridge

CH1730-CH1965

The existing earthen path enters an existing Annex 1 Alluvial woodland and continues eastwards on a raised earth path north of the Plassey Mill Race and approximately 10-20m to the south of the River Shannon.

Figure 4-44: Existing raised earthen path in the Annex 1 habitat Alluvial residual forest

CH1965-CH2150

An existing footbridge from the UL campus joins the earth path at CH1915.

Figure 4-45: Existing footbridge to University of Limerick and flowering Himalayan Balsam (looking west)

The existing earthen path continues eastward on an elevated earth mound with the Plassey Mill Race to the south and the River Shannon to the north.

Figure 4-46: Existing stone steps from earthen path to Plassey Beach

CH2150-CH2250

The existing earthen path continues alongside Plassey Beach.

Figure 4-47: Unpaved path at Plassey Beach

CH2250

There is an existing reinforced concrete bridge that crosses the start of the existing Plassey Mill race.

Figure 4-48: Existing concrete bridge at mouth of Plassey mill race (to be retained)

Figure 4-49: Existing concrete bridge at mouth of Plassey mill race with Plassey Beach in the background

Figure 4-50: Existing concrete bridge at mouth of Plassey mill race looking northeast

CH2250-CH2500

The existing route passes north of Kilmurray Student Village and reaches a junction.

Figure 4-51: Existing gravel path north of Kilmurray Student Village

The route south provides access to University Road and to Plassey Park Road. The route east provides access to Cook Medical in the IDA's National Technology Park and McLaughlan Road.

Figure 4-52: Existing earthbound path south of the River Shannon

Figure 4-53: Existing path east of Kilmurray Student village approaching the land boundary between UL and the IDA

Figure 4-54: Existing gate and culvert at the land boundary between UL and the IDA

CH2500-CH3180

The path changes from an earthen path to a desire line and continues eastwards running generally 20-50m south of the southern bank of the River Shannon. It crosses under overhead electric wires.

Figure 4-55: Desire line through green field

Figure 4-56: Desire line through green field approaching a small stand of trees

Figure 4-57: Desire line through green field weaving between small stands of trees

Figure 4-58: Proximity of desire line to River Shannon

Figure 4-59: Desire line along proposed Greenway route

CH3180-CH3490

The existing desire line continues along the southern bank of the River Shannon at the boundary between UL registered land and IDA registered land (approx. CH3180), but the proposed Greenway route turns south to McLaughlan Road.

Figure 4-60: Warning signs at the IDA boundary (at Cook Medical)

Figure 4-61: Overhead ESB utilities

Figure 4-62: Existing earth berm with Johnson & Johnson factory in background

Figure 4-63: Example of scrubland between the River Shannon and McLaughlan Road

CH3490-CH3805

There are existing concrete footpaths and grass verges alongside McLaughlan Road between the original entrance road into Cook Medical and Plassey Park Road. There is street lighting and other utilities including drainage, telecommunications, and underground electricity cables in this private road.

Figure 4-64: McLaughlan Road in the IDA park

Figure 4-65: McLaughlan Road in the IDA park with street lighting and junctions to other roads/entrances

Figure 4-66: McLaughlan Road where it joins Plassey Park Road (in background)

There is an existing zebra crossing on Plassey Park Road to the north-east of the junction between Plassey Park Road and McLaughlan Road.

Figure 4-67: Existing Zebra crossing on Plassey Park Road

CH000_C-CH300_C

There is a junction in the existing path east of Kilmurray Student Village and the southern route follows a desire line to an existing bridge east of the UL Agricultural Laboratory. The bridge crosses an existing drainage channel at the north of University Road.

Figure 4-68: Existing desire line connecting the riverside path to an existing bridge to the UL Agricultural Laboratory

There is a secure car parking area immediately south of the laboratory.

Figure 4-69: Secure car parking area immediately south of the laboratory

The entrance road to the UL Agricultural Laboratory runs west of the large drainage channel (bounded by an anti-climb fence) and there are rubbish bins and a car parking area between Kilmurray Student Village and the anti-climb fence. There is an entrance road and gate into Kilmurray Student Village that is generally locked. The gate opens onto University Road.

Figure 4-70: Existing gate access from Kilmurray Student Village to University Road

CH300_C-CH677_C

There are no footpaths along University Road but there are large parking bays and public lighting along the western side of the road. There are commercial/industrial buildings along the eastern side.

Figure 4-71: University Road (looking south)

Figure 4-72: Entrance to industrial buildings off University Road

The proposed Greenway will join into newly constructed Active Travel infrastructure at the southern part of University Road where it joins Plassey Park Road.

Figure 4-73: Junction of University Road and Plassey Park Road

4.2 PROPOSED GREENWAY AND BRIDGES

CH000 to CH795: Groody Bridge to Proposed Bridge 1

The proposed Greenway will divert to the southeast of the existing tarmac path because the existing path narrows to 2.2m width (between the existing wooden fences) and LCCC has received complaints from members of the public about near passes from cyclists and scooters. It is intended that walkers would continue to use the existing path and cyclists and other users travelling at speeds in excess of walking pace would utilise the proposed Greenway.

Figure 4-74: Proposed Greenway and existing path, and proposed rest area at CH 000

A new rest area with new benches will be provided (refer to Figure 4-95 for an example of the proposed bench). Proposed wooden bollards will redirect cyclists off the existing path and towards the proposed Greenway.

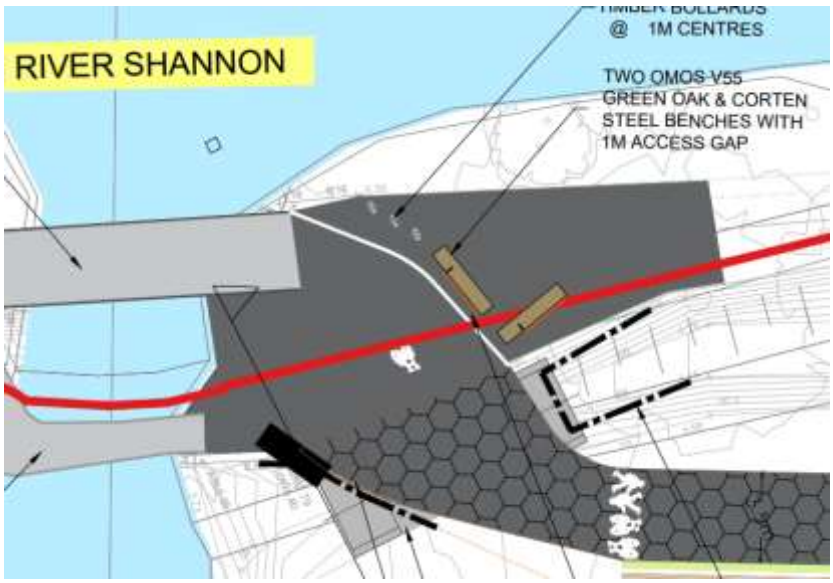

Figure 4-75: Proposed rest area at Groody Bridge

Figure 4-76: Example of wooden bollard that would be installed along the proposed Greenway

In the green field the proposed Greenway will run parallel to a land drain which runs parallel to the River Shannon. A proposed shallow land drain will run along the south side of the Greenway and drainage culverts will enable surface water to drain to the River Shannon. New public lighting will be provided.

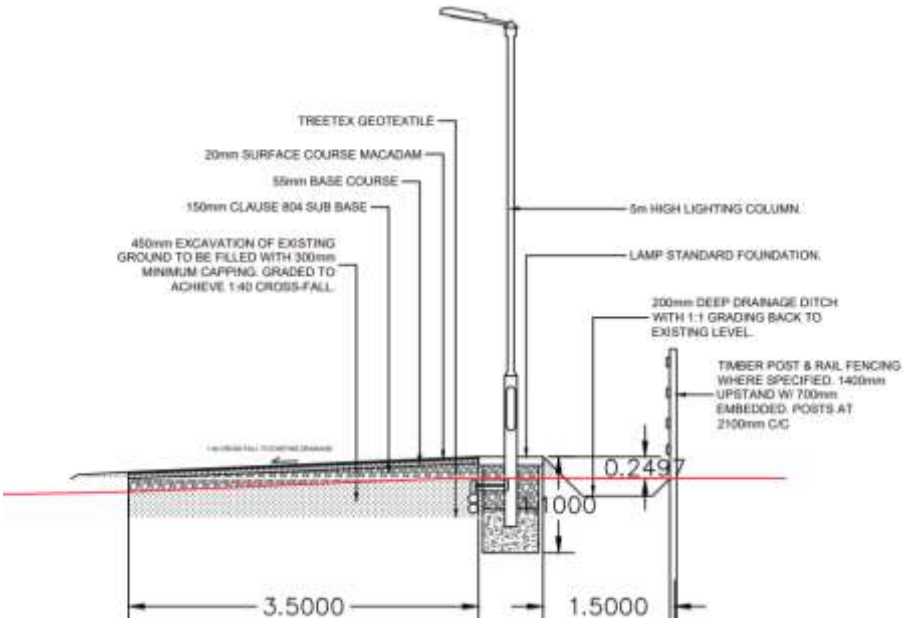

Figure 4-77: Proposed cross section of 3.5m greenway, public lighting column, and land drain

The proposed Greenway will divert north to join the existing 3.5m wide Smarter Travel path and avoid passing through a compensatory habitat area that was planted by the developers of the Living Bridge that connects the UL campus between Co. Limerick and Co. Clare. The proposed Greenway will cross an

existing bridge (CH 400). A new steel parapet will be installed above the low stone parapet on this existing bridge to replace the existing parapet which currently narrows the bridge.

Figure 4-78: Existing bridge at CH400

The existing path will be resurfaced.

In accordance with LCCC's tree replacement guide, there will be five trees planted for every tree that will be removed to facilitate construction of the proposed Greenway.

The proposed Greenway will divert south (@ CH430) east of the compensatory habitat area and continue in a green field until it will rejoin the existing 3.5m wide path immediately west of the UL Boat Club. The existing tarmac path will be resurfaced where it passes the existing slipway for the Boat club until CH725 where the existing 2.0m (approx.) wide gravel path will be replaced with a 3.5m wide tarmac path. The surface of the existing path will not be excavated except to install twin ducts for the public lighting and a cellular membrane will be paid onto the gravel path and appropriate building layers will form the base for the tarmacadam surface finish. This will ensure tree roots will not be disturbed.

Figure 4-79: Tree root protection system under new tarmac path in Fairview Park, Dublin 3

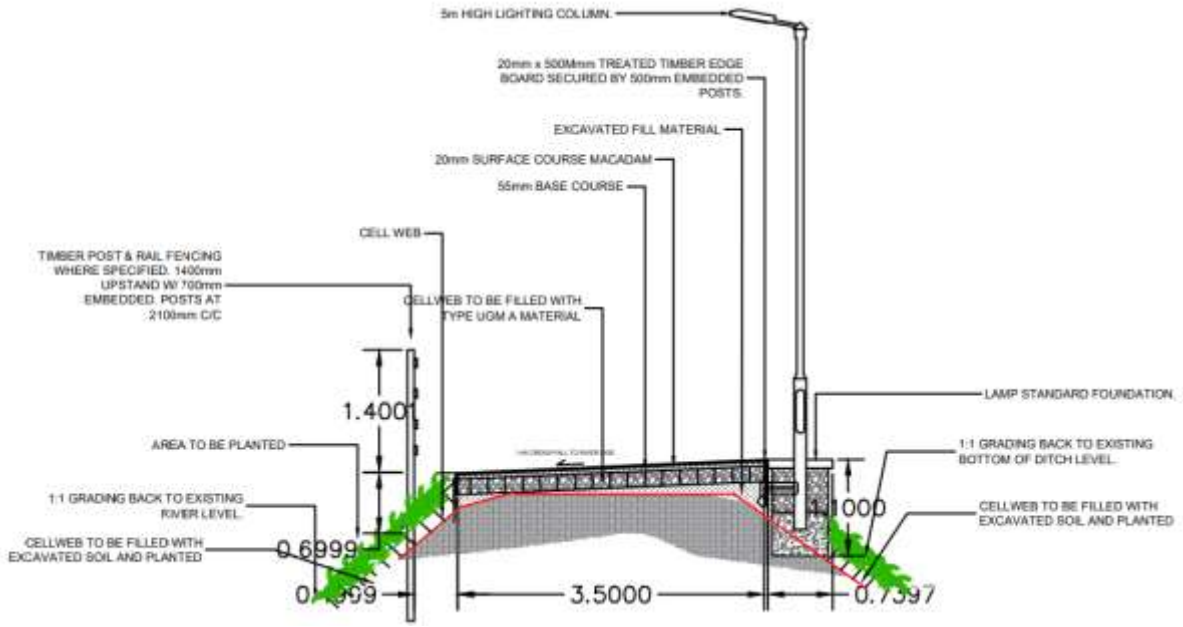

Figure 4-80: Replacement of gravel path with proposed 3.5m wide Greenway

At CH775 there is a proposed tarmac path to join to the existing UL campus shared surface. There are proposed replacement planting trees alongside this proposed path and a proposed bug hotel will be constructed from leftover construction wood and small bore tree branches that may be removed.

Figure 4-81: Example of a bug hotel that will recycle construction materials and reuse tree branches

CH795: Proposed Bridge 1

The proposed Greenway route will extend eastwards to an existing concrete bridge which will be replaced by a 4.8m long and 4.5m wide steel bridge on new concrete abutment walls (Bridge No. 1 @ CH 795). Refer to drawing RHA-XX-DR-C-PD0007.

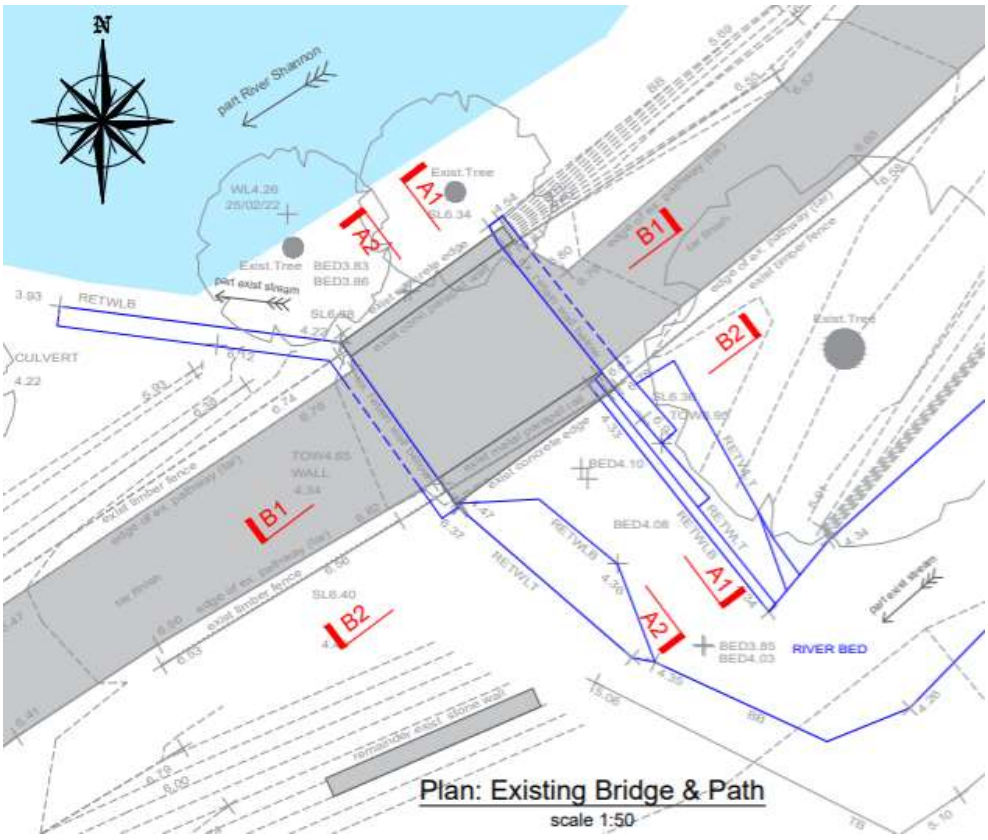

Figure 4-82: Plan of existing Bridge 1 (refer to drawing RHA-XX-DR-S-SP0010)

The existing bridge parapets, one is reinforced concrete, and the other is metal railing (refer to Figure 4-10, Figure 4-11, and Figure 4-12), will be taken down. The existing reinforced concrete bridge deck will be deconstructed by lifting it off the abutments and transporting it to the construction compound where it will be crushed. The crushed material will be recycled by using it to construct haul roads/temporary compounds/ and as a base for the proposed greenway path. Metal arisings, the parapet and the railing will be transported offsite to a licenced waste facility. The existing abutments will be deconstructed by breaking out the walls which will be removed to the construction compound for crushing and recycling, and the foundations will be exposed. Any concrete in the foundations will be broken out and mixed with stone rubble to form the base of the foundations for the proposed bridge abutments.

Dust will be suppressed during the wall and foundation breaking works. To avoid water runoff carrying fines, a shade cloth will be erected immediately adjacent to the concrete that will be broken out to trap dust arisings.

To carry out this deconstruction work and minimise the impact on the environment and local ecology there will be a water filled flood barrier to protect the work site from the River Shannon. To protect the River Shannon from contaminated liquids associated with construction activities including silt, a temporary sheet piled wall will be inserted into the riverbank between the water filled barrier and the worksite, and a silt curtain will be suspended in the River Shannon.

The breaking up and removal of the bridge abutment walls and foundation will be carried out on a dry day within a 6–8-hour period so those works will have a very short duration. The construction period of the bridge is expected to take 2-3 weeks. The existing drain under Bridge 1 is dry so there won't be a risk of drainage water running through the work site. The proposed sheet pile will prevent any material contaminated with dissolved chemicals (from broken concrete) from running into the river. The proposed shade cloth will prevent airborne dust from floating to the river. The proposed water filled flood barrier will prevent water from entering the worksite.

The proposed construction sequence for Bridge 1 is illustrated in Figure 4-83.

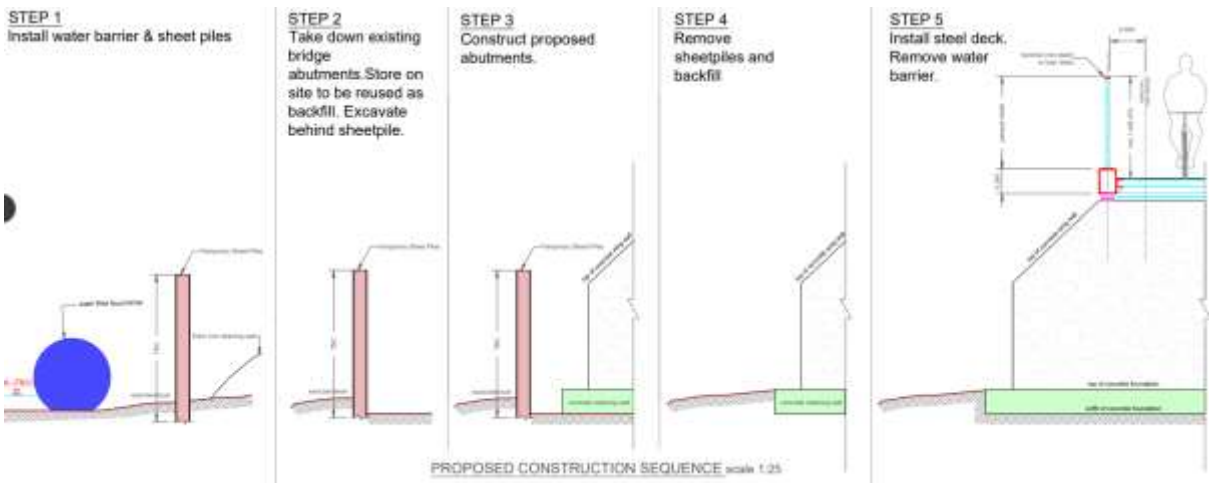

Figure 4-83: Proposed construction sequence for Bridge 1 (refer to drawing RHA-XX-DR-S-SP0012)

New bridge abutments are proposed to be constructed on new concrete foundations and a new steel deck with parapets will be installed by lifting a prefabricated structure into place. Refer to drawing RHA-XX-DR-S-SP0011.

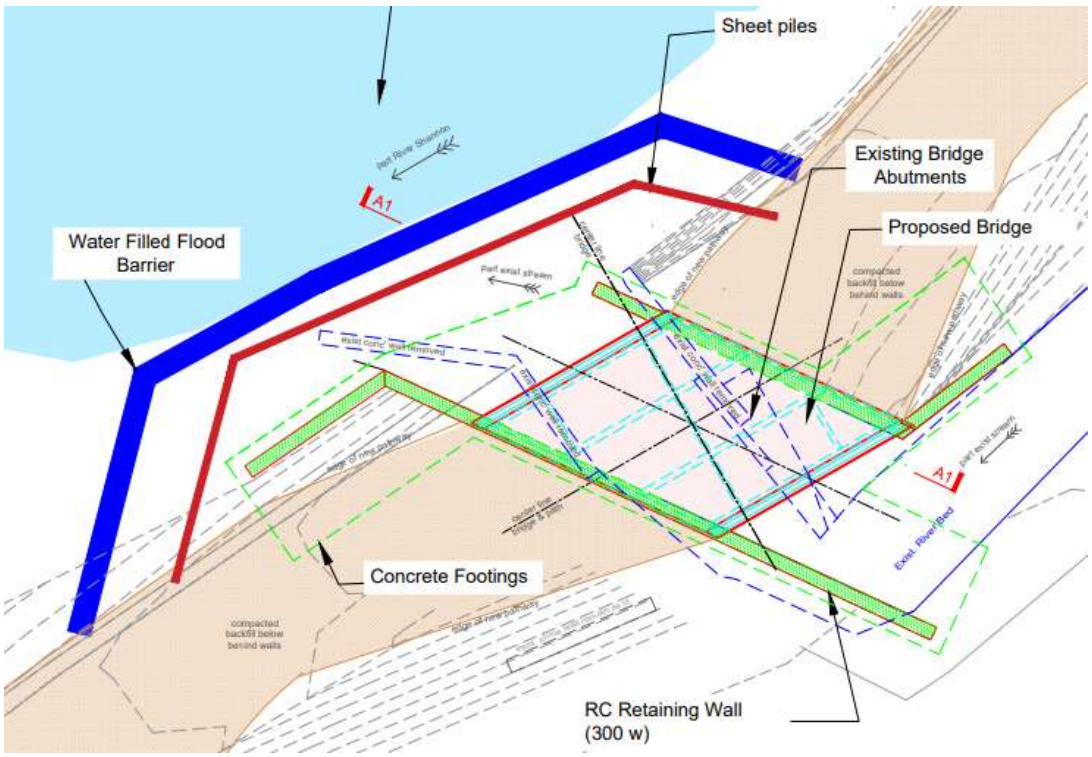

Figure 4-84: Proposed plan of Bridge 2, with ecology protection measures (refer to drawing RHA-XX-DR-S-SP0012)

Due to its proximity to the River Shannon which supports lamprey, the proposed works (including preparatory work) beside the River Shannon which supports salmonids shall be undertaken from May to October (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds, subject to the water level in the river.

Bat surveys have been carried out along the riverbank and in the location of Bridge 1. No trees with a potential for bat roots were identified at Bridge 1 and the closest tree with a potential for a Bar roost is 60m to the east.

The existing bridge and vegetation growing on it were surveyed by an experienced Ecologist to look for species such as dipper, grey wagtail, wren and other bird species that will use bridge structures as nesting sites, and there was no evidence of birds nests or bat roosts at the structure or vegetation. A survey by an experienced Ecologist shall be undertaken at Bridge 1 no more than 24 hours ahead of vegetation clearance or structure removal works to confirm there are no bats roosting or birds nesting in the vegetation or in the structure that will be taken down and removed.

The SAC boundary line runs through the existing and proposed bridge.

The existing area under Bridge 1 is dry so a flume is not proposed.

No refuelling will be permitted outside of construction compounds and all machinery will be periodically serviced and regularly maintained to ensure diesel and oils spills do not occur.

There will be a 40m long silt curtain installed in the River Shannon to catch any discharges from the worksite into the river. Silt curtains will catch materials that float or are suspended in the water. Silt curtains are typically made from PVC and closed-cell foam. They are a flexible, water permeable barrier that extends downwards in the body of water, where it is typically anchored or weighted to prevent the silt from moving. The foam provides buoyancy, while the PVC curtain controls sediment in the water.

Example photos of a silt curtain in the River Corrib in Galway are provided in Figure 4-85 and Figure 4-86.

Figure 4-85: Installation of a silt curtain in the River Corrib, Co. Galway

Figure 4-86: Silt curtain retaining contaminated water during advanced works for sheet piling

Figure 4-87: Example of sheet piling along the bank of the River Corrib

CH795 to CH970: Proposed 3-4m wide greenway

The proposed 3.5m wide greenway will be installed on top of the existing 1.5-2.0m wide gravel path and grass verges (refer to the cross section in Figure 4-77). The proposed Greenway will pass two trees with bat roost potential (although no roosts have been identified) at CH850. he public lighting columns have been designed at maximum distances from these trees to minimise light impact on bats if bats were to create roosts there in the future.

CH970: Proposed Bridge 2

The proposed Bridge No. 2 @ CH 970 will be a new 9.6m long and 4.5m wide steel and concrete bridge, and it will be constructed alongside an existing stone bridge. No demolition works are required for Bridge 2.

A photomontage which illustrates the proposed Bridge 2, the proposed Bridge 3, and the proposed amenity area can be seen in Figure 4-88.

Figure 4-88: Proposed bridges No 2 & 3 and rest area east of Plassey Mills

Due to its proximity to the River Shannon which supports lamprey, the proposed foreshore works (including preparatory work) beside all watercourses supporting salmonids shall be undertaken from May to October (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds, subject to the water level in the river.

The SAC boundary line runs through the proposed bridge.

The existing Bridge 2 plan and section are provided in Figure 4-89.

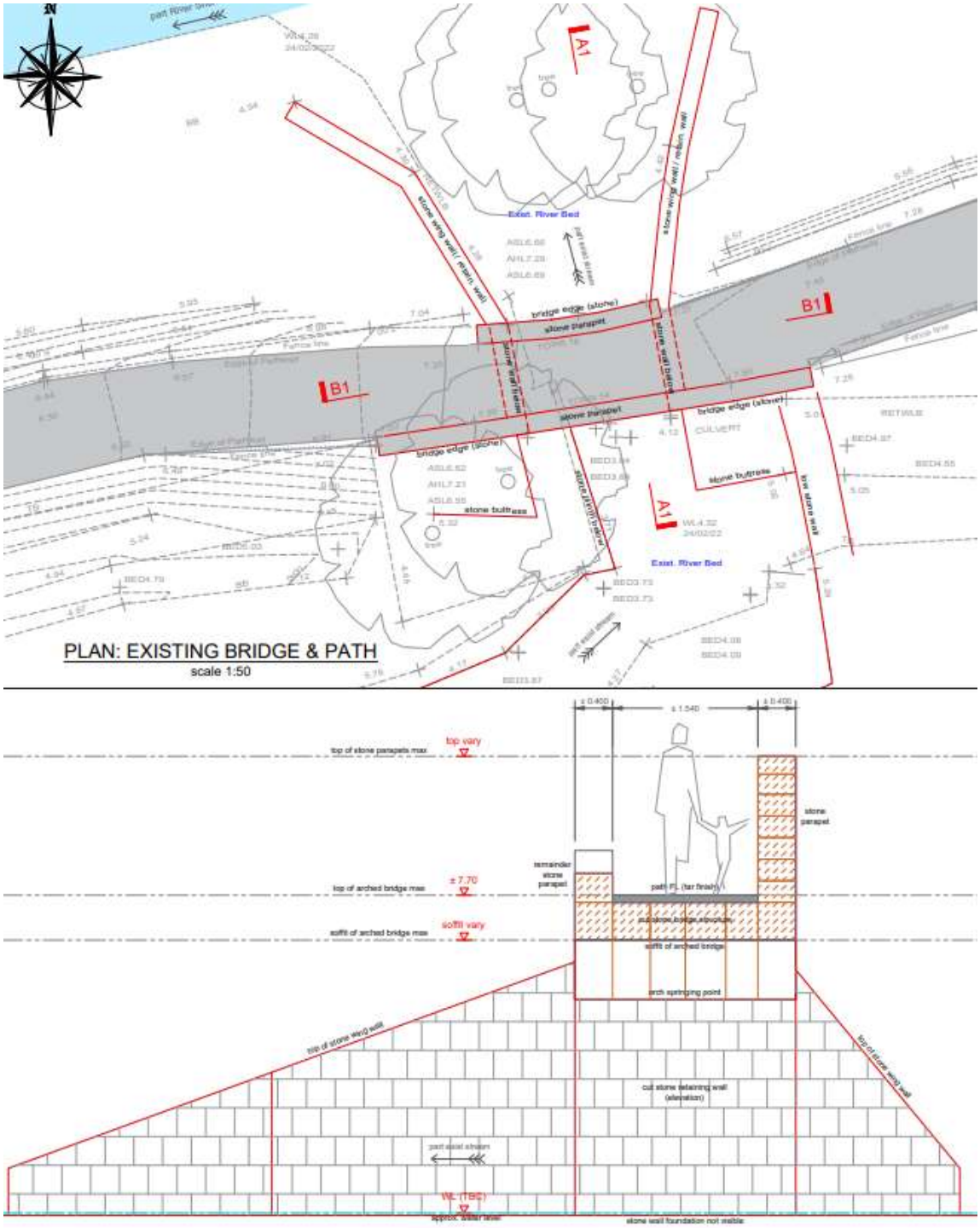

Figure 4-89: Existing plan and section for Bridge 2 (refer to drawing RHA-XX-DR-S-SP0020)

The plan for the proposed new bridge 2 alongside the existing stone bridge is illustrated in Figure 4-90 and the section drawing that illustrates the same is in Figure 4-91. The abutment for the existing stone bridge will remain untouched. The stonework for the existing bridge will be repointed and cleared of debris, and the low parapet wall will be restored by a stonemason, and a new metal railing will be installed onto it to ensure the existing stone bridge complies with current design standards for bridge parapets, i.e., 1.45m high. The bottom of the new metal parapet railing on the existing low stone parapet

will follow the arc of the stone wall to preserve its historical function which was to allow a tow rope to slide over the parapet while a horse was towing a barge down the River Shannon.

Figure 4-90: Plan for the proposed new bridge 2 alongside the existing stone bridge (refer to drawing RHA-XX-DR-S-SP0021)

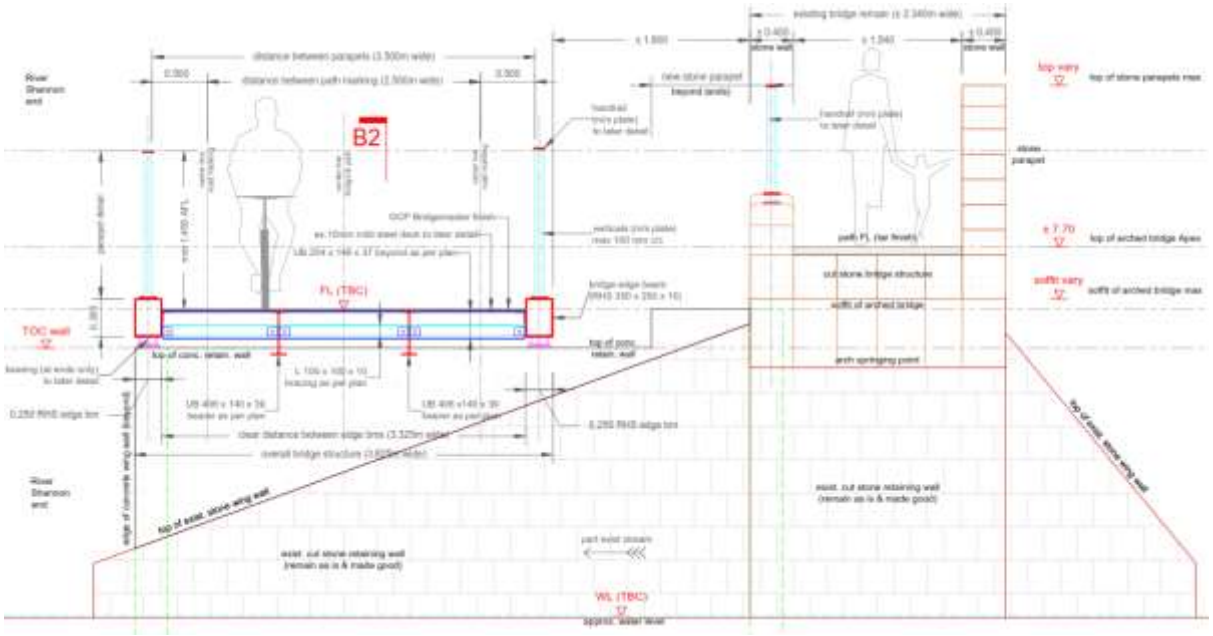

Figure 4-91: Section for the proposed new bridge 2 alongside the existing stone bridge (refer to drawing RHA-XX-DR-S-SP0021)

To carry out this construction work and minimise the impact on the environment and local ecology there will be a water filled flood barrier to protect the work site from the River Shannon. To protect the River Shannon from contaminated liquids associated with construction activities including silt, a temporary sheet piled wall will be inserted into the riverbank between the water filled barrier and the worksite, and a silt curtain will be suspended in the River Shannon. Refer to drawing RHA-XX-DR-S-SP0022.

The construction period of Bridge 2 is expected to take 2-3 weeks. The existing stream under Bridge 2 will be flumed during the works to keep the work site dry. The proposed sheet pile will prevent any material contaminated from running into the river. A proposed shade cloth will prevent airborne dust

from floating to the river. The proposed water filled flood barrier will prevent river water from entering the worksite.

There will be a 60m long silt curtain installed in the River Shannon to catch any discharges from the worksite into the river. Silt curtains will catch materials that float or are suspended in the water. Silt curtains are typically made from PVC and closed-cell foam. They are a flexible, water permeable barrier that extends downwards in the body of water, where it is typically anchored or weighted to prevent the silt from moving. The foam provides buoyancy, while the PVC curtain controls sediment in the water. Example photos of a silt curtain in the River Corrib in Galway are provided in Figure 4 85 and Figure 4 86.

Tree felling of immature trees and saplings will be required in the September to February period before the construction work for Bridge 2. All trees to be cut down shall be inspected by an experienced and qualified Ecologist to check for nests and roosts (despite their very limited habitat potential) and shall be laid on the ground for at least 24 hours before they will be recycled or mulched.

There will be aquatic wall plates bolted to the new abutments where they will be in contact with river/surface water drainage water. The purpose of the aquatic plates is to provide a habitat for fish and other aquatic life.

Figure 4-92: Example of aquatic plates to be installed on bridge abutments

CH1000: Proposed Deck replacement for Bridge 3

The existing temporary bridge across the Plassey Mill race @ CH1000 will be replaced with a new 5.4m long and 4.5m wide steel bridge deck. The new steel deck and parapets will be lifted onto new concrete plinths which will be cast directly onto the stone abutment walls. Refer to drawing RHA-XX-DR-S-SP0031.

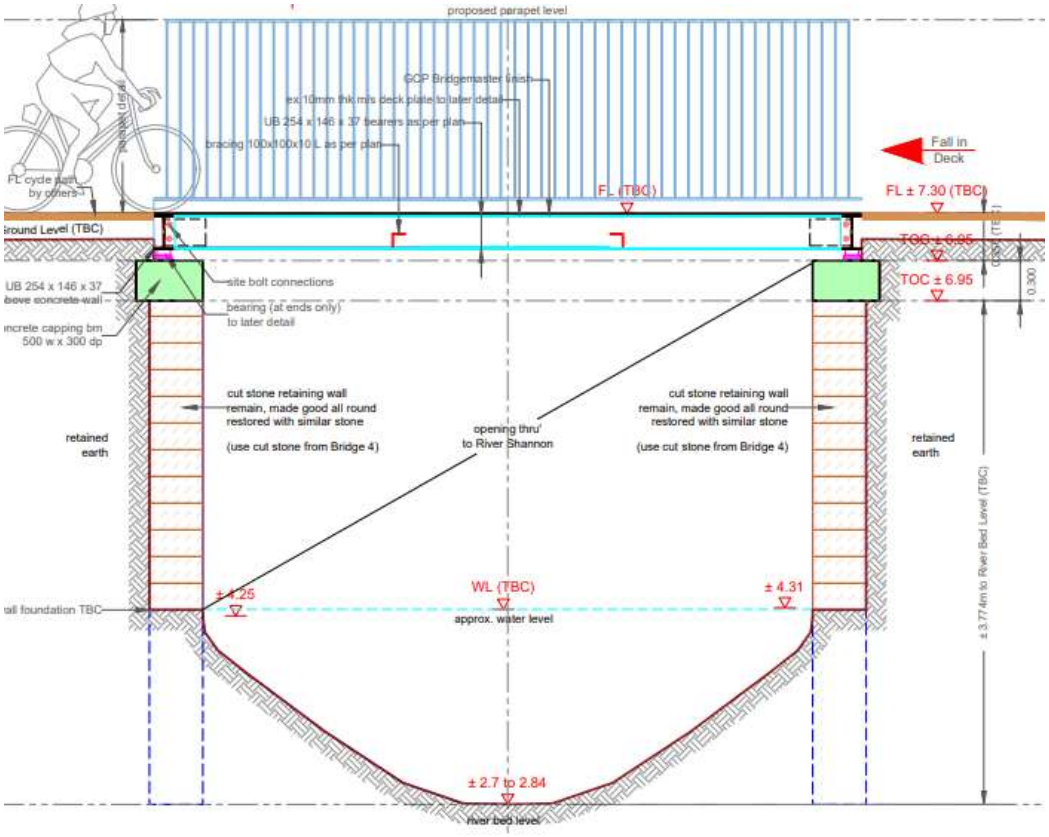

Figure 4-93: Proposed deck replacement for Bridge 3 with new concrete plinths on existing stone abutments

Due to its proximity to the River Shannon which supports lamprey, the proposed foreshore works (including preparatory work) beside all watercourses supporting salmonids shall be undertaken from May to October (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds, subject to the water level in the river.

There will be two 6m long silt curtains installed in the Mill Race stream to catch any discharges from the worksite into the stream. Silt curtains will catch materials that float or are suspended in the stream water. They are a flexible, water permeable barrier that extends downwards in the body of water, where it is typically anchored or weighted to prevent the silt from moving. Silt curtains are typically made from PVC and closed-cell foam. The foam provides buoyancy, while the PVC curtain controls sediment in the water.

The SAC boundary line runs through the existing and proposed bridge. Refer to the red line in Figure 4-94.

CH1010 to CH1030: Proposed rest area at Plassey Mills

The plan for the proposed rest area at Plassey Mills is illustrated in Figure 4-94.

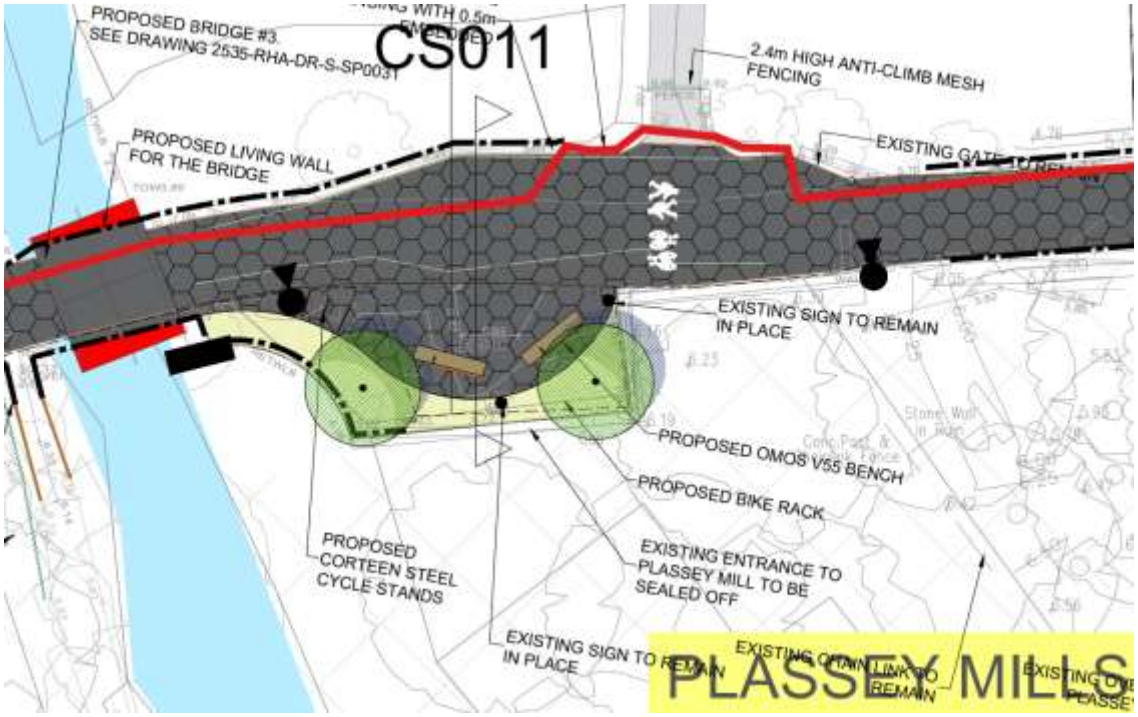

Figure 4-94: Proposed rest area at Plassey Mill

Two new benches similar to an OMOS green oak and Corten steel bench will be provided. A rack of new Corten steel cycle stands will also be provided and two new native Irish trees with understory will soften the interface between the existing stone/block walls and the proposed tarmac path surface.

Figure 4-95: Green Oak and Corten steel seat and cycle stand

A future connection to the Black bridge across the River Shannon to Co. Clare could join the proposed Greenway at this rest area.

CH1045: Proposed deck replacement for Bridge 4

A proposed 5.1m long and 4.5m wide steel bridge deck for Bridge 4 @ CH 1045 will replace the existing 3m wide concrete bridge deck across the overspill for the Plassey Mill race. The existing reinforced concrete bridge deck will be deconstructed by lifting it off the cut stone abutment walls and transporting it to the construction compound where it will be crushed. The crushed material will be

recycled by using it to construct haul roads/temporary compounds/ and as a base for the proposed greenway path. Metal arisings and the existing steel parapets will be transported offsite to a licenced waste facility. The existing cut stone abutment walls and foundations will remain in-situ. The proposed steel deck will sit on top of a concrete plinth that will be set into place on the existing stone abutments. The existing width of the dry Plassey Mill Race overspill channel will not be impacted.

New parapets will replace the existing stainless-steel parapets. Refer to drawing RHA-XX-DR-S-SP0042.

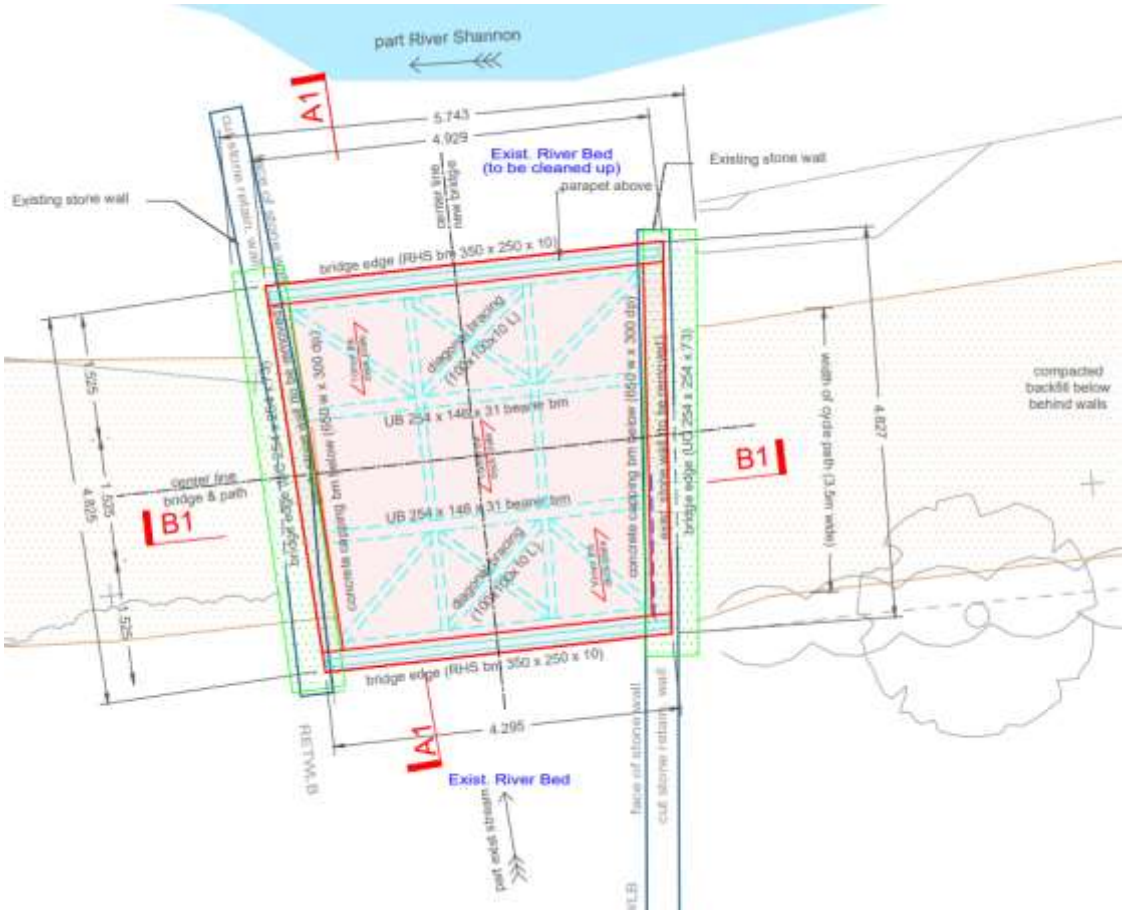

Figure 4-96: Proposed plan of Bridge 4 deck replacement

Due to its proximity to the River Shannon which supports lamprey, the proposed foreshore works (including preparatory work) beside all watercourses supporting salmonids shall be undertaken from May to October (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds, subject to the water level in the river.

The SAC boundary line runs through the existing and proposed bridge.

There are no trees proposed for removal to construct Bridge 4.

CH1050 to CH1320: Proposed route south of Fisherman Cottages

The proposed Greenway will turn southeast and will continue south of a collection of fishing huts and cross a section of mixed broadleaved woodland and amenity grassland (approx. CH 1050 – CH 1250).

The plan for the proposed Greenway route south of the Fisherman cottages is illustrated Figure 4-97.

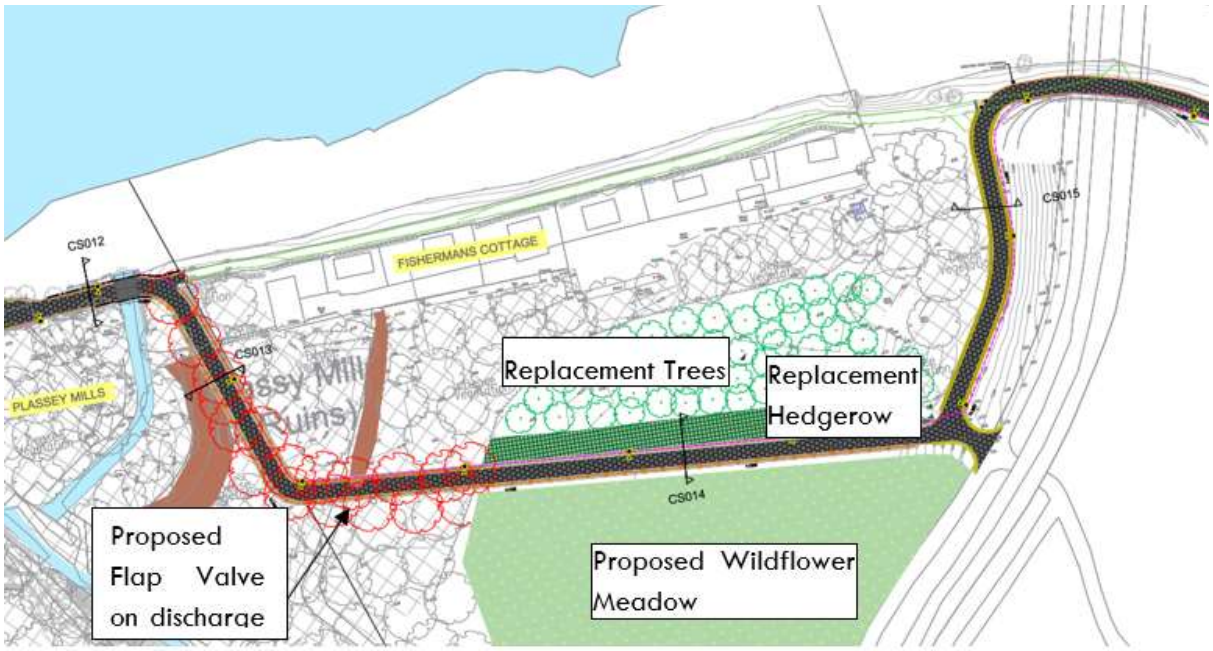

Figure 4-97: Proposed route south of Fisherman cottages

The trees and hedgerows that will be cut down to clear a path for the proposed Greenway will be replanted to act as a screen between the proposed path and the rear of the Fisherman cottages. All trees and hedgerows shall be cut down between September and February and shall be inspected by an experienced and qualified Ecologist to check for nests and roosts. They shall be laid on the ground for at least 24 hours before they will be recycled or mulched. Refer to the Landscape drawing 2525-RHA-XX-DR-C-LA0003 for proposed planting details for the Trees, Hedgerows, and wildflower meadow in this area.

The residents in the Fisherman cottages requested LCCC to resolve flooding at the rear of their properties. The proposed earth bund along the east (partially), south, and west (partially) of the properties will prevent flood water from the Plassey Mill Race from entering the rear of the properties. There will be proposed drainage channels on the north and south sides of the elevated Greenway path (refer to Figure 4-98) and surface water will drain towards the existing land drain that discharges to the Plassey Mill Race (refer to drawing RHA-XX-DR-C-PD0011). A proposed flap valve will prevent water from back entering the rear of the Fisherman Cottage properties from the Plassey Mill Race.

There is no direct drainage route to the river at the rear of the cottages. The area drains overland south to the Plassey Mill Race and the Plassey Mill Race overspill drain adjacent to the worksite is dry. Sediment mats will be placed between the bund and the Plassey Mill Race on the overland drainage route to trap material. If the area at the rear of the cottages needs to be drained dry ahead of the works, a silt buster tank to remove sediment from water will be utilised, before the water will be returned to the Plassey Mill race.

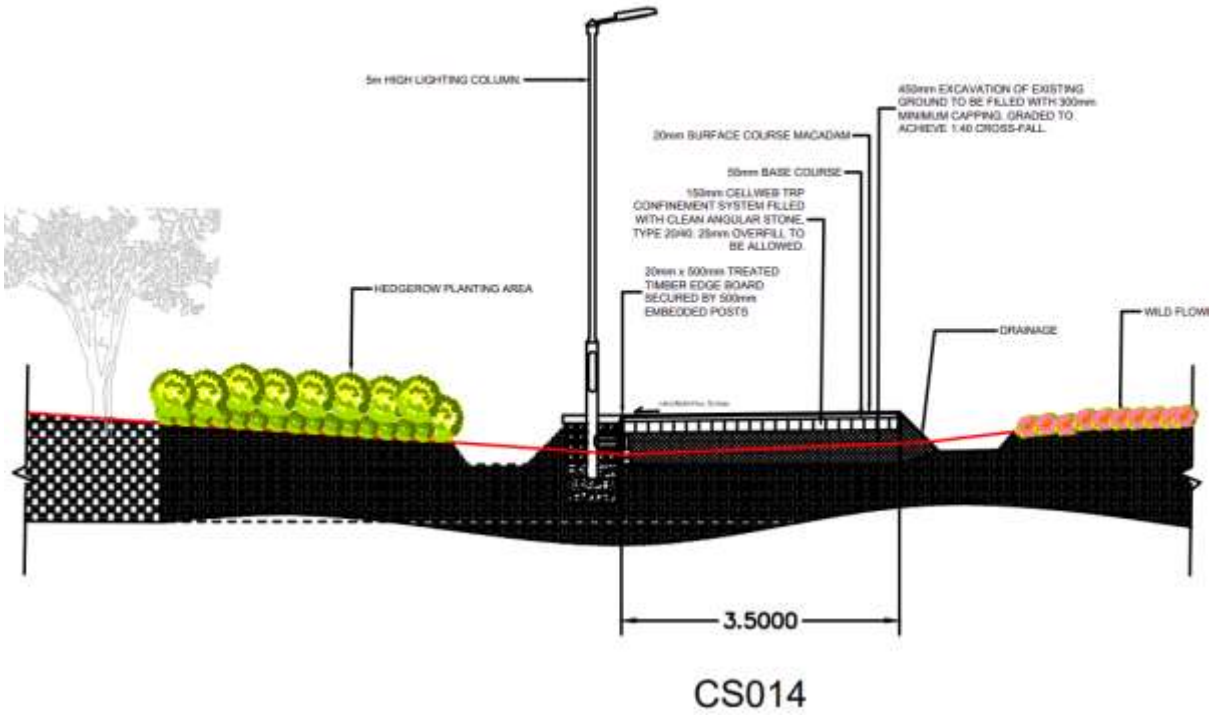

Figure 4-98: Cross Section 014 along proposed Greenway south of the Fisherman Cottages

Figure 4-99: Proposed Greenway south of the Fisherman cottages with proposed hedgerows and trees (looking west)

The proposed route will replace an existing gravel path going north towards Drumroe Village University Bridge, pass under the existing road bridge between Limerick and Clare, and turn east to continue along the River Shannon north of the Drumroe Student Village.

CH1320 to CH2180: Proposed Greenway through Annex 1 Alluvial Woodland forest area

East of the road bridge and east and west of the Living bridge between Co. Limerick and Co. Clare there is an Annex 1 Alluvial Woodland forested area. Refer to Figure 4-100. The existing path is illustrated by the orange line, and the proposed path in a green field is illustrated by the green line. The trees that are proposed to be cut down are illustrated in red outline. There is also an avenue of mature Beach trees along the riverbank within this wooded area and the proposed greenway avoids those trees.

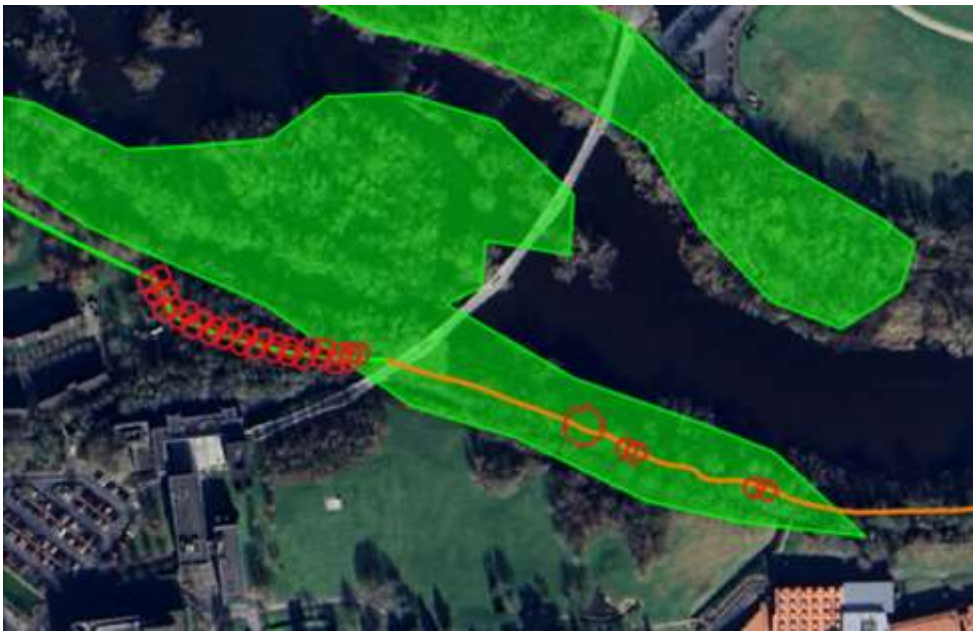

Figure 4-100: Existing Annex 1 Alluvial woodland

Figure 4-101: Proposed Greenway diverts from existing path to avoid the Annex 1 Alluvial Woodland north of Dromroe Student Village

The proposed Greenway avoids the mature Beach trees by diverting south of the existing gravel path (@ CH1420) to immature Birch trees where a 6m wide avenue of tree clearance will be required to construct the proposed Greenway. The trees that will be cut down are saplings and immature Birch with no habitat potential. Refer to Figure 4-132.

All trees shall be cut down between September and February and shall be inspected by an experienced and qualified Ecologist to check for nests and roosts. They shall be laid on the ground for at least 24 hours before they will be recycled or mulched.

These trees have been characterised as moderate quality by the project Arborist, namely '*Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality*' (further information is available in the LCG Tree Survey Report_Rev0).

Figure 4-102: Arborist map of moderate-quality trees east of the Living Bridge that will be removed for the proposed Greenway

The proposed Greenway will rejoin the existing gravel path and pass under the Living bridge (@ CH 1650).

Between the Living Bridge and Plassey Beach the proposed path will narrow to 3m at locations to avoid trees and will meander around existing trees. The new tarmac surface will be laid on top of the existing earth bank and no excavations will be carried out. Refer to Figure 4-104 for a photomontage where the proposed path will pass through the Annex 1 Alluvial Woodland forest with the River Shannon to the north and the Plassey Mill Race to the south.

Figure 4-103: Proposed Greenway under the Living Bridge (looking west)

Figure 4-104:Proposed Greenway in the Annex 1 Alluvial Woodland

CH2180 to CH2250: Proposed Bridge 5, Ramp to Plassey Beach, Rest area

The proposed infrastructure at Plassey Beach includes a new bridge, an access ramp to provide access from the path to the beach for all users, new seating for a rest area or for swimmers to change, new cycle stands, and new landscape planting areas as illustrated in Figure 4-105. The existing earthen embankment at the start of the Plassey Mill Race will be preserved.

The new bridge (Bridge 5) will facilitate pedestrians with limited mobility, wheelchair users, and cyclists to cross the Plassey Mill Race in this area whereas the existing bridge is narrow and has steps to access it which currently makes it inaccessible to users with limited mobility, buggies/prams, and wheelchair users (refer to Figure 4-48, Figure 4-49, and Figure 4-50). This existing narrow concrete bridge at the mouth of the Plassey Mill Race will remain in place.

There will be a new ramp for people to walk down, wheelchair users to roll down, and children's prams/buggies to be pushed down from the proposed Greenway to Plassey Beach providing an amenity that provides access for all.

New public lighting will be provided using both 5m high and 1.6m high columns depending on existing tree cover.

The SAC boundary line runs south of the Plassey Mill Race stream (refer to the red line in Figure 4 105) and the existing and proposed bridge, retaining wall, and ramp are within the SAC.

The trees that have to be removed are illustrated in red in Figure 4 105. They will be cut down between September and February. All trees to be cut down shall be inspected by an experienced and qualified Ecologist to check for nests and roosts and shall be laid on the ground for at least 24 hours before they will be recycled or mulched.

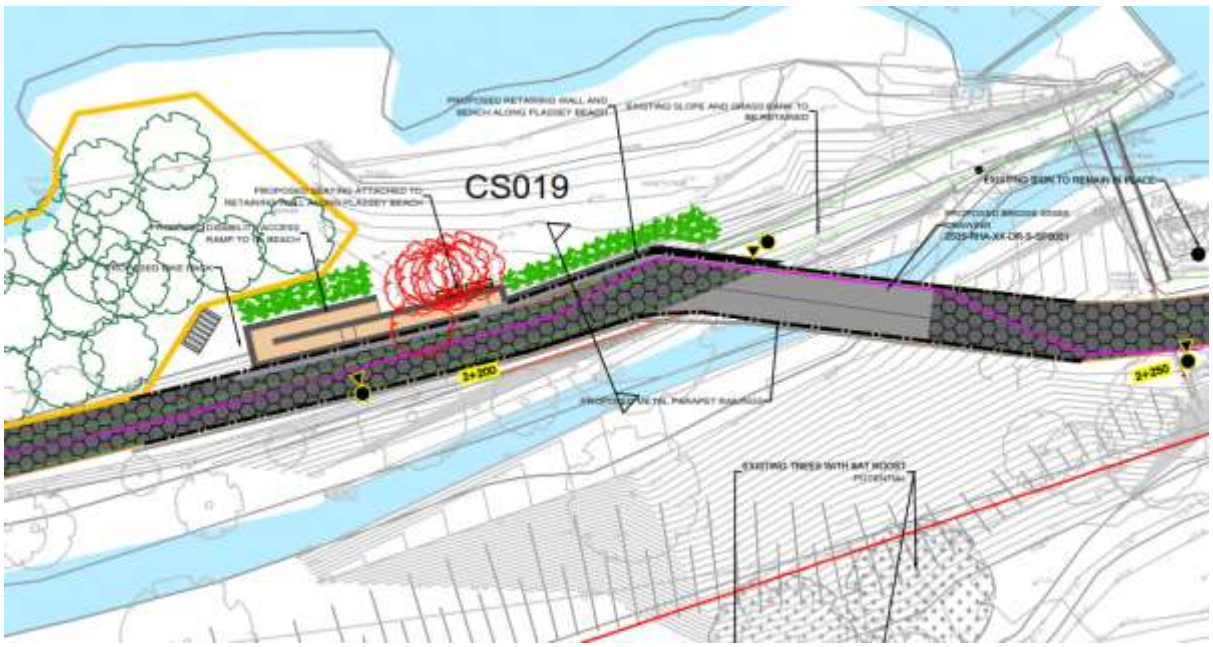

Figure 4-105: Proposed plan of ramp and Bridge 5 at Plassey Beach

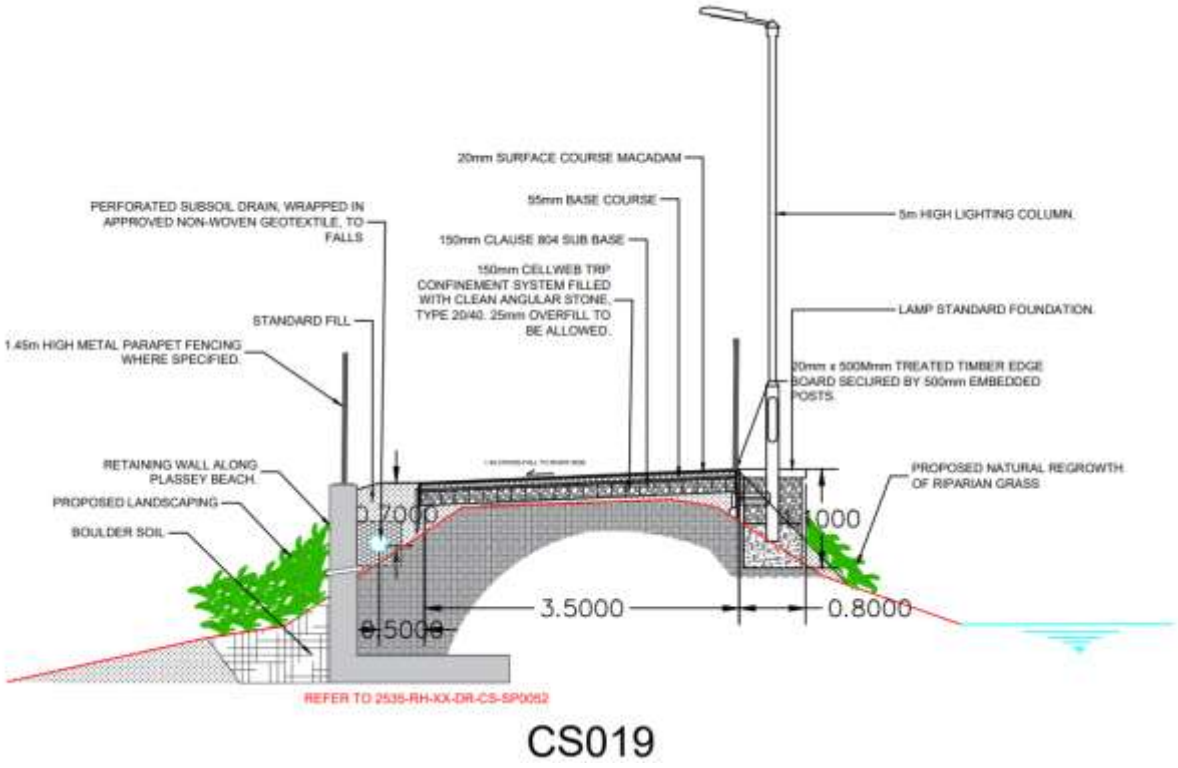

Figure 4-106: Proposed section of retaining wall for ramp at Plassey Beach

Figure 4-107: Proposed Bridge No. 5, existing embankment at Plassey Beach, and existing bridge in background

Figure 4-108: View of proposed Bridge 5 and ramp to Plassey Beach with landscaping, seating, and cycle stands

No instream works will take place at Plassey Beach or in the Plassey Mill Race. As per Bridge 1 and Bridge 2, the worksite will be protected from river water flooding by installing a water filled flood barrier on Plassey Beach, and the River Shannon and Plassey Mill Race will be protected from accidental spillages of contaminated water by proposed sheet piles and a silt curtain.

There will be a 100m long silt curtain installed in the River Shannon to catch any discharges from the worksite into the river. Silt curtains will catch materials that float or are suspended in the water. Silt curtains are typically made from PVC and closed-cell foam. They are a flexible, water permeable barrier that extends downwards in the body of water, where it is typically anchored or weighted to prevent the silt from moving. The foam provides buoyancy, while the PVC curtain controls sediment in the water. Example photos of a silt curtain in the River Corrib in Galway are provided in Figure 4 85 and Figure 4 86.

Dust will be suppressed during the construction works. To avoid water runoff carrying fines, a shade cloth will be erected immediately adjacent to the proposed concrete foundations and walls to trap dust arisings.

Dewatering of the area where the proposed foundations for the Bridge 5 abutment walls will be constructed will utilise a silt buster tank to remove silt from water before the water will be returned to the River Shannon.

The construction period of the bridge, the retaining wall, and the ramp is expected to take 4-5 weeks and the work will be carried out during the summer when it is expected to be dry and the river is at the lowest level during the year. The existing Mill Race stream under the proposed Bridge 5 will continue to run during the works and during the summer months the depth of this stream has been measured during the summer of 2022 as being 100mm deep. The proposed sheet pile will prevent any loose soil or suspended material from running into the Mill Race stream. The proposed shade cloth will prevent airborne dust from floating onto the stream or River Shannon. The proposed water filled flood barrier will prevent river water from entering the worksite.

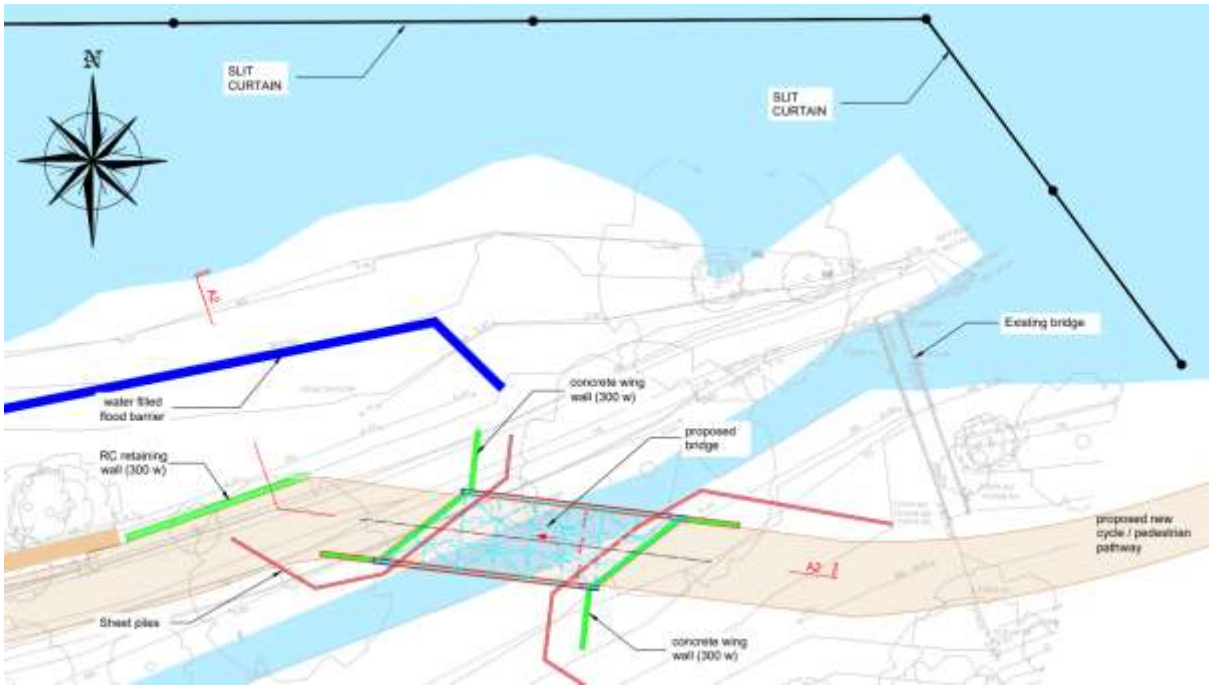

Figure 4-109: Plan of proposed Bridge 5 and proposed Ramp, showing proposed Silt Curtain, Sheet piles and water filled flood barrier (refer to drawing RHA-XX-DR-S-SP0052)

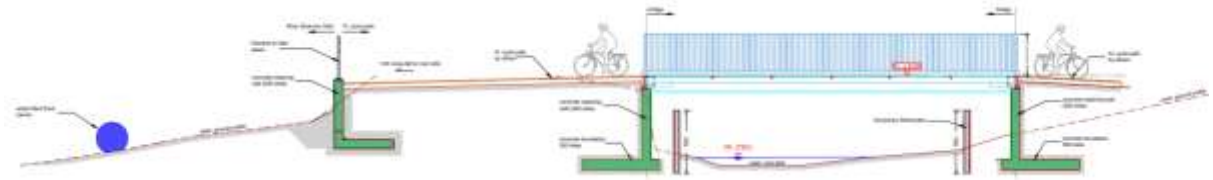

Figure 4-110: Section of retaining wall for proposed Ramp and Abutment walls for proposed Bridge 5 (refer to drawing RHA-XX-DR-S-SP0052)

The construction sequence for the bridge abutments is illustrated in the figure below.

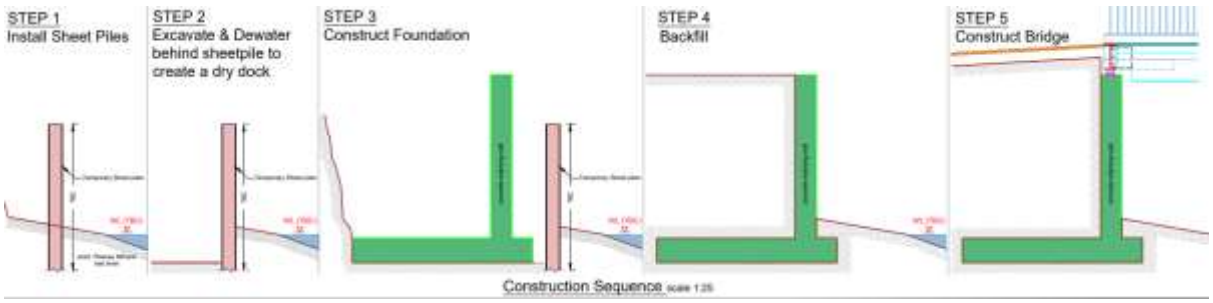

Figure 4-111: Construction sequence for abutment structures to support the steel deck of Bridge 5 (refer to drawing RHA-XX-DR-S-SP0052)

CH2250 to CH2500: Proposed Greenway on raised gravel path

East of Plassey Beach and north of Kilmurray Student village is an existing raised gravel path that will be covered with a tarmac surface. The proposed Greenway will cross an existing watercourse and the existing drainage pipe will be replaced with a proposed 900mm diameter culvert pipe.

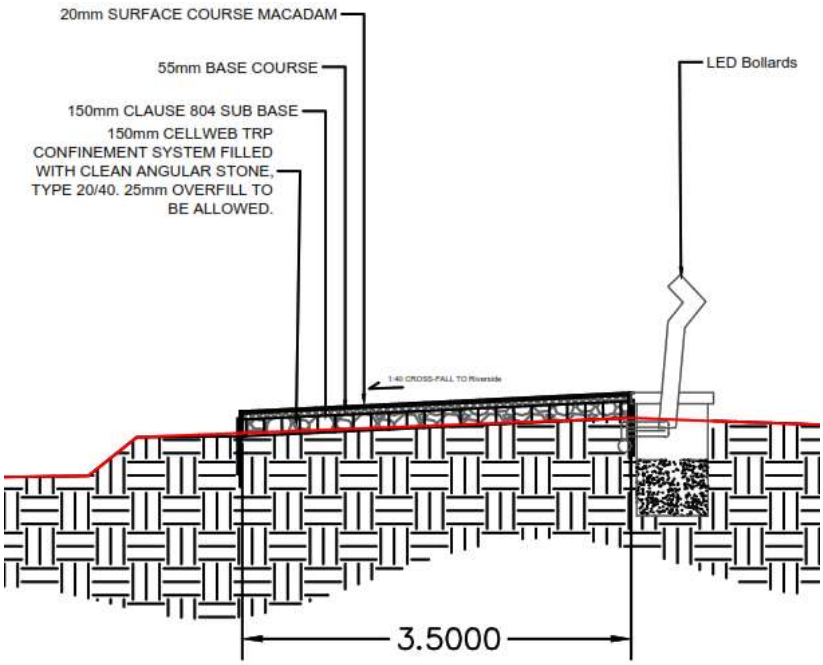

Figure 4-112: Proposed tarmac path and public lighting north of Kilmurray Student Village

At CH2500 the proposed Greenway will split into two paths. One will continue eastwards along an existing desire line to Cook Medical and onwards to McLaughlan Road. There will be a new swing gate installed at this junction so the section of proposed Greenway in the green field can be temporarily closed during and after flood events. The other path at the junction will turn south towards University Road and this is described in section 0.

Figure 4-113: Proposed junction on Greenway at CH2500 (refer to drawing RHA-XX-DR-C-PD0019)

CH2500 to CH3180: Proposed Greenway along desire line

The proposed Greenway route continues east and traversers amenity grassland and scrub areas where there is an unpaved desire line.

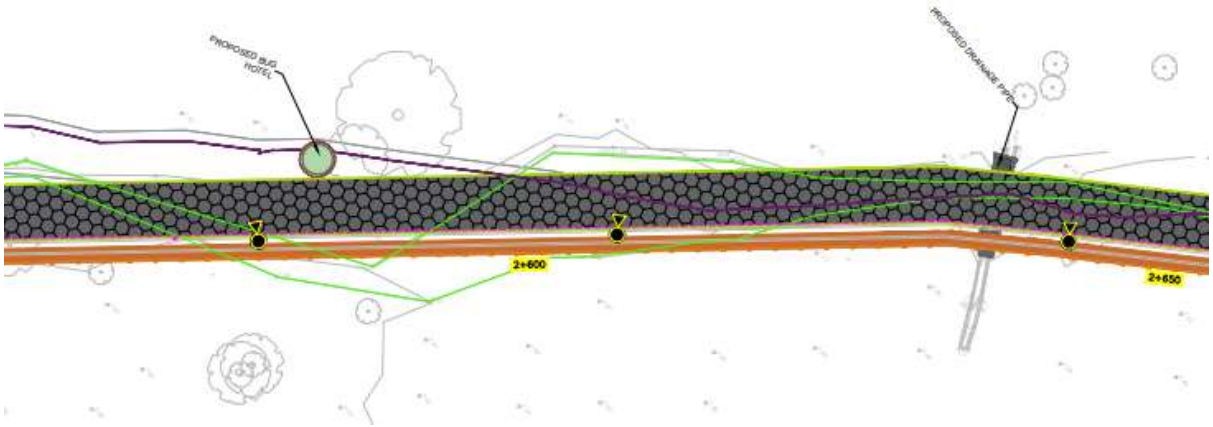

Figure 4-114: Proposed Greenway to replace existing grass desire line

There will be a new shallow land drain on the field side of the proposed Greenway and proposed drainage culverts will be constructed under the proposed path to drain surface water to the River Shannon, and to ensure the tarmac path can be utilised as soon as possible after flooding events (after LCCC maintenance personnel have inspected and cleared the path of flood debris).

The Flood Risk Assessment undertaken for this project, CFRAM flood mapping, confirms this part of the proposed Greenway will be subject to low probability (1 in 1000 year) and medium probability (1 in 100 year) flooding events. Anecdotal evidence collected during site visits and the public consultation event in August 2022 confirmed there will also be a high probability (1 in 10 year) of flooding events.

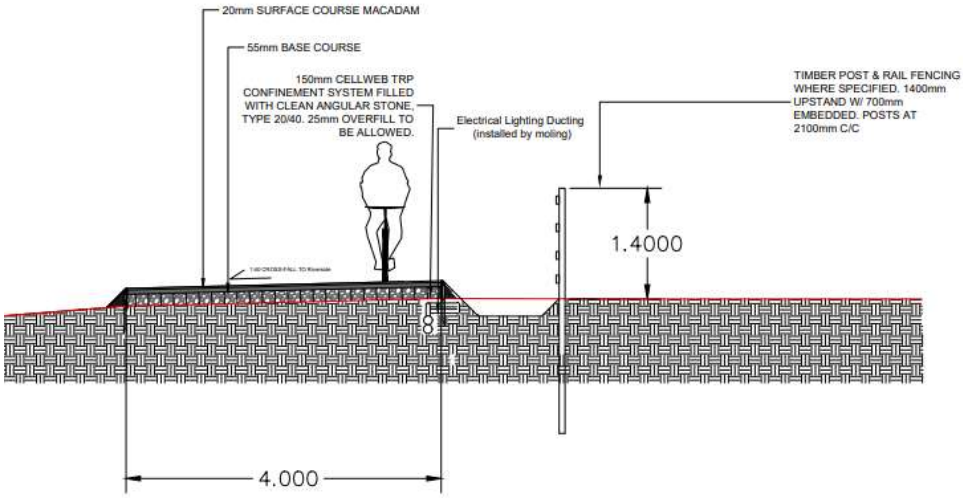

Figure 4-115: Proposed Greenway cross section in green field

CH3180 to CH3490: Proposed Greenway in green field

The proposed Greenway route turns south-east (CH 3180) to traverse the edge of trees, and through grassland and scrub areas. It will avoid the IDA's proposed surface water management system (shown in greyscale). There will be drainage channels along the east and west sides of the proposed Greenway to manage surface water and drain water towards the River Shannon.

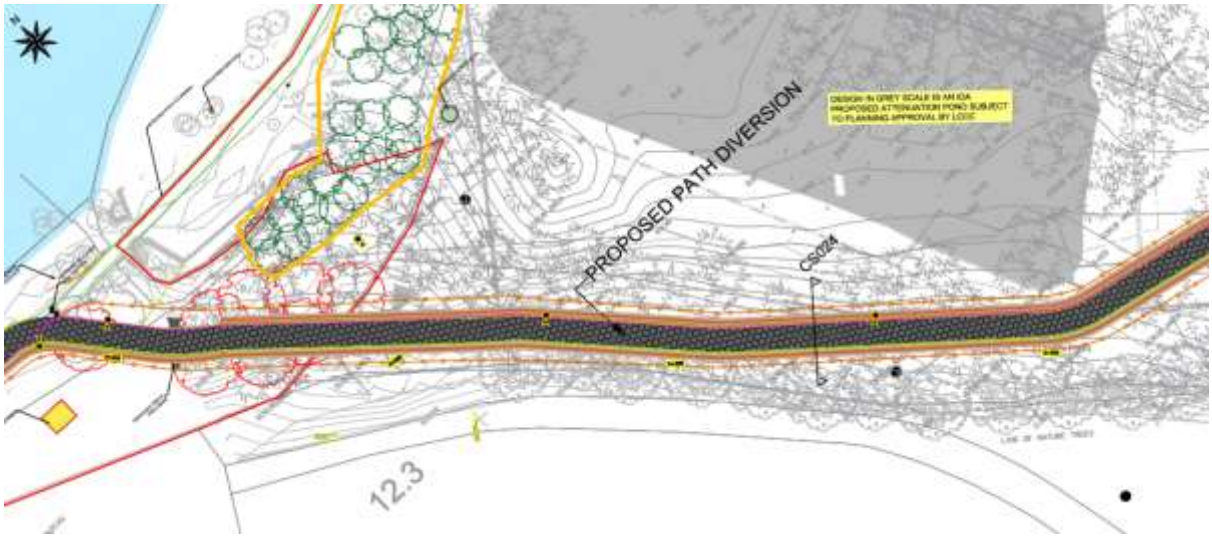

Figure 4-116: Proposed drainage alongside proposed path to manage surface water

The proposed Greenway will turn south-west to join to McLaughlan Road in the National Technology Park (NTP) at CH 3490.

CH3490 to CH3805: Proposed Cycle lane and Footpaths alongside McLaughlan Road

The proposed Greenway changes from a shared 3.5m wide greenway to Active Travel infrastructure with separate 1.8m wide footpaths and 1.8m wide cycle lanes along the eastern and western side of McLaughlan Road.

Figure 4-117: Proposed cycle lanes and footpath on McLaughlan Road where it joins the shared path

The proposed footpaths and cycle lanes will tie into existing footpaths and cycle lanes on Plassey Park Road at its junction with McLaughlan Road.

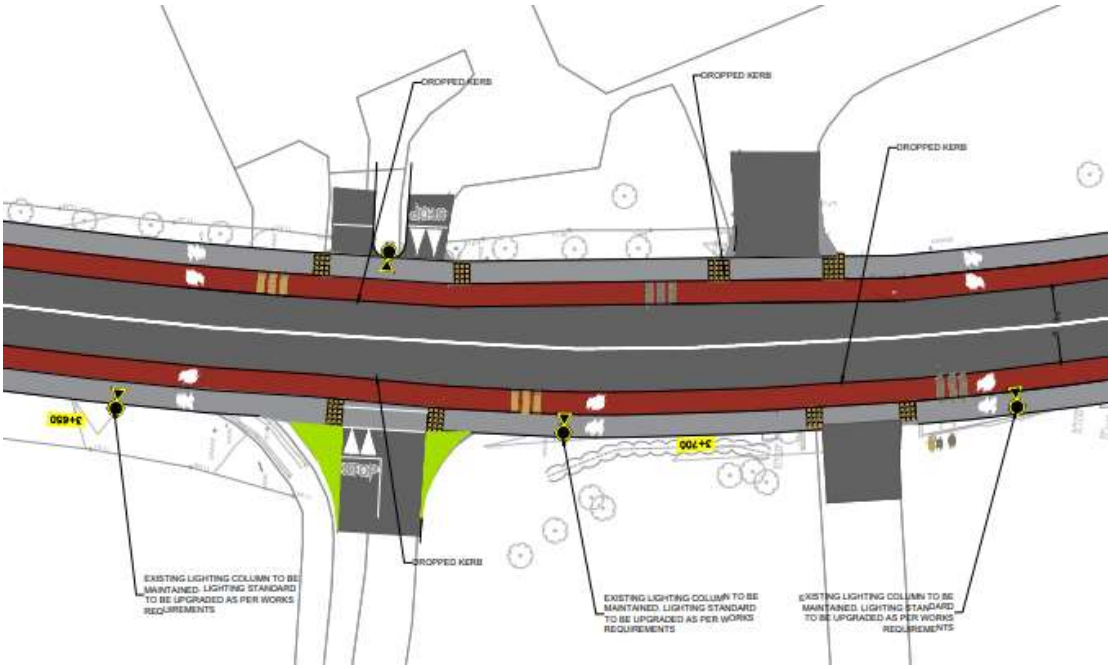

Figure 4-118: Proposed plan for footpaths and cycle lanes alongside McLaughlan Road

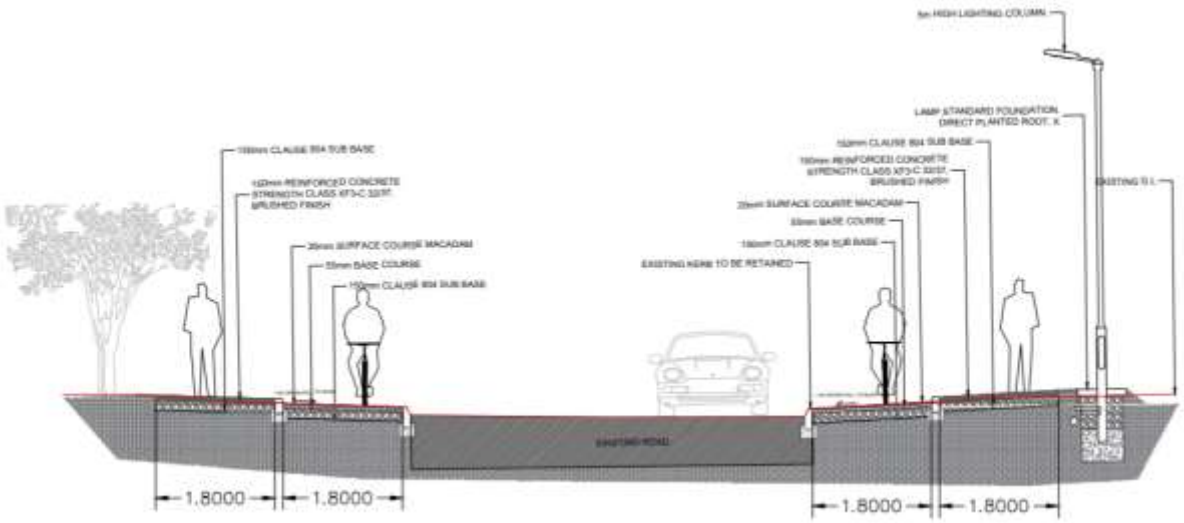

Figure 4-119: Proposed cross section for footpaths and cycle lanes alongside McLaughlan Road

An existing 2m wide raised table Zebra crossing on Plassey Park Road will be converted to a 6m wide Toucan crossing to prioritise crossings for pedestrians and cyclists and in accordance with design guidance for Toucan crossings on bus routes.

Figure 4-120: The existing Zebra crossing on Plassey Park Road proposed to be converted to a Toucan crossing

CH000_C to CH300_C:P Proposed Greenway east of Kilmurray Student Village

The proposed Greenway will run in a southerly direction past the eastern boundary of the UL Agricultural Laboratory building and Kilmurray Student Village. This short section of the Greenway will be a shared space between Greenway users and vehicles associated with the UL Agricultural laboratory, but removable bollards will be installed on the Greenway that will be operated by UL Facilities to manage vehicle movements. Typically the bollards would be locked in place to prevent unauthorized access for

vehicles to this section of the Grenway. Refer to drawing RHA-XX-DR-C-PD0029. The existing parking spaces to the east of Kilmurray Student Village will be reconstructed to accommodate the proposed Greenway. The existing rubbish bin area will be realigned for the same reason.

Figure 4-121: Proposed Greenway at UL Agricultural Laboratory building east of Kilmurray Student Village

Figure 4-122: Proposed Greenway approaching the eastern/rear entrance to Kilmurray Student Village

The proposed Greenway will leave the Kilmurray Student Village and join University Road.

Figure 4-123: Proposed Greenway at eastern entrance to Kilmurray Student Village

CH300_C to CH677_C: Proposed footpaths and cycle lanes on University Avenue

The proposed Greenway crosses the entrances to Kilmurry Student Village and the UL Gaelic grounds where it changes from a shared 3.5m wide greenway to Active Travel infrastructure with separate 1.8m wide footpaths and 2.0m wide cycle lanes along the eastern and western side of University Road.

Figure 4-124: Proposed Greenway on University Road

The proposed cycle lanes and footpaths on University Road will tie into Active Travel infrastructure which was constructed along Plassey Park Road as part of the Limerick Shannon Metropolitan Area Transport Strategy (refer to Figure 4-73).

4.3 PROPOSED AMENITY/REST AREAS, LANDSCAPING AND TREE PLANTING

In accordance with LCCC's replacement tree planting policy, there will be five native Irish trees (e.g.: Oak, Willow, Alder, Birch) are proposed to be planted for every tree that is cut down to enable construction of the proposed Greenway path.

There will be three new amenity/rest areas provided along the proposed Greenway with new seating and cycle stands.

There will be a new wildflower meadow (in accordance with the All-Ireland pollinator plan), a hedgerow, and tree planting south of the Fisherman cottages, and new understory planting at the Plassey Mills rest area. There will be new landscaping along the retaining wall and ramp at Plassey Beach.

CH000: Proposed Amenity/Rest area at Groody Bridge

There will be a proposed amenity/rest area east of Groody Bridge. The red line in Figure 4-125 is the SAC boundary line which passes through the existing path. Refer to drawings 2525-RHA-XX-DR-C-PD0001 and 2525-RHA-XX-DR-C-LA0002.

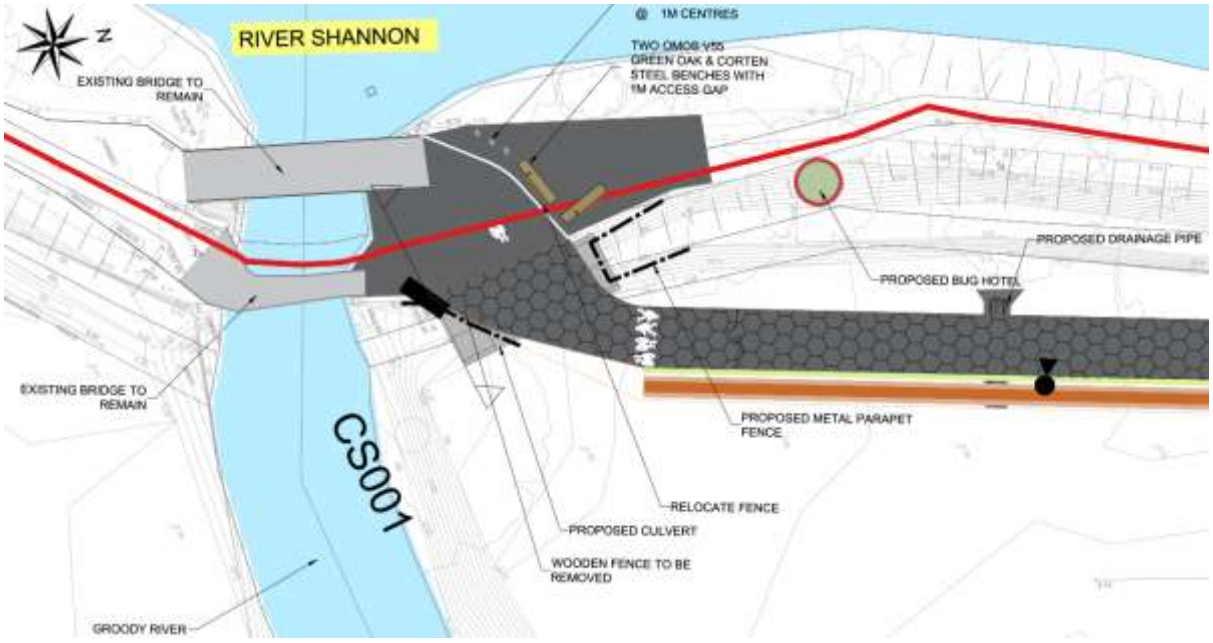

Figure 4-125: proposed amenity/rest area east of Groody Bridge

CH 770: Proposed Tree planting east of UL Boat Club

There will be native Irish trees planted along a proposed path between the proposed Greenway and an existing UL campus shared path. Refer to drawing 2525-RHA-XX-DR-C-PD0007. The replacement tree planting will support the propagation of and avoid gaps in the broad leaf woodland along the riverbank to the benefit of bats, especially the Lesser Horseshoe bat.

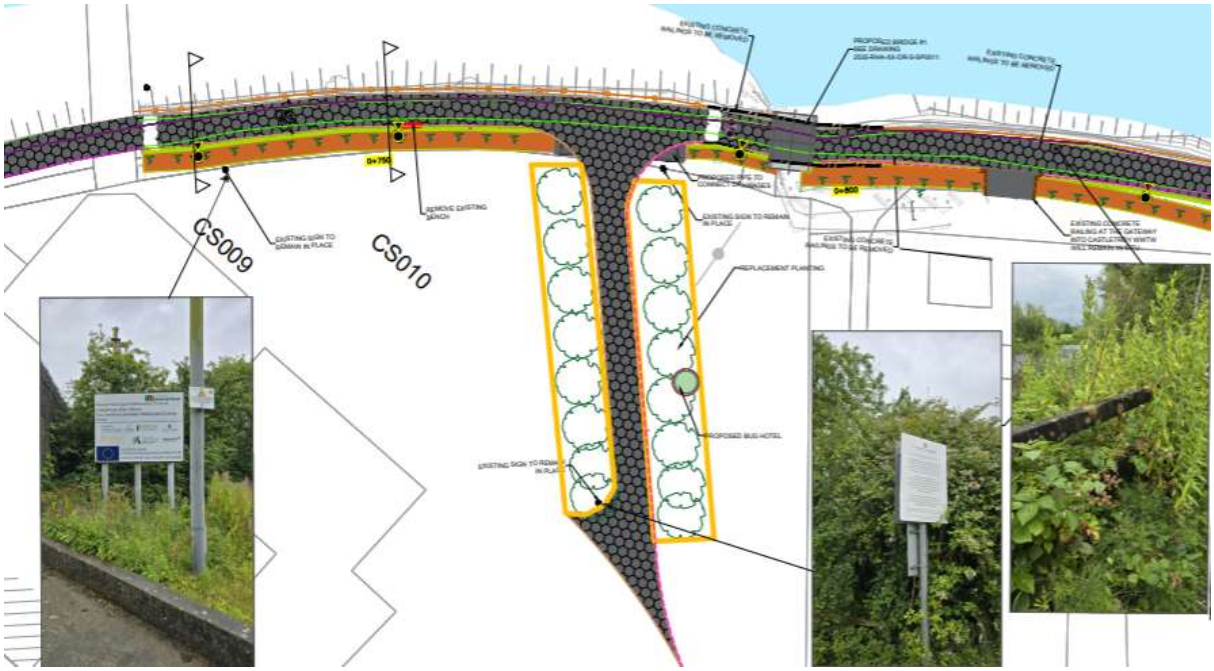

Figure 4-126: Proposed tree planting area west of proposed Bridge 1

CH1020: Proposed Amenity/Rest area at Plassey Mills

The proposed amenity/rest area at Plassey Mills will provide new seating and cycle stands. It could also function as a junction for any future usage of the currently sealed off Black bridge that crosses the River Shannon in this location.

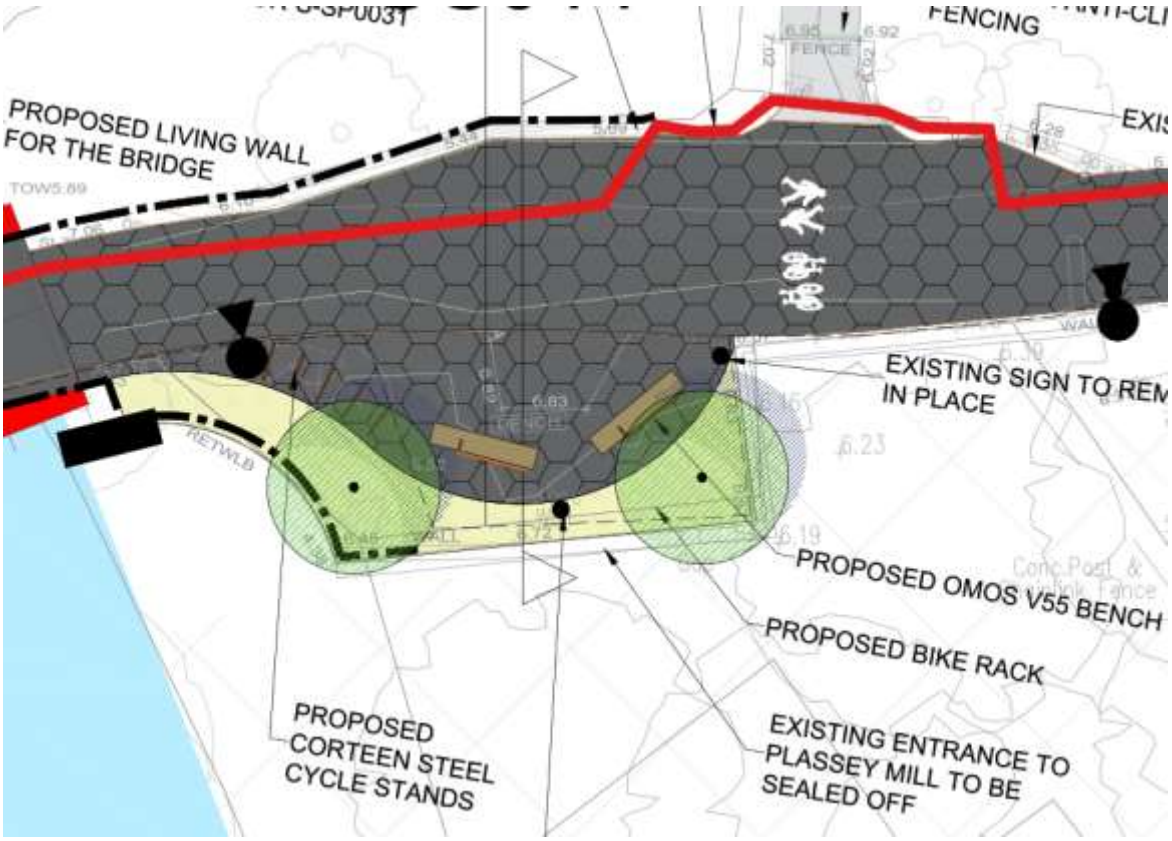

Figure 4-127: Proposed amenity/rest area at Plassey Mills

CH 1200; Proposed Landscaping south of the Fisherman cottages

There will be a new wildflower meadow (in accordance with the All-Ireland pollinator plan), a hedgerow, and tree planting south of the Fisherman cottages. Refer to drawings 2525-RHA-XX-DR-C-PD0001 and 2525-RHA-XX-DR-C-LA0003. The replacement tree planting will support the propagation of and avoid gaps in the broad leaf woodland along the riverbank to the benefit of bats, especially the Lesser Horseshoe bat.

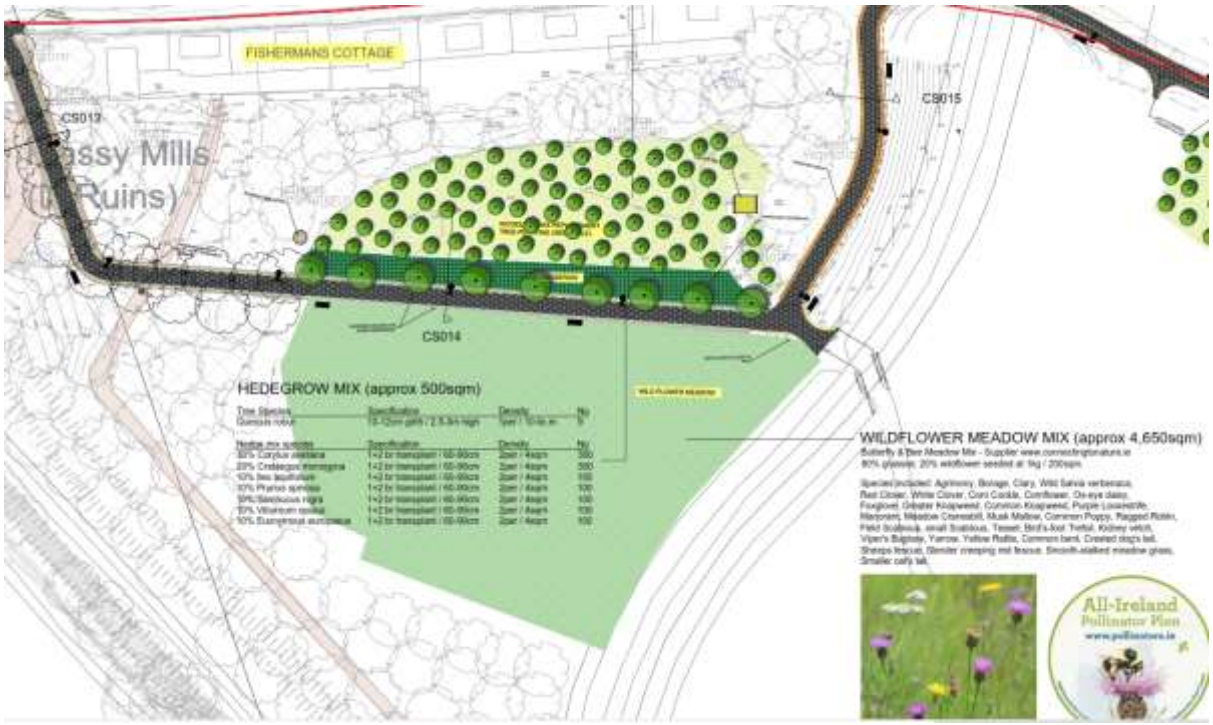

Figure 4-128: Proposed landscaping south of the Fisherman cottages

CH 1400-1520: Proposed Tree planting north of Dromroe Student Village

There will be replacement trees planted in a green field area to the north of Dromroe Student Village. Refer to drawings 2525-RHA-XX-DR-C-PD0011, 2525-RHA-XX-DR-C-PD0012, and 2525-RHA-XX-DR-C-LA0003. The replacement tree planting will support the propagation of and avoid gaps in the broad leaf woodland along the riverbank to the benefit of bats, especially the Lesser Horseshoe bat.

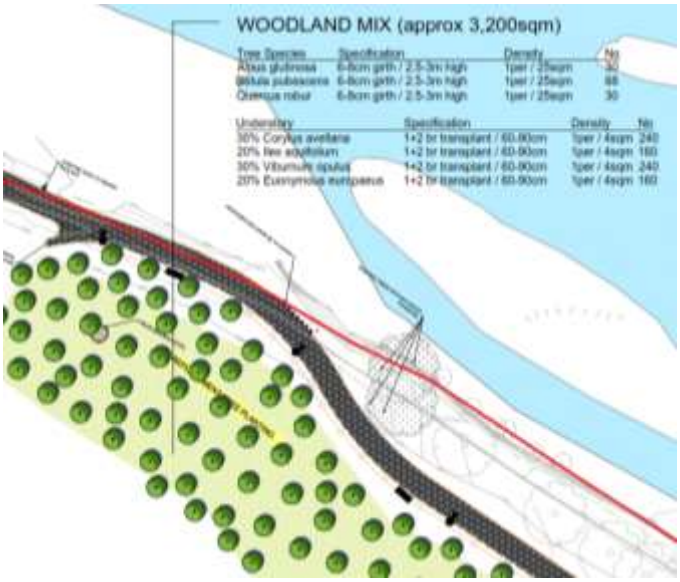

Figure 4-129: Proposed tree planting area north of Dromroe Student Village

CH 2105-2175: Proposed Landscaping and Amenity/Rest area at Plassey Beach

There will be new native Irish trees and new riverside shrubs planted at Plassey Beach. Refer to drawings 2525-RHA-XX-DR-C-PD0017 and 2525-RHA-XX-DR-C-LA0004. The replacement tree planting will support the propagation of and avoid gaps in the broad leaf woodland along the riverbank to the benefit of bats, especially the Lesser Horseshoe bat.

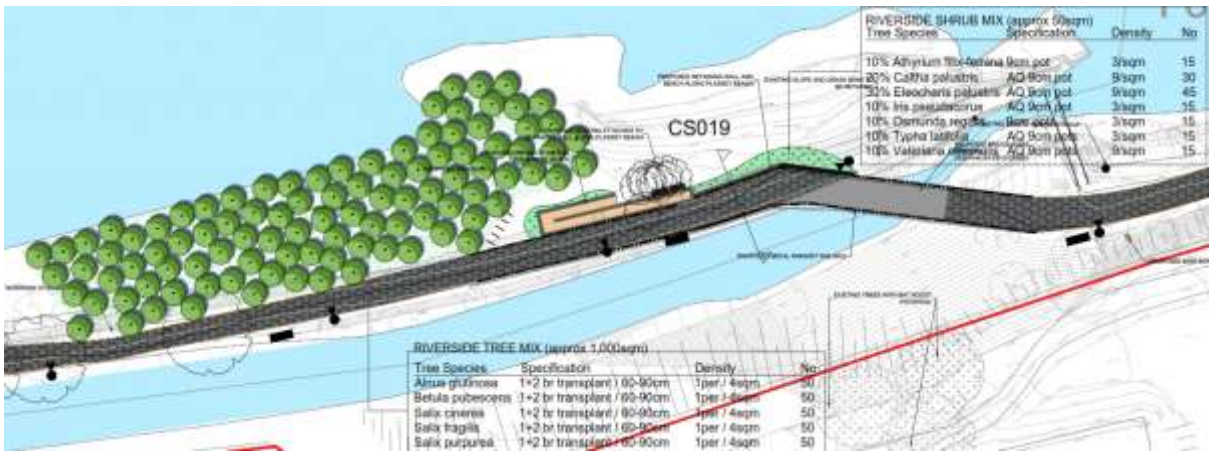

Figure 4-130: Proposed native Irish trees and new riverside shrubs at Plassey Beach

CH 3190-3450: Proposed Tree planting east of Cook Medical campus

There will be native Irish trees and an understory planted adjacent to the proposed path east of the Cook Medical campus and southwest of Troy Castle. Refer to drawing 2525-RHA-XX-DR-C-PD0023 and 2525-RHA-XX-DR-C-LA0005. The replacement tree planting will support the propagation of and avoid gaps in the broad leaf woodland along the riverbank to the benefit of bats, especially the Lesser Horseshoe bat.

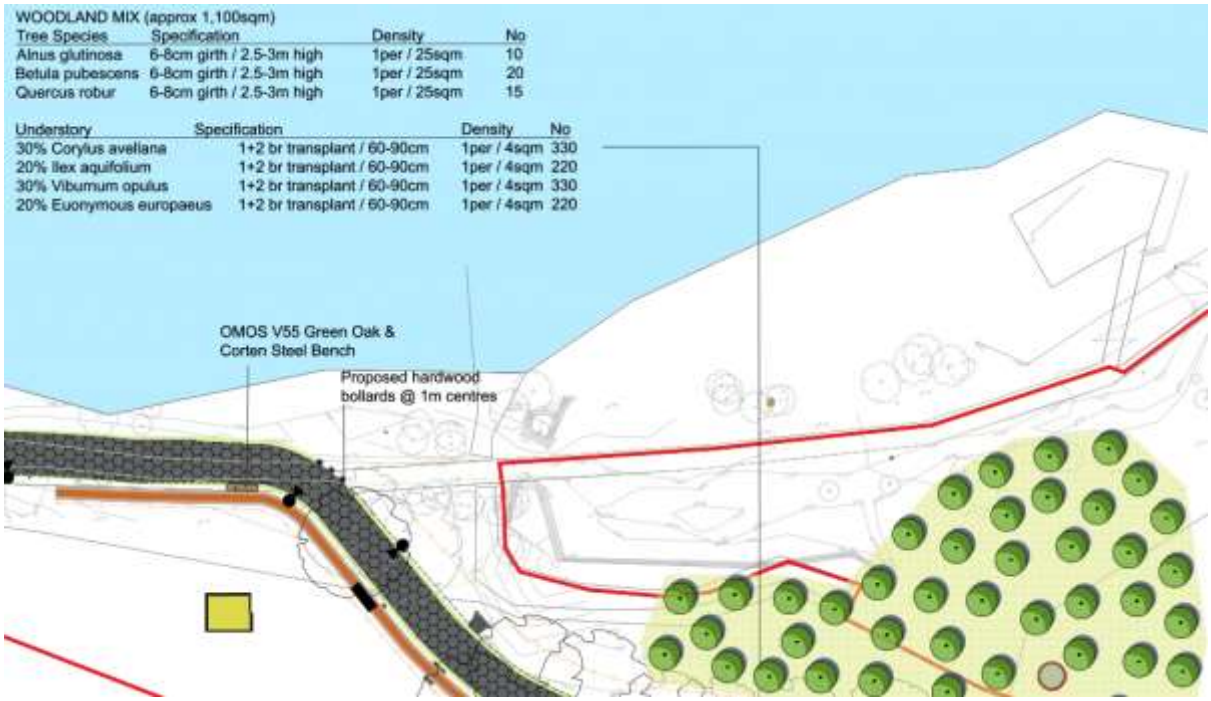

Figure 4-131: Proposed replacement tree planting east of Cook Medical

4.4 DESCRIPTION OF PROPOSED CONSTRUCTION WORKS

4.4.1 Tree removal

The proposed works have been designed to minimise disturbance to the habitat and limit tree removal within the site, but there are trees that will be cut down to construct the proposed Greenway. In accordance Section 40 of the Wildlife Act 1976 as amended by Section 46 of the Wildlife Amendment Act 2000 the proposed trees can only be removed between and 1st September and the last day of February in the following year. The trees that have to be removed will be cut down during this period.

The proposed path has been designed to avoid existing mature trees except for one dead mature tree and one dead semi-mature tree that will be felled ahead of the construction works. Tree overhang from approximately 30 No. semi-mature and mature trees will be cut down along the proposed path. These trees have been assessed by an experienced and qualified Arborist and an experienced and qualified Ecologist, and they have very limited habitat potential. There is one dead mature tree and four immature trees that will be removed in the Annex 1 habitat Alluvial woodland forest. The remainder of the trees to be cut down are outside the Annex 1 habitat Alluvial woodland and they are saplings and immature trees with no habitat potential. Refer to Figure 4-132.

Figure 4-132: Saplings and immature trees that will be removed along the route of the Greenway

All trees to be cut down between September and February shall be inspected by an experienced and qualified Ecologist to check for nests and roosts and shall be laid on the ground for at least 24 hours before they will be recycled or mulched.

LCCC requires trees that are cut down to be replanted at a rate of 5:1 so over 300 native trees are proposed to be planted along the proposed Greenway. This will help to deliver the LDP Objective EH O10 to plant 'native trees, hedgerows and vegetation and the creation of new habitats in all new developments and public realm projects'.

Tree branches and immature trunks which are felled will be reused in the production of bug hotels. Any leftover trunks and branches will be chipped and mulched at the closest construction compound for reuse on site.

Figure 4-133: Scrubland that will be cleared ahead of the Greenway construction works

4.4.2 Site Clearance

Surface stripping will be required in greenfield areas where topsoil and subsoil will be stripped along the route of the path to an average depth of 300mm. The topsoil and subsoil will be mounded and seeded on the river side of the path and will be left in place as a permanent installation. To prevent soil washing into the river, a sediment barrier will be erected at the base of the mounds on the river side.

In advance of construction works existing infrastructure items will be removed and disposed off-site, these include:

- One steel kissing gates along the existing gravel track at Plassey Mills and disposal off site;
- Approximately 500m of existing wooden, concrete, and steel fencing and disposal off site;

Advance work in Section 2 will require the removal of a temporary steel bridge at the location of Bridge No. 3.

Advance works will also include cutting out of four existing concrete footbridges and one set of bridge abutments and crushing of concrete within the construction compounds so the aggregate can be reused during the construction works.

Extensive areas of vegetation will need to be cleared in advance of construction works. Trees which are felled will be chipped on site for mulch for use on site. Vegetation clearance includes:

- Felling of trees and mulching for onsite use;
- Clearance of overhanging branches and mulching for onsite use;
- Clearance of native scrub from drainage channels, bagging, and disposal;
- Clearance of native scrub in heavy dense areas, bagging, and disposal.

Refer to the landscape drawings 2525-RHA-XX-DR-C-LA0001 to 2525-RHA-XX-DR-C-LA0005 for details of the proposed planting areas and species.

Advanced treatment and removal of invasive species including Giant Hogweed and Himalayan Balsam that have been surveyed in the work site shall be carried out ahead of construction works. Refer to the Invasive Species Management Plan in Appendix E for details.

If invasive species plants that spread by rhizomes (e.g. Japanese Knotweed) are encountered by site clearance crews, the plant will be removed in accordance with guidelines for managing invasive species, wrapped in plastic, and buried under topsoil and subsoil mounds so those invasive species plants cannot propagate. No invasive species will be moved to a different location within the works site or off site.

Site clearance will be required in advance of the Greenway's construction, as follows:

- At a minimum this will include excavation of topsoil and subsoil and establishment of permanent mounds (including reseeding) immediately alongside the stripped soil in green fields along the proposed route between Kilmurray Student village and Cook Medical;
- Existing infrastructure items obstructing the proposed path, such as metal gates, metal parapets, metal arisings from crushed concrete, and metal fences will be removed and disposed offsite to a licenced waste facility;
- Existing concrete footbridges will be or crushed in temporary construction compounds and the material will be reused as aggregate for haul roads during the works (metal arisings will be transported to a licenced waste facility);
- Vegetation clearance involves removing scrub and will be carried out in consideration of ecological restrictions between September and February.
- Trees which are felled will be mulched in a temporary construction compound for reuse on site to minimise soil erosion, keep soil wet, and prevent weed growth.
- Where excavation is required to remove roots from trees that have been cut down, any unconsolidated ground will be sown with grass seed following reinstatement to prevent erosion;

Temporary works will be put in place in advance of construction, including the provision of silt fences at all interfaces of the works area and the existing watercourse to prevent run off from the works area.

4.4.3 Temporary Construction Compounds

The temporary construction compounds will be temporarily surfaced with hard standing on a geomembrane to prevent generation and spreading of mud. Temporary perimeter fencing with silt

curtains at the base and shade cloths to act as dust curtains will be erected around compounds. Delivery trucks will not cross through the compounds, and they will drop their loads within the compounds. The construction works vehicles will be permitted to work on the Greenway side of the compounds only and will not pass through the compound to exit onto public roads. This will control mud spreading onto public roads and will help to prevent the spread of invasive species that are evident along the proposed path. The compounds will be adequately buffered to prevent any surface water runoff. The construction compounds will be constructed in Flood Zone C areas only.

The compounds will comprise the following elements:

- temporary site office, portaloo toilets, facilities for staff, and car-parking areas;
- crushing and storage areas for construction materials;
- bunded containment areas for plant refuelling which will only be permitted within the compounds,
- maintenance area for construction vehicles and plant;
- wheel wash area for construction vehicles and plant with water capture and settlement to prevent the spread of invasive species;
- storage of fuels, oils, lubricants, solvents, and site generators;
- a dedicated waste storage area for any construction waste generated. Skips or bays will be provided for recyclable material;
- wheel wash area for delivery vehicles (or road cleaning to be carried out as an alternative subject to UL, IDA and LCCC requirements).

Temporary compounds and a working area will be required during the construction period to accommodate workforce and vehicle movements, stockpiling of excavated material, and the construction (and removal where required) of haul roads. For each compound the top-soil and sub soil will be removed and mounded on the compound footprint, a geotextile layer will be laid across the entre area, imported fill (40mm crushed rock) will be spread across the area, and the compounds will have a temporary fence set up on their boundary.

Provision has been made for four temporary compounds with areas typically measuring 40m x 40m but these dimensions will be adjusted to suit site conditions and avoid tree felling. There is one temporary working area proposed in Castletroy wastewater treatment plant (WwTP) to set up a crane to lift in prefabricated concrete and steel sections associated with Bridges 2 and 3. Each of the compounds facilitate access to the five different sections of the proposed Greenway. Sectioning of the route in this way will allow part of the existing path to remain open for the public while works are being carried out in other sections. Refer to Figure 4-134.

Each temporary compound and working area will be removed after works in each section are completed and the area will be reinstated back to its original state.

Upon completion of sections of the Greenway, the temporary construction compounds and haul roads will be decommissioned, and the grounds will be reinstated to their original condition. Where possible, hardstanding materials removed will be reused in the construction of other temporary compounds and used in the construction of the base layers of the proposed Greenway project.

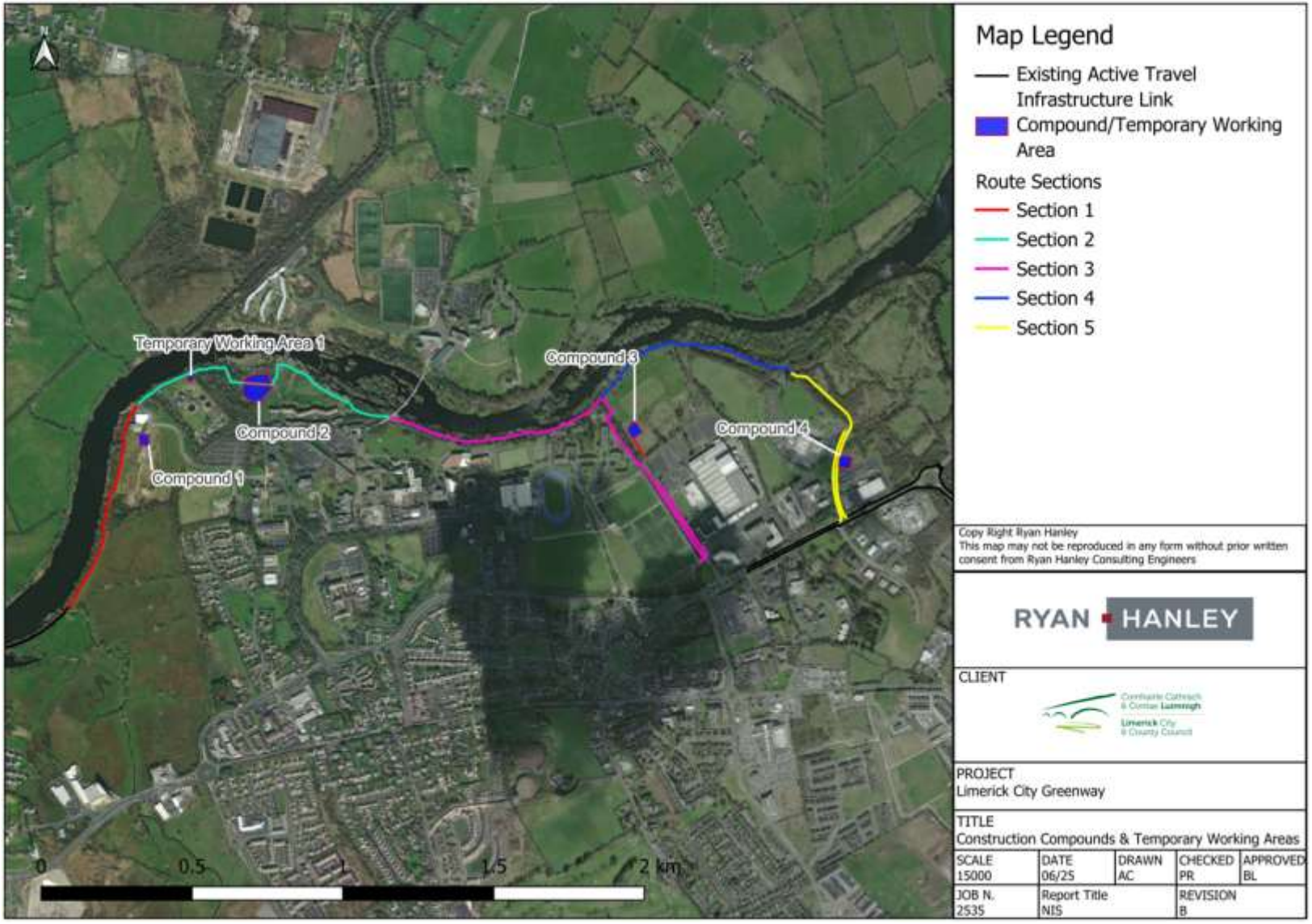

Figure 4-134: Proposed Sections, Compounds and Temporary Working area

4.4.4 Haul roads

Haul roads are required to facilitate the construction of the proposed Greenway. Haul road will be developed in green fields, scrublands, tree felling areas, and along existing gravel paths to enable construction vehicle movements. The haul roads will form the sub-base layer of the proposed path. Approximately 3.6km of haul roads will be developed along the proposed route as per Table 4-1.

Table 4-1: Lengths of Haul Roads per Section

Section Ref.	Haul Roads (m)
Section 1	736
Section 2	1005
Section 3	845
Section 4	725
Section 5	284
Total Length	3,595

The haul roads for construction vehicles will be developed along the route of the proposed path so the tarmac finished layer can be laid onto the haul road. The haul road will be approximately 3.5-4.0m wide and will comprise of the subbase layers of the proposed path: a geotextile layer, and crushed rock (UGM A). The depth of the subbase layer will generally be 300mm – 450mm depending on the ground conditions of the area and the haul roads will be laid in sections as the construction of the Greenway progresses.

Approximately 313m of temporary haul roads which do not lie along the proposed path will be constructed to facilitate access between the compounds and the works areas in each section. These haul roads will be removed after works in each section are completed and the area will be reinstated back to its original state.

Temporary haul roads will be constructed by excavating topsoil and subsoil and laying geotextile and aggregate/blinding (UGM A). The soil will be stored temporarily if it is required for reinstatement or will be permanently mounded and reseeded if it is not required for reinstatement. The haul roads will be laid in sections as construction of the path progresses.

On completion of sections of the proposed Greenway, the temporary haul roads will be removed, and materials will be reused in subsequent sections as the works advance, or the UGM A material, 55mm

binder course and 20mm surface macadam course will be laid above the haul roads in greenfield areas. Lath edging (50 x 75mm) will be laid at both side of path attached to stakes located at 900mm c/c.

4.4.5 Earthworks

There will be no excavation required for the proposed Greenway along existing tarmac or gravel paths. To protect trees alongside the path a 'Cellweb®TRP' tree root protection system (or equivalent) will be laid onto the existing path and imported material (i.e., crushed rock and gravel to UGM A, overlaid with tarmacadam) will build up the level of the path. The sloping banks on the river side and the Plassey Mill Race will also have a new 'Cellweb®TRP' system (or equivalent) to enable regrowth of bankside plants. Refer to Figure 4-135 for an example.

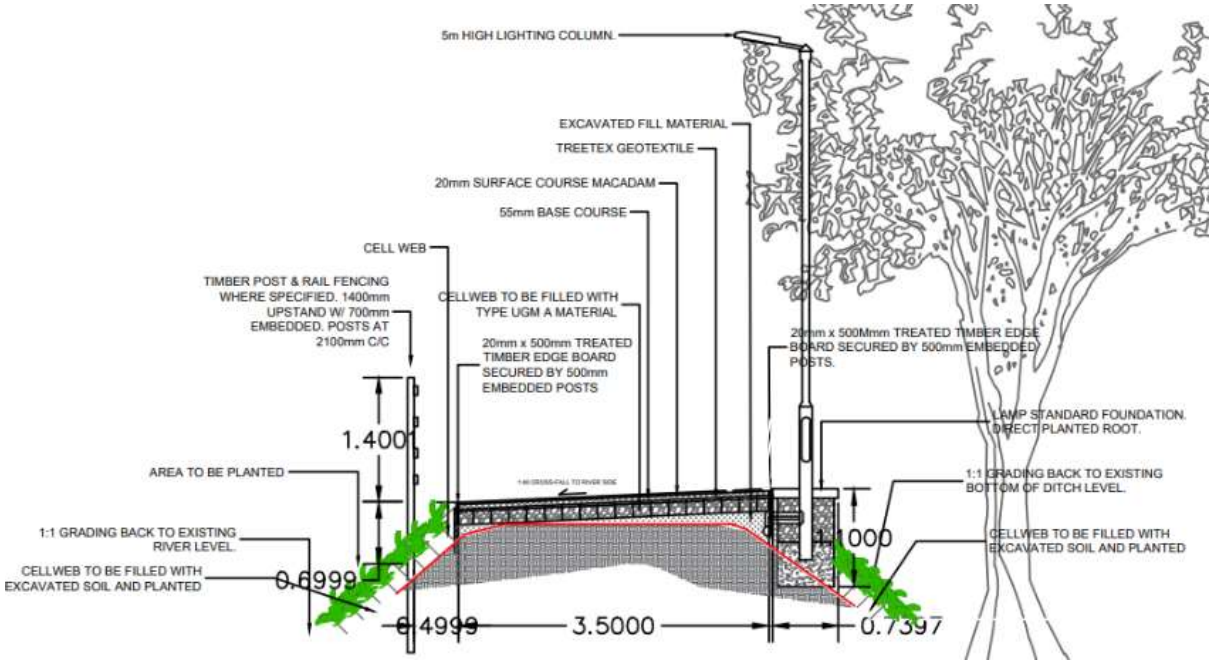

Figure 4-135: Tree root protection along proposed Greenway (Red line is existing ground level)

Excavation of topsoil and subsoil will be required where the proposed path passes through green field areas. Approx. 300mm depth of soil will be excavated and permanently left as a mound to be reseeded approximately 0.75m high and 2m wide on the river side of the path. Soil from areas that were contaminated with invasive species will be wrapped in plastic and buried under excavated soil. This accords with the project objective to ensure at least 95% of all waste is kept on site and not sent to a landfill.

Excavation of the carriageway, green verge, and footpaths will be required along University Road and McLaughlan Road to build up the concrete footpath and tarmac cycle lanes. A raised kerb will separate the existing roads from the proposed cycle lanes.

4.4.6 Testing of Imported Material

Clean Type UGM A fill material is required to be imported into the work site. To prevent cross contamination or pollution, a suite of testing from the source quarry will be required because the proposed Greenway is adjacent to water.

4.4.7 Traffic Management

A *Draft* Traffic Management Plan has been prepared for the proposed works and consultation has been carried out with UL Facilities and Uisce Éireann. The traffic management proposals have been presented to elected representatives. Construction and works delivery traffic will use the following existing roads/routes:

- The entrance road to the Castletroy WwTP;
- The road across the bridge to Co. Clare;
- University Road;
- McLaughlan Road;
- Plassey Park Road.

4.4.8 Construction of Greenway

Construction works should take place during daylight hours only with no temporary lighting on the site during the hours of darkness. Works shall only be carried between 08:00-18:00 during daytime hours or between dawn and dusk to minimize disturbance to nocturnal Qualifying Interests species. Motion detection sensors to turn on lights were considered but have not been proposed because the existing path is well used by the public so the use of always on lights from dusk until 23:00 hours is preferred over lights turning on and off, and risking the creation of a strobe light effect for nocturnal Qualifying Interests species.

During construction, noise limits, noise control measures, hours of operation and selection of plant items will be considered in relation to disturbance of birds. Plant machinery will be turned off when not in use.

The design and construction of the 4.25km long and 3.5-4.0m wide shared path, 1.5-2.0m wide footpath, and 1.8-2.0m wide cycle lanes has been carried out in accordance with the following:

- Transport Infrastructure Ireland (TII) Rural Cycleway Design DN-GEO-03047 (2022);
- Department of the Transport and Department of Housing, Local Government and Heritage, Design Manual for Urban Roads and Streets (DMURS, 2023);
- National Transport Authority's Cycle Design Manual (2023); and,
- Department of Transport, Tourism & Sport document Traffic Signs Manual (TSM) (2019).

Construction of the path will be carried out in sections. The sequencing of works per section is flexible. Each section will be reinstated before works commence in the next section. Existing users of the gravel track along the River Shannon will be directed around each section and there are existing footpaths and cycle lanes in the UL campus and along Plassey Park Road to accommodate diversions.

Isolation of the works area, including erection of fencing around the temporary works area and traffic management will be set up as required. The fenced area will include the full area required to facilitate the works including the temporary site compounds and the temporary haul roads.

Construction of the Greenway along the existing gravel path in wooded areas will involve the installation of lath edging (50 x 75mm) at both sides of the proposed path attached to stakes located at 900mm c/c, laying a 150mm thick root protection material onto the gravel track, filling this with UGM A material, laying a 55mm binder course onto it and finishing with 20mm surface macadam course;

Construction of the path along the existing gravel path in non-wooded areas will involve the installation of lath edging (50 x 75mm) at both sides of the proposed path attached to stakes located at 900mm c/c, laying 150mm of UGM A material directly onto the existing gravel path, laying a 55mm binder course onto that, and finishing with 20mm surface macadam course;

Where the path is being laid in an area with an existing tar pavement (i.e., along University Road and McLaughlan Road, the top 250mm of the existing surface will be removed and subsequently the depth of the subbase layer in these areas will be reduced to approximately 180mm.

Storage of other excavated material will be on a temporary basis, on site within the temporary works area and separate from the topsoil storage. Excavated material will be reused on-site, primarily for backfilling against new bridge abutments and the proposed retaining wall at Plassey Beach. This material will be classified as a construction by-product in the context of Article 27 of the European Communities (Waste Directive) Regulations. If there is any surplus excavated material, it will be transported off site to an authorised waste or recovery facility. Large volumes of excavated material will not be allowed to accumulate within the temporary working areas.

The construction works for reinforced abutment walls, retaining walls, concrete culverts, open drains will be carried out in parallel with the path construction.

The construction works for lighting column foundations and trenches for ducting will be carried out in parallel with the path construction. To protect the tree roots, ducts will be moled to a minimum crown depth of 600mm wherever the ducts pass mature trees.

Additional works including the installation of; signage, safety barriers, fencing, park benches and tree planting will be completed along the path prior to reinstatement of works area and the works area being reopened.

The works area will be reinstated to its original condition. This will involve levelling, raking, and seeding with grass.

4.4.9 Construction of Bridges, Retaining wall, Ramp

The five bridges on which the proposed path will cross existing drains, a stream, and the Plassey Mill Race (at two locations). These are as follows:

- A 4.9m long single span, steel frame bridge and new concrete abutments will be constructed for both pedestrians and cyclists at CH795;
- A 9.6m long single span steel bridge and 41m of concrete retaining wall and abutments will run adjacent to an existing stone footbridge at CH970;
- A 5.4m long single span, steel frame bridge for both pedestrians and cyclists will be constructed on existing cut stone abutments at CH1000;
- A 5.1m long single span, steel frame bridge for both pedestrians and cyclists will be constructed on existing cut stone abutments at CH1045;
- A 12.9m long single span, steel frame bridge for both pedestrians and cyclists will be constructed on new concrete abutments and obliquely cross the Plassey Mill Race at CH2220-2235. 28m of concrete abutments will support the 12.9m long steel deck;
- A new 12m long concrete retaining wall will be constructed at Plassey Beach;
- A new fully accessible 20m long ramp at a 3% slope will be constructed at Plassey Beach to provide access from the proposed Greenway to the beach for all users.

Construction of the new bridges will take place as follows:

- Temporary works will be put in place including silt barrages, and temporary flumes will be installed to manage overland drainage water.
- To prevent pollution to the adjacent stream and river bio-degradable hydraulic oils are to be used in machinery, and spill kits shall be ready on site for immediate use.
- Works beside streams will be restricted as a result of the spawning season for salmonids so work will not be carried out during Nov-March.
- Biosecurity management for in-stream works will be strictly monitored. With the presence of Giant hogweed (*Heracleum mantegazzianum*) and Himalayan balsam (*Impatiens glandulifera*) along the path route, regular cleaning of machinery to prevent spread of non-native species is very important.
- The foundations and abutment walls will be excavated down to formation level. Excavated material will be stored on site for reuse as backfilling. Formwork will be erected, and aggregate and blinding will be tamped into place. Reinforcement bars will be placed into the formwork and concrete will be poured in using a concrete pump crane. After the required curing time has passed the formwork will be removed.
- The new bridges will be constructed using prefabricated steel frames that will be placed and fixed *in situ* onto the concrete abutments or onto the existing cut stone abutments. Steel frames will be delivered to the construction compound by truck, and then transported to the proposed crossing location by digger. The steel frames will be swung into place using a crane or digger and placed and fixed by hand.
- The annulus between the new structures and the excavated areas will be backfilled with excavated material (and topped up with imported material if required), the area will be reinstated, and the section will be reopened.

4.4.10 Drainage infrastructure

A Flood Risk Assessment for the proposed greenway has been completed. The following figures illustrate the potential temporary impact that 1 in 100 year and 1 in 1000 year floods will have on the proposed Greenway, and demonstrates why a new drainage network of land drains and culverts will be required to convey surface water to the River Shannon after flood events. Maintenance of this drainage infrastructure by LCCC will be required.

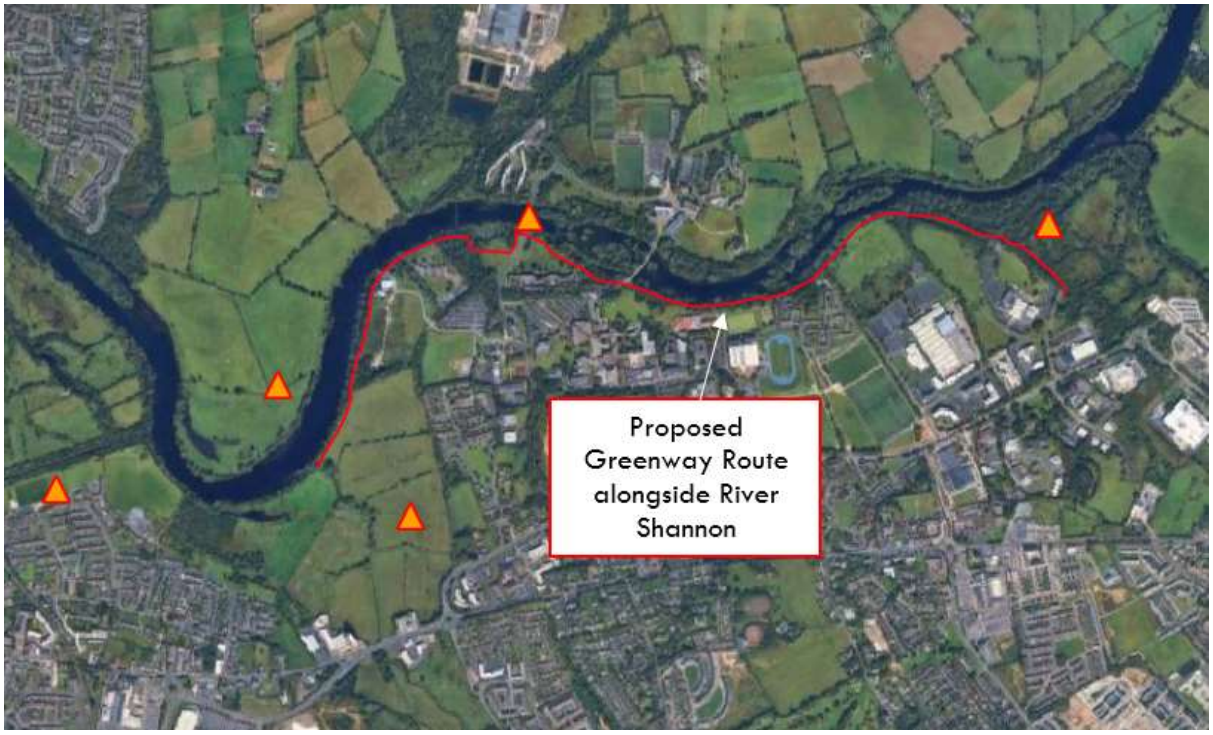

Figure 4-136: Past Flood Events OPW database (www.floodinfo.ie)

Flood Mapping developed by the OPW CFRAM programme confirms that appreciable lengths of the proposed Greenway are in Flood Zone A (2.36km) and Flood Zone B (2.77km) associated with the River Shannon and its tributaries scheme floodplains.

Portions of the existing paths and the proposed greenway are below the 10% AEP flood level.

The proposed scheme, being an "Amenity open space, outdoor sports and recreation" facility, is classed as a Water Compatible development in the OPW Planning System and Flood Risk management Guidelines, and therefore is an appropriate development for both Flood Zone A and B.

A justification test for the development in accordance with the Flood Risk Management Guidelines, further confirmed that the proposed development is appropriate albeit with mitigations. The Greenway track should be constructed to be water compatible, i.e. one which is resistant to damage caused by flooding and prolonged inundation, e.g. sealed surface, appropriate drainage etc.

Figure 4-137: November 2009 River Shannon Flood Event at UL campus in Co. Limerick on left hand side, with UL campus in Co. Clare on right hand side of figure, OPW database (www.floodinfo.ie)

Figure 4-138: Sections of Greenway at Flood Risk (1 in 100 or 1% AEP)

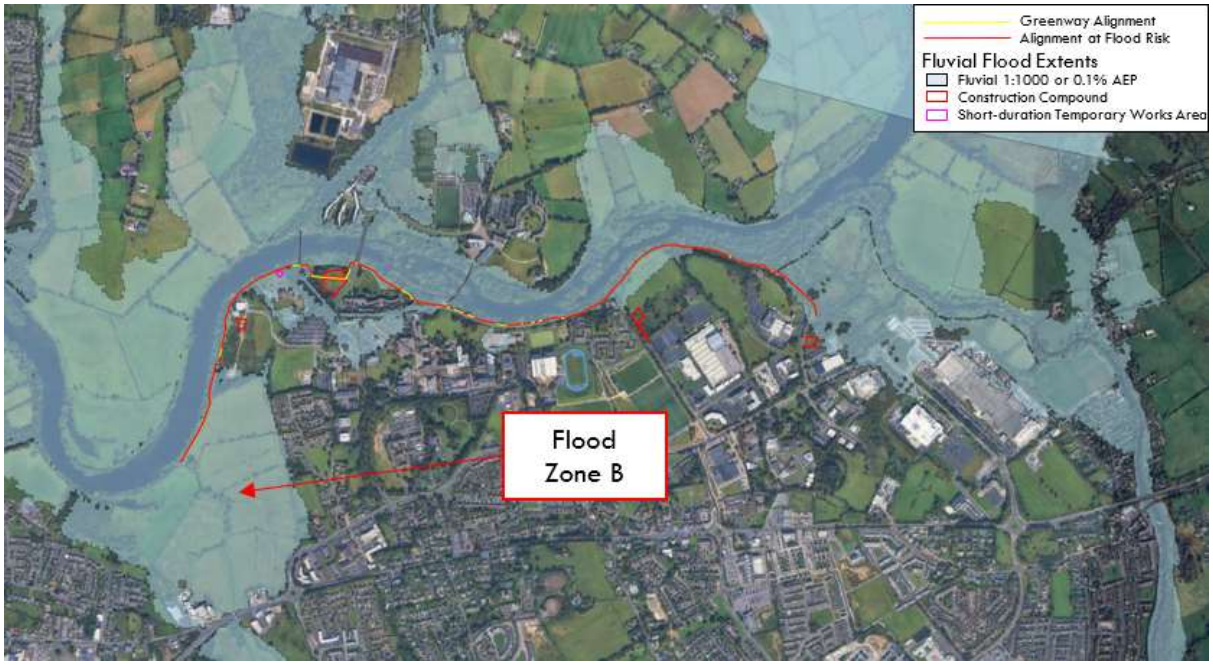

Figure 4-139: Sections of Greenway at Flood Risk (1 in 1000 or 0.1% AEP)

Surface water will be managed through a series of existing open drains alongside the proposed Greenway and existing culverts under existing paths, proposed open drains alongside the proposed Greenway, and new culvert pipes under the proposed path.

There will be 5 No. box culverts constructed in existing drainage channels where the proposed Greenway will cross it. Four are new culverts and one is a replacement culvert. They will have a minimum diameter of 0.9m and range up to 2.0m cross sectional diameter (exact diameters to be confirmed after completion of the Section 50 assessment).

22 No. precast concrete culvert pipes of 0.5m diameter and 6-8m in length and associated headwalls will cross under the proposed Greenway path at 100m intervals where there are no existing culverts. The purpose of these culverts is to enable groundwater which collects in the open drains alongside the path to be discharged to the rivers. The open drains will be shallow, approximately 1.0m wide and 200mm deep. The drains will collect storm water flows from the proposed path and runoff from the hilly green field in the IDA's National Technology Park. Water will flow in the drains to the 22 No. culverts and pass under the proposed path.

Following flood events there is a risk of debris in the minor watercourses culverts and drains pipes. Post flooding maintenance to clear the culverts of debris will be required by LCCC.

4.4.11 Public Lighting

The Public Lighting design for the proposed project will use best practice guidance notes "*Bats and artificial lighting in the UK*" as published by the Bat Conservation Trust, in respect of mitigation strategies, to minimise the impact of outdoor lighting upon bat populations. The LCCC Public Lighting standard has also been followed.

There will be new public lighting along the shared path which follows the south bank of the River Shannon for approximately 3km.

Public lighting will be controlled by light sensors so their turn on time will vary during the calendar year and turn on after dusk, but lights will turn off at 23:00 hours in accordance with the LCCC Public Lighting Design Specification.

Light emitting diodes (LEDs) type lanterns of the cool white type in accordance with the LCCC Public Lighting standard will be installed. They will have a Colour Temperature of 2,700°Kelvin, because it is considered less disruptive to the emergence of bats from roosts at dusk, and subsequent movement from habitats to foraging locations.

LED lanterns do not emit any ultraviolet or infra-red radiation, this again being a desirable feature in relation to impact upon bats, in terms of causing spatial exclusion from artificially lit areas.

Light levels have been kept as low as possible (P4 Class) by reference to levels specified in "Design of road lighting' - BS EN 5489-1: 2020, and these will be in accordance with the LCCC Public Lighting standard.

There will be two lighting columns; 1.6m high and 5m high. The 1.6m high lighting column will have an integrated lantern that will point directly onto the path, and they will be spaced 5m apart (Refer to the Preliminary design drawing 2535-RHA-XX-DR-C-PD-0016 for a photo of an equivalent lighting column). The Lanterns on 5m high columns will be mounted at 0° degree tilt and will be the fully cut off type with no light output above the horizontal plane. The 5m high lighting columns will be spaced approximately 35m apart to avoid siting lighting columns near mature trees with roost potential and the 1.6m high columns shall be used if there are any signs of bats in an area. The 1.6m high columns will be used in the Annex 1 Alluvial forest area.

Cable ducts for the public lighting will be installed by open trench to minimum 300mm cover in areas where no trees or tree roots are present, and by Moling technique in areas with trees. The moling will allow cable ducts to be installed to a minimum depth of 600mm so the cable ducts will pass under tree roots and protect them from damage.

Any temporary lighting required for health or safety reasons during the construction period shall be installed at a minimum of 10 metres from existing treelines and woodland habitats and directed away from such sensitive habitats.

4.4.12 Interface with roads

The proposed Greenway will interface with existing roads at several locations along the route. The features which define interfaces with roads relate to improving the safety of pedestrians, cyclists, and motorists where they interact. In addition to sign posting and path markings/decals, the following features have been included as safety measures at the interfaces with roads.

i) Tactile paving

Tactile paving will be installed on a footpath wherever a footpath crosses a road at road level and at raised tables to provide warning of approaching traffic for the visually impaired.

ii) Toucan Crossing

There will be 1 No. new Toucan crossing on Plassey Park Road to replace the existing raised table.

iii) Kerbs

Raised kerbs will run parallel to the proposed cycle lanes to provide a physical separation between the road and the proposed Greenway. At junctions, the proposed raised kerbs will transition to dipped kerbing to facilitate smooth for vehicles from the carriageway across the proposed cycle lanes and footpaths.

iv) Raised Tables

Alongside University Road, there will be raised tables crossing the road entrance into Kilmurry Village and the northern entrance to the UL Gaelic pitches. There will be raised tables at the southern part of McLaughlan Road. These raised tables will maintain a consistent level of the footpath and the cycle lanes where they cross a road, or a junction, and will signal traffic to slow down and check oncoming walkers and cyclists.

4.4.13 Road Markings

Cycle track markings will be carried out in line with Traffic Signs Manual, Chapter 7 – Road Markings – Department of Transport, Tourism & Sport (2019).

There will be decals on shared surfaces illustrating the side of the path that cyclists and walkers should adopt at transitions from shared surface paths to separated cycle lanes and footpaths.

4.4.14 Signage

There will be directional signs along the 4.25km of the proposed route. Existing signs along the proposed route will be retained. Refer to Figure 4-7 for a photo of an existing directional sign on the existing path.

Directional signage for the Greenway will be erected at the approach to junctions and interfaces with roads, and where the path splits into separate cycle lanes and footpaths. There will be signs to University Road, McLaughlan Road, Plassey Park Road, and at all the interface locations in the UL campus where the proposed path leads to other existing cycle lanes or interfaces with roads.

Speed control signs will be erected to remind cyclists to manage their speed and be mindful of other path users.

All signage will be clear and consistent and will be designed in accordance with the Department of Transport's 'Traffic Signs Manual'.

4.4.15 Information boards

Information boards will be erected at areas of interest including Plassey Beach and Plassey Mills. The information boards will include information about ecology (i.e., flora and fauna and biodiversity) and built heritage (architecture and/or structures of architectural or heritage importance).

4.4.16 Fencing

There will be 1.4m high timber post and rail fencing to Transport Infrastructure Ireland (TII) standard detail CC-SCD-00301 which will be erected at locations along the path including:

- Where the proposed Greenway runs adjacent to or crosses water
- Where the proposed Greenway approaches bridges or retaining walls;
- Where there is a ditch or steep slope adjacent to the path;
- At junctions;
- At sections of the boundary with UL;
- Along the boundary with private landowners; and,
- Along the boundary with the National Technology Park.

There will be 1.45m high corten steel fencing along the parapets of the proposed steel bridges and along the approaches to the existing stone bridges and cut stone abutments.

There will be 2.4m high anti-climb palisade fencing erected along the south-eastern boundary of Kilmurray Student Village and outside the commercial property BD-RCI Limerick on University Road to match the existing fence.

4.4.17 Amenity/Rest area Benches

Green Oak and corten steel benches will be installed in the amenity areas at Groody Bridge, Plassey Mills and Plassey Beach.

4.4.18 Construction Programme and sequencing

The construction duration for 4.25km of the proposed Greenway is approximately 30-60 months with works being carried out in one section at any one time. Sequencing of work in any of the five sections is flexible.

The works will be subject to ecological programme constraints as follows:

- Foreshore works (include preparatory work) beside all watercourses supporting salmonids shall be undertaken from May to October (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds.
- To avoid impacting on bird nesting sites, the vegetation removal within the defined working area will not be carried out during the peak bird nesting season of March to August (inclusive) prior to the onset of works.
- Invasive species along the proposed greenway should be treated and removed prior to construction works.

4.4.19 Reinstatement works

The temporary working areas and compounds will be reinstated to their original condition following completion of the construction phase in each section.

Tree planning is proposed alongside the Greenway to compensate for tree felling along the route. For every tree that is felled, there will be five trees planted to compensate, so approximately 305 trees are proposed to be planted along the proposed Greenway.

4.4.20 Post construction Maintenance

Adherence to best practice codes such as the "Code of Best Practice for National and Regional Greenways" ensures that a continuously high standard of the proposed Greenway is provided for all users. LCCC be responsible for the upkeep and maintenance including litter control and invasive species management through ongoing maintenance plans.

REFERENCES

Bat Conservation Trust (2018). Bats and artificial lighting in the UK. Institution of Lighting Professionals, Bat Conservation Trust, London.

Design of road lighting' - BS EN 5489-1: 2020.

IFI (2016). Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.

Transport Infrastructure Ireland (TII) Rural Cycleway Design DN-GEO-03047 (2022);

Department of the Transport and Department of Housing, Local Government and Heritage, Design Manual for Urban Roads and Streets (DMURS, 2023);

National Transport Authority's Cycle Design Manual (2023);

Department of Transport, Tourism & Sport document Traffic Signs Manual (TSM) (2019) and,

National Transport Authority's Limerick-Shannon Metropolitan Area Transport Strategy 2040 (LSMATS)

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5. HUMAN BEINGS, POPULATION & HUMAN HEALTH

5.1 INTRODUCTION

This section of the EIAR describes the assessment of potential impacts, mitigation measures and residual impacts of the proposed Limerick City Greenway (UL to NTP) on population and human health in the environs of the Project. The assessments have been completed in accordance with the guidance set out by the Environmental Protection Agency (EPA) in 'Guidelines on Information to be contained in Environmental Impact Statements' (EPA, 2022) and 'Advice Notes on Current Practice in the preparation of Environmental Impact Statements' (EPA, 2003) and the European Commission Guidance on the Preparation of the Environmental Impact Assessment Report (EC, 2017). A full description of the proposed Project is provided in Chapter 4 of this EIAR.

One of the principal concerns in the development process is that people, as individuals or communities, should experience no diminution in their quality of life from the direct or indirect impacts arising from the construction and operation of any development. Ultimately, all the impacts of a development impinge on human beings, directly and indirectly, positively and negatively. The key issues examined in this section of the EIAR relate to population and human health and incorporate population statistics, employment and economic activity, land-use, residential amenity, community facilities and services, tourism, property values, accidents/natural disasters, health and safety and other environmental hazards such as water contamination, air pollution and traffic.

Reference is also made, in this chapter, to nuisance impacts on human beings that are dealt with in other sections of this EIAR such as dust and noise from Chapter 7- Land use, Soils and Geology, Chapter 9 – Air Quality- Noise and Vibration; traffic from Chapter 13 - Material Assets and other impacts from Chapter 11- Landscape and Visual.

The focus of this chapter is to establish the potential for impacts of the proposed Greenway on population, health and economic activity in the area and on potential impacts to the community, including the resident, working and visiting community in the environs of the Project during construction and operation. The Limerick City Greenway (UL to NTP) has an indefinite operational duration; therefore, the impacts of decommissioning have not been assessed.

5.2 DESCRIPTION OF RECEIVING ENVIRONMENT

5.2.1. Data Sources

The following sources of information and literature pertinent to the area were used in the preparation of this section to establish any likely significant impacts that may occur:

- Central Statistics Office (CSO), Census Data (demographic data from Census 2011, Census 2016, Census 2022);
- Limerick Development Plan 2022-2028
- Clare County Development Plan, 2017 – 2023;
- Fáilte Ireland;
- GeoDirectory; and
- Aerial photography.

The appraisal of potential impacts on population and human beings was undertaken by reviewing the current socio-economic environment in the Study Area. Information regarding human beings and general socio-economic data were sourced from the Central Statistics Office (CSO), Limerick Development Plan 2022-2028, Clare County Development Plan 2017 – 2023, Fáilte Ireland and any other literature pertinent to the area. The study included an examination of the population and employment characteristics of the area. This information was sourced from the most recent census data, the Census of Ireland 2022 and from the CSO website, www.cso.ie. Census information is divided into State, Provincial, County, Major Town and District Electoral Division (DED) level. For the purposes of this section of the EIAR, data for the DED level was used wherever possible.

5.2.2. Human Beings in the Existing Environment

5.2.2.1. Study Area: *Definition of Study Area*

In order to assess the population in the vicinity of the site, the Study Area for the Population section of this EIAR was defined in terms of the District Electoral Divisions (DEDs) where the proposed Greenway is located, as well as nearby DEDs which may be affected by the proposed development. The site of the proposed Greenway lies within three main DEDs, Ballysimon and Ballyvarra located in Co. Limerick, and Cappavilla which is situated in Co. Clare. There are small sections of two other DEDs located to the west of the Study Area corresponding to Limerick South Rural and Abbey B. For the purposes of this chapter, the three main DEDs (Ballysimon, Ballyvarra and Cappavilla) will be referred to as the Study Area. This demographic area best reflects the population distribution of the regions surrounding UL which contains the target group of stakeholders affected by the proposed Project, including town's people and enterprise owners.

The Study Area has a combined population of approximately 1,129 persons, as of 2022 and comprises a total land area of 5.8 square kilometres (Source: CSO Census of the Population 2022). Population estimates were calculated based on DEDs area, total population and population density.

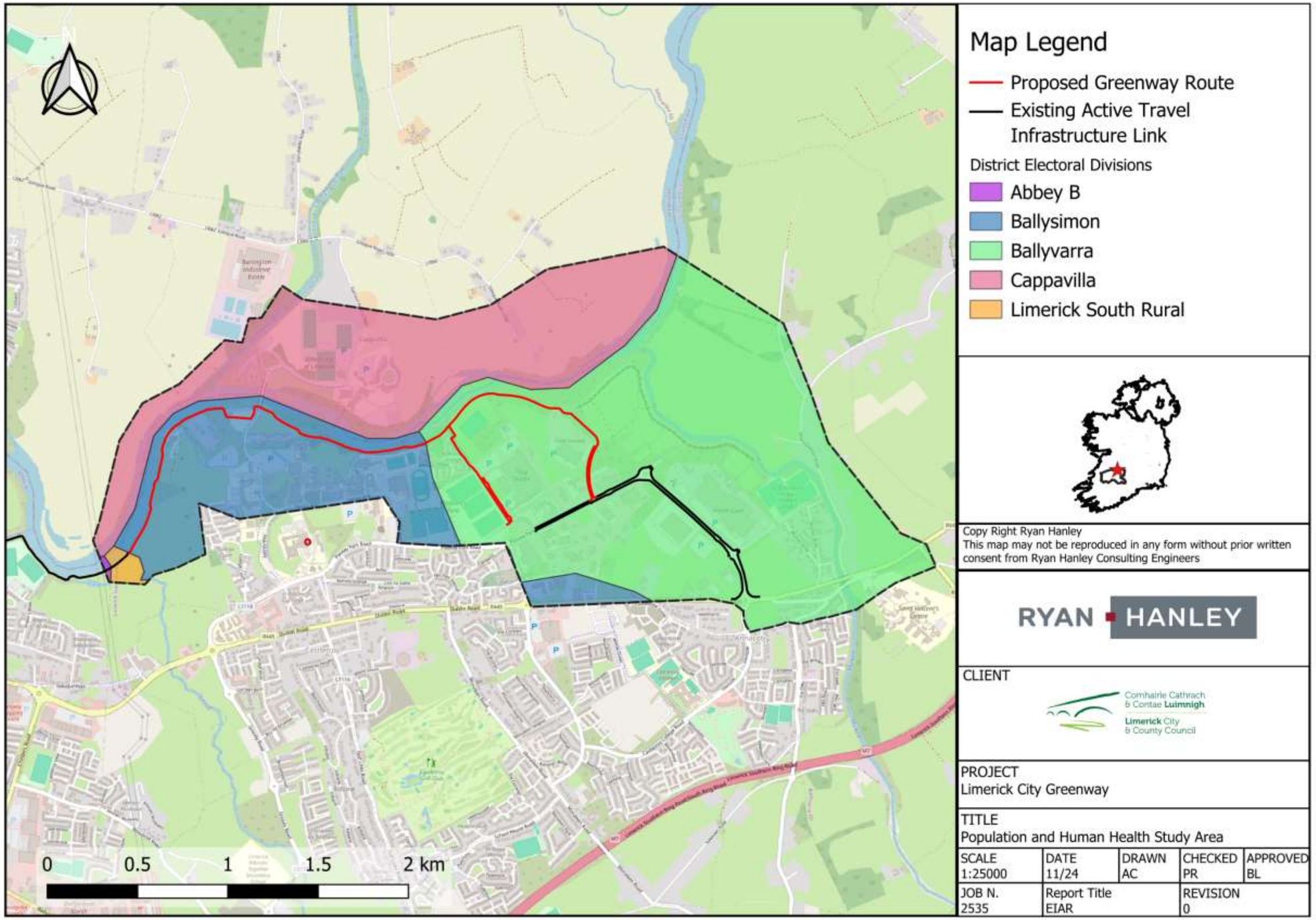

Figure 5. 1 Electoral Districts within the Study Area

5.2.2.2. Settlements and Planning Policy

The Study Area, and associated Limerick County DEDs, encompasses the local area of Castletroy which falls under the settlement structure Tier 1: The City and City Environs. Castletroy is located in the eastern environs of Limerick City, bisected by the R445 Dublin Road with the M7 Dublin to Limerick Motorway to the south and bounded by the River Shannon to the north. Castletroy contains a number of distinct components including the University of Limerick and National Technology Park, with the southern area primarily comprising of residential areas.

The area of Castletroy performs an important trade and service function for the population and surrounding hinterland as evident by the diverse range of services and businesses and its close proximity to Limerick City centre provides an ideal location to reside coupled with the university campus and wide range of sporting and amenity facilities.

The Limerick Development Plan 2022-2028 incorporates the area that was covered by the Southern Environs Local Area Plan and the Castletroy Local Area Plan. Therefore, the village of Annacotty is included in the overall spatial framework plan and zoning objectives. As part of the policies of the Plan it includes the growing of Limerick City and Suburbs, including Annacotty as a key driver for social and economic growth in Limerick. The objective CGR 08 of this policy states the following:

It is an objective of the Council to:

a) *Promote development which incorporates a high quality, sustainable and inclusive approach to proposals in the City and Suburbs (in Limerick), Mungret and Annacotty, which is supported by sustainable means of travel and which creates locally distinctive neighbourhoods and positively contributes to the existing built and natural heritage.*

5.2.2.3. Population

The route of the proposed Limerick City Greenway is predominantly located within the grounds of the University of Limerick along the banks of the River Shannon and diverts through the National Technology Park. Residential settlements are comprised of those associated with the University and the local area of Castletroy. Residential dwellings within the Study Area are quite scattered with the majority of this region being comprised of the University campus buildings and commercial enterprises associated with the National Technology Park.

Population Trends

In the four years between the 2011 and the 2016 Census, the population of Ireland increased by 3.8%, further increasing by 8.1% between 2016 and 2022. The change in the population between successive censuses can be broken down into the combined effect of natural increases and net migration. Between 2011 and 2016, the population of Co. Limerick grew by 1.9% from 191,306 to 194,899 persons. The population of Limerick County continued to grow by 7.5% between 2016 and 2022 from 194,899 to 209,536 persons. Population statistics for the State, County Limerick, County Clare, the Study Area and DEDs have been obtained from the Central Statistics Office (CSO) and are presented in **Table 5. 1.**

Table 5. 1 Population 2011-2022 (Source: CSO)

Area	Population			% Population Change	
	2011	2016	2022	2011-2016	2016-2022
State	4,588,252	4,761,865	5,149,139	3.8%	8.1%
County Limerick	191,306	194,899	209,536	1.9%	7.5%
County Clare	117,194	118,817	127,938	1.4%	7.7%
Study Area	978	967	1,129	-1.05%	16.8%
Ballysimon DED	13,073	13,590	16,560	4%	21.9%
Ballyvarra DED	4,269	4,288	4,513	0.45%	5.2%
Cappavilla DED	1,038	846	1,111	-18.5%	31.3%

It can be seen from **Table 5. 1** above that between the period 2011 to 2016 there was a slight population decrease in the Study Area, contrary to the both county and national levels which had a slight increase during that same period. Overall, the DEDs show population increases, in line with county and State levels, with the exception of Cappavilla DED which has seen a population decrease of 18.5% from 2011 to 2016. In the period 2011– 2016, Ballysimon DED experienced a population increase of 4% while this was slightly lower for Ballyvarra DED with just a 0.45%. The 2016-2022 population trends show a much higher increase in population during those four years for all the District Electoral Divisions. It is worth to note that the DEDs boundaries can change after some censuses' periods which might influence the total population.

Population Density

The population densities recorded within the State, Limerick City, the four DEDs and Study Area during the 2022 Census are shown in **Table 5. 2.**

Table 5. 2 Population Density in 2022 (Source: CSO)

Area	Population Density (Persons per square kilometre)
State	70.0
County Limerick	76.03
County Clare	37.17
Ballysimon DED	541
Ballyvarra DED	118
Cappavilla DED	127
Study Area	194.7

The population density of the Study Area recorded during the 2022 Census was 194.7 persons per square kilometre. In ascending order the district electoral division with lower population density is Ballyvarra with 118 persons per square kilometre, followed by Cappavilla with 127 persons per square kilometre. Ballysimon shows a much higher population density with 541 persons per square kilometre.

Household Statistics

The number of households and average household size recorded within the State, County Limerick, County Clare, the four DEDs and the Study Area during the 2016 and 2022 Censuses are shown in Table 5.3.

Table 5. 3 Number of households and average household size 2016-2022 (Source: CSO)

Area	2016		2022	
	No. of House-holds	Avg. Size (persons)	No. of House-holds	Avg. Size (persons)
State	1,702,289	2.75	1,841,152	2.74
County Limerick	71,224	2.70	76,472	2.70
County Clare	43,469	2.68	46,553	2.67
Ballysimon DED	4,551	2.93	5,566	2.89
Ballyvarra DED	1,415	3.07	1,473	3.08
Cappavilla DED	261	2.76	286	2.74
Study Area	327	2.95	386	2.92

Table 5. 3 shows an overall increase in the number of households across the board at both a state and county level, with a significant increase in the number of households between 2016 – 2022 observed in County Limerick. Average household size recorded Ballysimon and Cappavilla DEDs is in line with that observed at State and County level. However, Ballyvarra DED shows a higher average household size.

Age Structure

Table 5. 4 presents the percentages of the State, Counties Limerick and Clare and the Study Area population (estimations using population density and DEDs) within different age groups as defined by the Central Statistics Office during the 2016 and 2022 Census. The data is also displayed for the Population per Age Category in 2022 in Figure 5. 2.

Table 5. 4 Population per age category in 2022 (Source: CSO)

Area	Age Category				
	0 – 14	15 – 24	25 - 44	45 - 64	65 +
State 2016	21.14%	12.11%	31.45%	21.9%	13.39%
State 2022	19.66%	12.52%	27.62%	25.12%	15.08%
County Limerick 2016	20.32%	13.26%	28.39%	23.97%	14.07%
County Limerick 2022	18.84%	13.06%	27.19%	24.89%	16.03%
County Clare 2016	21.52%	11.50%	26.16%	25.96%	14.86%
County Clare 2022	19.54%	12.41%	24.02%	27.10%	16.93%
Study Area 2016	17.11%	27.63%	27.47%	18.49%	9.25%
Study Area 2022	15.73%	26.36%	27.64%	19.42%	10.83%

Comparisons of county level data from 2016 and 2022 show little change throughout the age categories, with percentages remaining relatively stable throughout counties Clare and Limerick, a similar trend is also observed for the State. For both counties Limerick and Clare, the highest population percentage lies within the 25 – 44 age category, which is similarly observed at State level.

For the study area[1], between 2016 and 2022 there is a slight decrease for population between the younger ages 0-4 and 15-24 and a slight increase for population ages between 25-44 and 45-64. Even though the lowest percentage of the population in the 65+ range, there was an increase of this age category between 2016 and 2022 from 9.25% to 10.83%. However, overall, this shows a relatively young population trend within the study area.

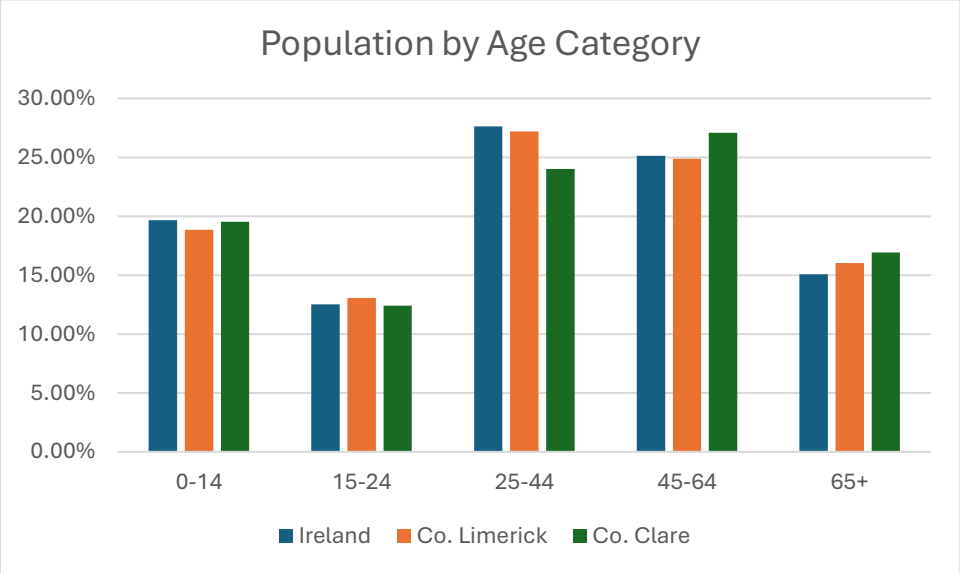

Figure 5. 2 Population per Age Category 2022 (Source: CSO)

5.2.2.4. Economic Activity

Employment

The 2022 Census of Population was examined to determine trends in relation to employment including the number of persons at work and unemployment levels. The total number of persons in the labour force grew by almost 10% from 2016 and 2022 at State level. Limerick County registered a 8.1% increase for that same period while Clare County had a similar growth of 10% of people in the labour force.

The manufacturing industry represents a strong economic industry at State and County levels. It adds to 14.10% for Clare, 12.63% for Limerick and 9.59% at State level. Human health and social work activities also represent an important industrial group with Limerick City and County Council with the highest percentage of 11.61% of the total workforce, followed by the State with 10.65% and Clare County with 9.7%. Other industrial groups with hight representation at both State and County levels include Retail, Professional, scientific and technical activities. Less represented groups include Mining, energy supply, waste management, household employers, among others. **Figure 5. 3** displays the percentage of total employment

[1] Estimates calculated considering the percentage distribution in the electoral divisions and the total population within the study area.

for each industry type utilising 2022 Census data for Counties Limerick and Clare and comparing them to the State figures.

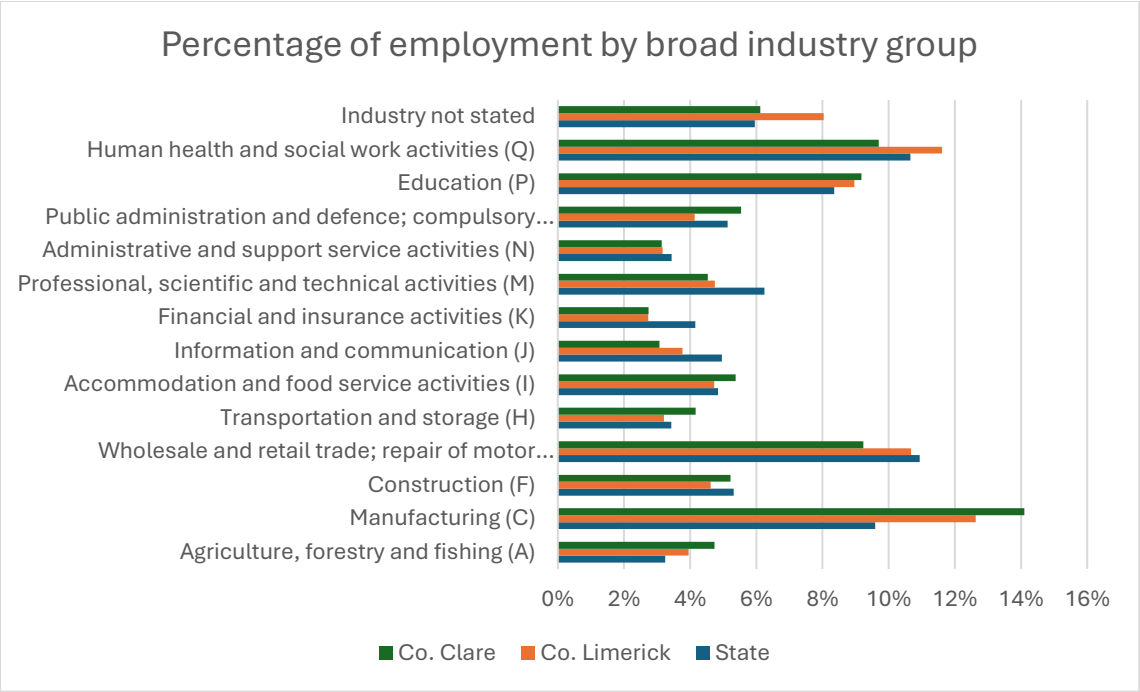

Figure 5. 3 Employment per broad industry group in 2022 (Source: CSO)

When compared to County level, employment trends within the study area show very similar percentages regarding employment categories. Following the County level trend, the study area has a high proportion of the workforce employed in Professional services (27.3%), followed by commerce and trade (21.1%).

Table 5. 5 Estimate employment type in the Study Area in 2022[2] (Source: CSO)

Industry	Total	%
Agriculture, Forestry and Fishing	7	1.5
Building and Construction	15	3.4
Manufacturing Industries	67	15.1
Commerce and Trade	94	21.1
Transport and communications	38	8.6
Public administration	19	4.4
Professional services	121	27.3
Other	83	18.7

[2] Estimates based on DEDs CSO data, total surface area and study area

The primary type of employment provided in the Study Area is professional service based employment, in addition to employment generated by commerce and trade as well as other types.

The 2022 CSO data from the DEDs which are intersected by the Study Area, illustrate most of respondents have a journey time of less than 30 minutes to their work or education, which indicates that a high percentage of employment and educational facilities are located relatively close by.

Unemployment

The labour force consists of people aged 16[3] or over, out of full-time education and not performing duties that prevent them from working. In 2022, there were 2,528,251 persons in the labour force in Ireland. **Table 5. 6** shows the percentage of the total population who were in the labour force during the 2022 Census. This figure is further broken down into the percentages that were at work, seeking first time employment or unemployed. It also shows the percentage of the total population who were not in the labour force, i.e. those who were students, retired, unable to work or performing home duties.

Table 5. 6 Economic status of the total population aged 15+ in 2022 (Source: CSO)

	Status	State	County Limerick	County Clare	Study Area
% of population aged 15+ who are in the labour force	Total % population in labour force	61.1%	58.2%	59.3%	50.1%
	At work	91.6%	91.3%	92.0%	93.2%
	First time job seeker	1.4%	1.4%	1.3%	1.5%
	Unemployed	7.0%	7.3%	7.0%	5.5%
% of population aged 15+ who are not in the labour force	Total % population not in labour force	38.9%	41.2%	40.7%	49.9%
	Student	28.6%	29.2%	28.0%	62.9%
	Family	17.0%	15.5%	15.7%	7.6%
	Retired	40.9%	40.2%	43.7%	22.5%
	Unable to work	11.8%	13.8%	10.6%	6.5%
	Other	1.7%	1.2%	2.0%	0.6%

In comparing the data in **Table 5. 6**, it is evident that the percentage of the population within and not within the labour force for Counties Limerick and Clare is comparable to the figures observed at State level. For counties Limerick and Clare, the greatest percentage of the population in the labour force are At Work,. The highest percentage of the population within the Counties Limerick and Clare that are not in the labour force, lie within the Retired category.

As for the study area, the percentage of population that is not within the labour force is slightly higher than the percentages shown at State and County levels, adding to 49.9% with a high percentage of the population being a student or pupil which matches that the study area is occupied mainly by university grounds.

[3] Minimum legal age for full time employment

Employment by Socio-Economic Group

Socio-economic grouping divides the population into categories depending on the level of skill or educational attainment required. These range from higher professional to unskilled. The 'Higher Professional' category includes scientists, engineers, solicitors, town planners and psychologists. The 'Lower Professional' category includes teachers, lab technicians, nurses, journalists, actors and driving instructors. Skilled occupations are divided into manual skilled, such as bricklayers and building contractors; semi-skilled, e.g. roofers and gardeners; and unskilled, which includes construction labourers, refuse collectors and window cleaners. **Figure 5. 4** shows the percentages of those employed in each socio-economic group in the State and Counties Limerick and Clare during 2022.

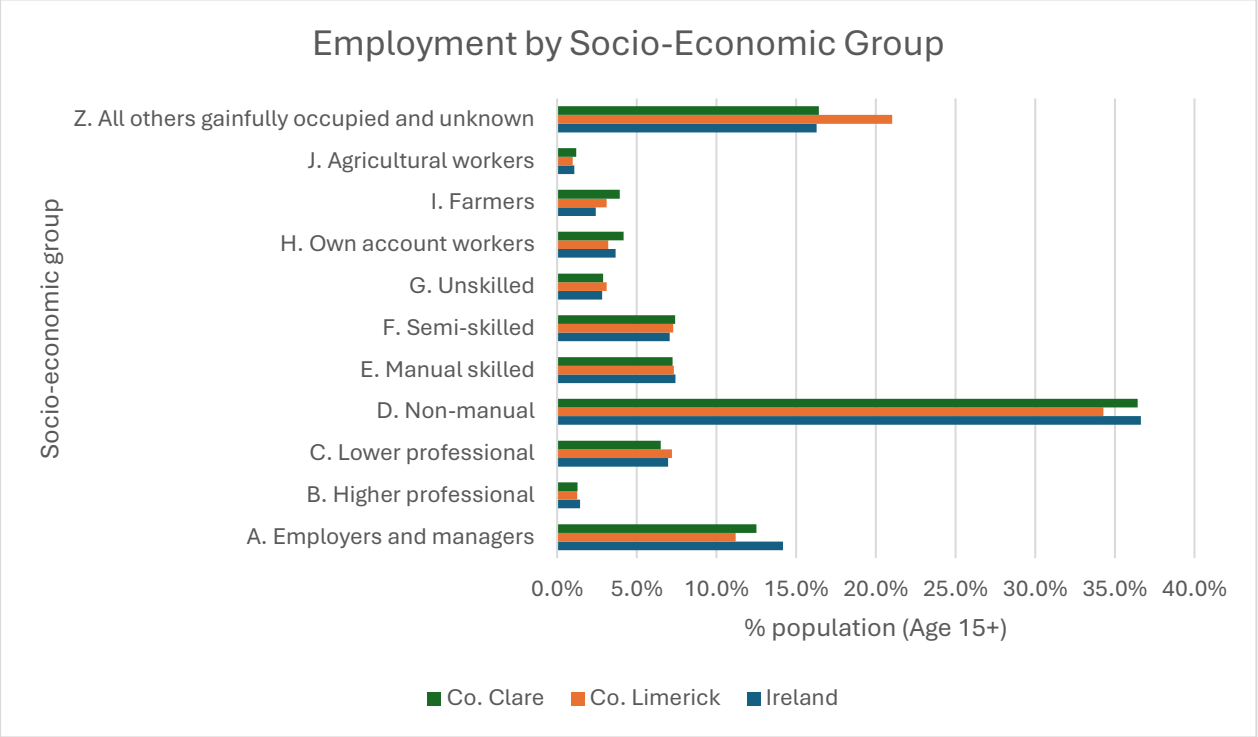

Figure 5. 4 Employment by socio-economic group in 2022 (Source: CSO)

When comparing the socio-economic groupings between the two Counties and State a similar trend can be seen throughout with Non-manual, Employers and managers and All others gainfully occupied and unknown workers comprising the greatest percentage of the socio-economic groupings. Similarly, the lowest percentage between the two Counties and State displays a similar trend throughout with Agricultural workers, Unskilled and Higher professional workers can be seen.

The CSO figures for socio-economic grouping have a limitation of including the entire population, rather than just those who are in the labour force. It is likely that this is what gives rise to the high proportion of the population shown to be in the All others gainfully occupied and unknown category in Figure 5.4.

5.2.2.5. Services

The proposed Greenway is situated within the local area of Castletroy, which as previously stated, contains a number of distinct components including the University of Limerick and National Technology Park and plays an important trade and service function for the population and surrounding area. Additionally, due to its

close proximity to Limerick City Centre it provides an ideal location to reside coupled with the University campus, diverse range of services and businesses and wide range of sporting and amenity facilities available.

Education

A majority of the proposed Greenway route is situated within the grounds of the University of Limerick which has a student population of 16,500, including more than 2,000 international students each year. Within the National Technology Park, Limerick City College is present which provides evening courses/classes.

Primary and secondary schools within the Study Area include Milford National School which is located within Castletroy and has a combined student population of 489. No pupils in addition to a secondary school, Castletroy College which has a student population of 1,218. No pupils.

Two childcare facilities are located within the Study Area, Unikids located in proximity to Troy Studios and Silver Apples Creche located adjacent to Glucksman Library.

The proposed Greenway will continue the existing City Centre to University of Limerick Riverbank Walk (a 3.25km shared walkway/cycleway which ends at the UL Boathouse) further providing a safe route for travel via walking or cycling from Limerick City and surrounding environs to the University Campus, Milford National School and Castletroy College which are present adjacent to the grounds of the University. The Greenway will provide a positive enhancement to the region, giving a safe and environmentally friendly means of travelling to the University and schools.

Access and Public Transport

The proposed development area lies along the banks of the River Shannon, with smaller sections connecting into the National Technology Park via University Road and McLoughlan Road. The Greenway can be accessed via several routes including Plassey Park Road (L1118) which runs in a west to east direction, and several internal roads associated with the University and Technology Park. An existing active travel link which runs from Dublin Road to Plassey Park Road also provides further connectivity to the proposed greenway.

The area surrounding the Study Area is serviced by public transport with several bus stops located along the Dublin Road and Plassey Park Road which are serviced by Limerick City Bus Éireann services 304 (Ballycummin to UL) and 304A (Raheen UHL to UL). These bus services run frequently on weekdays at 15- and 30-minute intervals, respectively, and every 15 to 30 minutes on Saturdays and Sundays.

The ease of access through regional and local roads and public transport provides a simple and straightforward means to access the Greenway from various locations outside of Castletroy region ensuring the use of the Greenway amenity for the wider community and population.

Amenities and Community Facilities

There are numerous amenities and community facilities within the Study Area, owing primarily to the University campus, including Munster Rugby HQ, UL Bohemian Rugby Club, the UL Sports Arena which has numerous outdoor facilities including all weather pitches, athletics track, tennis courts, hockey pitch and indoor facilities including a National 50m swimming pool, sports hall, climbing wall, gym, National Strength and Conditioning Centre and group fitness classes.

Walking routes along the River Shannon and throughout the University campus provide amenity within the Study Area.

Several personal services are present within the Study Area, primarily within the grounds of the University, including numerous cafés (i.e. Cube Café, Plaza Café, Starbucks, Café Sportif and No. 13 The Factory).

Restaurants including Eden Restaurant (UL campus), Neligan's Bar & Restaurant and Brew Boys are also situated within the Study Area.

The proposed Greenway amenity contributes further to existing facilities within the area and will provide greater custom to facilities such as cafés and restaurants. The proposed Greenway will provide a positive addition for the surrounding community.

Tourism in the Study Area

Tourist attractions in the region includes 7. No golf clubs in Co. Limerick and 13. No in Co. Clare, none of which are located within the Study Area. The closest golf club is Castletroy Golf Club which is located c. 1.0km south of the Study Area.

A desktop review of the angling amenities within the Study Area has been carried out and did not identify any angling clubs within the Study Area although the Shannon Mulkear Anglers and Limerick & District Angling Associations are active along the Rivers Shannon, Mulkear and their tributaries.

Fáilte Ireland accommodation listings dataset identifies Kilmurray Lodge Hotel within the Study Area, with Troy Holiday Village and Castletroy Park Hotel and Suites located to the south of the Study Area.

The surrounding area of Counties Limerick and Clare has numerous tourist attractions, with both counties forming part of the Wild Atlantic Way; a 2,500km route along the west coast of Ireland from Donegal to Cork. The wider regions of Limerick and Clare provide many opportunities for general indoor and outdoor recreation. Some local attractions of the surrounding area is listed below.

Co. Limerick:

- St. John's Castle: One of Limerick's most iconic landmarks is a 13th century fortress in the heart of medieval Limerick and is one of the best-preserved Norman castles in Europe and a fantastic visitor experience. St. Johns Castle is located within Limerick City Centre approximately 2.4km west of the Study Area.
- Saint Mary's Cathedral: Founded in 1168 A.D. the Cathedral is said to be built on the site of a Viking Thingmote, and later became the palace of Donal Mór O'Brien, the King of Munster. This 12th Century cathedral has evolved into a stunning architectural treasure over the years. Saint Mary's Cathedral is located within Limerick City Centre approximately 2.35km west of the Study Area.
- Hunt Museum: Located within Limerick City Centre on the banks of the River Shannon, the Hunt Museum displays an internationally important collection of 2,000 original works of art and antiquity and Ireland's greatest private collections dating from the Neolithic to the 20th Century. The Hunt Museum is located within Limerick City Centre approximately 2.4km west of the Study Area.
- University Concert Hall: The 1,000 seat venue located within the Study Area on the grounds of the University of Limerick hosts a variety of live entertainment events including concerts, recitals, drama and comedy.

Co. Clare:

- The Cliffs of Moher: Located along the coastline of Liscannor, Co. Clare, the Cliffs of Moher is one of Ireland's top visitor attractions and were awarded a UNESCO Global Geo Park status in 2011.

The Cliffs stretch for 8km providing a scenic walking route. The Cliff's are located approximately 65km north-west of the Study Area.

- The Burren: The 1,500 ha Burren National Park is a distinctive region with a unique ecosystem of rare native Irish plants and flowers and is open all year round. The Burren National Park is located approximately 42.7km north-west of the Study Area.
- Lahinch Beach: Situated within the head of Liscannor Bay, Lahinch is a popular resort town with many restaurants and accommodation, and a popular location for surfing with several surf schools located along the beach in addition to sea kayaking and kite surfing. The 2 km long beach of golden sands provides a walking amenity for visitors. Lahinch village is located approximately 58.7km north-west of the Study Area.

The proposed Greenway will assist in providing a positive impact on tourism in the region, creating an accessible walking and cycling route from Limerick City Centre to the University of Limerick and vice-versa, enabling access to various attractions, local accommodation and hospitality businesses.

5.2.2.6. Human Health

The health benefits of walking and cycling have been well documented and include improved mental wellbeing, strengthening of the immune system, improved muscle tone, maintenance of a healthy weight, improved cardiovascular fitness and reduction in the risk of cancer and heart disease. The Greenway offers a means in which the health benefits of walking and cycling outdoors can be obtained.

The National Physical Activity Plan (NPAP) was launched in 2016 with the aim to increase physical activity levels across the entire population thereby improving the health and wellbeing of people living in Ireland. The Implementation Summary 2019 of this Plan outlines 60 Actions as part of the NPAP of which Action 32 of the NAPA details the development and promotion of walking and cycling strategies in each local Authority area. Action 36 also highlights the National Planning Framework (NPF) which includes National Policy Objective 27; 'to ensure the integration of safe and convenient alternatives to the car into the design of our communities, by prioritising walking and cycling accessibility to both existing and proposed developments and integrating physical activity facilities for all ages'.

The NAPA outlines that walking or cycling for transport or leisure is a form of physical activity that can be easily incorporated into daily activities for many people. Having supportive environments, such as that as the proposed Greenway, for walking, cycling, recreational and outdoor physical activity has many benefits other than the immediate physical activity gains. Walking and cycling as a means of travel, improves air quality through the reduction of CO2 emissions, assisting in reducing traffic congestion and noise pollution. In turn, this supports the Government policies such as 'Smarter Travel: A Sustainable Transport Future", the 'National Cycle Policy Framework' and the National Strategy on Education for Sustainable Development.

Get Ireland Cycling initiative was launched through the NPAP as supported by the Health Service Executive and Cycling Ireland. Cycling Ireland published their Strategic Plan 2020 – 2024 with key actions including, the development of cycling participation opportunities through enhanced programming of access activities from schools to community rides and to support the development of participation opportunities to enable people of all ages and abilities to access cycling. Both actions are supported by the proposed Greenway.

Get Ireland Walking is a national initiative by Sport Ireland that aims to maximise the number of people participating in walking for health, wellbeing and fitness throughout Ireland.

Overall, the proposed Limerick City Greenway (UL to NTP) supports both the NPAP and NPF objectives providing a positive attribute and health benefit to the nearby community and population.

5.3 LIKELY SIGNIFICANT IMPACTS

This section deals with the impacts of the proposed Greenway in the Study Area with regard to population, employment and economic activity, land use, services and tourism. As well as these the impact on human beings is discussed. Noise, air quality, visual and traffic impacts will be dealt with in more detail in Chapters 9, 11 and 13 respectively.

5.3.1. 'Do-Nothing' Scenario

If the proposed Limerick City Greenway (UL to NTP) were not undertaken, the existing environment would remain as it is, with the loss of the opportunity and benefit to expand the amenity and recreation facilities in the region and the provision of a safe and accessible path into the University campus and Technology Park grounds.

The 'Do-Nothing' scenario would result in a lost opportunity in the improvement of facilities to support human health and wellbeing in the surroundings and wider community, the opportunity to extend the existing City Centre to University of Limerick Riverbank Walk further into the University and Technology Park grounds, and the opportunity to support the NPAP actions and objectives.

5.3.2. Construction Phase

5.3.2.1. Population Impacts

It is expected that the construction of the proposed sectional Greenway will take approximately 30-60 months and the construction cost of the project will be in the region of €15 million. Those working on the construction phase of the proposed development will travel daily to the site from the wider area. A smaller number of specialist construction workers may move into the area on a temporary basis for the duration of the construction phase. The construction phase will have no impact on the population of the Study Area in terms of changes to population trends or density, household size or age structure. There will be no perceptible impact on population demographics during construction phase.

5.3.2.2. Economic Impacts

There is potential for the proposed Project to influence commercial activity and existing businesses in a positive means within the region of Castletroy during the construction phase of the proposed project, primarily resulting from an increase of construction workers on site who might utilise existing hospitality facilities. Furthermore, construction workers could support existing employment through local spending and the demand for goods and services in the wider area, e.g., on fuel, food, building supplies, haulage services, etc. This could result in a slight short-term positive impact for local businesses.

Disruption and disturbance arising from temporary working areas and access routes in proximity to business premises may arise. These effects will occur for a temporary period only and no significant impacts such as job losses due to the construction are likely. Noise and dust from the works can also add to these temporary impacts.

Overall, in the absence of mitigation, during the construction phase the impacts to economic activity within the Study Area are likely to be short term slight negative for the majority of commercial activities and businesses but with the considered and applied measures, these impacts will not be significant.

5.3.2.3. Land-Use

Construction works may affect land use within the Study Area through temporary land take for construction purposes. The route of the Greenway has been chosen with regard to several factors including the goal to minimise impact on residential properties, University buildings and Technology Park businesses. In terms of the overall Study Area, predicted land use impacts will have both positive (utilisation of existing land for amenity and recreation purposes) and negative (for land requisitioned and related access) effects. Chapters 7 and 13 also assess these impacts in the context of land take and material assets.

The majority of the proposed Greenway will be constructed along existing pathways, amenity grassland, woodland areas and greenfield sites associated with the banks of the River Shannon, in addition to more urbanised land within the University and Technology Park grounds. Potential impacts during construction in respect of land use within the Study Area include:

- Temporary loss of amenity grassland and access to existing pathways during construction. During construction operations access to certain areas along the riverbank will be prohibited for a temporary period only. This will result in a temporary disruption to users;
- On completion of the Greenway, reinstatement of areas utilised as compounds or for other construction purposes will be completed;
- Interference to existing tracks on the University grounds which are used by maintenance vehicles;
- Dust - The activity of earth moving equipment, spoil transport and other ancillary vehicles could generate significant dust in the immediate vicinity of the proposed Project. The proliferation of dust can create a nuisance to individuals utilising the nearby areas;
- Traffic - There will be an increase in worker and material related traffic during the construction phase of the proposed Project.

Construction activities may potentially negatively impact on other sensitive land uses including commercial, educational, social and community land uses. More impacts can be found in Chapter 7- Land use, Soils and Geology.

5.3.2.4. Services

Construction works have the potential to impact on service network infrastructure (drainage, water, electricity, broadband and telecommunications) within the Study Area through accidental damage during excavation.

Chapter 13 gives further details on the predicted impacts on services for drainage networks, water, electricity, broadband and telecommunications distribution networks. Locations where potential impacts are predicted are discussed in Chapter 13. Potential impacts on each service will vary, but overall, the proposed Project will have a potential temporary moderate to significant negative impact on services in the absence of mitigation.

5.3.2.5. Tourism

In general, construction of the proposed Project will not impact on regional or local tourism activities or providers as the majority of these are outside of the Study Area and will not be influenced by construction activities.

The University Concert Hall was listed as a tourist attraction in Section 5.2.2.5; however, the Hall is located c. 215m south of the proposed route and will not be directly impacted by the construction works. Sections of

an existing walking track along the banks of the River Shannon which the proposed Greenway follows will be inaccessible at times during the construction phase, however this disruption will be temporary. The walking track will be incorporated into the route & design layout of the Greenway making for a safer travel experience.

Potential increases in noise and dust levels and temporary impacts on visual amenity related to the works may also deter and/or disturb visitors during the construction phase. These impacts will be short-term in duration. However, it should be noted that there are no significant tourist attractions pertaining to the site of the proposed Project and its immediate surroundings.

5.3.2.6. Noise

WHO published community noise guidelines (CNG) and night noise guidelines (NNG) for Europe in 1999 and 2009, respectively (WHO, 1999; WHO Regional Office for Europe, 2009). Since then, significant new evidence has accumulated on the health effects of environmental noise. Exposure to noise can lead to auditory and nonauditory effects on health. Through direct injury to the auditory system, noise leads to auditory effects such as hearing loss and tinnitus. Noise is also a nonspecific stressor that has been shown to have an adverse effect on human health, especially following long-term exposure.

There will be an increase in noise levels in the vicinity of the proposed Project during the construction phase, as a result of machinery and construction work. Works associated with the proposed development may contribute to noise impact are as follows:

- Site compound set up;
- Site clearance, surface stripping and construction of temporary haulage and access roads;
- Removal of existing infrastructure;
- Drainage, platforms and bridges;
- Greenway construction and laying of surface materials;
- Development or enhancement of amenity areas.

Construction noise at any given noise sensitive locations will be variable throughout the construction project, depending on the activities underway and the distance from the main construction activities to the receiving properties. The potential noise impacts that will occur during the construction phase of the proposed development are further described in Chapter 9 of this EIAR. In the absence of mitigation, these will have a potential temporary slight to significant negative impact depending on the location of the receptor, and the works being carried out. Construction related traffic is anticipated to have a potential short term negligible impact during the construction phase of the Project.

5.3.2.7. Dust

Dust is a concern from a health perspective. EU ambient air quality standards (Council Directive 2008/50/EC transposed into Irish law as S.I. 180 of 2011) centres on PM10 (particles less than 10 microns) as it is these particles which have the potential to be inhaled into the lungs and cause some adverse health impact.

Potential dust emission sources during the construction phase of the proposed Project include excavation and earth moving activities and resurfacing works. These activities will mainly produce particles of dust greater than 10 microns; these particles are considered a nuisance but do not have the potential to cause significant health impacts. Dust emissions may cause nuisance to residents and local businesses as well as road users.

The entry and exit of construction vehicles from the site may result in the transfer of mud to public roads, particularly if the weather is wet which may cause nuisance to residents and other road users.

As detailed in Chapter 9, given that background levels of fine particulate matter (PM10 and PM2.5) are likely to be below the ambient air quality limit values and as the construction phase of the Project is short term, the potential for dust nuisance and significant levels of PM10 and PM2.5 will be short term and will vary spatially during the construction phase, constituting a short term slight negative impact.

5.3.2.8. Traffic and Transport Infrastructure

A draft Traffic Management Plan (TMP) has been developed and a Contractor's TMP will be in place during the construction phase of the Project.

Works will primarily take place within the grounds of the University and Technology Park predominantly focussed on the banks of the River Shannon and regions inaccessible by vehicles. It is anticipated that the impact of the construction phase will have a short term slight negative impact on traffic volumes in the area.

The surrounding Plassey Park Road (L1118) and the Dublin Road (R445) will be utilised by construction vehicles prior to the entrance to work areas and construction compounds i.e., haulage of excavated material, delivery of materials and work force traffic. Encountering such vehicles could result in delays to non-project related journeys as a result of slow-moving vehicles.

Access routes within the Study Area to be utilised as part of the proposed Project include:

- Private road to Castletroy Wastewater Treatment Plant;
- Dromroe Village road in the UL campus between Co Limerick and Co. Clare;
- University Road;
- Mc Laughlan Road;
- Plassey Park Road;

Full details of potential effects regarding traffic and transport infrastructure are detailed in Chapter 13. Construction related traffic will originate from the delivery of materials to site, removal of surplus excavated material from site and transport of employees to, from and throughout the site. The estimated daily peak number of round trips is anticipated to be approximately, 28 No. assuming worst case scenario.

Traffic generated during the construction phase of the proposed Project is not anticipated to have a significant impact on traffic flow in the Castletroy area. Chapter 13 compares the predicted construction traffic volumes across the main road network leading into the Study Area.

Localised traffic disruption is also likely to occur at locations of proposed works on, or in the immediate vicinity of the road network in UL and the NTP. Detailed site investigation works and location of utilities and services will also be carried in the vicinity of all proposed works.

Temporary road closure details during construction can be found in Chapter 13. Diversion routes will be put in place during any proposed road closures and detailed in Traffic Management Plan.

In addition, construction traffic and machinery may lead to an increase in nitrogen dioxide, sulphur dioxide, benzene and carbon monoxide, as well as levels of fine particulate matter (PM10 and PM2.5) from diesel exhaust emissions, which has the potential to impact on health and the environment as discussed in Chapter 9. Given that background levels of nitrogen dioxide, sulphur dioxide, benzene and carbon monoxide in the vicinity of the proposed Project are likely to be below ambient air quality limit values, based on extensive

long-term data from the EPA (Chapter 9) and emissions will be short term in nature, this constitutes a potential short term slight negative impact in terms of air quality and effects on human health due to emissions from construction vehicles.

The localised disruptions due to lane and road closures also have the potential to cause temporary nuisance to local road users. Overall, the construction phase of the project will have a potential temporary slight negative impact on existing road users due to an increase in traffic associated with construction vehicle movements.

5.3.2.9. Amenity (including Visual Amenity)

During the construction phase of the Project a short-term negative impact will occur due to the loss of amenity walking areas as sections of the current track along the River Shannon will be closed at times. There will also likely be some impact on the visual amenity of the area due to the presence of site compounds, machinery and construction materials. The impact on visual amenity of the construction phase is assessed in full in Chapter 11 - Landscape and Visual of this EIAR. The areas with the most significant works will have the greatest impact. Overall, this has the potential to have a short-term slight to significant negative impact.

5.3.2.10. Human Health and Safety Impacts

Construction of the proposed development will necessitate the presence of construction sites. Construction sites and the machinery used on them pose a potential health and safety hazard to construction workers if site rules are not properly implemented. This will have a short-term potential significant negative impact.

5.3.3. Operational Phase

5.3.3.1. Population Impacts

There will be a significant positive impact afforded to the nearby and wider community as a result of the Project through the provision of improved amenity and recreation resources which will thus aim to benefit and improve human health and wellbeing, providing a safe and accessible walking and cycling route which will promote outdoor activity. This will result in a positive contribution to the population in the Study Area and greater surroundings. The Project will aim to enhance amenity areas along the route through the provision of rest areas for Greenway users at areas of interest. Furthermore, significant tree planting with a 5:1 ratio, is proposed along the route, which will improve the visual aesthetic of the area and assist in air quality improvements.

Predicted impacts are predominantly positive and long-term. For the residential and working populations of the Study Area, no mitigation is required provided reinstatement of lands, public road and pedestrian access damaged or disturbed during the construction phase are implemented in a timely manner following the conduction of the works.

5.3.3.2. Human Health and Safety

The proposed Project will be constructed and maintained in accordance with the relevant standards. No mitigation measures relating to health and safety are required in this regard.

The proposed Project will have a positive impact on human health for those who utilise the Greenway as it will improve overall health, fitness and wellbeing. The Greenway will be constructed to ensure a safe and easily accessible route with appropriate lighting, seating, bike racks, and information boards. Safety barriers will also be included where the Greenway crosses or merges onto existing roads. A raised table will also be installed nearby Troy Studios to prioritize path users.

The route includes new amenity spaces at the following locations:

- Plassey Mill; and
- Plassey Beach.

These areas will serve as rest and amenity areas for users and will be equipped with bicycle racks, park benches and information boards. These areas will also be well illuminated.

Overall, the proposed Greenway will have a long-term significant positive impact on the surrounding population and those who utilise it.

5.3.3.3. Economic Impacts

An increase in the volume of Greenway users to the area from the surrounding community may assist in supporting local businesses such as cafés and restaurants which will have a positive economic benefit.

The Greenway will provide an easy and environmentally friendly means of accessing the University grounds, and Technology Park which may help to support businesses located in this region through a new means of accessing the region from the City Centre and thus providing a positive economic impact. This is likely to encourage future inward investment in the area, creating further employment and a stronger local economy.

5.3.3.4. Land-use

The proposed Greenway is described in detail in Chapter 4 and will connect to the Limerick Smarter Travel, Route 2, between University of Limerick and the Kevin Hannan footbridge along the bank of the River Shannon and connects directly into the City Centre. The Greenway will provide a safe transport route connecting the National Technology Park to the city whilst also enhancing amenity value of the area.

The majority of the existing route follows an existing walking track along the bank of the River Shannon with additional sections of the route taking place in greenfield sites and built environments.

Chapter 7 gives further details on the predicted impacts on land-use in relation to residential and commercial properties in the area. Overall, the impact of the proposed Project on land use in the Study Area is imperceptible on a national and county level. In the absence of mitigation, the potential impact on land use in the Study Area ranges from imperceptible to slight negative impact during the operation phase of the path. Mitigation measures are presented in Section 5.4.

5.3.3.5. Tourism

The operational phase of the proposed Project will have no negative impact on tourism in the area, the Greenway may provide a positive impact in the creation of amenity and recreation resources for tourism through the extension of a safe transport route from Limerick City Centre to the University campus. The Project will have a long-term positive impact on the tourism and local amenities of the area.

5.3.3.6. Amenity (including Visual Amenity)

The operational phase of the proposed Project will have a strong positive impact on amenity in the area, including a positive impact on visual amenity whereby the views, wildlife and heritage of the area can be enjoyed. Significant tree planting is also proposed along the route. This is further discussed in full in Chapter 11- Landscape and Visual of this EIAR.

5.4 MITIGATION MEASURES

The mitigation measures proposed in the section below relate to the construction and operational period of the proposed Greenway project. Such measures relate only to the avoidance, reduction or remedy of impacts, which affect human beings in particular those which relate to the local population and human health

in relation to Noise and Vibration, Air Quality, and Landscape character and Visual amenity, and traffic and transport. The potential impact in relation to Noise and Vibration, Air Quality, and Landscape character and Visual amenity, and traffic and transport and the related mitigation measures are discussed within the corresponding chapters of this EIAR.

5.4.1. Construction Phase

Many of the impacts during the construction phase can be addressed through appropriate planning. A Project specific Construction Environmental Management Plan (CEMP) for the development will be prepared prior to construction and will identify a variety of measures that will be incorporated to mitigate against nuisance including provisions in relation to traffic, noise and dust on the site. A draft CEMP is provided in Appendix 4C of this EIAR.

5.4.1.1. Economic impacts

Impacts to economic activity within the Study Area were identified to be short-term slight negative. These impacts will be mitigated by the adoption of good construction and traffic management measures which will be identified in the Construction and Environmental Management Plan (CEMP) and draft Traffic Management Plan (TMP).

- Potential adverse impacts on local economic activity will be minimised through ensuring access to local businesses is maintained. A construction TMP will be prepared and implemented for the duration of the works in order to ensure that any impacts on traffic mobility are minimised. This will also result in a minimised potential impact on local businesses, as traffic management will only implement restrictions to local businesses when necessary and only for the shortest possible time.
- A CEMP will be implemented during the construction phase to ensure that environmental nuisances relating to the works are minimised. This will include measures to avoid and reduce noise and dust. Refer to Appendix 4C in this EIA report.

5.4.1.2. Land Use

General access to certain land uses will suffer some unavoidable localised slight temporary negative impacts during construction. Landowner consultation has been carried out during the development of the proposed Project to record the particular mitigation requirements for individual land parcels. Consultation with landowners will continue throughout detailed design and construction of the Project to ensure that appropriate mitigation for individual landowners will be implemented. The following mitigation measures will be implemented in respect of land use in the proposed Study Area:

- Mitigation measures regarding construction traffic, dust and noise are outlined in Chapter 9 and 13 of the EIAR;
- Existing accesses to all properties will, where practicable, be maintained during construction otherwise reasonable temporary access will be provided. The location of temporary access will be at a suitable location and, where possible, with agreement of the landowner;
- Machinery and machinery movement will be minimised as much as possible to avoid unnecessary damage to lands such as tracking and soil compaction;

- Any necessary permanent restoration of fences, walls, drains or land will be completed as soon as practicable after work has concluded;

Further mitigation details from construction activities which are relevant to land use impacts are detailed in Chapter 7 - Land use, Soil & Geology and Chapter 11 - Landscape & Visual.

5.4.1.3. Tourism

Construction phase impacts in respect of tourism will be mitigated in the same way as for the resident and working populations in sections 5.4.1.1 and 5.4.1.2 above, by the adoption of good construction and traffic management measures. Works will be designed to minimise impacts upon the amenity value of the Study Area during the construction period.

5.4.1.4. Human Health and Safety

During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan.

Construction works will be carried out in sections. The entire length of each section will be closed to the public so accidental conflicts between construction works and the public will be avoided. Temporary diversion routes for pedestrians and cyclists will be provided. Works in adjacent sections will be prohibited to reduce impact on existing path users during the works.

Harris fencing will be erected around all working areas including any excavations to prevent uncontrolled access to this area. Appropriate health and safety signage will also be erected on this fencing and at locations around the site.

Temporary lighting of works at or near entrances/exits onto public road will be erected for night and dark winter working.

5.4.1.5. Amenity

Works have been designed to minimise impacts upon the amenity value of the Study Area during the construction period; however, the short-term closure of existing walking tracks along the River Shannon will be unavoidable. Mitigation measures to avoid pollution of ground and surface waters as set out in Chapter 8 and measures to avoid impacts on biodiversity are presented in Chapter 6.

Mitigation measures relating to visual amenity impacts are presented in Chapter 11 (Landscape) of this EIAR.

5.4.1.6. Human Health and Noise

In order to sufficiently improve the likely noise and vibration impacts from the proposed works, a schedule of noise control measures has been formulated for the construction phase. Best practice measures for noise control will be adhered to onsite during the construction phase of the proposed Project in order to mitigate the potential temporary slight to significant negative impact associated with this phase of the Project. The measures include:

- All construction operations shall comply with guidelines set out in British Standard documents 'BS 5228-1: 2009: Code of Practice for Noise and Vibration Control on Construction and Open Sites: Noise,' which offers detailed guidance on the control of noise & vibration from demolition and construction activities;

- Construction noise will be limited by prescribing that standard construction work will be restricted to the specified working hours.;
- Materials will be selected taking account of the characteristics for generation of noise and/or vibration emissions from each item. All materials and machinery used on site shall comply with relevant E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of machinery near occupied properties will be controlled;
- Erection of noise screening (abatement) enclosures as necessary around noisy processes and items such as generators, heavy mechanical machinery or high duty compressors;
- Placing of noisy/vibratory machinery as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary;
- Training and supervision of operatives in proper techniques to reduce site noise, and self-monitoring of noise levels, if appropriate;
- Where, noise levels at noise sensitive locations (NSLs) are anticipated to exceed the daytime noise criteria (Chapter 9), hoarding for noise abatement extending to a height of 2.4 m will be erected between the works area and the NSL. If such measures are installed, the construction operations are expected to meet or be less than the 70 dB LAeq(1hr) criterion in most cases;
- Controlling consaw operations by erecting a hoarding around the cutting areas;
- Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- Establishing channels of communication between the contractor/developer, Local Authority and residents; inform affected residents of time of anticipated noise impact 24 hours in advance;
- Appointing a site representative responsible for matters relating to noise; and
- Monitoring typical levels of noise during critical periods and at sensitive locations.

Further mitigation details regarding noise and vibration from construction activities is detailed in Chapter 9.

5.4.1.7. Human Health and Dust

The generation of dust is dependent on the construction activity being carried out. Environmental factors such as rainfall, wind speed and wind direction will also affect dust emissions. Best practice measures for dust control as outlined in the dust minimisation plan included in the Construction Environmental Management Plan will be adhered to onsite during the construction phase of the proposed Project in order to mitigate the slight short-term negative impact associated with this phase of the Project. A number of measures will be implemented in order to minimise dust impacts including:

- In periods of extended dry weather, dust suppression (localised wetting of surfaces) may be necessary within and around the site to ensure dust does not cause a nuisance;
- All site roads within the construction works boundary shall be regularly inspected, cleaned and maintained during the construction phase;

- Truck wheels will be washed to remove mud and dirt before leaving the site. In the event of dust nuisance occurring outside the site boundary, movement of material must be terminated immediately, and procedures implemented to rectify the problem;
- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and removal is surplus material off site; and
- The dust mitigation measures put in place will be strictly monitored and assessed throughout the construction phase to ensure their effectiveness.

Further mitigation details regarding dust from construction activities is detailed in Chapter 9.

5.4.1.8. Services

The infrastructure proposed to facilitate alleviation of flood events have been designed to avoid, where possible, any interference with service network infrastructure within the works area. The following measures will be implemented in order to minimise impacts on human health due to services disruptions:

- All possible precautions will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works area, and the implementation of robust procedures when undertaking works in and around known infrastructure services. Any disruption to service network infrastructure will be reinstated immediately or an alternative source supplied until the original source is reinstated, unless otherwise agreed with the landowner;
- All existing land drains impacted by the Project will be incorporated into the drainage channel system;
- Locations of all underground and over ground services will be identified and considered during project design, in consultation with appropriate service network providers;
- Service disruptions impacting the surrounding residential, social and commercial properties shall be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions shall be given to all impacted properties. This shall include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties shall be undertaken prior to any proposed disruptions;
- A CEMP will be prepared and implemented by the nominated contractor in consultation with Limerick City and County Council and their Environmental Clerk of Works.

Further mitigation details regarding impacts on service networks from construction activities is detailed in Chapter 13.

5.4.1.9. Traffic

Localised traffic disruptions during the construction phase of the proposed development will be mitigated through the use of industry standard traffic management measures. These measures will be designed in accordance with the 'Guidance for the Control and Management of Traffic at Roadworks – Second Edition' (Dept. of Transport; Road Safety Authority of Ireland – 2010).

- Construction works will be sequenced so as to avoid unnecessary interruption to road users insofar as is practicable;
- All residents and interested parties shall be consulted when planning these road closures to optimise the timing of same; and
- A complete schedule of road closures will be published in advance of the works commencing to facilitate residents in making alternative arrangements where necessary.
- All road closures will be agreed in advance with Limerick City and County Council and implemented as per conditions set out in Traffic Management Plans and Road Opening Licences.

All excavations on roads will be temporarily reinstated immediately - with a permanent reinstatement to follow after 6 months - as per the following guidance:

- Guidelines for Managing Openings in Public Roads (April 2017) – for Local and Regional Roads.; and
- Requirements for the Reinstatement of Openings in National Roads (TII, May 2019) – for National Roads.

Road signage on the public road network must comply with the Department of the Transport's Traffic Signs Manual "Chapter 8 - Temporary Traffic Measures and Signs for Roadworks".

The following mitigation measure shall be implemented in relation to exhaust emissions during the construction phase:

- Machinery will be switched off when not in use;
- All construction vehicles and plant will be maintained in good operational order; and
- Aggregate materials used in construction shall be sourced locally where possible to reduce potential emissions.

5.4.2. Operational Phase

When the Project is operational, a maintenance and monitoring schedule will be put in place by LCCC to ensure that the proposed Greenway is operating to the appropriate design standard. Repairs will be made as necessary. This will ensure that there is no risk to human health as the Project ages.

During operation, no predicted adverse impacts on population, economic, tourism and amenities are identified. Accordingly, no mitigation measures are considered necessary.

5.5 RESIDUAL IMPACTS

5.5.1. Population

The implementation of a TMP and CEMP to reduce traffic and environmental nuisance impacts on the receiving environment during the construction phase will minimise the impact on local businesses. There will be a significant positive impact with the operation of the Project on the population within the Study Area.

5.5.2. Economic Activity

The improvement of amenity resources in the area will have a long-term significant positive impact on the local and wider community, and those who visit the region for tourism purposes.

Provided mitigation measures will be put in place during construction, impacts will be minimised to slight to moderate negative impacts, short-term in the context of the resident and working community. These will be unavoidable given the nature of the works required and should be considered in the context of the positive operation impacts.

5.5.3. Land use

The proposed Project will improve land use in the area via the upgrade of the existing walking track along the River Shannon and the development of greenfield sites. This will provide and enhancement to land use in the area and overall, the residual impact will be significant, long-term and positive.

The implementation of the mitigation measures listed in Section 5.4 will reduce the potential construction phase impacts on land use.

The route has been chosen with regard to several factors including the goal to enhance existing walking tracks currently in place along the banks of the River Shannon and to minimise the division of existing greenfield sites and land holdings where possible. Provided appropriate mitigation is agreed with landowners, significant adverse long-term impacts can be avoided, or the significance of these impacts reduced to slight or even imperceptible levels.

The impact of the proposed Project on land use is imperceptible on a national and county level and provides a significant positive impact in the long-term. The overriding benefits to the area are considered to outweigh any localised negative impacts incurred.

5.5.4. Services

With mitigation measures in place during the construction phase of the Project, no residual negative effects on the water distribution, drainage, electricity and telecommunications networks within the Castletroy area are anticipated.

5.5.5. Tourism

The implementation of a TMP and CEMP to reduce traffic and environmental nuisance impacts on the receiving environment during the construction phase will minimise the impact on tourism. Whilst the existing walking track along the riverbanks are used for amenity, the closure of these areas will be short-term with the long-term goal of the Project to improve and enhance amenity in the area. Additionally, the majority of the primary tourist attractions within the county are located outside of the Study Area.

Overall, the Project will have a long-term positive impact on the tourism and local amenities of the area.

5.5.6. Noise

During the construction phase, noise impacts at all receptors will be temporary and localised. At most of these, impacts will be imperceptible. At a number of dwellings and business premises, particularly those immediately adjacent to construction works, impacts will range from temporary slight negative to moderate negative. The application of noise control measures specified in Chapter 9, including implementing binding noise limits and hours of operation and the provision of screening will ensure that noise impact is kept to a minimum. The residual impact during the construction phase will be a temporary imperceptible to moderate negative impact. There will be no significant noise impacts during the operation phase of the Project.

5.5.7. Dust

Dust is a concern from a health perspective as well as potentially causing nuisance to residents, local businesses and road users. The implementation of the mitigation measures set out above will minimise impacts associated with dust generation during construction and will constitute a residual short-term negligible impact during the construction phase and a negligible impact once operational.

5.5.8. Traffic and Transport

Localised traffic disruption is likely to occur at locations of proposed works on, or in the immediate vicinity of the road network due to construction traffic entering and exiting the works areas as well as along the proposed haulage routes. With mitigation measures in place, a residual short term slight negative impact is anticipated during the construction phase and there will be no residual impact on completion of the proposed works.

With mitigation measures in place, the proposed lane and road closures as detailed in Chapter 13, are likely to cause a moderate temporary impact to the flow of traffic in the vicinity of the works. In the case of road closures, alternative diversion routes have been identified. There will be no residual impact once the proposed Project is completed.

The residual impact of the proposed Project on transport infrastructure will be a permanent slight to moderate positive impact during operational phase due to an alternative means of accessing the University campus and Technology Park via walking or cycling.

5.5.9. Amenity

The residual impact on visual amenity and the closure of existing amenity walking tracks along the riverbanks during the construction phase will be a short-term slight to moderate negative impact. Residual impacts during the operation phase are anticipated to be long term significant positive impacts.

5.5.10. Human Health and Safety

The implementation of the Health and Safety Plan and measures set out in Section 5.4 will ensure any potential risks to human health and safety are minimised. Based on the assessment above there will be no significant effects.

5.6 Vulnerability of the Project to Natural Disaster

The proposed Greenway is not a recognised source of pollution, and it is not an activity that falls within any thresholds requiring Environmental Protection Agency licensing under the Environmental Protection Agency Licensing Act 1992, as amended. As such, the proposed Project is not considered to have ongoing significant emissions to environmental media and the subsequent potential for impacts on the environment or human health effects. The Greenway promotes the use of a cleaner more environmentally friendly means of transport helping to decrease the use of vehicles and encouraging walking and cycling thus decreasing emissions from combustion engines.

Should a natural disaster occur the potential sources of pollution onsite during the construction and operational phases are limited. Sources of pollution that could possibly cause significant environmental pollution and associated negative effects on the environment and human health such as bulk storage of hazardous materials or wastes does not arise.

There is therefore limited potential for significant effects due to natural disasters to occur at the proposed development site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to flooding and fire.

It is considered that the risk of significant fire occurring, affecting the development and causing the Project to have significant environmental effects will not arise.

The development area will have a flooding risk, and this was considered in the preliminary design of the route and its links. Refer to Chapter 8 Water of the EIAr, and to the Planning Report.

Major industrial accidents involving dangerous substances pose a significant threat to humans and the environment; such accidents can give rise to serious injury to people or serious damage to the environment, both on and off the site of the accident. The Project is not regulated or connected to or close to any site regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations i.e. SEVESO sites and so there is no potential effects from this source.

5.7 CUMULATIVE IMPACT ASSESSMENT

All elements of the proposed Project were assessed in order to identify any cumulative effects.

Potential impacts on the receiving biodiversity could result in associated population and human health impacts in the context of a loss of ecosystem services. However, the mitigation measures described in this EIAR will ensure that these are suitability mitigated.

Potential impacts on the receiving land, soils and geology could also result in associated population and human health impacts due to changes in land use. However, the mitigation measures described in this chapter and Chapter 7: Land Use, Soils and Geology will ensure that these are suitably mitigated.

Potential impacts on the receiving air quality and climate could also result in associated population and human health impacts as a result of change to air quality in the local area during operational phase. There is potential for air quality impact on the local community during construction phase as a result of increased dust emissions. However, the mitigation measures described in the EIAR will ensure that these are suitably mitigated.

Traffic – Potential impacts on the receiving transport environment could also result in associated population and human health impacts due to nuisance and disturbance during construction. However, the mitigation measures described in the EIAR will ensure that these are suitably mitigated.

Potential impacts on the receiving environment due to noise and vibration could also result in associated population and human health impacts such as nuisance and noise disturbance during the construction phase. However, the mitigation measures described in the EIAR ensure that these are suitably mitigated.

Landscape and Visual Impact – Potential impacts on the receiving landscape and visual amenity could also result in associated population and human health impacts during the construction phase. However, the mitigation measures described in the EIAR will ensure that these are suitably mitigated.

Potential impacts on material assets including traffic, services (electricity, water, telecoms) and waste management may be disrupted during construction phase of the development and could result in human health impacts. However, the mitigation measures described in the EIAR will ensure that these are suitably mitigated.

For the assessment of cumulative in combination impacts, any other existing, permitted or proposed developments have been considered where they had the potential to generate a significant in-combination or cumulative impact with the proposed Greenway. These plans and projects are listed in Chapter 1.

The Limerick Development Plan 2022-2028 emphasises the promotion and facilitation of such Projects including an objective of the Plan to 'Seek the provision of appropriate, inclusive and accessible, safe amenity, recreational open space and community facilities that are available for all sectors of the community, both urban and rural at a convenient distance from their homes and places of work'. Limerick City and County Council also recognises the importance of cycling and walking as a mode of transport and recreational activity and supports the provision of provision of designated cycle routes, walking trails/ pathways and improved road surfaces.

Projects that were included in the Cumulative Impact Assessment for Population and Human Health included numerous small scale proposed, permitted and existing developments (e.g. dwelling house, commercial units, etc.).

Following a detailed assessment of the receiving environment and potential impacts of the proposed Project in combination with the potential impacts of the plans and projects set out in Chapter 3, no potential for significant in-combination cumulative effects on population and human health in the area are anticipated.

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6. BIODIVERSITY

6.1 INTRODUCTION

This section of the EIAR describes the potential impacts of the proposed Limerick City Greenway (UL to NTP) on biodiversity, flora and fauna and has been completed in accordance with the guidance set out by the Environmental Protection Agency in '*Guidelines on Information to be contained in Environmental Impact Statements*' (EPA, 2022), '*Advice Notes on Current Practice in the preparation of Environmental Impact Statements*' (EPA, Draft, 2015) and '*Guidelines for Ecological Impact Assessment in the UK and Ireland-Terrestrial, Freshwater, Coastal and Marine*' (CIEEM, 2018, V.1.2 2022).

This assessment is based on published literature and field visits that were made to the site by Ryan Hanley ecologists. Visits were made during 2020, 2021, 2022, 2023 and 2024 with a focus on habitats, mammals, bats, birds and freshwater aquatic ecology occurring within the environs of the proposed development (see Table 6.1 for a list of surveys conducted). The survey work was carried out by Ryan Hanley Ecologists as detailed in Chapter 1 of the EIAR. The ecology of the area surrounding the proposed development was first assessed in terms of habitats, flora, fauna and invasive species. The area over which the proposed development has the potential to result in effects to the Zone of Influence which is determined by careful scientific analysis as outlined in detail in Section 6.1.1 below. Following this, the chapter identifies the Key Ecological Receptors (KERs) within the Zone of Influence (ZoI) and accurately assesses the potential for effects thereon. KERs are features of the proposed development which are '*of sufficient value to be material in decision making and likely to be affected significantly*' (NRA, 2009). KERs are of local importance (Higher Value) or higher, as set out in detail in Section 6.2.1 below. Features of local importance (Lower Value) are not considered and are therefore excluded from impact assessment.

This chapter quantifies any potential direct and/or indirect significant effects relating to biodiversity and the identified KERs. It identifies the measures required to avoid, reduce and mitigate likely significant effects and assesses any residual effects that remain following implementation of mitigation. Identification of effects and prescribed mitigation has been derived following a collaborative approach working with a multi- disciplinary team of specialist consultants. The results of the ecological surveys were used to inform the ecological assessment which have been utilised to inform the design of the proposed development, thereby minimising potential effects on sensitive habitats and species of conservation interest.

Using the comprehensive assessment of the existing environment (baseline conditions), it has been possible to accurately predict the likely direct and indirect significant effects of the proposed development on the KERs and correctly assign an ecological significance to them.

Where detrimental effects have been identified, detailed and specific mitigations have been developed in accordance with the hierarchy of options suggested in the European Commission publication, '*Managing Natura 2000 Sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*', 2000. The adopted approach was - avoid at source, reduce at source, abate on site and finally, abate at receptor. These measures have been incorporated into the proposed development as part of the avoidance and environmental protection strategy.

The information provided in this EIAR chapter accurately and comprehensively describes the baseline ecological environment; provides an accurate prediction of the likely ecological effects of the proposed development and prescribes mitigation as necessary. It then describes the residual ecological effects and any monitoring that is to be undertaken post consent. The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines as fully described in the methodology section below.

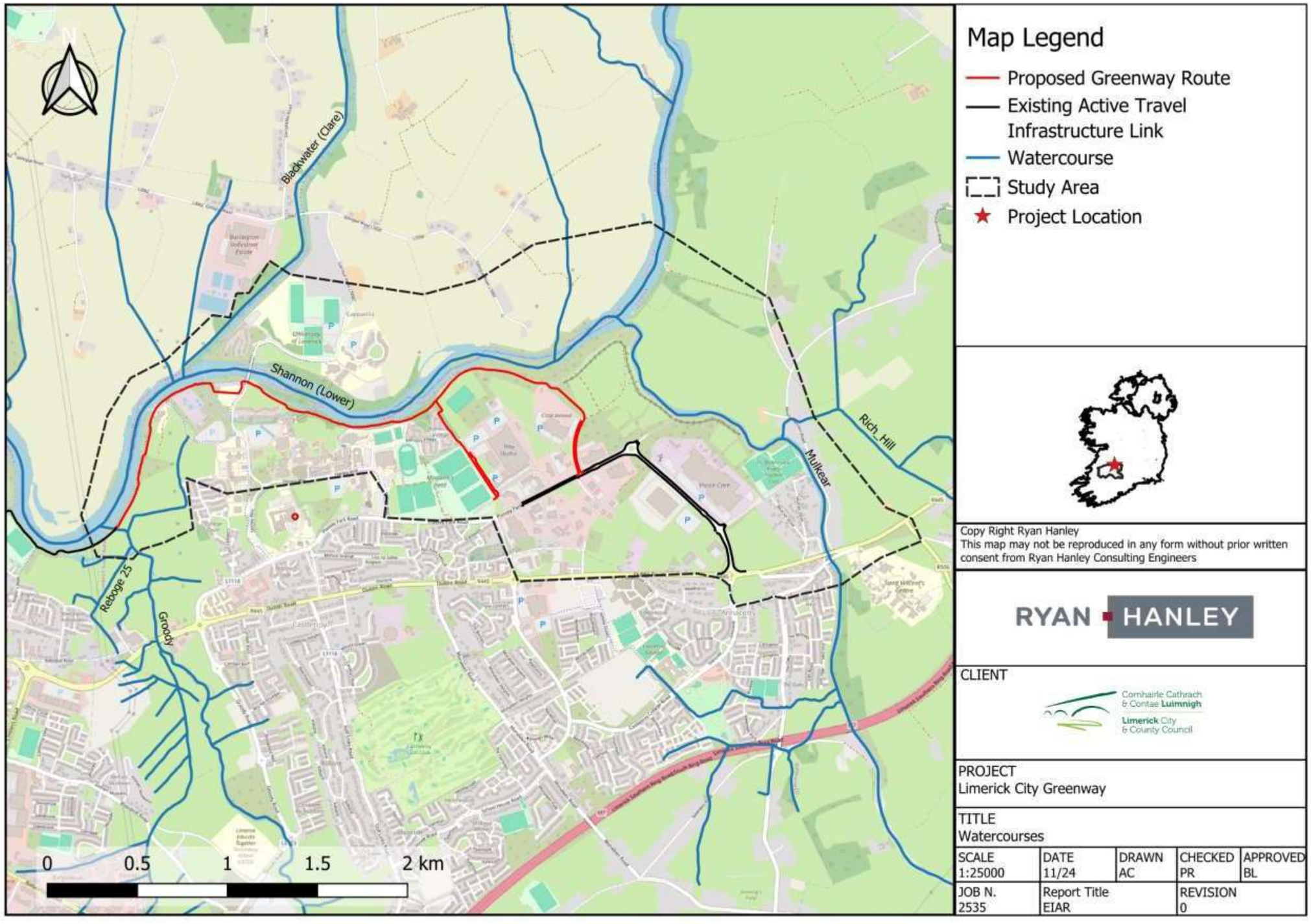

Figure 6.1 Study Area of the Limerick City Greenway (UL to NTP)

6.2 METHODOLOGY AND LIMITATIONS

An initial study area was determined as part of the Constraints Study and its outline is located along the banks of the River Shannon from the Groody River to the National Technology Park (NTP). The study area for the proposed Greenway is centred around the UL campus grounds and the National Technology Park (NTP) in Limerick. The area lies within the Lower Shannon Catchment, and it covers approximately 4.5km long and 3.5-4.0m wide shared path, 1.5-2.0m wide footpath, and 1.8-2.5m wide cycle lanes of design interfaces where the Greenway meets public paths and roads. The study area was selected based on ecological sensitivities, proximity to protected habitats and potential construction impact zones. The River Shannon is an EU designated site as Special Area of Conservation (SAC) with protected habitats and species. Accordingly, the study area was defined to encompass the proposed greenway alignment and a buffer area that goes beyond 150m from the riverbank, including any areas likely to be affected by access roads or any other ancillary construction activities. The study area also considered potential indirect impacts such as noise, lighting, and human disturbance on adjacent habitats, ensuring a comprehensive assessment of the potential impacts on biodiversity.

A preliminary walkover survey of the study area for was undertaken on the 04th & 05th November 2020 and follow-up surveys was conducted on the 14th and 15th May 2021 and 21st and 28th April 2022. These surveys were carried out in accordance with NRA Guidelines on '*Ecological Surveying Techniques for Protected Flora and Fauna on National Road Schemes*' (NRA, 2009).

Habitat mapping was undertaken with regard to guidance set out in '*Best Practice Guidance for Habitat Survey and Mapping*' (Smith *et al.,* 2011). Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follow '*Mosses and Liverworts of Britain and Ireland - a field guide*' (British Bryological Society, 2010).

The walkover surveys were designed to detect the presence, or likely presence, of a range of protected species.

During field surveys a survey for Badgers (*Meles meles*) was conducted adhering to best practice guidance (NRA, 2009) and was cognisant of '*Guidelines for the Treatment of Badger Prior to the Construction of National Roads Schemes*' (NRA, 2006) in order to determine the presence of badger signs along and adjacent to the proposed development within the study area. Whilst the best time for undertaking Badger surveys is between November and April, when vegetation cover is reduced, the Badger surveys conducted in May 2021 and April 2022 were not constrained by vegetation or season and a comprehensive survey was conducted. This survey was also repeated in July 2024 also. During these surveys no field sign of Badgers were recorded.

In addition, an Otter (*Lutra lutra*) survey was conducted adhering to the methodology of the '*Standard Otter Survey' method and outlined by the National Otter Survey publication (IWM76, Reid et al, 2013*)' in order to determine the presence of Otter signs along and adjacent to the proposed development within the study area. Whilst the best time for undertaking otter surveys is between November and April, when vegetation cover is reduced, the Otter surveys conducted in May 2021 and April 2022 were not constrained by vegetation or season and a comprehensive survey was conducted. This survey was also repeated in July 2024. During these surveys no field signs of Otters were recorded.

Habitats considered to be of ecological significance and in particular having the potential to correspond to those listed in Annex I of the EU Habitats Directive 92/43/EEC were identified and assessed.

During field surveys in November 2020, May 2021, April 2022, May 2023 and June 2024, searches for Invasive Alien Species listed under the Third Schedule of the European Communities (Birds and Natural

Habitats) Regulations 2011 (S.I. 477 of 2015) was conducted. Regulations 49 and 50 include legislative measures to deal with the dispersal and introduction of Invasive Alien Species. Regulation 50 has not yet been commenced. Invasive Alien Species are also addressed by EU Regulation 1143/2014 on the Prevention and Management of the Introduction and Spread of Invasive Alien Species, which seeks to address the problem of Invasive Alien Species in a comprehensive manner so as to protect native biodiversity and ecosystem services, as well as to minimise and mitigate the human health or economic impacts that these species can have.

The multi-disciplinary walkover surveys comprehensively covered the proposed Greenway. Seasonal factors that affect distribution patterns and habits of species were taken into account when conducting these surveys and the potential of the site to support certain populations (in particular those of conservation importance that may not have been recorded during the field survey due to their seasonal absence or cryptic nature) was assessed. **Table 6.1** summarises the field surveys completed to date in relation to the proposed development.

Table 6.1 Field Surveys undertaken for the Limerick City Greenway (UL to NTP)

Survey Type	Dates of Survey	Survey Locations
Preliminary Multi-disciplinary Walkover Survey;	04th November 2020 28th April 2022	Walkover Survey along route of Greenway route
Ecology Habitat survey	14th May 2021 28th April 2022	Within study area of Greenway.
Badger survey	15th May 2021 8th July 2024	25m buffer along the preferred Greenway
Bat Survey	19th July 2021 9th - 21st September 2021 10th of January 2024 19th of June & 10th of July 2024	50m buffer along the preferred Greenway
Breeding Bird surveys	2021, June 2022, April and June 2023, May and June	Line transect surveys, spot-counts, field scanning, river scanning and distribution mapping from varied vantage points affording good views.
Winter Bird Surveys	Field Surveys (5 no. visits; November 2021 – March 2022) Field Surveys (6 no. visits; October 2023 – March 2024)	Line transect surveys, spot-counts, field scanning, river scanning and distribution mapping from varied vantage points affording good views.
Alien Invasive Species survey	05th November 2020 14th May 2021 28th April 2022 3rd of May 2023 26th of June 2024	Within the footprint of the preferred Greenway route.
Otter survey	15th May 2021 8th July 2024	25m buffer along the preferred Greenway route

Survey Type	Dates of Survey	Survey Locations
Aquatic Ecological Appraisal survey	June 2021 November 2023	Within study area of the Greenway and adjacent to the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA.
RHAT Assessment	8th July 2024	Within the footprint of the preferred Greenway route.
Tree survey and Arboricultural Impact Assessment	26th May and 22nd June 2021, 20th and 25th February 2024.	Walkover Survey along route of Greenway.
Cultural Heritage	February, March and December 2023	Walkover Survey conducted

6.2.1 Methodology for Determining the Zone of Influence

According to the Chartered Institute for Ecology and Environmental Management (CIEEM) Guideline (CIEEM, 2018, V.1.2, 2022), the Zone of Influence (ZoI) for a project is 'the area over which ecological features may be affected by the biophysical changes as a result of the proposed project and associated activities. This is likely to extend beyond the project site, for example, where there are ecological or hydrological links beyond the site boundaries.'

Impact pathways can occur if there is a viable pathway between the proposed development and Key Ecological Receptors (KERs). Potential pathways for impact can occur via surface water, groundwater, air or land. Hydrological linkages (surface and groundwater) between a proposed development and KERs can occur over significant distances (several kilometres); however, the significance of the impact will be site specific depending on the receiving water environment and nature of the potential impact. Air and land linkages between the proposed development and KERs typically occur over shorter distances (hundreds of meters).

Given the location, nature and size of this proposed development and the proposed construction methodology it is considered for the purpose of this EIAR that the likely ZoI is the zone immediately around the construction site, and downstream catchment. Refer to Figure 6.1.

6.2.2 Methodology for Assessment of Effects

6.2.2.1 Geographical Framework for Determining Importance of Ecological Receptors

Guidance on Ecological Impact Assessment (CIEEM, 2018 updated in 2024) recommends categories of ornithological or nature conservation value that relate to a geographical framework (e.g., international to local level). This assessment utilises the geographical framework described in Chapter 3 of the '*Guidelines for Assessment of Ecological Impact of National Road Schemes*' (NRA, 2009). The guidelines provide a basis for determination of whether any particular receptor is of importance on the following scales:

- International;
- National;
- County;
- Local Importance (Higher Value); and
- Local Importance (Lower Value).

The Guidelines clearly set out the criteria by which each geographic level of importance can be assigned. Locally Important (Lower Value) receptors contain habitats and species that are widespread and of

relatively low ecological significance in a local context but may nonetheless provide links and continuity for the wider ecosystem. Internationally Important sites are designated for conservation as part of the Natura 2000 Network (SAC or SPA) or provide the best examples of habitats or internationally important populations of protected flora and fauna. Specific criteria for assigning each of the other levels of importance are set out in the guidelines and have been followed in this assessment. Where appropriate, the geographic frame of reference set out above was adapted to suit local circumstances. In addition, and where appropriate, the conservation status of habitats and species is considered when determining the significance of ecological receptors.

Any ecological receptors that are determined to be of Local Importance (Higher Value), County, National or International Importance following the criteria set out in NRA (2009) are considered to be KERs for the purpose of ecological impact assessment if there is a pathway for effects thereon. Any receptors that are determined to be of Local Importance (Lower Value) are not considered KERs.

6.2.2.2 Characterizations of Impacts and Effects

The proposed development will lead to impacts. These ecological impacts are described in accordance EPA guidelines (EPA, 2022) and EclA guidelines (CIEEM, 2018). The impact characterisations follow the headings outlined in the guidance document and are applied where relevant. A summary of the impact characteristics considered in the assessment is provided below:

- **Positive or Negative**: Evaluates whether the proposed development will have a positive or negative effect on the ecological receptor.
- **Extent**: Describes the spatial area over which the effect may occur.
- **Magnitude**: Considers the size, amount, intensity, and volume of the impact. This should be quantified whenever possible and expressed in absolute or relative terms, such as the amount of habitat lost, percentage change in habitat area, or percentage decline in a species population.
- **Duration**: Defined in relation to both ecological characteristics (such as the lifecycle of a species) and human timeframes. For example, five years may seem short-term from a human perspective but could span at least five generations of some invertebrate species.
- **Frequency and Timing**: Relates to the number of times an impact occurs and its frequency. Even a small-scale impact can have a significant effect if it is repeated frequently over a long period.
- **Reversibility**: Considers whether an effect is reversible within a 'reasonable' timescale. What is considered a reasonable timescale can vary between receptors and is justified where appropriate in the impact assessment section of this report.

The magnitude of the effects of the proposed development are determined following the precautionary principle and in accordance with the methodology set out in Section 5 of CIEEM (2018).

For the purpose of an ecological assessment for this proposed greenway, a 'significant effect' is one that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific, such as those for a designated site, broad, such as national or local nature conservation policies, or more wide-ranging, such as the enhancement of biodiversity. Effects can be considered significant at various scales, ranging from international to local.

When determining significance, consideration is given to whether:

- Any processes or key characteristics of key ecological receptors will be removed or changed.
- There will be an effect on the nature, extent, structure and function of important ecological feature.
- There is an effect on the average population size and viability of ecologically important species.

- There is an effect on the conservation status of important ecological habitats and species.

The terminology used in determining the magnitude and quality of effects follows the suggested language outlined in the EPA Guidelines (2022), as detailed in Section 1.6.2 of this EIAR.

Once the potential effects are characterized using the methodology outlined in Chapter 1 of this EIAR, the significance of these effects on the identified Key Ecological Receptors (KERs) will be determined following CIEEM Guidelines (2018).

6.2.2.3 Mitigation

The development has been designed to specifically avoid, reduce and minimise effects on all KERs. Where potential effects on KERs are predicted, mitigation has been prescribed to avoid, reduce and abate such effects, often by means of control and management measures.

Proposed best practice design and mitigation measures are specifically set out and are realistic in terms of cost and practicality. They have been subject to detailed design considerations and will address the likely effects on the identified KERs.

The potential effects of the proposed development were considered and assessed to ensure that all effects on KERs are adequately addressed, and no significant residual effects are likely to remain following the implementation of mitigation measures/best practice.

6.2.2.4 Limitations

The information provided in this EIAR chapter accurately and comprehensively describes the baseline ecological environment; provides an accurate prediction of the likely ecological effects of the proposed development; prescribes mitigation as necessary; and describes the residual ecological impacts. The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines. Regarding lands, assessment showed no significant limitations in scope, scale or context.

6.3 RECEIVING ENVIRONMENT

6.3.1 Desktop Study

A desk study was undertaken in order to collate available information on the existing local ecological environment and to inform the initial scope of the ecological surveys. The following sources of information were reviewed as part of this report:

- Ordnance Survey maps of the study area (www.osi.ie);
- Aerial photography of the Study Area;
- The National Parks and Wildlife Service (NPWS) site synopses and online database (www.npws.ie) of information on designated sites;
- A Guide to Habitats in Ireland (Fossitt, 2000);
- *New Atlas of the British & Irish Flora* (Preston *et al.*, 2002);
- Flora (Protection) Order 2022 Map Viewer: https://heritagedata.maps.arcgis.com/apps/webappviewer/index.html?id=a41ef4e10227499d8de17a8abe42bd1e
- Bat records from the Bat Conservation Ireland (BCI) databases (All-Ireland Daubenton's Bat Survey, Bat Monitoring Scheme BATLAS);

- The Bird Atlas 2007-2011, the British Ornithology Trust website www.bto.org/volunteer-surveys/birdatlas;
- The National Biodiversity Data Centre (NBDC) database www.biodiveristyireland.ie for records of rare, protected, threatened and invasive species;
- NPWS Rare and Protected Species Records;
- Environmental information/data from the Environmental Protection Agency (EPA) website http://www.epa.ie/rivermap/data;
- The Water Framework Directive website www.wfdireland.ie; and
- GeoHive online mapping http://map.geohive.ie/mapviewer.html.

6.3.2 Designated Sites

The potential for the proposed development to impact on sites that are designated for nature conservation was considered in this assessment.

Special Areas of Conservation (SACs) and Special Protection Areas for Birds (SPAs) are designated under the EU Habitats Directive and are collectively known as 'European Sites'. The potential effects on European Sites are fully considered in the Natura Impact Statement accompanying this application and are also discussed in this EIAR.

Natural Heritage Areas (NHAs) are designated under the Wildlife Act 1976, the Wildlife (Amendment) Act 2000, and all subsequent amending acts. Their management and protection are provided for by this legislation and planning policy. The potential effects on these designated sites are fully considered in this EIAR.

Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. Many pNHAs are protected under County Development Plan Objectives.

6.3.2.1 European Sites

The European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011) requires the establishment and conservation of a network of sites that are to be termed 'European Sites' which are known as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

The locations of the European sites within the zone of influence of the Study Area are shown in **Figure 6. 2** with details of each site provided in **Table 6. 2.** In conclusion with reference to **Table 6. 2,** identified European Sites, with the exception of the Lower River Shannon SAC, can be screened out due to the significant distance from proposed site as no viable Source » Pathway » Receptor was identified.

A section of the proposed Greenway, is located within and adjacent to the Lower River Shannon SAC. The potential for the project to result in adverse effects on European sites, in particular the Lower River Shannon SAC, is considered low. However, in line with a precautionary approach, a Stage 2 Appropriate Assessment of the proposed development is considered necessary in respect of close proximity of the proposed Greenway, a hydrological link to the River Shannon as well as potential for runoff of construction phase materials to occur.

As per EPA draft Guidance 2022, "a biodiversity section of an EIAR should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement," but should "incorporate their key findings as available and appropriate." This section provides a summary of the key

assessment findings set out in the Natura Impact Statement regarding the relevant Special Areas of Conservation.

The potential for the proposed development to result in adverse effects on the Lower River Shannon SAC, without mitigation, could not be excluded in the assessment contained in the Appropriate Assessment Screening report, leading to the preparation of a Natura Impact Statement. The potential for the proposed development to result in adverse effects on the integrity of these sites was considered in view of the conservation objectives of the site and in combination with other plans and projects. The following conclusion was reached (based on the reasons set out in the NIS):

It can be excluded, on the basis of objective scientific information, that the project, on its own or in combination with other plans or projects, will not adversely affect the integrity of any European Site, having regard to their site conservation objectives.

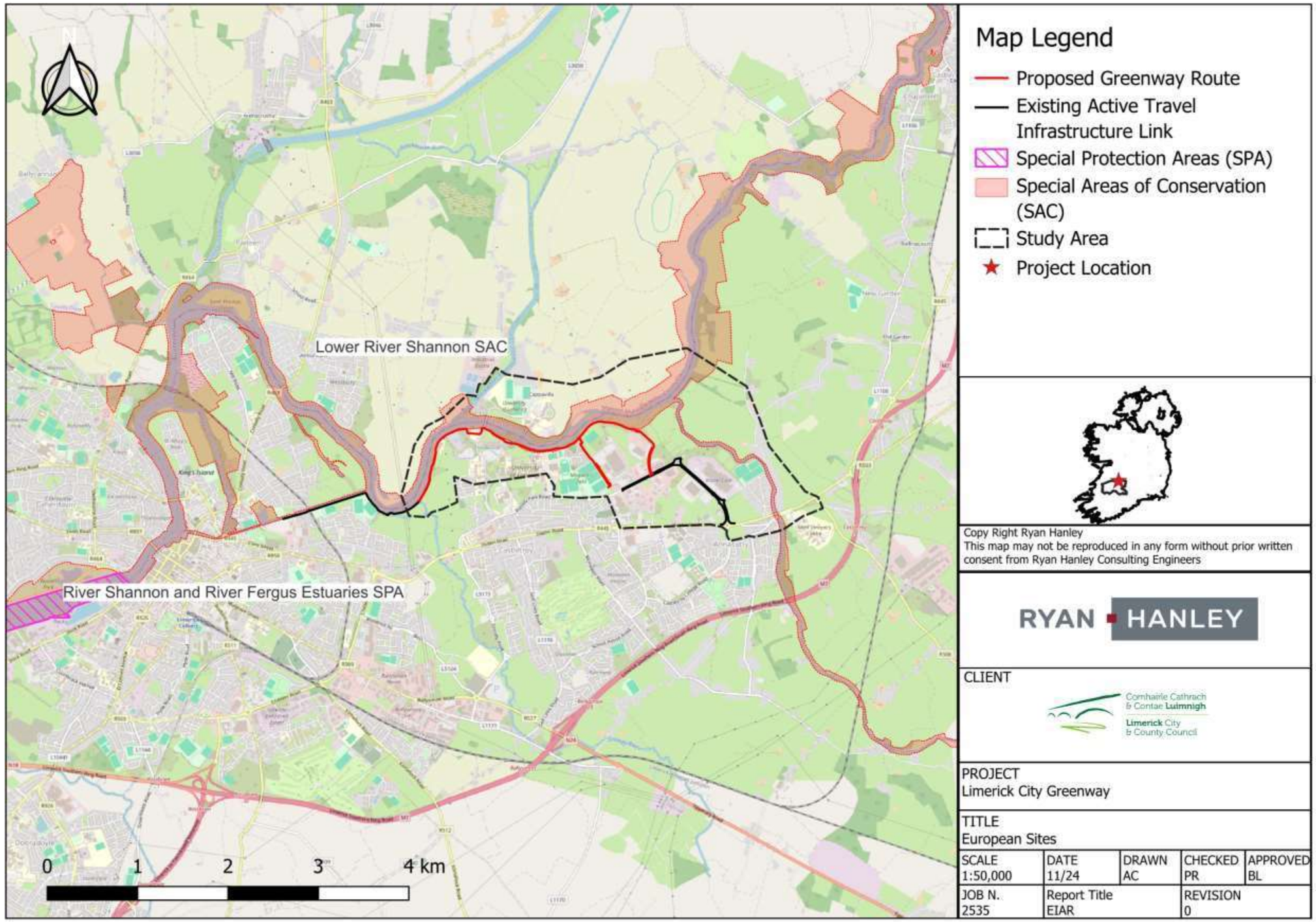

Figure 6. 2 European Sites Identified within Zone of Influence of the Study Area

Table 6. 2 European Sites Identified within the Zone of Influence of the Study Area. (* denotes priority habitat).

Designated site and code	Distance from Scheme	Qualifying Interests (QI's)	Pathway for Effect
Lower River Shannon SAC [002165]	Greenway within boundary of this SAC and adjacent to at various locations	▪ Sandbanks which are slightly covered by sea water all the time [1110]; ▪ Estuaries [1130]; ▪ Mudflats and sandflats not covered by seawater at low tide [1140]; ▪ Coastal lagoons [1150]*; ▪ Large shallow inlets and bays [1160]; ▪ Reefs [1170]; ▪ Perennial vegetation of stony banks [1220]; ▪ Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]; ▪ Salicornia and other annuals colonising mud and sand [1310]; ▪ Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330]; ▪ Mediterranean salt meadows (*Juncetalia maritimi*) [1410]; ▪ Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]; ▪ Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410]; ▪ Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]*; ▪ Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029]; ▪ Sea Lamprey (*Petromyzon marinus*) [1095]; ▪ Brook Lamprey (*Lampetra planeri*) [1096]; ▪ River Lamprey (*Lampetra fluviatilis*) [1099]; ▪ Salmon (*Salmo salar*) [1106];	Yes. Land and air pathways were identified due to a section (along the banks of the River Shannon) of the proposed Greenway taking place within the boundary of the Lower River SAC. Due to the close proximity of the proposed Greenway, a hydrological link to the River Shannon was identified, with the potential for runoff of construction phase materials to occur. However, risk of sediment or pollution is low and likely to be of short duration. There is the potential for the spread of the Third Schedule Invasive Species Himalayan balsam (*Impatiens glandulifera)* and Giant hogweed (*Heracleum mantegazzianum)* throughout the SAC, adversely affecting some of the Qualifying Interests.

Designated site and code	Distance from Scheme	Qualifying Interests (QI's)	Pathway for Effect
		▪ Common Bottlenose Dolphin (*Tursiops truncatus*) [1349]; and ▪ Otter (*Lutra lutra*) [1355]	
Glenomra Wood SAC [001013]	8.4km north	▪ Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	No. The proposed development will result in no potential significant effects on this European Site as there were no hydrological or ecological pathways for impact identified. Glenomra Wood SAC is located at a significant distance of 8.4km north from the proposed Greenway.
Slievefelim to Silvermines Mountains SPA [004165]	8.49km east	▪ Hen Harrier (*Circus cyaneus*) [A082]	No. The proposed Project will result in no potential significant effects on this European Site as there were no hydrological or ecological pathways for impact identified. Slievefelim to Silvermines Mountains SPA is located at a significant distance of 8.49km east from the proposed Greenway
Glenstal Wood SAC [001432]	9.38km east	▪ Killarney Fern (*Trichomanes speciosum*) [1421]	No. The proposed development will result in no potential significant effects on this European Site as there were no hydrological or ecological pathways for impact identified. Glenstal Wood SAC is located at a significant distance of 9.38km east from the proposed Greenway.
Danes Hole, Poulnalecka SAC [000030]	14.79km north-west	▪ Caves not open to the public [8310]; ▪ Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]; and ▪ Lesser Horseshoe Bat (*Rhinolophus hipposideros*) [1303]	No. The proposed development will result in no potential significant effects on this European Site as there were no hydrological or ecological pathways for impact identified as Danes Hole,

Designated site and code	Distance from Scheme	Qualifying Interests (QI's)	Pathway for Effect
			Poulnalecka SAC is located at a significant distance of 14.79km north-west from the proposed Greenway.
Tory Hill SAC [000439]	16km south	▪ 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]*; and ▪ Alkaline fens [7230].	No. The proposed development will result in no potential significant effects on this European Site as there were no hydrological or ecological pathways for impact identified as Tory Hill SAC is located at a significant distance of 16km south from the proposed Greenway.
River Shannon and River Fergus Estuaries SPA [004077]	5km southwest	▪ Cormorant (*Phalacrocorax carbo*) [A017]; ▪ Whooper Swan (*Cygnus cygnus*) [A038]; ▪ Light-bellied Brent Goose (*Branta bernicla hrota*) [A046]; ▪ Shelduck (*Tadorna tadorna*) [A048]; ▪ Wigeon (*Anas penelope*) [A050]; ▪ Teal (*Anas crecca*) [A052]; ▪ Pintail (*Anas acuta*) [A054]; ▪ Shoveler (*Anas clypeata*) [A056]; ▪ Scaup (*Aythya marila*) [A062]; ▪ Ringed Plover (*Charadrius hiaticula*) [A137]; ▪ Golden Plover (*Pluvialis apricaria*) [A140]; ▪ Grey Plover (*Pluvialis squatarola*) [A141]; ▪ Lapwing (*Vanellus vanellus*) [A142]; ▪ Knot (*Calidris canutus*) [A143]; ▪ Dunlin (*Calidris alpina*) [A149]; ▪ Black-tailed Godwit (*Limosa limosa*) [A156]; ▪ Bar-tailed Godwit (*Limosa lapponica*) [A157]; ▪ Curlew (*Numenius arquata*) [A160]; ▪ Redshank (*Tringa totanus*) [A162]; ▪ Greenshank (*Tringa nebularia*) [A164];	No. A hydrological connection exists between the proposed works and the European site (River Shannon and River Fergus Estuaries SPA), with portions of the works taking place on land adjoining the River Shannon. The SPA is located approximately 7.3 km downstream of the proposed works. Typically, where there is hydrological connectivity, potential construction-stage impacts on SCI (Special Conservation Interest) bird species could arise from deterioration in water quality, which may reduce prey availability and negatively affect foraging efficiency. However, in this instance, such risks are considered negligible. Between the proposed works and the designated site, the River Shannon receives input from several tributaries, including the SHANNON(LOWER)_060 and North Ballycannan_010, which contribute to significant dilution and dispersion of any potential contaminants. Additionally, the influence of tidal exchange within the estuarine environment further enhances dilution capacity.

			The distance of 7.3 km, in combination with this high dilution potential, means that any short-term construction-related runoff is unlikely to lead to significant changes in water quality at the SPA. Furthermore, the area of proposed works (although located within potential foraging zone of some SCI bird species) is small in scale and situated in an urbanised setting, which does not provide high-value foraging or roosting habitat. As such, there is no potential for significant effect on SCI bird species due to water quality, disturbance to SCI bird species, or for loss of significant habitat. As well as the SCI bird species this site is also designated for the 'Wetlands (A999)' habitat, which has the conservation objective "to maintain the favourable conservation condition of the wetland habitat in the River Shannon and River Fergus Estuaries SPA as a resource for the regularly occurring migratory waterbirds that utilize it." Given the absence of any expected deterioration in water quality and considering the nature and scale of the project, there is no risk of significant effect on this habitat or its ability to achieve this conservation objective. In relation to invasive species, surveys carried out by Ryan Hanley in 2024 identified the presence of giant hogweed (Heracleum mantegazzianum) and Himalayan balsam (Impatiens glandulifera) along the proposed greenway route. Without mitigation, there is potential for plant material (e.g. seeds or fragments) to enter adjacent watercourses and disperse downstream. However, both species are widely documented as being generally intolerant of saline conditions and frequent tidal inundation (Global Invasive Species Database, 2024; U.S. Department of Agriculture, Forest Service, 2005). As such, the potential for successful establishment of either species within the estuarine habitats of the SPA is considered to be negligible.

			Therefore taking into account the separation distance, the dilution and tidal dispersion capacity of the waterbody, the limited scale and urban nature of the proposed works, and the low likelihood of invasive species establishment in estuarine conditions, it is concluded that the project will not result in any significant adverse effects on the qualifying interests or conservation objectives of the European site, either alone or in combination with other plans or projects
		▪ Black-headed Gull (*Chroicocephalus ridibundus*) [A179]; and ▪ Wetland and Waterbirds [A999].	
Clare Glen SAC [000930]	16km east	▪ Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]; and ▪ *Trichomanes speciosum* (Killarney Fern) [1421].	No. The proposed development will result in no potential significant effects on this European Site as there were no hydrological or ecological pathways for impact identified. Clare Glen SAC is located at a significant distance of 16km east from the proposed Greenway.
Slieve Bernagh Bog SAC [002312]	22km north	▪ Northern Atlantic wet heaths with *Erica tetralix* [4010]; ▪ European dry heaths [4030]; and ▪ Blanket bogs (* if active bog) [7130].	No. The proposed development will result in no potential significant effects on this European Site as there were no hydrological or ecological pathways for impact identified. Slieve Bernagh Bog SAC is located at a significant distance of 22km east from the proposed Greenway.

6.3.2.2 Natural Heritage Areas and Proposed Natural Heritage Areas

Natural Heritage Areas (NHAs) are national heritage sites that are designated for the protection of flora, fauna, habitats, and geological sites deemed to be of national ecological importance and are afforded protection under Section 16 of the Wildlife (Amendment) Act 2000. Many NHA boundaries overlap with European sites. Proposed Natural Heritage Areas (pNHAs) have not been statutorily proposed or designated under the Act, however they do have some protection under schemes such as Agri-Environmental Schemes, Forest Service requirements, Licensing Authorities and County Development Plans. **Figure 6. 3** shows the NHA's and the proposed NHAs in proximity to the Project.

There are four NHA's and sixteen pNHA's within the zone of influence of the scheme. Where an NHA or pNHA overlaps with the boundary of a European designated site the potential for impacts have been considered under the European designation in Section 6.3.2.1 above. Nationally designated sites are listed in **Table 6.3**.

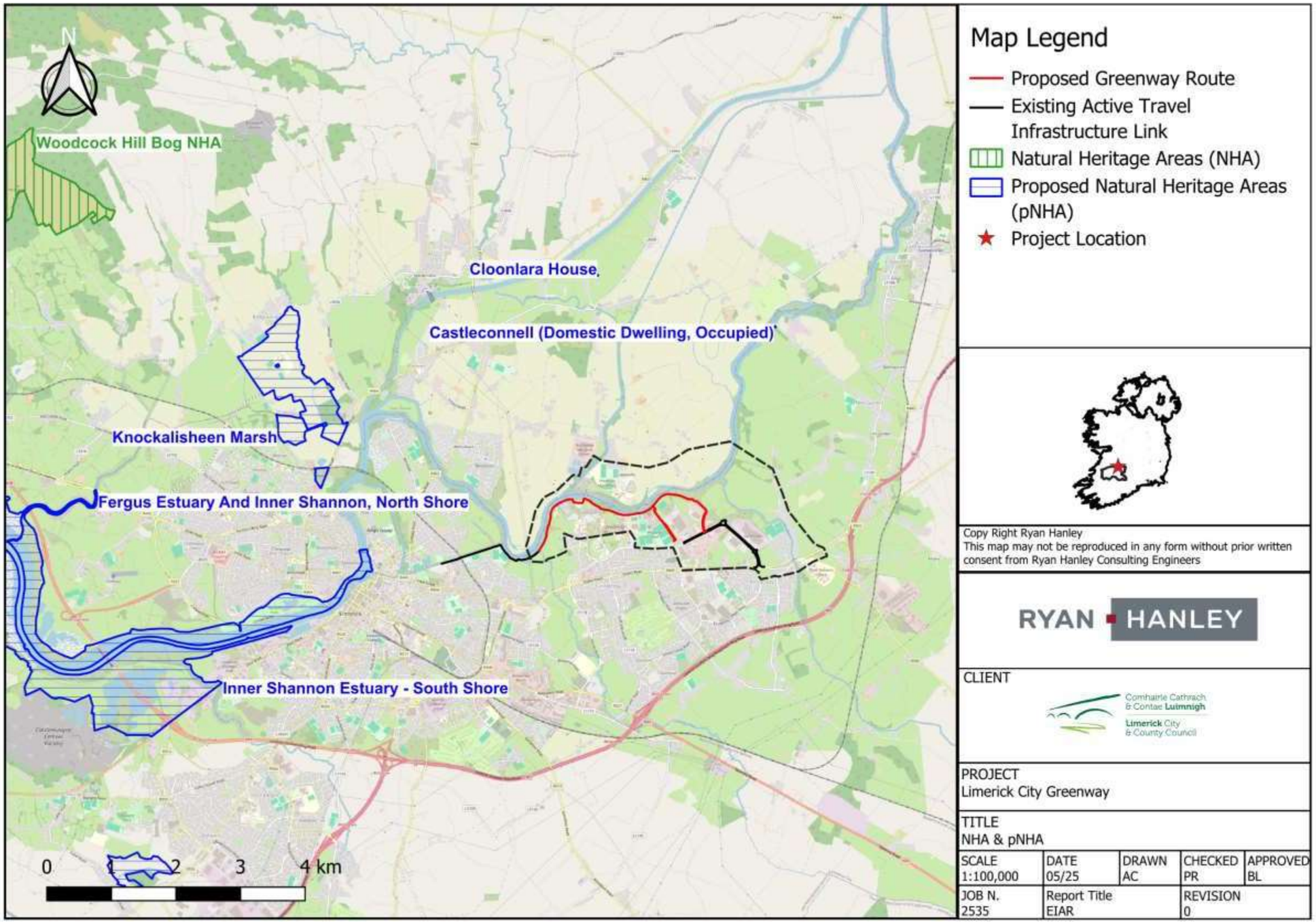

Figure 6. 3 National Heritage Areas Identified within Zone of Influence of the Study Area

Table 6.3 Natural Heritage Areas (NHA) and Proposed Natural Heritage Areas (pNHA) Identified within the zone of influence of the Study Area.

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
Natural Heritage Areas (NHA)			
Woodcock Hill Bog NHA [002402]	8.17km north-west	Woodcock Hill Bog NHA is an area of upland blanket bog and heath situated approximately 8km north-west of Limerick City and 5 km south-east of Sixmilebridge in Co. Clare. The northern, eastern and western margins of the site are bounded by plantation forestry fringed by firebreaks. Woodcock Hill Bog NHA is a site of considerable conservation significance comprising upland blanket bog and wet heath. Wet heath is dominated by Deergrass (*Scirpus cespitosus*) and Ling Heather (*Calluna vulgaris*). Other species occurring here include Cross-leaved Heath (*Erica tetralix*), Purple Moor-grass (*Molinia caerulea*), Carnation Sedge (*Carex panicea*), Tormentil (*Potentilla erecta*), Common Cottongrass (*Eriophorum angustifolium*), Hare's-tail Cottongrass (E. vaginatum) and Lousewort (*Pedicularis sylvatica*). Bog mosses (*Sphagnum spp.*) occur locally but rarely dominate. Lichens (*Cladonia spp.*) occur throughout the site. Hummocks of the moss *Racomitrium lanuginosum* occur on the summit. The Qualifying Interest for this site is Peatlands [4].	Woodcock Hill Bog NHA is located at a significant distance of 8.17km north-west from the proposed Study Area. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Gortacullin Bog NHA [002401]	12.7km north	Gortacullin Bog NHA contains a mosaic of upland blanket bog and wet heath and is located approximately 4 km south-west of Broadford, Co. Clare and approximately 9km northeast of Sixmilebridge, in Co. Clare. The northern margins of the site are bounded by enclosed agricultural land and the southern and eastern margins are bounded by commercial forestry plantation. Blanket bog is confined to the lower slopes of the centre and eastern part of the site with wet heath occupying the drier areas on slightly higher ground. There is a	Gortacullin Bog NHA is located at a significant distance of 12.7km north-west from the proposed Study Area. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
		large flush in the north part of the site and regenerating cutover bog with scrub woodland occurs in the south-centre. Much of the of the blanket bog vegetation consists of Deergrass (*Scirpus cespitosus*), Ling Heather (*Calluna vulgaris*), Cross-leaved Heath *(Erica tetralix*), Common Cottongrass (*Eriophorum angustifolium*), Hare's-tail Cottongrass (*Eriophorum vaginatum*), Bog Asphodel (*Narthecium ossifragum*), Purple Moor-grass (*Molinia caerulea*), Tormentil (*Potentilla erecta*) and Carnation Sedge (*Carex panicea*). Bog mosses (*Sphagnum spp.*) are present throughout the site and in the wetter areas are present as carpets. In the flushes, carpets of bog moss *S. recurvum* occur with Soft Rush (*Juncus effusus*) and the Common and Hare's-tail Cotton grasses. Wet heath habitat is found on the better drained slopes and is characterized by a higher cover of Ling Heather with Common Bent (*Agrostis capillaris*), Heath Rush (*Juncus squarrosus*), Bell Heather (*Erica cinerea*), Heath Milkwort (*Polygala serpyllifolia*), Heath Wood-rush (*Luzula multiflora*), Devil's-bit Scabious (*Succisa pratensis*), Bilberry (*Vaccinium myrtillus*) and Carnation Sedge. Old cutover is mainly dominated by Ling Heather. Birch (*Betula sp.*) and Willows (*Salix spp.*) also occur along drains in the centre of this cutover area The Qualifying Interest for this site is Peatlands [4].	
Grageen Fen & Bog NHA [002186]	13.7km east	Grageen Fen and Bog NHA is an upland bog and alkaline fen located on the southern side of the Slievefelim Mountains, approximately 6km east of Moroe and 7km south-east of Newport, Co. Limerick. A mature conifer plantation forms the eastern boundary, while a young conifer plantation forms part of the western boundary. The southern boundary and remainder of the western boundary are defined by the transition from intact blanket bog to cutover bog habitat. The blanket bog vegetation is typified by a tall, unburnt and ungrazed canopy of Ling Heather (*Calluna vulgaris*), Cottongrasses (*Eriophorum angustifolium, E. vaginatum*), Deergrass (*Scirpus cespitosus*) with occasional Purple Moor-grass	Grageen Fen and Bog NHA overlaps with Slievefelim to Silvermines Mountains SPA, located approximately 137.km east from the proposed Study Area. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
		(*Molinia caerulea*), Cross-leaved Heath (*Erica tetralix*) and scattered Bog Asphodel (*Narthecium ossifragum*). There is a well-developed moss ground flora with frequent hummocks of bog mosses (*Sphagnum capillifolium* and *S.* subnitens). The moss lawns and hummocks are frequently colonised by Crowberry (*Empetrum nigrum*) and Cranberry (*Vaccinium oxycoccos*). The Qualifying Interest for this site is Peatlands [4].	
Doon Lough NHA [000337]	14.7km north	Doon Lough Bog NHA is situated approximately 3km north-east of Broadford, Co. Clare. The site comprises a raised bog, that includes both areas of high bog and cutover bog, woodlands, lakes, marsh, fen and wet meadows. The high bog is bounded by mineral ridges to the west and east and wet grassland to the south. Much of the high bog has vegetation typical of a Western Raised Bog, with such species as Ling Heather (Calluna vulgaris), Common Cottongrass (*Eriophorum angustifolium*), White Beak-sedge (*Rhynchospora alba*), Bog Asphodel (*Narthecium ossifragum*), Deergrass (*Scirpus cespitosus*) and Cross-leaved Heath (*Erica tetralix*). Bog mosses present include the hummock-formers *Sphagnum imbricatum, S. fuscum, S. capillifolium and S. papillosum,* as well as *S. cuspidatum* which is found in hollows. The site also includes a large lake system with a variety of fringing habitats, which include scrub, woodland, marsh, and wet grassland. The Qualifying Interest for this site is Peatlands [4].	Doon Lough Bog NHA is located at a significant distance of 14.7km north from the proposed Study Area, with the majority of this designated site sitting outside of the 15km buffer (Figure 6.3). No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Bleanbeg Bog NHA [002450]	14.7km east	Bleanbeg Bog NHA is a site of considerable conservation importance and consists primarily of upland blanket bog. It is located approximately 7 km east of Newport in south Tipperary. It incorporates a broad plateau of upland blanket bog habitat that grades into heath, upland grassland on peaty soil, and cutover bog. The vegetation in this extensive, rather flat expanse of upland blanket bog is dominated	Bleanbeg Bog NHA is located at a significant distance of 14.7km east from the proposed Study Area. No Source-Pathway-Receptor chain could be

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
		by Deergrass (*Scirpus cespitosus*) and cottongrasses (*Eriophorum angustifolium* and *E. vaginatum*) with frequent Purple Moor-grass (*Molinia caerulea*), low Ling Heather (*Calluna vulgaris*) and occasional Cross-leaved Heath (*Erica tetralix*), Bell Heather (*Erica cinerea*) and Bog Asphodel (*Narthecium ossifragum*). Several Red Data Book species, including Red Grouse and Irish Hare, have been recorded on the site. A pair of Hen Harriers, also a Red Data Book species, nest within 1 km of the site and are known to forage over the site. Blanket bog habitat is a globally scarce resource and long-term survival of this habitat requires sensitive management. The Qualifying Interest for this site is Peatlands [4].	identified. Potential impacts are not considered.
Proposed Natural Heritage Areas (pNHA)			
Fergus Estuary and Inner Shannon, North Shore pNHA [002048]	2.7 km west	This site is part of the River Shannon and River Fergus Estuaries SPA [004077] and Lower River Shannon SAC [002165]. The River Shannon and River Fergus Estuaries SPA is an internationally important site that supports an assemblage of over 20,000 wintering waterbirds. It holds internationally important populations of four species, i.e. Light-bellied Brent Goose, Dunlin, Black-tailed Godwit and Redshank. In addition, there are 17 species that have wintering populations of national importance. The site also supports a nationally important breeding population of Cormorant. Of particular note is that three of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover and Bar-tailed Godwit. Parts of the River Shannon and River Fergus Estuaries SPA are Wildfowl Sanctuaries. This Lower River Shannon SAC is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitats lagoon and alluvial woodland, the only known resident population of Bottle-nosed Dolphin in Ireland and all three	Yes. There is a hydrological link to this pNHA via the Shannon (Lower)_060 riverbody and Limerick Dock Transitional Waterbody, with the potential for runoff of construction phase materials to occur. Sections of the pNHA are located within the same groundwater body (Limerick City North) as the proposed works area. Risk of sediment or pollution is low as the pNHA is located approximately 7km downstream and works are likely to be of short duration.

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
		Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush.	
Castleconnell (Domestic Dwelling Occupied) pNHA [000433]	2.9km northeast	This is an occupied domestic dwelling in the village of Castleconnell on the banks of the River Shannon in Co. Limerick.	No. Castleconnell (Domestic Dwelling Occupied) pNHA is located c. 3km upstream of the Shannon (Lower)_060 north of the proposed Study Area. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Knockalisheen Marsh pNHA [002001]	3.5km northwest	Knockalisheen Marsh is part of the Lower River Shannon SAC (2165) and a proposed Natural Heritage Area (pNHA). The habitat is made up of marsh, and wetland areas, an open water area of marsh & willows and a riverside natural habitat. There is a second open water area fringed with bulrush south of the railline (NHA) and a third which is the largest area of open water with reedbeds, and unimproved damp grassland species with low intensity grazing. This area is north of the rail line and crosses into County Clare.	Yes, however effects are unlikely. Knockalisheen Marsh pNHA is located c. 3.9km downstream of the Shannon (Lower)_060 riverbody west of the proposed Study Area. There is the potential for runoff of construction phase materials to occur however the border of the pNHA is 274 meters from the river margin and the river is flowing past and away from the pNHA south to Limerick Dock. Sections of the pNHA are located within the same groundwater body (Limerick City North) as the proposed works area.
Cloonlara House pNHA [000028]	3.5km north	This is a bat site which is located in a three-story domestic dwelling house and contains over 100 Leisler's Bats (*Nyctalus leisleri*) during the summer months. Ireland is likely to contain the largest population of this species in Europe. This site is one of the biggest nursery sites in Ireland and in Europe and is a site of international importance.	No. Cloonlara House pNHA is located upstream of the Shannon (Lower)_060 north of the proposed Study Area. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
Inner Shannon Estuary South Shore pNHA [000435]	4.1km west	This site is part of the River Shannon And River Fergus Estuaries SPA [004077] and Lower River Shannon SAC [002165]. The River Shannon and River Fergus Estuaries SPA is an internationally important site that supports an assemblage of over 20,000 wintering waterbirds. It holds internationally important populations of four species, i.e. Light-bellied Brent Goose, Dunlin, Black-tailed Godwit and Redshank. In addition, there are 17 species that have wintering populations of national importance. The site also supports a nationally important breeding population of Cormorant. Of particular note is that three of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Golden Plover and Bar-tailed Godwit. Parts of the River Shannon and River Fergus Estuaries SPA are Wildfowl Sanctuaries. This Lower River Shannon SAC is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the E.U. Habitats Directive, including the priority habitats lagoon and alluvial woodland, the only known resident population of Bottle-nosed Dolphin in Ireland and all three Irish lamprey species. A good number of Red Data Book species are also present, perhaps most notably the thriving populations of Triangular Club-rush.	Yes. There is a hydrological link to this pNHA via the Shannon (Lower)_060 riverbody and Limerick Dock Transitional Waterbody, with the potential for runoff of construction phase materials to occur. Risk of sediment or pollution is low as the pNHA is located approximately 7.8km downstream and works are likely to be of short duration.
Glenomra Wood pNHA [001013]	8.6km north	Glenomra Wood is a good example of a deciduous semi-natural woodland and is of considerable conservation significance as it is of a type listed on Annex I of the E.U. Habitats Directive. The site is a Special Area of Conservation (SAC) selected for [91A0] Old Oak Woodlands. Further habitat diversity is created by the presence of streams within the woodland, and also, by the presence of a small area with raised bog vegetation. Here bog mosses (*Sphagnum* spp.) and Heather (*Calluna vulgaris*), amongst other species, are found. Three Red Data Book mammals occur in the site: Badger, Pine Marten and Hare. A large population of Common Frog breeds in the south-west of the site. This amphibian is also listed in the Red Data Book. Pheasant, Woodcock and Snipe are also present in the site.	No. Glenomra Wood pNHA is located 8.6km north and upstream of the proposed Study Area. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Glenstal Wood pNHA [001432]	8.8km east	Glenstal Wood, which is associated with Glenstal Abbey, lies in the western foothills of the Slievefelim Mountains, about 8 km north-west of Cappamore, Co. Limerick. The site is an SAC and is of conservation importance for the presence of Killarney Fern (*Trichomanes speciosum*), a rare species that is listed on Annex II of the E.U. Habitats Directive and that is also protected under the Flora (Protection) Order, 1999. Oak (*Quercus* sp.) woodland remnants occur at the site which support a rich	No. Glenstal Wood pNHA is located 8.8km east of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
		fern, bryophyte and lichen flora. The rare lichen, *Enterographa elabora*, a species known from only three other counties in Ireland, has been recorded at the site.	
Loughmore Common Turlough pNHA [000438]	9.3km southwest	Loughmore Turlough lies in a shallow basin, elongated in an east-west direction and floods shallowly (30-40cm) in winter. A variety of plant communities occur, depending on the substrate type and degree of wetness. Greater Bird's-foot-trefoil (*Lotus uliginosus*) and Common Fleabane (*Pulicaria dysenterica*) are present and although relatively more common here than other regions have not been recorded in any other Irish Turlough. The rare plant species Opposite leaved pondweed (*Groenlandia densa*) and Meadow Barley (*Horedeum secalinum*) occur on site (Both protected under the Flora (Protection) order, 1999). The site provides suitable winter habitat for Lapwing and Golden Plover and is a breeding ground for Snipe. The sites southerly location, shallowness, proximity to the sea and some calcium enrichment cause the flora of Loughmore to have a unique element, enhancing the conservation value of the turlough.	No. Loughmore Common Turlough pNHA is located 9.3km southwest of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Clare Glen pNHA [000930]	9.3km east	The woodland, although planted with many exotic trees, is mature and conforms to a type listed on Annex II of the E.U. Habitats Directive. The site is scenic and popular as an amenity area, and the presence of a number of rare and scarce species adds further to its importance. The site is a Special Area of Conservation (SAC) selected for [91A0] Old Oak Woodlands [1421] and Killarney Fern (*Trichomanes speciosum*). A rich bryophyte flora is associated with the river and the wet rocks around it, including the rare mosses *Amblystegium fluviatile, Fissidens exiguus* and *Pohlia campotrachela,* and the liverworts *Lejeunea holtii, Colura calyptrifolia* and *Dumortiera hirsuta*. The site is also notable for the presence of several rare species of Myxomycete fungus, namely *Fuligo muscorum, Stemonitopsis hyperopta* and *Licea testudinacea,* the last-named in one of only two known Irish sites.	No. Clare Glen pNHA is located 9.3km east of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Ballyvorheen Bog pNHA [001849]	9.9km southeast	This site is part of the Lower River Shannon SAC and is a water-dependent raised bog habitat located northwest of Cappamore. It is a Cutaway raised bog bordered by woodland; dominant *Calluna vulgaris* (Heather), *Molinia caerulea* (Purple Moor-grass), and many self-sown *Pinus sylvestris* (Scots Pine); *Sphagnum* patches with abundant *Vaccinium oxycoccos* (Cranberry).	No. Ballyvorheen Bog pNHA is located 9.9km southeast of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
Garrannon Wood pNHA [001012]	10.8km west	This small deciduous wood is located immediately east of Cratloe and less than 10km Limerick City. It is situated on a rocky knoll and is surrounded mostly by pasture fields. There have been signs of fox, badger, and pine marten in the wood. Some uncommon beetles have also been recorded from the site. The importance of this site is that it is a good example of a fairly intact and mature oak wood. It is likely that the site has been wooded for a long period.	No. Garrannon Wood pNHA is located 10.8km west of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Derrygareen Heath pNHA [000931]	11.6 km east	This site is situated to the northwest of the Slievefelim Mountains, 4km southeast of Newport. The site is a rocky area of shallow peaty soils with vegetation of un-reclaimed healthland, dominated by Heather (*Calluna vulgaris*) with Cross-leaved Heath (*Erica tetralix*) and grasses such as Common Bent (*Agrostis capillaris*). Scrub species are widespread, most notably Eared Willow (*Salix aurita*) and Gorse (*Ulex europaeus*) with patches of Bracken (*Pteridium aquilinum*). Although the vegetation could be described as typical, it is atypical for such an area as to remain unfertilised, un-reclaimed and largely unplanted with conifers (Small conifer plantation to the east of the site).	No. Derrygareen Heath pNHA is located 11.6 km east of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Dromsallagh Bog pNHA [001850]	12.2km southeast	Dromsallagh Bog is a small site of cutaway raised bog and its associated habitats. It is situated approximately 2km north-west of Cappamore. The bog is regenerating and supports a variety of acidophile communities. There is good *Sphagnum* regeneration, and the site supports tall Heather (*Calluna vulgaris*) dwarf shrubs. Several bog pools and cutaway pools occur at this site, adding to its biodiversity. The site is being invaded by Downy Birch (*Betula pubescens*) woodland with isolated Rhododendron (*Rhododendron ponticum*) seen in places. Species of note include Cranberry (*Vaccinium oxycoccos*) and White Sedge (*Carex curta*). The continuing loss of virgin peatland in Ireland, particularly raised bog, makes these regenerating cutaways of ever-increasing importance.	No. Dromsallagh Bog pNHA is located 12.2km southeast of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Skoolhill pNHA [001996]	13km south	Skoolhill is situated in Grange in Co. Limerick. Two woodlands occur here, with a mixture of native tree species such as Ash *(Fraxinus excelsior)*, Hazel (*Corylus avellana*), Hawthorn (*Crataegus monogyna*) and oak (*Quercus* spp.) as well as exotics like Beech (*Fagus sylvatica*) and Sycamore (*Acer pseudoplatanus*). The ground vegetation in the woods is quite sparse, with Ivy (*Hedera helix*), Bramble (*Rubus fruticosus* agg.), ferns and Hogweed (*Heracleum sphondylium*) present. Rough grassland exists on the hill outside the woods, with quite natural vegetation present around the limestone rock outcrops. Plants such as Yarrow (*Achillea millefolium*),	No. Skoolhill pNHA is located 13 km south of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.

Designated site and code	Distance from Scheme	Site Synopsis	Pathway for Effect
		Common Knapweed (*Centaurea nigra*) and Selfheal (*Prunella vulgaris*) are found here. The outstanding value of this site is as the only known location in Ireland of the grass Various leaved Fescue (*Festuca heterophylla*). This was discovered here in 1977 and has still not been recorded elsewhere in Ireland.	
Castle Lake pNHA [000239]	14.7km northwest	This site contains a diversity of wetland and woodland habitats ranging from open water and reed-beds to lakeside wet deciduous woodland to ash/oak woodland and scrub to species-rich wet fields and marsh. This is a relatively small site but still retains substantial habitat diversity in the face of considerable reclamation work in the area over the years. The main habitat present within this site is open water including Castle Lake and Ballymulcashel Lough. MaCarthy's Island, in the middle of Castle Lake, is dominated by old willow trees (*Salix* spp.) and a large Cormorant colony breeds here. Two secondary habitats present within the site include Hazel scrub and ask/oak woodland. A number of wet fields on the southwest of the site are included and a marsh with rich bryophyte flora and many sedges (*Carex* spp.) occurs at the north end of the site. There are mixed woodlands at the southeast and southwest corners of the site.	No. Castle Lake pNHA is located 14.7km northwest of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.
Danes Hole, Poulnalecka pNHA [000030]	14.8km northwest	This site consists of a small fossil cave in the banks of the Ahaclare River situated within a wood approximately 4 km west of Broadford, Co. Clare. It is a winter hibernation site and also a mating site of the Lesser Horseshoe Bat. A nearby summer roost for the bat and the commuting routes between the two are also included. The site is a Special Area of Conservation (SAC) (Danes Hole, Poulnalecka 000030) selected for [8310] Caves, [91A0] Old Oak Woodlands and [1303] Lesser Horseshoe Bat (*Rhinolophus hipposideros*). In November 1998, 250 Lesser Horseshoe Bats were counted at the cave, making the site one of international importance. In the national context this site is considered important because it is one of the most eastern points in the distribution of this bat in Ireland.	No. Danes Hole, Poulnalecka pNHA is located 14.8km northwest of the proposed study site. No Source-Pathway-Receptor chain could be identified. Potential impacts are not considered.

6.3.3 Records of Protected, Rare and other Notable Species

The following sections describe the desk study sources consulted and results obtained during the assessment. Records of rare or protected flora and fauna within 10km of the proposed development were obtained from the National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC), Botanical Society for Britain and Ireland (BSBI) and Bat Conservation Ireland (BCI).

6.3.3.1 New Flora Atlas & NBDC

A search was made in the *New Atlas of the British & Irish Flora* (Preston *et al*. 2002) and the National Biodiversity Centre (NBDC) database to identify if any rare or protected plant species have been previously recorded from hectad R65 within which the proposed development is located. The search targeted vascular plants that are listed in Annex II of the EU Habitats Directive, the Flora (Protection) Order (FPO) of 2022, and those listed in *The Irish Red Data Book* (Jackson *et al*. 2016). There are sixteen records of species listed under the Flora Protection Order, Annex II or the Irish Red List within the 10 km grid square (**Table 6.4** below).

Table 6.4 Plant (Vascular and Bryophytes) species of conservation concern recorded within Hectad R65.

Common Name	Scientific Name	Conservation Status
Opposite-leaved Pondweed	*Groenlandia densa*	Flora (Protection) Order 2022 Red Book Status: Near threatened, vulnerable.
Pyramidal Bugle	*Ajuga pyramidalis*	Red book status – Rare (R) - Vulnerable
Garden Yellow Archangel	*Lamiastrum galeobdolon subsp. argentatum*	Red book status – Rare (R) - Least Concern
Corncockle	*Agrostemma githago*	Red book status – Extinct -Waiting list
Cornflower	*Centaurea cyanus*	Red book status – Extinct -Waiting list
Corn marigold/ daisy	*Glebionis segetum*	Red book status: Near threatened
Slender Tufted-sedge	*Carex acuta*	Red book status: Near threatened
Tubular Water-dropwort	*Oenanthe fistulosa*	Red book status: Near threatened
Fringed Heartwort	*Ricciocarpos natans*	Red book status: Near threatened
Clustered Feather-moss	*Rhynchostegium confertum*	Red book status: Least concern
Common Feather-moss	*Eurhynchium praelongum*	Red book status: Least concern
Heart-leaved Spear-moss	*Calliergon cordifolium*	Red book status: Least concern
Rough-stalked Feather-moss	*Brachythecium rutabulum*	Red book status: Least concern
Sickle-leaved Hook-moss	*Sanionia uncinata*	Red book status: Least concern
Smaller Lattice-moss	*Cinclidotus fontinaloides*	Red book status: Least concern

Common Name	Scientific Name	Conservation Status
Upright Brown Grimmia	*Schistidium strictum*	Red book status: Near threatened
Wall Feather-moss	*Rhynchostegium murale*	Red book status: Least concern
Wall Thread-moss	*Bryum radiculosum*	Red book status: Least concern
Wedge-leaved Screw-moss	*Tortula cuneifolia*	Red Book Status: Critically Endangered

6.3.3.2 NPWS Records of Protected Species

NPWS online records (Article 17 species data) were searched to see if any rare or protected species of flora or fauna have been recorded from hectad R65. An information request was also sent to the NPWS requesting records from the Rare and Protected Species Database (13th August 2021). An updated request was sent on the 25/01/2024. **Table 6. 5** lists rare and protected species records obtained from the data request and Article 17 species data.

Table 6. 5 Rare and Protected Species Records for Hectad R65.

Common Name	Scientific Name	Source	Conservation Status
Atlantic Salmon	*Salmo salar*	NPWS Article 17	EU Habitats Directive, Annex II & V
Brook Lamprey	*Lampetra planeri*	NPWS Article 17	EU Habitats Directive, Annex II
Common Frog	*Rana temporaria*	NPWS request & Article 17	EU Habitats Directive, Annex V & Wildlife Acts 1976 – 2017
Common Kingfisher	*Alcedo atthis*	NPWS request	EU Birds Directive, Annex I, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
Common Lizard	*Zootoca vivipara*	NPWS request	Wildlife Acts 1976 – 2017
Common Pipistrelle	*Pipistrellus pipistrellus*	NPWS Article 17	EU Habitats Directive, Annex IV and Wildlife Acts 1976 – 2017
Darnel	*Lolium temulentum*	NPWS request	Flora (Protection) Order, 2015. Endangered species – IUCN Red list
Daubenton's Bat	*Myotis daubentonii*	NPWS Article 17	EU Habitats Directive, Annex IV & Wildlife Acts 1976 – 2017
Eurasian Badger	*Meles meles*	NPWS request	Wildlife Acts 1976 – 2017
European Otter	*Lutra lutra*	NPWS request & Article 17	EU Habitats Directive, Annex II & IV and Wildlife Acts 1976 – 2017

Common Name	Scientific Name	Source	Conservation Status
Freshwater White-clawed Crayfish	*Austropotamobius pallipes*	NPWS request & Article 17	EU Birds Directive, Annex II and Wildlife Acts 1976 – 2017
Irish (mountain) hare	*Lepus timidus* subsp. *hibernicusLepus timidus*	NPWS request & Article 17	EU Habitats Directive, Annex V and Wildlife Acts 1976 – 2017
Irish stoat	*Mustela erminea*	NPWS request	Wildlife Acts 1976 – 2017
River Lamprey	*Lampetra fluviatilis*	NPWS request & Article 17	EU Habitats Directive, Annex II & V
Lesser Horseshoe Bat	*Rhinolophus hipposideros*	NPWS request & Article 17	EU Habitats Directive, Annex II & IV and Wildlife Acts 1976 – 2017
Lesser Noctule/Leisler's Bat	*Nyctalus leisleri*	NPWS Article 17	EU Habitats Directive, Annex IV and Wildlife Acts 1976 – 2017
Opposite-leaved pondweed	*Groenlandia densa*	NPWS request	Flora (Protection) Order, 2015. Near threatened species - IUCN Red list
Pine Marten	*Martes martes*	NPWS Article 17	EU Habitats Directive, Annex V and Wildlife Acts 1976 – 2017
Sea Lamprey	*Petromyzon marinus*	NPWS request & Article 17	EU Habitats Directive, Annex II
Smooth Newt	*Lissotriton vulgaris*	NPWS request	Wildlife Acts 1976 – 2017
Soprano Pipistrelle	*Pipistrellus pygmaeus*	NPWS Article 17	EU Habitats Directive, Annex IV, Wildlife Acts 1976 – 2017
Spiked sedge	*Carex spicata*	NPWS request	Near threatened species - IUCN Red list

6.3.3.3 *NPWS Article 17 Datasets and Additional Habitat Databases*

A review of the NPWS Habitat Directive - Article 17 datasets, Irish Semi-Natural Grassland Survey datasets, National Survey of Native Woodland datasets and Ancient and Long-Established Woodland dataset was conducted on the 18th of November 2021. An updated review was completed on the 13/02/2024. The datasets were downloaded and overlain on the proposed development area.

No records of Irish Semi-Natural Grassland Survey, National Survey of Native Woodland datasets and Ancient and Long-Established Woodland data were present within the Study Area. Areas of Annex 1 habitats Residual Alluvial Forests (91E0), Hydrophilous tall herb (6430) and Floating river vegetation (3260) are reported within the study area along the banks (north and south) of the River Shannon. Limerick Dock (1130 Estuaries) (part of the Upper Shannon Estuary) is located 2.3km downstream.

6.3.3.4 *National Biodiversity Data Centre Data*

A search of the National Biodiversity Data Centre (NBDC) website was conducted with a focus on records of protected fauna, macroinvertebrates and insects from hectad R65. The results of the database search are provided below in **Table 6. 6.**

Table 6. 6 NBDC records for protected species records for Hectad R65.

Common Name	Scientific Name	Conservation Status
Barn Owl	*Tyto alba*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Red List
Barn Swallow	*Hirundo rustica*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Black-headed Gull	*Larus ridibundus*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Red List
Brown Long-eared Bat	*Plecotus auritus*	EU Habitats Directive, Annex IV & Wildlife Acts 1976 – 2017
Common Coot	*Fulica atra*	EU Birds Directive, Annex II & III, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
Common Frog	*Rana temporaria*	EU Habitats Directive, Annex V & Wildlife Acts 1976 – 2017
Common Grasshopper Warbler	*Locustella naevia*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Common Kestrel	*Falco tinnunculus*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Common Kingfisher	*Alcedo atthis*	EU Birds Directive, Annex I, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
Common Linnet	*Carduelis cannabina*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Common Lizard	*Zootoca vivipara*	Wildlife Acts 1976 – 2017
Common Pheasant	*Phasianus colchicus*	EU Birds Directive, Annex II & III, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
Common Pipistrelle	*Pipistrellus pipistrellus*	EU Habitats Directive, Annex IV and Wildlife Acts 1976 – 2017
Common Pochard	*Phasianus colchicus*	EU Birds Directive, Annex II & III, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
Common Sandpiper	*Actitis hypoleucos*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Common Snipe	*Gallinago gallinago*	EU Birds Directive, Annex II & III, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
Common Starling	*Sturnus vulgaris*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List

Common Name	Scientific Name	Conservation Status
Common Swift	*Apus apus*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Common Wood Pigeon	*Columba palumbus*	EU Birds Directive, Annex II & III and Wildlife Acts 1976 – 2017.
Corn Crake	*Crex crex*	EU Birds Directive, Annex I, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Red List
Daubenton's Bat	*Myotis daubentonii*	EU Habitats Directive, Annex IV & Wildlife Acts 1976 – 2017
Eurasian Badger	*Meles meles*	Wildlife Acts 1976 – 2017
Eurasian Curlew	*Numenius arquata*	EU Birds Directive, Annex II, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Red List
Eurasian Pygmy Shrew	*Sorex minutus*	Wildlife Acts 1976 – 2017
Eurasian Red Squirrel	*Sciurus vulgaris*	Wildlife Acts 1976 – 2017
Eurasian Teal	*Anas crecca*	EU Birds Directive, Annex II & III, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
Eurasian Woodcock	*Scolopax rusticola*	EU Birds Directive, Annex II & III, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
European Golden Plover	*Pluvialis apricaria*	EU Birds Directive, Annex I, II & III, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Red List
European Otter	*Lutra lutra*	EU Habitats Directive, Annex II & IV and Wildlife Acts 1976 – 2017
Fallow Deer	*Dama dama*	Invasive Species: Regulation S.I. 477, Wildlife Acts 1976 – 2017.
Freshwater White-clawed Crayfish	*Austropotamobius pallipes*	EU Birds Directive, Annex II and Wildlife Acts 1976 – 2017
Great Black-backed Gull	*Larus marinus*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Great Cormorant	*Phalacrocorax carbo*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Greylag Goose	*Anser Anser*	Invasive Species: Regulation S.I. 477 (Ireland), Wildlife Acts 1976 – 2017, EU Birds Directive Annex II, Section I Bird Species, Annex III, Section II Bird Species, Threatened Species: Birds of Conservation Concern - Amber List
Herring Gull	*Larus argentatus*	Wildlife Acts 1976-2017. Threatened Species: Birds of Conservation Concern - Red List
House Martin	*Delichon urbicum*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List

Common Name	Scientific Name	Conservation Status
House Sparrow	*Passer domesticus*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Irish (mountain) hare	*Irish Hare (Lepus timidus subsp. hibernicus)Lepus timidus*	EU Habitats Directive, Annex V and Wildlife Acts 1976 – 2017
Irish Stoat	*Mustela erminea subsp. hibernica*	Protected Species: Wildlife Acts 1976 – 2017
Jack Snipe	*Lymnocryptes minimus*	EU Birds Directive, Annex II & III and Wildlife Acts 1976 – 2017
Lesser Black-backed Gull	*Larus fuscus*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Lesser Horseshoe Bat	*Rhinolophus hipposideros*	EU Habitats Directive, Annex II & IV and Wildlife Acts 1976 – 2017
Lesser Noctule	*Nyctalus leisleri*	EU Habitats Directive, Annex IV and Wildlife Acts 1976 – 2017
Little Egret	*Egretta garzetta*	EU Birds Directive, Annex I and Wildlife Acts 1976 – 2017
Little Grebe	*Tachybaptus ruficollis*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Mallard	*Anas platyrhynchos*	EU Birds Directive, Annex II & III and Wildlife Acts 1976 – 2017
Mew Gull	*Larus canus*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Mute Swan	*Cygnus olor*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Northern Lapwing	*Vanellus vanellus*	EU Birds Directive, Annex II, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Red List
Northern Wheatear	*Oenanthe oenanthe*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Pine Marten	*Martes martes*	EU Habitats Directive, Annex V and Wildlife Acts 1976 – 2017
Rock Pigeon	*Columba livia*	EU Birds Directive, Annex II and Wildlife Acts 1976 – 2017
Sand Martin	*Riparia riparia*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Sky Lark	*Alauda arvensis*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Smooth Newt	*Lissotriton vulgaris*	Wildlife Acts 1976 – 2017
Soprano Pipistrelle	*Pipistrellus pygmaeus*	EU Habitats Directive, Annex IV and Wildlife Acts 1976 – 2017
Spotted Flycatcher	*Muscicapa striata*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List

Common Name	Scientific Name	Conservation Status
Stock Pigeon	*Columba oenas*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Amber List
Tufted Duck	*Aythya fuligula*	EU Birds Directive, Annex II & III, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
West European Hedgehog	*Erinaceus europaeus*	Wildlife Acts 1976 – 2017
Whooper Swan	*Cygnus cygnus*	EU Birds Directive, Annex I, Wildlife Acts 1976 – 2017 & Threatened Species: Birds of Conservation Concern – Amber List
Yellowhammer	*Emberiza citrinella*	Wildlife Acts 1976 – 2017. Threatened Species: Birds of Conservation Concern – Red List

6.3.3.5 *Invasive Alien Species Records*

A search of the NBDC and LCCC invasives website was conducted with a particular focus on records of Invasive Alien Species recorded from the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) in hectad R65. The results of the database search are provided below in **Table 6. 7.**

Table 6. 7 Third Schedule Invasive Alien Species records for hectad R65.

Common Name	Scientific Name	Conservation Status
Greylag Goose	*Anser anser*	Invasive Species: Regulation S.I. 477 (Ireland), Wildlife Acts 1976 – 2017, EU Birds Directive Annex II, Section I Bird Species, Annex III, Section II Bird Species, Threatened Species: Birds of Conservation Concern - Amber List
Dace	*Leuciscus leuciscus*	MI Invasive Species, Invasive Species Reg S.I. 477
Water Fern	*Azolla filiculoides*	MI Invasive Species, Invasive Species Reg S.I. 477
Canadian Waterweed	*Elodea canadensis*	HI Invasive Species, Invasive Species Reg S.I. 477
Giant Hogweed	*Heracleum mantegazzianum*	HI Invasive Species, Invasive Species Reg S.I. 477
Giant Knotweed	*Fallopia sachalinensis*	HI Invasive Species, Invasive Species Reg S.I. 477
Indian Balsam	*Impatiens glandulifera*	HI Invasive Species, Invasive Species Reg S.I. 477
Japanese Knotweed	*Fallopia japonica*	HI Invasive Species, Invasive Species Reg S.I. 477
Nuttall's Waterweed	*Elodea nuttallii*	HI Invasive Species, Invasive Species Reg S.I. 477
Brown Rat	*Rattus norvegicus*	HI Invasive Species, Invasive Species Reg S.I. 477
Eastern Grey Squirrel	*Sciurus carolinensis*	HI Invasive Species, Invasive Species Reg S.I. 477
Fallow Deer	*Dama dama*	HI Invasive Species, Invasive Species Reg S.I. 477. Protected Species, Wildlife Acts 1976-2017.

Common Name	Scientific Name	Conservation Status
Three-cornered garlic/leek	*Allium triquetrum*	MI Invasive Species, Invasive Species Reg S.I. 477
Cherry Laurel	*Prunus laurocerasus*	HI Invasive Species
European Rabbit	*Oryctolagus cuniculus*	MI Invasive Species
Douglas Fir	*Pseudotsuga menziesii*	MI Invasive Species
Butterfly Bush	*Buddleja davidii*	MI Invasive Species
Japanese Rose	*Rosa rugosa*	MI Invasive Species
Least Duckweed	*Lemna minuta*	MI Invasive Species
Sycamore	*Acer pseudoplatanus*	MI Invasive Species
Common Garden Snail	*Cornu aspersum*	MI Invasive Species
Jenkins' Spire Snail	*Potamopyrgus antipodarum*	MI Invasive Species
Bank Vole	*Myodes glareolus*	MI Invasive Species
Greater White-toothed Shrew	*Crocidura russula*	MI Invasive Species
Winter Heliotrope	*Petasites fragrans*	LI Invasive Species

**MI – Medium Impact, HI – High Impact, LI – Low Impact.*

6.3.3.6 Bat Conservation Ireland Database

A search for records of bat activity and roosts within a 10km radius of the study area was conducted using the Bat Conservation Ireland (BCI) database, which is presented on the NBDC. A number of observations have been recorded within 10km of the proposed works (**Table 6. 8**). From the NBDC bat landscape suitability mapping, a Bat Landscape Suitability Index (Lundy *et al.*, 2011) score of 42.56 on the index (from 0-58.6) indicates that there are highly suitable habitats within the Study Area for bats.

Table 6. 8 BCI and NBDC data at Hectad R65.

Survey Type	Location	Species Recorded	Survey	Conservation Status
-	R610580	Brown Long-eared Bat (*Plecotus auratus*)	EIS and Road Surveys/ NBDC Database	Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts
-	R601577	Lesser Noctule (*Nyctalus leisleri*)	EIS surveys/ NBDC Database	Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts
Transect	R643577	Daubenton's Bat (*Myotis daubentonii*)	All Ireland Daubenton's Bat Waterways Survey/ NBDC Database	Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts

-	R679549	Soprano Pipistrelle (*Pipistrellus pygmaeus*)	National Bat Database of Ireland (BATLAS 2010)/ NBDC Database	Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts
-	-	Lesser Horseshoe Bat (*Rhinolophus hipposideros*)	NBDC Database	Protected Species: EU Habitats Directive >> Annex II >> Annex IV || Protected Species: Wildlife Acts
-	-	Common Pipistrelle *(Pipistrellus pipistrellus sensu lato)*	NBDC Database	Protected Species: EU Habitats Directive >> Annex IV || Protected Species: Wildlife Acts

6.3.3.7 Water Framework Directive Surveillance Monitoring Fish Stock Survey

During the most recent Water Framework Directive surveillance monitoring fish stock surveys (2021) conducted in transitional waters (downstream of the proposed developed area) by staff from Inland Fisheries Ireland (IFI), species recorded included:

- Dab (Limanda limanda),
- Common goby (Pomatoschistus microps),
- Flounder (Platichthys flesus),
- Eel (Anguilla anguilla),
- Plaice (Pleuronectes platessa),
- Smelt (Osmerus eperlanus),
- Sprat (Sprattus sprattus), and
- Three-spined stickleback *(Gasterosteus aculeatus*)

The fish ecological status, classified for transitional waters using the 'EMFI' method (Harrison and Kelly, 2013) ranged between poor and good across the two sites within the Shannon Estuary (Lower Shannon SH_060_0300 and Limerick Dock SH_060_0900).

6.3.4 EPA Water Quality Data

The proposed Greenway is situated on the banks of the Lower River Shannon_060 watercourse. The Mulkear (Limerick)_050 is located to the northeast of the study area, and the Blackwater (Clare)_020 situated in the north of the Study Area. The Study Area sits within the Lower Shannon (25D) Catchment which covers an area of 1,041 km² and includes the lower reaches of the River Shannon to Limerick City and the catchment of the Mulkear River. Both the Mulkear (Limerick)_050 River and Blackwater (Clare)_020 drain into the Lower River Shannon_060. The Lower River Shannon_060 drains into the transitional waterbody Limerick Dock. Limerick Dock drains into the Upper Shannon Estuary.

The Environmental Protection Agency (EPA) Maps were consulted regarding the water quality status of the watercourses within the Study Area. The Biotic Index of Water Quality (BIWQ) was developed in Ireland by the EPA. Q values are assigned using a combination of habitat characteristics and structure of the macro-invertebrate community within the waterbody. Individual macro-invertebrate families are classified according to their sensitivity to organic pollution and the Q-value is assessed based primarily on their relative

abundance within a sample. Sampling stations are present within each of the nearby Rivers (Lower Shannon, Mulkear, and Blackwater (Clare). The results from these sampling stations are shown in **Table 6. 9** below:

Table 6. 9 Water Quality Sampling Stations within the Study Area.

Station Code	Station Location	Up or Downstream of proposed works site	Date of last Q Value	Q-Value Rating
RS25M040600	MULKEAR (LIMERICK) - 1km d/s Annacotty Br (LHS)	Upstream	1987	4-5 (High - unpolluted)
RS25M040590	Annacotty Br d/s weir	Upstream	2021	4 (Good - unpolluted)
RS25B060300	BLACKWATER (CLARE) - Gilloge Bridge	Upstream	1988	4 (Good – unpolluted)
RS25S012600	Athlunkard Br (d/s LHS)	Downstream		3-4 (Moderate – Slightly polluted)
RS25G050300	GROODY - Groody Br (G1)	Upstream		3 (Poor – Moderately polluted)
RS25M040500	MULKEAR (LIMERICK) - Ford d/s Killeengarriff R	Upstream		4-5 (High - unpolluted)

River Basin Management Plans (RBMPs) have been published for all River Basin Districts in Ireland in accordance with the requirements of the Water Framework Directive (WFD) and have been superseded by the National River Basin Management Plan 2018-2021 and draft River Basin Management Plan for Ireland 2022-2027. The online EPA Maps viewer provides access to water quality information at individual waterbody level and at Water Management Unit level for all the River Basin Districts in Ireland. Waterbodies can relate to surface waters (these include rivers, lakes, estuaries [transitional waters] and coastal waters) or to groundwater.

The ecological status of the waterbodies within the Study Area includes good ecological status for the Mulkear (Limerick) River_050, and moderate ecological status for Blackwater (Clare)_020 and The Lower River Shannon_060 waterbodies. With regards to each river body's ability to meet the WFD objectives by 2027, the Mulkear (Limerick) River_050 is "Not at risk", the Lower River Shannon_060 is "Under Review" and the Blackwater (Clare)_020 is "At Risk". Limerick Dock and the Upper Shannon Estuary are both classed as having "Poor" WFD status and are "At Risk".

The study area runs along the boundary of two groundwater bodies. Limerick City East which begins below the southern banks of the Lower Shannon river and Limerick City North which begins on the Northern banks of the same river. Limerick City North has a "Good" WFD status and is "Not at risk". Limerick City East has a "Good" WFD status but is currently "At Risk".

6.3.5 Birds

6.3.5.1. *Bird Atlases*

The principal published sources of information regarding the distribution of breeding birds in Ireland are 'Bird Atlas 2007-11: The breeding and wintering birds of Britain and Ireland' (Balmer *et al.*, 2013). This is the most recent comprehensive work on wintering and breeding birds in Ireland. The First Atlas of Breeding

Birds in Britain and Ireland: 1968-1972 (Sharrock, 1976), The Second Atlas of Breeding Birds in Britain and Ireland: 1988-1991 (Gibbons *et al.,* 1993) and The First Atlas of Wintering Birds in Britain and Ireland: 1981/82-1983/84 (Lack, 1986) were also consulted.

The atlas' provides data for breeding and wintering birds respectively in individual 10km grid squares (also known as hectads). The Study Area lies within hectad R65. **Table 6. 10, Table 6. 11 and Table 6. 12** present a list of species found in hectad R65, which are recorded in each of the breeding and wintering bird atlases consulted and are also protected under the EU Birds Directive or listed on the Birds of Conservation Concern in Ireland (2013) (BoCCI) red list (Colhoun & Cummins, 2013). Birds listed under Annex I are offered special protection by the EU Birds Directive. Those listed on the BoCCI red list meet one or more of the following criteria:

- IUCN: Global conservation status (Critically Endangered (CE), Endangered I or Vulnerable (V), but not Near Threatened. These species are recognised as the highest priorities for action at a global scale and are thus priorities at an all-Ireland level;
- European conservation status. The conservation status of all European species was assessed most recently by Birdlife International (2004), one of the main changes in the revision being to include the IUCN criteria. These species are those of global conservation concern (including those classified as Near Threatened) and are Red-listed;
- The Irish breeding population has undergone significant historical decline since 1800;
- The Irish breeding population or range has declined by 50% or more in the thirteen years from 1998-2011 (BDp1) or the 25 years from 1980-2013 (BDp2);
- The Irish non-breeding population has undergone a significant decline of 50% in the last 25 years; and
- The Irish breeding range has undergone a decline of 70% or more in the last 25 years.

For the purposes of this desk study Meadow Pipit (*Anthus pratensis*) and Grey Wagtail (*Motacilla cinerea*) have not formed part of this assessment because both of these species (especially the former) are widespread and frequently encountered. They have recently (Colhoun and Cummins, 2013) been moved from the BoCCI green list (low conservation concern) to the red list (high conservation concern). These two species were placed on the red list because their breeding populations declined by 50% or more over the 13-year period from 1998-2011 (BDp1). However, recent data from the Countryside Bird Survey (CBS) indicate that both of these species have been in recovery since 2011 (Crowe *et al.,* 2014). It should be noted that the absence of a record does not necessarily imply that the species was absent from that square.

Table 6. 10 Breeding Bird Atlas Data (1968-1972 & 1988-1991) (Hectad R65)

Name	Conservation Status	Name	Conservation Status
Barn Owl (*Tyto alba*)	Wildlife Acts, Birds of Conservation Concern Red List	**European Golden Plover (*Pluvialis apricaria*)**	Wildlife Acts, EU Birds Directive Annex I, Annex II, Section II, Annex III, Section III, Birds of Conservation Concern Red List
Barn Swallow (*Hirundo rustica*)	Wildlife Acts, Birds of Conservation Concern Amber List	**Great Black-backed Gull (*Larus marinus*)**	Wildlife Acts, Birds of Conservation Conce–n - Amber List
Black headed gull (*Larus ridibundus*)	Wildlife Acts, Birds of Conservation Concern Red List	**Great Cormorant *(Phalacrocorax carbo)***	Wildlife Acts, Birds of Conservation Conce–n - Amber List

Name	Conservation Status	Name	Conservation Status
Common coot (*Fulica atra*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section II, Birds of Conservation Concern Amber List	**House Martin (*Delichon urbicum*)**	Wildlife Acts, Birds of Conservation Concern Amber List
Common Grasshopper Warbler (*Locustella naevia*)	Wildlife Acts, Birds of Conservation Concern Amber List	**House Sparrow (*Passer domesticus*)**	Wildlife Acts, Birds of Conservation Concern Amber List
Common Kestrel (*Falco tinnunculus*)	Wildlife Acts, Birds of Conservation Concern Amber List	**Little Grebe (*Tachybaptus ruficollis*)**	Wildlife Acts, Birds of Conservation Concern Amber List
Common Kingfisher (*Alcedo atthis*)	Wildlife Acts, EU Birds Directive, Annex I, Birds of Conservation Concern, Amber List	**Mallard (*Anas platyrhynchos*)**	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section I
Common Linnet (*Carduelis cannabina*)	Wildlife Acts, Birds of Conservation Concern Amber List	**Mew Gull (*Larus canus*)**	Wildlife Acts, Birds of Conservation Concern Amber List
Common Pheasant (*Phasianus colchicus*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section I	**Mute Swan (*Cygnus olor*)**	Wildlife Acts, Birds of Conservation Concern Amber List
Common Pochard (*Aythya farina*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section II, Birds of Conservation Concern, Amber List	**Northern Lapwing (*Vanellus vanellus*)**	Wildlife Acts, EU Birds Directive, Annex II, Section II, Birds of Conservation Concern, Red List
Common Sandpiper (*Actitis hypoleucos*)	Wildlife Acts, Birds of Conservation Concern Amber List	**Northern Wheatear (*Oenant6-37rquata6-37the*)**	Wildlife Acts, Birds of Conservation Concern Amber List
Common Snipe (*Gallinago gallinago*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section III, Birds of Conservation Concern Amber List	**Rock Pigeon (*Columba livia*)**	Wildlife Acts, EU Birds Directive, Annex II, Section I
Common Starling (*Sturnus vulgaris*)	Wildlife Acts, Birds of Conservation Concern Amber List	**Sand Martin (*Riparia riparia*)**	Wildlife Acts, Birds of Conservation Concern Amber List
Common swift (*Apus apus*)	Wildlife Acts, Birds of Conservation Concern Amber List	**Sky Lark (*Alauda arvensis*)**	Wildlife Acts, Birds of Conservation Concern Amber List
Common wood pigeon	Wildlife Acts, EU Birds Directive, Annex II,	**Spotted Flycatcher (*Muscicapa striata*)**	Wildlife Acts, Birds of Conservation Concern Amber List

Name	Conservation Status	Name	Conservation Status
(*Columba palumbus*)	Section I, Annex III, Section I		
Corn Crake (*Crex crex*)	Wildlife Acts, EU Birds Directive, Annex I, Birds of Conservation Concern Red List	**Stock Pigeon** (*Columba oenas*)	Wildlife Acts, Birds of Conservation Concern Amber List
Eurasian Curlew (*Numenius Arquata*)	Wildlife, EU Birds Directive, Annex II, Section II, Birds of Conservation Concern Red List	**Turfted duck** (*Aythya fuligula*)	Wildlife Acts, EU Birds Directive, Annex II, Section I Bird Species, Annex III, Section II Bird Species, Birds of Conservation Concern Amber List
Eurasian teal (*Anas crecca*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section II, Birds of Conservation Concern Amber List	**Whooper swan** (*Cygnus cygnus*)	Wildlife Acts, EU Birds Directive, Annex I Bird Species, Birds of Conservation Concern Amber List
Eurasian Woodcock (*Scolopax rusticola*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section III, Threatened Species: Birds of Conservation Concern Amber List	**Yellowhammer** (*Emberiza citronella*)	Wildlife Acts, Birds of Conservation Concern Red List

Table 6. 11 Wintering Bird Atlas Data (1981/82-1983/84) (Hectad R65)

Name	Conservation Status	Name	Conservation Status
Barn Owl (*Tyto alba*)	Wildlife Acts, Birds of Conservation Conce–n - Red List	**Eurasian Teal** (*Anas crecca*)	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section II, Birds of Conservation Conce–n - Amber List
Black-headed Gull (*Larus ridibundus*)	Wildlife Acts, Birds of Conservation Conce–n - Red List	**Eurasian Woodcock** (*Scolopax rusticola*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section III, Birds of Conservation Conce–n - Amber List
Common Coot (*Fulica atra*)	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section II, Birds of Conservation Conce–n - Amber List	**European Golden Plover** (*Pluvialis apricaria*)	Wildlife Acts, EU Birds Directive, Annex I Bird Species, Annex II, Section II, Annex III, Section III, Birds of Conservation Conce–n - Red List
Common Kestrel (*Falco tinnunculus*)	Wildlife Acts, Birds of Conservation Conce–n - Amber List	**Great Black-backed Gull** (*Larus marinus*)	Wildlife Acts, Birds of Conservation Conce–n - Amber List
Common Linnet (*Carduelis cannabina*)	Wildlife Acts, Birds of Conservation Conce–n - Amber List	**House Sparrow** (*Passer domesticus*)	Wildlife Acts, Birds of Conservation Conce–n - Amber List
Common Pheasant	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section I	**Little Grebe** (*Tachybaptus ruficollis*)	Wildlife Acts, Birds of Conservation Conce–n - Amber List

Name	Conservation Status	Name	Conservation Status
(*Phasianus colchicus*)			
Common Pochard (*Aythya ferina*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section II, Birds of Conservation Conce–n - Amber List	**Mallard** (*Anas platyrhynchos*)	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section I
Common Sandpiper (*Actitis hypoleucos*)	Wildlife Acts, Birds of Conservation Conce–n - Amber List	**Mute Swan** (*Cygnus olor)*	Wildlife Acts, Birds of Conservation Conce–n - Amber List
Common Snipe (*Gallinago gallinago*)	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section III, Birds of Conservation Conce–n - Amber List	**Northern Lapwing** (*Vanellus vanellus*)	Wildlife Acts, EU Birds Directive Annex II, Section II, Birds of Conservation Conce–n - Red List
Common Starling (*Sturnus vulgaris*)	Wildlife Acts, Birds of Conservation Conce–n - Amber List	**Tufted Duck** (*Aythya fuligula*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section II, Birds of Conservation Conce–n - Amber List
Common Wood Pigeon (*Columba palumbus*)	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section I Bird Species	**Whooper Swan** (*Cygnus cygnus*)	Wildlife Acts, EU Birds Directive, Annex I, Birds of Conservation Conce–n - Amber List
Eurasian Curlew (*Numenius arquata*)	Wildlife Acts, EU Birds Directive Annex II, Section II, Birds of Conservation Conce–n - Red List		

Table 6. 12 Bird Atlas Data (2007 – 2011) (Hectad R65)

Name	Conservation Status	Name	Conservation Status
Barn Owl (*Tyto alba*) **Breeding & Wintering**	Wildlife Acts, Birds of Conservation Concern - Red List	**Great Cormorant** *(Phalacrocorax carbo)* **Wintering**	Wildlife Acts, Birds of Conservation Concern - Amber List
Barn Swallow (*Hirundo rustica*) **Breeding**	Wildlife Acts, Birds of Conservation Concern Amber List	**Greylag Goose** (*Anser anser*) **Breeding & Wintering**	Invasive Species: Regulation S.I. 477 (Ireland), Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section II, Birds of Conservation Concern - Amber List
Black-headed Gull (*Larus ridibundus*) **Wintering**	Wildlife Acts, Birds of Conservation Concern - Red List	**House Martin** (*Delichon urbicum*) **Breeding**	Wildlife Acts, Birds of Conservation Concern Amber List
Common Coot (*Fulica atra*) **Wintering**	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section II, Birds of Conservation Concern - Amber List	**House Sparrow** (*Passer domesticus*) **Breeding & Wintering**	Wildlife Acts, Birds of Conservation Concern - Amber List

Name	Conservation Status	Name	Conservation Status
Common Grasshopper Warbler (*Locustella naevia*) **Breeding**	Wildlife Acts, Birds of Conservation Concern Amber List	**Lesser Black-backed Gull (*Larus fuscus*)** **Wintering**	Wildlife Acts, Birds of Conservation Concern - Amber List
Common Kestrel (*Falco tinnunculus*) **Breeding & Wintering**	Wildlife Acts, Birds of Conservation Concern - Amber List	**Little Egret (*Egretta garzetta*)**	Wildlife Acts, EU Birds Directive, Annex I Bird Species
Common Kingfisher (*Alcedo atthis*) **Breeding & Wintering**	Wildlife Acts, EU Birds Directive, Annex I, Birds of Conservation Concern, Amber List	**Little Grebe (*Tachybaptus ruficollis*)** **Wintering**	Wildlife Acts, Birds of Conservation Concern - Amber List
Common Linnet (*Carduelis cannabina*) **Breeding**	Wildlife Acts, Birds of Conservation Concern Amber List	**Mallard (*Anas platyrhynchos*)** **Breeding & Wintering**	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section I
Common Pheasant (*Phasianus colchicus*) Breeding & Wintering	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section I	**Mew Gull (*Larus canus*)** **Wintering**	Wildlife Acts, Birds of Conservation Concern Amber List
Common Snipe (*Gallinago gallinago*) **Wintering**	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section III, Birds of Conservation Concern - Amber List	**Mute Swan (*Cygnus olor)*** **Breeding & Wintering**	Wildlife Acts, Birds of Conservation Concern - Amber List
Common Starling (*Sturnus vulgaris*) **Breeding & Wintering**	Wildlife Acts, Birds of Conservation Concern - Amber List	**Northern Lapwing (*Vanellus vanellus*)** **Wintering**	Wildlife Acts, EU Birds Directive Annex II, Section II, Birds of Conservation Concern - Red List
Common swift (*Apus apus*) **Breeding**	Wildlife Acts, Birds of Conservation Concern Amber List	**Rock Pigeon (*Columba livia*)** **Breeding**	Wildlife Acts, EU Birds Directive, Annex II, Section I
Common Wood Pigeon (*Columba palumbus*) **Breeding & Wintering**	Wildlife Acts, EU Birds Directive, Annex II, Section I, Annex III, Section I Bird Species	**Sand Martin (*Riparia riparia*)** **Breeding**	Wildlife Acts, Birds of Conservation Concern Amber List
Eurasian Curlew (*Numenius arquata*) **Wintering**	Wildlife Acts, EU Birds Directive Annex II, Section II, Birds of Conservation Concern - Red List	**Spotted Flycatcher (*Muscicapa striata*)** **Breeding**	Wildlife Acts, Birds of Conservation Concern Amber List

Name	Conservation Status	Name	Conservation Status
Eurasian Teal (*Anas crecca)* **Wintering**	Wildlife Acts, EU Birds Directive Annex II, Section I, Annex III, Section II, Birds of Conservation Concern - Amber List		

6.3.6 Consultation

At the start of the design stage in 2021, an informal scoping pack was sent to a range of statutory and non-statutory consultees during the preparation of this EIAR as follows:

- Waterways Ireland
- Office of Public Works
- National Parks & Wildlife Service
- Inland Fisheries Ireland
- An Garda Siochana
- LCCC Heritage
- LCCC Archaeologist
- LCCC Architectural Conservation

No responses with particular reference to biodiversity were received.

In addition to the listed statutory and non-statutory consultees, the following state agencies and utilities were kept informed during the design of the proposed greenway:

- IDA Castletroy
- UL Facilities
- Environmental Protection Agency
- Dept. of Environment
- Dept. of Housing, Local Government and Heritage (Developments Applications Unit)
- An Taisce
- Failte Ireland
- ESB
- Uisce Eireann
- Eirgrid
- Enet
- Gas Networks Ireland

6.4 Field Surveys

6.4.1. Habitats and Flora

Habitat surveys of the Study Area were undertaken during 2020-2024. The habitats identified during these surveys are listed in

Table 6.13 below. Habitat classifications and codes correspond to those described in '*A Guide to Habitats in Ireland*' (Fossitt, 2000). The habitats identified during site visits are shown on a habitat map to illustrate the habitats encountered during the field surveys, see **Figure 6. 4**. A detailed description of the region and its flora is also provided below.

Table 6.13 Habitats recorded within the Study Area

No.	Habitat	Code
1	Earth banks	BL2
2	Buildings & Artificial Surfaces	BL3
3	Exposed sand, gravel or till	ED1
4	Spoil and bare ground	ED2
5	Recolonising bare ground	ED3
6	Depositing/lowland Rivers	FW2
7	Canals	FW3
8	Drainage ditches	FW4
9	Improved Agricultural grassland	GA1
10	Amenity grassland (improved)	GA2
11	Dry meadows and grassy verges	GS2
12	Wet grassland	GS4
13	(Mixed) broadleaved woodland	WD1
14	Scattered trees and parklands	WD5
15	Hedgerows	WL1
16	Tree lines	WL2
17	Riparian woodland	WN5
18	Wet willow-alder-ash woodland	WN6
19	Scrub	WS1

6.4.1.1. Overview

A large proportion of the habitats are within the Lower River Shannon SAC, which is of international conservation importance, with mostly grassland and riparian broadleaved woodland habitats outside of this designated site. The River Shannon forms the northern boundary of the study area and greatly influences the adjacent low-lying habitats. The Mulkear River confluence with the River Shannon carries a considerable silt load during floods. This sediment is deposited at and downstream the Mulkear/Shannon confluence due to the reduction in water velocity of the Mulkear when it enters the much larger and regulated Shannon channel.

Annex I habitat Residual alluvial forest with *Alnus glutinosa* and *Fraxinus excelsior* (91E0) is found within the Zone of Influence of the proposed works. This habitat can be found on flood plains in a range of situations from islands in river channels to low-lying wetlands alongside the channels. The habitat typically occurs on moderately base-rich, eutrophic soils subject to periodic inundation There are downstream Supratidal Annex 1 habitats which contain a diverse macro-invertebrate community, e.g. *Macoma-Scrobicularia-Nereis*, which provides a rich food resource for the wintering birds. Salt marsh vegetation frequently fringes the mudflats and this provides important high tide roost area for the wintering birds.

Overall, there will be a small impact on this area of the Annex I habitat, given that the proposed works will result in individual tree felling of 5 trees within this habitat that were assessed by a specialist arborist as having a low value, and 7 trees adjacent to the habitat.

The dominant habitats within and adjacent to the proposed Greenway is buildings and artificial surfaces (BL3), depositing/lowland rivers (FW2), amenity grassland improved (GA2) and riparian woodland (WN5). Areas of tree lines (WL2), hedgerows (WL1), drainage ditches (FW4), mixed broadleaved woodland (WD1), scrub (WS1), dry meadows and grassy verges (GS2), spoil and bare ground (ED2), wetl grassland (GS4), scattered trees and parklands (WD5), and (GA1) improved agricultural grassland were also identified during the site walkover (.

Earth banks (BL2)

Most of this habitat is found upstream from the Mulkear River confluence with the River Shannon. It runs along the proposed Greenway for approximately 600 meters downstream along the River Shannon. The earth bank acts as a field boundary, constructed most likely to prevent flooding impacts in the developed areas.

Evaluation: Earth banks at the location mentioned above, are considered of local importance (lower value), presenting growth of different grass species but none of significant ecological importance.

Buildings & Artificial Surfaces (BL3)

Parts of the Greenway route are surfaced with tarmac which along with other artificial surfaces correspond to buildings and artificial surfaces habitat. Roads, car parks, pavements, yards, paths and driveways elsewhere in the study area are also categorised as buildings and artificial surfaces habitat.

Evaluation: Buildings and artificial habitat were evaluated as being of local importance (lower value) although they might provide habitats for bats.

Exposed sand, gravel or till (ED1)

The area known as Plassey Beach is an area where sand has been deposited and this is a pedestrian residential area. This anthropogenic impact is likely to support macroinvertebrates and wading birds. Pedestrians and dogs do impact on fauna.

Evaluation: This habitat is of low botanical importance in the Plassey Beach area as it is a manmade sandy beach for residential use. It does provide foraging habitat for some invertebrate and bird species.

Spoil and bare ground (ED2)

Parts of the proposed development corresponding to original unimproved pathways site that are currently used by pedestrians, cyclists and other users of the trail are categorised as areas of bare ground which are subject to ongoing trampling. This habitat is classified as spoil and bare ground (ED2).

Margins of the track comprises clay in parts, and supports a variety of ruderal (weed) species, as well as some hedgerow and grassland species, including knotgrass (*Polygonum aviculare*), redshank (*Polygonum Persicaria*), shepherd's purse (*Capsella bursa-pastoris*), white clover (*Trifolium repens*), greater plantain (*Plantago major*), creeping buttercup and creeping bent-grass.

Evaluation: Spoil, bare and recolonising ground habitat is evaluated as being **of local importance (lower value)** where it occurs outside of the SAC as it is a modified and disturbed habitat of little ecological significance but where it occurs within the SAC designation it is of **International Importance**.

Recolonising bare ground (ED3)

Upstream and along the Mulkear River there is an area where disturbed ground, adjacent to an artificial surface (Johnson & Johnson), has been covered with herbaceous vegetation, reaching over 50% of its total

surface. This area can be important for wildlife and supports a diverse flora with a high proportion of non-native species.

Evaluation: Recolonising ground habitat is evaluated as being of local importance (lower value) although needs to be monitored due to the high possibility of growing non-native species within the proposed works and being located within the SAC.

Depositing/lowland rivers (FW2)

The proposed Greenway runs along the River Shannon, where fine sediments are deposited on the riverbed. The river erodes its banks and meanders across floodplains creating depositing conditions where gradients are low and water flow is slow and sluggish.

Evaluation: The River Shannon provides spawning and nursery habitats for fish species, contributing to the wider River Shannon catchment. Its environmental and ecological condition has an influence on water quality locally therefore they have been assigned as **International Importance**.

Canals (FW3)

There is a canal in the area where the proposed works will take place (i.e. the Plassey Mill Race), that runs downstream from the east end of Kilmurray village, crossing the Living Bridge and diverting inland towards Drumroe Student Village after which it goes back towards the River Shannon.

Evaluation: Some freshwater species might choose this habitat as a refuge for reproduction. Furthermore, they can act as wildlife corridors, connecting diverse habitats and species. Canals can also contain a range of vegetation that create a foraging area for many insects. The canal found within the proximity of the proposed Greenway is considered of **Local Importance (Higher Value).**

Drainage ditches (FW4)

Several drainage ditches have been found running along LCC Waste Water Treatment Plant to UL Boathouse, covering a distance of approximately 450 meters. Ditches help control water flow and can support wetland vegetation. Although at the time water level was quite low and most of the drainage ditches were dry with very little vegetation.

Evaluation: The water level of drainage ditches may vary and so the density of the vegetation that grows in them. However, from an ecological point of view drainage ditches are part of the surface water network and a habitat for wetland flora and amphibians/invertebrate fauna and influence the quality of receiving water body, therefore of **Local Importance (Higher Value).**

Amenity Grassland (improved) (GA2)

This type of grassland is improved, or species-poor, and is managed for purposes other than grass production. It includes amenity, recreational or landscaped grassland. The amenity grassland found along the proposed Greenway is associated with lawns of various buildings and institutions, as well as sports fields.

Evaluation: The observed areas are species-poor, presenting mostly broadleaved herbs, resulting in a local importance (lower value) habitat.

Dry meadows and grassy verges (GS2)

This habitat is best represented by grassy verges on the side of the Greenway and on the margins of the river's embankment. Grassy verges support tall, coarse grasses but can also have smaller broadleaved herbs. Corresponds to the annexed habitat, 'lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) (6510). They provide some space for flowering plants on which insects can feed.

Evaluation: Plants can be scarce in these areas, resulting in a low ecological value. Therefore, it is assigned

as **local importance (lower value)** but it does provide foraging habitat for some fauna. Where it occurs within the SAC designation, it is of **International Importance**.

Wet grassland (GS4)

It occurs on wet or waterlogged mineral or organic soils that are poorly-drain, after the University Bridge and in the confluence area of the River Shannon and Mulkear River. Wet, nutrient-rich areas nearest the river experience the greatest variations in water level, and typically support species-poor but highly productive vegetation, dominated by tall vigorous grasses such as common reed and reed sweet-grass.

Evaluation: It appears in localised area associated with historical flooding, with many wet grassland species. Its ecological value is of **Local Importance (Higher Value).**

Broadleaved woodland (mixed) (WD1)

Several areas of broadleaved woodland habitat can be found within the works area of the proposed Greenway. This habitat includes native and non-native tree species. Diversity in the structure of the woodlands leads to biodiversity.

Evaluation: These broadleaved woodlands provide habitat for birds and mammals (including potential roost or foraging habitat and commuting routes for bats) in addition to providing connectivity in the landscape and habitat linkage, resulting in a habitat of **Local Importance (Higher Value).**

Scattered trees and parklands (WD5)

This habitat of scattered trees but with prominent visual, can be found at the north side of Kilmurry Village. The proportion of non-native trees in this area is usually high and can contain a diverse biodiversity adapted to these patched habitats.

Evaluation: This habitat is of low botanical importance. It does provide foraging habitat for some fauna as well as for vertebrates and arthropods, but is considered of local importance (lower value).

Treeline (WL2)

Treelines can be found in several areas along the proposed Greenway. Typically occurs along field or property boundaries, like the ones found at Troy Studios boundaries. Most treelines are planted and trees are often regularly spaced. They commonly comprise a high proportion of non-native species.

Evaluation: This habitat is considered of **Local Importance (Higher Value)**. Treelines provide habitat for birds and mammals (including potential roost or foraging habitat and commuting routes for bats) in addition to providing connectivity in the landscape and habitat linkage.

Riparian Woodland (WN5)

Riparian woodland habitat can be found along the whole length of the proposed Greenway. These areas are populated by wet woodlands on the River Shannon margins and are usually subject to frequent flooding.

Evaluation: Important features along the river margins within study area providing shade, bank stability, connectivity and allowing foraging for bird and mammal species, assigning this habitat as **Local Importance (Higher Value)**.

Wet willow-alder-ash woodland (WN6)

Includes woodlands of permanently waterlogged sites that are dominated by willows (*Salix spp.*), Alder (*Alnus glutinosa*) or Ash (*Fraxinus excelsior*). A small area of this habitat can be found a few meters upstream from the confluence between River Shannon and Mulkear River.

Evaluation: Waterlogged woods provide important habitats for biodiversity with an abundance of lichens, mosses, sedges, rushes and ferns and large numbers of invertebrates which support amphibians, mammals

and birds. They are of **Local Importance (Higher Value).**

Scrub (WS1)

Developed as a precursor to woodland and trees are included as components of scrub if their growth is stunted as a result of exposure, poor soils or waterlogging. Scrub occurs in small patches in the study area and occasionally along watercourses.

Evaluation: Scrub can provide habitat for birds and refuge for fauna, resulting in **Local Importance (Higher Value)** from an ecological point of view.

Improved agricultural grassland (GA1)

This category is used for intensively managed or highly modified agricultural grassland that has been reseeded and/or regularly fertilized and is now heavily grazed and/or used for silage making. It includes regularly reseeded monoculture grasslands and rye-grass leys that are planted as part of an arable rotation. These differ significantly from areas of permanent grassland. Improved agricultural grassland is typically species-poor. This habitat occurs near the eastern portions of the proposed development.

Evaluation: While the habitat can provide some foraging areas for certain fauna, the observed areas are species-poor resulting in a local importance (lower value) habitat.

Hedgerows (WL1)

This habitat describes linear strips of shrubs, often with occasional trees, that typically form field or property boundaries. Most hedgerows originate from planting, and many occur on raised banks of earth that are derived from the excavation of associated drainage ditches. The dimensions of hedgerows vary considerably, depending largely on management and composition, and are taken here as being mainly less than 5 m high and 4 m wide. This habitat occurs near the eastern portions of the proposed development mostly as field boundaries.

Evaluation: This habitat is considered of **Local Importance (Higher Value**). Hedgerows provide habitat for birds and mammals (including potential foraging habitat and commuting routes for bats) in addition to providing connectivity in the landscape and habitat linkage.

Plate 1 (a): Plassey Beach adjacent to the River Shannon Plate 2 (b): Plassey Beach embankment

Plate 3: Existing walking and cycling surface. Plate 4: Existing bridge over exiting stream

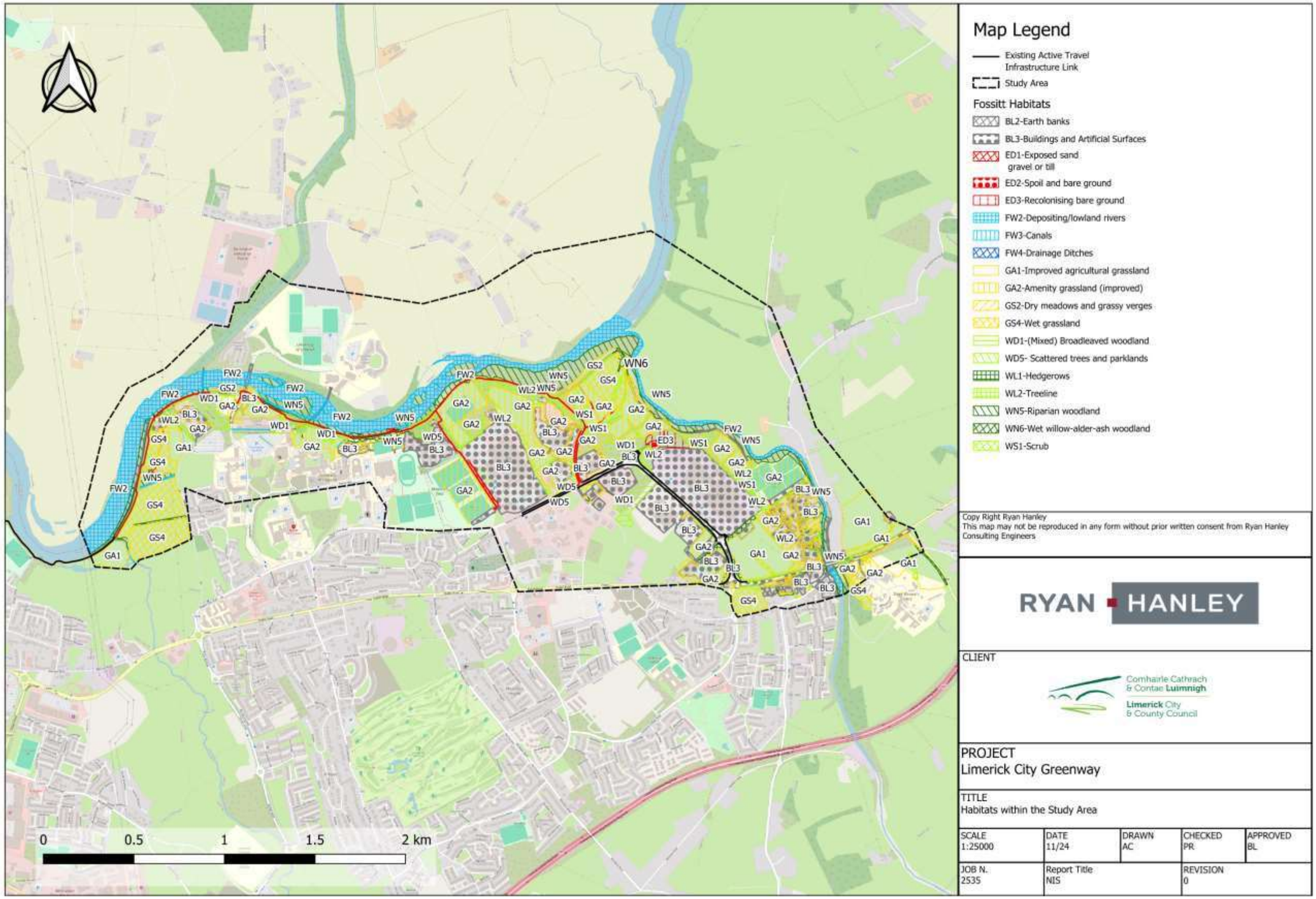

Figure 6. 4 Habitat Classifications within the study area of the Limerick City Greenway (UL to NTP)

6.4.1.2. Botanical Species Present

As outlined in Table 6.1 above, an extensive series of ecological field surveys were undertaken to inform the preparation of this report. Habitat surveys conducted on the 14th of May 2021 and the 28th of April 2022 included a detailed assessment of the entire study area for the presence of rare or protected flora listed on Annex II of the EU Habitats Directive, those protected under the Flora (Protection) Order, 2022, and species of conservation concern listed in the Irish Red Data Book.

No such species were recorded during these or any other ecological surveys carried out.

6.4.1.3. Invasive Alien Plant Species

During field surveys, observations of Invasive Alien Plant Species (IAPS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2011) were recorded. Walkover surveys were conducted on 5th November 2020, 14th May 2021, 28th April 2022, 3rd May 2023 and the 26th of June 2024. A number of invasive alien species (IAS) including Himalayan balsam (*Impatiens glandulifera*) and Giant hogweed (*Heracleum mategzzianum*) were recorded during these walkovers and documented growing within the Study Area of the proposed Greenway project (**Figure 6. 5 & Figure 6. 6**).

Stands of Giant Hogweed and Himalayan Balsam were identified within the study area of the proposed greenway route interspersed with one another within the Study Area. Giant Hogweed was identified at a total of 32 No. locations and Himalayan balsam identified at 37 No. locations during the 2021 survey. Both were reidentified and new stands were recorded during the 2022, 2023, and 2024 surveys (**Figure 6. 8**). Himalayan balsam was primarily concentrated on the banks and shoreline of the Lower River Shannon and Mulkear River. The location numbers do not indicate the number of plants at each location as the numbers of both invasive species were too large to record or estimate. No other species listed in the Third Schedule were identified within the Study Area during any of the field surveys. Additionally, the non-native species Winter Heliotrope (*Petasites fragrans*), Cherry laurel (*Prunus laurocerasus*), Butterfly bush (*Buddleja davidii*), Sycamore (*Acer pseudoplatanus*) and New Zealand flax (*Phormium tenax*) were recorded, however, these species are not listed on the Third Schedule and as such do not require specific measures for their control or disposal, therefore no further assessment for these species are required.

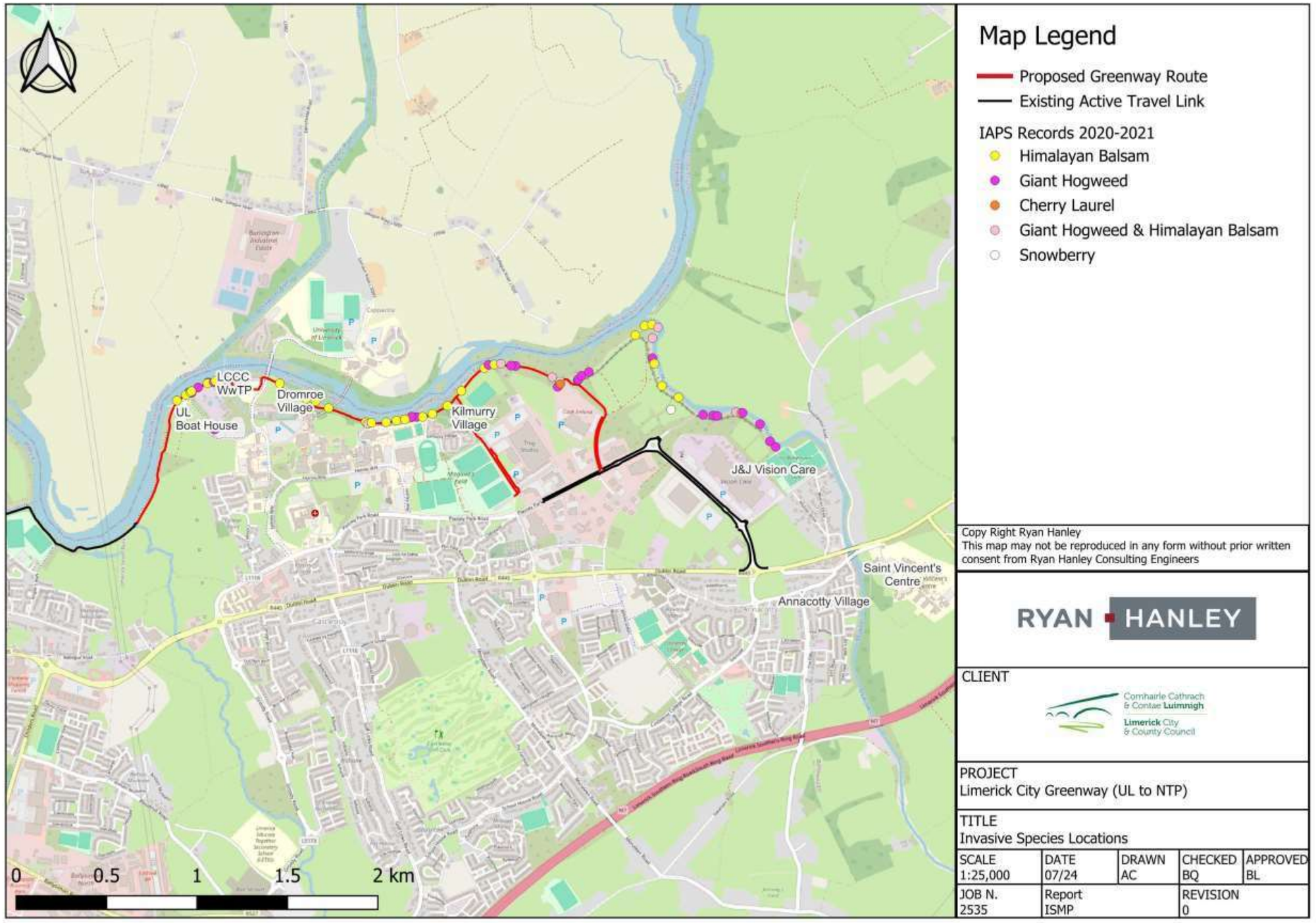

Figure 6. 5 Invasive Species locations during walkover surveys

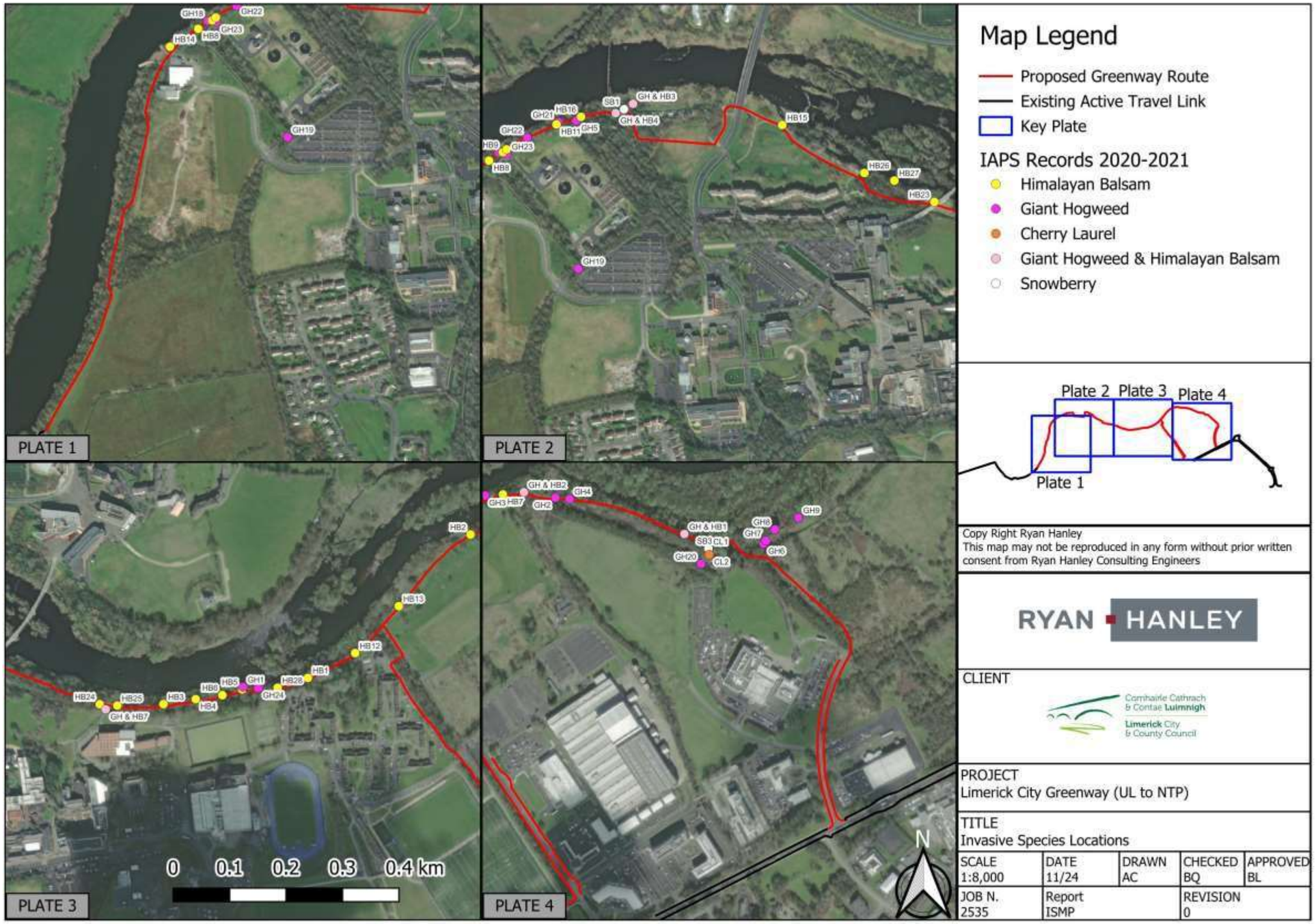

Figure 6. 6 Invasive Species locations during walkover survey, 2020-2021.

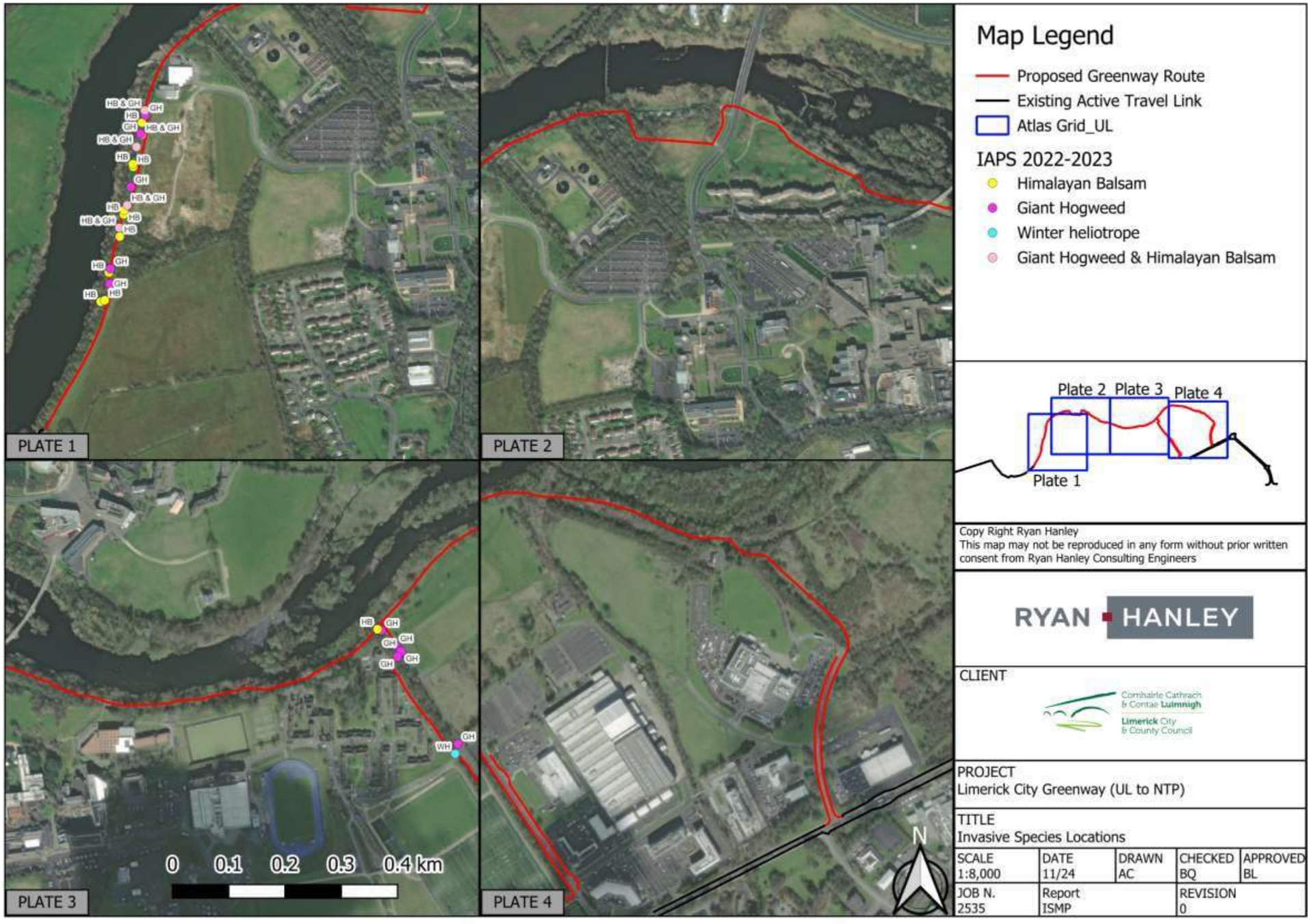

Figure 6. 7Invasive Species locations during walkover survey, 2022-2023.

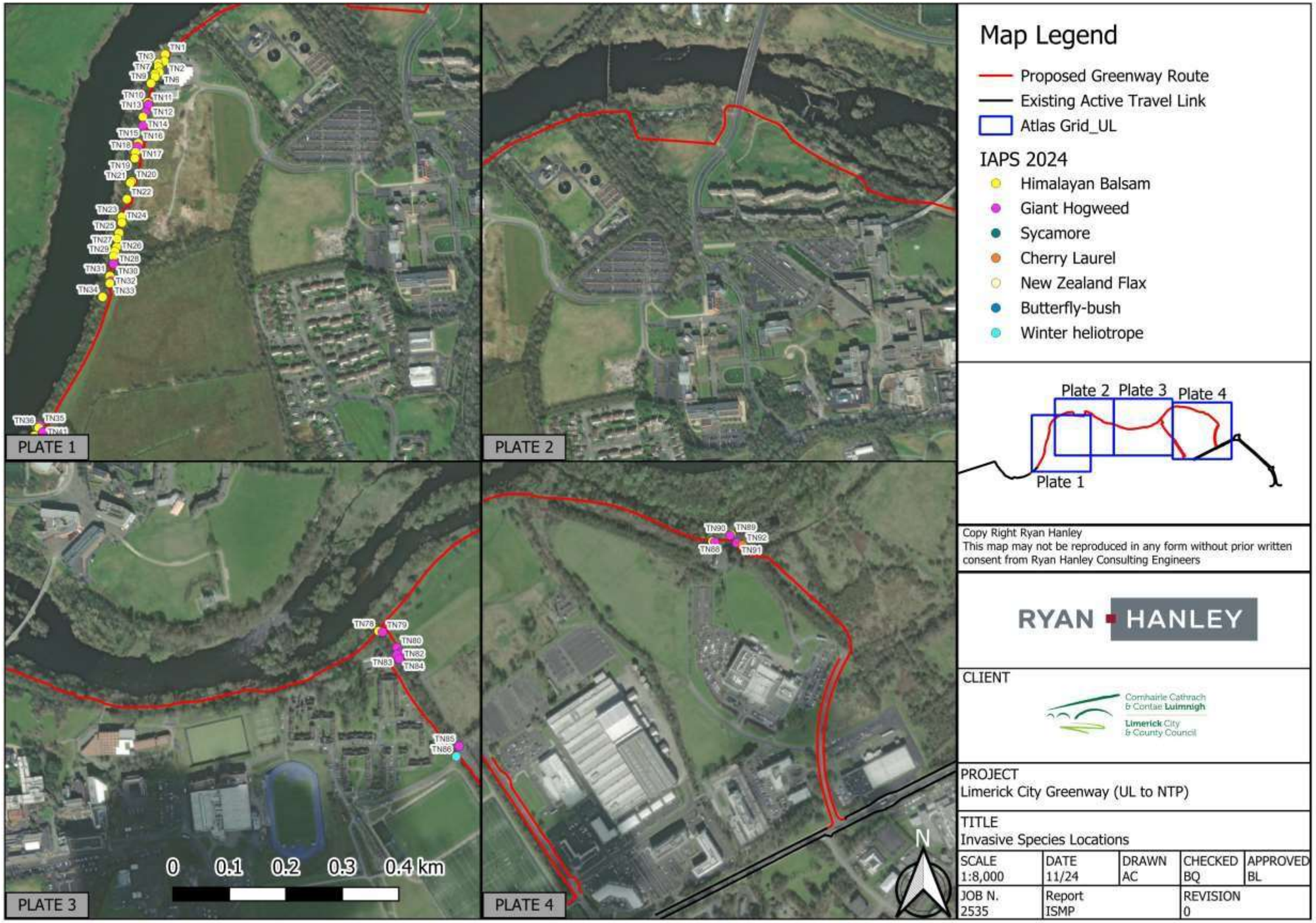

Figure 6. 8 Invasive Species locations during walkover survey, 2024.

6.4.1.4. Significance of Habitats and Flora

Annex I habitat (EU Habitats Directive) Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* is present within the Zone of Influence of the proposed works, within the Islands within the River Shannon and along the banks, specifically from Drumroe Student Village until Thomond College, reappearing from Troy studios up until the merge with the River Mulkear. This habitat is located on both east and west side of the bank although not in a continuous manner. This habitat is considered of **International Importance**.

Habitat type 3260 'Floating River Vegetation' is known to be present throughout most major rivers in the Lower Shannon River SAC and is therefore highly likely to be present in the vicinity of the proposed works[1].

Wet grassland woodlands, hedgerows, treelines and scrub within the study area were assigned **Local Importance (Higher Value)**. These features provide potential habitat for a range of protected fauna including bat species listed on IV of the EU Habitat Directive and those species protected under the Wildlife Acts 1976-2023 and provide semi-natural habitats with high biodiversity in a local context and provide connectivity to the wider area. These habitats in the study area are classified as Key Ecological Receptors.

The Study Area is situated where the River Shannon (Shannon (Lower) _060 river waterbody – IE_SH_25S012600) flows westwards towards Limerick city.

The WFD status of the waterbodies within the Study Area includes good status for the Mulkear (Limerick) River_050, and moderate status for the Lower River Shannon_060 waterbody. With regards to each river body's ability to meet the WFD objectives by 2027, the Mulkear (Limerick) River_050 is "Not at risk", the Lower River Shannon_060 is "Under Review". Limerick Dock and the Upper Shannon Estuary are both classed as having "Poor" WFD status and are "At Risk". The study area runs along the boundary of two groundwater bodies. Limerick City East which begins below the southern banks of the Lower Shannon River and Limerick City North which begins on the Northern banks of the same river. Limerick City North has a "Good" WFD status and is "Not at risk". Limerick City East has a "Good" WFD status but is currently "At Risk".

The River Shannon is classified as a Special Area of Conservation and includes various Annex I & II habitats and species and therefore has been assigned **International Importance**. The rest of the watercourses, canals and drainage ditches within the study area have been assigned **Local Importance (Higher Value)** as they have the potential to provide habitats for fish, amphibians, and other species.

Improved agricultural grassland, Amenity grassland (Improved) and Dry meadows/grassy verges have been assigned Local Importance (Lower Value) on the basis that these habitats are largely fragmented within the study area and are subject to regular anthropogenic disturbance and modification. The remaining habitats recorded included highly managed and built areas that were assigned Local Importance (Lower Value) and are not classified as Key Ecological Receptors.

Floral species of conservation concern were not recorded within the proposed works area. Non-native invasive species are not an ecological receptor that requires assessment of value; however, they are considered throughout this assessment in terms of management as a negative indicator for ecological receptors. Invasive species which are addressed in the Invasive Species Management Plan (ISMP) can spread easily and compete with native species. **Table 6.14** provides a summary of the habitat importance valuation and identifies the habitats classified as Key Ecological Receptors (KERs).

[1] APEM (2023) Limerick City Greenway Aquatic Ecological Appraisal – 2023 Update

Table 6.14 Summary of Habitat Significance

Habitat Name	Habitat Code	Receptor Importance/Ecological Value	Key Ecological Receptor
Earth banks	BL2	Local importance (lower value)	No. This habitat is of limited botanical importance.
Buildings & Artificial Surfaces	BL3	Local importance (lower value)	No. This habitat is of limited botanical importance although building may provide habitat for bats.
Exposed sand, gravel or till	ED1	Local importance (lower value)	No. This habitat is of low botanical importance in the Plassey Beach area as it is a manmade sandy beach for residential use. It does provide foraging habitat for some invertebrate and bird species.
Spoil and bare ground	ED2	International importance (within SAC) Local importance (lower value) outside SAC	No. This habitat is of low botanical importance; however, it does provide foraging habitat for some invertebrate and bird species
Recolonising bare ground	ED3	Local importance (lower value)	No. Recolonising ground habitat is evaluated as being of local importance (lower value) although needs to be monitored due to the high possibility of growing non-native species within the proposed works and being located within the SAC.
Depositing /lowland rivers	FW2	Local importance (higher value)	Yes. The River Shannon provides spawning and nursery habitats for fish species, contributing to the wider River Shannon catchment. Its environmental and ecological condition has an influence on water quality locally.
Canals	FW3	Local importance (higher value)	Yes. Some freshwater species might choose this habitat as a refuge for reproduction. Furthermore, they can act as wildlife corridors, connecting diverse habitats and species. Canals can also contain a range of vegetation that create a foraging area for many insects.
Drainage Ditches	FW4	Local importance (higher value)	Yes. Drainage ditches are part of the surface water network and a habitat for wetland flora and amphibians/invertebrate fauna and influence the quality of receiving water body.
Improved Agricultural Grassland	GA1	Local importance (lower value)	No. This habitat is of low botanical importance. It does provide foraging habitat for some fauna.
Amenity Grassland (improved)	GA2	Local importance (lower value)	No. This habitat is of low botanical importance. It does provide foraging habitat for some fauna.
Dry meadows and grassy verges	GS2	International importance (within SAC) Local importance (lower value) outside the SAC	No. Lower value habitat but important to overall biodiversity, invertebrates and foraging as well as green image within campus.
Wet grassland	GS4	Local importance (higher value)	Yes. Localised area with many wet grassland species in proximity to the River Shannon and River Mulkear associated with historical flooding.

Habitat Name	Habitat Code	Receptor Importance/Ecological Value	Key Ecological Receptor
Broadleaved woodland (mixed)	WD1	Local importance (higher value)	Yes. An area of broadleaved woodland (mixed) which includes some native tree species provide habitat for birds and mammals (including potential roost or foraging habitat and commuting routes for bats) in addition to providing connectivity in the landscape and habitat linkage.
Scattered trees and parklands	WD5	Local importance (lower value)	No. This habitat is of low botanical importance. It does provide foraging habitat for some fauna.
Hedgerows	WL1	Local importance (higher value)	Yes. Hedgerows provide habitat for birds and mammals (including potential roost or foraging habitat and commuting routes for bats) in addition to providing connectivity in the landscape and habitat linkage.
Treeline	WL2	Local importance (higher value)	Yes. Treelines provide habitat for birds and mammals (including potential roost or foraging habitat and commuting routes for bats) in addition to providing connectivity in the landscape and habitat linkage.
Riparian woodland	WN5	Local importance (higher value)	Yes. Important feature along the river margins within study area providing shade, bank stability, connectivity and allowing foraging for bird and mammal species.
Wet willow-alder-ash woodland	WN6	Local importance (higher value)	Yes. Waterlogged woods provide important habitats for biodiversity with an abundance of lichens, mosses, sedges, rushes and ferns and large numbers of invertebrates which support amphibians, mammals and birds.
Scrub	WS1	Local importance (higher value)	Yes. Scrub occurs in small patches in the study area and occasionally along watercourses. Scrub can provide habitat for birds and refuge for fauna.

6.4.2. Fauna

6.4.2.1. *Breeding Birds*

Breeding Bird Surveys took place over 5 no. visits during each of the following time periods; June 2021, April and June 2022 and May and June 2023. Bird Survey methodology undertaken for the Limerick City Greenway (UL to NTP) included line transect surveys, spot-counts, field scanning, river scanning and distribution mapping from varied vantage points affording good views. Three belted transects (T1-T3) were surveyed in 2021/2022, while four transects (T1-T4) with all birds seen or heard recorded (Bibby *et al.*, 2000) and as per line transect methodologies presented in BirdWatch Ireland (2012). Birds were recorded in three distance bands from the observer: <25m, 25-100m and >100m.

Table 6.15 Breeding Bird species recorded during the walkover surveys 2021/2022.

Species name[2]	Scientific name	Species name[1]	Scientific name
Mallard	Anas platyrhyncos	Pied Wagtail	Motacilla alba yarrelli
Mute Swan	Cygnus alor	Sand Martin	Riparia riparia
Cormorant	Phalacrocorax carbo	Swift	Apus apus
Greylag Goose	Anse anser	Swallow	Hirundo rustica
Herring Gull	Larus argentatus	Lesser Black-backed Gull	Larus fuscus
Grey Heron	Ardea cinerea	Mistle Thrush	Turdus viscivorus
Wren	Troglodytes troglodytes	Reed Bunting	Emberiza schoeniclus
Bullfinch	Phyrrula phyrrula	Cuckoo	Cuculus canorus
Robin	Erithacus rubecula	Pheasant	Phasianus colchicus
Song Thrush	Turdus philomelos	Grey Wagtail	Motacilla cinerea
Blackbird	Turdus merula	Collared Dove	Streptopelia decaocto
Blue Tit	Cyanistes caeruleus	Starling	Sturnus vulgaris
Great Tit	Parus major	Kingfisher	Alcedo atthis
Coal Tit	Periparus ater		
Long-tailed Tit	Aegithalos caudatus		
Goldfinch	Carduelis carduelis		
Chaffinch	Fringilla coelebs		
Chiffchaff	Phylloscopus collybita		
Willow Warbler	Phylloscopus trochilus		
Goldcrest	Regulus regulus		
Blackcap	Sylvia atricapilla		
Whitethroat	Sylvia communis		
Jackdaw	Corvus monedula		
Rook	Corvus frugilegus		
Hooded Crow	Corvus corone		
Magpie	Pica pica		
Woodpigeon	Columba palumbus		
Dunnock	Prunella modularis		

The visits were conducted during early and late breeding season, along line transect locations selected as a representative sample of the proposed greenway footprint and surrounding environs.

The surveys confirmed breeding for Mallard and Mute Swan and Greylag Goose, while Swallow and Sand Martin were seen to forage over the main channel of the river. Possible breeding evidence was displayed by Willow Warbler and Goldcrest in the wet woodland / scrub and broadleaved woodland habitats fringing the cycleway.

[2] Conservation status assigned by 'traffic light' system of colour coding, in accordance with the Birds of Conservation Concern in Ireland (Gilbert *et al.*, 2021).

The shaded riparian banks of the River Shannon and Mulkear River in the study area do provide suitable foraging and nesting habitat (vertical earthen banks) for the Annex I species Kingfisher (*Alcedo atthis*) and other protected species including Swift and Grey Wagtail.

The proposed Greenway footprint and environs do not provide a suitable habitat for ground nesting wading and wildfowl species, given the abundance of tree and scrub cover and the baseline levels of anthropogenic activity and associated baseline disturbances to ground nesting bird species.

Table 6. 16 Breeding Bird species recorded during the walkover surveys 2024.

Species name	Scientific name	Species name	Scientific name
Mallard	Anas platyrhyncos	Willow warbler	Phylloscopus trochilus
Mute Swan	Cygnus alor	Swallow	Hirundo rustica
Cormorant	Phalacrocorax carbo	Goldcrest	Regulus regulus
Greylag Goose	Anse anser	House sparrow	Passer domesticus
Sand Martin	Riparia riparia	House martin	Delichon urbicum
Starling	Sturnus vulgaris	Grey Wagtail	Motacilla cinerea
Grey Heron	Ardea cinerea		
Wren	Troglodytes troglodytes		
Bullfinch	Phyrrula phyrrula		
Robin	Erithacus rubecula		
Song Thrush	Turdus philomelos		
Blackbird	Turdus merula		
Blue Tit	Cyanistes caeruleus		
Great Tit	Parus major		
Coal Tit	Periparus ater		
Long-tailed Tit	Aegithalos caudatus		
Goldfinch	Carduelis carduelis		
Chaffinch	Fringilla coelebs		
Chiffchaff	Phylloscopus collybita		
Willow Warbler	Phylloscopus trochilus		
Blackcap	Sylvia atricapilla		
Jackdaw	Corvus monedula		
Rook	Corvus frugilegus		
Hooded Crow	Corvus corone		
Magpie	Pica pica		
Woodpigeon	Columba palumbus		
Dunnock	Prunella modularis		
Pied Wagtail	Motacilla alba yarrelli		
Collared Dove	Streptopelia decaocto		

Amber listed species identified during the 2023 breeding bird survey included the Starling, Willow warbler, Goldcrest, Greylag goose, Mallard, Mute swan, House sparrow, Cormorant, Sand martin and Swallow. Kingfisher was not recorded during the 2023 breeding bird survey but had been recorded during the 2022 breeding bird survey and in the breeding season of 2024.

Grey wagtail, a Red listed species, was recorded during the 2023 breeding bird survey, within transect 1, near the UL pontoon.

Breeding Birds as an ecological receptor have been assigned as **Local Importance (Higher value)** on the basis of the potential for a population within the study area.

6.4.2.2. *Wintering Birds*

Wintering Birds Surveys were carried out over 5 no. visits in November 2021 to March 2022 and 6 no. visits in October 2023 to March 2024. The surveys included line transect surveys, spot-counts, field scanning, river scanning and distribution mapping from varied vantage points affording good views. These were supplemented by walkover surveys of habitats and targeted survey areas.

Table 6. 17 Wintering Bird species recorded during the walkover surveys 2021/2022

Species name[3]	Scientific name	Species name[3]	Scientific name
Mallard	*Anas platyrhyncos*	Mistle Thrush	*Turdus viscivorus*
Mute Swan	*Cygnus alor*	Grey Wagtail	*Motacilla cinerea*
Cormorant	*Phalacrocorax carbo*	Kingfisher (Ann. I)	*Alcedo atthis*
Greylag Goose	*Anse anser*	Moorhen	*Gallinula chloropus*
Grey Heron	*Ardea cinerea*	Coot	*Fullica atra*
Wren	*Troglodytes troglodytes*	Lapwing	*Vanellus vanellus*
Robin	*Erithacus rubecula*	Fieldfare	*Turdus pilaris*
Song Thrush	*Turdus philomelos*	Black-headed Gull	*Chroicocephalus ridibundus*
Blackbird	*Turdus merula*	Kestrel (Ann. I)	*Falco tinnunculus*
Blue Tit	*Cyanistes caeruleus*	Raven	*Corvus corax*
Great Tit	*Parus major*	Stonechat	*Saxicola torquatus*
Coal Tit	*Periparus ater*	Jay	*Garrulus glandarius*
Long-tailed Tit	*Aegithalos caudatus*	Mistle Thrush	*Turdus viscivorus*
Goldfinch	*Carduelis carduelis*	Treecreeper	*Certhia familiaris*
Chaffinch	*Fringilla coelebs*	Collared Dove	*Streptopelia decaocto*
Chiffchaff	*Phylloscopus collybita*	Buzzard	*Buteo buteo*
Willow Warbler	*Phylloscopus trochilus*		
Goldcrest	*Regulus regulus*		
Blackcap	*Sylvia atricapilla*		
Rook	*Corvus frugilegus*		
Hooded Crow	*Corvus corone*		
Magpie	*Pica pica*		
Woodpigeon	*Columba palumbus*		
Dunnock	*Prunella modularis*		
Pied Wagtail	*Motacilla alba yarrelli*		
Redwing	*Turdus iliacus*		

The proposed Greenway footprint and the section of the River Shannon and Mulkear River support a small number and low diversity of over-wintering avifauna.

Kestrel was the only raptor species identified during the wintering bird surveys. Species such as Sparrowhawk, Peregrine and Buzzard may utilise the wider study area for foraging and hunting purposes.

[3] Conservation status assigned by 'traffic light' system of colour coding, in accordance with the Birds of Conservation Concern in Ireland (Gilbert *et al.*, 2021).

The proposed development footprint is not located within suitable Grey Wagtail wintering habitat. Golden Plover and Lapwing were identified along the margins of the Mulkear River, each on one occasion over the wintering period. It is likely that they utilise this area intermittently and opportunistically for foraging and roosting purposes. The proposed route does not interact with the Mulkear River.

Table 6. 18 Wintering Bird species recorded during the Winter Bird Survey 2023/2024

Species name	Scientific name	Species name	Scientific name
Mallard	*Anas platyrhyncos*	Curlew	*Numenius arquata*
Mute Swan	*Cygnus alor*	Grey Wagtail	*Motacilla cinerea*
Cormorant	*Phalacrocorax carbo*	Kingfisher (Ann. I)	*Alcedo atthis*
Herring gull	*Larus argentatus*	Goldcrest	*Regulus regulus*
Black-headed Gull	*Chroicocephalus ridibundus*		
Greylag Goose	*Anse anser*		
Chaffinch	*Fringilla coelebs*		
Blackbird	*Turdus merula*		
Blue Tit	*Cyanistes caeruleus*		
Great Tit	*Parus major*		
Grey Heron	*Ardea cinerea*		
Jackdaw	*Corvus monedula*		
Long-tailed Tit	*Aegithalos caudatus*		
Robin	*Erithacus rubecula*		
Woodpigeon	*Columba palumbus*		
Wren	*Troglodytes troglodytes*		
Little egret (Ann. I)	*Egretta garzetta*		
Rook	*Corvus frugilegus*		
Song Thrush	*Turdus philomelos*		
Treecreeper	*Certhia familiaris*		
Coal Tit	*Periparus ater*		
Pied Wagtail	*Motacilla alba yarrelli*		
Water rail	*Rallus aquaticus*		
Magpie	*Pica pica*		

Mute swan, Cormorant, Greylag geese, Mallard, Black-headed gulls and Grey herons were the most consistent wintering species recorded throughout the winter bird survey season 2023/2024.

Amber listed species identified during the winter bird surveys 2023/2024 included Mute swan, Mallard, Cormorant, Black-headed gull, Herring gull, Greylag goose, Goldcrest and Kingfisher.

Red listed species identified during the winter bird surveys included the Grey wagtail and Curlew. Grey wagtail was recorded in December 2023 and January 2024 within Transect 1, flying and foraging near the River Shannon. Curlew were identified along the River Shannon and its adjoining agricultural lands, on one occasion over the wintering period (January 2024). It is likely that they utilise this area intermittently and opportunistically for foraging and roosting purposes.

One American mink, Third Schedule Invasive Species, was recorded swimming in the River Shannon near the UL pontoon during the winter bird season 2023/2024.

Wintering Birds as an ecological receptor have been assigned as **International importance** considered some are part of the River Shannon and River Fergus Estuaries SPA that might use the wider areas for foraging, and some are listed as Annex I species of the Birds Directive (Directive 2009/147/EC). However, the species encountered within the study area of the proposed greenway, are considered low in numbers and diversity, compared to their usual populations in the SPA.

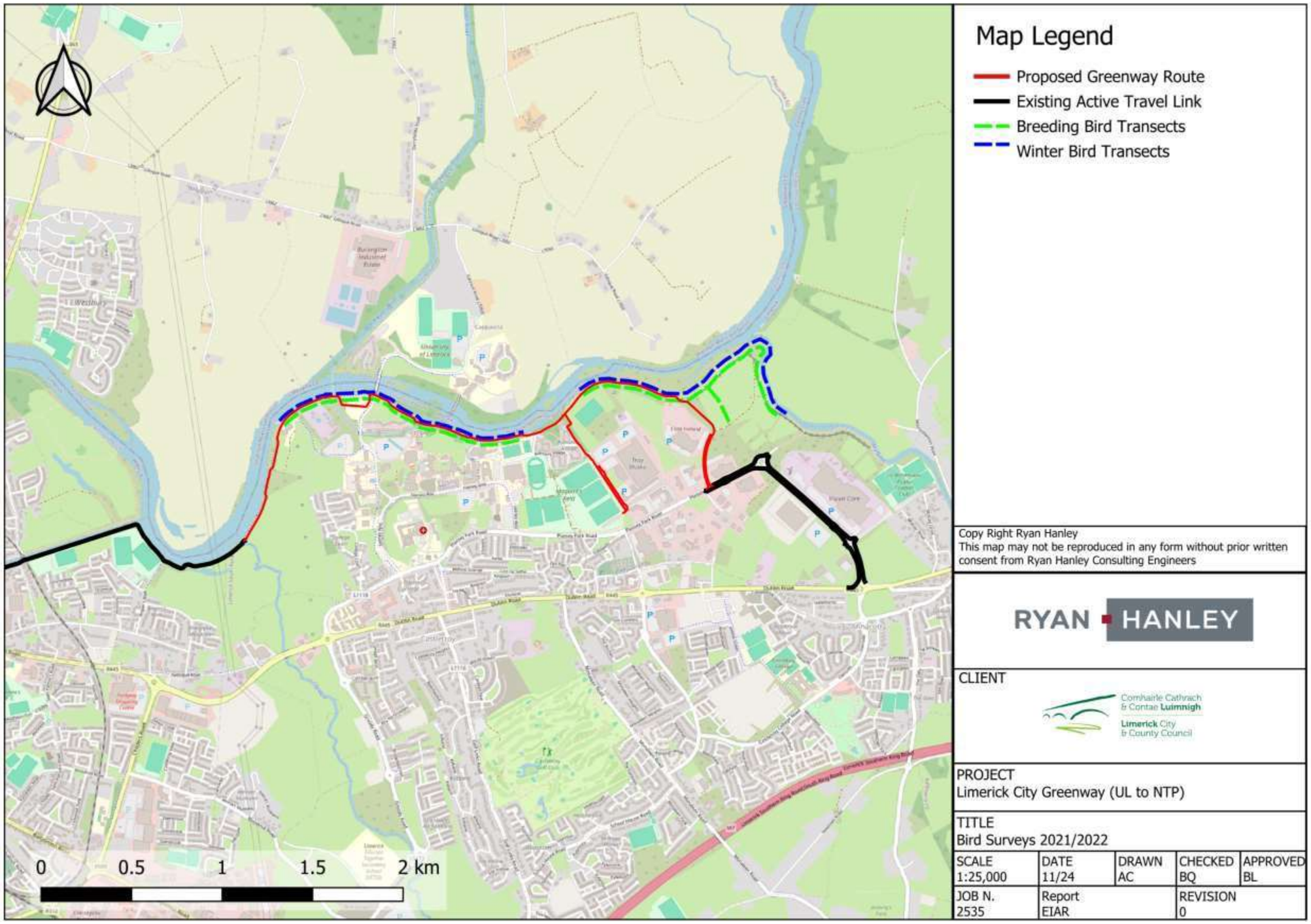

Figure 6.9 Bird survey transects along the Greenway 2021/2022

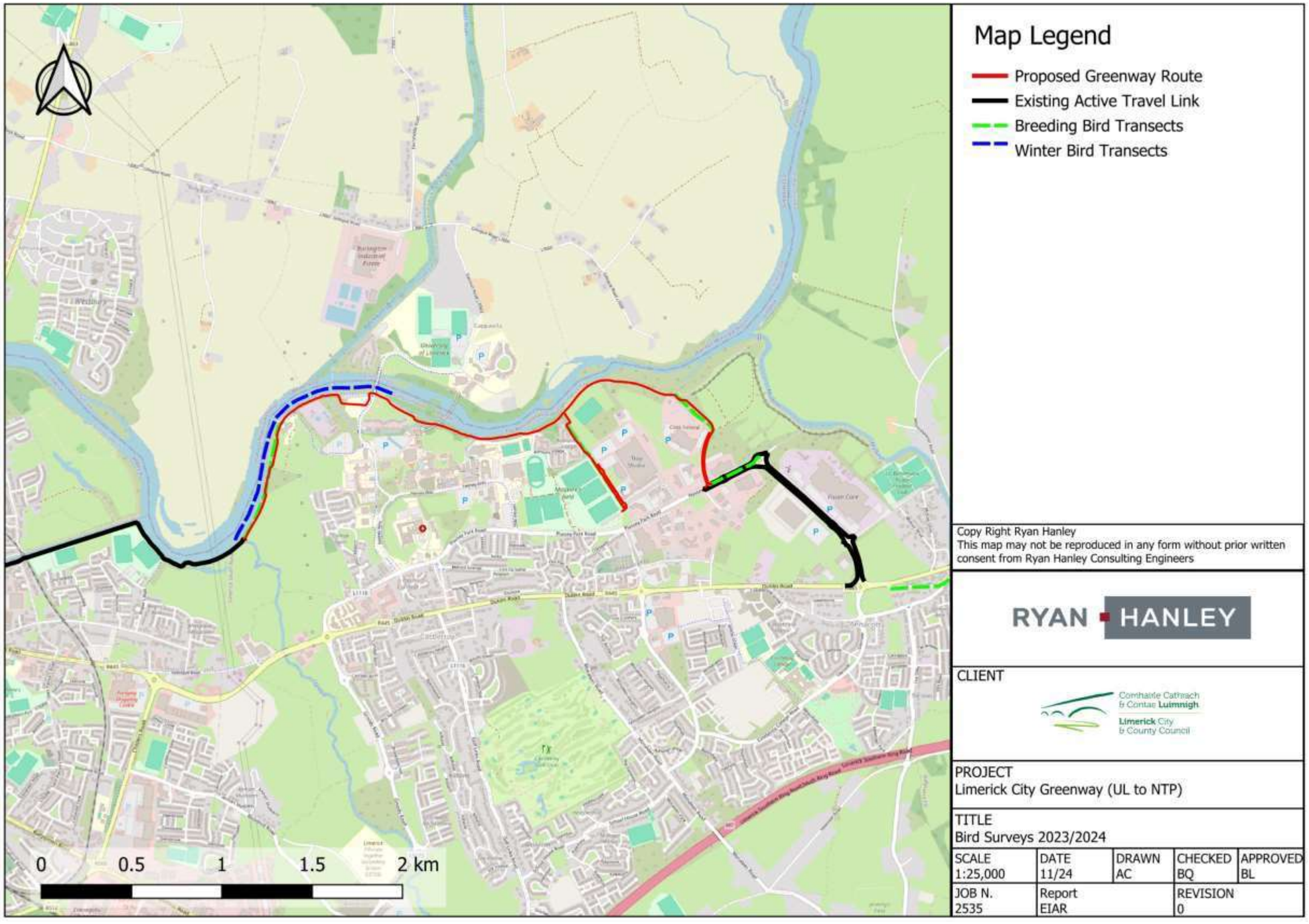

Figure 6.10 Bird survey transects along the Greenway 2023/2024

6.4.2.3. *Mammals*

The Study Area was assessed for signs of mammal activity with particular interest in signs for Badger and Otter. Other species that are likely to occur in the area but were not recorded include Fox (*Vulpes vulpes*), Eurasian Pygmy Shrew (*Sorex minutus*), Red Squirrel (*Sciurus vulgaris*), European Hedgehog (*Erinaceus europaeus*), Rat (*Rattus norvegicus*) and Stoat (*Mustela erminea*). The recorded evidence does not suggest that the study area is utilized by populations of higher than local significance.

Otter

During the walkover surveys undertaken during November 2020, May 2021 and April 2022 the Study Area and watercourses were searched for signs of Otter. The Otter survey was undertaken along the route of the proposed Greenway, following the river Shannon's bank. There were no definitive sights for Otter, such as spraints, tracks, holt or couch sites but potential trails were observed. Some areas of the proposed Greenway were considered suitable for Otter. Otter require suitable bankside vegetation as cover for their holts. An updated Otter Survey was conducted during July 2024, which yielded the same results as previous surveys.

It should be noted that while no Otters or field signs of Otters were recorded along the River Shannon, it should be considered that habitats are suitable for Otter. The Precautionary Principle will be undertaken during construction in consideration for the potential of Otters to forage and/ or inhabit the area especially on the opposite banks to the construction works.

Otter as an ecological receptor have been assigned as **International importance** on the basis of suitable riparian habitats along the study area, and it is protected internationally and nationally.

Badger

Badger is protected under the Wildlife Acts 1976-2012. During the walkover surveys undertaken in 2020, 2021 and 2022 the Study Area was searched for signs of badger. The study area was checked for physical evidence of badgers including setts, latrines, and paths in-line with Best Practice methodologies.

A sett like structure was found along the proposed Greenway, between the Engineering Research Building and Thomond College, however it is more likely that the structure was more recently used as a possible fox hole as there were no fresh signs of badgers in the area.

An updated Badger survey was conducted during June 2024 where no signs of Badger were found.

No other badger setts or similar structures were identified along the Greenway route.

Badger as an ecological receptor has been assigned **Local Importance (Lower value)** on the basis on that the habitats within the study area are unlikely to support a badger population of Local Importance.

Bats

During the walkover surveys undertaken in 2021, the study area was searched in terms of landscape suitability for bat habitat.

Bat surveys were undertaken for this EIAR on the 19th of July 2021, between the 9th – 21st September 2021, on the 10th of January 2024 and on the 19th of June and 10th of July 2024. The surveys included visual roost survey and bat activity survey to determine the areas and habitats within the ZoI of the proposed works which are being used by bats; the diversity and relative abundance of bats present and if bat roosting is occurring or likely to occur in the zone of influence of the proposed works.

The visual roost survey was carried out to identify any bat roosting potential and it included a survey of structures during daytime to inspect Potential Roost Features (PRFs), as well as a survey of trees by ground-level roost assessment.

Bat activity was surveyed by transect survey at dusk and by using passive ultrasonic bat detectors, deployed at two locations along the proposed development. The purpose of the passive detector survey was to supplement information gathered during bat activity surveys.

The site contains some limited semi-natural habitat which mostly consists of riparian vegetation associated with the River Shannon as well as nearby areas of grassland. There are some bat roosting opportunities present in buildings and trees adjoining the proposed development.

A high level of bat activity and species diversity was recorded during the survey period. The study area provides a diversity of habitats and foraging opportunities for bats. Light pollution here is typically low and the area has good landscape connectivity with surrounding habitats.

The overall bat suitability index value (42.56) according to 'Model of Bat Landscapes for Ireland' (Lundy *et at*. 2011) suggests the landscape in which the proposed site is located is of high suitability for bats in general.

Further bat activity surveys were carried out on the 19th of June and the 10th of July 2024. The surveys included nighttime walkover (transect) surveys and passive acoustic surveys to determine the areas and habitats within the ZoI of the proposed works which are being used by bats; the diversity and relative abundance of bats present and if bat roosting is occurring or likely to occur in the zone of influence of the proposed works. Passive detectors were placed in two locations for a total of 7 days (Detector 1: 19th-25th of June 2024 Inclusive. Detector 2: 03rd to the 09th of July 2024). Eight species of bat were detected during these passive surveys: Soprano Pipistrelle; Brown Long-eared Bat; Common Pipistrelle. Leisler's Bat; Daubenton's Bat; Natterer's Bat; Whiskered Bat and Nathusius' Pipistrelle. Soprano Pipistrelles were the most frequently recorded species during both the active transect and passive surveys followed by Common Pipistrelle, Daubenton's Bat and Leisler's Bat.

Bats as an ecological receptor have been assigned as **County Importance** on the basis of the potential for a population within the study area.

6.4.2.4. *Reptiles and Amphibians*

Common frog (*Rana temporaria*), and Smooth newt (*Lissotriton vulgaris*), while not recorded during site surveys, may occur within the study area. It is likely that common frog are present in areas of standing water, damp areas and vegetation in the proposed development area.

Viviparous lizard are known to occupy damp or wet areas with abundant grass tussocks in high densities and can be found on grassland, hedgerows and road embankments (Edgar *et al.,* 2010). The proposed development will not result in a significant loss of suitable habitat for reptiles and amphibians. Therefore, no further survey was deemed necessary.

Reptiles and Amphibians as ecological receptors have been assigned as **Local Importance (Lower value)** on the basis of the potential for a population within the study area.

6.4.2.5. *Invertebrates*

Invertebrates were considered in the initial screening assessment of the site, including a desktop review of rare and protected invertebrates and searches made during the ecological field surveys.

Given its status as the only Irish insect species listed on Annex II of the EU Habitats Directive, particular attention

was paid to the Marsh Fritillary (Euphydryas aurinia) during ecological surveys. Survey efforts focused both on direct detection of the species and on the identification of potentially suitable habitat. The Marsh Fritillary is a weak flyer with a short flight period from May to June, adults therefore generally remain close to their emergence sites. Although the species may utilize a range of habitat types, its distribution is limited by the availability of its sole known larval foodplant in Ireland—Devil's-bit Scabious (Succisa pratensis).

No Marsh Fritillary were identified and no evidence of Marsh Fritillary were recorded during the ecological field surveys. Additionally, Succisa pratensis was not observed in notable abundance across the surveyed areas. A review of National Biodiversity Data Centre (NBDC) records for the grid squares overlapping the proposed development area found no existing records of the species.

An aquatic ecological appraisal was done by APEM in 2021 and 2023. No species on the list were considered to be protected or threatened in Ireland, with the exception of the Freshwater Pearl Mussel (Margaritifera margaritifera), however this species has not been reported or observed within the study area.

Invertebrates as ecological receptors have been assigned as Local Importance (Lower value) on the basis of the potential for a population within the study area.

6.4.2.6. *Macroinvertebrates*

Macroinvertebrate data was obtained from NBDC (NBDC, 2021) and from the National River Macroinvertebrate Surveys Ireland, 2007-2018 (Feeley *et.al*, 2020). Data was available immediately upstream of the proposed Greenway, Shannon (Lower)_050 waterbody (Waterbody ID IE_SH_25S012500), as well as for Mulkear (Limerick)_050 waterbody. An aquatic ecological appraisal (consisting of a desk study and field walkover) was completed by APEM in 2021 and updated in 2023.

Table 6.19 shows data collected from the NBDC database. Although the greenway route no longer follows the Mulkear River, data from this waterbody was included as part of the desktop assessment for completeness.

Table 6.19 Macroinvertebrate species obtained from NBDC/ National River Macroinvertebrate Surveys in Ireland 2007/2018.

Waterbody ID	Distance	Genus/species
Shannon (Lower)_50	~ 7 km	*Margaritifera margaritifera*
		Hellobdella sp.
		Acari sp.
		Corophium sp.
		Gammarus sp.
		Canis sp.
		Serratella ignita
		Heptagenia sp.
		Ecnomus tenellus
		Hydropsyche sp.
		Polycentropus sp.
		Draissena polymorpha
		Valvata (Cincinna piscinalis)
		Bithynia sp.
		Potamopyrgus antipodarum
		Thedoxus sp.
	On site	*Acari sp.*
		Gammarus sp.
		Elmis aenea
		Limnius volckmari
		Dicronota sp.
		Alainites muticus
		Baetis rhodani/atlanticus
		Serratella ignita

		Ecdyonurus sp.
		Heptagenia sp.
		Leuctra sp.
		Perla bipunctata
		Hydropsyche sp.
		Potamopyrgus antipodarum
		Theodoxus sp.

Additionally, species from the family *Chironomidae* were observed in the River Shannon.

The proposed works are temporary and no long-term impacts on these species are anticipated. However, some Macroinvertebrate taxa that are sensitive to reductions in habitat and water quality may be present on site. Avoiding degradation, or further degradation, of these river habitats would therefore preferable considering future impacts on macroinvertebrate communities.

Macroinvertebrates as ecological receptors have been assigned as **Local Importance (Lower value)** on the basis of the potential for a population within the study area.

6.4.2.7. *Fisheries Habitat*

Whilst electric fishing survey data were available for the Shannon River (IFI, 2022), these were from sites located over 100 km upstream from the proposed cycleway location and were therefore not considered relevant to this assessment. However, data was obtained from 2014, 2017, 2021 and 2023 surveys of transitional waters in the Shannon Estuary, Fergus Estuary and Limerick Docks (Kelly et al., 2015; Ryan et al., 2018; Corcoran et al., 2024) in conjunction with records from the NBDC, 2023.

According to the NBDC (2023) sea lamprey (*Petromyzon marinus*) can be found within the ZoI. Lamprey ammocoete habitat was recorded at numerous locations throughout the Aquatic Ecological Appraisal walkover at several locations in the Mill Race. Numerous other species which undertake migratory movements were found, including Brook lamprey (*Lampetra planeri*), Atlantic salmon (*Salmo salar*) and European eel (*Anguilla Anguilla*). The Atlantic salmon and river lamprey are protected under Annex II and V of the EU Habitats Directive, whilst brook lamprey and sea lamprey are protected under Annex II of the same legislation.

The fisheries habitat as an ecological receptor have been assigned as **Local Importance (Higher value)** on the basis of the potential for a population within the study area but not likely to be impacted by the temporary construction works as no works will take place within the main channel or the adjacent streams and rivers.

6.4.2.8. *Significance of Fauna*

Fauna evaluation in this section was assessed in accordance with the receptor importance classification methodology outlined in NRA (2009); "*Guidelines for Assessment of Ecological Impacts of National Roads Schemes*".

Of the faunal species recorded or known to be present in the area, there are three species of **International Importance**:

1. Otter is listed under Annex II and Annex IV of the EU Habitats Directive and is also protected under the Wildlife Act (as amended);
2. Salmon is listed on Annex II of the EU Habitats Directive. Otter and Salmon are two of the qualifying interests (QI) present in the Lower Shannon SAC. However, it is not considered that these species will be significantly affected by the proposed development; and
3. Sea Lamprey *(Petromyzon marinus*) was recorded by the NBDC on site and it is a qualifying interest

of the Lower Shannon SAC and listed as Annex II of the EU Habitats Directive. No instream works are proposed as part of the works so it is not considered that this species will be significantly affected by the proposed development.

A high level of bat activity and species diversity was recorded during the survey period. The study area provides a diversity of habitats including treelines, hedgerows, and many foraging opportunities for bats. Light pollution here is typically low and the area has good landscape connectivity with surrounding habitats.

The suitability of the proposed development site for bats was considered and while the site is likely to be used by foraging and commuting bats the proposed development is unlikely to result in loss or damage to any significant roosting habitat as such bats are classified as **Local Importance (Higher value)**.

The other species recorded such as breeding bird species are classified as **Local Importance (Higher value)** in the context of the proposed development. These species are common and widespread in the local area and are not dependent on the site of the proposed works. Wintering bird species have been considered of **International importance** given the presence of Annex I species, which although were recorded in very low numbers, indicates that these species might use the surrounding areas for foraging.

The low-medium quality of habitats within the study area overall, coupled with the limited records of fauna species protected under the Wildlife Act (as amended) from both the desktop study and field walkovers, would suggest that no additional fauna species populations utilise the study area in higher than local significance. As such other fauna species are not considered key ecological receptors of potential impacts or threats from the proposed development and are not assessed further in this Chapter.

Table 6.20 Summary of fauna significance

Species	Receptor Importance/Ecological Value	Key Ecological Receptor
Breeding birds	Local importance (higher value)	Yes. Some species recorded were Red listed in the BOCCI record. The shaded riparian banks of the River Shannon and Mulkear River in the study area do provide suitable foraging and nesting habitat (vertical earthen banks) for the Annex I species Kingfisher (*Alcedo atthis*) and other protected species including Swift and Grey Wagtail.
Wintering Birds	International importance	Yes. Some species recorded are listed in Annex I of the Birds Directive. Although in low numbers, the presence of these species suggests the area provides suitable foraging habitat.
Otters	International importance	Yes. Suitable riparian habitats along the study area, and it is protected internationally and nationally.
Badger	Low importance (lower value	No. Habitats within the study area are unlikely to support a badger population.
Bats	County importance (higher value)	Yes. A high level of bat activity and species diversity was recorded during the survey period. The study area provides a diversity of habitats and foraging opportunities for bats.
Reptiles and Amphibians	Local importance (lower value)	No. It is unlikely that the study area supports amphibian populations, and these were not recorded during the field surveys.

Invertebrates	Local importance (lower value)	No. No species recorded were considered to be protected or threatened in Ireland, with the exception of the Freshwater Pearl Mussel (*Margaritifera margaritifera*), however this species has not been reported or observed within the study area.
Macroinvertebrates	Local importance (lower value)	No. On the basis of potential for a population within the study area, considering the desk study and survey findings.
Fisheries Habitat	Local importance (higher value)	Yes. Considering potential populations of protected species within the ZoI of the proposed development.

6.4.3. Identification of KERs

The sections above identified receptors and assigns them an ecological importance in accordance with the Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009). It also provides the rationale for this determination and identifies the habitats and species that are considered Key Ecological Receptors.

6.5 ECOLOGICAL IMPACT ASSESSMENT

The following section presents the assessment of likely significant effects on biodiversity within the zone of influence of the proposed works. All elements of the proposed works have been considered in assessing effects on ecological receptors.

6.5.1. Do Nothing/Current Scenario

If the proposed Greenway for which this EIAR has been prepared were not to go ahead, it is likely that there would be no change to the existing situation. The continued use of the lands in their current state would remain. There would be no direct loss or change of habitat.

Without the proposed greenway the transition to greener transport modes would not be supported and the link between the city, the campus and the technology park would not be facilitated. Furthermore, if the proposed development were not to go ahead, it would not be in line with policies and objectives set out in national, regional and local plans related to greener transportation systems, greener infrastructure and climate resilience.

6.5.2. Effects on Designated Areas

Regarding European Sites (SACs & SPAs), an Appropriate Assessment Screening Report (amended), prepared by Ryan Hanley (July 2024), 'screened in' the potential for significant effects on one European Sites: Lower River Shannon SAC (002165). A Natura Impact Statement (NIS) was prepared for the proposed development. The NIS concluded that '*the development of the proposed Limerick City Greenway (UL to NTP) works will not adversely affect the integrity of the European site, either alone or in combination with other plans or projects, and there is no reasonable scientific doubt in relation to this conclusion*'.

6.5.3. Construction Phase Effects

The proposed Greenway route has been specifically designed to avoid, where possible, or otherwise minimize the loss or disturbance of ecologically sensitive habitats identified in the area, such as the River Shannon and the associated riparian corridor. A CEMP is attached in the 'EIAr Part 3_Appendices' of this EIAR. Section 4 of the CEMP details all measures related to environmental management measures to be applied for the construction works detailed in Section 2.3 of the CEMP document. Environmental Management

Plans include construction management plans (prevention of pollution measures, dust control, noise and vibration control, traffic management, water quality and soil, biodiversity, refueling and hazardous materials, cement-based products), invasive species, and waste management. Section 7 of the CEMP groups together all mitigation measures and monitoring proposals currently identified for the proposed development.

6.5.3.1 Loss of Habitat, Fragmentation and Disturbance (Direct Effects)

The proposed development will result in medium-term habitat loss, fragmentation and disturbance to habitats classified as of Local (lower) and Local (higher) importance. Construction activities and site clearance during the construction phase of the greenway can lead to direct loss of amenity lands as well as tree lines (riparian woodland), scrub and hedgerows. Construction works will also require the establishment of 4 No. temporary central base construction compounds for drop-off and storage of materials including fuel, site offices and other staff facilities which will be located within the study area on lands of little conservation value. Although impacts arising from disturbance to habitats will last longer than the construction period, it is likely to be reversible over time (7-15 years for hedges and 15-60 years for any trees) once construction ceases allowing habitats to recover or re-establish within the area of the proposed development, as addressed by the proposed mitigation.

Habitat loss resulting from the construction of the Greenway within areas of riparian habitat are assigned local importance (higher value). There will be both a permanent and temporary loss of habitats as a result of the project and a list, completed with the area to be lost are provided in the tables below, considering a 5m buffer corridor from the works along the proposed Greenway.

Table 6.21 Temporary habitat loss associated to temporary working areas and compounds

Fossitt code	Description	Total area affected (ha)
WS1	Scrub	0.103
ED2	Spoil and bare ground	0
GA2	Amenity grassland (improved)	0.904
WL2	Treeline	0.016
BL3	Buildings and artificial surfaces	0.007
WD1	(Mixed) Broadleaved woodland	0.03
GS4	Wet grassland	0.08

Table 6.22 Habitat loss along the proposed greenway route, considering a 5m buffer

Fossitt code	Description	Total area affected (ha)
BL3	Buildings and artificial surfaces	1.309
GA2	Amenity grassland (improved)	0.749
FW3	Canals	0.02
FW4	Drainage ditches	0.089
WD1	(Mixed) Broadleaved woodland	0.546
WL2	Treeline	1.491
WN5	Riparian woodland	0.641
GS2	Dry meadows and grassy verges	0.03
WD5	Scattered trees and parkland	0.055
GS4	Wet grassland	0.04
WS1	Scrub	0.097
ED2	Spoil and bare ground	0.006
FW2	Depositing/lowland river	0.006

Loss of Amenity Grassland (GA2)

Construction works for the proposed Greenway are predominantly in amenity grassland habitats. The majority of this land will be removed within the boundary of the works corridor in the central, western and eastern sections of the proposed Greenway. The amenity grassland within the footprint of the work is of low ecological value as they are modified from its natural state, subject to high levels of management, have reduced diversity and are widespread within the local area. The Project is assessed as having a **permanent/temporary neutral to slight negative effect** and as such, the loss of these habitats will not represent any significant loss of biodiversity and are not considered to be Key Ecological Receptors.

Loss of Riparian Woodland (WN5)

There are several regions of riparian woodland habitat, some of which are alluvial in nature, particularly to the central and eastern sections of the proposed Greenway. The greenway passes through an area with Annex I habitat Residual alluvial forest with *Alnus glutinosa* and *Fraxinus excelsior* (91E0) of International importance, although only a few individual trees of low value will be removed (5 No.), not affecting the integrity of the habitat or its ecological benefits. The riparian woodland is of high ecological value. The project is assessed as having a **permanent/temporary moderate negative** effect. The riparian woodland is an important feature along the river margins within the study area providing shade, bank stability, connectivity and allowing foraging for bird and mammal species and is considered to be Key Ecological Receptor.

Loss of (Mixed) broadleaved woodland (WD1)

There are small regions of (mixed) broadleaved woodland in the western section of the Greenway which will be lost during construction. The (mixed) broadleaved woodland is of high ecological value. The project is assessed as having a **permanent/temporary moderate negative** effect and is an area which includes some

native tree species provide habitat for birds and mammals (including potential roost or foraging habitat and commuting routes for bats) in addition to providing connectivity in the landscape and habitat linkage. A total of approximately 61 trees will be removed as part of the proposed works

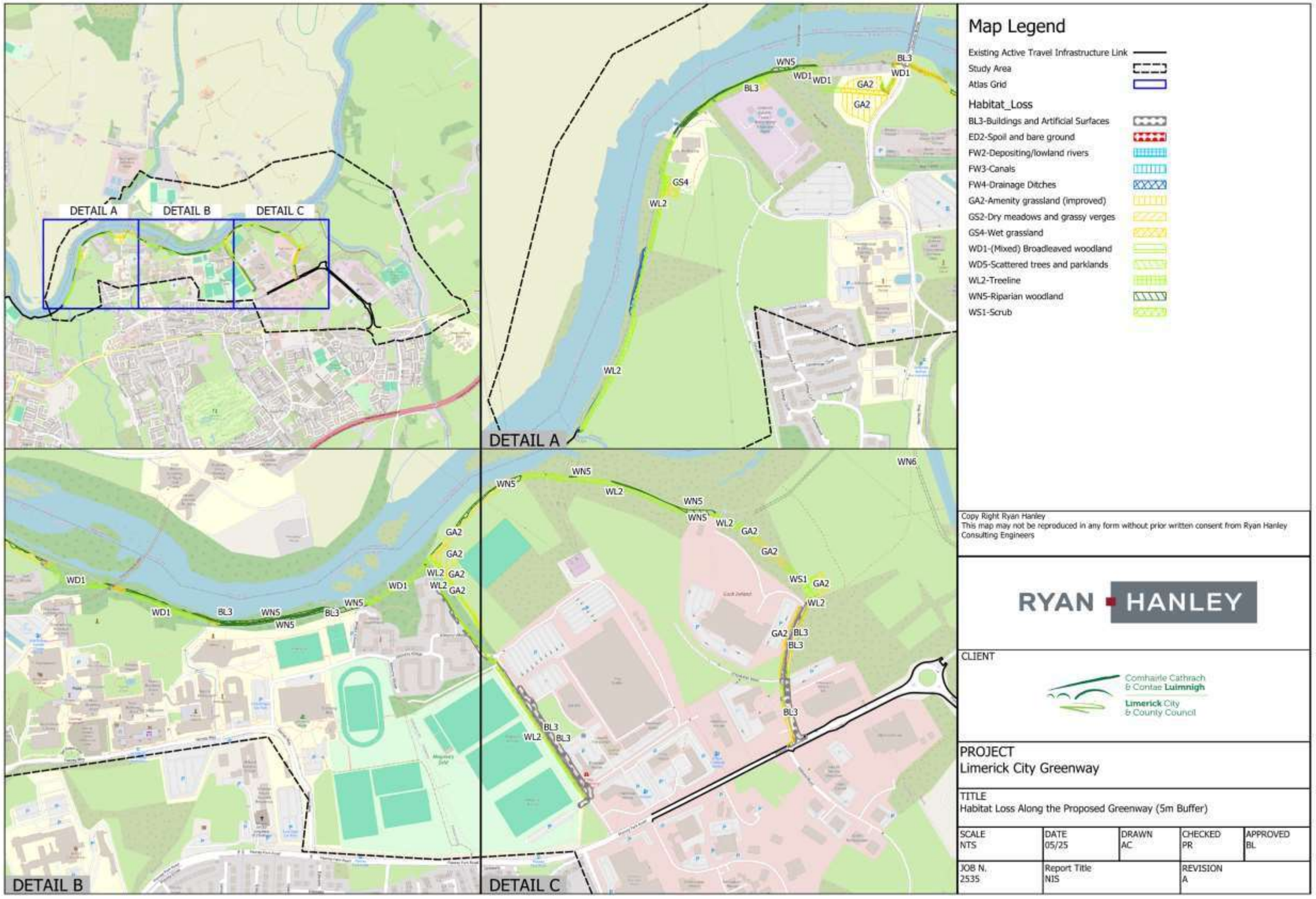

Figure 6.11 Habitat Along the Proposed Greenway Route Within a 5m Buffer

6.5.3.2 *Effects on Watercourses and Aquatic Species*

The mobilisation of contaminants near the bankside or river sediments, in addition to physical impacts of sediment, can release nutrients or industrial waste into the water, with further impacts on local habitat and water quality. The River Shannon provides habitats for a number of Qualifying Interests (QIs) within the Lower River Shannon SAC [002165], including otters *(Lutrinae sp.)*, kingfishers *(Alcedinidae sp.)*, brook lamprey *(Lampetra planeri)*, river lamprey *(Lampetra fluviatilis)*, sea lamprey *(Petromyzon marinus)*, freshwater pearl mussel *(Margaritifera margaritifera)* and Atlantic salmon *(Salmo salar)*. Depending on the timing of the proposed works, different life stages of migratory fish species may be impacted by factors increased sediment ingress into the watercourse or other factors such as noise and disturbance associated with construction works.

Near-banks work (bridge upgrades, culvert replacement, clearance) may disturb nursery and spawning habitats of lamprey species. Construction activities can increase sediment run-off, resulting in an increase in siltation reducing water quality and indirectly affecting aquatic species. This can result in short term moderate effects on lamprey species.

The clearance and installation of the site compounds, use of construction equipment, during demolition, clearance, and construction of the greenway in the vicinity of the watercourse presents a risk of chemical discharges in the form of fuel spills. Many substances used and produced on construction sites have the potential to pollute both groundwater and surface water if not properly managed and treated (i.e. lubricants, cement, mortar, silt, soil, waste from site compound facilities, and other substances which arise during construction). The washing of construction vehicles and equipment also poses a pollution risk to watercourses. The spillage or leaking of fuel or oil from fuel tanks or construction vehicles has the potential to contaminate soils, groundwater and surface water. Such substances entering the receiving surface water and groundwater bodies could damage the habitat of local populations of fish which are qualifying species within the Lower River Shannon SAC. This can lead to temporary slight to moderate negative effects.

The proposed works will not alter flow of any of the smaller streams or the River Shannon, as there will be no instream works.

An analysis of the predicted impacts of the proposed greenway on biodiversity has been completed and include potential effects on local aquatic habitats and species during the construction phase. This will be temporary short term in nature and confined to the construction phase. Upon completion, aquatic habitat, flora and fauna within the affected lengths of the River Shannon channel (c. 3km) should recover and re-colonise from adjacent sources resulting in **a temporary/short-term slight-moderate negative effect.**

No long-term negative impacts on habitats, species and water quality are foreseen.

6.5.3.3 *Disturbance to Fauna*

The proposed clearance, demolition and construction works for the Greenway has the potential to result in medium term loss of resting sites and disturbance to a range of faunal species such as small mammals and birds in the absence of mitigation where hedgerows, trees and scrub are to be trimmed back and unavoidably removed in some areas. There is potential for the Greenway to have some impact on ecological features used by fauna species in the study area permanently, through the removal of suitable habitats to facilitate the Greenway construction, or temporarily during the construction works in such a way that suitable habitats are not available for use by fauna species during the construction period due to disturbance and displacement. Visual and noise disturbance and presence of human beings throughout the construction phase have the potential to cause the greatest disturbance. It is considered that the proposed greenway will have

a potential **permanent/temporary moderate negative effect** related to the disturbance of local fauna. Fauna species that are subject to disturbance as identified in Section 6.4.3 and the effects on these species are considered further below.

6.5.3.4 Effects on Badger

A sett-like structure was found along the proposed greenway however it is more likely that the structure was more recently used as a possible fox hole as there were no fresh signs of badgers in the area. No badger signs were found during the updated survey undertaken in 2024. The proposed development will not result in the loss of any badger setts within the Study Area. There is low potential for temporary loss of foraging habitat during the construction of the proposed greenway.

Construction works during breading season (December to June) could lead to disturbance to badger setts in the area. Potential for disturbance, in the absence of mitigation, is considered a **potential indirect short-term slight/moderate negative effect** on badger populations in the area.

6.5.3.5 Effects on Bats

No bat roosts were confirmed within the proposed development area and no historic roosting was found. However, usage of trees and buildings by individual or small numbers of bats as temporary roosting sites cannot be ruled out. Some structures identified within the zone of influence had 'moderate' and 'low' suitability for roosting bats. No buildings or structures will be directly impacted by the proposed works.

The proposed development will involve other works in close proximity to a number of other trees with some suitability to host roosting bats. In the absence of mitigation, if any treelines and buildings had to be removed as a result of the construction works, there would be potential for bat mortality.

Semi-natural habitats which support insects provide an important food source for bats. Loss or degradation of commuting/foraging habitat has the potential to reduce feeding opportunities and/or displace bat populations but is not likely to be significant given the relatively small amount of habitat loss involved in the context of the overall landscape.

Artificial lighting associated with construction and operation of the proposed greenway has the potential to adversely affect bat populations, particularly in riparian zones along the River Shannon, which can support important commuting and foraging corridors. Excessive or poorly directed lighting can cause light spill which can reduce foraging efficiency.

Construction works of the proposed greenway can lead to ecological issues which do not occur during the operational phase of the development. Some of these issues include disturbance during construction works; disturbance to roosting sites; reduce foraging habitat; impaired ability to commute; and disturbance due to illumination.

The suitability of the proposed development site for bats was considered and while the site is likely to be used by foraging and commuting bats the proposed development is unlikely to result in loss or damage to any significant roosting habitat.

In most areas of the scheme the potential for loss of commuting and foraging habitat will be minor and short-term in nature.

Overall, the proposed greenway will result in a **permanent, 'not significant', negative effect** on bat ecology at a local scale.

6.5.3.6 *Effects on Birds*

All birds and nests are protected under the Wildlife Act 2000 as amended. If vegetation clearance is carried out during the breeding bird season (1st March to 21st August), there is the potential for significant negative impacts to local breeding bird populations. During the breeding season, noise, vibration and movement of construction vehicles associated with the construction phase of the proposed development has the potential to result in a disturbance to local breeding bird populations. This could result in reduced breeding success of birds in habitats adjacent to the construction zone. The construction of the proposed development will require the removal of some areas of scrub, hedgerows and treelines that have potential to provide breeding habitats which could result in disturbance and damage/destruction of nests.

Wintering birds were found in small numbers and diversity. Direct impacts of the proposed works on these species may result from disturbance by human and mechanical work activities, and related noise and vibration. Existing levels if human activity and background disturbance are moderate in the areas of the proposed works, considering the existing greenway route and adjacent university grounds, sports complex and technological park. The potential for the direct effect of disturbance impacts of the proposed construction works on bird distribution may be quantified using the assessment methodology applied in the Conservation Objectives Supporting Document for River Shannon and River Fergus Estuaries SPA (NPWS, 2012 v1).

Figure 6.12 Scoring system for disturbance (NPWS, 2012 v1)

Frequency/ Duration	(A) Timing Score	Intensity	(B) Scope Score	Response	(C) Severity Score	TOTAL SCORE A + B + C
Continuous	3	Active, high-level	3	Most birds disturbed all of the time	3	9
Frequent	2	Medium level	2	Most birds displaced for short periods	2	6
Infrequent	1	Low-level	1	Most species tolerate disturbance	1	3
Rare	0	Very low-level	0	Most birds successfully habituate to the disturbance	0	0

Scores 0 – 3 = Low
Scores 4 – 6 = Moderate
Scores 7 – 9 = High

Based on the consideration above, most wintering bird species within the proposed greenway area will be used to human activities related disturbance and therefore rarely and/or infrequently disturbed, resulting in a 'low' disturbance score overall.

Disturbance from the proposed works on bird species found and recorded within the study area are considered to have a **potential short-term slight-moderate negative effect.**

6.5.3.7 *Effects on Fish Species*

The River Shannon and Mulkear river (within the study area) are known to support good populations of salmonid species as well as providing key migratory corridors. The ecological status of the waterbodies within the Study Area includes good ecological status for the Mulkear (Limerick) River_050, and moderate ecological status for Blackwater (Clare)_020 and The Lower River Shannon_060 waterbodies. With regards to each river body's ability to meet the WFD objectives by 2027, the Mulkear (Limerick) River_050 is "Not at risk", the Lower River Shannon_060 is "Under Review" and the Blackwater (Clare)_020 is "At Risk". Limerick Dock and the Upper Shannon Estuary are both classed as having "Poor" WFD status and are "At Risk". Direct impacts on salmon or other aquatic species are not anticipated. As there will be no instream works there will be no loss of suitable spawning habitats within the study area as a result of construction of the greenway.

The proposed works are temporary, and no long-term impacts on these species are anticipated. However, these species may be present on site, and in-direct impacts on these species, such as deterioration in habitat quality due to sediment ingress and/or pollution incidents, can have effects on their populations. Other potential effects may include localised displacement of fish species resulting from deterioration in water quality as a result of pollution or suspended solids runoff. Significant displacement is not anticipated given the absence of instream works.

Loss of bank riparian cover as a result of construction works could result in increased light incidence and may encourage greater in-stream productivity i.e., increased algal growth and benthic macroinvertebrate density. A decrease in channel shading can also impact negatively on fish distribution. Riparian tree cover plays an important role in regulating stream ecology, e.g., stream temperature, carbon input, and in-stream vegetation cover.

It is considered these species would move back into the area once construction works cease resulting in a **potential short-term slight-moderate negative effect.**

6.5.3.8 Effects on Otter

During the desktop study a search for otter from the NBDC database indicated a presence within the R65 hectad and there is a confirmed sighting of a "live animal" on the campus near the living bridge. During the walkover surveys no otter holts, nor any other physical evidence of otter, was found but potential trails were observed and some areas of the proposed greenway were considered suitable for otter.

Although no active otter holts, couches, or significant foraging or commuting habitats were identified during field surveys or recorded by NPWS (GIS data) for the study area, riparian vegetation still offers potential for occasional passage or resting use, particularly given the species' wide-ranging and opportunistic behaviour. Clearance of bankside or riverside vegetation could result in the temporary disturbance of marginal habitats. Although this is unlikely to significantly otter populations in the Shannon (Lower), where the proposed works will take place.

Due to the suitability of the habitats to support otters, the Precautionary Approach will be taken to minimise the potential impact on otter populations if present in the Study Area and ZoI.

It is considered these species would move back into the area once construction works cease resulting in a **potential short-term slight-moderate negative effect.**

6.5.3.9 Effects on Amphibians and Reptiles

No amphibians or reptiles were observed in the proposed development study area during site surveys though it is possible that these species groups utilise the area. In the absence of mitigation, there could be a negative impact on these species through direct mortality during construction works by machinery in lands adjacent to the proposed development. Removal of vegetation also has the potential to result in direct mortality where these species may be sheltering/hibernating.

It is considered these species would move back into the area once construction works cease resulting in a potential **short-term 'not-significant' negative effect.**

6.5.3.10 Spread of Invasive Species

Two invasive plant species listed on the Third schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477/2011, as amended) were identified within the study area of the proposed development during the walkover surveys, Himalayan balsam (*Impatiens glandulifera*) and Giant hogweed (*Heracleum mantegazzianum*).

Invasive species can be introduced into a location or spread from a location by contaminated vehicles and equipment, in particular tracked vehicles which have been used previously in locations that contain invasive alien plant species. They can also be spread to a location via vector materials such as soil. Therefore, construction works, have the potential to introduce invasive species into areas within the Study Area that were previously free of invasive species. In the absence of mitigation this could result in a **long term reversible moderate-significant negative impact.**

6.5.4. Operational Phase Effects

6.5.4.1 Effects of Maintenance

During the operational phase of the Greenway there will be considerably less site activity within the study area than during the construction phase. The Limerick City and County Council (LCCC) will be required to maintain the Greenway in proper repair and effective condition under a maintenance programme. Maintenance is required to ensure that the any quality facilities provided are maintained during the first year and subsequent years. A maintenance plan would include but no limited to:

- Servicing of waste bins;
- Litter picking and removal of any fly tipped waste;
- Maintaining of vegetation and/or low hanging branches; and
- Repair and maintenance of lighting.

Routine maintenance activities, such as vegetation management and habitat restoration, are expected to improve local biodiversity. The maintenance efforts aim to preserve and enhance the aesthetic value of the greenway, contributing positively to the local landscape and providing recreational opportunities for the community. These maintenance activities can **result in a long-term moderate positive effect** on the local environment.

It is envisaged that the maintenance requirements of the proposed Greenway will be monitored and reviewed on an annual basis by LCCC. It is envisaged that any maintenance works to be carried out will be subject to the relevant environmental and health & safety assessment requirements, including screening for Appropriate Assessment, to consider the environmental sensitivities around the maintenance required, and will be required to be carried out in line with current best practice at the time of maintenance.

6.5.4.2 Effects on Designated Sites

Significant effects are not anticipated during the operational phase of the greenway, as the route is currently being used by cyclists and pedestrians. Increased public usage can lead to informal access to the riverbanks which could disturb sensitive riparian zones and trample of bank vegetation, or cause disturbance to protected species in the area. However, the improvement of the greenway and installation of formalized boundaries and barriers along the route will minimise the indirect effects of increased public usage. Overall, the operational phase of the proposed greenway will result in **a long-term not significant neutral effect** on SAC.

6.5.4.3 Effects on Habitats

On completion of the Greenway, areas from which vegetation was removed will be replanted and landscaped with appropriate vegetation and a replanting programme. Significant effects are not anticipated during the operational phase of the Greenway as there will be no overall loss or fragmentation of habitats associated with the operation of the Greenway. The predicted human activity using the Greenway is anticipated to be medium-high, given that the upgraded route might attract more users and it might be

expected that at time anti-social activities might have **brief to temporary not significant negative effect** on vegetation/habitats.

During the operational phase of the greenway, the planting scheme (305 trees) will promote biodiversity in the area according to a dedicated Landscape Plan prepared for the proposed development (see ElAr Part 3_Appendices) , in line with the Biodiversity Plan and All Ireland Pollinator Plan. This will result in a **long-term/permanent slight to moderate positive effect** on biodiversity in the area.

6.5.4.4 Effects on Birds

Upon completion of the Greenway, operational impacts on bird populations are considered to be minimal. As there will be minimal clearance of vegetation, and consequently potential nesting habitat removed as part of the maintenance works, the effects on birds is assessed as **temporary imperceptible negative**. If these maintenance works require vegetation removal during breeding bird season (1st March to 31st August), although unlikely, they could have the potential for **temporary significant negative impacts** to local breeding bird populations. During breeding season, noise, vibration, increased human presence and movement of vehicles associated with the maintenance has the potential to result in a disturbance to local breeding bird populations. The construction works will aim to follow the ecological calendar for surveys and mitigation to minimise any potential impacts.

The operational phase can lead to increased levels of human activity, including walking, cycling, dog-walking and potential off-trail access to riverbank areas that may cause disturbance to feeding and roosting wintering birds. The disturbance will likely be very localized and species dependent. This could result in a potential **brief/temporary slight negative effect** on individuals of wintering bird species found within the greenway area.

6.5.4.5 Effects on Otter

Although no otter holts, couches, or key foraging or commuting habitats were recorded within the greenway footprint, the operational phase of the greenway may still result in low-level disturbance to otters due to increased human activity, including walkers, cyclists, and dog walkers along the river corridor.

The operational phase of the greenway might result in a **potential temporary not significant negative effect** on otters in the area.

6.5.4.6 Effects on Badger

As no badger activity was identified during surveys, it is not anticipated that the Greenway will result in any significant effects on any local badgers' populations during operation. There is no potential for the operation of the proposed development to result in significant effects on badger.

6.5.4.7 Effects on Bats

The operational phase is unlikely to affect any bat species using the habitats within the study area. During the operational phase there could be a **temporary 'not significant' negative impact** on bat roosts due to noise disturbances and traffic in areas adjacent to the greenway.

Increased artificial lighting may affect bat species particularly near bridges, woodland edges, or treelines, which could disrupt nocturnal foraging and commuting routes, especially for light sensitive species. This would result in a **brief/temporary not significant negative effect** on bats in the area.

6.5.4.8 Effects on Fish Species

There will be no habitat loss or fragmentation associated with the operational phase of the proposed development. No direct works will take place within the nearby waterbodies, the Lower River Shannon and

Mulkear river, with no direct/indirect effects because of the operational phase of the Greenway anticipated.

6.5.4.9 Effects on Invasive Species

The operational phase of the greenway may inadvertently facilitate the spread of invasive plant species through maintenance activities, machinery movement, or pedestrian dispersal if control and biosecurity measures are not implemented. This can lead to unlikely **temporary/short-term slight negative** impact as invasives can displace native vegetation along the greenway route or be introduced in areas where no invasive species are currently present.

6.5.4.10 Effects on the Benefitting Lands

The construction method proposed for the Greenway includes aspects that will benefit some areas within the Zone of Influence of the project.

A tree planting scheme will prevent long-term net loss by implementing a mitigation measure of an approximate ratio of 1:5, using replacement species with similar mature canopy spread, and maintaining contiguous stands to conserve habitat value.

Furthermore, the area in which the route diverges from the original pathway through the broadleaved woodland (WD1) habitat will create a benefit for not only the original pathway as there will be less impact from the current footprint of the users but it will also benefit bats by creating a new area of potential foraging habitat.

Overall it is considered that the operational phase of the greenway will have **a long-term moderate positive effect** on certain areas of land that are adjacent to the greenway, by reducing disturbance and enhancing biodiversity.

6.6 Mitigation Measures

This section describes the measures that are in place to mitigate any potentially harmful or negative effects associated with the proposed development and the identified Key Ecological Receptors as described in the preceding sections. General environmental management measures included within the design and construction methods of the Project are described first, with more specific measures to avoid, prevent or minimise effects on the individual receptors provided subsequently.

6.6.1 Mitigation through Best Practice

The design of the Project as described in Chapter 4 of this EIAR and related appendices set out clearly how the proposed Greenway will be constructed and operated in accordance with best industry practice to avoid significant effects within and outside the site including the prevention of impacts on watercourses.

Some of the key features of the environmental management strategy are provided below:

- A suitable qualified Ecological Clerk of Works (ECoW) shall be appointed for part time attendance for the full duration of the works and will supervise all aspects of the construction of the path.
- The ECoW will hold a minimum University degree in Environmental Science, (NFQ Level 8); preferably be a member of a relevant professional institute, minimum of 5 years' post-graduate experience in ecological assessment, appraisal techniques and mitigation monitoring;
- The ECoW will be responsible for biodiversity monitoring elements in particular for those key environmental receptors identified in this chapter, and providing toolbox talks;

- The ECoW should be present for works related to vegetation removal and any works that might have potential effects on sensitive habitats and/or species;
- The ECoW should oversee the implementation of the CEMP, particularly in relation to ecological and biodiversity related measures; and

The ECoW will be responsible for monitoring water quality throughout the works duration. Discrete monitoring (field and laboratory analysis) will be undertaken during all phases of the proposed works and frequency will be determined by the Water Quality Monitoring Plan to de developed before any works commence. It is essential to monitor indicator parameters that have the greatest potential to be impacted. The main concern in relation to the construction activity and water quality are potential increases in siltation and release of P and N. At least the following surface water parameters are to be tested/analysed in the field and/or in the laboratory: alkalinity (mg/l CaCO3), molybdate reactive phosphorus (mg/l P), ammonia (mg/l NH3), nitrate (mg/l N), nitrite (mg/l N), biochemical oxygen demand (mg/l), total suspended solids (mg/l), pH, temperature, dissolved oxygen, electrical conductivity, ammonium (NH4), turbidity. Sondes will be employed to measure turbidity in the main channel upstream and downstream of the works area during the construction stage. Sondes will be employed within the River Shannon to determine a baseline Nephelometric Turbidity Unit (NTU) value. During the construction period, alarms will trigger where there is a 20% difference between the NTU value recorded in the upstream and downstream Sondes when NTU is above its baseline value. All works will cease immediately until the source is identified and rectified (if caused by the construction works). The ECoW, project manager and contractor site manager should be contacted. If the increase is not attributed to the construction works, works will proceed.

- All personnel involved with the project shall be informed of the requirement for protection of designated habitats including the aquatic environment, i.e. Lower River Shannon SAC, and best practice methodologies to be employed via toolbox talks or formal presentation from the ECoW;
- The ECoW shall be onsite part time until all works have finished, and all machinery has been demobilised and has left the site;
- The access location to the proposed works shall be clearly marked out prior to the commencement of works. No works will be permitted outside of this works area;
- Appropriate fencing shall be installed and maintained for the duration of the works to prevent the public from entering the works site;
- Clearance of vegetation shall be undertaken as early as possible prior to the commencement of works and maintained until work commences to prevent bird nesting. In the event that vegetation clearance is not possible before the commencement of works, upon agreement by the NPWS, a check to confirm the absence of nesting birds should be carried out by a suitably experienced ecologist no more than 24 hours prior to works;
- Works shall only be carried out in dry, low flow conditions. Met Eireann five-day forecasts will be monitored on a daily basis prior to works commencing and no work will be carried out if more than 10mm of rainfall is predicted in a 24 hour period;
- Works shall only be carried between 08:00-18:00 during daytime hours or between dawn and dusk to minimize disturbance to nocturnal QI species;
- Excavated material shall not be stored beyond the working day, however in the event that this is not practical, appropriate precautions in relation to the material will be taken. These precautions will include appropriate storage and covering;
- Full method statements and Risk Assessments shall be provided and approved prior to the commencement of works. Approval will require coordination between the contractor, ECoW, project manager and local authorities;

- The proposed public lighting is designed to prevent light spill on to habitat features, such as the River Shannon and the Plassey Mill Race stream, and concentrate artificial light only where required. It will use best practice guidance notes "Bats and artificial lighting in the UK" as published by the Bat Conservation Trust, in respect of mitigation strategies, to minimise the impact of outdoor lighting upon bat populations. The LCCC Public Lighting standard has also been followed. Public lighting will be controlled by light sensors that will turn the lanterns on after dusk and off at 23:00 hours. Light emitting diodes (LEDs) type lanterns of the cool white type in accordance with the LCCC Public Lighting standard will be installed. They will have a Colour Temperature of 2,700°Kelvin, because it is considered least disruptive to the emergence of bats from roosts at dusk, and subsequent movement from habitats to foraging locations. LED lanterns do not emit any ultraviolet or infra-red radiation, this again being a desirable feature in relation to impact upon bats, in terms of causing spatial exclusion from artificially lit areas. Light levels have been kept as low as possible (P4 Class) by reference to levels specified in "Design of road lighting' - BS EN 5489-1: 2020, and these will be in accordance with the LCCC Public Lighting standard. Two Lanterns are proposed; one Lantern will be on a 5m high column approximately 35m apart mounted at 0o degree tilt and fully cut off type with no light output above the horizontal plane, while the other column will be 1.6m high with an integrated light in the column and they will be spaced approximately 5m apart. 5m high Lighting columns will not be placed within 15m of mature trees that have been identified by bat specialists as having roost potential and the 1.6m high columns shall be used if there are any signs of bats in an area. The 1.6m high columns will be used in the Annex 1 Alluvial forest area.
- Cable ducts for the public lighting will be installed by open trench to minimum 300mm cover in areas where no trees are present, and by Moling technique in areas of dense tree coverage. The moling will allow cable ducts to be installed to a minimum depth of 600mm where the cable ducts will pass under tree roots and protect them from damage.
- Construction works should take place during daylight hours only with no lighting on the site during the hours of darkness.
- Any temporary lighting required for health or safety reasons during construction shall be installed at a minimum of 10 metres from existing treelines and woodland habitats and directed away from such sensitive habitats.
- During construction, noise limits, noise control measures, hours of operation and selection of plant items will be considered in relation to disturbance of birds. Plant machinery will be turned off when not in use.
- A Biodiversity Management Plan and a Construction Environmental Management Plan have been prepared for this project and they are included as appendices to this NIS.

The following mitigation calendar will be applied and followed to ensure protection of habitats and species during construction and operational phases of the greenway. In general, the construction works should be planned during the 'green' periods in the calendar year, as long as appropriate mitigation measures are implemented. The exception to this is Fish (salmonoid spawning) because foreshore works (including preparatory work) beside all watercourses supporting salmonids shall be undertaken from May to October (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds.

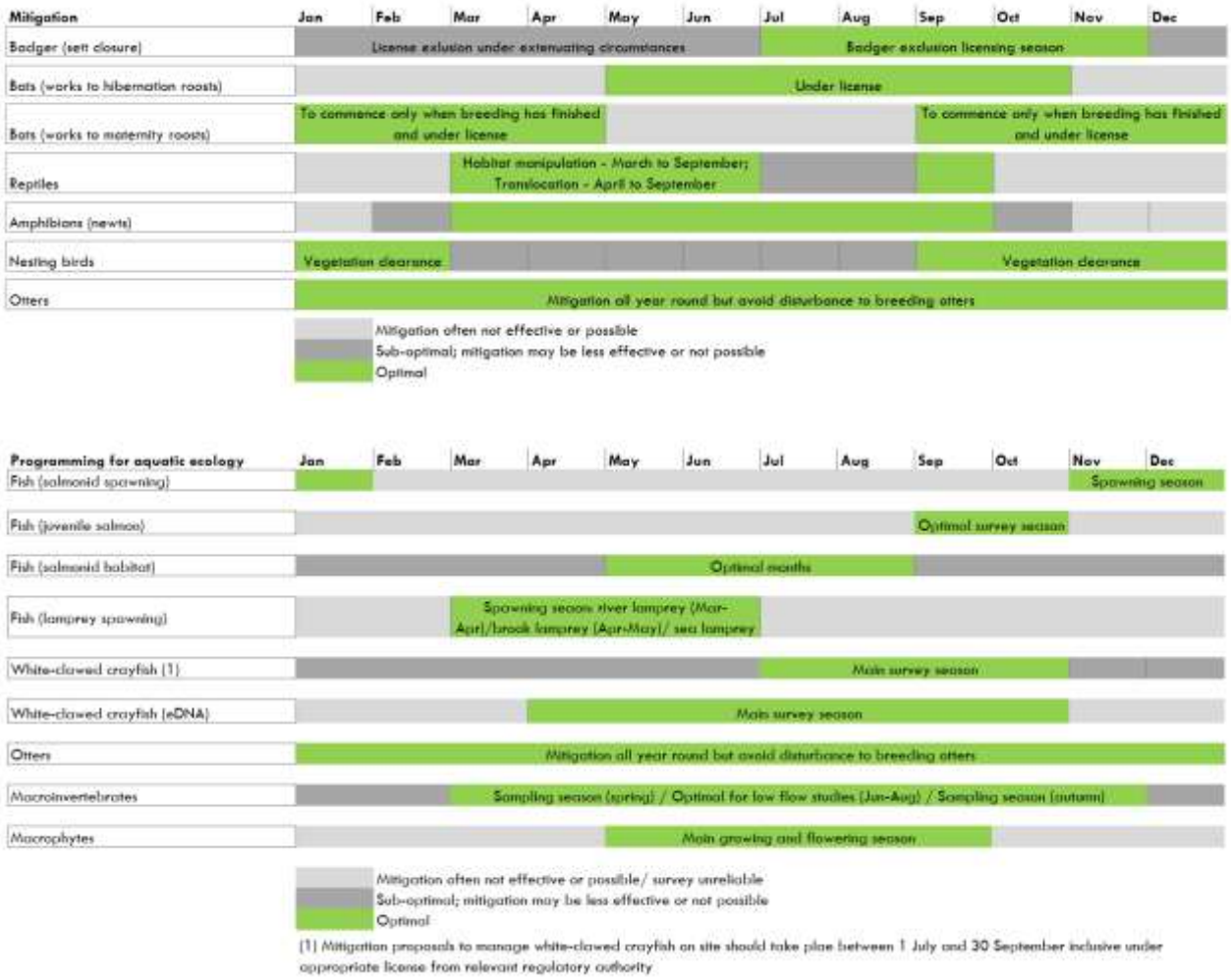

Figure 6.13 Mitigation timing - ecological calendar

6.6.2 Measures to protect the Aquatic Environment

The proposed development has been identified as potentially giving rise to negative effects on watercourses within the study area. The following measures should be adopted during construction works:

- No abstraction from any watercourses will be permitted to facilitate the works.
- A silt curtain will be floated in the River Shannon and the Plassey Mill Race ahead of, during and shortly after the construction works for the bridges, retaining wall, and ramp to protect aquatic species from soil and suspended material associated with the construction works.
- A water filled flood barrier will act as a barrier to prevent river water entering the proposed work sites for the bridges, retaining wall, and ramp but if water enters the work site a sump pump will pump water to a silt buster to remove contaminated material from water before it is returned to the River Shannon downstream.
- Sheet piles will be temporarily pushed into the riverbank and stream bank to facilitate construction of foundations and abutment walls for the bridges and retaining wall. They will be removed immediately after the bridge decks have been bolted into place. The sheet piles will act as a physical barrier between the worksite and the banks and prevent soil or other construction material runoff from the work site to the riverbank, stream bank, river or stream.
- Consumables and/or waste material will be removed from all water sampling locations and returned

to the site compound for disposal to a licenced waste facility.

- Alarm sondes will be triggered when there is a 20% difference between NTU value recorded in the upstream and downstream sondes.
- Machinery will be stored in purpose built temporary construction compounds which will be constructed in Flood Zone C areas only.
- There will be no storage of machinery in the temporary construction compounds (including drill rigs) fuel, samples, or chemicals (e.g. bentonite, drilling fluid) within 20m of any drain or watercourse.
- Fuel storage tanks will only be placed within temporary construction compounds. They shall have secondary containment provided by means of an above ground bund to capture any oil leakage irrespective of whether it arises from leakage of the tank itself or from associated equipment such as filling and off-take points, sighting gauges, etc., all of which should be located within the bund. Bund specification should conform to the current best practice for oil storage (Enterprise Ireland, BPGCS005).
- Oil booms and oil soakage pads shall be kept in the temporary construction compounds to enable a rapid and effective response to any accidental spillage or discharge. The site foreman shall be trained in the deployment of oil soakage pads in case of an emergency at the works sites.
- Waste oils and hydraulic fluids shall be collected in suitable leak-proof containers and transported from the temporary construction compounds for disposal or recycling;
- Machinery used on site shall be regularly inspected in the temporary construction compounds to ensure there is no leakage from them and to ensure the machinery shall not cause contamination of watercourses.
- Protection measures shall be put in place by the Contractor to ensure that all hydrocarbons used during the works are appropriately handled and stored within the temporary construction compounds and disposed off-site in a licenced facility in accordance with recognised standards as detailed by the Environmental Protection Agency.
- Guidelines for minimising impacts on water quality and fisheries in relation to Construction shall be implemented including, but not limited to, CIRIA C532 "Control of water pollution from construction sites - Guidance for consultants and contractors", Inland Fisheries Ireland guidelines and TII guidelines.
- It is recommended that target lamprey surveys should be undertaken within the Mill Race, prior to any site investigation or construction works that could disturb the stream.
- It is also recommended that white-clawed crayfish surveys are undertaken in the vicinity of any proposed riverbank works, prior to works commencing.

6.6.3 Effects on Badger

No badger activity was established within the study area however the activity status of this species could change in the intervening period between the site surveys and the commencement of construction of the scheme. The habitat is unlikely to support badgers but the Precautionary Approach will be implemented along with Best Practice to avoid badgers entering the site or spoil heaps. An additional badger survey should be undertaken prior to construction works commencing to identify any potential badger activity.

6.6.4 Effects on Bats

As no bats were identified as roosting within the study area no specific mitigation in relation to roost loss is

recommended. General protective measures are outlined below:

- Where possible, treelines and hedgerows shall be retained. Any trees requiring removal to facilitate construction works must be subject to a visual inspection to identify potential for bat roosts;
- The removal of linear features can result in the disconnection of commuting corridors such as hedgerows and treelines. Where possible, these linear features should be reconnected using native hedgerow or tree species to compensate for the loss of these features;
- Construction works should take place during daylight hours only with no lighting on the site during the hours of darkness. Any lighting required for health or safety reasons should be installed at a minimum of 10 metres from existing treelines and woodland habitats and directed away from such sensitive habitats.
- The proposed public lighting should be designed to minimise light spill on to habitat features, such as the River Shannon or the bat boxes present along the pathway, and concentrate artificial light only where required.
- Lighting will be avoided wherever possible. Any lighting required as part of the construction of the project will follow published best practice including BS EN 5489-1: 2020 to minimise the impact of outdoor lighting upon bat populations. Warm white LED lanterns are specified which are considered least disruptive to the emergence of bats from roosts at dusk, and subsequent movement from habitats to foraging locations.
- Generators or other sources of noise, vibration and emissions should not be located with 50m of the existing woodland habitat throughout the site. There should be avoidance of noise and vibration in so far as possible.
- Consultation with an arboriculturist should be sought to protect the trees to be retained during the proposed works. Root protection zones should be established prior to commencement of any works and there should be an appropriate barrier to prevent access by machinery.
- In line with Bat Conservation Trust Guidance, (2023), at least one bat survey should be undertaken during the appropriate bat survey season to assess potential use of the tree by bats in advance of any felling, and to assess the need for mitigation, if required.

Following the implementation of the avoidance and mitigation measures, the potential for temporary disturbance due to construction works is minimised. The potential for loss of minor potential roosting features is partially mitigated in the short and medium term by the provision of bat boxes in suitable locations.

- Bat boxes should be installed on mature trees, positioned to face south, southeast, or southwest and at heights no less than 4m above ground level to avoid predations and allow appropriate access and exit (Bat boxes are available from a variety of commercial outlets). Bat boxes can be positioned at any time of year, but they are more likely to be used during their first Summer if they are put up before the bats emerge from hibernation in late Spring. A suitably experienced Ecologist must oversee the installation of the boxes. All personnel should wear gloves to reduce transmission of human pheromones, which may reduce or delay uptake of boxes by bats.

As part of the mitigation measures, approximately 305 No. trees are proposed to be planted along the Greenway, guided by a dedicated Landscape Plan (EIAr Part 3_Appendices).

6.6.5 Effects on Birds

Breeding birds have been identified as KERs of the proposed works as there were significant populations

recorded as likely to be impacted by the proposed works. The proposed works will result in the loss of some habitat for breeding birds in the form of some scrub, vegetation and some individual trees.

To limit potential impacts of construction on breeding birds, woody vegetation removal, including treelines and any hedgerows, will not be permitted during the breeding bird season (1st of March to the 31st of August inclusive).

During construction, noise limits, noise control measures, hours of operation and selection of plant items will be considered in relation to disturbance of birds. Plant machinery will be turned off when not in use.

All plant and equipment for use will comply with *BS 5228-1: 2009: Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise*, as specified in Chapter 9- Air & Climate, Noise & Vibration.

6.6.6 Effects on Otter

Where possible, bank slopes should be protected along the River Shannon and Mulkear. This will ensure that riparian habitat is permanently available for otters, thus providing potential breeding and sheltering opportunities. Construction works may result in the temporary loss of some riparian vegetation adjacent to the new proposed Greenway, but this will re-establish quickly post construction. A careful approach will be taken to assure a significant distance from the river banks during the construction stage of the proposed development (a minimum 10-30m for the protection of riparian habitat, subject to be increased if presence of otter is detected).

Holts must be protected during construction with a minimum exclusion zone of 150m. It is important to note that no otter holts were found during the specialised survey within or near the works area, but the measure must be considered if holts are found pre-commencement of the works.

A pre-construction survey is recommended prior to any works being undertaken, to detect the presence of otter and/or otter holts within the proposed works area.

6.6.7 Biosecurity measures

The desktop study and site visits have identified a number of invasive species within the Greenway clearance area, including stands of Himalayan balsam and Giant hogweed. Invasive species have the potential to spread to other locations via machinery used on site or via the river itself if plant material is disturbed. The following biosecurity measures will be put in place to ensure no spread of invasive species:

- A pre-construction survey for invasive species will be conducted at the earliest stage possible to update and inform on the status of invasive plant species in or near the works area. Particular attention should be given to identifying those invasive species identified on the Third Schedule of the Birds and Natural Habitats Regulations 2011 (as amended). This survey should be undertaken during the appropriate botanical season (April to September);
- Continuous monitoring of work sites by an experienced and qualified Ecologist for invasive species growth shall be conducted.
- Biosecurity zones must be established on-site prior to site works commencing and will specify the area of the zones, the required actions that must be taken in each zone and who must carry out the actions. All staff will be educated on the health and safety and biosecurity measures that should be followed around each species;
- All plant machinery and construction related vehicles that will travel between the work site and the temporary construction compounds will be checked for the presence of plant material e.g. leaves roots and rhizomes from non-native invasive species. There shall be a bunded area in the temporary construction compound to wash down water from plant machinery and construction related vehicles,

particularly for plant machinery and construction related vehicles that are leaving the worksite and travelling elsewhere. The wash down water shall be pumped to a silt buster to remove contaminated material and soils before the water is returned downstream to the River Shannon;

- Delivery vehicles to the temporary construction compound shall be inspected for any plant material before entering or leaving the 'delivery' side of the compound and will be washed down in the bunded area. The wash down water shall be pumped to a silt buster to remove contaminated material and soils before the water is returned downstream to the River Shannon;
- Where there is potential for cross-contamination on site (machinery or personnel moving from one biosecurity zone to another or from the biosecurity zone to other areas on site), vehicles or machinery will be designating to specific sites to prevent spread of invasive species;

All staff will be trained by the ECoWs in the identification of invasive species and noxious weeds and the associated biosecurity measures required when working on site;

- Non-native invasive species will be managed or avoided where they occur throughout the works area, in line with the NRA Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Road Schemes (NRA, 2010), and any other best practice guidance which may be available in the interim;
- Any Himalayan balsam identified during the site survey will be hand-pulled prior to the commencement of the works. Hand pulling must only take place before the plant goes to seed around mid-June depending on the growing season. The stalks shall be left to wither where they are pulled and shall not be collected or moved off site;
- Giant hogweed shall be sprayed or injected with Glyphosate when actively growing, usually in April and May when the plants have grown to about 50cm in height with full leaves;
- Removal of Giant Hogweed flower heads in June/July prior to seed production will be carried out;
- If invasive species plants that spread by rhizomes (e.g. Japanese Knotweed) are encountered by site clearance crews, the plant will be removed in accordance with guidelines for managing invasive species, wrapped in plastic, and buried under topsoil and subsoil mounds so those invasive species plants cannot propagate;
- No invasive species will be moved to a different location within the works site or off site; and,
- A three to five year programme of invasive plant species control will be required to extend beyond the works period.

To prevent these species from spreading advanced treatment prior to the construction phase has been advised with an invasive species management plan (ISMP) produced outlining biosecurity and best practice measures.

Following the construction of the Greenway, it is important that the site is systematically re-surveyed to determine the success of control measures and to identify areas where invasive plants are reinvading. It is important to note that untreated Giant Hogweed and Himalayan balsam in the wider environment of Limerick, adjacent to or on the riverbanks of the Shannon and Mulkear upstream of the proposed greenway route are a risk to recolonise the study area after treatment. Work in partnership with neighbouring landowners to treat Giant hogweed and Himalayan balsam is encouraged. Establishing a good sward of grasses/ native riparian vegetation soon after treatment of these invasive species will help to reduce the rate of re-colonisation of the area by these species and help to prevent the slippage of banks. If invasive species are found, then they shall be treated as per the measures outlined in this plan and the species-specific guidelines above

6.6.8 Post construction works/Reinstatement

Following completion of the construction of the Greenway, construction area and sectors will be reinstated

as far as is practicable. The following measures are proposed:

- Where opportunity exists, enhancement measures may be employed. This will be carried out in liaison with the competent authority and the ECoW;
- Upon completion of the site works, all plant and machinery will be removed. The adjacent grasslands to the site will be left to regenerate naturally or reinstated to its original condition and site fencing will be removed;
- Any reinstatement of breaches in hedgerows and tree lines will be carried out in consultation with a suitably qualified ecologist. Local strains of native species shall be planted and hedge management shall reflect local traditional styles; and,
- A tree planting scheme will be implemented, with proposed planting of more than 300 trees, at a 5:1 ratio for trees that will be cut down. It will include native hedgerow, and tree species which promote biodiversity such as oak, willow, birch, etc.

6.6.9 Operational phase mitigation measures

The following mitigation measures are proposed to be implemented during the operational phase of the proposed greenway:

- Maintain native vegetation along the greenway corridor, including regular mowing and pruning, while ensuring that invasive species are controlled.
- Use pollinator-friendly plants along the greenway to support local pollinator populations.
- Where necessary, restore habitats, particularly along watercourses and riparian zones.
- Implement a maintenance programme for bridges and culverts to maintain habitat connectivity and reduce wildlife fragmentation. This will allow for safe movement of species.
- Install clear signage that creates awareness for users about wildlife and biodiversity conservation.
- Provide adequate waste disposal facilities and ensure regular cleaning and maintenance to prevent litter accumulation.
- Continue monitoring and treatment of invasive alien plant species along the greenway.
- Where appropriate, install fences or barriers to prevent wildlife from accessing dangerous areas such as roadways or areas with high human activity.
- Engage local communities, environmental groups, and stakeholders in the ongoing management of the greenway, raising awareness on protected species and their habitats.

6.7 RESIDUAL IMPACTS

Most residual impacts on biodiversity will be not significant after mitigation measures are applied, considering the assessment undertaken in Section 6.5 of this report.

The implementation of mitigations measures described in section 6.6 ensure that there is no net loss of habitat and that connectivity throughout the Study Area is retained. Residual impacts of habitat loss will depend on the scope and success of compensatory habitat restoration. If restoration works are not undertaken, residual impacts will remain moderate/significant negative.

This habitat loss is assessed as **Medium-term Moderate Negative Effect** that with the appropriate compensatory habitat restoration and design, the residual impacts could lead to a **Permanent Neutral Effect**.

Table 6.23 Summary of residual impacts

Impact Source	Ecological Feature	Impact Significance	Mitigation	Residual Impact
Construction phase	Habitat loss	Moderate negative	Site management & rehabilitation	Slight negative
Construction disturbance	Fauna	Moderate negative	Best practice	Slight negative
Invasive species	Habitat, Flora	Significant negative	Invasive species management plan	Slight positive
Operational phase	Habitat loss	Not significant negative	Best practice	Slight positive
Operational phase-disturbance	Fauna	Slight negative	Monitoring	Imperceptible
Lands	Habitat, fauna, flora	Moderate positive	None required	Moderate positive
Cumulative impacts	Habitats, flora, fauna	Moderate negative	Project specific	Not significant negative

6.8 Cumulative and In Combination Effects

6.8.1 In-Combination Effects

The interaction of the various elements of the proposed development was considered and assessed in this EIAR. The potential for each individual element of the proposed development on its own to result in significant effects on biodiversity was considered in the impact assessment. The entire project, including the interactions between all its elements, was also considered and assessed for its potential to result in significant effects on biodiversity in the impact assessment presented above. The complex interactions between the requirements for earthmoving and construction works adjacent to the Lower River Shannon to facilitate the project requirements was considered in-combination along with and the requirement to protect biodiversity within and downstream of the study area. Any potential in-combination impacts were taken into account and any significant impacts avoided through a series of mitigation measures that were fully described above in this chapter. The requirement to minimise disturbance on humans was considered and evaluated in-combination in the assessment, when considering the potential for disturbance to wildlife. The requirements to minimise impacts on the landscape were similarly considered when assessing the impact of the development on biodiversity. Following the in-combination assessment of the interactions between all aspects of the project, no additional effects were identified and a full and comprehensive cumulative assessment of the potential effects of the proposed development on biodiversity has been achieved.

6.8.2 Cumulative Effects

The potential for the proposed development to result in cumulative effects on biodiversity when considered cumulatively with a number of other relevant plans and projects was assessed. This includes a review of online Planning Registers and to identify past and future projects, their activities and their predicted environmental effects. This assessment is provided below and focuses on the potential for cumulative effects on key ecological receptors identified as part of the current assessment.

The Limerick Development Plan 2022-2028 has objectives relating to the protection, conservation management and restoration of European Sites. In its Land Use Zoning objectives related to semi natural and open spaces, it states that the plan will protect Natura 2000 designated sites, proposed sites and flood plains. With this objective it recognises the importance and need for protection of these areas for their protected species, habitats and ecosystems. It highlights that within these areas; development will be

prohibited in order to maintain the integrity of the site. The plan is accompanied by an Appropriate Assessment Natura Impact Statement (Volume 4 of the LDP, adopted June 2022)

https://www.limerick.ie/sites/default/files/media/documents/2022-07/Appropriate-Assessment-Natura-Impact-Statement.pdf

It concludes that "The risks to the qualifying interests, special conservation interests and conservation objectives of the Natura 2000 site have been addressed by the inclusion of mitigation measures, through policy measures such as non-encroachment of zoning on Natura 2000 sites in the case of zoning objectives and in relation to implementation of Article 6 elsewhere (…) taking into account mitigation measures that have already been integrated into the draft plan and the additional mitigation measures mentioned in this report, it is concluded that the proposed material alterations to the Limerick Draft Plan are not foreseen to have any significant effects on the integrity of any European site, alone or in combination with other plans or projects."

The review of the Limerick City & County Council planning register documented relevant general development planning applications in the vicinity of the proposed greenway, most of which relate to the provision and/or alteration of one-off housing and other structures. No potential for cumulative impacts on European Sites were identified when considered in conjunction with the current proposal.

The Castletroy WwTP Upgrade Project is an element of Irish Water's 2017-2021 Investment Plan, whereby 52 Wastewater 'Above Ground' (i.e., treatment) projects were identified. The planning application (permitted by An Bord Pleanála 12/10/2023, Case reference: PA91.316168) for the upgrade works at Castletroy WwTP will cater for the 10-year growth projections from 45,000 PE to 77,500 PE, which includes a future IDA load of 5,500 PE. There will be provision made in the infrastructural development of the plant (i.e. tank sizing and pipework) for 25-year population growth projection of 81,100PE. Procurement and Construction is scheduled between 2024-2026.

The IDA has proposed upgrade works to existing flood defences under a new planning application that has been submitted to Limerick City & County Council planning section, with Case reference: 25/60477. It was deemed invalid on 24th June 2025. The proposed works consist of the construction of 1.1m – 1.8m sheet pile wall to act as a flood barrier from the River Shannon and Mulkear River; associated drainage works including new drainage trenches, pipes and attenuation pond; construction of 11 no. mammal crossings comprising earth ramps filled to the top of the proposed sheet piles along the River Shannon and Mulkear River; Localised relocation of an existing boundary fence to the adjacent Johnson and Johnson facility to facilitate the proposed development; Removal of existing berm along the Mulkear River; All associated ancillary site development works.

The potential cumulative impacts with the Limerick City Greenway should be considered in the EIAR if the construction programmes overlap.

There are no known additional plans/projects on-going or proposed (at the time of this study) which in combination with the proposed project may give rise to any form of cumulative impact on the European Sites.

Table 6.24 provides a summary of the most relevant plans and projects considered for the assessment of potential cumulative effects when considered with the proposed greenway.

Table 6.24 Summary of relevant plans and projects

Plans and Projects	Key Policies/Issues/Objectives Directly Related to European Sites in the Zone of Influence	Assessment of Potential Impact on European Sites
Limerick Development Plan 2022 – 2028.	▪ The Draft Plan sets out two main strategic objectives relating to Biodiversity and protected species and habitats. ▪ Strategic objectives of the Draft Plan include: ▪ No. 8: Protect, enhance, and connect areas of natural heritage, green infrastructure, and open space for the benefits of quality of life, biodiversity, protected species and habitats, while having the potential to facilitate climate change adaptation and flood risk measures ▪ No. 9: Protect, conserve, and enhance the built and cultural heritage of Limerick, through promoting awareness, utilising relevant heritage legislation and ensuring good quality urban design principles are applied to all new developments. The principle that well planned and integrated development enhances the sustainability, attractiveness and quality of an area should be at the centre of any proposal ▪ All plans and projects with the potential to have significant effects on the Natura 2000 network will be subject to the Appropriate Assessment process.	The Development plan was comprehensively reviewed, no potential for cumulative impacts when considered in conjunction with the current proposal were identified.
Mid-West Area Strategic Plan 2012-2030	▪ T-BFF-01: The Strategy alone or in combination should not significantly impact on valuable ecological habitats and species including European Designated Sites (SACs and SPAs), Nationally Designated Sites (NHA's) other designated sites (e.g. sensitive waters, bathing waters) ecological corridors or local sites. ▪ T-BFF-02: To ensure compliance with Article 10 of the Habitats Directive and protect ecological connectivity between Natura 2000 sites. ▪ T-BFF-03: The Strategy alone or in combination should not impact the biological diversity within the study area and to ensure that invasive species do not impact significantly on the biodiversity of the region there is no significant loss of valuable habitats and species not protected as European Designated Sites.	The strategic plan was comprehensively reviewed, no potential for cumulative impacts when considered in conjunction with the current proposal were identified.
Project Ireland 2040 – National Planning Framework	▪ National Policy Objective 59: Enhance the conservation status and improve the management of protected areas and protected species by: Implementing relevant EU Directives to protect Ireland's environment and wildlife; Integrating policies and objectives for the protection and restoration of biodiversity in statutory development plans; Developing and utilising licensing and consent systems to facilitate sustainable activities within Natura 2000 sites; Continued research, survey programmes and monitoring of habitats and species.	The plan was comprehensively reviewed, no potential for cumulative impacts when considered in conjunction with the current proposal were identified.

Plans and Projects	Key Policies/Issues/Objectives Directly Related to European Sites in the Zone of Influence	Assessment of Potential Impact on European Sites
Ireland's 4th National Biodiversity Action Plan Ireland's 4th National Biodiversity Action Plan 2023–2030	▪ Outcome 2A: The protection of existing designated areas and protected species is strengthened and conservation and restoration within the existing protected area network are enhanced. ▪ Outcome 2D: Biodiversity and ecosystem services in the marine and freshwater environment are conserved and restored. ▪ Outcome 2H: Invasive alien species (IAS) are controlled and managed on an all-island basis to reduce the harmful impact they have on biodiversity and measures are undertaken to tackle the introduction and spread of new IAS to the environment.	No. The proposed development will not result in significant effects on protected areas, habitats and features of ecological importance, biodiversity and ecosystem services or increase the spread of invasive species.
Limerick City and County Council planning register.	The review of the Limerick City and County Council planning register documented relevant general development planning applications in the vicinity of the proposed Greenway, most of which relate to the construction of facilities within the university grounds, with domestic planning applications within the residential region near Mulkear River. These applications have also been taken account on describing the baseline environment and in the relevant assessments.	No potential for cumulative impacts when considered in conjunction with the current proposal were identified.
Other Cycle Paths/Ways.	In line with the Limerick/Shannon Metropolitan Area Transport Strategy 2040 additional travel/cycle networks/routes are proposed throughout the city including Corbally to Limerick City Centre, UL to City Centre along the River Shannon and Canal, Southill, Ballysimon, Monaleen and Castletroy to City Centre and Southill and Roxoboro Shopping Centre to City Centre.	No potential for cumulative impacts when considered in conjunction with the current proposal were identified.

Further details on potential positive and negative cumulative effects of the proposed greenway project with other main national, regional and local projects, is detailed in Table 6.25.

Table 6.25 Summary of potential cumulative effects of plans/projects with the proposed greenway

Plan/Project	Potential Positive Cumulative Effects	Potential Negative Cumulative Effects	Mitigation Measures
Mid West Area Strategic Plan 2012-2030	Support strategic transport and green infrastructure corridors, reinforcing the greenway as an alternative and more sustainable transport mode	Increased land use due to regional development which could result in land use conflict near the greenway area	Implement land-use buffer areas and ensure all planning applications contain the appropriate mitigation measures for habitats and species, especially near SACs and SPAs
Project Ireland 2040: National Planning Framework	The framework supports compact growth and active travel, in line with the aim of the proposed greenway	Infrastructure priorities might constrain greenway routes and designs	Coordination between projects to ensure these complement each other and that they integrate the necessary measures to

Plan/Project	Potential Positive Cumulative Effects	Potential Negative Cumulative Effects	Mitigation Measures
			protect key environmental features
Limerick Shannon Metropolitan Area Transport (LSMATS)	Encourages a modal shift in transport to walking and cycling which is the aim of the proposed greenway	Potential construction programmes overlap, which may lead to temporary disruptions	Coordination so that phasing of works is carefully planned between projects and reduce any potential cumulative impacts
Limerick Development Plan 2022-2028	Policies of the CDP support greenway infrastructures	Zoning changes might reduce available areas for greenway corridors	Create buffer areas for greenway routes to restrict development that might reduce the greenway area
Ireland's 4th National Biodiversity Action Plan Ireland's 4th National Biodiversity Action Plan 2023–2030	Supports biodiversity protection, enhancement and integration with projects. The proposed greenway is designed to protect local environmental features, and proposes a planting scheme that supports habitat creation	Poor implementation can lead to potential negative effects on habitat and species	Mitigation measures proposed for all the phases of the project will ensure that any potential impacts on habitats and species are minimised and biodiversity net gain is achieved

The proposed development was considered cumulatively with the above plans and projects and no significant additional effects or potential for cumulative/ in combination adverse effects on biodiversity were identified. Any potential negative cumulative effect is minimised by appropriate mitigation measures considered in each of the plans/projects to make sure no biodiversity features are impacted. The proposed development will not result in significant direct or indirect effects on any biodiversity when considered on its own and therefore cannot contribute to any additional, cumulative or in combination effects when considered alongside any other plans or projects.

6.9 Concluding Statement

The proposed Greenway project has been designed to achieve its aim of promoting cycling as a realistic choice as a mode of transport in the Limerick Metropolitan Area, providing a safe, clear and accessible network of cycle networks from UL to the National Technology Park and beyond. The identified impacts and potential direct and indirect significant effects of the Project on biodiversity have been fully identified, assessed, quantified and where necessary and appropriately mitigated. The design considered and allowed to the sensitivity to the existing key ecological receptors within the area.

The outcome of the assessment of the effects of the proposed Limerick City Greenway (UL to NTP) on biodiversity, is that there will be local moderate losses of amenity grassland and wooded habitat and in respect of key ecological receptors associated with the these and other habitats within the proposed development study area, prior to mitigation measures. Fauna species, including otter, badger, bats, birds, fish and amphibians were considered in the assessment and was determined that for some of these species, there is potential for moderate negative effects as a result of the construction activities. Invasive species have also been assessed, and if no mitigation measures are applied, this could result in a moderate negative effect on the surrounding area and native flora communities.

Based on the above, environmental management and design measures are proposed, chiefly to limit tree

and hedge clearance along the route, control and limit sediment and potential contaminant runoff, to protect watercourses against water quality deterioration, minimise disturbance to fauna in the area, and propose reinstatement and a planting scheme measures through a detailed Landscape Plan, that will minimise any potential impacts and/or effects from the construction and operational phases of the proposed greenway.

Furthermore, an assessment of the potential for significant effects on European sites downstream of the project was conducted in accordance with the requirements of the Habitats Directive, of which details are provided in the Natura Impact Statement prepared for the proposed greenway. This assessment concluded that the proposed Greenway, both in isolation and in combination with other plans or projects, is not likely to result in significant effects on any European Sites. Accordingly, no adverse effects on the integrity of these sites are anticipated.

It has been concluded that the development of the proposed Limerick City Greenway (UL to NTP) works will not adversely affect key ecological receptors nor the European Sites, and there is no reasonable scientific doubt in relation to this conclusion.

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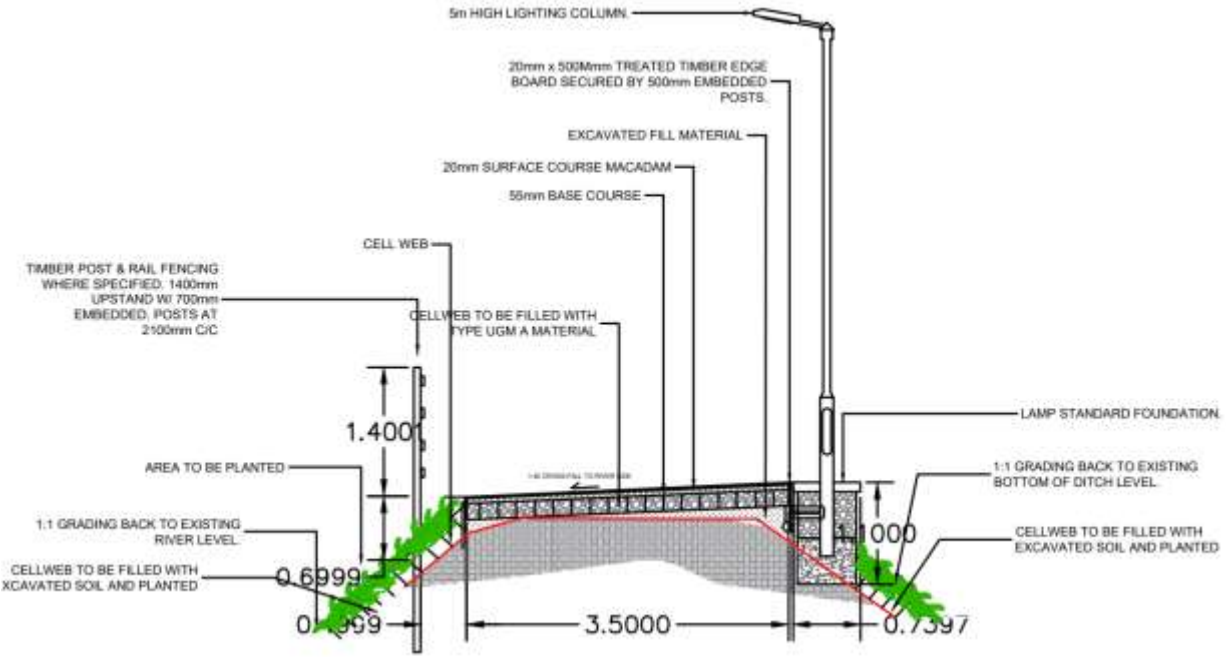
7 LAND USE, SOILS AND GEOLOGY

This chapter provides an assessment of the baseline for land use, soils and geology in the Study Area and investigates how the proposed Limerick City Greenway (UL to NTP) may impact on the existing soil and geological environment as well as land use during the construction and operational phases of the project.

As described in Chapter 4 – Description, the general construction of the greenway will be in accordance with the TII document on *Rural Cycleway Design* DN-GEO-03047 and will comprise as detailed in Drawing PD0007 and as follows;

- Excavated Fill Material;
- Treetex Geotextile;
- Cellweb (to be filled with Type UGM A Material);
- 55mm Base Course (Clause 804); and
- 20mm Surface Course Macadam.



In a number of sections along the proposed route, the greenway changes to Active Travel infrastructure with separate footpaths consisting of 150mm Clause 804 Sub-base and 150mm reinforced concrete and two-way cycle lanes comprising a 22mm Surface Course Macadam, 55mm Base Course and 150mm Clause 804 Sub Base.

Where negative effects are anticipated, mitigation measures and monitoring are proposed and residual effects of the proposed Scheme on land, soil and geology are assessed. The cumulative effects of the project and the cumulative effects in-combination with other plan and projects are also presented in this Chapter.

The Limerick City Greenway (UL to NTP) has an indefinite operational duration; therefore, it is not considered necessary to assess the impacts of decommissioning.

7.1 METHODOLOGY

This chapter was compiled in accordance with the following:

- The European Commission '*Guidance on the Preparation of the Environmental Impact Assessment Report*' (2017);
- The EPA '*Guidelines on the information to be contained in Environmental Impact Assessment* Reports' (2022);
- The EPA '*Advice Notes on Current Practice in the preparation of Environmental Impact Statements*' (*Draft* September 2015);
- The Institute of Geologists of Ireland (IGI) '*Geology in Environmental Impact Statement – A Guide*' (2002);
- Institute of Geologists of Ireland (IGI) 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (2013);
- The Department of Housing's '*Guidelines for Planning Authorities and An Bord Pleanála on Carrying out Environmental Impact Assessment*' (August 2018); and
- National Road Authority (NRA) (Now Transport infrastructure Ireland (TII)) '*Guideline on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*' (2009).

A desktop study and review of published literature was carried out in order to ascertain a comprehensive baseline for the Study Area and give a description of the existing environment. Stakeholder consultation, meetings and detailed background surveys were conducted. Information collected was then used to inform this Chapter of the Environmental Impact Assessment Report (EIAR) with regard to land use, geology and soils within the Study Area. It was then possible to propose practicable mitigation measures to ensure that any potential impacts identified will not have a significant effect on the environment during the construction and operation of the Greenway.

7.1.1 Assessment of Significance of Geological Impact on the Receiving Environment

An impact rating has been developed for each of the phases of development of the greenway based on the Institute for Geologists Ireland (IGI) Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.

In line with IGI guidance the receiving environment (Geological Features) is identified, then the importance of the geological features is rated (Table 7-1) followed by an estimation of the magnitude of the impact (Table 7-2). This determines the significance of the impact prior to application of mitigation measures as set out in Table 7-3.

Table 7.1 – Criteria Rating Site Importance of Geological Features

Magnitude	Criteria	Typical 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	• Geological feature on a regional or national scale (NHA). • Large existing quarry or pit.

Magnitude	Criteria	Typical Example
	national or regional scale. Volume of peat and/or soft organic soil underlying the site is significant on a national or regional scale	• 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 the site 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 high fertility soils • Moderately sized existing quarry or pit • Marginally economic extractable mineral resource
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 the site 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
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 the site 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 • Uneconomic extractable mineral resource

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the potential impact. The magnitude criteria for geological impacts are defined as set out in Tables 7-1 and 7-2.

Table 7.2 – Estimation of Magnitude of Impact on Geology Attribute

Magnitude	Criteria	Typical Example
Large Adverse	Results in loss of attribute	• Loss of high proportion of future quarry or pit reserves • Irreversible loss of high proportion of local high fertility soils • Removal of entirety of geological heritage feature • Requirement to excavate / remediate entire waste site • Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Loss of moderate proportion of future quarry or pit reserves • Removal of part of geological heritage feature • Irreversible loss of moderate proportion of local high fertility soils • Requirement to excavate / remediate significant proportion of waste site • Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Loss of small proportion of future quarry or pit reserves • Removal of small part of geological heritage feature • Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils • Requirement to excavate / remediate small proportion of waste site • Requirement to excavate and replace small proportion of peat, organic soils

Magnitude	Criteria	Typical Example
		and/or soft mineral soils beneath alignment
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• No measurable changes in attributes
Minor Beneficial	Results in minor improvement of attribute quality	• Minor enhancement of geological heritage feature
Moderate Beneficial	Results in moderate improvement of attribute quality	• Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	• Major enhancement of geological heritage feature

The matrix in Table 7-3 determines the significance of the impacts based on the importance and magnitude of the impacts as determined by Table 7-2 and the determination of the significance of each impact for the proposed greenway is discussed in the following sections.

Table 7.3 Ratings of Significance of Impacts for Geology

Importance of Attribute	Magnitude of Impact			
	Negligible	**Small Adverse**	**Moderate Adverse**	**Large Adverse**
Very High	Imperceptible	Significant/ Moderate	Profound/ Significant	Profound
High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Profound/Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

7.1.2 Published Material

The baseline study of the existing geological and hydrogeological environment throughout the Study Area was prepared using the Geological Survey of Ireland's (GSI) online database, published literature and additional source material. A comprehensive list is included below:

- The GSI online database (www.gsi.ie);
- Limerick Development Plan 2022-2028 (www.limerick.ie);
- CORINE Database (www.epa.ie);
- Aerial Photography, 1:5000 and 6 Inch base mapping;
- General Soil Map of Ireland;
- Explanatory Bulletin to Soil Map of Ireland 1980;
- Irish National Soils Map, 1:250,000k, V1b (2014). Teagasc, Cranfield University (EPA, 2014); and
- OPW - Lower Shannon Hydro-Geomorphology Study 2020.

An initial site investigation was commissioned for the purposes of project design and to inform this EIAR and was completed in March 2022. A change to the proposed greenway route resulted in the requirement for additional site investigation works which is expected to be completed in Q3/Q4 2024 and concentrate in a greenfield site along the River Shannon west of the UL Boat Club, and in a greenfield site to the rear of existing fishing cottages.

The site investigation works comprised trial pits (TP), slit trenches (ST), archaeological test trenching (ATT), boreholes (BH) completed by a combination of shell & auger cable percussion drilling and rotary core drilling, cone penetration tests (CPT), standard penetration test (SPT), plate testing, *in-situ* testing, sampling and external laboratory testing along the route of the proposed Greenway. The recorded data was used to confirm and verify information obtained from the above sources.

7.1.3 Definitions

Land is introduced into the Environmental Impact Assessment Report as per the 2014 Directive as a prescribed factor addressing the issues of land take. Land use requirements have also been identified and assessed.

Environmental scientists generally understand the word '*soil*' to refer to the fertile, organic rich layer which occurs on the surface of the Earth and the underlying layers which interact with it in terms of nutrient, ion, water and heat exchange. Using this definition, the depth of the soil layer is typically 0.3m to 1.0m thick. Geologists and engineers, on the other hand, generally understand the word '*soil*' to refer to all unconsolidated (non-lithified) organic and inorganic deposits which occur above bedrock.

For the purpose of this EIAR, the term '*soil*' refers to the unconsolidated, organic rich material closest to the Earth's surface ('*topsoil*), while the term '*subsoil*' (Quaternary Geology) is used to refer to all other unconsolidated (non-lithified) materials which occur above bedrock.

The Study Area referred to in this Chapter relates to the area within which physical works are proposed to be constructed, accessed and maintained, as detailed in Chapter 1 Section 1.2 Study Area.

7.2 'DO-NOTHING' SCENARIO

If the proposed project were not to proceed, the land, soils and geology within the Study Area would be left as it is, and no changes would be made to the existing land- use practices.

Connectivity between NTP and the University of Limerick with Corbally and Limerick City Centre is essential to the future plans for the city as stated in '*Limerick 2030, An Economic and Spatial Plan for Limerick*'. In implementing the '*Do nothing*' alternative, the opportunity to allow for a direct, safe, and enjoyable walking and cycling link from campus to campus would be lost.

7.3 LAND

The assessment of land use generally considers land take or acquisition and changes in baseline land use. The CORINE (Co-ordinated Information on the Environment) data series was established by the European Community (EC) as a means of compiling geo-spatial environmental information in a standardised and comparable manner across the European continent. The land in the Study Area can be described as follows:

Agricultural areas: Some agricultural lands (*231 - Pastures*) lie on the north side of the River Shannon surrounding existing UL sports, leisure, accommodation and educational facilities and also to the east of the Mulkear. Agricultural practices on properties on the north side are moderately intensive in nature and the predominant farm enterprises are beef. Lands to the east of the of the study area where the River Shannon and Mulkear river merge are described as class *243 - Lands principally occupied by agriculture with significant areas of natural vegetation.*

Artificial surfaces: The main UL campus where the Greenway will traverse is classed *121 – Industrial or commercial units* and *142 – Spots and leisure facilities* which comprises areas of sport, leisure and educational facilities as well as industrial and commercial units. Some discontinuous urban fabric can also be found south and east within the study area.

Wetlands, Forests and Semi-Natural Areas: Pockets of class *411 - Inland marshes* exist to the southwest of the Study Area as a mostly non-forested area with dominantly herbaceous vegetation, subject to flooding by running water.

Table 7.4. Land use within the Study Area (CORINE Land cover)

Class Value	Description	Total Surface (ha)	Surface Occupied (%)
112	Discontinuous urban fabric	59.48	10.11
121	Industrial or commercial units	140.95	23.97
142	Sport and leisure facilities	39.26	6.68
231	Pastures	212.45	36.13
243	Land principally occupied by agriculture with significant areas of natural vegetation	68.98	11.73
411	Inland marshes	22.67	3.85
511	Watercourses	44.28	7.53

Most of the land use within the Study Area is dedicated to agriculture in the form of pastures other forms of agricultural use (47.86%) and artificial surfaces (40.76%). Pasture lands are mostly located north of the River Shannon, opposite from where the works will be undertaken. The preferred Greenway route runs along the River Shannon, classified as watercourse which occupies 7.64% of the total land use and finally inland marshes can be found at the western side of the Study Area (3.85%) occupying a much smaller surface area.

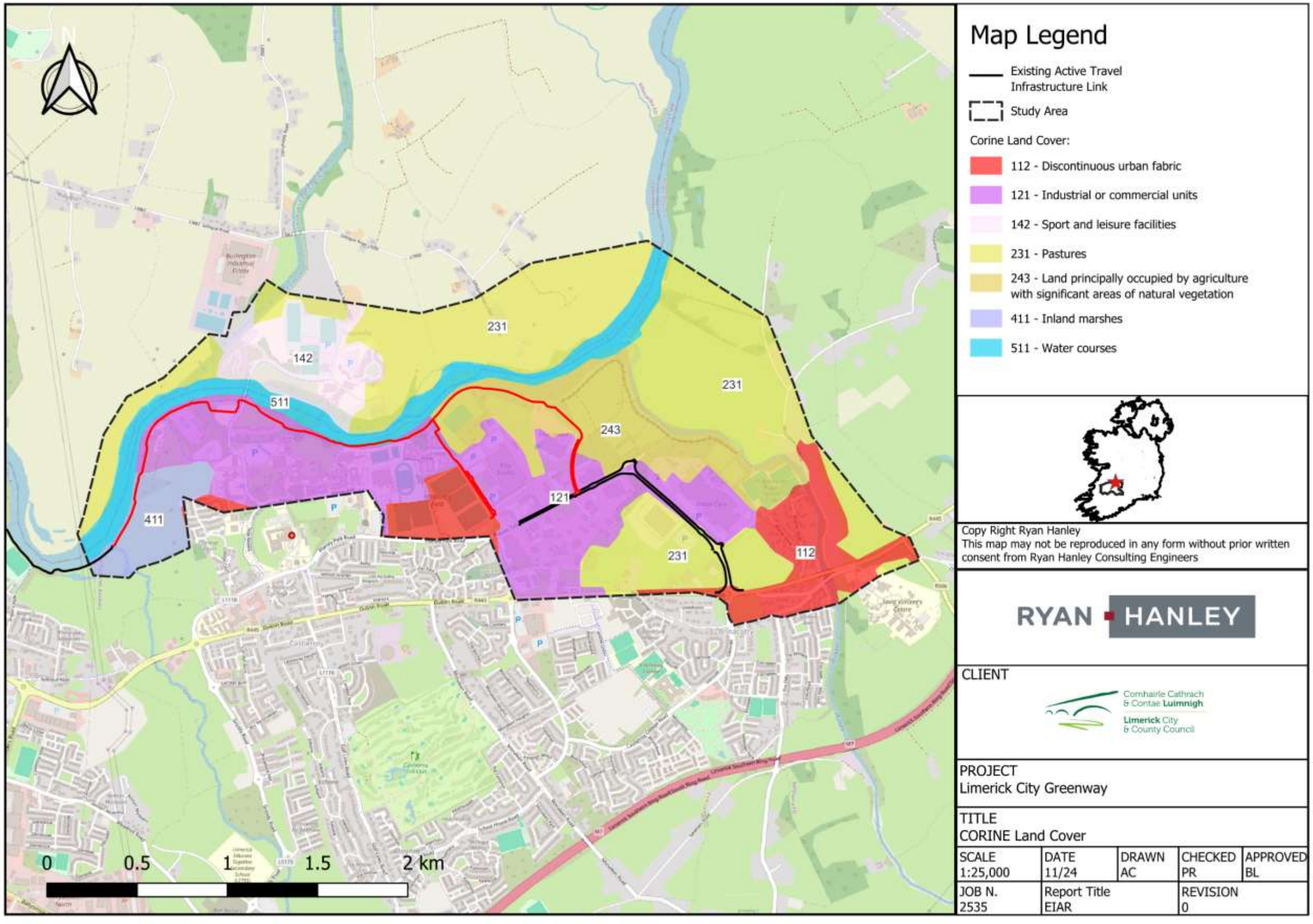


Figure 7. 1 CORINE Land Use cover in the Greenway Study Area

7.3.1 Impact on Agricultural Land

7.3.1.1 Impact on agriculture nationally

Permanent Not Significant Neutral Impact

The national agricultural land area is 4,509,256 ha including commonage and rough grazing, including 4,151,456 ha of grassland, 265,592 ha of cereals and 92,208 ha of other crops, fruit and horticulture (Central Statistics Office, 2020).

There are 135,037 farms in Ireland with an average farm size of 33.4 ha. The proposed Greenway is a 3.5-4.0m wide path which will run over a distance of approx. 4.5km primarily along an existing trail on the banks of the River Shannon which will not have a significant effect at a country wide level.

7.3.1.2 Impact on agriculture in County Limerick

Permanent Not Significant Neutral Impact

The surrounding area is primarily industrial, commercial and residential with some agricultural lands. The majority of agricultural lands in the study area lay to the north of the River Shannon. The proposed Greenway is a 3.5-4.0m wide path which will run primarily along an existing trail on the south bank of the River Shannon, and local roads will not have a significant effect on agriculture at a county level.

7.3.1.3 Impact on agriculture in the study area

Construction Phase

Potential Short-Term Slight Negative Impact

The proposed scheme will not impact on any active farm activities, farm buildings or farm facilities. Construction activities may have the potential to impact on agriculture due to noise and/or dust. In the absence of mitigation, the potential impact on agricultural land use in the Study Area ranges from slight to significant negative impact.

Operation Phase

Permanent Not Significant Neutral Impact

No impacts on agriculture are anticipated during the operation phase of the Greenway.

Mitigation Measures

Landowner consultation has been carried out during the development of the proposed Greenway as outlined in Chapter 3 – Sections 3.2.2.2 to 3.2.2.4. Consultation with landowners will continue throughout detailed design and construction of the Greenway. The following mitigation measures will be implemented in respect of land use in the Study Area to reduce any construction phase impacts:

- Existing accesses to all properties will, where practicable, be maintained during construction otherwise reasonable temporary access will be provided. The location of any temporary access will be at a suitable location and, where possible, with agreement of the landowner;
- Machinery and machinery movement will be minimised as much as possible to avoid unnecessary damage to lands such as tracking and/or soil compaction;
- Where any fences, walls, hedges, drains or land are during the course of construction or operation related maintenance work accidentally damaged they will be remedied immediately and repair

works carried out, where necessary. Any necessary permanent restoration of fences, walls, hedges, drains or land will be completed as soon as practicable after work has concluded; and

- Mitigation measures will be implemented in relation construction traffic, services, dust and noise as set out in Chapter 9 – Air Quality, Noise & Vibration and in Chapter 13 – Material Assets of the EIAR.

There will be no additional negative impacts on agriculture post construction during the operational phase of the Greenway.

Residual Impact

Temporary Not Significant to Imperceptible Impact & Temporary Not Significant Neutral Impact

Based on this assessment, the impact of the proposed Scheme on agricultural land is imperceptible on a national and county level. It is also anticipated that a temporary not significant to imperceptible impact on agricultural lands within the Study Area during construction and a temporary not significant neutral impact during the operation.

The overriding benefits to the area of a fully integrated Greenway will provide a safe transport route along the banks of the River Shannon, within the UL campus, University Road and Mc Laughlan Road and to Plassey Park Road in the National Technology Park, connecting to existing active travel infrastructure which extends to Annacotty Roundabout, whilst also enhancing the amenity value of the area.

7.3.2 Impact on Artificial Surfaces

Construction Phase

Potential Temporary Not Significant to Slight Negative Impact

A large section of the construction phase of the proposed Greenway is on an existing walking route, involves connection with existing active travel infrastructure or construction of a two-way cycle lane and footpath. Stripping of gravel, tar and/or topsoil will be required along the length of the proposed route and to prepare the ground for the Greenway to be laid in its place. Any works will constitute a potential temporary not significant to slight negative impact on artificial surfaces. The potential impact on existing pathways, access routes and road infrastructure are assessed further in Chapter 13, Material Assets. Works will be carried out and reinstated in sequence thereby reducing the temporary loss of and disruption to existing artificial surfaces at any one time.

Operational Phase

Permanent Not Significant Positive Impact

The existing pathway will not only be reinstated to its original condition following surface stripping of tar and/or soil, but will incorporate significant improvements in terms of health & safety, technical design and construction material resulting in a positive impact on artificial surfaces. Overall, the improvement to the existing routes and construction of new sections of Greenway will constitute a permanent not significant positive impact on artificial surfaces.

Mitigation Measures

The following mitigation measure will be implemented in order to minimise an impact to artificial surfaces during the construction phase of the Scheme and following reinstatement.

- General condition and structural surveys of all transport infrastructure (roads, bridges, culverts, etc) on all routes, including any haulage routes, that may be impacted as a result of the proposed

Greenway before works commence on site and after completion. Further detail is provided in Chapter 13 Material Assets.

- Haulage roads will be developed to access the Greenway, where necessary, for the purpose of construction and will be removed, incorporated into new Greenway and/or reinstated post construction. The haulage roads are of particular importance to provide access to locations along the route where works structural items such as bridges are proposed.
- Cleaning regime for machinery to be implemented in order to minimise mud/dust or other contaminants on public roads.

Residual Impact

Construction Phase

Temporary Imperceptible Negative Impact

Based on this assessment, the implementation of the measures listed above will mitigate against impacts to artificial surfaces during the construction phase of the Scheme. The residual impact will be a temporary imperceptible negative impact during the construction phase.

Operation Phase

Permanent Significant Positive Impact

Any artificial surfaces removed during works will be reinstated to their original condition in accordance with TII Publication Requirements for Rural Cycleway Design (Offline & Greenway) (TII, Aug, 2022) and any roads impacted by the Scheme will be reinstated in accordance with the TII Publication Requirements for the Reinstatement of Openings in National Roads (TII, Apr 2017) – for National Roads. In addition, an improved and integrated Greenway designed to current standards & design practices will result in a permanent significant positive impact on artificial surfaces within the Study Area.

7.4 GEOLOGY

7.4.1 Ground Investigations

Detailed site investigation (SI) was carried out by Priority Geotechnical Ltd. between 16th March and 30th March 2022 along the proposed route as reported in University of Limerick to National Technology Park Cycle Path Project, Site Investigation, Factual Report.

A change to the proposed greenway route resulted in the requirement for additional site investigation works which is expected to be completed in Q3/Q4 2024 and concentrate in a greenfield site along the River Shannon west of the UL Boat Club, and in a greenfield site to the rear of existing fishing cottages.

With regard to Cultural Heritage, where previously undisturbed areas will be impacted by proposed construction works; advance archaeological testing trenches and archaeological monitoring, as detailed in Chapter 12 – Cultural Heritage will be undertaken to ensure that previously unrecorded archaeological deposits are identified and that appropriate mitigation is employed during construction phase.

The site investigation objectives were to determine the subsurface conditions, the extents of soft ground, made ground and likely depths to rock and rock strength. The GI investigation consisted of Cable Percussion Boreholes (BH), Trial Pits (TP) and Cone Penetration Tests (CPT).

7.4.2 Bedrock Geology

The '*Geological Survey of Ireland Online Database*' indicates that the proposed Scheme extends across two bedrock units assigned to the Dinantian Period.

- Dinantian Visean Limestone Formation (Undifferentiated);
- Dinantian Rathkeale Formation; Dark muddy limestone & shaly mudstone;

The Visean Limestones (undifferentiated) are situated on the western side of the study area and the Rathkeale Formation which is comprised of dark muddy limestone & shaly mudstone on the eastern side of the study area. The Lough Gur Foundation, which is present in the study area but not along the proposed greenway route, is described as dark grey to black cherty overlies the Waulsortian Limestones, as illustrated in Figure 7.1.

The depth to bedrock was found to vary across the site, from 1.4m below ground level (BGL) towards the middle of the scheme area to 9.0m BGL in the west.

7.4.3 Geological Heritage

Geological heritage encompasses the earth science component of nature conservation including both bedrock and unconsolidated (soil) deposits close to the surface and processes (past and present) that shaped the land surface. The identification of geological heritage is achieved by finding sites or areas that best demonstrate particular types of geology, processes or phenomena that rank as noteworthy. A site selection process has been completed by the Geological Survey of Ireland (GSI), through the Irish Geological Heritage (IGH) Programme and '*The Geological Heritage of County Limerick – An Audit of County Sites in County Limerick*' was published in 2021.

The IGH programme is a partnership between GSI and the National Parks and Wildlife Service (NPWS) and aims to identify, document the wealth of geological heritage, and protect and conserve it against threats through local authority planning and promote its value with landowners and the public. The primary national site designation for geological heritage (and nature conservation in general) is the Natural Heritage Area (NHA) designation. Designation of national sites is the responsibility of the National Parks and Wildlife Service (NPWS), working in partnership with the IGH programme. The second-tier designation is that of County Geological Sites (CGS). CGSs as adopted under the National Heritage Plan are included in County Development Plans and in the Geographical Information Systems (GIS) of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system.

The Limerick Development Plan (2022-2028) states that it is an objective of the Council to "seek the conservation and protection of features of geological interest within Limerick, particularly those that would have been recognised in the past as Areas of Scientific Interest or by the Geological Survey of Ireland as being of particular value".

The GSI records show that there are no County Geological Sites in the vicinity of the proposed Scheme or the surrounding area. The nearest recorded geological site is Ballycar South, Co. Clare (IGH 02) which is located approximately 7.0km north-west of the proposed Greenway.

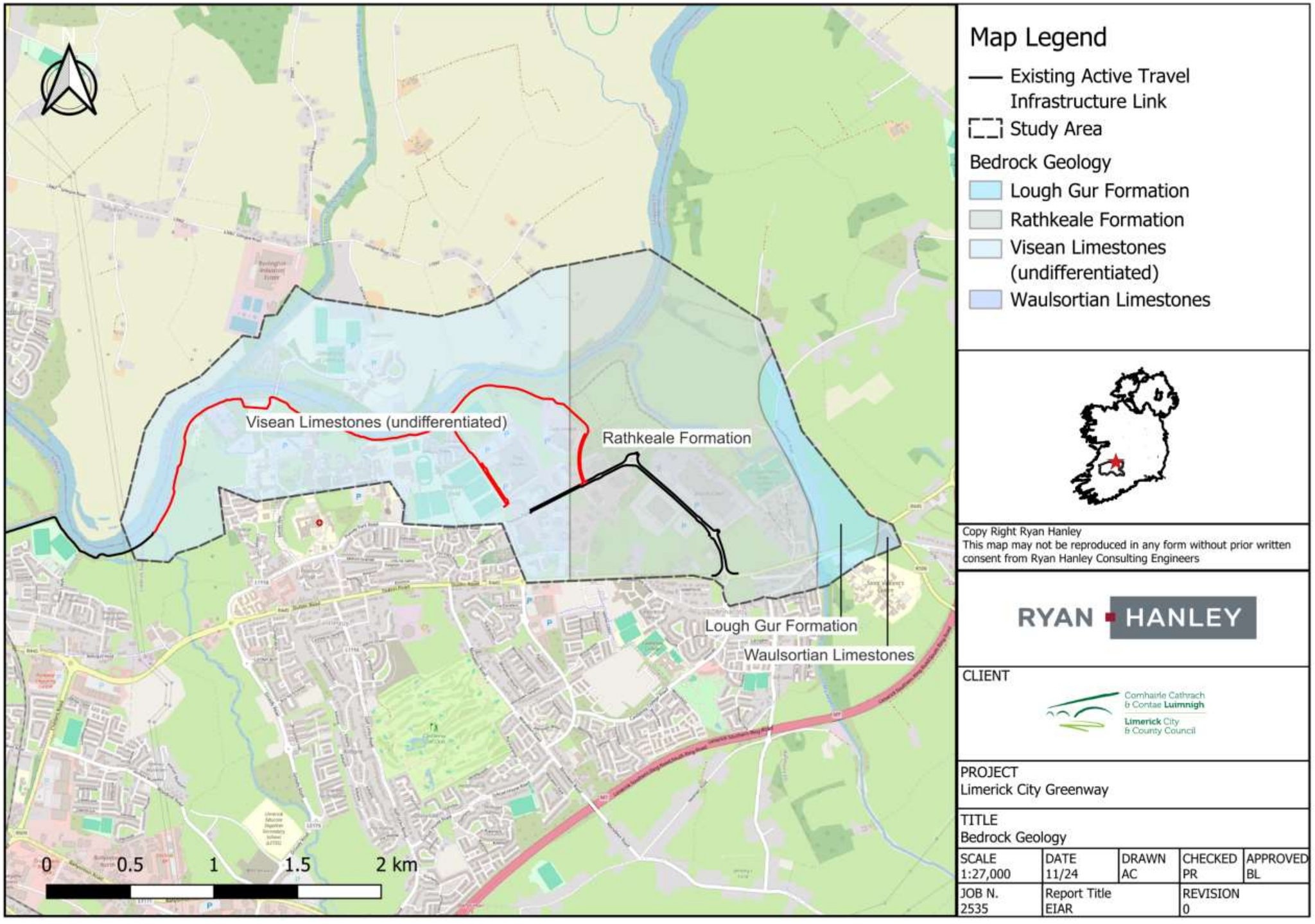


Figure 7.1. Bedrock Geology within the Greenway Study Area

7.4.4 Economic Geology

The term '*economic geology*' refers to commercial activities involving soil and bedrock. The activities involved principally comprise aggregate extraction (sand and gravel pits and quarries) and mining. A number of sources were examined for information on such commercial activities within the Study Area, including:

- GSI Active Quarry Directory 2014 www.gsi.ie;
- Aerial Photographs (2020); and
- ENVision Mines Site, the EPA's online Historic Mines Inventory.

The sources consulted above indicate that there are no active quarries within the Study Area. The nearest active quarries are presented in Table 7.5. As the abovementioned quarries are outside the Study Area, it is not envisaged the proposed Greenway will have any impact on these facilities.

Table 7.5 Quarries outside the Study Area

Location	Status	Operators
Gooig Pit, Castleconnell ~7.0km outside Study Area	Active	Roadstone Ltd.
Dereen Sand & Gravel Pit, Portcrusha. ~7.5km outside Study Area	Active	Dereen Concrete Ltd.

7.4.5 Geohazards

Upon consultation with the National Landslide Database for Ireland (Landslides Working Group), it was found that there are no known geohazards within the study area or within 10km of the study area.

7.4.6 Quaternary Geology (Subsoil)

The Quaternary Period extended from the beginning of the Ice Age to the present day and is the final one of geological time scale. Almost all surface deposits were deposited during the Quaternary Period either directly by glacier ice or by glacial meltwater. As the ice flowed over the underlying rock surface, pieces of protruding and loose rock became attached to its base. As these were carried along they both abraded the underlying rock and were ground down themselves. The rock that was picked up by the ice and partly ground down was later deposited either directly from the base or margin of the ice, or by meltwater flowing from the ice. In the former case it became Till and in the latter case it was separated out and deposited as gravel, sand, silt or clay. The composition of these sediments reflects the type of rock or substrate over which the ice flowed.

Subsoils deposited since the end of the last glaciation are typically referred to as '*recent deposits*'. The most widespread recent deposits in Ireland is peat, which occurs both as upland blanket peat and lowland raised bog.

The Geological Survey of Ireland Online Database and information obtained from the site investigations indicate that the Study Area comprises the following subsoils:

- Made ground;
- Marine/Estuarine Sediments;
- Alluvial Minerals; and
- Tills.

7.4.6.1 Made Ground

Madeground is defined as material, including soil, which has been deposited on land and/or altered by anthropogenic (human) activity. Madeground was encountered during the site investigation and ranged in thickness from 0.1 to 2.3 m. The site investigation indicates that localised pockets of made ground are to be found along the route of the proposed Greenway. The pockets of madeground as well as containing some traces of timber and bricks are composed of both reworked glacial and recent subsoils.

The key risk associated with madeground is its uncertain age and potential to harbour contamination. However, no evidence of historical activities which could potentially have contributed to soil contamination were identified along the route or in the vicinity of the proposed Scheme.

7.4.6.2 Marine/Estuarine Sediments

Deposits of silts and clays of marine/estuarine origin is recorded within the Study Area. The subsoil mapping as presented on the EPA geoportal Database shows these deposits are found along the banks of the River Shannon. These deposits are characterised by very fine-grained subsoils and are evident where high sediment cliffs are formed. Drilling logs recorded a fine to course sandy gravelly clay which was overlain by a layer of madeground. It is unlikely that the installation of the proposed Greenway which will be shallow (<0.5m BGL) will have any significant impact on Marine/Estuarine Silts and Clays.

7.4.6.3 Alluvium

Alluvium is a young sediment that was recently eroded and carried off the hill side by a surface watercourses. The sediment is ground into finer and finer grains each time it moves downstream, a process that can take thousands of years.

Alluvium soils are typically found at or in the vicinity of a surface watercourse. The EPA geoportal Database indicates that Alluvium mineral subsoils are predominantly situated in the eastern areas of the study area. As outlined in Lower Shannon Hydro-Geomorphology Study mixed sediment from the Mulkear River tributary enters the River Shannon and this material is deposited on the left bank as a submerged bar and riverside feature like Plassey beach. With shallow excavations (<0.5m BGL) expected close to this deposit in the eastern part of the study area, it is unlikely that the proposed Scheme will impact on Alluvium.

7.4.6.4 Tills

Glacial till is a generic term which applies to glacially derived and/or transported soil which is deposited beneath or on the margins of a glacier or ice sheet. The Teagasc subsoil map, as presented on the Geological Survey of Ireland Online Database, indicates that glacial till is the predominant subsoil occurring in the Study Area and is principally derived from limestones and gravels.

Areas of exposed till material are evident along the river Shannon and Mulkear where in some areas they form elevated cliffs. As the ground investigation for the proposed development was focused on areas where bridge and platform infrastructure are to be concentrated, there was no intensive ground investigation carried out within the area recorded as Glacial Till. As such there are no borehole records to confirm or deny

the Teagasc Subsoil mapping as shown on the GSI Online Database. However, given the shallow excavations expected, It is unlikely that the proposed scheme will impact on this Glacial Till.

7.4.7 Potential Impacts on Geology

Construction Phase

The key effect associated with the construction phase of the Greenway is the excavation, handling, storage, processing and transport of any earthwork materials. The estimated volume of excavation anticipated during the construction phase is presented on Table 7.6.

Table 7.6 Volumes of Excavated Material

Origin of Excavation	Total Volume of Excavated Material	Volume of Excavated Material to be Transported Off Site
Excavation of ground along proposed route on Southern banks of River Shannon for the Greenway	6,181 m^3	0 m^3

There are a number of potentially negative environmental impacts associated with the handling of excavated materials. These impacts can arise directly as a result of on-site excavation and construction activities or indirectly, due to placement of excess unsuitable materials at off-site locations.

In general, the potential impacts on soils and geology associated with the greenway construction include, excavation and compaction of soils, use of stone and aggregate for construction of greenway pavement, use and storage of fuels presenting a contamination risk and erosion of soils exposed during earthwork.

It is also considered that the importation of granular fill and other products in the form of concrete or other construction related products will have a permanent moderate/slight impact on the source quarries.

Site investigations were undertaken to inform detailed design of the project, the impact of which is predicted to be imperceptible based on the scale of the proposed site investigation works and as such has not been assessed below.

7.4.7.1 Loss of Bedrock

Potential Permanent Slight Negative Impact

As detailed in Section 7.4.1, the Study Area is underlain by the Dinantian Visean Limestone Formation (Undifferentiated) and Dinantian Rathkeale Formation; Dark muddy limestone & shaly mudstone. A small section to the east of the Study Area is on Waulsortian Limestones. A section of the Lough Gur Foundation which is described as dark grey to black cherty overlies the Waulsortian Limestones. As highlighted in Section 7.4.2, the depth to bedrock based on geotechnical data collected was found to vary across the site, from 1.4m below ground level (BGL) towards the middle of the scheme area to 9.0m BGL in the west

Based on geotechnical data collected, on maximum proposed excavation depths for the greenway sections of approximately 0.5m BGL for the greenway sections and an average depth of 1.0m for manhole chambers as described in Chapter 4 - Description, it is considered unlikely that any significant quantities of bedrock will be encountered.

It is expected that no bedrock or indeed any significant quantities will be encountered during the proposed works, however as the type of bedrocks (if encountered) are abundant throughout the Study Area any portion to be removed will be imperceptible in comparison to the volumes retained and as such will not have a significant impact on the bedrock of the Study Area.

Mitigation Measures

One of the primary mitigation measures employed at the preliminary design stage is the minimisation of volumes of bedrock excavation during the greenway construction.

Where it is necessary to remove bedrock in green fields to facilitate construction of the proposed greenway, the material removed will be transported to the closest storage compound suitably and reused where possible.

Where it is necessary to remove existing concrete to facilitate construction of the proposed greenway, the concrete shall be transported to the closest temporary construction compound and reused where possible.

Residual Impact

Permanent Imperceptible Negative Impact

With the mitigation in place, any loss of bedrock as a result of the installation of the Greenway will be minimal, this impact will constitute a permanent imperceptible negative impact.

Operation Phase

Minor amounts of granular material may be required to maintain the greenway during operation which will result in an

7.4.7.2 Loss of Geological Heritage

Potential Neutral Impact

There are no geological heritage sites in the vicinity of the proposed works of sufficient geological or geomorphological importance on a national or county scale to merit consideration for designation as a Natural Heritage Area (NHA). In addition, there are no County Geological Sites (CGSs) in the vicinity of the Study Area.

It is considered that the potential impact will be neutral.

7.4.7.3 Loss of Quaternary Geology

Potential Permanent Slight Negative Impact

As described in Section 7.4.6, the Study Area is underlain by madeground, marine/estuarine sediments, alluvial minerals and till derived from limestone rocks.

The impact of the removal of excavated material from the proposed work area will be minimal as these subsoils are in abundance throughout the Study Area, and the county as a whole.

The majority of the proposed route of the Greenway is underlain by madeground or ground which has been manipulated and reworked by human activity. There is a risk however that contaminated material may be encountered during the construction phase. No evidence of historic activities which could potentially have contributed to soil contamination was identified in the immediate vicinity of the proposed Greenway during the desk study or geotechnical investigation. Although the key risk with madeground is its uncertain origin,

on the basis of available evidence and taking into consideration the anticipated volume of made ground to be excavated, the potential impact is regarded as being slight negative.

Mitigation Measures

It is expected that excavated soil will be reused as fill where possible during the construction of the proposed Greenway. Excavated subsoils will be mounded on the river side of the path and reseeded.

Residual Impact

Permanent Imperceptible Negative Impact

With the mitigation in place, the loss of quaternary geology will be minimised. This impact will constitute a residual permanent imperceptible negative impact.

Operation Phase

No impacts on quaternary geology are anticipated during the operation phase of the Greenway.

7.5 SOILS

Soil is the top layer of the earth's crust. It is formed by mineral particles, organic matter, water, air and living organisms. It is an extremely complex, variable and living medium and its characteristics are a function of parent subsoil or bedrock materials, climate, relief and the actions of living organisms over time.

Soil can take thousands of years to evolve and is essentially a non-renewable resource. Soil performs many vital functions. It supports food and other biomass production (for example forestry and biofuels) by providing anchorage for vegetation and storing water and nutrients long enough for plant to absorb them. Soil also stores, filters and transforms other substances including carbon and nitrogen. It has a role supporting habitats and serves as a platform for human activity, landscape and archaeology.

7.5.1 Soil Formation

There are three principal soil formation processes that take place in Ireland, leaching, gleisation and calcification.

Through the *leaching* process, soluble constituents are carried down through the soil profile, the soil becomes progressively more acidic until relatively insoluble constitutes such as iron, aluminium and humus are washed deeper into the soil. Organic matter may accumulate on the surface and an iron pan may be formed at a lower level in the soil. At this point the leaching process may be referred to as podzolisation.

Gleisation is the soil-forming process resulting from the water-logging, possibly due to high water tables, or the impermeable nature of the soil itself. The movement of water through the soil is highly restricted and as a result leaching is very limited. Due to anaerobic conditions many soil constituents are converted by chemical processes into reduced forms. The soil usually takes a grey or blue colour as a result of the reoxidation processes.

Calcification is a process resulting in the redistribution of calcium carbonate in the soil profile without complete removal of it. Regions where rainfall is typically 750mm or less are affected by this process. Since the rainfall is low, the percolation of water through the profile is not sufficient to completely remove the calcium carbonate that existed in the parent material or that was produced by reaction between carbonic acid and the calcium hydrolysed from silicate minerals. Accumulation of carbonates at some point in the profile is typical of calcification. Calcium also tends to keep fine clay in a granular condition resulting in very little downward clay movement.

Due to the climate in Ireland, Leaching and Gleisation are the two most common soil formation processes.

7.5.2 Soil Associations

The General Soil Map of Ireland classifies the lands within in which the Study Area as '*Alluvial region*' and '*Lowland*'.

The alluvial region includes the extensive river and estuarine flats associated mainly with the River Shannon. In the vicinity of Limerick City, the Shannon alluvium extends a mile of so on either side of the river. The lowland region mainly occupies central and eastern Limerick. The lowland region, in general coincides with the Carboniferous limestone formations. The topography of the region is gently undulating to easy rolling with most slopes less than 8◦.

These lands generally have a slope ranging between 2 and 6° and generally occur at elevations below 150 m. The Study Area comprises principally Brown Podzolics (60%). Associated soil classifications are defined as Acid Brown Earths (20%) and Gleys (20%). These soils are mainly derived from Mica schist glacial till. Madeground from the surface was recorded in a number of locations as part of the site investigation contract.

Brown Podzolic soils were formed under the influence of the podzolisation process, whereby soils are subject to leaching and are depleted of nutrients and become acid. The profile of Brown Podzolics generally consists of a surface A1 horizon in which organic and mineral matter are mixed which overlays a reddish-brown B horizon in with iron, aluminium and sometimes humus have accumulated. The physical characteristic of Brown Podzolic soils makes them suitable for cultivated cropping and pasture production. The low nutrient content of the soil can be remedied with the addition of lime and fertiliser.

Acid Brown Earths are relatively mature, well drained, mineral soil with a relatively uniform profile. These soils have not been extensively leached with the result that there are no obvious signs of removal and deposition of iron oxides, humus or clays. In many cases a certain degree of leaching has taken place resulting in the translocation of soluble constituents, notably calcium and magnesium. The majority of Brown Earths result from lime deficient parent minerals and are therefore acidic in nature. The desirable structure and drainage characteristics results in these soils being the most extensively cultivated soils, making up for a relatively low nutrient status by responding well to manurial amendments.

Gleys are soils in which the effects of poor drainage dominate and which have developed under the influence of waterlogging, characterised by the Gleisation process described above. Most gleys have poor physical conditions which make them unsuitable for cultivation or for intensive grassland farming. Their productive capacity is also affected by restricted growth in spring and autumn.

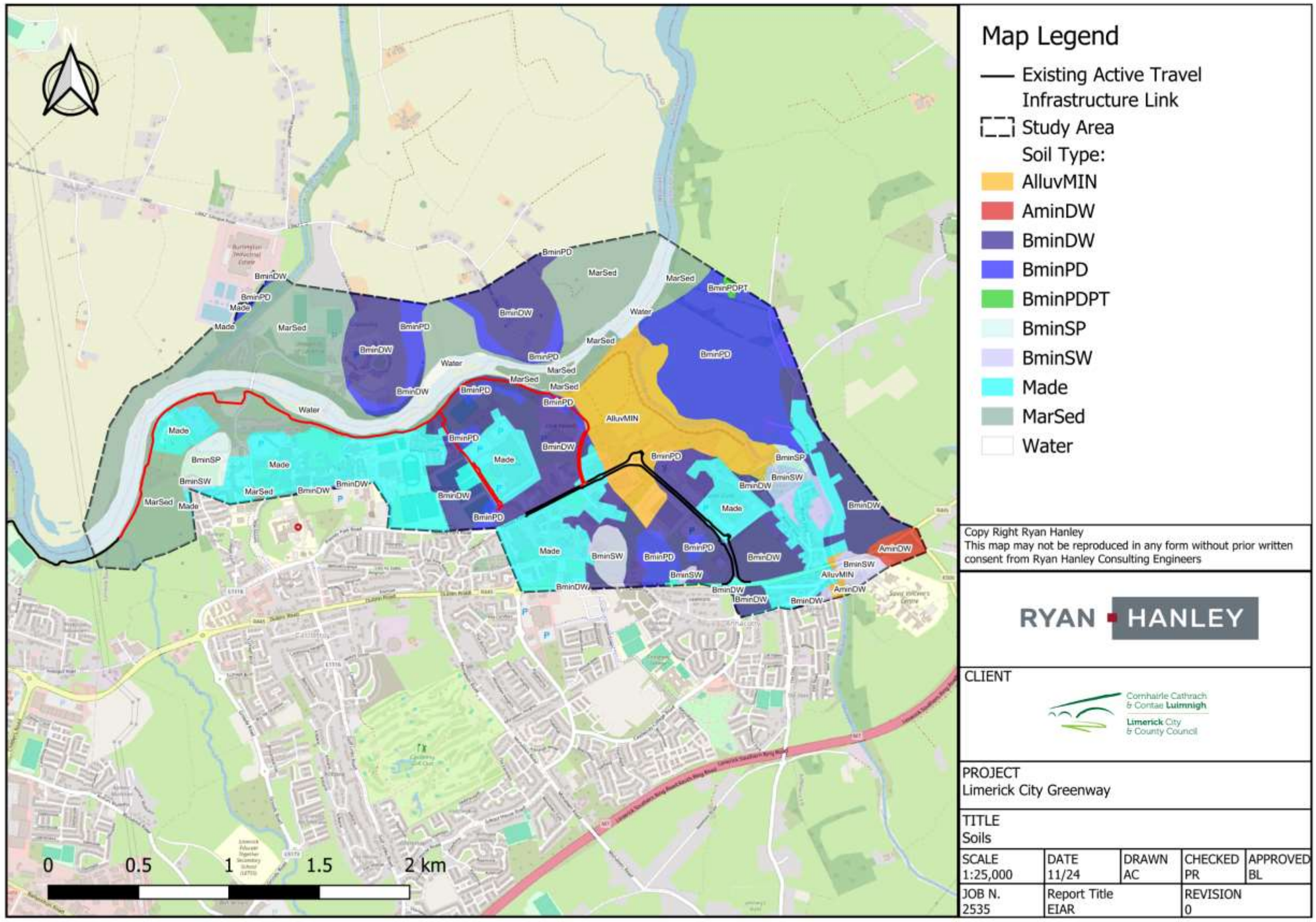


Figure 7.2. Soils within the Study Area of the proposed Greenway

7.5.3 Potential Impacts on Soil

7.5.3.1 Loss of Soil

Construction Phase

Permanent Slight to Moderate Negative Impact

As the proposed Greenway traverses areas of land outside of artificial surfaces such as areas of amenity grassland and scrub areas prior to connecting onto McLoughlin Road in the National Technology Park (NTP) and also taking into account the soil profiles encountered during the site investigation it is likely that the project will have some impact on the soil in the area.

Any loss of soil, or other potential impacts will be during the construction phase and likely to be associated with excavation, handling, storage, processing and transport of earthworks materials related to the Greenway. Where soils are disturbed, excavated and/or temporarily stored for re-use during construction and subsequent reinstatement of topsoil, they are prone to erosion by wind and/or surface water run-off. *In-situ* soils may also be compacted by construction machinery, reducing their ability to store water, which in turn may lead to an increase in run-off and possible soil erosion.

Soils underlying the proposed footprint of works are abundant on a local and regional scale, the soils are also considered to be composed of both reworked shallow topsoil. The volume of soils exposed during the construction phase will also be relatively small. The volume requiring excavation will be offset by its reuse during construction works. This constitutes a potential permanent slight to moderate negative impact.

Mitigation Measures

Any excavated topsoil will be temporarily stored in site compounds and used to for reinstatement purposes as and where required. The amount stored at any time will be minimised by completing the areas of the Greenway in a timely and efficient manner and on a sectional basis with each section being completed before proceeding to the next as set out in Chapter 4, Sections 4.19 and 4.2. Storage compounds will be defined and fenced off with silt fencing and a surface water management system in place to prevent run off and minimise the volume of suspended solids transported by surface water run-off and discharged into local watercourses. Excavated soil will be reused where possible in the sub-base material or for use in graded banking material.

The following measures will form part of the surface water management system; preventing sediment erosion and ingress into the watercourse (as detailed in Chapter 6 Biodiversity and Chapter 8 Water) and will be implemented during the construction phase:

Where bank stabilisation works are to take place, excessive ingress of sediment into the watercourse should be prevented where possible. Sediment barriers such as sediment netting/ fences or silt traps should be used to temporarily trap sediment and prevent sediment transport into watercourse, at all interfaces of the works area with a waterbody in advance of construction works on the banks of the watercourse;

- Works undertaken on the banks should be fully consolidated to prevent scour and run off of silt, Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and may also the sowing of grass seed on bare soil.
- Particular care to prevent run-off of sediment or pollutants into the river should be taken at the Compound Site 1, Compound Site 2 and Compound Site 3, where their proximity to the River as having the potential for the highest surface runoff.

- Guidelines for minimising impacts on water quality and fisheries in relation to Construction shall be implemented including, but not limited to, CIRIA C532 *"Control of water pollution from construction sites - Guidance for consultants and contractors"*, Inland Fisheries Ireland (IFI) guidelines and Transport Infrastructure Ireland (TII) guidelines

Residual Impact – Permanent Slight Negative Impact

Taking into account that any excavated topsoil and subsoil will be used in the reinstatement of works areas and as a subbase landscaping material in conjunction with the mitigation measures as outlined above, the residual impact of the proposed scheme on the soil in the area is a permanent slight negative impact.

Operation Phase

No impacts on soils are anticipated during the operation phase of the scheme.

7.5.3.2 Contaminated Land

Construction Phase

Short Term Moderate Negative Impact

With the presence of an extensive road network within the study area and along the route of the proposed greenway there is a risk of historic fuel leakages and other localised road related contamination in the upper soils which must be considered an unknown risk during construction.

Potential effects may arise from the improper management, storage and handling of fuels and lubricants for equipment and machinery and of non-hazardous or hazardous liquid and solid wastes during the construction phase of the proposed Greenway. There is always a risk of localised contamination of soils resulting from an accident, spill or leak.

A site investigation was carried out in March 2022. The soil profiles from the SI, indicates the presence of made ground along the route of the proposed Greenway, composted of both reworked glacial and recent subsoils. Made ground is also likely to be encountered in works areas associated with the path and road crossing as well as junction realignment. It is also possible that hazardous materials may be encountered during excavation works at these locations during the construction phase of the Greenway.

In addition, two invasive species were identified within the Study Area during surveys carried out between 2020 and 2024; Giant Hogweed (*H. mategzzianum*) and Himalayan balsam (*I. glandulifera*). Invasive species infestation was found to be extensive throughout the length of the proposed Greenway within the Study Area the locations of which are shown in Chapter 6, Figure 6.6.

Failure to implement appropriate management of soil contaminated with Giant Hogweed or Himalayan balsam during the construction phase of the Scheme could result in the spread and regrowth of the species in other areas.

Operational Phase

Temporary not significant negative impact

The maintenance activities and responsibilities associated with the Greenway are outlined in Chapter 4, Section 4.22. Maintenance activities are predicted to have a potential temporary impact in terms of the improper use of fuels used in equipment and machinery for repair work, maintenance of vegetation and grass cutting. Due to the localised and small-scale nature of these works, the potential impact is anticipated to be a temporary not significant negative impact during the operation phase of the Scheme.

Mitigation Measures

In order to reduce the risk of soil contamination as a result of accidents, spills, leaks or flooding the following measures will be implemented:

Fuels, chemicals, liquids, and solid wastes will be stored on impermeable surfaces. Fuels stored on site will also be kept to a minimum. Machinery refuelling shall be undertaken using a jeep mounted bowser to minimise storage of fuel on site. Small quantities of chemicals and petrol required for tools shall be stored with drip trays in a vented fuel store in the temporary works compound.

Plant refuelling shall be undertaken on hard standing at designated areas, and not within 10 metres of any watercourse, in accordance with best practice guidelines. No refuelling will be permitted in or near soil or rock cuttings. Only designated trained operatives will be authorised to refuel machinery on-site.

Machinery and equipment shall be inspected regularly for any leaks.

Storage of fuel and oil will be regularly inspected for leaks or signs of damage.

A lock system will be fitted on all taps, nozzles or valves associated with refuelling equipment.

All hydrocarbons and other potential contaminants will be stored within suitably constructed bunds in accordance with best practice guidelines. The bunds will be sized to hold 110% of the volume of the stored contaminants in order to contain a spill should it occur. The base and walls of the bund shall be impermeable to water and oil.

Spill kits will be provided at refuelling areas and at high risk/sensitive areas.

Large volumes of excavated material will not be allowed to accumulate within the temporary working areas. Any stockpiling of soils will be confined to compound areas and runoff will be prevented by the use of a silt fence or bund.

There will be no storage of materials, machinery or soil in areas that are susceptible to flooding or along the proposed greenway route. Storage of materials will happen in temporary construction compounds in Flood Zone C areas only. Materials to be used in constructing the greenway will be brought to site and used immediately.

Any contaminated soil if encountered will be stored separately from non-hazardous waste in bunded areas before being collected by an authorised waste contractor and transported to an approved waste facility for treatment and safe disposal.

An emergency response plan to deal with accidental spillages is contained within the Construction Environmental Management Plan. This will include providing toolbox talks regarding the appropriate use of spill kits and best practice for the management of accidental spills.

All Giant Hogweed and Himalayan balsam within and surrounding the site of the proposed works will be subject to the Invasive Species Management Plan.

Residual Impact –Short Term Slight Negative Impact

The implementation of the above measures will mitigate the risk of contamination as a result of fuels, chemicals and invasive species associated with construction phase of the project. The residual impact is considered to be a Short Term Slight Negative Impact.

7.6 Assessment of Cumulative and In-combination Impacts

7.6.1 Cumulative Impact Assessment

All elements of the proposed development were assessed in order to identify any cumulative effects.

The movement and removal of soils, overburden and rock during the construction phase of the proposed development has the potential to give rise to impact on water quality and aquatic ecology as addressed in Chapter 6 - Biodiversity and Chapter 8 - Water, respectively. The EIAR chapters and the Construction Environmental Management Plan provide robust information on how to avoid such effects.

The movement and removal of soils, overburden and/or rock during the construction phase has the potential to give rise to noise and dust impacts. However, these effects and the measures that are in place to avoid any cumulative or interactive effects are fully described in Chapter 9 – Air Quality, Noice and Vibration of the EIAR.

Based on the assessment of all elements of the proposed Scheme, no significant cumulative effects are anticipated.

It is considered that the proposed Limerick City Greenway (UL to NTP), the linear scale of the works and the implementation of effective mitigation and best practice will ensure that the Greenway, when considered on its own, will minimise as much as possible significant effects on land, soils and geology. Overall, the benefits of installation of a complete Greenway linking up with Active Travel routes will have a positive effect on the area.

7.6.2 In-Combination Impact Assessment

A search in relation to plans and projects that may have the potential to result in a cumulative in-combination effects on the environment was carried out as part of the EIAR. The proposed Greenway project has been considered, in combination with plans and the projects set out in Chapter 3, Section 3.5 of the EIAR. In addition, the following data sources were assessed:

- Limerick Development Plan 2022-2028;
- An Bord Pleanála Website (Planning Searches);
- Myplan.ie; and
- Web search for major infrastructure projects in Annacotty, Castletroy and surrounding areas.

The above sources were consulted to identify developments which could cause cumulative in-combination impacts with the proposed project. No significant housing developments are planned for within the study area which would have a potential effect. There is a grant of planning for a golf academy west of the UL Boat Club and this will expire in 2026 so there should be no overlap with the proposed Greenway. There is a grant of planning for a playing pitch project east of Kilmurray Student village, but the proposed greenway will not interfere with the proposals.

Following a detailed assessment of the receiving environment, the potential for any further impact when considered in combination with any or all of the plans and projects set out in Chapter 3, section 3.5, was found to have no potential for significant in-combination cumulative effects on land, soils and geology.

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8 WATER

8.1 INTRODUCTION

The chapter assesses and evaluates the proposed Limerick City Greenway (UL to NTP) concerning the hydrological and hydrogeological environment. Refer to Figure 8.1. The impact of the Limerick City Greenway (UL to NTP) is assessed in this chapter against the baseline conditions and character of the Study Area. Mitigation measures are provided to minimise or eliminate any potential negative effects on water and the residual effects are assessed. Potential for cumulative effects on the hydrological and hydrogeological environment is also assessed in this chapter.

A detailed description of the proposed development and construction activities is provided in Chapter 4: Description of Proposed Development. Impacts on Aquatic Ecology are assessed in Chapter 6: Biodiversity.

The Limerick City Greenway (UL to NTP) has an indefinite operational duration; therefore, it is not considered necessary to assess the impacts of decommissioning.

The Study Area, for the purposes of this chapter, covers an area of approximately 5.8km^2 and includes UL Campus, the National Technology Park (NTP), and the south bank of the Lower River Shannon. The main water body present is the Lower River Shannon which traverses through the centre of the Study Area. The River Groody is present at the western end of the area and the River Mulkear is at the eastern end. A small section of the Blackwater is present to the north of the Study Area near the Cappavilla UL Campus.

The scope of this chapter entails the following:

- Description of the hydrological, hydrogeological and water quality setting relevant to the proposed works;
- Assessment of the 'do nothing' scenario
- Description and evaluation of the likely impacts (on the water environment) of the development in terms of construction and operational phases including the character, magnitude and duration of such impacts;
- Description and development of proposed mitigation measures to minimise any potential impacts;
- Description of the residual impacts after mitigation; and
- Description of impact interactions and cumulative impacts.

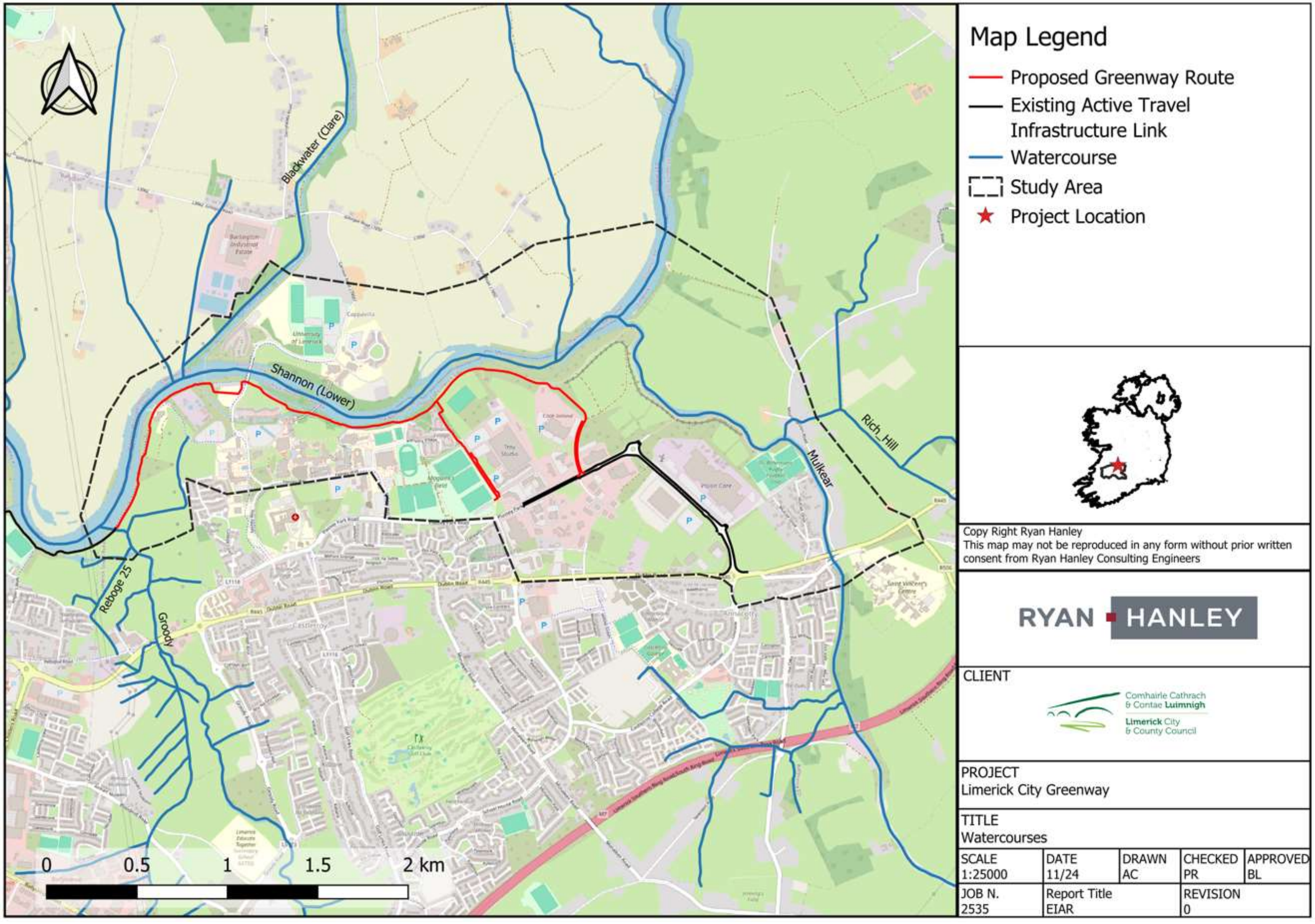


Figure 8-1: Study Area

8.2 METHODOLOGY

8.2.1 Literature Review

A desk study of relevant data was conducted in July/August 2024. The following documentation and sources were reviewed:

- The Water Framework Directive
- National River Basin Management Plan (2022 – 2027)
- Ordnance Survey Ireland (OSI) mapping – www.osi.ie
- Geological Survey of Ireland (GSI) – www.gsi.ie
- The Environmental Protection Agency (EPA) - a data request was submitted for any relevant water quality data within the Lower Shannon catchment, limited to the last ten years. An online search of the EPA databases was conducted through the following websites:
    - www.catchments.ie for all catchment data
    - water quality database www.epa.ie
- Met Éireann meteorological data - www.met.ie;
- The Floods Directive (2007/60/DC)
- OPW hydrological data:
    - www.floodinfo.ie;
    - Real time data - www.waterlevel.ie;
    - Archived data - www.opw.ie/hydro-data;
- Limerick City and County Council:
    - Limerick Development Plan 2022-2028
    - Planning Register;
    - Water Services – Abstractions, Discharges & Supply Schemes;
- National Parks and Wildlife Services (NPWS):
    - Designated Areas Mapping;
    - Site Synopsis Reports;
- National Biodiversity Data Centre (NBDC) - https://maps.biodiversityireland.ie
- Well card data compiled by the Geological Survey of Ireland (GSI).

8.2.2 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union (EU) Directive 2011/92/EU on the assessment of the effects of projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU. The key objective of the amendment was to protect water resources and prevent a deterioration of water in compliance with the EU Water Framework Directive (2000/60/EC).

The WFD requires EU member states to manage their water resources on an integrated basis to achieve at least '*good*' ecological status. In Ireland this is achieved through the River Basin Management Plan for Ireland 2022-2027 (DoHGLP, 2024; 'the RBMP'). The RBMP outlines all the actions required to improve the ecological status, with county councils and Uisce Éireann (UÉ) playing an important role in the implementation of the plan.

WFD characterisation, monitoring and status assessment programmes are governed by three Regulations:

- Water Policy Regulations 2003 - 2014;
- European Communities Environmental Objectives (Surface Waters) Regulations 2009 - 2019 which provide an extensive suite of environmental standards for Irish surface waters; and
- European Communities Environmental Objectives (Groundwater) Regulations 2010 – 2016 which provide groundwater quality standards and threshold values for groundwater characterisation and protection against deterioration.

The WFD's main objectives are:

- To protect, enhance and restore the status of all bodies of water and to prevent their further deterioration;
- To achieve at least 'good status' by 2027 (with some limited exemptions);
- To promote sustainable use of water;
- To reduce the pollution of water by particularly hazardous 'priority' substances; and
- To lessen the effects of flooding and drought.

This project will contribute to the achievement of the WFD as cycling is an environmentally friendly activity and encourages a sustainable interaction with the water environment without placing direct pressure on this resource. The proposed Greenway will also support natural vegetation along the River Shannon and reduce sedimentation which will prevent a deterioration in water quality.

The requirements of the following legislation are complied with:

- Planning and Development Acts, 2000 (as amended).
- Planning and Development Regulations, 2001 (as amended).
- S.I. No 296/2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law.
- S.I. No. 94/1997 European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of '*daughter*' Groundwater Directive (2006/118/EC).

Other relevant Acts include:

- Quality of Salmonid Waters Regulations (S.I No 293 of 1988) (Although this has been superseded by the WFD).

This chapter was also informed in accordance with the following guidelines:

- Guidelines on the Information to be contained in Environmental Impact Assessment Reports, EPA, 2022;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses.
- CIRIA (Construction Industry Research and Information Association) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006).
- CIRIA (Construction Industry Research and Information Association) Control of Water Pollution from Construction sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001.
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes
- Advice Notes for Preparing Environmental Impact Statements, Draft September 2015.

8.2.3 Status of Water Bodies

'Status' is a descriptor term that incorporates ecological, physio-chemical and hydromorphological data and facilitates catchment comparisons on an EU scale and is assessed by the EPA. Biological information is provided in the form of Q values. Q values are biotic indices used to express ecological water quality and are based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. Q1 indicates a seriously polluted water body and Q5 indicates unpolluted water of high quality. A value of Q3 indicates moderately polluted water. These Q value ratings are shown in **Table 8:1**.

The Ecological Quality Ratio (EQR) represents the comparison between the observed biological parameter values (such as Q-values) for a surface water body and the values expected under pristine or reference conditions for that water type. The macroinvertebrate EQR is used to classify sites based on their ecological quality, as required by river basin management planning under the WFD. The EQR is a numerical score ranging from 0 to 1, where values near 1 indicate high ecological status, and values near 0 indicate poor status. This system allows consistent comparison of water quality across the European Union, as each member state assigns EQR values to ecological status categories: 'High', 'Good', 'Moderate', 'Poor', and 'Bad'. According to the WFD, all surface waters must achieve or be maintained at least at 'Good Ecological Status' (Q4) within specific timeframes outlined in the River Basin Management Plans (RBMPs), and high-status waters (Q4-5 and Q5) must not deteriorate.

Table 8:1 Q Value Classification

Quality Ratings	EQR*	Pollution Status		Ecological Status
Q5	1.0	Unpolluted	Good	**High**

Quality Ratings	EQR*	Pollution Status		Ecological Status
Q4-5	0.9	Unpolluted	Fair to Good	
Q4	0.8	Unpolluted	Fair	**Good**
Q3-4	0.7	Slightly Polluted	Doubtful to Fair	**Moderate**
Q3	0.6	Moderately Polluted	Doubtful	**Poor**
Q2-3	0.5	Moderately Polluted	Poor to Doubtful	
Q2	0.4	Seriously Polluted	Poor	**Bad**
Q1, Q1-2	<0.3	Seriously Polluted	Bad to Poor	

*Ecological Quality Ratio

In addition to the status assessment (conducted every three years at EPA monitoring stations), each waterbody is classified into different risk categories based on whether it is likely to meet the WFD objectives by 2027. Risk is determined by combining monitoring data, catchment pressures, and information on implemented protection measures.

The three risk categories are:

- Waterbodies At Risk of not meeting WFD objectives.
- Waterbodies Not at Risk, meaning they are currently meeting WFD objectives.
- Waterbodies classified as Review, where additional information is needed to assess their risk status.

The receiving water body associated with the proposed Greenway, which could potentially be impacted upon is the Shannon (Lower)_060' (IE_SH_25S012600).

8.2.4 Consultations

A scoping document was prepared and issued to the relevant stakeholders (incl. Limerick County Council., EPA, NPWS and IFI) and any responses received are included in Chapter 2 of the EIAR. Consideration has been given to these responses in the preparation of this Chapter of the EIAR.

8.2.5 Surface Water Chemistry

River Shannon Data Review

A review of available River Shannon EPA water chemistry data was conducted for the relevant study area. Physico-chemical parameters were interpreted with respect to legally binding environmental quality national standards (EQSs) under Surface Water Regulations (S.I. 77 of 2019) to support the achievement of high and good ecological status, as set out in Table 8:2.

Table 8:2: Physio-chemical boundary values for status in Irish Rivers (S.I. 77 of 2019)

Parameter	High Status	Good Status
Ortho P (MRP) (mg P/l)	≤ 0.025 (mean); ≤ 0.045 (95%ile)	≤ 0.035 (mean); ≤ 0.075 (95%ile)
Ammonia (mg N/l)	≤ 0.040 (mean); ≤ 0.090 (95%ile)	≤ 0.065 (mean); ≤ 0.140 (95%ile)
BOD (mg O_2/l)	≤ 1.3 (mean) or ≤ 2.2 (95%ile)	≤ 1.5 (mean) or ≤ 2.6 (95%ile)
Dissolved Oxygen (% sat.)		80 -120%

8.2.6 Hydraulic Modelling

The hydraulic modelling data contained within this chapter relating to flood levels on the River Shannon was accessed via the OPW flood data Web Mapping Service (WMS).

8.2.7 Assessment of Effects Criteria

This assessment identifies and describes likely significant effects of the proposed development based on the sensitivity of the receptors. Using the above methodologies, the sensitivities of water environment receptors were analysed using a combination of desk and baseline field studies. Levels of hydrological and hydrogeological receptor importance are then defined using criteria in Table 8:3 and Table 8:4, respectively.

The likely effects are described as per EPA (2022) concerning their quality (positive, neutral or negative), significance (imperceptible to profound), extent/magnitude, context (e.g., geographical), probability (likely or unlikely), duration (momentary to permanent), frequency and reversibility. The impact assessment descriptors used in this chapter are shown in Table 8:5 and Table 8:6 (from EPA 2022).

Table 8:3: Criteria for rating Site Importance for Hydrological Attributes at EIA stage (NRA, 2008)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	▪ River, wetland or surface water body ecosystem protected by EU legislation, e.g. '*European sites*' designated under the Habitats Regulations or '*Salmonid waters*' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	▪ River, wetland or surface water body ecosystem protected by national legislation – NHA status. ▪ Regionally important potable water source supplying >2500 homes. ▪ Quality Class A (Biotic Index Q4, Q5). ▪ Flood plain protecting more than 50 residential or commercial properties from flooding. ▪ Nationally important amenity site for a wide range of leisure activities.

Importance	Criteria	Typical Example
High	Attribute has a high quality or value on a local scale	▪ Salmon fishery ▪ Locally important potable water source supplying >1000 homes. ▪ Quality Class B (Biotic Index Q3-4). ▪ Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Medium	Attribute has a medium quality or value on a local scale	▪ 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	▪ 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 8:4: Criteria for rating Site Importance for Hydrogeological Attributes at EIA stage (NRA, 2008)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	▪ Groundwater supporting river, wetland or surface water body ecosystem protected by EU legislation, e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	▪ Regionally Important Aquifer with multiple wellfields. ▪ Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status. ▪ Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	▪ Regionally Important Aquifer Groundwater (provides large proportion of baseflow to local rivers). ▪ Locally important potable water source supplying >1000 homes. ▪ Outer source protection area for regionally important water source. ▪ Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	▪ Locally Important Aquifer. ▪ Potable water source supplying >50 homes. ▪ Outer source protection area for locally important water source.

Importance	Criteria	Typical Example
Low	Attribute has a low quality or value on a local scale	▪ Poor Bedrock Aquifer ▪ Potable water source supplying <50 homes.

Table 8:5: Ecological Impact Duration Criteria (from EPA, 2022)

Significance of Effect	Criteria
Neutral	No impact
Imperceptible	An impact capable of measurement but without noticeable consequences
Not Significant Effects	An impact which causes noticeable changes in the character of environment but without significant consequences
Slight Effects	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Effects	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant Effects	An impact which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment
Very Significant Effects	An impact which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment

Table 8:6: Ecological Impact Duration Criteria (from EPA, 2022)

Impact Duration	Criteria
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 from which spontaneous recovery is possible within a reasonable timescale or which may be counteracted by mitigation.
Irreversible Effects	Effects from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it.

8.3 EXISTING ENVIRONMENT

8.3.1 Physical Environment

The proposed 4.483km long route of the Greenway is located along the River Shannon, in Castletroy, Co. Limerick. The proposed route follows the south bank of the River Shannon, from the bridge on the Groody River, west from UL Boat House (R 657834.53, 560288.70) passing Troy Studio after which turns south (R 658627.17, 562678.42) to reach McLoughlan Road and joins Plassey Park Road. A separate spur turns south at Kilmurray Student Village and continues south along University Road until it joins with Plassey Park Road.

The route runs alongside the River Shannon for approximately 3 km, before turning south towards McLoughlan Road.

The reaches of the River Shannon that follow the Greenway route are typical of an urbanised river catchment. Riparian and marginal habitats on either side are dominated by dense weed and low shrub cover, with a sporadic tree canopy throughout. There is evidence of common invasive non-native plant species (INNS), including Himalayan balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*). Land use is mixed, with agricultural (livestock), amenity and green urban areas, though some of this has given way to construction and transitional woodland (CLMS, 2018).

There are multiple drains that flow either directly into the watercourse or terminate in the riverbank along the surveyed reach. During the walkover surveys, some were discharging grey water, indicative of urban run-off and/ or wastewater, suggesting that there may be point-source pollution and water quality issues in this area.

8.3.1.1 Catchment Description

The Study Area is within Hydrometric Area 25D (Lower Shannon catchment), that consists of the lower south-east of the catchment (Figure 8-2). The Shannon river basin district (RBD) is the largest in Ireland and drains a catchment of approximately 11,600 km^2 before entering the sea via the Shannon estuary. The Shannon RBD is the full River Shannon catchment including Shannon Estuary.

The zone of influence (ZoI) of the proposed development on the water environment is primarily limited to localised area within the sub basin in which the proposed development is located, specifically Shannon (Lower) _060 (RWB). The downstream finish of the Shannon_060 becomes tidal. The northern shoreline of the River Shannon falls under sub-catchment Shannon (Lower)_100.

Throughout the Study Area the River Shannon is principally a deep channel with braided islands and exhibiting an increased degree of sinuosity downstream as it passes Limerick City towards the Shannon Estuary. Much of the River Shannon catchment is rural, however, there are six significant urban centres within the RBD comprising Limerick City (59 km^2), Ennis (25 km^2), Tralee (22 km^2), Mullingar (22 km^2), Athlone (11 km^2) and Tullamore (30 km^2). The River Shannon flows through an area of unsorted alluvial material (glacial till) assumed to consist of mixed sediment-size sand and gravel. There is some evidence of mixed marine sediments extending up the Shannon Valley. The general slope of the River Shannon through the proposed Greenway is 1.5 m/km. The groundwater body associated with the proposed Greenway is Limerick City East (IE_SH_G_138).

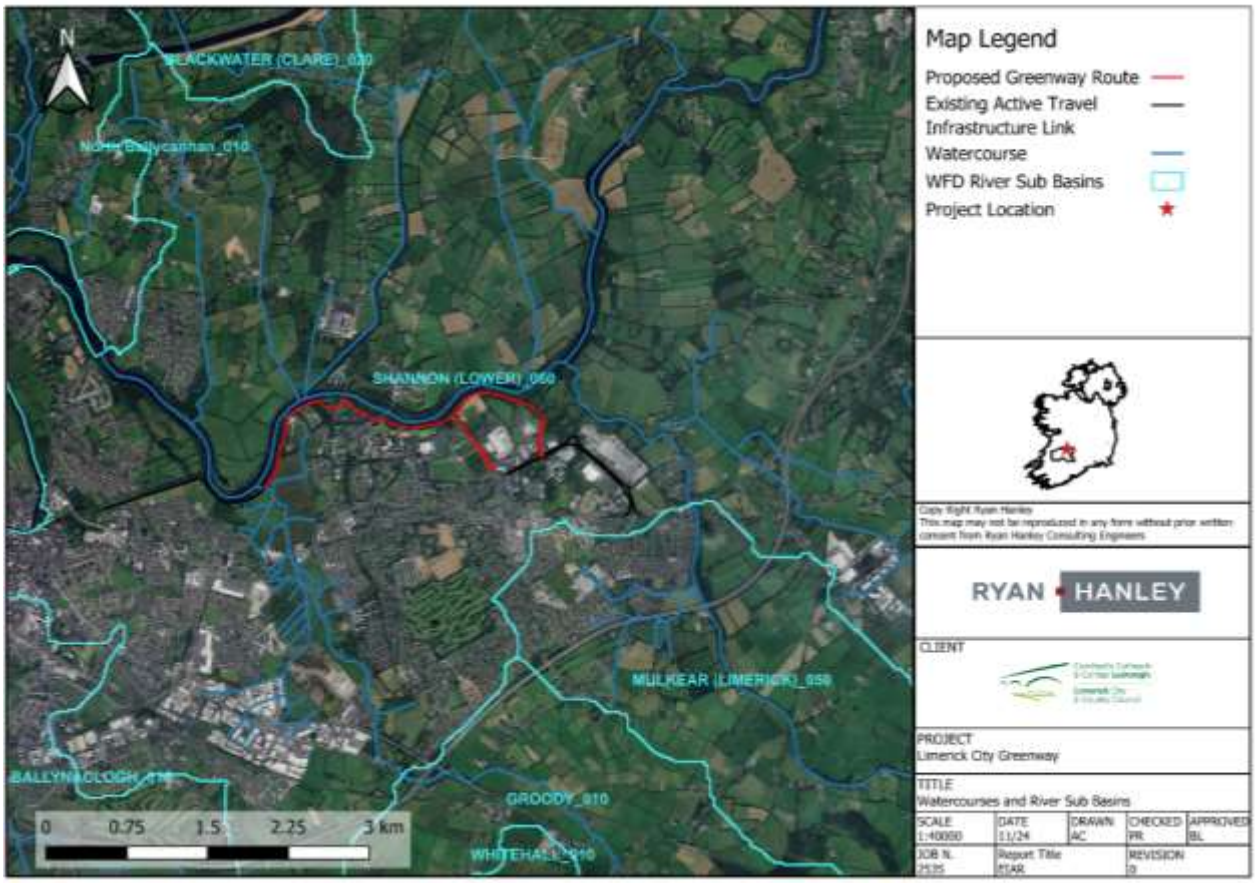


Figure 8-2: Relevant River Water Bodies in the ZoI

In summary the proposed Greenway consists of glacial till deposits with some minor estuarine deposits and is characterized by mixed terrain soils consisting of poorly drained mineral soils, well-drained mineral soils and gleys which occasionally contain water. The bedrock geology is limestone.

Grazing may be a notable pressure for both rivers. Channelisation and embankment are present and may impact both hydrological and morphological conditions, and therefore alter habitat within the waterbody. River water quality within the entire sub-catchment has been described as moderate-good.

Geology and subsoils are assessed in Chapter 7, the Study Area is underlain by two main bedrock units: Dinantian Visean Limestone Formation (Undifferentiated) and Dinantian Rathkeale Formation. The GSI Online Database indicates that subsoils within and in the vicinity of the Study Area comprise tills, alluvium minerals, marine/estuarine sediments and areas of made ground.

The Works Area (described in Chapter 4) is characterized as a locally important bedrock aquifer that is moderately productive in local zones. There are no records of groundwater abstractions being used for potable supply.

In line with Step 3 of the Institute of Geologists of Ireland (IGI) guidelines, the baseline information indicates the hydrogeological environment is determined to be:

- **Type A - Passive geological/hydrogeological environments e.g. areas of thick low**

permeability subsoil, areas underlain by poor aquifers, recharge areas, and historically stable geological environments.

This conclusion is based on the area being underlain by two main groundwater systems (Appendix 8A), both locally important. There is a small section to the east of the Study Area with a third groundwater body but the surface occupied by the Study Area is not significant. One of the groundwater systems is described as moderately productive with bedrock composed of undifferentiated Visean Limestones, dark muddy limestone & shaly mudstone. The Visean Limestone bedrock extends to a depth of <20 m and covers a greater part of the Limerick area. The other bedrock aquifer is comprised of Volcaniclastic rock and is described as only moderately productive in local zones. Recharge potential of both areas are in the moderate - high percentages and the recharge coefficient not suitable to provide adequate recharge of ground water bodies. The study area covers several groundwater vulnerability codes ranging from extreme to moderate.

A range of activities can potentially interact and impact with the hydrogeological environment:

- earthworks;
- storage/ transmission of leachable and /or hazardous materials;
- discharges to ground; and
- excavation of materials above and below the water table.

8.3.1.2 Hydrological Cycle

The River Shannon, which originates in the slopes of Cuilcagh Mountain in Co. Cavan, is susceptible to intense rainfall and as a result is prone to flooding.

There are several Met Éireann Rainfall stations within the Shannon catchment, however only Mount Dillion (Co. Roscommon), Mullingar (Co. Westmeath) and Gurteen (Co Tipperary) have long-term rainfall averages for the period 1981-2010, which are 1047.1 mm, 970.9 mm and 948.2 mm respectively. Other gauges in the catchment have been discontinued or have been installed post 2008. Figure 8-3 indicates the annual rainfall recorded at each station.

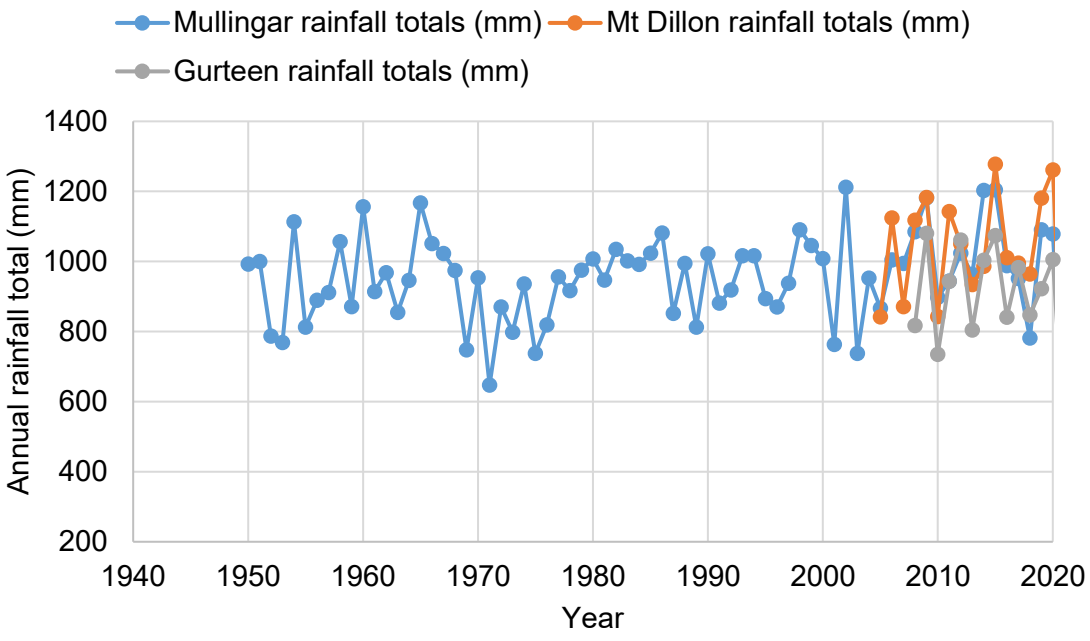


Figure 8-3 Annual Rainfall

The closest synoptic station where air temperature and average potential evapotranspiration (PE) are recorded is at Shannon Airport, Co. Clare, located approximately 20 km west of the Lower Shannon sub-catchment. The long-term average annual PE for this station is 562.6 mm/ year. The effective annual average rainfall (ER) represents the water available for runoff or groundwater recharge and is the rainfall less the actual evapotranspiration. The ER for the proposed Greenway is ~524.6 mm as reported by GSI (www.gsi.ie)

The OPW have a water level gauge at Balls Bridge (25061) on a branch of the Park Canal which joins the east and west side of Limerick city on a large meander on the River Shannon, the gauge is approximately 6.5 km downstream from the proposed Greenway. Water level measurements Above Ordnance Datum (AOD) have been recorded since 2002 at this location (*Figure 8-4*).

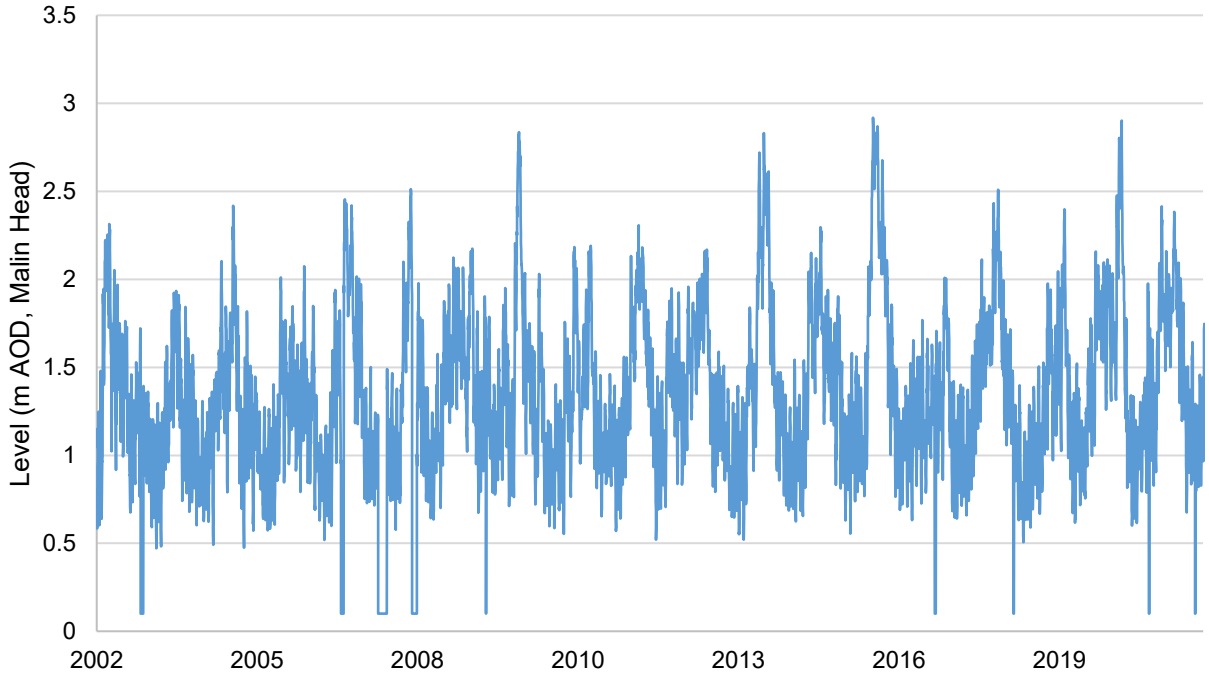


***Figure 8-4** Daily average Balls Bridge water level (m AOD)*

Furthermore, the OPW maintain a water level gauge at Limerick Dock (24063) approximately 10 km downstream from the proposed Greenway; the gauge has been recording for two years (Figure 8.5).

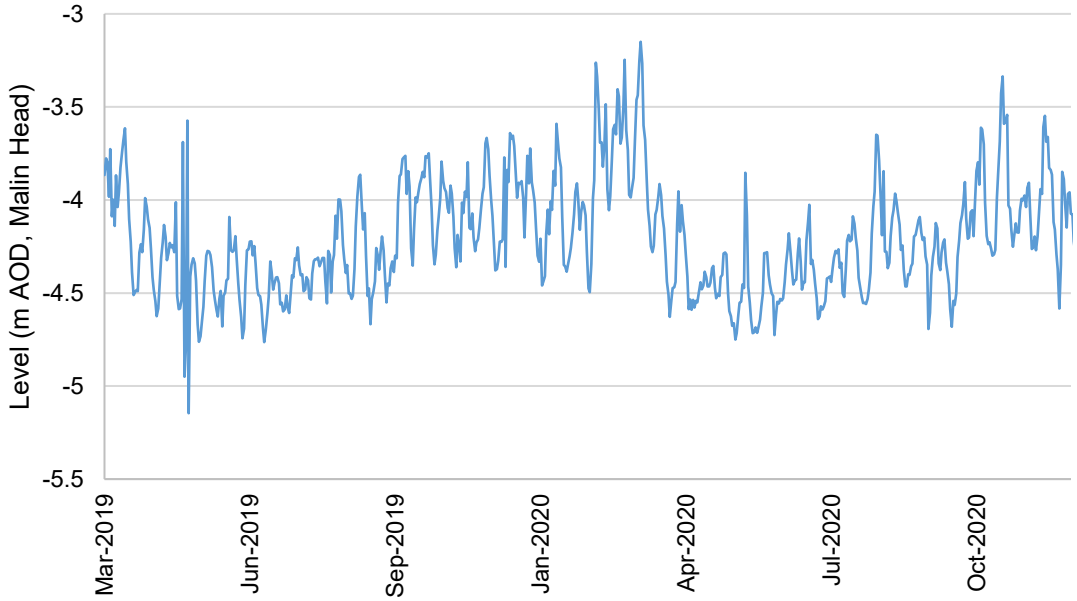


Figure 8-5 Limerick Dock water level

8.3.1.3 Drainage and Flooding

A Flood Risk Assessment was prepared for this project. Maintenance of this drainage infrastructure by LCCC will be required.

A justification test for the development in accordance with the Flood Risk Management Guidelines, further confirmed that the proposed development is appropriate albeit with mitigations. The Greenway track should be constructed to be water compatible, i.e. one which is resistant to damage caused by flooding and prolonged inundation, e.g. sealed surface, appropriate drainage etc.

Flood Mapping developed by the OPW CFRAM programme confirms that appreciable lengths of the proposed Greenway are in Flood Zone A (2.36km) and Flood Zone B (2.77km) associated with the River Shannon and its tributaries scheme floodplains.

The proposed scheme, being an "Amenity open space, outdoor sports and recreation" facility, is classed as a Water Compatible development in the OPW Planning System and Flood Risk management Guidelines, and therefore is an appropriate development for both Flood Zone A and B.

Much of the River Shannon floodplain displays evidence of past glaciation where flood water flows around topography to form floodplain connectivity which is not evident under normal flows. At the upstream extent the Shannon floodplain is approximately 1.5 km wide, narrowing to 500 m at the downstream extent. The Shannon displays a slow response to rainfall, so flood events are generally due to long-sustained periods of heavy rainfall, rather than short duration intense rainfall events which may cause flash flooding in more responsive catchments.

The presence of Lough Ree, which has a surface area of 105 km^2 and catchment area of 4,530 km^2, within the upper Shannon is another significant feature which reduces peak flow response to rainfall. There is a history of flood risk associated with lower Shannon close to the proposed Greenway route, and a summary is provided in Table 8.7.

Table 8.7 *Significant flood events near the proposed Greenway on the River Shannon*

Date	River	Description
December 1954	Shannon	Large flood events during Christmas 1954, much of rural Shannon catchment was affected, farmland inundated (Irish Independent, 1954).
February 1990	Shannon	Significant flooding, many residents evacuated in and around Limerick, high flow in the Shannon and high tides. (Limerick Chronicle, 1990)
December 1999	-	Reported widespread European flooding; in Ireland worst hit areas included Limerick but no specifics provided (Irish Independent, 1999)
December 2006	Shannon	No additional information available, University of Limerick (UL) and surrounding area shown to be inundated on OPW archived aerial imagery. Limerick and Ballyvolane significantly flooded.
November 2009	-	Significant flooding understood to be as severe as the 1990 flood, UL impacted, Limerick significantly impacted, aerial photographs available within OPW archive show fields around UL significantly inundated, aerial imagery available on OPW archives. Castletroy area (around UL) also reported as being significantly inundated during flood event.

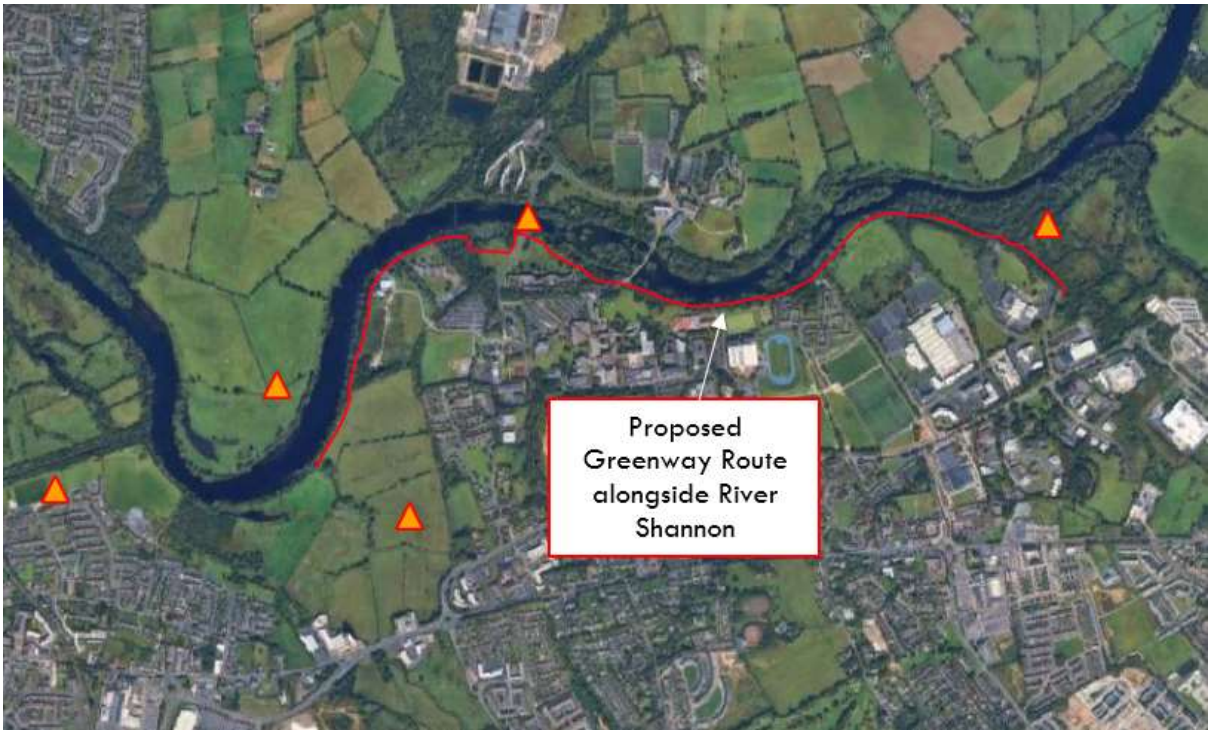


***Figure 8-6*: Past Flood Events OPW database (www.floodinfo.ie)**

inundation, e.g. sealed surface, appropriate drainage etc.

***Figure 8-7*:: November 2009 River Shannon Flood Event at UL campus in Co. Limerick on left hand side, with UL campus in Co. Clare on right hand side of figure, OPW database (www.floodinfo.ie)**

***Figure 8-8*:: Sections of Greenway at Flood Risk (1 in 100 or 1% AEP)**

Modelled flood levels on the River Shannon are available via the OPW flood data Web Mapping Service (WMS); there are nine nodes adjacent to the River Shannon. Elevations along the Greenway adjacent to the River Shannon have been sampled from OPW light detecting and ranging (LiDAR) digital terrain model

(DTM) data. These have been compared with the modelled maximum flood levels for the 50%, 5%, 2%, 1%, 0.5% and 0.1% Annual Exceedance Probability events. Refer to Figure 8-6. The modelled flood levels indicate that much of the existing ground levels of the proposed Greenway are inundated during a 5% AEP (AKA 20-year) flood event; the area inundated during this event type is typically considered a functional floodplain.

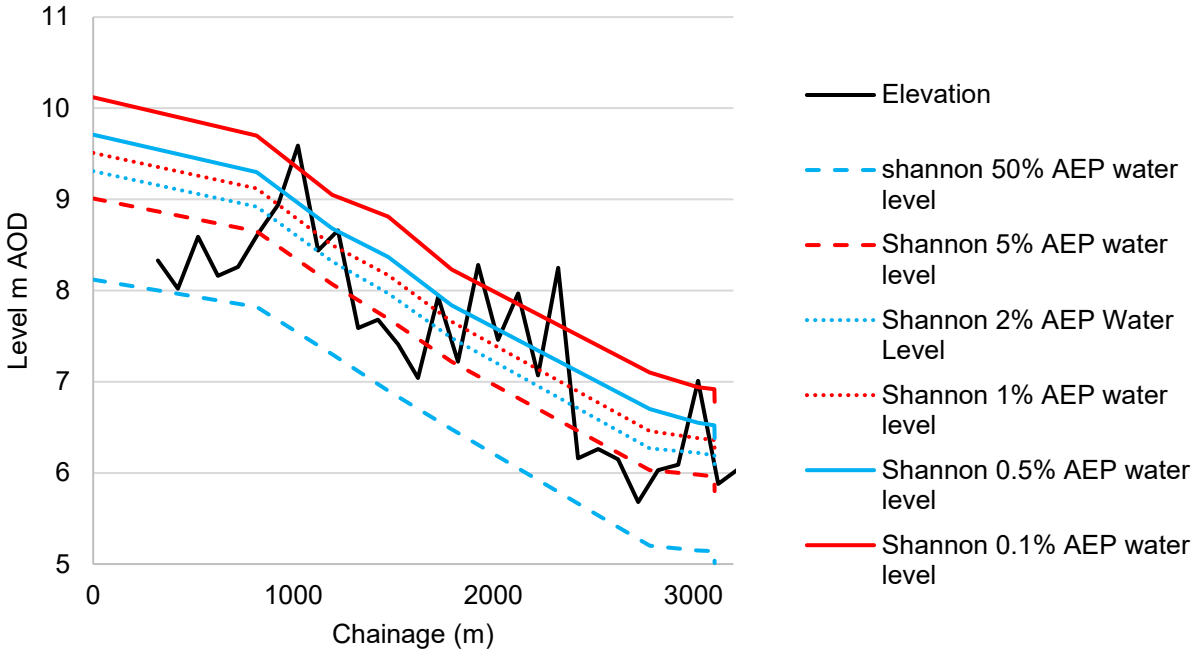


Figure 8-9: OPW modelled water levels along the Shannon overlain with levels sampled from the OPW LiDAR data DTM along the Greenway extent

Reviewing the Flood Risk Assessment and the OPW flood maps for present day fluvial flood risk and high end future climate change scenario fluvial flood risk, which are reproduced in Figure 8-10 to Figure 8-16, it is evident that parts of the proposed Greenway have a high probability of flooding, for the present day low probability event and future events. In the present day 1:10 year event (refer to Figure 8-7) the route between the River Groody bridge and the UL Boat House is predicted to flood but anecdotal evidence from local users of the existing path in this location has confirmed that the existing path can be used during high river levels because it is elevated.

This prediction for flooding is to be expected due to the proximity of the proposed Greenway to the River Shannon which has known historic flooding. As probability decreases severity increases and the flood extent is shown to swell for the lower probability events. When considering the impact of climate change i.e. the *high end future scenario*, the proposed Greenway is flooded and the surrounding floodplain are inundated to a greater extent than the present day scenario.

The maps below contain Irish Public Sector Information licensed under a Creative Commons Attribution 4.0 International (CC BY 4.0) license (source: www.floodinfo.ie – provided by the Office of Public Works).

Contains data from © OpenStreetMap contributors.

Portions of the existing paths and the proposed greenway are below the 10% AEP flood level.

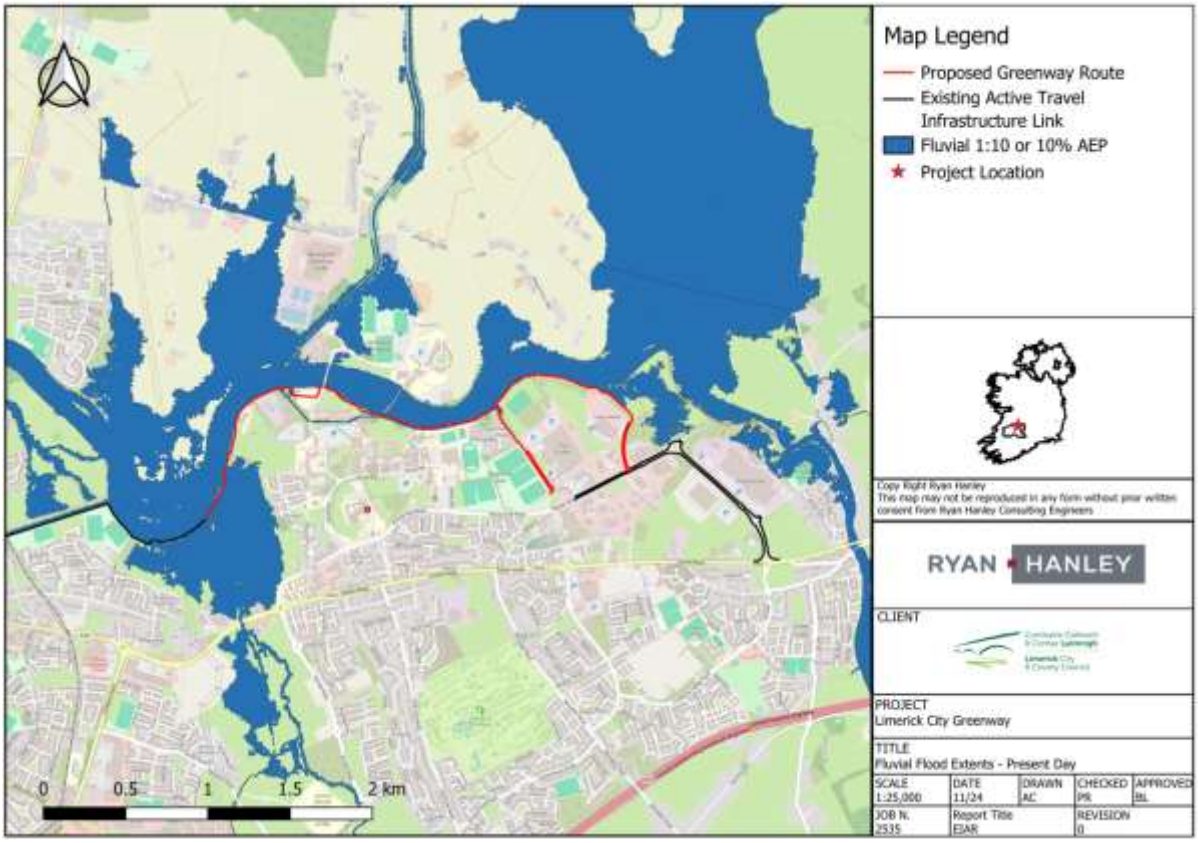


***Figure 8-10** Present Day fluvial flood risk, high probability (i.e. 10% AEP) event flood extents*

Figure 8-11 ***Present Day flood risk, medium probability (i.e. 1% AEP) event flood extents***

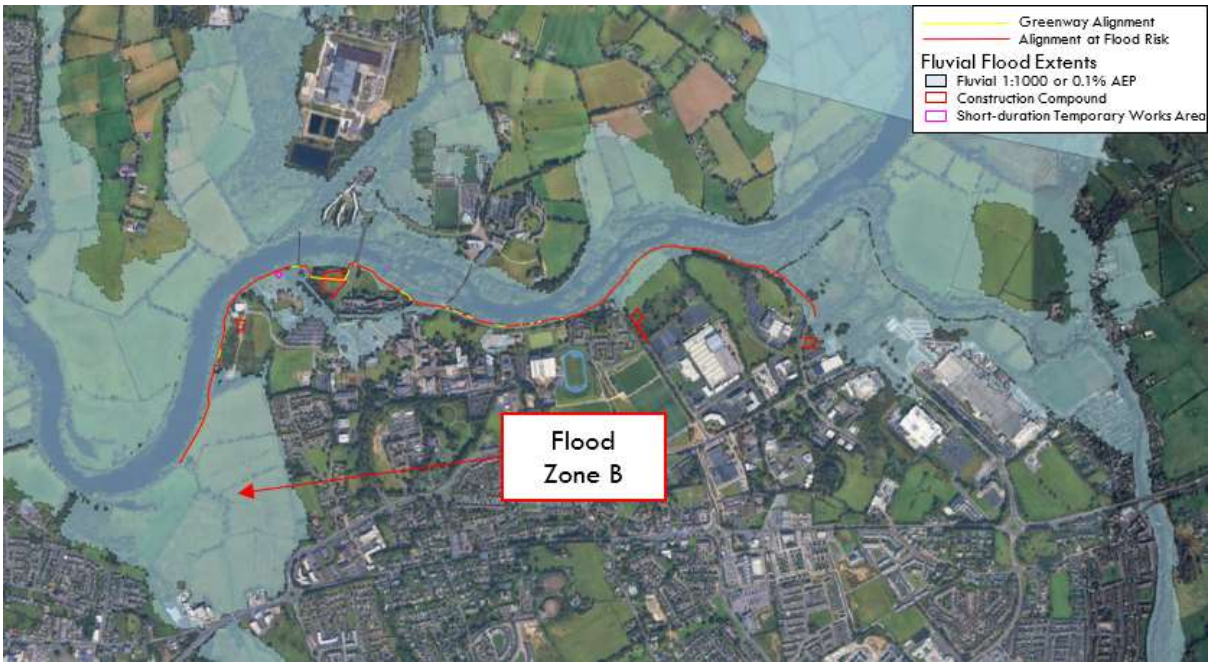


***Figure 8-12** Present Dat flood risk, low probability (i.e. 0.1% AEP) event flood extents*

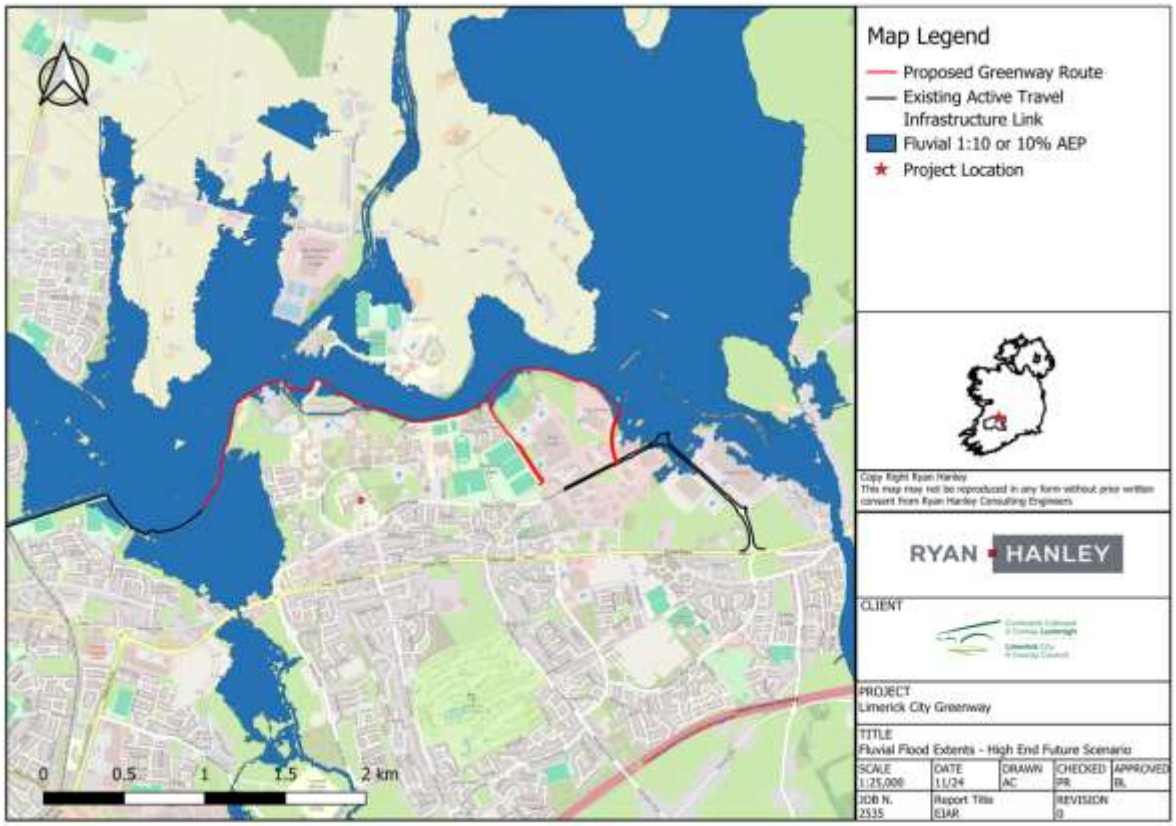


***Figure 8-13** High End Future flood risk, high probability (i.e. 10% AEP) event flood extents*

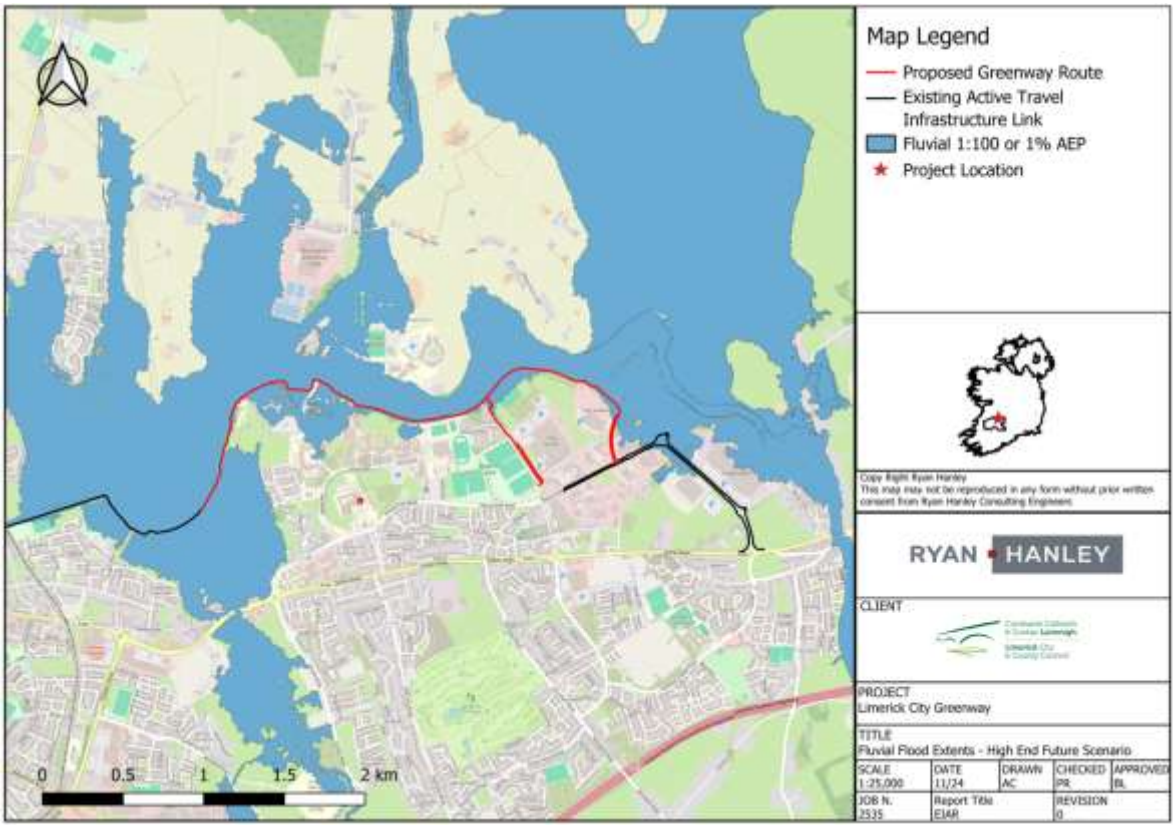


Figure 8-14 High End future flood risk, medium probability (i.e. 1% AEP) event flood extents

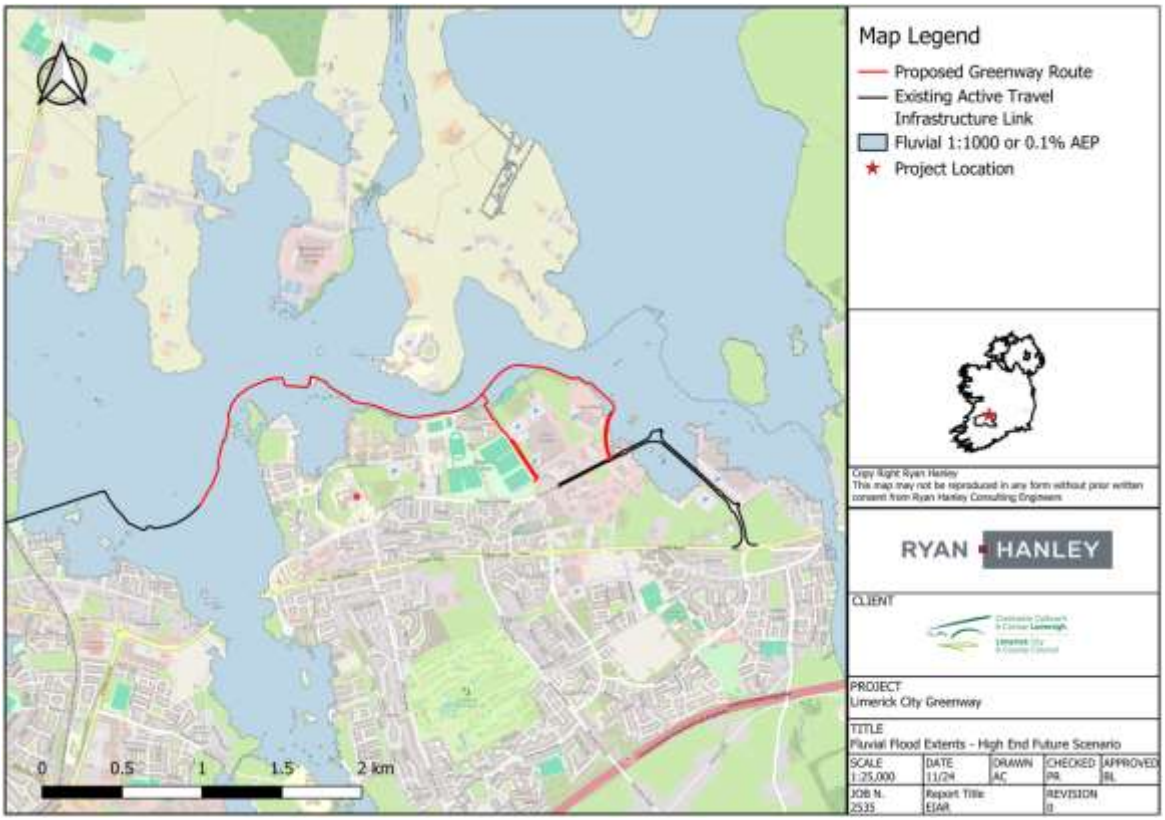


Figure 8-15 High End future flood risk, low probability (i.e. 0.1% AEP) event flood extents

A review of the OPW modelled flood levels at the nodes closest to the three bank reinforcement locations upstream, central and downstream) has been undertaken. These are model nodes SHAN05, SHAN07 and SHAN08. Refer to Figure 8-13.

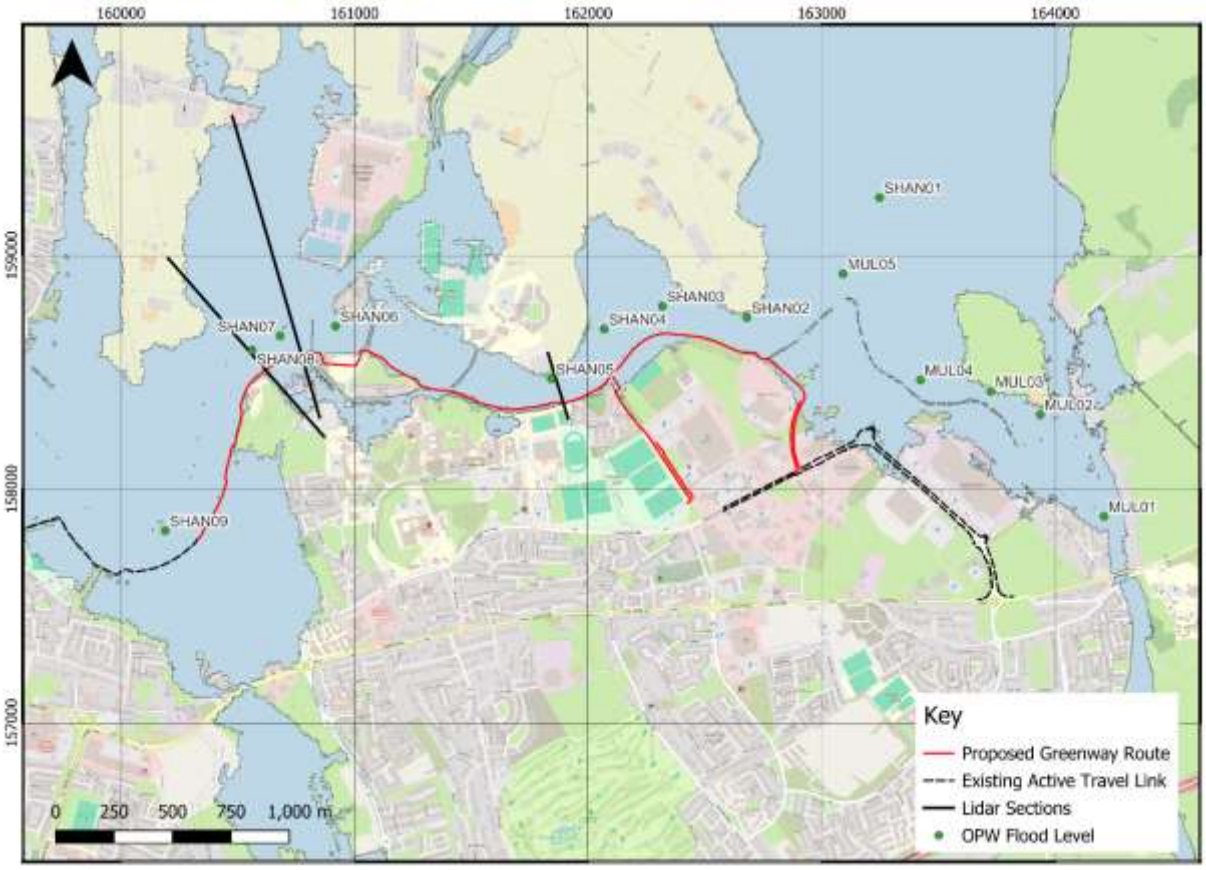


Figure 8-16 OPW modelled flood node locations, overlain with LiDAR sections locations. 1,000 year present day flood extent shown for indication of River Shannon floodplain.

The flood level at each location has been compared with a cross-section of floodplain taken from OPW LiDAR data to estimate a cross-sectional flow area at each water level. The cross-sectional flow area at each location is substantial even during the QMED return period (Table 8.8 and Table 8).

Ground levels adjacent to the DS bank reinforcement location (SHAN08) are generally between 5.2 to 6.0 m AOD, therefore the existing bridge structures at the location are likely to be surcharged or submerged during fluvial flood events occurring on the River Shannon in excess of the QMED return period. Ground levels adjacent to the Central bank reinforcement location (SHAN07) are generally between 5.8 to 6.4 m AOD, therefore the existing structures are likely to be surcharged or submerged during the 1% Annual Exceedance Probability (AEP) and greater fluvial flood event occurring on the River Shannon. Ground levels adjacent to the US bank reinforcement location (SHAN05) are generally between 7.8 and 8.4 m AOD, therefore the existing bridge structure is likely to be surcharged above the 10% AEP return period and submerged during fluvial flood events greater than the 1% AEP event on the River Shannon.

Surface water will be managed through a series of existing open drains alongside the proposed Greenway and existing culverts under existing paths, proposed open drains alongside the proposed Greenway, and new culvert pipes under the proposed path.

There will be 5 No. box culverts constructed in existing drainage channels where the proposed Greenway will cross it. Four are new culverts and one is a replacement culvert. They will have a minimum diameter of 0.9m and range up to 2.0m cross sectional diameter (exact diameters to be confirmed after completion of the Section 50 assessment).

22 No. precast concrete culvert pipes of 0.5m diameter and 6-8m in length and associated headwalls will cross under the proposed Greenway path at 100m intervals where there are no existing culverts. The purpose of these culverts is to enable groundwater which collects in the open drains alongside the path to be discharged to the rivers. The open drains will be shallow, approximately 1.0m wide and 200mm deep. The drains will collect storm water flows from the proposed path and runoff from the hilly green field in the IDA's National Technology Park. Water will flow in the drains to the 22 No. culverts and pass under the proposed path.

Following flood events there is a risk of debris in the minor watercourses culverts and drains pipes. Post flooding maintenance to clear the culverts of debris will be required by LCCC.

Table 8.8: OPW modelled flood levels on the River Shannon (Lower) at the location of the proposed bank reinforcement

Location	Return period (Annual Exceedance Probability) and water level (m AOD)			
	50% AEP (QMED)	10% AEP	1% AEP	0.1% AEP
US bank reinforcement (SHAN05)	6.48	7.01	7.66	8.23
Central bank reinforcement (SHAN07)	5.15	5.77	6.38	6.94
DS bank reinforcement (SHAN08)	5.14	5.75	6.36	6.92

Table 8.9 The estimated cross-sectional flow area of River Shannon for each return period based on OPW modelled water levels and OPW LiDAR digital terrain model

Location	Return period (Annual Exceedance Probability) and flow area (m^2)			
	50% AEP (QMED)	10% AEP	1% AEP	0.1% AEP
US Bank Reinforcement (SHAN05)	119.9	177.1	248.0	310.7
Central bank reinforcement (SHAN07)	303.1	810.9	1379.1	1946.8

DS bank reinforcement (SHAN08)	150.8	498.7	820.1	1131.0

OPW surface water flood mapping is not available for Limerick or the surrounding area. To identify potential surface water flooding pathways to the proposed Greenway a GIS watershed analysis was undertaken utilising the OPW LiDAR data at the proposed Greenway. Refer to Figure 8-17. The analysis has identified seven potential surface water flow routes which may materialise during or shortly after an extreme rainfall event to the south of the proposed Greenway. Four of the surface water flow routes appear to be associated with minor watercourses close to the proposed Greenway and are not considered to be surface water flow routes. These are:

- land drains/minor streams discharging into the River Groody to the west of the proposed Greenway;
- one which flows through the main university campus to the Limerick Wastewater Treatment Works (WwTW) at the western extent of the proposed Greenway;
- Thomond College towards the centre-west of the proposed Greenway; and,
- East of the Cook Ireland Limited Campus, which is east of the proposed Greenway,

One surface water flow route through the playing pitches in the UL Campus may be a source of flood risk to the proposed Greenway during an extreme rainfall event, however considering the local topography, which slopes towards the River Shannon for the extent of the proposed Greenway, it is unlikely that surface water would pond on the proposed Greenway and would in all likelihood discharge to the River Shannon. The other two flow routes are and on the northern banks of the River Shannon and would not impact the proposed Greenway. Flood risk from surface water to the proposed Greenway is therefore considered to be low.

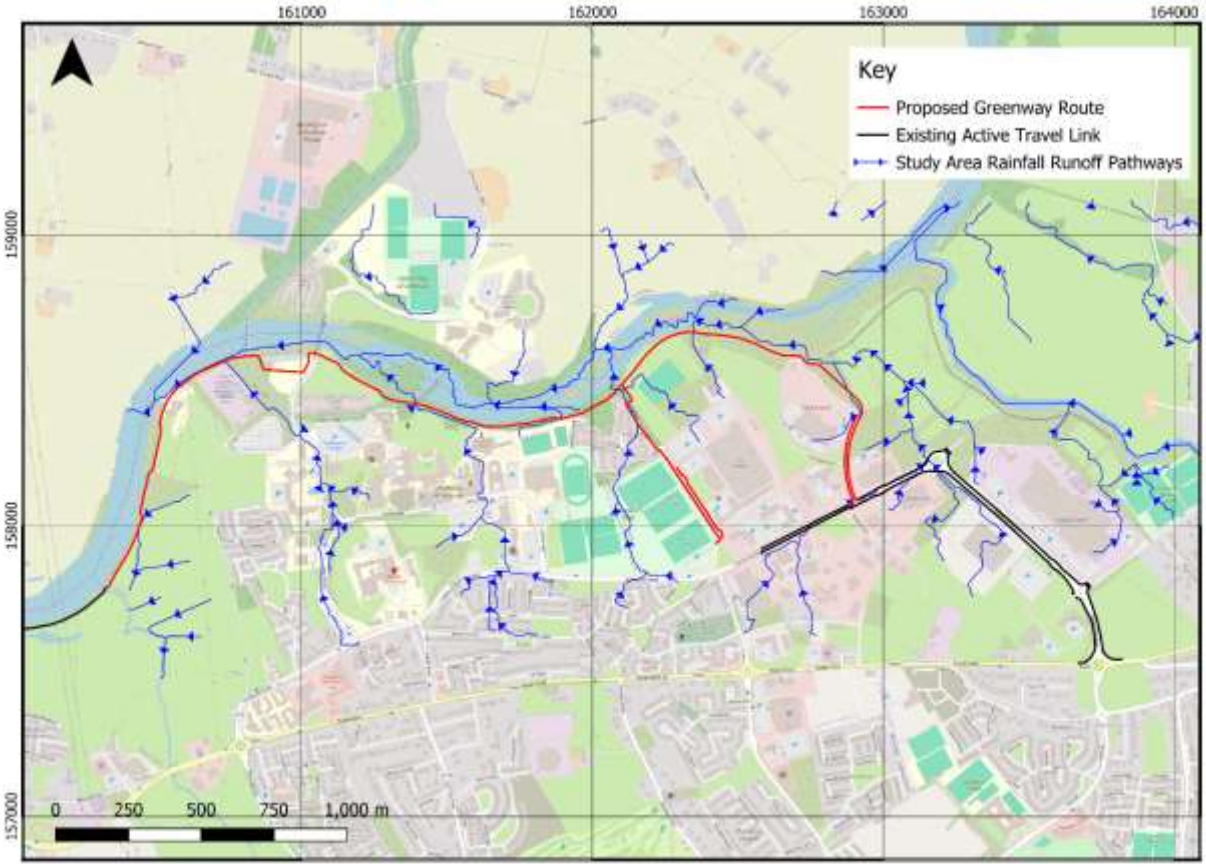


Figure 8-17 OPW LiDAR generated surface water flow routes which may impact the proposed Greenway

The aquifers underlying the proposed Greenway are classified as 'Lm' Locally Important Bedrock Aquifer (Recharge coefficient: 22.5%; and recharge 118 mm/yr). Groundwater vulnerability, a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities, is 'Moderate' (limestone till). Flood risk to the proposed Greenway from groundwater sources is low, considering only moderate productivity from the bedrock aquifer and the general topography surrounding the proposed Greenway which would allow any groundwater emergence to flow overland towards the River Shannon rather than ponding above ground.

8.3.2. Ecological Environment (See also Chapter 6)

8.3.2.1 Biological Status

The receiving waterbody associated with the Study area which could potentially be impacted upon is the Shannon (Lower)_060' (IE_SH_25S012600).

The 'Shannon (Lower)_060' water body WFD status is 'Moderate' (Table 8.10) and the risk status is under "Review" (WFD Status 2016-2021).

WFD classes and Q-Values were obtained from the National River Macroinvertebrate Surveys in Ireland, 2007 – 2018 (Feeley et al, 2020), www.catchments.ie/data and https://gis.epa.ie/EPAMaps/Water.

Table 8.10 Water body classifications and most recent Q value results

Waterbody Name	Station Type	WFD Water body risk	Latest Q Value	WFD Status (of Q value)	Year Sampled
Shannon (Lower)_60	Operational	Review	3-4	Moderate	2020

8.3.3 Chemical Environment

The EPA and Limerick City and County Council have monitored the water quality and chemistry in the Lower Shannon for a number of years. These include monitoring stations on the Lower Shannon at the Bridge within the University of Limerick (ST2) and nearby at Plassey Bridge (ST3). Refer to Table 8.11 and Figure 8-15.

The 'Shannon (Lower)_060' water body WFD status is 'Moderate' according to the 3rd cycle data. The Shannon is not listed as a priority area for action.

Summary statistics were based on reported values provided by the EPA. Where results were reported below the minimum levels of detection, the values provided were used and minimum levels of detection noted. The data show a generally good quality of water in the river, with no specific evidence for any contaminants that may, in association with proposed construction, cause negative impacts.

Table 8.11 EPA/Limerick City and County Council water chemistry monitoring data (www.catchments.ie/data/)

	ST2_Shannon Br UL			ST3_Shannon_Plassy		
Parameter	Dates	Mean ± SD	N	Dates	Value	N
Alkalinity-Total (mg/l $CaCO_3$)						
BOD-5 days Total (mg/l)	2015-2020	1.19 ± 0.61**	74	05/03/2013	1**	1
Conductivity (µS/cm)						
Dissolved Oxygen (mg/l)						
Dissolved Oxygen (% O_2)	2015-2020	98.7 ± 12.7	75	05/03/2013	106	1
pH (pH units)	2015-2020	8.2 ± 0.2	75	05/03/2013	8.4	1
Sulphate (mg/l)						
Temperature (°C)	2015-2020	11.9 ± 4.7	75	05/03/2013	6	1
Ammonia-Total (mg/l N)	2015-2020	0.022 ± 0.009*	75			
Total Oxidised Nitrogen (mg/l N)						
Nitrate (mg/l N)						
Nitrite (µg/l N)						
Ortho-Phosphate (mg/l P)	2015-2020	0.019 ± 0.014	75	05/03/2013	0.018	1

*Minimum Limit of Detection: 0.04; **Minimum Limit of Detection: 2

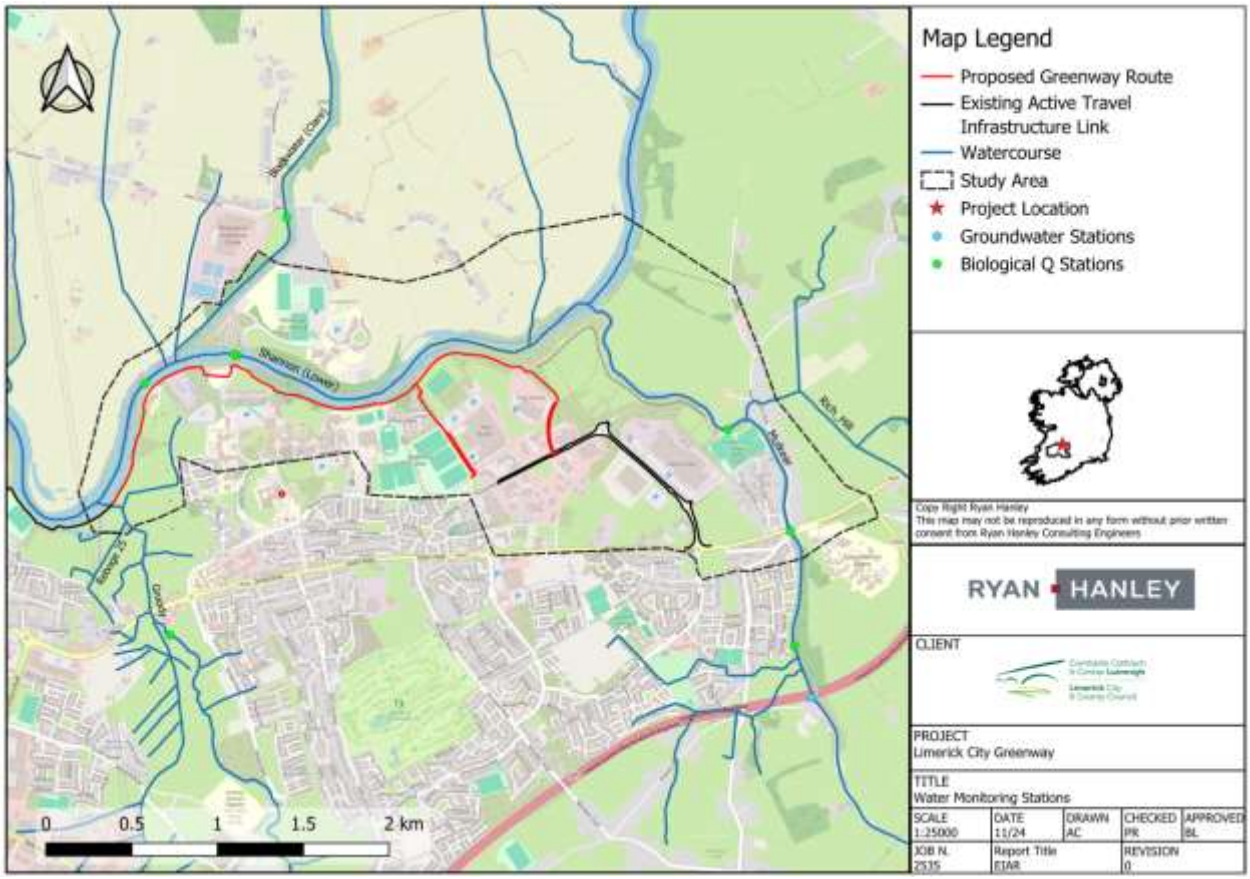


Figure 8-18 EPA River waterbodies and water monitoring stations

The Shannon (Lower)_050 water body is upstream, with a WFD status of 'Poor' and a classification of 'at risk' for the third cycle (EPA, 2018). Limerick Dock (transitional water body) is downstream, also classified as 'at risk'. Groundwater bodies present include Limerick City East and Limerick City North. Limerick City East is classified as "at risk" while Limerick City North is "not at risk".

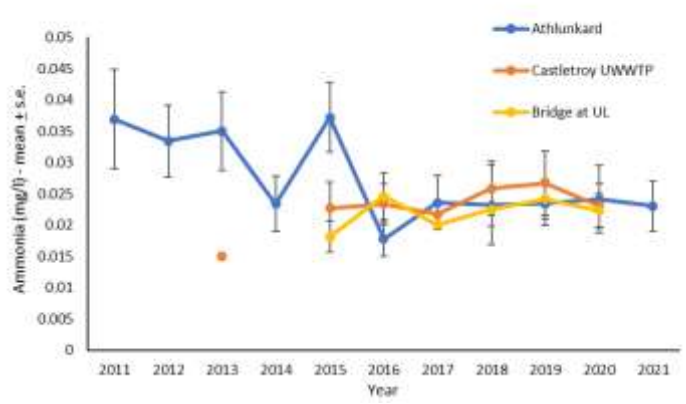
8.3.3.1 Supporting Chemistry Trends

There are three WFD water quality monitoring stations in the vicinity of the Greenway (Table 8.12). Data from the past ten years was examined to identify patterns and/or trends relevant to this assessment.

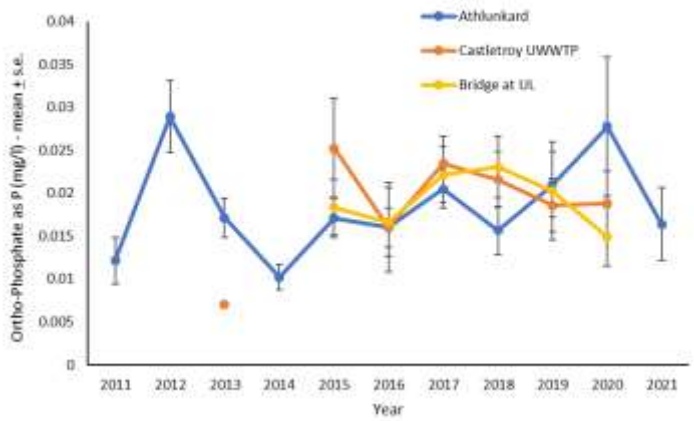
Table 8.12 Details of water quality monitoring data from the River Shannon

Location	Relative to Greenway site	Time Period Included
Shannon River - Bridge at UL	Downstream end of Greenway	2015 - 2021
Shannon River - Castletroy Urban Waste Water Treatment Plant (UWWTP)	Downstream of Greenway	2015 - 2021
Shannon River - Athlunkard	Downstream of Greenway	2011 - 2022

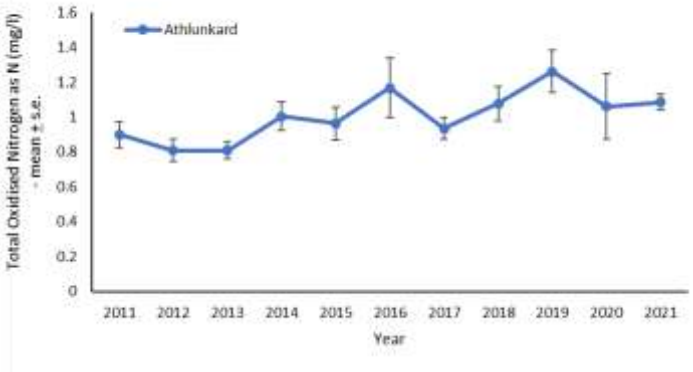
Key water quality parameters for the Lower River Shannon (Shannon (Lower)_60) are shown in Figure 8.16. Total oxidised nitrogen was comprised largely of nitrate, with very low concentrations of nitrite. Ammonia and nutrient concentrations (ortho-phosphate and total oxidised nitrogen) have remained consistently low in the Shannon, and dissolved oxygen saturation high.



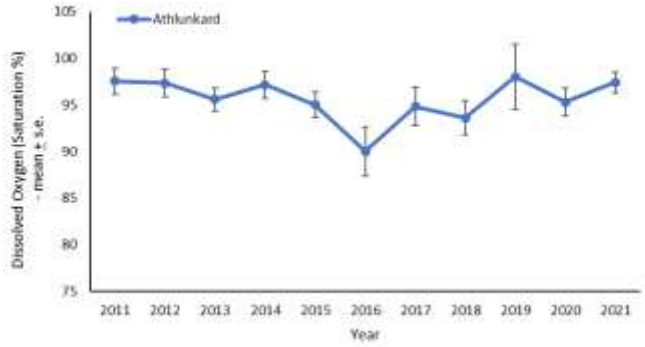
a) Ammonia



b) Ortho-phosphate



c) Total Oxidised Nitrogen



d) Dissolved Oxygen

Figure 8-19 Water quality trends for Shannon L_060

8.3.4 Water Resources and Beneficial Uses

8.3.4.1 Water Supply

The River Shannon at the Study Area are within the River Shannon lower (060) Protected area for River abstraction and Groundwater abstraction (Limerick City East) for drinking water Article 7, Water Framework Directive (2000/60/EC) and European Communities (Drinking Water, No. 2) regulations SI No. 278/2007.

The EPA were consulted for information on public water abstraction within proximity to the Study Area. The EPA advised that the University of Limerick and surrounding area are supplied by the Limerick City Environs Public Drinking Water Supply scheme. The scheme is based at Claireville Water Treatment Plant where two public water abstractions feed the plant, one from the River Shannon via a canal feed into the plant located 4 km upstream from the Study Area. The second public water abstraction is from the Clonlara head race channel which feeds the Ardnacrusha Hydropower plant and confluences with the River Shannon 5km downstream from the Study Area. The scheme supplies a population of approximately 114,138 and is the main source of water for drinking supply in Co. Limerick. A database was also accessed of public water abstractions > 25 m^3 per day for Co. Limerick where one Groundwater abstraction was identified (Figure 8.17). The groundwater well lies within the Study Area and abstracts for cooling purposes.

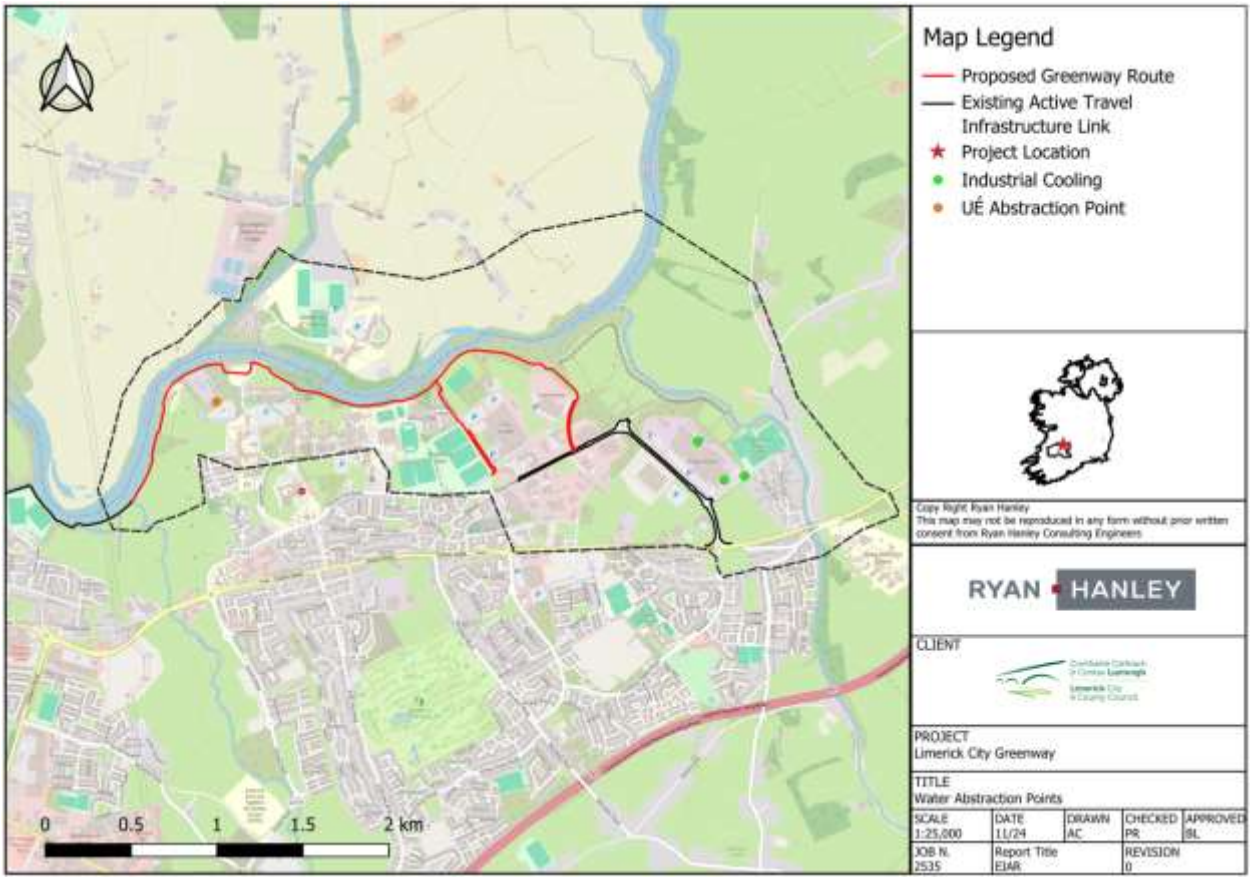


Figure 8-17: Public water abstractions (Source EPA, 2024)

8.3.4.3 Recreation and Landscape Value

The Lower Shannon provides ample opportunities for a range of recreational activities, such as rowing, kayaking and swimming. They are popular with residents, students and tourists in the local area.

The section of the lower River Shannon considered in this report provides valuable salmon and trout spawning and nursery habitats. Catch and release is permitted for salmon in this area, and the stretch is very popular for fly fishing.

Water quality is currently good for both recreational activities and supporting salmonid fish (although note that concentrations of faecal indicator organisms have not been examined). Consideration during construction work should be taken to minimise water quality impacts, both chemically and with respect to mobilisation of fine sediment that may impede any spawning beds.

8.3.4.4 Sub-catchment Pressures

Data concerning significant pressures for the Shannon (Lower)_060 water body were not available. However, the adjoining upstream water body, 'Shannon (Lower)_50' is cited as being under significant pressure for 'hydromorphology' (EPA, 2018).

Further information on pressures obtained from sub-catchment assessments conducted for the implementation of the 3rd Cycle of the WFD through the RBMP 2022-2027(www.catchments.ie/data), from mapping the catchments (https://gis.epa.ie/EPAMaps/Water) and from reviewing the OPW datasets (www.opw.ie) identified the following:

- There are multiple drains that flow either directly into the watercourse or terminate in the riverbank along the surveyed reach. During the walkover, those that were active were discharging grey water, indicative of urban run-off and/ or wastewater, suggesting that there may be point-source pollution and water quality issues throughout this section of the watercourse;
- There is evidence of commonly occurring Invasive Non Native Species (INNS), Himalayan balsam (*Impatiens glandulifera*) and Giant hogweed (*H. mantegazzianum*);
- Castletroy Urban Waste Wastewater Treatment Plant (UWWTP) is adjacent to the proposed Greenway and within the Shannon (Lower)_060 reach; and
- Limerick City East Groundwater body is mapped as under significant pressure from 'agriculture'. A significant agricultural pressure can be diffuse and/or point source of pollution and includes nutrient pollution. No further detail was provided.

8.4 UPDATED SURVEY RESULTS

As part of the update to the original AEA undertaken by APEM, the desk study and field work undertaken in 2021 were repeated by APEM in 2023 to check the continued validity of the original data, and to provide any additional species or site data made available between 2021 and 2023.

Results below were provided by APEM, detailed in their report from November 2023.

8.4.1 Main findings

8.4.1.1 Species

Species data within the vicinity of the site have been refined within the scope of an AEA to include fish, macroinvertebrates, macrophytes, and white-clawed crayfish.

Table 8.73 Fish species recorded in the vicinity of the proposed works

Species	Latin name	Distance	Years
National Biodiversity Data Centre			
European eel	*Anguilla anguilla*	On site	2021 - 2023
Brook lamprey	*Lampetra planeri*	> 2km	2011 - 2021

Species	Latin name	Distance	Years
Sea lamprey	*Petromyzon marinus*	On site	2021 - 2023
IFI Transitional Waters Report 2017 – Shannon and Fergus Estuaries (Coyne *et al*, 2017)			
Ballan wrasse	*Labrus bergylta*	> 2km	2017
Brill	*Scophthalmus rhombus*	> 2km	2017
Brown trout	*Salmo trutta*	> 2km	2017
Common dragonet	*Callionymus lyra*	> 2km	2017
Common goby	*Pomatoschistus microps*	> 2km	2017
Common sole	*Solea solea*	> 2km	2017
Conger eel	*Conger conger*	> 2km	2017
Corkwing wrasse	*Symphodus melops*	> 2km	2017
Dab	*Limanda limanda*	> 2km	2017
Dace	*Leuciscus leuciscus*	> 2km	2017
European eel	*Anguilla anguilla*	> 2km	2017
European seabass	*Dicentrarchus labrax*	> 2km	2017
Fifteen spined stickleback	*Spinachia spinachia*	> 2km	2017
Five bearded rockling	*Ciliata mustela*	> 2km	2017
Flounder	*Platichthys flesus*	> 2km	2017
Grey gurnard	*Eutrigla gurnardus*	> 2km	2017
Lesser sandeel	*Ammodytes tobianus*	> 2km	2017
Lesser spotted dogfish	*Scyliorhinus canicula*	> 2km	2017
Lumpsucker	*Cyclopterus lumpus*	> 2km	2017
Nilsson's pipefish	*Syngnathus rostellatus*	> 2km	2017
Painted goby	*Pomatoschistus pictus*	> 2km	2017
Perch	*Perca fluviatilis*	> 2km	2017
Plaice	*Pleuronectes platessa*	> 2km	2017
Pogge	*Agonus cataphractus*	> 2km	2017
Pollack	*Pollachius pollachius*	> 2km	2017
Poor cod	*Trisopterus minutus*	> 2km	2017
Pouting	*Trisopterus luscus*	> 2km	2017
Roach	*Rutilus rutilus*	> 2km	2017
Sand goby	*Pomatoschistus minutus*	> 2km	2017
Sand smelt	*Atherina presbyter*	> 2km	2017
Scad	*Trachurus trachurus*	> 2km	2017
Short spined sea scorpion	*Myoxocephalus scorpius*	> 2km	2017
Smelt	*Osmerus eperlanus*	> 2km	2017

Species	Latin name	Distance	Years
Sprat	*Sprattus sprattus*	> 2km	2017
Thick lipped grey mullet	*Chelon labrosus*	> 2km	2017
Thornback ray	*Raja clavata*	> 2km	2017
Three spined stickleback	*Gasterosteus aculeatus*	> 2km	2017
Two spotted goby	*Gobiusculus flavescens*	> 2km	2017
Whiting	*Merlangius merlangus*	> 2km	2017
Worm pipefish	*Nerophis lumbriciformis*	> 2km	2017

Table 8.14 Macroinvertebrate species recorded in the vicinity of the proposed works

Waterbody ID	Distance	Years	Order	Family	Genus / Species
National Biodiversity Data Centre					
*	*	2021 - 2023	Unionida	Margaritiferidae	Freshwater pearl mussel (*Margaritifera margaritifera*)
National River Macroinvertebrate Surveys in Ireland, 2007 – 2018 (Feeley *et al*, 2020)					
Shannon (Lower)_050	~ 7 km	2018	Rhynchobdellida	Glossiphoniidae	*Helobdella* sp.
			Acari	-	*Acari* sp.
			Amphipoda	Corophiidae	*Corophium* sp.
				Gammaridae	*Gammarus* sp.
			Diptera	Chironomidae	-
			Ephemeroptera	Caenidae	*Canis* sp.
				Ephemerellidae	*Serratella ignita*
				Heptageniidae	*Heptagenia* sp.
			Trichoptera	Ecnomidae	*Ecnomus tenellus*
				Hydropsychidae	*Hydropsyche* sp.
				Polycentropodidae	*Polycentropus* sp.
			Myida	Dreissenidae	*Dreissena polymorpha*
			Ectobranchia	Valvatidae	*Valvata (Cincinna) piscinalis*
			Littorinimorpha	Bithyniidae	*Bithynia* sp.
			Neotaenioglossa	Hydrobiidae	*Potamopyrgus antipodarum*
			Neritopsina	Neritidae	*Theodoxus* sp.
			Lubriculida	Lumbriculidae	-
			Acari	-	*Acari sp.*

Waterbody ID	Distance	Years	Order	Family	Genus / Species
Shannon (Lower)_060	On site	2018	Amphipoda	Gammaridae	*Gammarus duebeni*
					Gammarus zaddachi
			Coleoptera	Elmidae	*Elmis aenea*
					Limnius volckmari
			Diptera	Chironomidae	-
				Pediciidae	*Dicranota sp.*
			Ephemeroptera	Baetidae	*Alainites muticus*
				Ephemerellidae	*Baetis rhodani/atlanticus*
					Serratella ignita
				Heptageniidae	*Ecdyonurus sp.*
					Heptagenia sp.
			Plecoptera	Leuctridae	*Leuctra sp.*
				Perlidae	*Perla bipunctata*
			Trichoptera	Hydropsychidae	*Hydropsyche sp.*
			Neotaenioglossa	Hydrobiidae	*Potamopyrgus antipodarum*
			Neritopsina	Neritidae	*Theodoxus sp.*

Numerous aquatic macroinvertebrate taxa were identified that are known to be sensitive to reductions in water quality, including Plecoptera (stonefly) and Trichoptera (caddisfly) species. However, no species on this list are considered to be protected or threatened in Ireland (Nelson et al., 2019), with the exception of the freshwater pearl mussel (*Margaritifera margaritifera*).

No historic macrophyte survey data was found for the River Shannon. A review of the NBDC identified records of nine protected plant species between 2021 and 2023, of which three may be found in aquatic environments.

Table 8.15 Protected macrophyte records in the vicinity of the proposed works

Species	Latin name	Distance	Years
National Biodiversity Data Centre			
Irish St John's-wort	*Hypericum canadense*	> 2km	2021 - 2023
Opposite-leaved pondweed	*Groenlandia densa*	> 2km	2021 - 2023
Chickweed willowherb	*Epilobium alsinifolium*	> 2km	2021 - 2023

There were no survey records of white-clawed crayfish were found on the River Shannon. Although no occurrences of non-native crayfish species have been reported in Ireland, multiple occurrences of crayfish

plague have been reported in a number of Irish rivers since 2015, though no records have been reported on the River Shannon (NBDC, 2023b).

8.4.1.2 Field survey

Results from the walkover survey carried out by APEM the 8th of November 2023, highlighted the following:

- Drainage ditches along the route can provide suitable habitat for lamprey ammocoete;
- Slow-flowing aquatic habitats found along the route may provide suitable refugia for salmonids;
- Streams crossing the route may offer suitable habitat for lamprey ammocoete due to their connectivity with the River Shannon;
- The island network splits near the Living Bridge, on the left bank, may offer suitable habitat for salmonids due to the presence of cobble and gravel substrate with boulders. This offers both refugia and foraging habitat for juvenile salmon and trout and potential suitable spawning habitat for adults;
- Lamprey ammocoete habitat was identified both at the upstream end of the Mill Race and further downstream towards the middle of the Mill Race; and
- The River Shannon may offer suitable spawning habitat for both river and sea lamprey.

8.5 IMPACT ASSESSMENT

An analysis of the predicted impacts of the proposed Greenway on the hydrology/ hydrogeology and water quality, during and after the construction phase, has been completed in line with the guidance documents specified in Section 8.2.

The assessments are based on the description of the works and construction methods as set out in Chapter 4 of this EIAR.

8.5.1 Rating Site Attribute Importance

The Site Attribute Importance was determined using NRA (now TII) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (2008), and in particular the use of five important criteria from the guidelines – Extremely High, Very High, High, Medium and Low depending on attribute quality (Table 8:3). The two attributes in the Study Area that are potentially affected by the proposed works are lower River Shannon, and the underlying aquifer.

Whilst the Study Area is situated within the Protected Area for Drinking Water River Shannon (lower) and the population supplied is >113,000; the relevant section of the River Shannon is 4km downstream from the abstraction on the River Shannon and not within close proximity to the Clonlara head race abstraction. The influence of the proposed Greenway on drinking water is therefore considered to be negligible. The bedrock aquifer classification of the Study Area is "Locally Important" and "Moderately Productive", there are no group scheme preliminary groundwater source protection areas within the proposed Greenway and as such the scheme has been assigned a rating of; Medium. This is judged on the basis of criteria for rating site attributes - estimation of the importance of hydrology attributes (NRA, 2008).

8.5.2 Do Nothing Scenario

The option assessment considered this solution unfavourable since even if the works are not carried out there would be no negative impacts on the natural surroundings (biodiversity, soils, water, etc.), this would lead to a lack of fulfilment of the proposed objectives in the Limerick Smart Travel Project, slowing down the shift towards more sustainable travel modes.

If the proposed works are not implemented, the environmental, social and economic benefits resulting from the Greenway won't reach the beneficiary local community that would make use of it, increasing unwelcome impacts such as traffic congestion, air pollution, increased greenhouse gases emissions and reduced connectivity between the key hubs within Limerick City.

The "do-nothing" scenario was considered to represent an inappropriate and inefficient use of the Greenway; particularly having regard to the opportunity to provide the much-needed connectivity for the Limerick City area.

8.5.3 Potential Impacts

The potential impacts of the proposed construction activities on the hydrology, hydrogeology, water quantity and quality relate to:

- Construction Phase;
- Use of Potential Water Contaminants; and
- Flood Risk

Potential impacts of the operation of the Scheme are:

- None anticipated

8.4.3.1 Construction Phase: Sediment erosion and ingress into the watercourse generating silt-laden run off & increase in Suspended Solids

Potential Short Term Significant Negative Impact

The Lower River Shannon SAC is designated in part for the presence of EU habitat type habitat type 3260 'Floating River Vegetation', which is known to be present throughout most major rivers in the catchment and was noted during the preliminary walkover conducted in June 2020. This habitat type is particularly important to river habitats, as it promotes flow heterogeneity, fine sediment deposition, and shelter and food for fish and macroinvertebrates.

The River Shannon provides habitat for a number of Qualifying Interests (QIs) within the Lower River Shannon SAC [002165], including brook lamprey, river lamprey, sea lamprey, freshwater pearl mussel and Atlantic salmon. The proposed bank side construction works will take place in accordance with the period prescribed in the Mitigation timing - ecological calendar, so the life stages of migratory fish species will not be impacted by factors such as increased sediment ingress into the watercourse or noise and disturbance associated with installation of sheet piling in the river bank.

The Mitigation timing - ecological calendar will be applied and followed to ensure protection of habitats and species during construction and operational phases of the greenway. In general, the construction works should be planned during the 'green' periods in the calendar year, as long as appropriate mitigation measures are implemented. The exception to this is Fish (salmonoid spawning) because foreshore works (including preparatory work) beside all watercourses supporting salmonids shall be undertaken from May to October (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds.

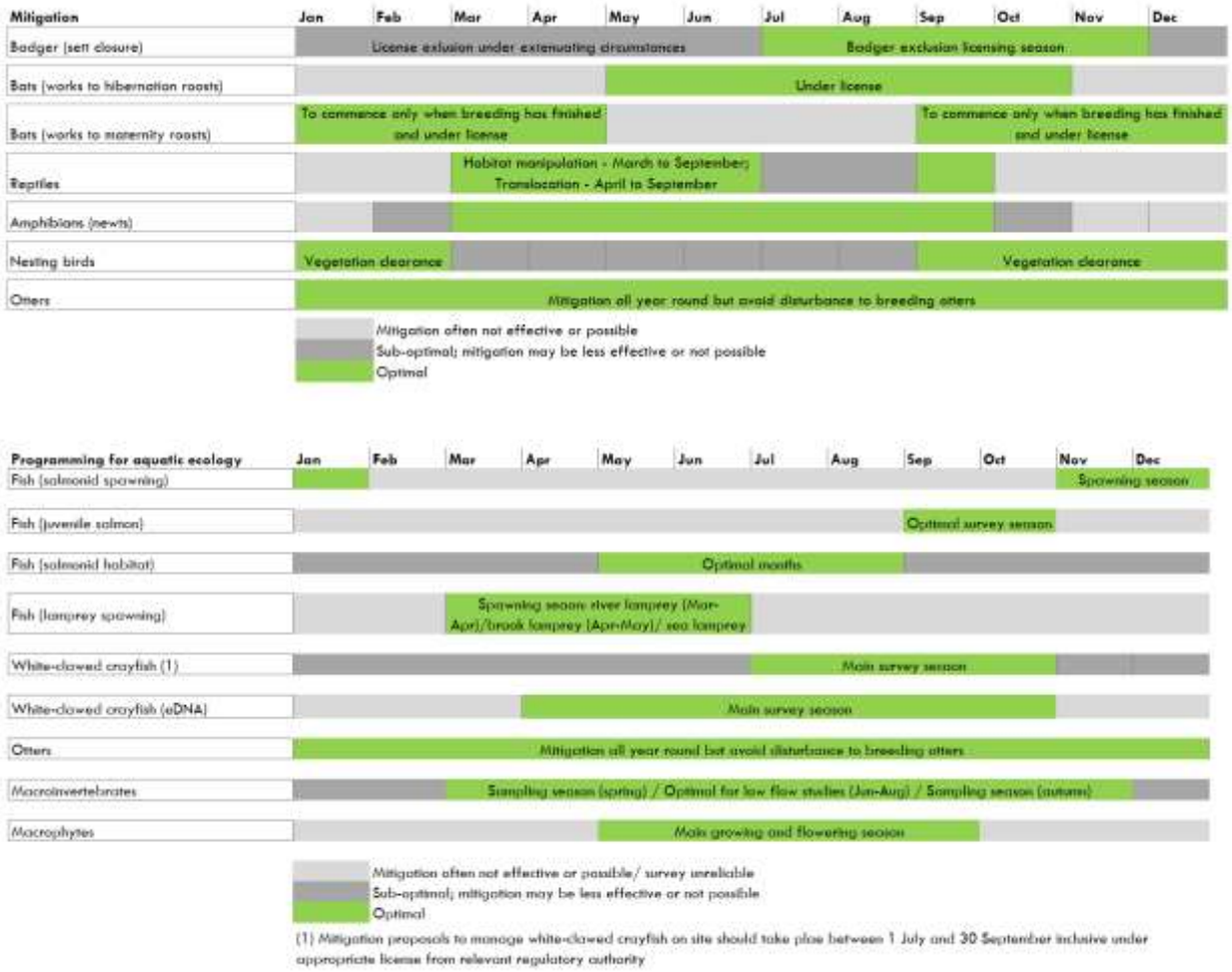


Figure 8 18: Mitigation timing - ecological calendar

Juvenile lamprey habitat was present east of Kilmurray Student Village, in addition to being present at multiple suitable areas along the river, it is therefore possible that these works could negatively impact this habitat.

White-clawed crayfish are known to be present within 2 km of the proposed Greenway. The white-clawed crayfish is protected by national legislation (the Wildlife Act 1976, The Wildlife (Amendment) Act 2000) and is protected under Annex II and Annex V of the EU Habitats Directive (Nelson *et al*, 2018). Direct impacts to these species (such as deterioration in habitat quality due to sediment ingress and/or pollution incidents) are possible. The proposed works are temporary and no long-term impacts on these species are anticipated.

Numerous macroinvertebrate taxa that are sensitive to reductions in habitat or water quality may be present on site, and direct impacts to these species (such as deterioration in habitat quality due to sediment ingress and/or pollution incidents) are possible. This is particularly important on the River Shannon because it was assigned Q-Values of 3-4 (WFD Moderate; slightly polluted) (Feeley *et al*, 2020). Degradation (or further degradation) of the river habitats with increased sediment and/or pollution incidents is possible. However, as previously stated, the proposed works are temporary and no long-term impacts on these species are anticipated.

Mapping of Pollution Impact Potential (PIP) Phosphorus Focused Delivery Flow Paths maps (Figure 8-19) showed areas of converging runoff that result in an increasing accumulation of flow. The red flow paths have the highest surface runoff. Where these cross High PIP areas, higher P losses can be expected. Although the proposed Greenway does not intersect any High PIP areas, the works themselves may be more subject to

increased runoff at these points and particular care should be made to ensure sediment or pollutants are prevented from entering the waterways at these points (particularly east of Construction Compound 4 and west of Construction Compound 2).

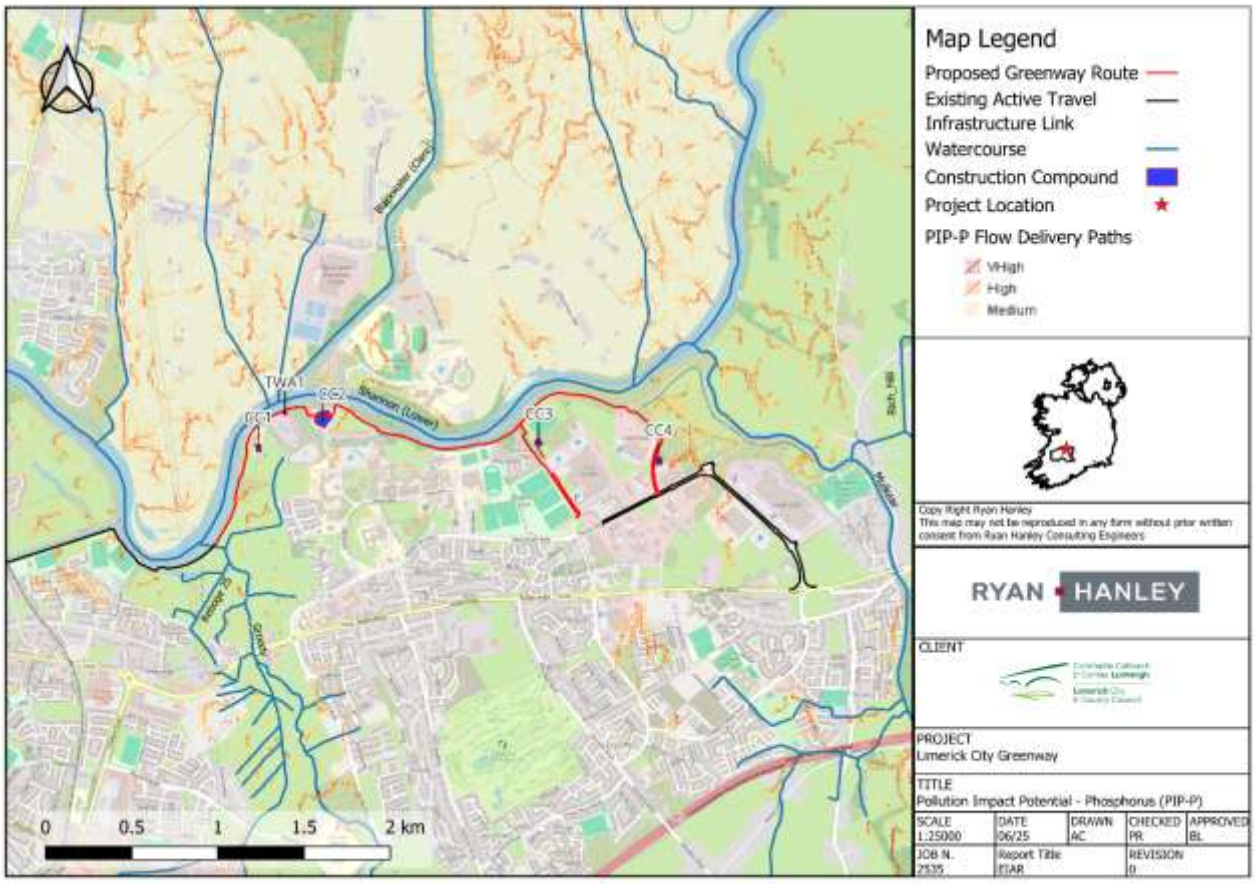


Figure 8-19: Pollution Impact Potential Phosphorus (PIP-P) Flow Delivery Paths in the vicinity of the proposed development

8.4.3.2 Use of Potential Water Contaminants:

Potential Short Term, Significant, Negative Impact

Many substances used and produced on construction sites have the potential to pollute both groundwater and surface water if not properly managed and treated (i.e. lubricants, cement, mortar, silt, soil, waste from site compound facilities, and other substances which arise during construction). The washing of construction vehicles and equipment also poses a pollution risk to watercourses. The spillage or leaking of fuel or oil from fuel tanks or construction vehicles has the potential to contaminate soils, groundwater and surface water.

Such substances entering the receiving surface water and groundwater bodies could damage the habitat of local populations of fish which are qualifying species within the Lower River Shannon SAC (see Appendix), the Floating River Vegetation' habitat for which the Lower River Shannon is designated an SAC, as well as protected species, otter and aquatic invertebrates, and ultimately cause direct harm to all aquatic fauna and reduce water quality.

The are no data available on potential chemical contaminants in riverbed or bankside sediments. If present, these could be mobilised and released into the water during construction. While the area has no major industrial or urban heritage, and is unlikely to be contaminated in this way, it is recommended that a small

number of sediment samples are analysed for key indicators, including metals on the WFD priority substance list.

8.4.3.3 Flood Risk

Potential Short Term Significant Negative Impact

The construction of physical structures, temporary or permanent within proximity to the River Shannon or within adjacent floodplain lands may result in loss of some conveyance or water storage should the river flood.

8.4.3.4 Operational Phase

Permanent Long Term Negative Impact

The introduction of porous but hard-standing area (i.e. the paved tarmacadam surface of the path) is likely to increase surface water runoff locally during or following an extreme rainfall event, this may result in an increase in peak flow within the Rivers Shannon (Lower). Whilst this may represent a potential source of diffuse pollution, the tarmac surface will be porous so there should be minor impact from changing the existing gravel hard standing area to tarmac along the River Shannon north of UL grounds. There will be a new hard standing area 3.5 - 4.0m wide in the IDA grounds but there will be a shallow drain on the non-river side of the proposed path to collect surface water from the hill and discharge it through 21 No. new culverts to the River Shannon. Should the River Shannon experience a significant flood event, and the proposed Greenway become inundated a minor increase in local flood water velocity may be experienced during shallower floods due to decreased surface friction when compared with another surface type e.g. hardcore or grass, but this effect would be quickly diminished should the Greenway become submerged to any significant depth.

A porous material will be used for surfacing and no hard standing areas will be constructed along the vast majority of the proposed path. The exception will be the new concrete bridge west of Plassey Mill, and the disability access ramp at Plassey Beach. These small areas will create a loss of infiltration area.

Physical obstructions during the construction phase (e.g. site equipment, machinery, temporary raised earthworks or construction materials) within the floodplain of the Rivers Shannon (Lower) may impede flood flow routes and remove some floodplain capacity. Materials such as machinery could become mobile during a flood event of significant magnitude which poses a flood hazard and a blockage risk to structures within the River Shannon should the equipment find its way into the watercourse. This risk would be associated with the construction phase and would cease to exist once permanent structures are built.

The construction of three new steel and concrete bridge structures and replacement of two concrete decks with steel decks has the potential to reduce the capacity of existing drainage channels and potentially increase the chance of flooding. However, the width of existing drainage channels and Mill Race channel will remain unchanged, and the bridge structures will be raised well above the water level to the existing path level. The risk of a reduction in the capacity of the existing drainage channels and associated flood risk would be minimal.

Additionally, the ground levels adjacent to the existing structures suggest that these structures are likely to be surcharged and potentially submerged during a significant fluvial flood event on the River Shannon.

No long-term negative impacts on the water quality of the river are foreseen, provided the recommended plans, mitigation measures and monitoring are conducted and an Environment Clerk of Works (ECoW) is employed to oversee the planned works.

8.5.4 Mitigation Measures

8.4.4.1 Construction Phase

Sediment erosion and ingress into the watercourse generating silt-laden run off & increase in Suspended Solids

The following mitigation and monitoring measures will be put in place to protect the ground and surface waters in the Study Area and will ensure no leaching of sediment to enter localised groundwater or surface waters.

Mitigation Measures, Monitoring & Surveys Required

- Works shall be carried out in accordance with the **Mitigation timing - ecological calendar.**
- Measures specified in the Construction Environmental Plan (CEMP) will be adhered to in order to ensure all works are carried out in a manner designed to avoid and minimise any adverse impacts on the receiving environment.
- Measures which are specified in the Invasive Species Management Plan (ISMP) have been produced to reduce the spread of all Invasive Non Native Species (INNS) during the movement of personnel and equipment into and out of the construction area and to ensure Standard 'Check, Clean, Dry' procedures are followed to minimise the risk of INNS spread. A Biosecurity Management section is contained in the in the ISMP and also outlined in the OCEMP.
- Engagement of an Ecological Clerk of Works (ECoW) to supervise the proposed works and implement the recommendation contained within the Water Quality Monitoring Plan and ISMP and surveys of the bankside and close bank channel and all areas where bank side work is proposed.
- Where bank side works are proposed, ingress of sediment into the watercourse must be prevented. Sediment barriers such as sediment netting/fences or silt traps shall be used to temporarily trap sediment to prevent sediment transport into the river, at all interfaces of the works area with a waterbody in advance of construction works on the banks of the river.
- Bankside works should be undertaken at times of good weather and low flow in the River where there is no potential for the works area to become inundated with water and no potential for significant volumes of surface water runoff from the works area.
- Where possible, works should be timed to avoid the key periods of sensitivity for migratory fish species. Works/ construction activities should also be confined to standard daylight hours. To reduce disturbance to fish, areas where bank side works are required should be accessed from the bank/ existing cycle path.
- All works undertaken on the banks should be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.
- Particular care to prevent run-off of sediment or pollutants into the river should be taken in areas where the potential for the highest surface runoff (east of Construction Compound 4 and west of Construction Compound 2) on the map of Pollution Impact Potential (PIP) Phosphorus Focused Delivery Flow Paths;
- A silt fence should be erected on all sides of the temporary site compounds to prevent any runoff from the perimeter of the compounds.
- Temporary or permanent loss of riparian and marginal habitat during both the pre- and post-construction phases should be avoided.
- To prevent noise and disturbance to designated species and habitats where possible, works should be timed to avoid the key periods of sensitivity for migratory fish species as illustrated in Figure 8.20. Works and construction activities should also be confined to standard daylight hours. In order to reduce disturbance to fish species, areas where bank side works are required should be accessed from the bank/ existing path.

Species	Life stage	J	F	M	A	M	J	J	A	S	O	N	D
Atlantic salmon	Spawning & egg incubation												
	Juveniles												
	Adult U/S migration												
	Smolt D/S migration												
Brook lamprey	Spawning & egg incubation												
	Ammocoetes												
River lamprey	Spawning & egg incubation												
	Ammocoetes												
	U/S migration												
	D/S migration												
Sea lamprey	Spawning & egg incubation												
	Ammocoetes												
	U/S migration												
	D/S migration												

Figure 8-20 Key timings of migratory fish species with the lower River Shannon SAC

- To prevent pollution by leakage or spillage of water contaminants stockpiling should be confined to compounds which are >30m from watercourses.
- There will be no refuelling of machinery near the river channel. Refuelling will take place at designated locations in the site compound (details of site compounds are provided in Chapter 4) on an impermeable surface at distances of greater than 50 metres from the watercourse.
- No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times.
- Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated site compound at a location that is removed from the river. The locations of the site compounds are shown on Figure 8-19. All construction materials and plant should be stored in the site compounds. Compounds should be located on ground that is not prone to flooding or should be surrounded by a protective earth bund to prevent inundation. The site compounds will be surfaced with a hard standing to prevent generation of mud. A silt fence will be erected on all sides of the compounds to prevent any runoff from the perimeter of the compounds. The locations of the site compounds will be adequately buffered to prevent any surface water runoff.
- All vehicles should be regularly maintained and checked for fuel and oil leaks
- During the construction phase site materials should, where reasonably practicable be stored outside of the present day high likelihood flood extent. Site managers should regularly consult the Met Eireann flood warnings website https://www.met.ie/warnings/today if significant flooding is expected, construction materials which could become mobile should be anchored securely or moved to a location where flooding is not anticipated.
- The surface area of the proposed Greenway upgrade is approximately 0.03km2, and the path surface will be porous tarmacadam in accordance with TII and NTA design manuals. Considering the underlying bedrock aquifer is only moderate productivity and the catchment area of the River Shannon (Lower) at the Study Area is several orders of magnitude greater than the area of proposed Greenway, it is not considered that mitigation for groundwater recharge is required and surface water should be allowed to flow freely overland towards the River Shannon (Lower) or infiltrate naturally into surrounding ground. This approach should be confirmed with the EPA prior to final design.
- Whilst fast flowing water over the Greenway surface during a flood is a concern, physical interventions will not mitigate this without causing further environmental impacts e.g. diversion of flow paths. Therefore, it is recommended that signage is utilised to identify areas of potential flood risk and advise users not to cycle or walk through water should the river flood, the signage could also recommend users check the Met Eireann flood warnings website https://www.met.ie/warnings/today.

- The review of ground levels around the existing structures has shown they are likely flooded and/or surcharged during significant flood events occurring on the River Shannon, therefore, the new bridge structures in the locations will also experience flooding. The final design of the bridges will ensure that the deck levels match the existing deck levels. The construction of the bridges will be a steel frame design without solid parapets and therefore is unlikely to significantly reduce channel capacity or floodplain capacity. As with other locations of the Greenway where the risk of flooding cannot be mitigated, signage should be utilised to inform users of the potential flood risk and discourage usage should the River Shannon be within a state of flood.
- It is understood that piles will be designed so that there will be no loss of conveyance of water and no creation of structures that impact floodplains, either during the construction phase or as a result of the final build. In this scenario (which will be confirmed by the construction plan), flood risk as a result of loss of conveyance or water storage would be minimised.

Monitoring

- Daily monitoring of excavations and works areas by a suitably qualified person such as the Environmental Manager (EM) or the Environmental Clerk of Works (ECoW) will occur during the construction phase. Run-off from works, stockpile and/or compound areas will be monitored and observed daily by ECoW to ensure that it is not impacting on any local watercourses.
- Monitoring should occur upstream and downstream of any areas of active construction.

8.5.5 Residual Impacts during the Construction Phase

Improvement of flood protection at rear of Fisherman Cottages

Long Term Perceptible Positive Impact

The residents in the Fisherman Cottages requested LCCC to resolve surface water drainage problems that is caused by rising water levels from water associated with the Plassey Mill Race. This project will deliver a solution because the proposed raised bank at the rear of the cottages will create an earth bund and prevent surface water from entering the read of the cottages. Any surface water that accumulates with the earth bund area can be drained through proposed drains towards the Mill Race. A flap valve on the outlet pipe will prevent backflow into the rear of the cottages.

Generation of Silt-Laden Run-off & Increase in Suspended Solids

Short Term Imperceptible Negative Impact

With the abovementioned mitigation measures and monitoring in place, the residual impact on water quality resulting from the generation of silt-laden run-off and increase of suspended solids during the construction phase of the scheme is anticipated to be short term imperceptible negative impact. No significant effects or deterioration in water quality are anticipated.

Use of Potential Water Contaminants

Short Term Imperceptible Negative Impact

With the abovementioned mitigation measures and monitoring in place, the residual impact on water quality resulting from the use of potential water pollutants during the construction phase of the scheme is anticipated to be short term imperceptible negative impact. No significant effects or deterioration in water quality are anticipated.

Invasive Species

Short Term Imperceptible Negative Impact

With the abovementioned mitigation measures and adherence to control measures contained in the Invasive Species Management Plan (ISMP), it is anticipated that no change in the distribution of Invasive Non Native Species should take place during the construction phase of the scheme. A short term imperceptible negative impact is anticipated.

Loss of Riparian and Marginal Habitat

Short Term Imperceptible Negative Impact

With the abovementioned mitigation measures including limited bank side works and no in-stream and proposed mitigation measures, it is anticipated to be short term imperceptible negative impact. No significant effects or loss of riparian and/or marginal habitat is anticipated.

Migratory Fish Species

Short Term Imperceptible Negative Impact

With the abovementioned mitigation measures so that construction works are timed correctly and key periods of sensitivity for migratory fish species are adhered to. No significant effects or spawning, egg incubation, ammocoetes, and migration are anticipated.

8.5.6 Cumulative and In-Combination Impacts Assessment

8.4.6.1 Cumulative Impact Assessment

All elements of the proposed development were assessed in order to identify any cumulative effects.

Although individually a scheme may have an insignificant impact on WFD quality elements within a reach, the combined effect of several schemes within a water body may cause deterioration. The cumulative effects of existing pressures and other planned schemes that may have similar effects within a water body must be considered in combination with the impacts of the proposed scheme.

The risk of flooding is relatively high so works in Flood Zone A area should be planned when river levels in the River Shannon are historically low (i.e. Irish summer). Works shall also be planned in accordance with the ecology calendar.

Site activities during the construction phase have the potential to give rise to water pollution, and consequential impacts on flora and fauna. Extensive mitigation is proposed to minimise the potential for water pollution arising from the works which also minimises the potential for any cumulative or interacting effect.

8.4.6.2 In-Combination Impact Assessment

The proposed Scheme has been considered, in combination with plans and the projects set out in Chapter 3, Section 3.5 of the EIAR in order to assess any in-combination effects.

The Limerick Development Plan 2022-2028 and planning register were consulted to identify any developments which could cause cumulative impacts with the proposed project. No major developments that would have in-combination effects are planned for the area within this time period.

For the reasons outlined in this Chapter and with mitigation measures in place, the proposed work will not lead to any deterioration in water quality status. Following a detailed assessment of the receiving environment and potential impacts of the proposed Scheme in combination with the potential impacts of the

plans and projects set out in Chapter 3, Section 3.5, no potential for significant in-combination cumulative effects on water are anticipated.

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9 AIR QUALITY / NOISE & VIBRATION

This section of the Environmental Impact Assessment Report (EIAR) assesses the impact of the Limerick City Greenway (UL to NTP) on

(i) Air quality, and

(ii) Noise and vibration, in the context of current relevant standards and guidance, and identifies any requirements or possibilities for mitigation.

Where negative effects are anticipated, mitigation measures and monitoring are set out. Any residual effects of the proposed development on air quality, noise and/or vibration are assessed. The cumulative effects of the development and the cumulative effects in-combination with other plans and projects are also presented in this Chapter.

One of the key objectives of the proposed works is to increase the number of users availing of sustainable transport infrastructure between Limerick City Centre and the University of Limerick (Limerick Smarter Travel – Route 2 Planning Report, April 2014). The proposed development will therefore, have a positive impact on air quality during the operational phase as discussed in further detail in Sections 9.1.4.4.

Impacts on air quality, noise and vibration may occur during the construction phase of the Limerick City Greenway (UL to NTP). Construction activities such as excavation, material handling and operation of construction plant and machinery and can lead to emissions of pollutants such as sulphur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ & PM_{10}) and carbon monoxide (CO), all of which can impact on air quality. The impact of the proposed works on air quality is presented in Section 9.1 of the EIAR.

Noise and vibration impact assessments have been prepared for the construction phase of the proposed works in relation to the nearest noise sensitive locations (NSLs) and are presented in Section 9.2.

The Limerick City Greenway (UL to NTP) has an indefinite operational duration; therefore, it is not considered necessary to assess the impacts of decommissioning.

A description of the proposed works is provided in Chapter 4 of the EIAR.

The air quality, noise and vibration impact assessments presented in this section of the EIAR have been completed in accordance with the 'EIA Directive' as amended by Directive 2014/52/EU and the relevant guidance listed in Chapter 1.

9.1 AIR QUALITY STANDARDS

9.1.1 Ambient Air Quality Standards

The Air Quality Framework Directive (96/62/EC) was published in 1996 and sets out the principles of the European Commission's approach to monitoring, assessing and managing ambient air quality in order to reduce the risk to human health from poor air quality. Following this, four "daughter" directives were published which set out limits for specific pollutants:

- 1st Daughter Directive (1999/30/EC): Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead.
- 2nd Daughter Directive (2000/69/EC): Carbon monoxide and benzene.
- 3rd Daughter Directive (2002/3/EC): Ozone.

- 4th Daughter Directive (2004/107/EC): Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air.

In May 2008, the Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was published which replaced the Air Quality Framework Directive and Daughter Directives 1-3 listed above. The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) and the 4th Daughter Directive was transposed into Irish legislation by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009). The Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) was revoked on 31 December 2022 and has been replaced by the Ambient Air Quality Standards Regulations 2022 (S.I. No. 739/2022).

On December 2024, the revised EU Ambient Air Quality Directive (AAQD) (EU 2024/2881) entered into force. The Directive is an important milestone in achieving the European Union's zero pollution ambition, particularly the reduction of air pollution to levels no longer considered harmful to humans and the environment by 2050.

The EU Directive 2024/2881 merges and updates the two previous ambient air quality directives and brings 2030 EU air quality standards closer to the World Health Organisation's (WHO) Global Air Quality Guidelines (2021). EU members have until 11th of December 2026 to transpose the AAQD into national law and are required to meet updated air quality standards by 2030. The measures introduced in the Directive include:

- Reducing by more than half the allowed annual limit value for fine particulate matter (PM2.5).
- Updating air quality standards for allowed levels in ambient air for a total of twelve air pollutants.
- Reviewing air quality standards frequently.

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2022 (S.I. No. 739/2022), which incorporate EU Directive 2008/50/EC which combines the previous air quality framework and subsequent daughter directives. Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Tables 9.1 – 9.3).

There are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been set in respect of this development. However, guidelines from the Department of the Environment, Heritage and Local Government currently exist for dust emissions from quarrying and ancillary activities (DEHLG, 2004). These can be implemented with regard to dust emissions from the proposed construction site. The German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible level for dust deposition of 350 mg/m2/day averaged over a one-year period at any receptors outside the site boundary. Recommendations outlined by the Department of the Environment, Health & Local Government, apply the Bergerhoff limit of 350 mg/m2/day to the site boundary of quarries (DEHLG, 2004).

The concern from a health perspective is focused on particles of dust which are less than 10 microns. EU ambient air quality standards (Council Directive 2008/50/EC transposed into Irish law as S.I. 180 of 2011) centres on PM10 (particles less than 10 microns) as it is these particles which have the potential to be inhaled into the lungs and cause some adverse health impact. The Directive also sets an ambient standard for PM2.5 (particles less than 2.5 microns) which came into force in 2015. The European Environment Agency report Air Quality in Europe – 2022 indicated that in 2020, 610 deaths in Ireland were attributed to exposure to pollutants including fine particulate matter (PM2.5), nitrogen oxides (NOx) and Ozone (O3) (EEA, 2022).

Table 9.1 Air Quality Standards Regulations 2022 (Based on Directive 2008/50/EC as amended and S.I. 739 of 2022)

Pollutant	Regulation Note 1	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide (NO_2)	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	40% until 2003 reducing linearly to 0% by 2010	200 µg/m³ NO_2
		Annual limit for protection of human health	40% until 2003 reducing linearly to 0% by 2010	40 µg/m³ NO_2
		Annual limit for protection of vegetation	None	30 µg/m³ NO + NO_2
Lead (Pb)	2008/50/EC	Annual limit for protection of human health	100%	0.5 µg/m³
Sulphur Dioxide (SO_2)	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	150 µg/m³	350 µg/m³
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 µg/m³
		Annual & Winter limit for the protection of ecosystems	None	20 µg/m³
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50%	50 µg/m³ PM_{10}
		Annual limit for protection of human health	20%	40 µg/m³ PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health	20% from June 2008. Decreasing linearly to 0% by 2015	25 µg/m³ $PM_{2.5}$
$PM_{2.5}$ (Stage 2)Note 2	-	Annual limit for protection of human health	None	20 µg/m³ $PM_{2.5}$
Benzene (C_6H_6)	2008/50/EC	Annual limit for protection of human health	100% until 2006 reducing linearly to 0% by 2010	5 µg/m³
Carbon Monoxide (CO)	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10 mg/m³ (8.6 ppm)

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

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

Table 9.2 US National Ambient Air Quality Standards (NAAQS) & PSD Increments

Pollutant	Averaging Period	Primary / Secondary Note 1	*Level*
$PM_{2.5}$	1 Year – annual mean, averaged over 3 years	Primary	12 ($\mu g/m^3$)
	1 Year – annual mean, averaged over 3 years	Secondary	15 ($\mu g/m^3$)
	24 Hour - 98th Percentile, averaged over 3 years	Primary & Secondary	35 ($\mu g/m^3$)
PM_{10}	24-Hour – not to be exceeded more than once per year on average over 3 years	Primary & Secondary	150 ($\mu g/m^3$)
NO_2	1 hour – 98th Percentile of 1-hour daily maximum values, averaged over 3 years	Primary	100 ($\mu g/m^3$)
	1 Year – Annual Mean	Primary & Secondary	53 ($\mu g/m^3$)
CO	8 Hour – not to be exceeded more than once per year	Primary	9 ppm
	1-Hour – not to be exceeded more than once per year	Primary	35 ppm
Hydrocarbon (Benzene)	3 Hours (6-9 AM) (corrected for methane)		160

Note 1 Primary standards to protect public health whilst secondary standards are set to protect public welfare

Table 9. 3 WHO Air Quality Guidelines 2005 and 2021

Pollutant	AQGs 2005	AQGs 2021	Averaging Time
Nitrogen dioxide (NO_2)	- $\mu g/m^3$ 40 $\mu g/m^3$	25 $\mu g/m^3$ 10 $\mu g/m^3$	24 hour Annual
Sulphur Dioxide (SO_2)	20 µg/m	40 $\mu g/m^3$	24 hour

Carbon monoxide	- mg/m^3	4 mg/m^3	24 hour
Ozone (O_3)	- µg/m^3 100 µg/m^3	60 µg/m^3 100 µg/m^3	Peak season 8-hour
Benzene	Note 1		
Particulate matter ($PM_{2.5}$)	25 µg/m^3 10 µg/m^3	15 µg/m^3 5 µg/m^3	24 hour Annual
Particulate matter (PM_{10})	50 µg/m^3 20 µg/m^3	45 µg/m^3 15 µg/m^3	24 hour Annual

Note 1 No safe level recommended owing to carcinogenicity.

9.1.2 Air Quality - Existing Environment

9.1.2.1 Meteorological Data

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

The nearest weather station collating detailed weather wind rose records is Shannon Airport which is location approximately 20 km north of the proposed Greenway. Data collated by Met Eireann for the 30-year average (1991 – 2020) indicates that the mean windspeed at Shannon Airport is 9.1 knots. The predominant wind direction is south-southwest.

Based on the above, the mean windspeed at Limerick is likely to be in the region of 9.1 knots with a predominant south-southwest wind direction.

9.1.2.2 Background Air Quality Monitoring Data

Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The *National Ambient Air Quality Network* is a series of air quality monitoring stations across the country. Air quality data from the stations is assessed against the European legal limit values and World Health Organisation (WHO) guideline values, as detailed in Section 9.1.1.

The most recent annual report on air quality "*Air Quality in Ireland 2023*" (EPA, 2024), details the range and scope of monitoring undertaken as part of the National Ambient Monitoring Programme (AAMP) which

commenced at the end of 2017. Nine new EU Level monitoring sites were brought online by the end of 2023. Ireland met all of its EU legal requirements in 2023 but failed to meet WHO[1] guideline levels for health. Achieving WHO Aire Quality Guidelines (AQG) in the future will be a major challenge for Ireland and all Europe. The report identifies two main pollutants in Ireland responsible for reducing air quality: particulate matter and nitrogen dioxide. The use of coal, peat and wood as solid fuel for home heating is noted to be the largest problem for air quality in Ireland. Along with traffic in major town and cities. Levels above the WHO air quality guideline (AQG) values were observed in 2023 for particulate matter (PM_{10} and PM_{25}), ozone, nitrogen dioxide and sulphur dioxide.

The Clean Air For Europe Directive (Directive 2008/50/EC on ambient air quality and cleaner air for Europe) requires that areas are divided into zones for the assessment and management of air quality. In Ireland, Zone A is the Dublin Conurbation, Zone B is the Cork Conurbation, Zone C is all large towns in Ireland with a population >15,000 and Zone D is all remaining area. Limerick City is categorised as Zone C.

Nitrogen Dioxide (NO_2)

The operation of construction plant and machinery has the potential to produce oxides of nitrogen (NOx). Nitrogen dioxide (NO_2) is of most concern due to its impact on health. The WHO has reported that epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long term exposure to NO_2 (WHO, 2006). The primary source of NO_2 in Ireland is from road transport, particularly diesel engine vehicles (EPA, 2024). Other sources identified by the EPA as contributing to NO_2 emissions are off road machinery, industrial and construction activities as well as electricity and heat production equipment (EPA, 2024).

NO_2 monitoring was carried out at 36. No stations in Ireland in 2023. All concentrations observed were below the annual limit values. From 2005 there was a reduction in approximately 22% in NO_2 levels considering all Zones.

Monitoring of NO_2 levels in Zone C locations which was carried out by the EPA from 2005 to 2021 indicates that levels were consistently below the EU annual limit and WHO guideline value (40 µg/m^3) for NO_2 **(Figure 9. 1**). Hence long-term average concentrations measured at Zone C locations, including Limerick, were significantly lower than the EU annual average limit value for the protection of human health of 40 µg/m^3.

[1] WHO Air Quality Guidelines are not legally binding however Ireland and Europe should move towards achieving them.

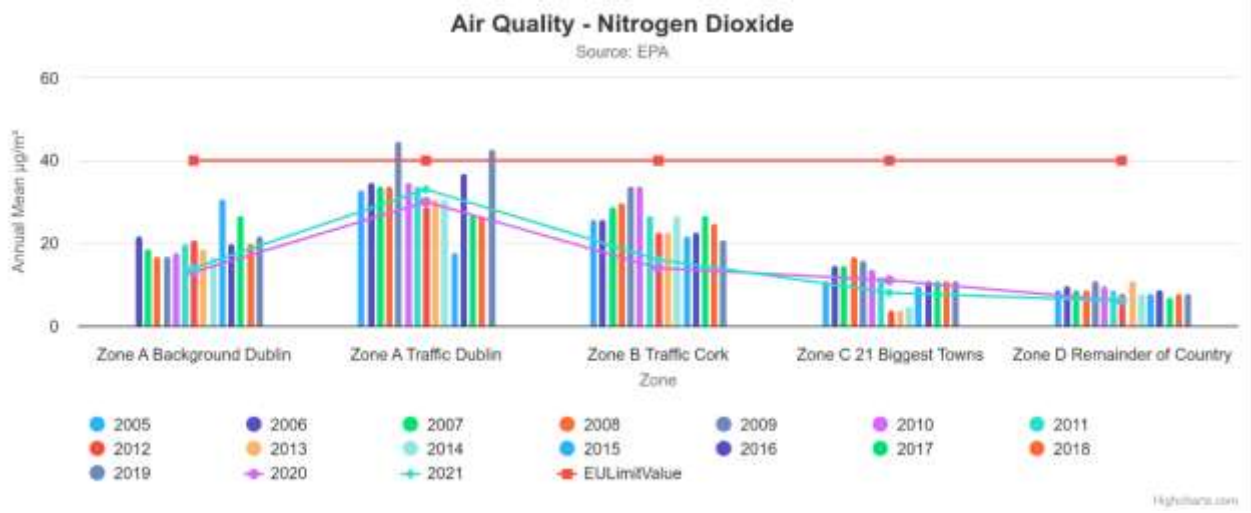

Figure 9. 1 EPA Air Quality - Nitrogen Dioxide (Source : EPA 2022, https://www.epa.ie/resources/charts--data/air/air-quality---nitrogen-dioxide.php

In addition to the above, real time air quality monitoring (January 2023) at three Limerick City and County Council air quality monitoring stations, located in O'Connell Street, Castletroy and Mungret, indicate that the measured long term mean NO_2 from Mar 2023 – Mar 2024 was 22 µg/m³, 12 µg/m³ and 10 µg/m³, respectively (LCCC, March 2024). The maximum recorded short-term mean values for NO_2 in March 2024 are presented in **Table 9. 4** below and indicate that there were no exceedances of the EU limit value or WHO Guideline Values (LCCC, March 2024).

Table 9. 4 Maximum Recorded Short-Term Mean Values for NO2 at Local Air Monitoring Sites in Limerick (LCCC, March 2024)

Location	Date	Pollutant	Averaging Period	WHO Guideline Value	Maximum Value Registered
O'Connell St, Limerick	Mar 2024	NO_2	1 hour	200 µg/m3	71 µg/m³
Castletroy, Limerick					10 µg/m³
Mungret, Limerick					29 µg/m³

Additionally, nitrogen dioxide (NO2) concentrations are currently been monitored at a number of locations within the Limerick urban area through the joint EPA/local authority diffusion tube monitoring programme using passive diffusion tube samplers (A. Finn - LCCC, per comm, Oct 2022). Indicative results show low level concentrations <10 µg/m³ (i.e good air quality) along the route of the proposed Greenway at Limerick Boathouse.

Based on the above information and baseline EPA monitoring data, the expected background concentration for Limerick City is below the EU annual mean and WHO annual mean guideline limit values of 40 µg/m³ and the WHO guideline 1-Hour limit value of 200 µg/m³.

Particulate Matter (PM_{10})

PM_{10} is defined as particulate matter with a particle size of 10 microns or less. Exposure to PM_{10} is a concern from a health perspective as particles of this size can penetrate and lodge inside the lungs causing adverse health impacts, predominantly to respiratory and cardiovascular systems (WHO, 2006). The main source of particulate matter (particularly fine particulate matter) is from burning of solid fuels. In addition, natural sources such as pollen can contribute to PM_{10} (EPA, 2024). Construction activities have also been identified as a source of PM_{10} (EPA, 2024). PM_{10} is generated on construction sites during activities such as resuspension of road dust, excavation, handling and stockpiling of soil and aggregates and from cutting of materials.

PM_{10} monitoring was carried out at 106. No monitoring stations in Ireland in 2023. No exceedance of the EU limit values (annual and daily) were recorded. However, WHO limit values were exceeded as they are more challenging to comply with.

Monitoring of PM_{10} levels in Zone C locations which was carried out by the EPA from 2005 to 2021 indicates that levels were consistently below the EU limit value for PM_{10} (**Figure 9. 2**). Hence long-term average concentrations measured at Zone C locations, including Limerick, were significantly lower than the EU annual average limit value for the protection of human health of 40 µg/m³. Although the WHO limit value of 20 µg/m³ was exceeded some years, it wasn't the case for 2021, with higher levels recorded in Zone C with 19 µg/m³ .

Figure 9. 2 EPA Air Quality - Particulate Matter 10 (Source : EPA 2022, https://www.epa.ie/resources/charts--data/air/air-quality---pm10.php)

Real time air quality monitoring (March 2024) at three Limerick City and County Council air quality monitoring stations, located in O'Connell Street, Castletroy and Mungret, indicate that the measured long term mean PM_{10} from March 2023 – March 2024 was 12 µg/m³, 7 µg/m³ and 11 µg/m³, respectively (LCCC, March 2024). The maximum daily mean values for PM_{10} in January 2024 are presented in **Table 9. 5** below and indicate that there were no exceedances of the EU limit value or WHO Guideline Values (LCCC, January 2024).

Table 9. 5 Maximum Daily Mean Values for PM10 in March 2024 at Local Air Monitoring Sites in Limerick (LCCC, March 2024)

Location	Date	Pollutant	Averaging Period	WHO Guideline Value	Maximum Value Registered
O'Connell St, Limerick	March 2024	PM_{10}	24-hour	45 µg/m³	22 µg/m³
Castletroy, Limerick					19 µg/m³
Mungret, Limerick					39 µg/m³

Based on the above information and baseline EPA monitoring data, the expected background concentration for Limerick City is below the EU annual limit value of 40 µg/m³. WHO guideline 24-hours limit value of 45 µg/m³ was not exceeded.

Fine Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ is classed as fine particulate matter with a particle size of 2.5 microns or less. Exposure to $PM_{2.5}$ is more health-damaging than PM_{10} as fine particulate matter can penetrate the lung barrier and enter the bloodstream leading to adverse health impacts (WHO,2006). Fine Particulate Matter is generated from construction activities such as excavation, handling and stockpiling of soil and aggregates, and from cutting of materials as well as emissions from diesel fuel combustion by construction plant and machinery and haulage heavy goods vehicles (HGVs).

$PM_{2.5}$ monitoring was carried out at 101. No monitoring stations in Ireland in 2023. No exceedances of the EU annual limit value were recorded. WHO limit values were not exceeded in 2021 but reached the 10 µg/m³ Zone D.

Monitoring of $PM_{2.5}$ levels in Zone C locations which was carried out by the EPA from 2005 to 2021 indicates that levels were consistently below the EU limit value for $PM_{2.5}$ (**Figure 9. 3**) however exceedances of the WHO guideline value (10 µg/m³) was observed. Long-term average concentrations measured at Zone C locations, including Limerick, were lower than the EU annual average limit value for the protection of human health of 20 µg/m³.

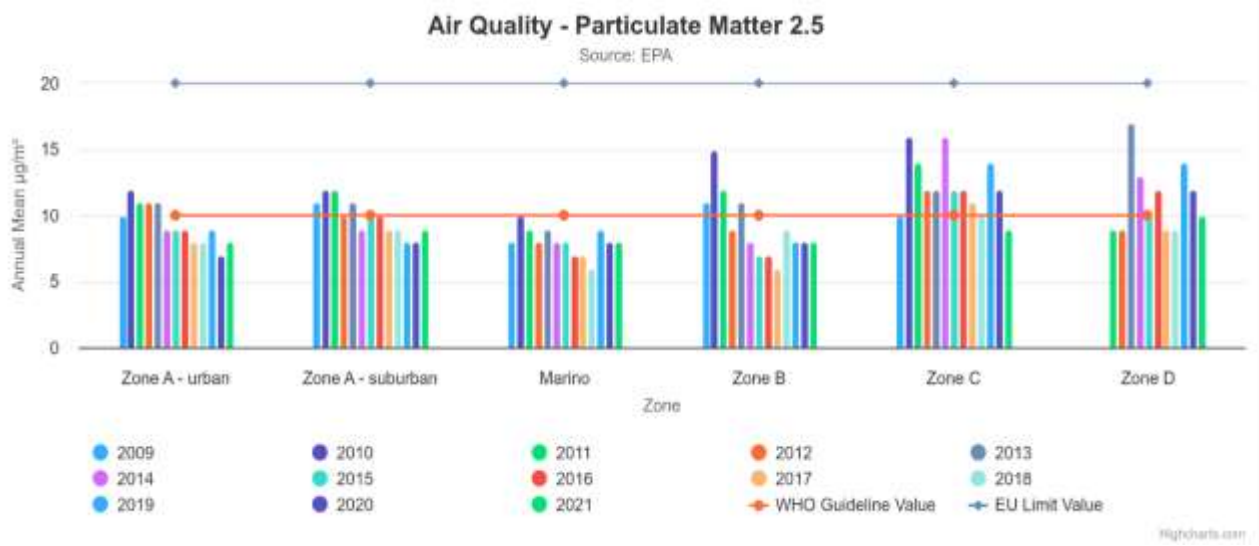

Figure 9. 3 EPA Air Quality - Particulate Matter 2.5 (Source : EPA 2022, https://www.epa.ie/resources/charts--data/air/air-quality---particulate-matter-25.php)

Real time air quality monitoring (March 2024) at three Limerick City and County Council air quality monitoring stations, located in O'Connell Street, Castletroy and Mungret, indicate that the measured long term mean $PM_{2.5}$ from March 2023 – March 2024 was 8 µg/m³, 6 µg/m³ and 6 µg/m³, respectively (LCCC, March 2024). The maximum recorded daily mean values for $PM_{2.5}$ in March 2024 are presented in Table 9.6 and indicate that there were no exceedances of the EU limit value but WHO Guideline Values were exceeded at all three stations (LCCC, March 2024).

Table 9. 6 Maximum Daily Mean Values for PM2.5 in March 2024 at Local Air Monitoring Sites in Limerick (LCCC, March 2024)

Location	Date	Pollutant	Averaging Period	WHO Guideline Value	Maximum Value Registered
O'Connell St, Limerick	January 2023	$PM_{2.5}$	24-hour	15 µg/m³	19 µg/m³
Castletroy, Limerick					17 µg/m³
Mungret, Limerick					14 µg/m³

Based on this information, the anticipated background $PM_{2.5}$ concentration for Limerick is below the EU annual mean limit value for protection of human health of 20 µg/m³. But above WHO guideline values for O'Connell St., and Castletroy stations.

Benzene (C_6H_6)

The WHO has reported that exposure to Benzene is associated with a range of acute and long-term adverse health effects and diseases (WHO, 2010). Benzene emissions from the construction of the Greenway may

arise from exhaust emissions and evaporation losses from construction machinery, and evaporation losses during the handling, distribution and storage of petrol.

With regard to benzene, continuous monitoring was carried out at Kilkenny Seville Lodge (Zone C), and Rathmines (Zone A) in 2019, with annual averages of 0.12 µg/m^3 and 0.26 µg/m^3 respectively (EPA, 2019). Monitoring of Benzene in Dublin, Cork and Kilkenny from 2007 – 2017 indicates that levels were consistently below the EU limit value over the time period (EPA, 2018).

Based on the above information a conservative estimate of the background benzene concentration for the region of the proposed development is below 1.0 µg/m^3. This is below then EU annual limit for protection of human health of 5 µg/m^3.

Carbon Monoxide (CO)

Carbon monoxide (CO) plays a role in air pollution. CO affects the abundance of methane, carbon dioxide and ozone in the atmosphere. CO emissions from the construction of the proposed development may arise from exhaust emissions from construction plant.

In terms of CO, results for the Zone C location of Portlaoise was 0.1mg/m^3 annual mean for the rolling 8-hour CO concentration in 2019, while Enniscorthy (Zone D) was 0.06 mg/m^3 for the annual average in 2016. Monitoring of CO in Dublin and Cork from 2007 – 2017 indicates that levels were consistently below the EU limit value and WHO guideline value have been recorded over the time period (EPA, 2018).

Real time air quality monitoring (January 2024) at three Limerick City and County Council air quality monitoring stations, located in O'Connell Street, Castletroy and Mungret, indicate that the measured long term mean CO from March 2023 – March 2024 was 0.22 µg/m^3, 0.11 µg/m^3 and 0.25 µg/m^3, respectively (LCCC, March 2024). There are no WHO or EU CAFÉ Directive annual mean limits established for this gas.

The EU maximum 8-hour limit value for the protection of human health is set at 10 mg/m^3. Based on the above information the background CO concentration for the region of the proposed development is expected to be significantly lower than the EU limit value.

In summary, based on a review of extensive long-term data from the EPA and real time monitoring at three air quality monitoring stations in Limerick City, existing baseline levels of NO_2, PM_{10}, $PM_{2.5}$, CO and C_6H_6 are likely to be below ambient air quality limit values in the vicinity of the proposed development. In addition, the EPA's Air Quality Index for Health (AQIH) is a rating which indicates the current air quality in a region in terms of potential impact on human health and is based on five air quality pollutants: Ozone gas, nitrogen dioxide gas, sulphur dioxide gas and particulate matter (PM_{10} and $PM_{2.5}$). The AQIH for Limerick (People's Park and Henry Street Stations) is currently 2 – Good (Index calculated 12th March, EPA, 2024, https://airquality.ie/)

Ammonia (NH_3)

The agricultural sector accounts for mostly all (99%) of ammonia emissions in Ireland. Emissions are 14.4% higher than in 1990 (EPA, 2021). National emissions of ammonia are tightly linked to cattle population and nitrogen fertilizer use. Road transport accounts for <1% of national ammonia emissions as a result of three-way catalysts in passenger cars.

The Ambient Air Quality Standards Regulations 2022 (S.I. No. 739/2022) which transpose EU Directive 2008/50/EC does not include limit values for ammonia.

The Air Pollution Information System (APIS) developed in partnership by the UK and Ireland conservation agencies and regulatory agencies and the UK Centre for Ecology and Hydrology. The latest available data of ammonia dates from 2018. Results show a 2.53 ug m-3 of NH_3. According to APIS Ammonia critical levels

range from 1 to 3 ug m-3. Most of ammonia levels in Ireland are closer to the upper-level threshold, surpassing levels that might be recommended to protect certain habitats.

9.1.3 Potential Impacts – Air Quality

A full detail on the description of the potential impact is given in Chapter 1 of this EIAR.

9.1.3.1 Do Nothing' Scenario

One of the key objectives of the proposed Greenway is providing an alternative, more sustainable mode of transport which minimises the negative impacts of unsustainable transport modes on the environment through the reduction of localised air pollutants and greenhouse gas emissions. If the proposed development were not to proceed, this opportunity to reduce air pollutants and greenhouse gas emissions would be lost.

9.1.3.2 Air Quality – Dust and Particulate Matter (PM_{10} & $PM_{2.5}$) Generation

Construction Phase - Potential Temporary Slight Negative Impact

Dust particles can be defined as those that are easily deposited (coarse fraction of particulates) and airborne particles that remain suspended in air for longer periods. The size of deposited and suspended particles therefore affects their distribution.

Currently there are no EU, WHO or Irish Statutory standards or limits for the assessment of dust deposition. The German TA Luft Air Quality Standard sets a guideline limit value for total dust deposition of 350 $mg/m^2/day$ (averaged over a 30 +/- 2 day period).

A study by the UK ODPM (2000) gives estimates of likely dust deposition levels in specific types of environments. In open country a level of 39 $mg/m^2/day$ is typical, rising to 59 $mg/m^2/day$ on the outskirts of town and peaking at 127 $mg/m^2/day$ for a purely industrial area. As a worst-case, a level of 127 $mg/m^2/day$ can be estimated as the existing dust deposition level for the current location which is below the TA Luft guidelines of 350 $mg/m^2/day$. The German TA Luft Regulations set criteria for 'possible nuisance' of 350 $mg/m^2/day$ and 'very likely nuisance' of 650 $mg/m^2/day$.

Construction activities may lead to the emission of dust. Dust is classified as matter with a particle size of between 1 and 75 microns (1-75 µm). As dust particles fall out of suspension in the air, dust deposition typically occurs in close proximity to the site and potential impacts generally occur within 500 metres of the dust generating activity. Deposition rates decrease with distance from the generating source and larger particles deposit closer to the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is expected to stop.

The potential for dust to be emitted will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction. Assuming worst case scenario, dust deposition may impact on properties within 500 m of the works during the construction phase of the development.

Dust generation rates depend on the site activity, particle size (in particular the silt content, defined as particles smaller than 75 microns in size), the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under "wet day" conditions where rainfall greater than 0.2 mm has fallen. 30-year average data (1981 - 2010) from Shannon Airport meteorological station identified that typically 211 days per

annum are "wet", respectively. Therefore, for greater than 58% of the time no significant dust generation will be likely due to meteorological conditions.

Large particles which are greater than 75 microns in size fall out of atmospheric suspension and are therefore deposited in close proximity to the source. Smaller particles which are less than 75 microns can remain in atmospheric suspension for a greater distance and therefore give rise to potential dust nuisance. Particles which are less than 75 microns in size are referred to as silt. Emission rates are normally predicted on a site-specific particle size distribution for each dust emission source. A proportion of generated $PM_{2.5}$ will be owing to diesel particulate matters are typically spheres about 15–40 nm in diameter, and approximately more than 90 % of PM is smaller than 1 μm in diameter. The formation process of PM emissions is dependent on many factors as the combustion and expansion process, fuel quality (sulfur and ash content), lubrication oil quality, and consumption, combustion temperature, exhaust gas cooling (Burtscher 2005)

The majority of dust produced during the construction period will be deposited in close proximity to the source and any impacts from dust will generally be within several hundred meters of the construction area (UK ODPM, 2000).

Construction activities such as excavating and earth moving are likely to produce some level of dust during the construction phase of the project. These activities will mainly produce particles of dust greater than 10 microns, these particles are considered a nuisance but do not have the potential to cause significant health impacts. Given that background levels of PM_{10} and $PM_{2.5}$ are likely to be below the ambient air quality limit values and as the construction phase of the proposed Greenway is temporary, the potential for dust nuisance and significant levels of PM_{10} and $PM_{2.5}$ will be temporary and will vary spatially during the construction phase, constituting a temporary slight negative impact. Mitigation measures relating to dust generation are detailed in Section 9.3.4.

Operational Phase - Potential Permanent Slight Positive Impact

The proposed Greenway will increase the number of people using sustainable transport to commute between Limerick City Centre, University of Limerick, NTP, and Annacotty due to connections with existing active travel infrastructure links which extend to Dublin Road (R445). This will result in a long term slight positive impact in terms of air quality by reducing the amount of air pollutants that would otherwise have been emitted from transport vehicles if the Greenway was not available.

9.1.3.3 Air Quality – Exhaust Emissions (NO_2, C_6H_6 & CO)

Construction Phase - Potential Temporary Slight Negative Impact

Construction related traffic originating from the delivery of materials to the site, the removal of surplus excavated material from the site and the transport of workforce to, from and within the site will give rise to emissions of nitrogen dioxide, sulphur dioxide, benzene and carbon monoxide within the site boundary (set out in Chapter 1 Figure 1.1) and along the anticipated transport routes presented in Chapter 12 Material Assets. This has the potential to impact on health and the environment as discussed in Sections 9.1.1, 9.1.2 and 9.1.3. Given that background levels of nitrogen dioxide, sulphur dioxide, benzene and carbon monoxide are likely to be below ambient air quality limit values as discussed in Section 9.1.3 and emissions will be temporary in nature, this constitutes a potential temporary slight negative impact in terms of air quality during the construction phase of the Greenway. Mitigation measures relating to exhaust emissions are detailed in Section 9.1.5.

Operation Phase - Potential Permanent Slight Positive Impact

The proposed Greenway will provide an alternative and sustainable transport option for cyclists and pedestrians undertaking recreational and/or commuting trips between Limerick City Centre, University of Limerick, NTP, and Annacotty due to connections with existing active travel infrastructure links which extend to Dublin Road (R445). Users will benefit from the higher quality air in comparison to alternative urban routes as well as making a positive contribution to urban air quality.

This will result in a long term slight positive impact in terms of air quality due to exhaust emissions during the operation phase of the development by reducing the amount of exhaust emissions that would otherwise have been emitted from transport vehicles if the Greenway was not available.

9.1.4 Mitigation Measures – Air Quality

9.1.4.1 Air Quality - Dust and Particulate Matter (PM_{10} & $PM_{2.5}$) Generation

The generation of dust and particulate matter is dependent on the construction activity being carried out and environmental factors such as rainfall, wind speed and wind direction. A worst-case scenario has been assumed in the assessment. In order to predict and reduce the volume of dust emissions pertaining to the construction phase of the proposed development, a dust minimisation plan has been developed and is included in the Construction Environmental Management Plan (CEMP) (Appendix 4C). Any measures specified in the plan that are to be carried out by third parties will be contractual obligations.

The following measures will be implemented in order to minimise dust impact:

- All site roads within the construction works boundary shall be regularly inspected, cleaned and maintained during the construction phase. The construction works boundary is shown in Chapter 4,
- Hard surface roads within the construction site boundary shall be regularly cleaned and dampened down to prevent the generation of dust;
- Any road that has the potential to give rise to dust emissions must be regularly inspected and watered during periods of dry and/or windy weather to minimise the movement of dust particles to the air and ensure that dust does not cause a nuisance;
- Speeds shall be restricted on hard surface roads and vehicles transporting materials with dust potential must ensure that the material is enclose or covered with tarpaulin at all times;
- The construction traffic routes identified in Chapter 12, shall be regularly inspected for cleanliness and cleaned as necessary to minimise the movement of dust particles to the air, as detailed in the CEMP;
- The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure that best practice and procedures are in place to minimise dust emissions;
- All plant and materials shall be stored in dedicated compound areas on site;
- Stockpiling of material will be minimised and stockpiles will be covered or fenced to prevent wind whipping. Materials which have the potential to produce dust will be removed from site as soon as possible;
- In the event of dust nuisance occurring outside the site boundary, movement of materials must be terminated immediately and procedures implements to rectify the problem; and

- A record of all dust and air quality complaints will be maintained, along with details of the cause of emissions and the measures implemented to reduce emissions. All records will be made available to Limerick City and County Council.

9.1.4.2 Air Quality - Exhaust Emissions (NO_2, C_6H_6 & CO)

A number of mitigation measure will be implemented in relation to exhaust emissions during the construction phase:

- Machinery will be switched off when not in use;
- All construction vehicles and plant will be maintained in good operational order;
- Aggregate materials used in construction shall be sourced locally where possible to reduce potential exhaust emissions; and
- Where possible, mains electricity or battery power equipment will be used in lieu of diesel or petrol-powered generators.

9.1.4.3 Monitoring

The dust mitigation measures put in place will be strictly monitored and assessed throughout the construction phase to ensure their effectiveness as identified in the CEMP (Appendix 4C).

Dust monitoring will be carried out as follows:

- Daily inspections shall be carried out to monitor dust within and in the vicinity of the Study Area, including roads. Monitoring shall include regular dust soiling checks of surfaces within 100 m of the site boundary.
- Regular site inspections shall be carried out and logged with all the relevant information (responsible staff, time, site, weather condition) by the site engineer in order to ensure that the measures specified in the dust minimisation plan are being implemented effectively.
- The frequency of site inspections shall be increased when activities with a high potential to produce dust are being carried out (e.g. excavation) or during prolonged dry or windy conditions.
- Dust deposition, dust flux or PM_{10} monitoring locations shall be agreed with the Local Authority. Baseline monitoring shall be carried out a minimum of 3 months in advance of works commencing on site. The purpose of the monitoring is to ascertain that the dust levels would comply with the 1-hour average and 24-hour average. Dust monitoring methodology can range from active samplers (powered) to measure specific dust fractions to passive samplers (unpowered) that measure dust flux, dust deposition and soiling. Baseline monitoring allows to define existing conditions more accurately and help with the interpretation of "trigger threshold". The site engineer will ensure data is collected and registered.
- Inspection results shall be recorded and made available to the Local Authority on request.

9.1.5 Residual Impact – Air Quality

Temporary Not Significant Negative Impact and Permanent Slight Positive Impact

The implementation of the mitigation measures set out above will minimise impacts associated with dust generation and air pollutant emissions during the construction phase, therefore the proposed development will have a temporary negligible impact on air quality during the construction phase.

The proposed development will have a permanent positive impact on air quality once operational by providing a sustainable alternative mode of transport.

9.2 NOISE AND VIBRATION

The noise and vibration assessment has been undertaken in accordance with the overarching EIA guidance and in accordance with:

- EPA (2016) Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4).
- Transport Infrastructure Ireland (TII) (NRA) (2004) Guidelines for the Treatment of Noise and Vibration in National Road Schemes.
- Transport Infrastructure Ireland (TII) (2014) Good Practice Guidance for the Treatment of Noise and Vibration during the Planning of National Road Schemes.
- British Standard Institution (BSI) 7385-2 (1993) Evaluation and measurement of vibration in buildings Part 2: Guide to damage levels from ground borne vibration.
- British Standard Institution (BSI) (2014) 5228-1 and 2:2009+A1:2014 Code od practice for noise and vibration control on construction and open sites. Noise and Vibration.
- World Health Organisation (2018) Environmental Noise Guidelines for the European Region.

9.2.1 Construction Noise Level Criteria

The potential noise impact of the proposed development on the surroundings will occur during the construction phase, much of which will be generated by construction plant and machinery.

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion. The majority of the construction activity is expected to occur during normal working hours.

The following documents contain guidance in relation to acceptable noise control on construction sites:

- British Standard BS 5228 – 1: 2009+A1:2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites: Noise.*
- NRA *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (2004)

In the absence of specific noise limits, criteria relating to permissible construction noise levels for a development of this type may be found in the abovementioned documents and is summarised below.

BS 5228-1:2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites: Noise* sets out a procedure for determining the impacts of construction noise on surrounding receptors. **Table 9.7** sets out the threshold noise levels (L_{AEQ}) as set out in the Standard. The Standard recommends that total noise levels during construction should not exceed the threshold levels.

Table 9.7 Noise Threshold Levels determined in accordance with BS 5228-1:2009+A1:2014

Assessment Category and Threshold Value Period (L_{AEQ})	Threshold Value (dB)		
	Category A	Category B	Category C
Monday to Friday 07:00 to 19:00hrs Saturdays (07:00 – 13:00)	65	70	75

Assessment Category and Threshold Value Period (L_{AEQ})	Threshold Value (dB)		
	Category A	Category B	Category C
Monday to Friday 19:00 to 23:00hrs Saturday (13:00 – 23:00) Sunday (07:00-23:00)	55	60	65
Monday – Sunday (23:00 – 07:00)	45	50	55

Note:

Category A: threshold values to use when ambient noise levels (when rounded to nearest 5 dB) are less than these values

Category B: threshold values to use when ambient noise levels (when rounded to nearest 5 dB) are the same as Category A values

Category C: threshold values to use when ambient noise levels (when rounded to nearest 5 dB) are higher than Category A values

The NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004) also recommends threshold noise levels for the construction phase of road projects. **Table 9.8** indicates the maximum permissible noise levels at the facade of dwellings during the construction period as recommended by the NRA (Now TII). These limits are widely applied in Ireland to construction projects.

Table 9.8 Maximum permissible noise levels at the facade of dwellings during construction

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60*	65*

***Note:** Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

Based on the above, **Table 9.9** suggests limits considered suitable for the construction of the proposed development. Given that the majority of receptors are located adjacent to streets/ roads, the Category B levels from **Table 9.7** have been applied along with the NRA guidance levels. The threshold values specified in **Table 9.9** will be adopted as the noise criteria in the assessment of noise impacts on receptors in Section 9.2.5.

Table 9.9 Suggested noise levels at receptors during construction based on BS 5228:2009 and NRA Guidance

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 23:00hrs	60	65
Saturdays 07:00 to 16:30hrs	65	75
Sundays & Bank Holidays 07:00 to 23:00hrs	60	65
Night-time 23:00 to 07:00	50	60

9.2.2 Vibration Criteria

Any potential vibration impact associated with the proposed works on the surroundings will occur during the construction phase. No vibration impacts will occur following construction.

Vibration standards are divided into two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, the magnitude of vibration is considered in terms of Peak Particle Velocity (PPV).

Humans are particularly sensitive to vibration stimuli and any perception of vibration may lead to concern. In the case of road traffic, vibration greater than 0.5 mm/s may be disturbing. Higher levels of vibration are typically tolerated for events of short duration or single events.

The following documents contain guidance in relation to acceptable vibration within buildings:

British Standard BS 7385 - 2 (1993): *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration*, and;

British Standard BS 5228 – 2 (2009)+A1:2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites: Vibration.*

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228 recommends that, for 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 particle velocity of 15mm/s for transient vibration at frequencies below 15Hz and 20mm/s at frequencies above than 15Hz. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

NRA, 2004 details the permissible vibration levels during construction phase for national road schemes. These are listed in Table 9.10.

Table 9. 10 Allowable Vibration 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 10Hz	**10 to 50Hz**	**50 to 100Hz (and above)**
8 mm/s	12.5 mm/s	20 mm/s

It is suggested that the NRA criteria be applied in the assessment of vibration impacts in Section 9.2.9.

9.2.3 Existing Environment

The Agglomeration of Limerick Noise Action Plan 2024-2028 (NAP) provides significant baseline data on the levels of noise in the Limerick area and its environs.

The Plan includes the two main noise indicators for developing strategic noise maps:

- L_{den} – the annual average noise level for the day, evening and night periods and is designed to indicate overall annoyance; and
- L_{night} – the annual average noise level for the night-time periods from 23:00 to 07:00 hourse, and it is designed to indicate sleep disturbance.

Supplementary noise indicators are also included in the plan, namely $L_{Aeq,16hr}$ (the annual average noise level for the daytime/evening periods from 07:00 to 23:00 hours) which has been approved by the EPA as the appropriate noise indicator to inform candidates for Quiet Areas.

Quiet Areas in the Limerick Agglomeration are monitored by the Council through fixed monitoring at the principal park in the city, The People's Park and began monitoring at the Castletroy Greenway in January 2023. The results of monitoring are shown below.

Table 9. 11 Results of monitoring at Castletroy Greenway in 2023 (Limerick Agglomeration - Noise Action Plan 2024-2028)

Monitoring results (2023)					Strategic Noise Mapping 2021	
$L_{Aeq,\ 16hr}$	L_{den} (dB)	L_{day} (dB)	$L_{evening}$ (dB)	L_{night} (dB)	L_{den} (dB)	L_{night} (dB)
55.2	55.6	56.1	49.6	45.1	<55	<50

The noise exposure assessment undertook as part of the Plan, indicates that noise exposure is mostly associated with road traffic. The following table shows the percentage of people exposed to different noise source within the Limerick agglomeration.

Table 9.12 Percentage of total population exposed to noise sources (Limerick Agglomeration - Noise Action Plan 2024-2028)

Noise exposure (dB Lden)	All Roads	All Railway	All Industry
55-59	24%	1%	0%
60-64	13%	1%	0%
65-69	5%	0%	0%
70-74	1%	0%	0%
>= 75	0%	0%	0%

Noise exposure (dB Lnight)	All Roads	All Railway	All Industry
55-59	10%	0%	0%
60-64	1%	0%	0%
65-69	0%	0%	0%
70-74	0%	0%	0%
>= 75	0%	0%	0%

The Environmental Noise (Amendment) Regulations 2021 set out the assessment methods for harmful effects, which considers ischaemic heart disease (IHD), high annoyance (HA) and high sleep disturbance (HSD).

For the Limerick agglomeration area, with a total population of 101,028 persons, around 9% might be affected by road noise and display health effects (ischaemic heart disease, highly annoyed, highly sleep disturbed). While a 0.4% might be affected by railway noise and display harmful effects such as high annoyance and sleep disturbance (NAP 2024-2028).

The most relevant source of environmental noise within the Limerick Agglomeration is road traffic, where there is a total 42,900 people in dwellings exposed to road traffic noise greater or equal to 55 dB L_{den}, in comparison to 1,600 people exposed to railway source and 0 from industry sources.

The following figures show the strategic noise maps for road traffic and industry, included in the Limerick Agglomeration NAP 2024-2028, highlighting the location where the proposed greenway will be located.

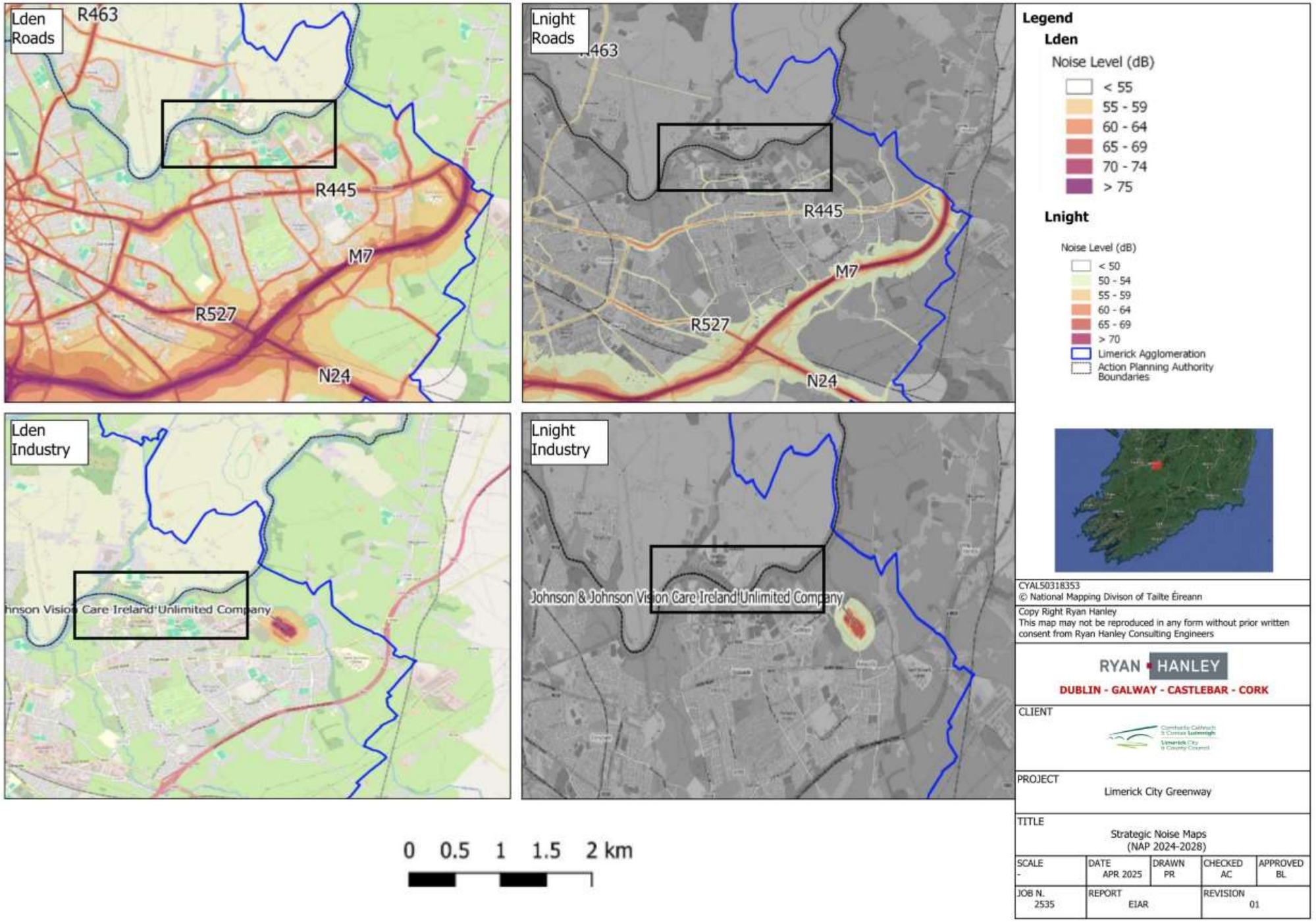

Figure 9.1 Strategic Noise Map for Road and Industry (Limerick Agglomeration NAP 2024-2028)

9.2.4 Potential Impacts – Noise

9.2.4.1 'Do Nothing' Scenario

If the proposed development were not to proceed, the existing noise and vibration environment would remain unchanged.

9.2.4.2 Noise Sensitive Receptors

Sensitive receptor locations are defined by TII[2] guidance as *residential housing, schools, hospitals, places of worship, sport centres and shopping areas i.e. locations where members of the public are likely to be regularly present*. Sensitive receptors were identified along the greenway route considering the path, temporary working areas and construction compounds. **Figure 9.4** shows the location of the noise sensitive receptors that have been identified as being in close proximity to the proposed works areas. **Table 9.13** provides further details relating to the Noise Sensitive Locations (NSLs).

Table 9.13 Distance from Works Noise Emission to Nearest NSLs

NSL	Location	Works Section/s
NSL1	Dromroe Student Village and UL Language Centre	Temporary working area 1 / Compound 2
NSL2	UL Physical Education and Sport Sciences (PESS) Building	Compound 2 and 3
NSL3	Kilmurry Student Village (Western Block)	Compound 3
NSL4	Kilmurry Student Village (Eastern Block)	Compound 3

[2] 'Air Quality Assessment of Specified Infrastructure Projects – Overarching Technical Document' (TII, 2022), and 'Air Quality Assessment of Proposed National Roads-Standard' (TII, 2022)

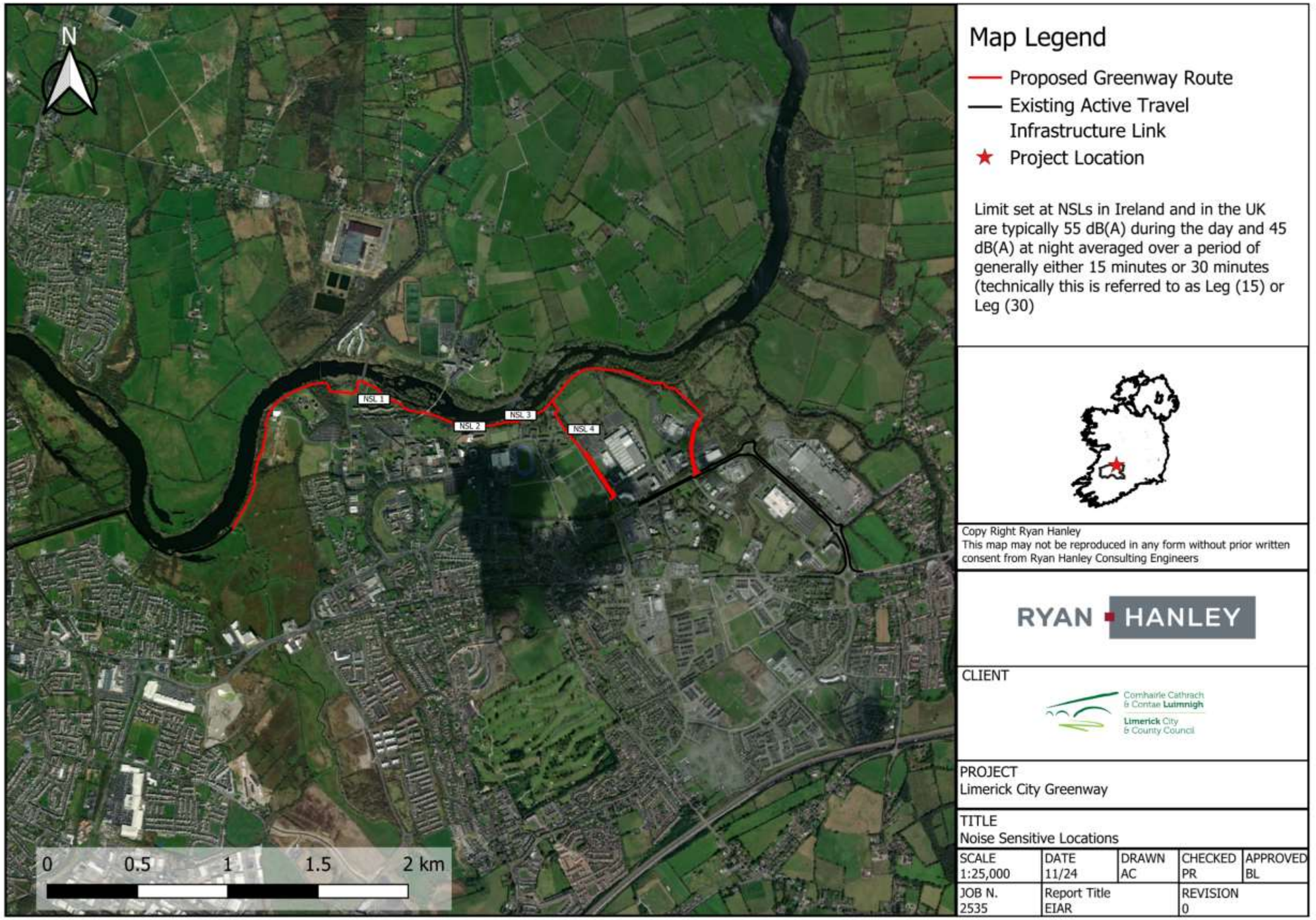

Figure 9.4 Noise Sensitive Locations (NSL) Map

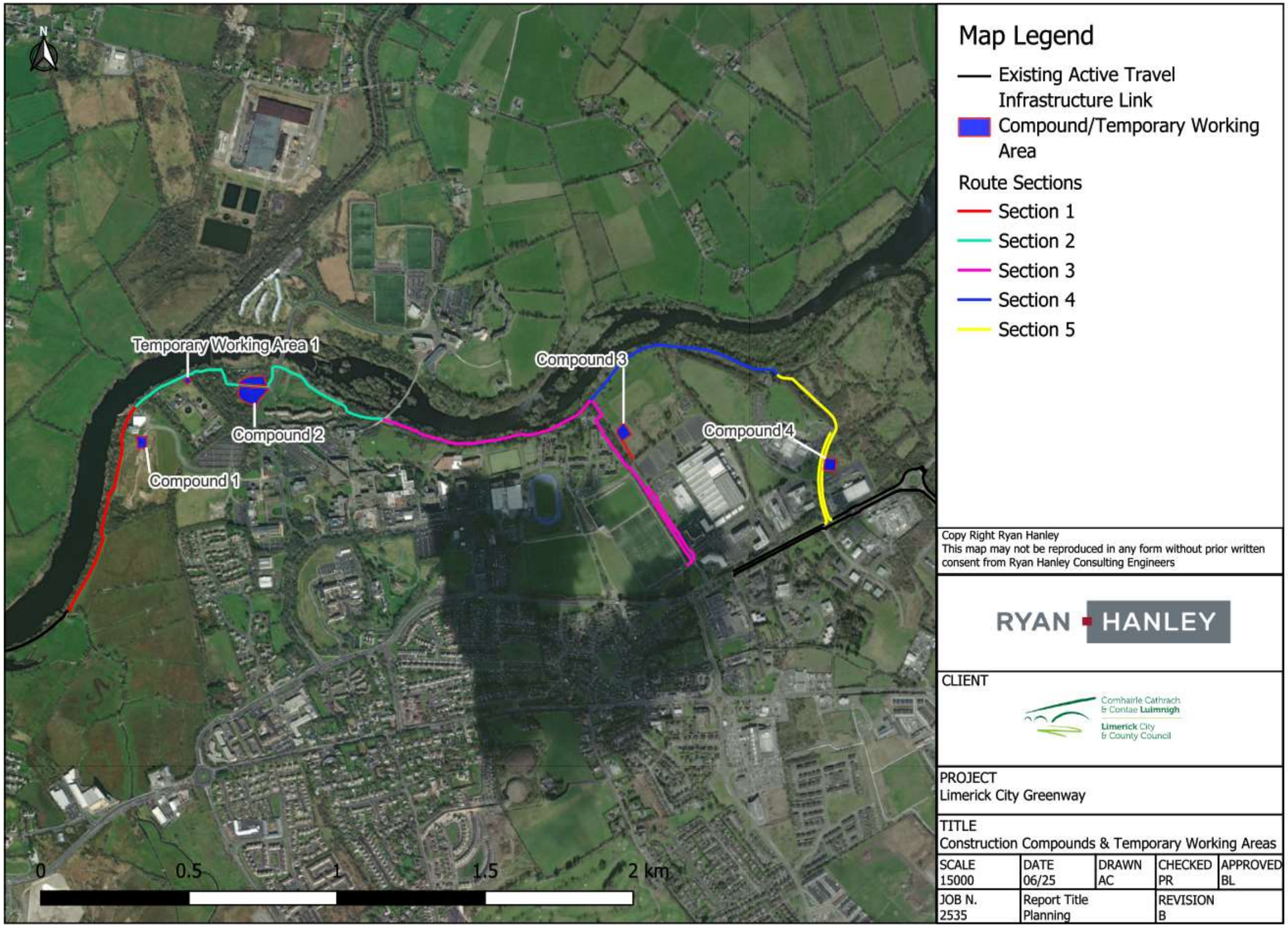

Figure 9.5 Site compounds and temporary working areas locations

9.2.4.3 Potential Impact - Noise

Works associated with the proposed development that may contribute to noise impact during the construction phase are as follows:

- Site compound set up;
- Compound operations;
- Site clearance and installation of temporary access roads;
- Installation of tree root protector;
- Installation of utilities/ services, construction of drainage infrastructure including open drains, installation of lighting;
- Construction of haul roads, and Greenway;
- Construction of bridges and stream crossings by culverts/concrete beams;
- Landscaping, reinstatement, and surfacing, and
- HGV movements delivering to construction compounds.

9.2.4.3.1 Construction Works

A variety of items of plant will be in use for each of these work activities, such as excavators, lifting equipment and dump trucks, as set out in **Table 9.14**. Site clearance and installation of temporary access road works are expected to have the highest noise emissions.

The following factors are noted in relation to the prediction of noise impacts associated with the construction of the proposed Greenway;

- The construction programme has been established in outline form only and is presented in Chapter 4;
- The timing, duration and amplitude of noise emissions associated with each activity will vary considerably;
- Construction details and plant and machinery requirements are likely to change on a regular basis during construction. In additional each individual noise source will be relocated frequently e.g. excavators, dumper trucks etc; and
- There will be extended periods when little or no noise emissions arise.

Due to the above factors, it is not possible to calculate the actual magnitude of noise emissions to the local environment. However, the following section presents calculations of indicative noise levels for typical noise sources associated with each of the identified activity types.

Table 9.14 presents the expected sound pressure level (SPL) in the works areas based on typical plant sound pressure levels at 10 m as specified in BS 5228: 2009+A1:2014: *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise.*

Table 9.14 Expected sound pressure level (SPL) at 10m

Activity	Equipment	SPL at 10 m	Total SPL at 10 m
Compound Set Up	14T Excavator x1 (C.2.25)	69 dB	83 dB
	Dump Truck x 1 (C.2.30)	79 dB	

Activity	Equipment	SPL at 10 m	Total SPL at 10 m
	Truck x 1 (C.2.34)	80 dB	
Compound Operations	Generator x 1 (C.6.39) Truck x 2 (C.2.34) 25T Excavator x1 (C.2.19)	65 dB 80 dB 77 dB	84 dB
Site clearance & installation of temporary access road	14T Excavator x1 (C.2.25) Dump Truck x1(C.2.30) Truck x 1(C.2.34) Chainsaw x 2 (D.2.14)	69 dB 79 dB 80 dB 86 dB	90 dB
Construction of Greenway and surfacing	14T Excavator x1 (C.2.25) Dump Truck x2 (C.2.30)	69 dB 79 dB	82 dB
Installation of utilities/ services, Construction of drainage infrastructure including French drains, Installation of Lighting / CCTV	14T Excavator x1 (C.2.25) Dump Truck x1 (C.2.30)	69 dB 79 dB	80 dB
Installation of tree root protector	Tractor and Flat-bed trailer x 1(C.4.75)	79 dB	79 dB
Construction of bridges and stream crossings by culverts/ concrete beams	25T Excavator x 1 (C.2.19) Tractor and Flat-bed trailer x1 (C.4.75) 50T Crane x 1(C.4.46)	77 dB 79 dB 67 dB	81 dB

The calculated noise impacts at the NSLs illustrated in Figure 9.4 are presented in Table 9.13Error! Reference s ource not found., based on the distance from the relevant works area to the closest point at each of the NSLs.

A worst-case scenario has been assumed whereby the listed plant items are assumed to be in operation cumulatively at the closest point to each of the noise sensitive locations. The assessment does not take account of any screening. In each instance, source information was obtained from BS 5228: 2009+A1:2014: *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* which sets out typical noise levels for items of construction plant.

A summary of the impacts presented in Table 9.13 is provided below in light of the 70 dB $L_{AEQ\ (1hr)}$ criterion discussed in Section 9.2.1.

Table 9.15 Predicted Noise Levels at NSLs

Works Element	Predicted Noise Level at NSL Locations (dB $L_{Aeq, 1hr}$)			
	1	2	3	4
Site Compound Set Up	**73**	59	59	59
Compound Operations	**76**	60	60	60
Site Clearance and Installation of Temporary Access Road	**82**	66	66	66
Construction of Greenway and surfacing	**73**	**71**	**78**	**78**
Installation of utilities/ services, Construction of drainage infrastructure including French drains, Installation of Lighting	**72**	69	**72**	**74**
Installation of tree root protector	**71**	69	**74**	**74**
Construction of bridges and stream crossings by culverts/ concrete beams	57	57	65	57

As specified above, the calculated levels listed above are commensurate with a worst-case condition, that would only occur during the short span of time, that the listed plant items are at the closest point to each of the noise sensitive locations and assuming that no screening is in place. The worst-case scenario is unlikely to occur routinely, if at all.

Site Compound Set Up

Potential Temporary Imperceptible to Significant Negative Impact

four temporary compounds are proposed at the locations shown in Figure 9.5. The site compound set up will involve site clearance and the removal and delivery of materials to and from the works area. Based on the assessment, a number of dwellings at NSL 1 (Dromroe Student Village) within 25 m of Site Compound 2 may be subject to LAEQ (1h) levels above 70 dB in the absence of mitigation. Works to set up each of the compounds will be carried out over a short duration and are anticipated to last for approximately 10 days. This constitutes a potential temporary significant negative impact at NSL1 for receptors within 25m of site Compound 2, in the absence of mitigation measures. Noise impacts are expected to be imperceptible to not significant at NSL 2, 3 and 4.

Site Compound Operations

Potential Temporary Imperceptible to Significant Negative Impact

The primary sources of noise emission from the site compounds will include the transport of materials to and from the compounds, and the running of a generator. Based on the assessment, a number of dwellings at NSL1 (Dromroe Student Village) that are within 25 m of Site Compound 2 may be subject to LAEQ (1h) levels above 70 dB in the absence of mitigation. Operations at Site Compound 2 are anticipated to last for 120 days. In the absence of mitigation, this constitutes a potential temporary significant negative impact for receptors at NSL1 that are in close proximity of Site Compound 2. Noise impacts due to site compound operations are anticipated to be imperceptible to slight negative at NSLs 2, 3 and 4.

Site Clearance and Installation of Temporary Access Road

Potential Temporary Not Significant to Significant Negative Impact

Site clearance will be required within the temporary works areas. Works will include the removal of topsoil, vegetation clearance and removal of existing infrastructure items which are obstacles to the proposed Greenway. Temporary access roads will be installed to facilitate the construction of the Greenway and will subsequently form the subbase layers of the Greenway. Works will include vegetation cutting/clearance with a chainsaw, excavation, and delivery and placing of subbase layers. Based on the assessment, receptors within 90 m of the proposed site clearance and temporary access road works areas may be subject to $L_{AEQ\ (1h)}$ levels above 70 dB in the absence of mitigation. These include NSLs 1; Dromore Student Village. The works will be ongoing for a short duration and are anticipated to take 1-5 days depending on the construction compound or haul route. This constitutes a potential temporary significant negative impact for receptors within 90 m of the site clearance and temporary access road works areas. Noise impacts at NSL2, 3 and 4 are expected to be not significant.

Construction of Greenway and Surfacing

Potential Temporary Moderate to Significant Negative Impact

Works to construct the Greenway will include excavation, earthmoving and delivery of materials to the works areas. Based on the assessment, receptors within 40 m of the proposed Greenway works areas may be subject to $L_{AEQ\ (1h)}$ levels above 70 dB in the absence of mitigation. These include all the Noise Sensitive Locations given their proximity to the proposed greenway route. The works will be ongoing for a temporary period and are anticipated to take 90-150 days for different sections. In the absence of mitigation, this constitutes a potential temporary moderate to significant negative impact for receptors within 40 m of the Greenway construction and surfacing works.

Installation of utilities/services, construction of drainage infrastructure, installation of lighting

Potential Temporary Not Significant to Significant Negative Impact

The installation of utilities/services, construction of drainage infrastructure and installation of lighting along the Greenway will require excavation and delivery of materials to the site. Based on the assessment, receptors within 30 m of the proposed Greenway works areas may be subject to $L_{AEQ\ (1h)}$ levels equal to or above 70 dB in the absence of mitigation. These include Dromroe village (NSL1), Kilmurray village -west (NSL3), Kilmurray village – east (NSL4) that are within 30m of the works. Utility, drainage and lighting works are anticipated to take 20-30 days in each section. This constitutes a potential temporary significant negative impact for receptors within 30m of the works in Section 3. Noise impacts at NSL2 are anticipated to be not significant.

Installation of Tree Root Protector

Potential Temporary Imperceptible to Significant Negative Impact

The installation of tree root protector will require the use of a mini digger, dump truck, and utility vehicle.

Based on the assessment, receptors within 29 m of the proposed works areas may be subject to $L_{AEQ\ (1h)}$ levels above 70 dB in the absence of mitigation. These include dwellings at Dromroe Village (NSL1), Kilmurray village – west (NSL3) and Kilmurray village – east (NSL4) that are within 29 m of the works area. Tree root protection works are anticipated to take 2-5 days in each of these works areas. This constitutes a potential temporary significant negative impact for receptors within 29 m of tree root protection works at NSL1, NSL3 and NSL4. in the absence of mitigation. Noise impacts at NSL2 are anticipated to be imperceptible to not significant.

Construction of Bridges and Stream Crossings by Culverts/Concrete Beams

Potential Temporary Not Significant

5 no. new bridges and stream crossings will be constructed along the route of the Greenway as detailed in Chapter 4, Section 4.1.8. Works will include excavation works, delivery of materials the works areas and installation of prefabricated or precast units. Based on the assessment, the noise impacts associated with the construction of bridges and stream crossings are anticipated to be a temporary not significant impact at NSLs 1, 2, 3 and 4 as the proposed bridge works will be at a greater distance of 34 m from the NSLs.

9.2.4.3.2 HGV Movements

Potential Temporary Not Significant Impact

The construction phase of the proposed Greenway will give rise to additional traffic which may incur a noise impact on the adjacent noise sensitive locations. Construction traffic will access the works areas along the existing roads and temporary access roads shown on the planning drawings.

The noise level associated with an event of short duration, such as a passing vehicle movement, may be expressed in terms of its Sound Exposure Level (L_{AX}). The Sound Exposure Level can be used to calculate the contribution of an event or series of events to the overall noise level in a given period.

The appropriate formula is given below:

$$L_{Aeq,T} = L_{AX} + 10\log_{10}(N) - 10\log_{10}(T) - 20\log_{10}(r_2/r_1)dB$$

where:

$L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (in seconds);

L_{AX} is the "A-weighted" Sound Exposure Level of the event considered (dB);

N is the number of events over the course of time period T;

r_1 is the distance at which L_{AX} is expressed;

r_2 is the distance to the assessment location.

The mean value of Sound Exposure Level for truck moving at low to moderate speeds (i.e. 15 to 45km/hr) is in the order of 82 dB L_{AX} at a distance of 5 metres from the vehicle. This figure is based on a series of measurements conducted under controlled conditions.

As specified in Chapter 13, the average daily construction traffic ranges is estimated to be between 4 to 24 round trips per day while works are being carried out at each works section. Assuming a worst-case scenario, whereby all HGV movements required for completion of each section work are assumed to take place on the same day, the maximum daily number of HGV round trips during the construction phase of the Greenway in each works section is anticipated to be 28 round trips. Using the equation detailed above and taking into account the attenuation due to distance, and assuming a worst-case scenario that all trips take place within one hour, the predicted noise levels at each of the noise sensitive locations (NSLs) to the main haulage routes are listed in Table 9.16.

Table 9.16 Predicted construction traffic noise emission at nearest NSLs

Location	Distance From Roadway / Easement (m)	HGV Sound Exposure Level at 5 metres (dB,L_{AX})	Predicted Noise Level (dB, $L_{Aeq,1hr}$)
NSL1	20	82	41

Location	Distance From Roadway / Easement (m)	HGV Sound Exposure Level at 5 metres (dB,L_{AX})	Predicted Noise Level (dB, $L_{Aeq,1hr}$)
NSL2	400		15
NSL3	180		22
NSL4	20		41

The predicted noise emission levels range between 15 dB and 53 dB $L_{Aeq,1hr}$ with 53 dB $L_{Aeq,1hr}$ being the expected maximum at the any remaining noise sensitive locations along construction traffic routes that are located immediately adjacent to the road (i.e. < 10 m away). These predicted noise levels are within the minimum design criterion of 70dB L_{Aeq}. Therefore, the impact of construction traffic on the local environment is expected to be a temporary not significant impact.

9.2.4.4 Mitigation Measures – Noise

In order to sufficiently ameliorate the likely noise impacts from the construction of the proposed works, a schedule of noise and vibration control measures has been formulated for the construction phase and are further detailed in the Construction Environmental Management Plan (CEMP) (Appendix 4C). Any measures to be carried out by third parties will be contractual obligations.

Reference will be made to BS 5228-1: 2009+A1:2014: *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise*, which offers detailed guidance on the control of noise & vibration from demolition and construction activities.

In particular, it is proposed that various practices be adopted during construction, including:

- where noise levels at NSLs are anticipated to exceed the daytime noise criteria, hoarding extending to a height of 2.4 m will be erected at the works boundary between the works area and the NSL. If such measures are installed, the construction operations are expected to meet or be less than the 70 dB $L_{Aeq(1hr)}$ criterion in the majority of cases as shown in Table 9.13.
- limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise;
- monitoring typical levels of noise during critical periods and at sensitive locations

Furthermore, a variety of practicable noise control measures will be employed. These will include:

- selection of plant with low inherent potential for generation of noise;
- erection of enclosures as necessary around noisy processes and items such as generators and heavy mechanical plant;
- placing of noisy plant as far away from sensitive properties as permitted by site constraints.

If noise levels are non-compliant during the construction activities, the below should be followed:

- Reschedule specific activities: temporarily halt and reschedule works that are causing exceedances.
- Additional barriers: install more robust noise shielding solutions.

- Set up a community liaison and complaint mechanism. Investigate and address noise complaints promptly.

Noise disturbance to fauna is addressed in detail in Chapter 6 – Biodiversity of this EIAR. Noise thresholds will be complied with as specified in Table 9.7 to avoid any potential impacts to the environment and the population in the area.

9.2.4.5 Monitoring – Noise

During the proposed works, noise monitoring will be conducted during construction activities that have been identified as potentially exceeding the 70 dB $L_{Aeq(1hr)}$ criterion at NSLs. It is considered that short term attended noise measurements would be appropriate to ensure that the project design criteria are being met. The Construction Environmental Management Plan (CEMP) defines the critical periods, persons responsible for monitoring and the noise sensitive locations that will be monitored and is provided in Appendix 4C.

The following survey methodology will be employed for attended noise monitoring:

- measure LAeq, LAMax, LAMin, LA10 and LA90 over a sample period of 15 minutes;
- detailed notes will be taken in relation to primary noise sources, weather and prevailing winds;
- measurements will be conducted at various locations on a cyclical basis over the course of a typical day.

Noise monitoring will be conducted in accordance with ISO 1996: 2007: *Acoustics – Description, measurement and assessment of environmental noise*.

9.2.4.6 Residual Impact – Noise

Temporary Imperceptible to Moderate Negative Impact

During the construction phase, noise impacts at all receptors will be temporary and localised. With the mitigation measures specified in Section 9.2.6 in place, impacts will be imperceptible at the majority of receptors, as detailed in Table 9.15. The assessment assumes a worst-case scenario that would only occur during the short span of time, that the listed plant items are at the closest point to each of the noise sensitive locations. The worst-case scenario is unlikely to occur routinely, if at all.

Table 9. 17 Residual noise levels at NSLs with screening in place (worst case scenario)

Works Element	Predicted Noise Level at NSL Locations (dB $L_{Aeq, 1hr}$)			
	1	2	3	4
Site Compound Set Up	69	54	54	54
Compound Operations	67	50	50	50
Site Clearance and Installation of Temporary Access Road	**72**	56	56	56
Construction of Greenway and surfacing	65	65	67	67

Installation of utilities/ services, Construction of drainage infrastructure including French drains, Installation of Lighting	63	59	65	65
Installation of tree root protector	60	59	63	65
Construction of bridges and stream crossings by culverts/ concrete beams	47	47	55	47

At a number of dwellings, impacts will range from temporary slight negative to moderate negative. Furthermore, the application of binding noise limits and hours of operation, along with implementation of appropriate noise control measures such as screening will ensure that noise impact is kept to a minimum. The residual impact will be a temporary imperceptible to moderate negative impact.

9.2.5 Potential Impact – Vibration

Potential Temporary Slight to Moderate Negative Impact

The majority of the construction activities which will be employed during the construction phase of the Greenway with the exception of the installation of piles at proposed Bridge No. 2 and Bridge No. 5 are unlikely to generate perceptible vibrations at the sensitive locations.

Piling activity is generally one of the most significant sources of vibration on construction sites.

Assuming worst-case scenario and the use of traditional piling methods, this will likely result in a temporary negative impact ranging in severity depending on the distance from the sensitive receptor to the works location. Therefore, assuming the worst-case scenario, there is likely to be a slight to moderate amount of vibration impact at NSL 1, although it would occur over short durations.

9.2.5.1 Mitigation Measures – Vibration

In order to sufficiently ameliorate any likely vibration impacts from the proposed works, a schedule of noise and vibration control measures has been formulated for the construction phase and are detailed in the Construction Environmental Management Plan (CEMP) (Appendix 4C).

Reference will be made to BS 5228-1: 2009: *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 2: Vibration*, which offers detailed guidance on the control of vibration from demolition and construction activities. In particular, the following practices will be adopted during construction:

- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to vibration;
- monitoring typical levels of vibration during critical periods and at sensitive locations

Furthermore, a variety of practicable vibration control measures will be employed. These will include:

- selection of plant with low potential for generation of vibration;
- The vibration transmission associated with piling can be significantly reduced if piling operations are conducted using methods that are viable to reducing vibration impacts such as the 'press-in' method. Although the exact levels will depend on ground composition, research indicates that vibration levels

at a distance of 10m from the piling rig would be of the order of 1mm/s (White et al. 2002). This level is well below the BS 5228 guidance criteria limits. If traditional piling methods are employed, a test pile will be erected at the piling location closest to the nearest sensitive location. Vibration monitoring will then be conducted to confirm that ground borne vibration will be within the guidance criteria limits listed in Table 9.10 and that no structural damage will therefore occur to adjacent buildings.

- Vibration from construction activities will be limited to the values set out in Table 9.10.
- Table 9. 10 Vibration monitoring will also be conducted at locations along the bed of the mill race which is close to piling activities on Plassey Beach to ensure that vibration will not adversely affect the aquatic environment. Ensure the duration of piling activities is short and temporary;
- Placing of vibratory plant as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary.

9.2.5.2 Monitoring – Vibration

During the proposed works, vibration monitoring will be conducted during construction activities that may give rise to vibration. It is considered that short term attended vibration measurements would be appropriate to ensure that the project design criteria are being met. The Construction Environmental Management Plan defines the critical periods, persons responsible for monitoring and the sensitive locations that will be monitored and is provided in Appendix 4C.

The following survey methodology will be employed for attended vibration monitoring or test pile measurements:

- measure the maximum PPV at each location over a sample period of 15 minutes;
- detailed notes will be taken in relation to primary vibration sources;
- measurements will be conducted at the locations on a cyclical basis over the course of a typical day (attended vibration monitoring only).

Vibration monitoring will be conducted in accordance with either BS 7385-1 (1990) *Evaluation and measurement for vibration in buildings — Part 1: Guide for measurement of vibrations and evaluation of their effects on buildings* or BS 6841 (1987) *Guide to Measurement and Evaluation of Human Exposure to Whole-Body Mechanical Vibration and Repeated Shock* as appropriate.

9.2.5.3 Residual Impact – Vibration

Temporary Imperceptible Negative Impact

With the implementation of the above mitigation measures and monitoring, the likely impact of vibration from the proposed construction works on the local environment will be a temporary imperceptible negative impact.

9.3 CUMULATIVE AND IN-COMBINATION IMPACT ASSESSMENT

9.3.1 Cumulative Impact Assessment

All elements of the proposed development were assessed in order to identify any cumulative effects.

Site activity during the construction phase of the Greenway could give rise to noise that could cause potential disturbance to fauna. All construction activities will be temporary in nature with limited interaction on sensitive habitats and will progress across the four works sections, minimising the duration of works in any one area.

The movement of construction vehicles both within and to and from the works areas has the potential to give rise to noise and dust nuisance impacts during the construction phase. However, these effects and the measures that are in place to avoid any cumulative or interactive effects are fully described in this EIAR.

The operation of construction plant and machinery during the construction phase of the Greenway has the potential to give rise to emissions which can impact human health, air quality. However, these effects and the measures that are in place to avoid any cumulative or interactive effects are fully described in this EIAR.

Based on the assessment of all elements of the proposed development, no significant cumulative effects relating to air quality, noise and vibration are anticipated.

9.3.2 In-Combination Impact Assessment

The potential cumulative effects on air quality, noise and vibration between the proposed development and other plans and projects in the vicinity, as presented in Chapter 3, Section 3.5 of the EIAR, were also assessed.

Air Quality

The construction phase of the proposed Greenway, in combination with the construction phases of projects listed in Chapter 3 will have the potential to negatively impact on air quality of the area due to cumulative dust and construction plant emissions. The mitigation measures employed during the construction phase of the proposed development will minimise the contribution that it will make towards impacting on air quality. Given that existing baseline levels of NO_2, PM_{10}, $PM_{2.5}$, CO and benzene are likely to be below ambient air quality limit values in the vicinity of the proposed works, and with mitigation measures in place, there is the potential for a short-term negligible cumulative impact in terms of air quality. Overall, the proposed Greenway will constitute a permanent positive impact during the operation phase due in terms of air quality by reducing the amount of air pollutants that would otherwise have been emitted from transport vehicles if the Greenway was not available.

Noise & Vibration

In the unlikely event of all of the projects listed in Chapter 3 being constructed simultaneously, there is a potential for a short-term slight to moderate negative cumulative noise and vibration impact. With implementation of the mitigation measures listed in 9.2.6 and 9.2.10 above during the construction phase, the potential cumulative impact that this project will be minimised. Any impacts from the proposed Greenway will be temporary and transient in nature as the works progress along the four proposed works sections. Impacts will also differ between receptors, depending on distance to the works areas, and the type of works being carried out in the area. Given the mitigation measures being implemented for the construction phase of the Greenway, and depending on the receptor in question, there is potential for no impact or a temporary imperceptible to moderate negative cumulative impact.

Based on the assessment of the proposed development in combination with all other programmes and projects in the vicinity, no significant in-combinate cumulative effects relating to air quality, noise and vibration are anticipated.

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10 CLIMATE

A summary of the relevant legislation in relation to climate is provided in the following sections. As well as greenhouse gas emissions and carbon gains for the proposed project.

10.1 CLIMATE CHANGE AND GREENHOUSE GASES

Although variation in climate is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities in the last few decades. Climate change is one of the most challenging global issues and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on biodiversity which cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and fight climate change.

10.1.1 Greenhouse Gas Emission Targets

Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries.

Under the Kyoto Protocol, industrialised countries are required to reduce the emissions of six greenhouse gases (CO2, which is the most important one, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride) on average by 5.2 % below the 1990 levels during the first "commitment period" from 2008 to 2012.

Under the Kyoto Protocol, the EU committed itself to reducing its greenhouse gases emissions by 8% during the first commitment period from 2008 to 2012. This target is shared between the Member States under a legally binding burden-sharing agreement, which sets individual emissions targets for each Member State, among which is Ireland.

10.1.1.1 Doha Amendment to the Kyoto Protocol

In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of 5% below 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18% below 1990 levels in the eight-year period from 2013 to 2020. Ireland and the EU signed up to both the first and second commitment periods.

Under the protocol, countries must meet their targets primarily through national measures, although market-based mechanisms (such as international emissions trading) can also be utilised.

10.1.1.2 COP21 Paris Agreement

The COP 21 or the Paris Climate Conference led to a new international climate agreement, applicable to all countries, aiming to keep global warming at 1.5°C - 2°C, in accordance with the recommendations of the Intergovernmental Panel on Climate Change (IPCC).

In response to the climate challenge, the agreement recognises that States have common but differentiated responsibilities, i.e. depending on respective capabilities and different national circumstances.

The purpose is to hold the increase in global average temperature to well below 2°C above pre-industrial levels and to ensure that efforts are pursued to limit the temperature increase to 1.5 °C. To achieve this, the Paris Agreement stipulates that all countries shall review their contributions to reducing greenhouse gas emissions every five years. Each new contribution set out on a national level should include a progression compared with the precedent. The Parties committed to reaching a global peak in greenhouse gas emissions as soon as possible, in order to achieve a balance between emissions and their removal in the second half of the century. The States are also required to increase their efforts to mitigate and reduce their greenhouse gas emissions.

10.1.1.3 COP26 Climate Change Conference Glasgow

COP26 took place in Glasgow, Scotland between the 31st October and 12th November 2021. The summit was centred around the fact that "climate change is the greatest risk facing us all." The UK, as hosts for the summit, have developed a ten point plan to deliver a green industrial revolution, seeking to lead the world in tackling and adapting to climate change.

The key items COP26 seeks to achieve are:

- Secure global net zero by mid-century and keep 1.5 degrees within reach;
- Adapt to protect communities and natural habitats;
- Mobilise finance

New deals and announcements were also made during the COP26:

- Forests: 137 countries took a landmark step forward by committing to halt and reverse forest loss and land degradation by 2030. The pledge is backed by $12bn in public and $7.2bn in private funding. In addition, CEOs from more than 30 financial institutions with over $8.7 trillion of global assets committed to eliminate investment in activities linked to deforestation.
- Methane: 103 countries, including 15 major emitters, signed up to the Global Methane Pledge, which aims to limit methane emissions by 30 per cent by 2030, compared to 2020 levels. Methane, one of the most potent greenhouse gases, is responsible for a third of current warming from human activities.
- Cars: Over 30 countries, six major vehicle manufacturers and other actors, like cities, set out their determination for all new car and van sales to be zero-emission vehicles by 2040 globally and 2035 in leading markets, accelerating the decarbonization of road transport, which currently accounts for about 10 per cent of global greenhouse gas emissions.
- Coal: Leaders from South Africa, the United Kingdom, the United States, France, Germany, and the European Union announced a ground-breaking partnership to support South Africa – the world's most carbon-intensive electricity producer— with $8.5 billion over the next 3-5 years to make a just transition away from coal, to a low-carbon economy.

- Private finance: Private financial institutions and central banks announced moves to realign trillions of dollars towards achieving global net zero emissions. Among them is the Glasgow Financial Alliance for Net Zero, with over 450 firms across 45 countries that control $130 trillion in assets, requiring its member to set robust, science-based near-term targets.

10.1.1.4 COP27 Climate Change Conference Sharm-el-Sheikh

Held in Egypt, COP27 was dubbed the Africa COP, providing an important opportunity to table issues critical to the continent; and the COP of implementation, where pledges would be translated into action on the ground.

The most important achievement of COP27 was that an agreement was finally reached to establish and operationalise a new loss and damage fund.

COP27 did not progress commitments or show evidence of significant action by countries to further draw down global emissions. By this measure, COP27 was a missed opportunity and potentially a step back.

However, it was encouraging to witness China and the US reopen their conversation on tackling climate change, and to see adaptation dialogues begin on enhancing resilience for 4 billion people living in the most climate-vulnerable communities by 2030.

10.1.1.5 COP28 Climate Change Conference Dubai, United Arab Emirates

COP 28 was particularly momentous as it marked the conclusion of the first 'global stocktake' of the world's efforts to address climate change under the Paris Agreement. Concluded that the progress was too slow across all areas of climate action – from reducing greenhouse gas emissions, to strengthening resilience to a changing climate, to getting the financial and technological support to vulnerable nations – countries responded with a decision on how to accelerate action across all areas by 2030. This includes a call on governments to speed up the transition away from fossil fuels to renewables such as wind and solar power in their next round of climate commitments.

The main outcomes of the COP28 conference were:

- Establishment of a loss and damage fund for countries suffering from the effects of climate change;
- Fossil Fuel Phase-Out and increasement of renewable energy capacity, calling for a tripling of renewable energy capacity globally by 2030; and
- Mobilization of the private sector to invest in low-carbon and private-resilient projects.

10.1.1.6 COP29 Climate Change Conference Baku, Azerbaijan

The 2024 UN Climate Change Conference (COP29) took place in November 2024 and was characterised by five key expectations:

- All developing counties expected the adoption of a new global climate finance goal.
- The EU, United States and small islands states sough a strong platform to push for higher ambition of emission reductions and advance the global energy-related targets agreed in COP28.
- The EU especially wanted to finish rules for the Paris agreement offset mechanisms.
- China, India, Saudi Arabia and other major emerging economies wanted to avoid being pushed towards higher mitigation ambition.
- The African states prioritised a strong outcome on adaptation.

The main outcomes of COP29 was named the Baku Climate Unity Pact, comprising the following:

- A new global climate financial goal: It calls on all actors to scale up finance by 2035.
- Mitigation work programme: Proposals and identification of technical options to reduce emissions in cities and encourage collaboration between governance levels. A digital platform, to be designed in 2025, will enable exchanging information on mitigation actions.
- Global goal on adaptation: The Baku Adaptation Roadmap keeps indicators to measure progress towards global resilience permanently in the agenda.

10.1.2 European Green Deal – European Climate Law (2021)

The European Green Deal, initially introduced by the European Commission in December 2019, sets out the 'blueprint' for a transformational change of the 27-country bloc from a high- to a low-carbon economy, without reducing prosperity and while improving people's quality of life, through cleaner air and water, better health and a thriving natural world. The Green Deal is intended to work through a framework of regulation and legislation setting clear overarching targets, e.g. a bloc-wide goal of net zero carbon emissions by 2050 and a 55% cut in emissions by 2030 (compared with 1990 levels). This is a substantial increase compared to the existing target, upwards from the previous target of at least 40% (2030 Climate & Energy Framework), and furthermore, these targets demonstrate the ambition necessary to keep the global temperature increase to well below 2°C and pursue efforts to keep it to 1.5°C as per the Paris Agreement.

10.1.3 Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change.

In August 2021, the IPCC released their *Sixth Assessment Report Climate Change 2021: The Physical Science Basis* which categorically states the rise in global temperatures and increase in frequency and severity of natural disasters experienced across the world is related to human activity.

Continued greenhouse gas emissions will lead to increasing global warming, with the best estimate of reaching 1.5°C in the near term in considered scenarios and modelled pathways. Every increment of global warming will intensify multiple and concurrent hazards. Deep, rapid, and sustained reductions in greenhouse gas emissions would lead to a discernible slowdown in global warming within around two decades.

Some future changes are unavoidable and/or irreversible but can be limited by deep, rapid and sustained global greenhouse gas emissions reduction. The feasibility and effectiveness of options increase with integrated, multi-sectoral solutions that differentiate responses based on climate risk, cut across systems and address social inequities.

In 2023 the IPCC published the Sixth Assessment Report (AR6) which confirmed that unsustainable an unequal energy and land use as well as more than a century of using fossil fuels has caused global warming, with a global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. This has resulted in global impacts and related losses and damages to nature and people. The report also concluded that the earth's temperature will increase by 1.5°C by the first half of 2030 and will continue to increase to 2°C towards the end of the 21st century.

To slow down and eventually stop human-caused global warming, a net zero approach is needed. Rapid mitigation and accelerated implementation of adaptation measures could reduce projected losses and damages to human populations and ecosystems, while resulting in improvements for air quality and health.

10.1.4 Climate Change Performance Index

Established in 2005, the Climate Change Performance Index (CCPI) is an independent monitoring tool which tracks countries climate protection performance. It assesses individual countries based on: climate policies, energy usage per capita, renewable energy implementation and Greenhouse Gas Emissions (GHG) and ranks their performance in each category and overall.

Results from the CCPI showed that Ireland is 43rd in the 2024 CCPI, but it has climbed 14 places to 29th in the 2025 CCPI. Ireland receives a medium rating in Renewable Energy, Energy Use, and Climate Policy, but a low in GHG Emissions.

Ireland made significant progress in climate policy with the introduction of legally binding carbon budgets and sectoral emissions ceilings in 2022. However, government implementation remains low with necessary actions and measures delayed or overlooked in many areas.

The country's agricultural policies continue to support intensification of livestock farming, which increases GHG emissions, harms water and air quality, and is a primary contributor to biodiversity loss in Ireland. The CCPI highlight the need to reduce use of reactive nitrogen in fertiliser and to pay for ecosystem services.

Government plans for offshore wind are substantial, and new schemes have been introduced in transport, microgeneration, and energy efficiency. Use of coal in power generation, however, has increased. Energy retrofits and solar photovoltaics are not being delivered at the necessary scale and not reaching those most at risk of energy poverty. Fossil gas infrastructure and gas connections are also still being promoted.

Although hard work still remains to improve the overall CCPI, Ireland is making steady progress towards the set GHG 2030 emissions target compared to a well below 2°C benchmark.

10.2 National Legislation and Policy

10.2.1 Climate Action and Low Carbon Development (Amendment) Act, 2021

The Climate Action and Low Carbon Development (Amendment) Act 2021 has been signed into law committing Ireland to 2030 and 2050 targets for reducing greenhouse gas (GHG) emissions and providing the governance framework. The country is on a legally binding path to net-zero emissions no later than 2050, and to a 51% reduction in emissions by the end of this decade.

The key issues collated in the act are:

- A national climate objective is to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally-sustainable and climate-neutral economy;
- The first two five-year carbon budgets proposed by the Climate Change Advisory Council should equate to a total reduction of 51% over the period to 2030, relative to a baseline of 2018;
- The role of the Climate Change Advisory Council has been strengthened;
- The Government must adopt carbon budgets that are consistent with the Paris agreement and other international obligations;
- The Government will determine, following consultation, how to apply the carbon budget across the relevant sectors, and what each sector will contribute in a given five-year period;
- Actions for each sector will be detailed in the Climate Action Plan which must be updated annually;

- Government Ministers will be responsible for achieving the legally-binding targets for their own sectoral area with each Minister accounting for their performance towards sectoral targets and actions before an Oireachtas Committee each year; and
- Local Authorities must prepare individual Climate Action Plans which will include both mitigation and adaptation measures and will be updated every five years. Local Authority Development Plans must be aligned with their Climate Action Plan.

10.2.2 Climate Action Plan

The Climate Action Plan 2023 (CAP 23) is the first updated plan to be published since the introduction of the Climate Action and Low Carbon Development (Amendment) Act 2021. CAP 23 aims to keep Ireland's emissions within its mandatory carbon budget and achieve the legally binding target of reducing emissions by 51% (from a 2018 baseline) by 2030.

The plan aims to reduce emissions and take actions in the following main sectors:

- Reduce by 75% emissions coming from the electricity sector by 2030 through renewable energy infrastructure. Ensure that renewable energy generation projects and associated infrastructure are considered to be in the overriding public interest;
- Work on reducing the built environment emissions by 45% from the commercial buildings and 40% from the residential constructions by 2030. Achieved by using more efficient heating systems and opting for renewable energy sources;
- 25% reduction in emissions of the agricultural sector by 2030 by reducing chemical nitrogen and promoting biomethane produced on farms;
- Reduce by 35% emissions in the industrial sector by 2030 using low carbon substitutions and support emission reduction measures through SEAI;
- Promote sustainable transport initiatives to reduce by 50% emissions of this sector by 2030; and
- Increase Ireland's afforestation and carbon sinks.

The Climate Action Plan 2024 is the third annual update to Ireland's Climate Action Plan. The CAP 2024 sets the course to reduce emissions in half by 2030 and reach net-zero no later than 2050.

The Plan calls for further accelerated action to support Ireland achieving its 2030 targets, mitigate against the worst effects of climate change, build more resilient cities while improving the country's economic competitiveness.

In relation to reducing emissions from the transport sector, the CAP24 highlights the key targets that remain to be achieved which include the reduction by 20% in total vehicle kilometres travelled relative to business as usual, a 50% reduction in fossil fuel usage, a significant behavioural shift from private car usage to increase the total share of journeys undertaken by walking, cycling or public transport.

To achieve this, more policy measures will continue to be proposed to promote greater efficiency in the transport system, along with significant investment in sustainable travel alternatives, incentives and regulatory measures to promote the accelerated take-up of low carbon technologies.

10.2.3 Emissions Projections

As noted in Section 10.2.1 above, the Climate Action and Lowe Carbon Development (Amendment) Act 2021 commits Ireland to reduce its overall greenhouse gas emissions by 51% by 2030, compared to 2018 levels and achieving no later than 2050 the transition to a climate resilient, biodiversity rich, sustainable and climate neutral economy.

The Environmental Protection Agency (EPA) publish Ireland's Greenhouse Gas Emission Projections and at the time of writing, the most recent report, 'Ireland's Greenhouse Gas Emissions Projections 2023—2050' was published in May 2024. The report includes an assessment of Ireland's progress towards achieving its emission reduction targets out to 2030, 2040 and 2050 set under the EU ESD and Effort Sharing Regulation (ESR).

The EPA has produced two scenarios in preparing these greenhouse gas emissions projections: a "With Existing Measures" (WEM) scenario and a "With Additional Measures" (WAM) scenario. These scenarios forecast Irelands greenhouse gas emissions in different ways. The WEM scenario assumes that no additional policies and measures, beyond those already in place are implemented. The WAM scenario assumes that in addition to the existing measures, there is also full implementation of planned government policies and measures to reduce emissions such as those in the 2023 and 2024 Climate Action Plan.

The report shows that when only accounting for the impact of implemented and existing policies, Ireland's total emissions are expected to decrease by 9% in 2030, compared to 2005 levels. Factoring in additional measures, results in a projected decrease in GHG emissions of 25% in 2030 relative to 2005. The projections assume significant emissions reductions in key sectors such as electricity generation, residential buildings, transport, commercial and public services, and agriculture, with full and early implementation of existing policy commitments by 2030.

Under the EPA's projections, emissions in the first two carbon budgetary periods (2021-2025 and 2026-2030) are expected to exceed their limits by a margin of 17-27%, with the sectoral emissions ceilings for both budgetary periods projected to be exceeded in almost all sectors. It also indicates that if all the unmodelled measures in CAP23, and the yet unallocated emissions savings, were accounted for, the projected emissions reduction in 2030 would be 42%, 9 percentage points below our 2030 target.

Targets for 2030 under the ESR include binding annual limits per member state known as "Annual Emission Allocations" (AEAs). The AEAs required updating to reflect the 42% reduction target set in 2023. This is shown in the figure below.

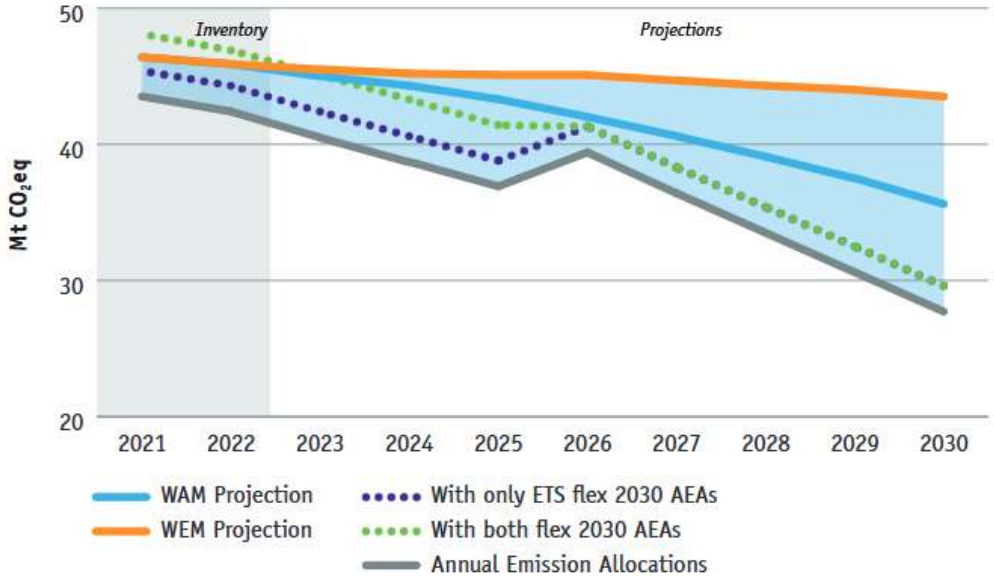

Figure 10. 1 Projected emissions and Annual Emissions Allocations (AEAs) under the Effort Sharing Regulation for the period 2021-2030 (Source: EPA, 2024)

Under the WEM scenario, the projections indicate that Ireland will cumulatively exceed its ESR 2021-2030 emissions allocation of 369.4 Mt CO2 eq by 80.3 Mt CO2 eq without the use of flexibilities. Under the WAM scenario, the projections indicate that Ireland will cumulatively exceed the ESR 2021-2030 emissions allocation by 50.1 Mt CO2 eq without the use of flexibilities.

The ESR provides two flexibilities (EU-ETS and LULUCF) to allow for a fair and cost-efficient achievement of the targets. The ETS flexibility available to Ireland for 2021 to 2030 is a maximum of 19.1 Mt CO2 eq (or 1.91 Mt CO2 eq annually).

The report concludes that urgent implementation of all climate plans and policies, plus, further new measures are needed for Ireland to meet the 51% emissions reduction target and put Ireland on track for climate neutrality by 2050.

10.2.4 Programme for Government

The Programme for Government was published in October 2020 and last updated April 2021. The programme focuses on different areas to face the impacts and challenges posed by climate change.

In terms of climate governance the programme establishes the commitment to update the Climate Action Plan annually; ensure that the appropriate departments have the capacity and expertise to manage the transition in energy efficiency and renewable energy; review the structure and operations of state agencies that will be responsible for delivery of targets; and work with the European Commission to advance a stronger National Energy and Climate Plan (NECP) for 2030.

In relation to energy, the programme proposes a National Energy Efficiency Action Plan to reduce energy use, including behavioural and awareness aspects of energy efficiency such as building and data management. It proposes to take all the necessary actions to deliver o at least 70% renewable electricity by 2030, as part of a rapid decarbonisation needed to meet the set targets, especially in the energy sector.

The Programme for Government was updated in 2025, and this updated document it includes a section related to climate change and the protection of the environment. It relates Ireland's climate commitments and goals with the UN Sustainable Development Goals (UN SDGs) and details the actions that the government will undertake to reduce the potential impacts of climate change. Some of these actions include:

- Making buildings more sustainable and energy efficient, reducing reliance on fossil fuels and lowering energy costs in households.
- Establishing a clear regulatory pathway, enable network upgrades, improve port facilities and ensure dependable schedule of renewable energy auctions to achieve 80% of Ireland's electricity generation from renewable source by 2030.
- Empower communities in renewable energy and making climate action accessible.
- Launch a roadmap to help industries reduce emissions through investment in efficient, low-carbon technologies.
- Develop and implement policies that promote and support modal change in transport and accelerate the decarbonisation of the sector.

Furthermore, the programme includes an investment plan for the future which includes the transport sector and proposes investing in diverse transport options among which active travel, to enhance the connectivity across urban and rural areas in a more sustainable manner.

10.3 Local Plans and Policy

10.3.1 Limerick Climate Action Plan 2024-2029

The Climate Action Plan sets out key actions to help County Limerick become more climate resilient while enhancing its biodiversity, becoming greener and more sustainable and achieving climate neutrality by 2050.

The targets of the plan include a 50% improvement in the Council's energy efficiency by 2029; a 51% reduction in the Council's greenhouse gas emissions by 2030; reducing the impacts of future climate change related events; and actively engage and inform the community about the climate actions taken.

The plan accounts for Limerick's emissions and the result show that transport is the third largest contributor to GHG emissions, with an estimated 11% of total emissions. Therefore, careful consideration is given to transition to more sustainable transport modes which require significant investment.

The Plan seeks to reduce the modal split of cars by 50% over its lifetime, pursuing the 50% reduction of the Council's overall GHG emissions. To achieve its objectives, the Plan proposes the following actions:

- Fleet strategy: includes reducing the energy and fuel use within the current fleet, shifting to more sustainable transport modes, public and active travel, and improve energy efficiency through adaptation of new technologies.
- Limerick Shannon Metropolitan Area Transport Strategy: reinforce its objectives to reduce transport emissions by 50% by 2030 through increased use of public transport, walking and cycling, and conversion of the transport fleet to zero emissions vehicles.
- Active Travel: expand and improve the cycling and pedestrian infrastructure as part of the shift to more sustainable transport modes.

The proposed Greenway is in line with the objectives and targets set in the Limerick Climate Action Plan and contributes to the benefits of reducing greenhouse gas emissions by promoting greener travel, cycling environmental benefits by reducing traffic congestion, active travel benefits and health benefits.

10.3.2 Limerick City and County Council: Climate Change Adaptation Strategy 2019-2024

The LCCC Climate Change Adaptation Strategy 2019-2024 is a high-level document designed to mainstream the issue of climate change in local authority plans, policies and operations. The overriding objective is to mainstream climate adaptation in all the functions and activities of the local authority.

Following on from the main objective there are a series of climate adaptation themes. Under each theme, there are a number of objectives, each with a number of linked actions. There are six themes in total listed below:

1. Extreme Weather Event Response
2. Land Use and Planning
3. Infrastructure, Built Environment and Service Provision
4. Environment
5. Economic Development Activities
6. Emerging Issues

There are three timeframes associated with the actions, short term within three years, medium term, three to five years and long term, five to ten years.

The report highlights some of the actions that are being undertaken by LCCC to mitigate against the effects of climate change. These include, among others, the changeout of public lighting to energy

efficient lighting, development of urban and rural greenways to promote sustainable transport and contribute to a better quality of life, shift to electric vehicles, use renewable energy at LCCC's offices.

10.4 Climate and Weather in the Existing Environment

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The World Meteorological Organization (WMO) recommends that climate averages are computed over a 30-year period of consecutive records. The period of 30 years is considered long enough to smooth out year to year variations. Henceforth Met Éireann will reference 1991 to 2020 as the baseline period for day-to-day weather and climate comparisons.

The following table has the climate averages for the closest weather station located at Shannon Airport which is 20km north from the proposed Greenway.

The study area for this chapter is defined considering various levels, global, state and county, and how the project contributes to Limerick City and County Council and Ireland's greenhouse gases emissions accounting as well as supporting their commitment and objectives to reduce the impacts of climate change.

The Zone of Influence (ZoI) for the climate impacts associated with the greenway project encompasses both global and national dimensions. Greenhouse gas (GHG) emissions generated by the project contribute to the cumulative atmospheric concentration of GHGs, influencing climate patterns on a planetary scale. Climate change is inherently a global phenomenon, where the emissions from any single project become part of the collective global impact.

To assess the project's climate impacts in a more localised context, the ZoI also considers the state performance of Ireland concerning GHG emissions. Ireland's Climate Action Plan and sector-specific targets set the framework for reducing national emissions. The project's contribution to climate change is evaluated against key economic sectors.

The regional ZoI is also considered, focusing on the project's role in supporting local climate resilience and sustainable transport initiatives. The reduction of local emissions through increased active travel and decreased vehicle dependency contributes to regional targets within the context of local climate action plans.

Details of the project's contribution can be found in Section 10.5 of this chapter.

Table 10.1 Data from Met Eireann Shannon Airport weather station averages 1991-2020

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean daily max	8.9	9.4	10.9	13.4	16	18.3	19.5	19.1	17.5	14.2	11.1	9.2	14
mean daily min	3.3	3.3	4	5.8	8.1	10.8	12.6	12.4	10.7	8.1	5.5	3.7	7.4
mean temperature	6.1	6.3	7.5	9.6	12	14.5	16	15.8	14.1	11.2	8.3	6.4	10.7
absolute max.	14.7	15.5	19.6	23	27.8	32	30.2	29.2	25.6	21.9	17.2	15.4	32
min. maximum	-2.4	0.7	0.2	5.5	7.5	12.2	13.4	14.3	10.7	7	0.8	-6	-6
max. minimum	11.5	12.2	11.7	13	14.4	17.8	18	18.6	17.5	16.2	13.3	12.6	18.6
absolute min.	-11.2	-5.1	-5.8	-2.9	0.1	3.1	6.2	4.4	1.7	-2.3	-6.6	-11.4	-11.4
mean num. of days with air frost	5.2	4.6	3.2	0.6	0	0	0	0	0	0.4	1.9	4.4	20.3
mean num. of days with ground frost	13	11.8	11.9	7.7	2.9	0.2	0	0	0.8	3.3	8	11.3	70.9
mean 5cm soil	5	5.1	6.6	9.4	12.9	16	17.2	16.5	14.2	10.7	7.7	5.6	10.6
mean 10cm soil	5.1	5.2	6.4	9	12.3	15.2	16.6	16.1	14	10.8	7.9	5.8	10.4
mean 20cm soil	5.8	5.9	7.1	9.5	12.5	15.3	16.7	16.5	14.7	11.7	8.7	6.6	10.9
RELATIVE HUMIDITY (%)													
mean at 0900UTC	87.8	87.9	85	79.3	76.2	76.6	80	82.3	85.1	87.4	89.9	88.9	83.9
mean at 1500UTC	81.2	75.4	69.8	64.1	63.5	64.6	69.3	69.1	70	75	81	83.5	72.2
SUNSHINE (hours)													
mean daily duration	1.7	2.4	3.6	5.4	5.9	5.5	4.4	4.6	3.9	3	2.1	1.5	3.7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
greatest daily duration	8.1	10.2	11.5	13.6	15.6	15.8	15.7	14.4	12.2	10.1	8.3	7.1	15.8
mean num. of days with no sun	9.1	5.9	5.3	2.3	1.9	1.8	2.1	2.1	2.6	5.1	7.7	10.1	56
RAINFALL (mm)													
mean monthly total	103.8	86.7	75.8	62.3	63.1	69.6	75.8	87.6	77.4	95.5	106.6	115.4	1019.7
greatest daily total	38.2	33.8	34.8	40.2	25	45.3	39.5	51	52.3	36.9	29.4	33.5	52.3
mean num. of days with >= 0.2mm	21.3	18.3	18	16.2	16.2	15.5	18.3	19	17.7	19.9	21.6	21	223
mean num. of days with >= 1.0mm	16.9	13.9	13.4	11.4	12.1	11.3	13.5	13.7	12.9	15.4	16.8	17.2	168.5
mean num. of days with >= 5.0mm	7.8	5.8	5.5	4.7	4.6	4.8	4.9	5.8	4.8	7	8	8.5	72.2
WIND (knots)													
mean monthly speed	10	10.1	9.6	9.2	9	8.5	8.4	8.3	8.4	8.9	9.1	9.7	9.1
max. gust	75	86	63	66	52	51	52	61	58	66	69	83	86
max. mean 10-minute speed	47	61	44	45	37	37	38	44	44	47	50	57	61
mean num. of days with gales	1.8	1.2	0.9	0.4	0.2	0.2	0	0.1	0.1	0.5	0.8	1.3	7.5
WEATHER (mean no. of days with..)													
snow or sleet	1.5	1.8	1.2	0.3	0	0	0	0	0	0	0.1	1	5.9
snow lying at 0900UTC	0.2	0	0.1	0	0	0	0	0	0	0	0	0.1	0.5
hail	3.1	3.4	2.8	2	0.7	0	0	0.1	0.1	0.5	1	2.3	16
thunder	0.9	0.4	0.3	0.3	0.5	0.4	0.7	0.5	0.2	0.3	0.3	0.4	5.2
fog	3.4	2.2	2.4	1.8	1.3	1	0.9	1.6	2.8	3.1	4	3.8	28.3

10.4.1 Extreme Weather Events

Historic extreme weather events are recorded and updated in the Limerick City and County Council "Severe Weather" web page (https://www.limerick.ie/tags/severe-weather/articles), where weather alerts and statements are available and accessible for the public, working also as a warning system.

A few of the most recent extreme weather events registered by LCCC are listed in the following table.

Table 10.2 Extreme weather events registered by LCCC.

Extreme weather event	Date	Actions/Measures
Storm Brian	October 2017	Yellow wind and rainfall warning Provision of sandbags Deployment of crews after localised flooding in Limerick City
Low temperatures	November 2017	Yellow snow-ice warning and low temperatures Roads under winter road maintenance programme gritted
Low temperatures	January 2018	Red alert for snow and ice Closing of public offices and spaces
Storm Emma	February 2018	Red weather warning Gritting of strategic road network
Storm Lorenzo	October 2019	Orange wind warning Yellow rainfall warning Temporary flood defences deployment
Storm Barra	December 2021	Orange wind warning Yellow rain warning Parks and playgrounds closed Flood defences erected in strategic areas
Storm Eunice	February 2022	Orange weather warning
Extreme Heat	July 2022	Yellow high temperature warning Fire Danger notice Summer ready information page
Storm Darragh	December 2024	Orange wind warning Boardwalk closure
Storm Eowyn	January 2025	Red weather alert Historic storm causing multi-hazard events

The Office of Public Works (OPW) flood maps (https://www.floodinfo.ie/map/floodmaps/#) has records of past flood events in the Study Area of the proposed Greenway, associated with river floods of the Shannon.

Table 10.3 Flood events in the Study Area

Flood event	Type of Event	Year
Flooding at Castletroy to Limerick	Recurring flood	2020
University of Limerick Area	Single flood event	2009
Castletroy, Limerick	Single flood event	2009
Plassey to Groody/Shannon Confluence	Single flood event	2009

10.4.2 Climate Change Projections

Representative concentration pathways (RCP) portray possible future greenhouse gas and aerosol emissions scenarios. To address uncertainty in future concentrations of greenhouse gases and emissions of aerosols, data made available incorporates two RCPs: RCP 4.5 and RCP 8.5.

RCP 4.5 is described by the Intergovernmental Panel on Climate Change (IPCC) as a moderate scenario in which emissions peak around 2040 and then decline. RCP 8.5 is the highest baseline emissions scenario in which emissions continue to rise throughout the twenty-first century. Therefore, climate change projected under RCP 8.5 will typically be more severe than under RCP 4.5.

These scenarios can be viewed through Climate Ireland along with climate change variables. Climate Ireland works as a research service that connects and integrates scientific research, policy making and adaptation practice for the purposes of enhancing adaptation decision making in Ireland.

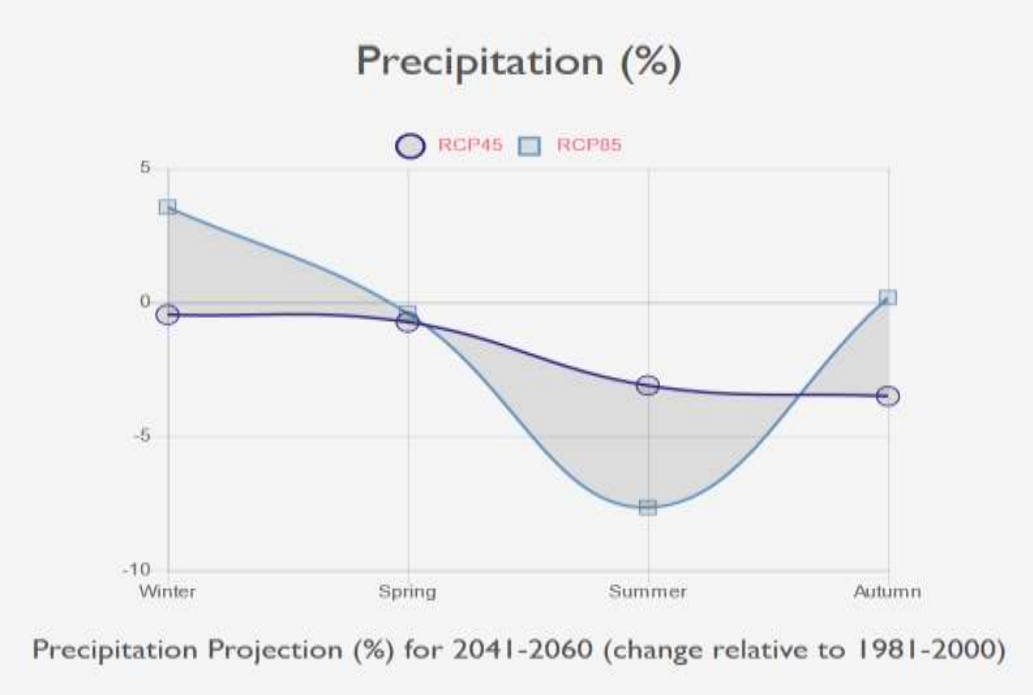

Figure 10. 2 Precipitation change for RCP 4.5 and 8.5 scenarios (Source: Climate Ireland)

The RCP 4.5 scenario show a decrease in precipitation for all seasons. While for RCP 8.5 scenario extreme weather events are more evident as there is an increase in precipitation during winter and autumn of 3.6% and 0.17% respectively while there is a severe drop during summer time of -7.67%. The percentage change in number of wet days (>30mm) for the Study Area is between 22.5 and 25%.

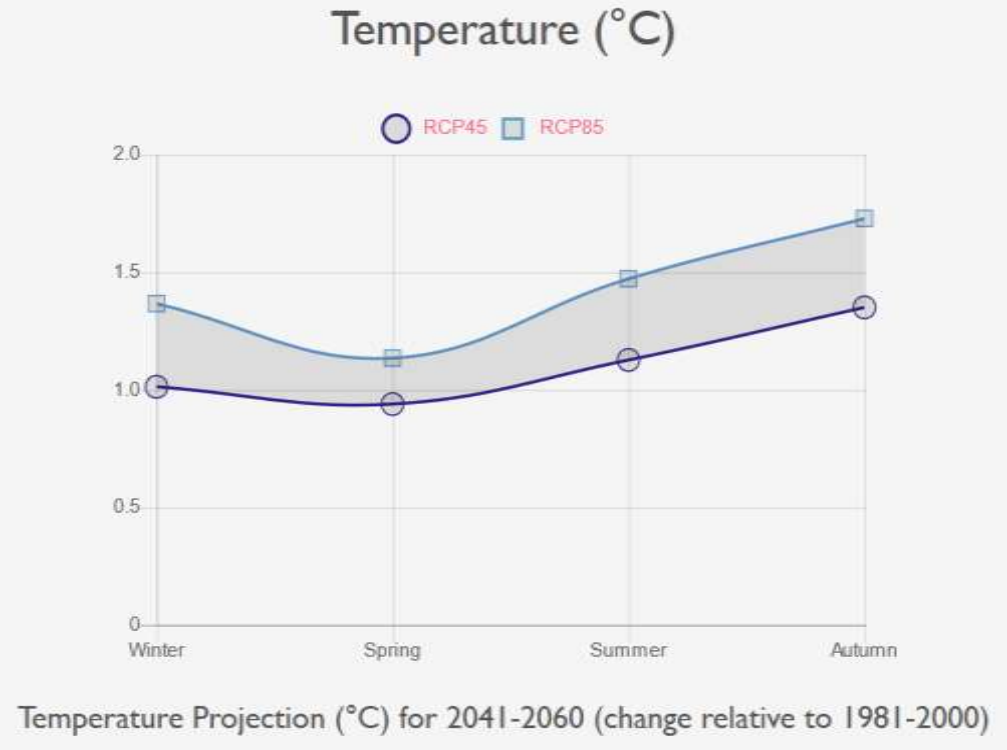

Figure 10. 3 Temperature change for RCP 4.5 and 8.5 scenarios (Source: Climate Ireland)

The projected change in average temperature for RCP 4.5 shows an increase of approximately 1°C up to 1.13°C in autumn. The RCP 8.5 scenario predicts an increase of up to 1.73°C for that season. Trends show increased temperatures for the upcoming years for all seasons compared to the 1981-2000 registered temperatures.

Increased temperatures can result in heatwaves which in the Study Area the number of heatwaves will increase between 4 and 6 days for the RCP 4.5 scenario and between 6 and 8 days for RCP 8.5.

10.4.3 Climate Risk Assessment for the Proposed Greenway

Climate risks result from four different factors.

Figure 10.4 Definition of risk based on IPCC AR6

The IPCC Sixth Assessment Report (AR6) provides standard definitions for each of these factors:

- Vulnerability: is the tendency of the receptors to be affected by climate related hazards. It is a product of:

- Sensitivity: which is the degree to which the receptors are affected, either negatively or positively by climate change.
- Adaptive capacity: which is the ability to adjust to potential damage, taking advantage of opportunities or to respond to consequences.

- Hazards: are associated with extreme weather-related events and may cause negative or positive impacts to receptors.
- Exposure: refers to the presence of receptors in places and settings that could be affected.
- Responses: can reduce or increase risks by affecting each of the other factors.

10.4.3.1 Hazards

Severe windstorm events have impacted upon Limerick City and County most frequently over the period 1945-2025, with coastal flooding, river flooding, pluvial flooding and heatwaves affecting the County on a number of occasions. Coastal erosion, cold spells, droughts, heavy snowfall, and groundwater flooding have also impacted Limerick City and County, but less frequently.

Having assessed the range of climate hazards, the Climate Action Plan includes projected changes in the frequency and intensity of climate hazards to understand how existing climate impacts and risks may be exacerbated.

Table 10.4 Climate hazards for Limerick City and County

Hazard type	Projected change	Future frequency
Heatwaves	Overall increase in temperature between 1.4 and 1.5°C. Under the high emissions scenario heatwaves will become more frequent	↑ Frequent
Droughts	Summer rainfall is expected to reduce, contributing to drought conditions	↑ Common
Cold spell	Decrease in the number of frost days and ice days	↓ Occasional
Heavy snowfall	Annual snowfall in the region is projected to decrease.	= Rare
Sever windstorms	There is uncertainty about the projections. By mid-century, there is indication that the average wind speed will remain similar.	= Very frequent
Coastal flood	Increase of up to 0.25m by 2050 which will increase frequency of coastal inundation	↑ Frequent
Coastal erosion	A rising sea level is linked to an increase in erosion rates and extent.	↑ Common
Pluvial and fluvial flood	Increase in frequency of heavy rainfall days, resulting in an increase of associated fluvial and pluvial flooding	↑ Very frequent
Groundwater flood	Projected changes are currently not available as there is uncertainty in the change in groundwater flooding frequency	= Occasional

Based on the climate hazards identified in Table 10.4, a detailed assessment of their potential impacts on the proposed Greenway project has been conducted. In this assessment, river and pluvial flooding have been combined, reflecting their interconnected nature and similar consequences on infrastructure and operations. This combination allows for a more holistic evaluation of flood-related risks.

The focus of this analysis is on hazards with a higher likelihood of occurrence and significant potential to impact the project's construction and operational phases.

10.4.3.2 Vulnerability

Vulnerability is the tendency of the exposed system and its components to be adversely affected. To identify the climate change vulnerability of the project, the extent to which the project is sensitive to climate-related hazards was considered, along with related adaptive capacities. The sensitivity analysis was qualitative in nature and did not involve computation.

Table 10.5 Sensitivity analysis

	Hazards								
	Heatwaves	Drought	Cold spells	Heavy snowfall	Severe windstorms	Coastal flood	Coastal erosion	Pluvial and fluvial Flood	Groundwater flood
Sensitivity of the project	O	O	x	x	O	O	O	O	x

O = Sensitive, x = Not Sensitive

The greenway, considering its location along the River Shannon is potentially vulnerable to climate change hazards, particularly due to its exposure and sensitivity to flooding, erosion, and extreme weather events. The greenway's proximity to the river makes it highly exposed to the risk of flooding, especially in the context of increased rainfall and more frequent storm events driven by climate change. Higher river flows, combined with rising sea levels, could lead to more frequent and severe flooding events, damaging the path and surrounding infrastructure. Additionally, the greenway may be sensitive to soil erosion and land degradation, as stronger and more frequent storms can erode riverbanks, affecting the stability of the greenway and its accessibility. These climate hazards may disrupt local biodiversity and recreational use of the greenway, undermining its value as a public space and transportation corridor. Adapting the greenway to these threats will require addressing these vulnerabilities through resilient design, flood defences, and ongoing monitoring to safeguard its long-term sustainability.

10.4.3.3 Risk

The EU published the Commission Notice "Technical guidance on the climate proofing of infrastructure in the period 2021-2027" (2021/C 373/01). Part of the aim of this guidance is to identify the relevant climate hazards for the given specific project type at the planned location.

The risk of a project can be defined as the possibility to suffer negative effects in the future, and it is not constant but rather it is constantly evolving (IPCC, 2012). Since climate change impacts cannot be accurately predicted, generally the "climate risks" are a combination of the likelihood of an impact to occur and the magnitude of these.

Risk = Likelihood x Magnitude

The following qualitative and quantitative definitions for Likelihood and Magnitude are an adaptation from the EU Technical Guidance (2021/C 373/01) and the UKCIP (2003)[1].

Likelihood

- 1. Rare: highly unlikely to occur.
- 2. Unlikely.
- 3. Moderate: as likely to occur as not.
- 4. Likely.
- 5. Almost certain.

Magnitude

The magnitude of the consequences are relevant to each of the risk areas considered, as detailed in the table below.

Table 10. 6 Magnitude of consequences across risk areas

Risk areas	Magnitude of consequence				
	0 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophe
Asset damage/Engineering	Impact can be absorbed through normal activity	An adverse event that can be absorbed by continuous actions	A serious event that requires additional actions	A critical event that requires extraordinary actions	Disaster with the potential to lead to shut down or loss of the asset
Safety and Health	First aid case	Minor injury, medical treatment	Serious injury or lost work	Major or multiple injuries, permanent injury or disability	Single or multiple fatalities
Environment	No impact on baseline environment. Localised in the source area	Localised within the site boundaries.	Moderate harm with possible wider effects. Recovery in one year	Significant harm with local effect. Recovery longer than one year. Failure to comply with environmental regulations	Significant harm widespread effect. Recovery longer than one year. Limited prospect of full recovery
Social	No negative social impact	Localised, temporary social impact	Localised, long term social impact	Failure to protect vulnerable groups. National, long-term social impacts	Loss of communities.
Financial	No financial impact	Financial impact can be absorbed without difficulties	Financial impacts can be absorbed but with greater difficulties	Important financial loss	Great financial loss that results in the loss of the asset

[1] UKCIP (2003). Climate adaptation : Risk, uncertainty and decision making. UKCIP Technical Report (R.Willows & R.Connell, Eds.). Oxford, UK.

Risk areas	Magnitude of consequence				
	0 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophe
Reputation	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short-term impact on public opinion, negative national media coverage	National, long-term impact with potential to affect stability of authorities
Cultural Heritage	Insignificant impact	Short-term impact. Possible recovery and repair	Serious damage with wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society

The above categories are then combined into a single matrix to obtain the risk.

Table 10.7 Risk=Likelihood x Magnitude

Likelihood / Magnitude	Score	Rare	Unlikely	Moderate	Likely	Almost certain
Score		1	2	3	4	5
Insignificant	0	0	0	0	0	0
Minor	2	2	4	6	8	10
Moderate	3	3	6	9	12	15
Major	4	4	8	12	16	20
Catastrophe	5	5	10	15	20	25

Risk	Quantitative value
High	15-25
Moderate	8-10
Low	2-6
Insignificant	0
Unknown	-

10.4.4 Identified Climate Risks

The following table evaluates the potential impacts of each identified climate hazard specifically for the Limerick City Greenway and related infrastructure.

Table 10.8 Potential impact description

Hazard	Risk area	Potential Impact
River and pluvial flooding	Asset damage/engineering	Potential flooding of the greenway path, bridges, and complementary infrastructure, causing physical damage and access issues.

Hazard	Risk area	Potential Impact
	Safety and Health	Risk to users' safety, with flooded paths leading to slipping hazards.
	Environment	Damage to local ecosystems, especially sensitive areas of Annex I habitats along the riverbanks, including aquatic habitats and riparian vegetation.
	Social	Disruption to recreational activities and public transport routes for nearby communities
	Financial	Significant costs for repairs and restoration of the greenway following flood events.
	Reputation	Public dissatisfaction due to repeated disruptions and lack of flood resilience.
	Cultural Heritage	Potential damage to historical or cultural sites along the greenway route and the along the river.
Heatwaves	Asset damage/engineering	Overheating of outdoor equipment such as benches, signage, or lighting, potentially leading to wear or failure.
	Safety and Health	Increased risk of heat-related illnesses for greenway users, particularly during long periods of direct sun exposure.
	Environment	Increased stress on vegetation and wildlife along the greenway, especially for vulnerable species.
	Social	Discomfort for users, reduced foot traffic, and possible decreased use of the greenway during extreme heat periods.
	Financial	Potential costs for installing cooling infrastructure or shading along the greenway, and repair of heat-damaged elements.
	Reputation	Negative public perception due to insufficient cooling measures or lack of accessibility during heatwaves.
	Cultural Heritage	Potential damage to historical structures or artefacts along the greenway if they are exposed to extreme temperatures.
Droughts	Asset damage/engineering	Reduced water availability may reduce the aesthetic appeal of the site.
	Safety and Health	Higher temperatures may increase the risk of heat exhaustion for users, especially those engaging in physical activities along the greenway.
	Environment	Dry conditions may affect the health of riverine and riparian ecosystems, including flora and fauna that depend on regular water flow.
	Social	Reduced water features may make the greenway less attractive, decreasing recreational use and local engagement.
	Financial	Potential costs for maintaining water features or implementing water-saving measures to adapt to drought conditions.
	Reputation	Perception that the greenway is underperforming or unattractive during dry periods.
	Cultural Heritage	Minimal impact unless heritage areas are depended on local water features for cultural or aesthetic significance.
Severe windstorms	Asset damage/engineering	Damage to greenway structures like signage, seating, and trees, potentially obstructing paths or creating debris hazard.
	Safety and Health	Increased safety risks from falling debris or trees, leading to injury for users of the greenway.
	Environment	Destruction of vegetation and damage to wildlife habitats along the riverbank of the greenway, disrupting local ecosystems.

Hazard	Risk area	Potential Impact
	Social	Temporary closure or restricted access to the greenway for safety reasons, disrupting public access.
	Financial	High costs for debris removal, tree clearing, and repairing damaged infrastructure.
	Reputation	Negative public perception of the greenway's vulnerability to storms and insufficient resilience.
	Cultural Heritage	Windstorm damage could impact historical sites along the greenway and in nearby areas if they are not adequately protected.
Coastal erosion	Asset damage/engineering	If erosion affects areas near the river, it could weaken the greenway's path and embankments, causing damage to infrastructure.
	Safety and Health	Erosion could compromise the stability of greenway structures near the river, creating safety hazards for users.
	Environment	Loss of habitat along the riverbank due to erosion, impacting biodiversity and the overall ecological health of the area.
	Social	Reduced accessibility if erosion undermines the path or if sections of the greenway are closed for safety.
	Financial	High costs for implementing erosion control measures, such as reinforced riverbanks or re-routing paths.
	Reputation	Public concern regarding the long-term viability of the greenway and its environmental management.
	Cultural Heritage	Erosion may expose or damage cultural heritage sites along the riverbank.
Coastal flooding	Asset damage/engineering	Inundation of sections of the greenway, particularly near low-lying areas along the river, leading to structural damage.
	Safety and Health	Flooded areas increasing risks of slips and falls for users, as well as making access difficult for maintenance crews.
	Environment	Contamination of river ecosystems from floodwaters, potentially damaging sensitive habitats along the greenway.
	Social	Disruption to public access and recreational activities due to flooded areas, reducing community engagement.
	Financial	Repair costs following flooding events, along with potential lost income from reduced greenway usage.
	Reputation	Damage to the greenway's reputation due to persistent flooding risks and poor management of water hazards.
	Cultural Heritage	Coastal flooding may damage or destroy heritage sites near the greenway that are sensitive to water damage.

Table 10.9 Overall impact of the essential climate variables and hazards

Risk area	Climate variables	Likelihood	Magnitude	Risk
Asset damage/engineering	River and pluvial flooding	4	3	12
	Heatwaves	4	2	8
	Drought	2	2	4
	Severe windstorms	3	3	9
	Coastal flooding	4	2	8

Risk area	Climate variables	Likelihood	Magnitude	Risk
	Coastal erosion	3	2	6
Safety and Health	River and pluvial flooding	3	3	9
	Heatwaves	3	2	6
	Drought	2	2	4
	Severe windstorms	3	2	6
	Coastal flooding	3	2	6
	Coastal erosion	2	2	4
Environment	River and pluvial flooding	3	3	9
	Heatwaves	3	2	6
	Drought	2	2	4
	Severe windstorms	2	2	4
	Coastal flooding	3	2	6
	Coastal erosion	2	2	4
Social	River and pluvial flooding	3	3	9
	Heatwaves	3	3	9
	Drought	2	2	4
	Severe windstorms	3	2	6
	Coastal flooding	3	2	6
	Coastal erosion	2	2	4
Financial	River and pluvial flooding	3	2	6
	Heatwaves	2	2	4
	Drought	0	2	0
	Severe windstorms	3	2	6
	Coastal flooding	3	2	6
	Coastal erosion	2	2	4
Reputation	River and pluvial flooding	4	2	8
	Heatwaves	3	2	6
	Drought	2	2	4
	Severe windstorms	3	2	6
	Coastal flooding	3	2	6
	Coastal erosion	2	2	4
Cultural Heritage	River and pluvial flooding	3	2	6
	Heatwaves	2	2	4
	Drought	2	1	2
	Severe windstorms	2	2	4
	Coastal flooding	3	2	6
	Coastal erosion	2	2	4

As identified in the LCCC Climate Action Plan, river and pluvial flooding, along with coastal flooding pose the highest risks to infrastructure and operational continuity of the greenway. Heatwaves, as they will increase in frequency, can pose a risk to health and safety for the greenway users. These hazards have the potential to damage assets, the surrounding environment and affect the public's perception of the greenway as a climate resilient infrastructure and alternative.

The analysis highlights the necessity of implementing robust adaptation measures tailored to each identified risk. Sustainable drainage systems, structural reinforcement, tree planting scheme, all are valuable measures to safeguard assets and environmental and social health against flooding and other climate hazards.

10.5 Carbon Accounting Calculations from the Proposed Greenway

10.5.1 Background

The value of the Limerick City Greenway (UL to NTP) cannot be understated. It is a place of congregation, celebration and connections that brings natural ecosystems into the city and links people to nature. Its gardens, trees, provide numerous aesthetic, health and economic benefits to the city. Its natural ecosystems also store a modest, but notable, amount of carbon while providing these community benefits. As the role of nature-based solutions emerge as a critical element of combating climate change, understanding this component of its natural assets will allow the Greenway to better align its operational and educational missions with global climate objectives.

10.5.2 Methodology

The assessment evaluates the carbon footprint of the Limerick City Greenway (UL to NTP). The methodology includes the carbon emissions associated with the embodied carbon of the materials that will be used for the construction of the greenway, as well as emissions during the construction phase that involves traffic, machinery used, vegetation clearance, etc. On the other hand, an effort will be made to calculate the carbon savings, through the planting scheme proposed as part of the Greenway design.

Data for the calculations was collected by the project's engineering team, carbon emission factors databases and calculators (Inventory of Carbon and Energy -ICE, DESNZ/DEFRA, Ireland's electricity mix, TII Carbon Calculator Tool, etc.) and guidance from the GHG Protocol. For above ground carbon, various available studies were used, included in the reference section of this report.

10.5.2.1 Guiding principles

These principles will help ensure the credibility and consistency of efforts to quantify and report emissions. They are the principles by which the main carbon calculation guidelines abide to. These principles are listed below.

Completeness

All relevant information should be included in the quantification of a project's GHG emissions and in the aggregation of the total GHG footprint. This ensures that there are no material omissions from the data and information that would substantively influence the assessments and decisions of the users of the emissions data and information.

Consistency

The quantification of GHG emissions requires that methods and procedures are always applied to a project and its components in the same manner, that the same criteria and assumptions are used to evaluate significance and relevance.

Transparency

Clear and sufficient information should be available to allow for the credibility and reliability of reported GHG emissions to be assessed. Specific exclusions or inclusions should be clearly identified, and assumptions should be explained. Appropriate references should be provided for both data and assumptions. Information relating to the project boundary, the explanation of the baseline choice, should be sufficient to replicate results and comprehend the conclusions drawn.

Conservativeness

Conservative assumptions, values and procedures should be used. Conservative values and assumptions are those that are more likely to overestimate absolute emissions and "positive" relative emissions (net increases) and underestimate "negative" relative emissions (net reductions).

Accuracy

Carbon footprints involves many forms of uncertainty, including uncertainty about the identification of secondary effects, the identification of baseline scenarios, and baseline emission estimates. Therefore, GHG estimates are, in principle, approximate. Uncertainties with respect to GHG estimates or calculations should be reduced as far as is practical. Where accuracy is reduced, the data and assumptions used to quantify GHG emissions should be conservative.

Relevance

GHG sources, GHG sinks, GHG reservoirs, data and methodologies appropriate to the needs of the intended user should be selected.

10.5.2.2 Greenhouse Gases included in the assessment

The GHGs included in the footprint include the seven gases listed in the Kyoto Protocol, namely: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3). The GHG emissions quantification process converts all GHG emissions into tonnes of carbon dioxide called CO2e (equivalent) using the Global Warming Potentials (GWP).

Table 10.10 Global Warming Potentials in CO_2 equivalent

Greenhouse Gas	CO_2 equivalent (GWP) AR5	CO_2 equivalent (GWP) AR6
CO_2	1	1
CH_4	28	29.8 fossil origin 27.2 non-fossil origin
N_20	265	273

10.5.2.3 Classification of emissions

Greenhouse gas emissions can be divided into 3 scopes (GHG ,2011):

- Scope 1 emissions: These comprise of emissions that originate on-site. This is either fugitive gases from the site's processes or the combustion of fuels on-site.

- Scope 2 emissions: These emissions originate from the generation of electricity used on-site
- Scope 3 emissions: These are emissions that are out of the control of the facility. These include transport emissions, outsourced services, etc.

10.5.3 Project Boundaries

The extent of carbon footprint assessments depends on the boundaries (or scope) defined. Typical boundaries used in footprint calculations are the "cradle to grave" and "cradle to gate". Cradle to grave involves all carbon dioxide equivalent emissions throughout the life of the product. This includes the extraction of raw materials, manufacturing of the product, operation, maintenance, transport and finally the disposal of the product. The "cradle to gate" approach encompasses all the impacts from the extraction of raw materials to the departure of the finished product from the facility.

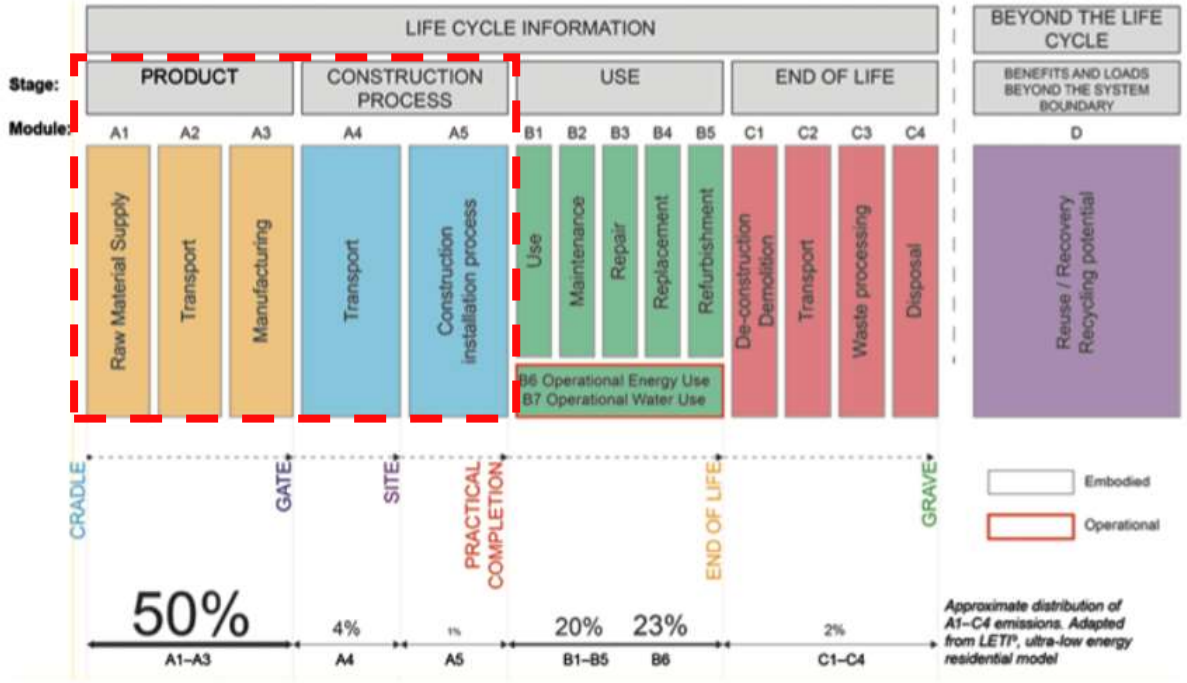

Figure 10.5 Building life cycle stages considered in EN 15978:2011

For the Limerick City Greenway (UL to NTP), the stages considered include the embodied carbon for the materials used during the construction and the construction process itself called the "Upfront carbon". The Use stage of the life cycle has been scoped out given the limited information at the time of writing the report and considering that the objective of the greenway is to have net zero carbon during its operation, through the promotion of sustainable transport modes.

Based on **Figure 10.5** above, the stages included in the assessment for the proposed works at the time of writing this report considering the information available, are:

- A1-A3 Cradle to Gate: product stage also known as 'cradle to gate' and modules A1–A3, are carbon emissions (kgCO2e) released during raw material extraction, processing, manufacture (including prefabrication of components or elements), and transportation of materials between these processes until the product leaves the factory gates to be taken to site.
- A4-A5: are associated with the embodied carbon released during the transport of materials/products to the site (A4), the energy usage due to activities on site (machinery use,

etc.), and the carbon emissions associated with the production, transportation, and end of life processing of materials wasted on-site (A5).

10.5.4 Carbon Footprint Calculation

A carbon footprint calculation was completed as part of the EIAR, using the Transport Infrastructure Ireland (TII) Carbon Assessment Tool for Road and Light Rail projects (2024) and the ICE Database (2019).

The tools were used to calculate the total embodied carbon for the construction phase of the proposed Greenway in terms of tonnes of carbon dioxide equivalency (tCO2 eq.)

10.5.4.1 Embodied carbon of materials

For the purposes of this report embodied carbon represents the carbon emissions released during the lifecycle of building materials, including extraction, manufacturing and transport to the construction site.

Embodied carbon is calculated as global warming potential (GWP) and expressed in carbon dioxide equivalent units (CO_2e).

The main materials considered for the embodied carbon calculations of the proposed Greenway were:

- Gravel;
- Steel;
- Concrete;
- Asphalt products;
- Brick materials.

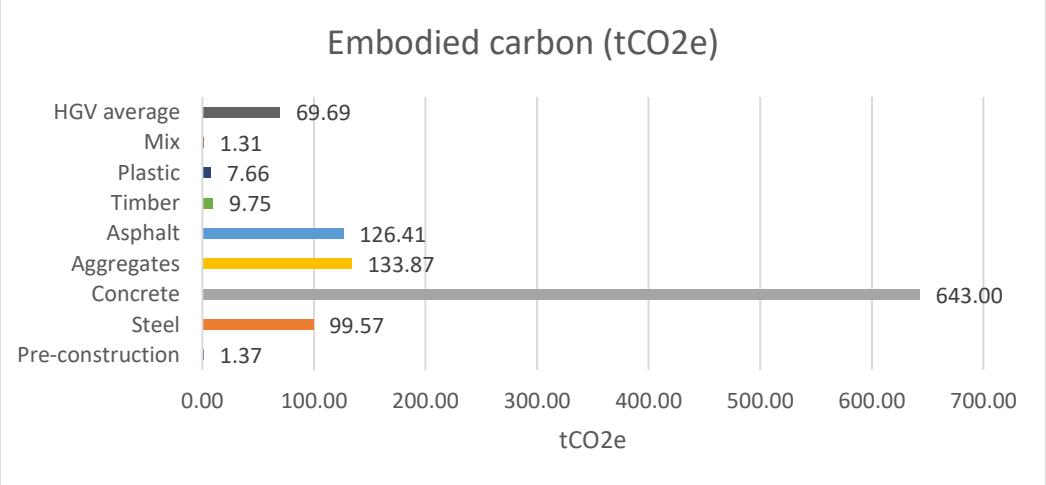

Figure 10.6 Emissions in tCO2e for the embodied carbon of materials and transport

The most carbon intensive material is concrete and so it shows in the carbon calculations. Concrete is responsible for more than 58% of the total embodied carbon from the materials considered for the construction of the greenway. Most concrete will come from prefabricated concrete kerbs and precast concrete circular pipework for the French drains. The two other most carbon intensive materials are asphalt (12%) and aggregates (12%). Asphalt will be used in the form of macadam for the proposed Greenway surface and crossings. Aggregates in the form of gravel will be used for the proposed Greenway surfacing. Steel is the next material with significant emissions adding to 10% of the total embodied carbon.

Land use change and clearance was also accounted as part of the embodied carbon calculations, as pre-constructions works. The most clearance will occur in agricultural land (2.8 ha) and resulting carbon emissions add to 1.37 tCO_2e.

10.5.4.2 Construction activities

The carbon emissions calculated for the construction activities include the construction processes such as transport, use of machinery, commuting and waste generated as a result of these activities.

For the construction of the greenway, fuel use from machinery which include excavators, dump trucks, tractors, cranes, and a generator make up for 95% of all construction activities' emissions. Total carbon from fuel use results in 371.13 tCO_2e.

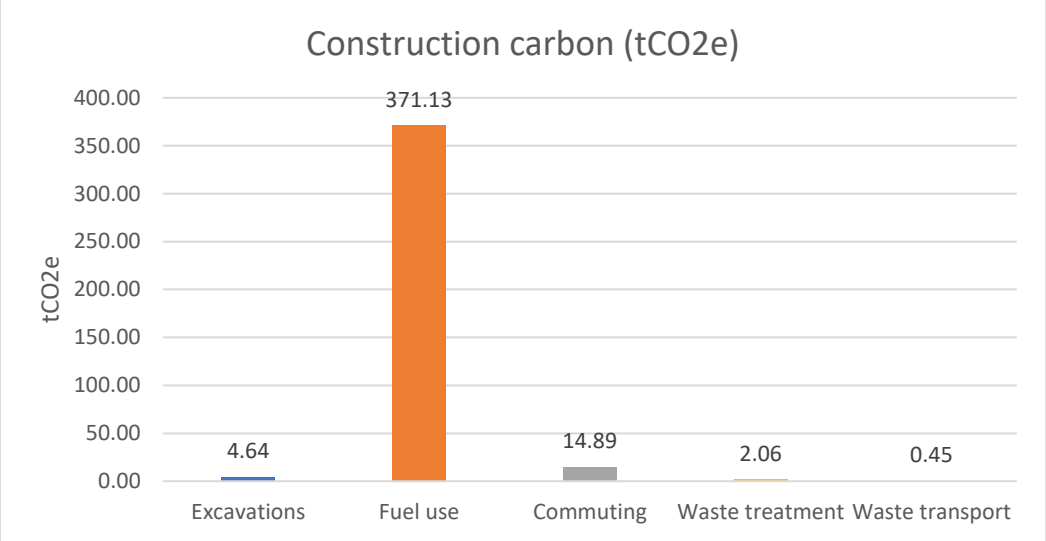

Figure 10. 7 Construction related emissions

Commuting makes up almost 4% of construction emissions, with an average commute distance of 16.8 km. Total carbon emissions related to commuting to the construction site was calculated to be 14.89 tCO_2e. Excavations make for just over 1% of the total emissions, followed by waste treatment (0.52%) and waste transport (0.11%).

10.5.4.3 Operation

Emissions related to operation of the greenway are linked to energy usage of LED lighting assumed to come from 121 streetlights with 100W LED. This adds to 105,996 khw annual consumption which results in 472.74 tCO_2e for a 20-year lifetime.

10.5.4.4 Summary

The overall carbon footprint for the various screened stages of the Limerick City Greenway (UL to NTP) are presented in Table 10. 11.

Table 10. 11 Overall carbon footprint for the various screened stages for the proposed green greenway

Carbon Footprint - Summary		
	tCO2e	% total
Embodied carbon	1092.63	55.79%
Construction	393.17	20.07%
Operation	472.74	24.14%
TOTAL		**1,958.54**

The embodied carbon of materials is the highest source of emissions, especially related to concrete as seen above. Embodied carbon for the construction of the greenway represents 55.79% of the total carbon emissions. This is followed by the operation over a 20-year life cycle related to energy use of the street lighting along the greenway (24.14%) and finally construction related mostly to fuel use (20.07%).

10.5.5 Emission Sectors

In 2023, Ireland's emissions are 1.2% below the historical 1990 baseline for the first time in over 30 years. The latest emission data showed a decreased of 6.8% compared to 2022 which were seen in most of the sectors except for transport which showed an increase of 0.3% (EPA latest emission data, updated July 2024).

10.5.5.1 Manufacturing and Industry sector

In 2023 the manufacturing combustion sector was responsible for 7.5% of Ireland's greenhouse gas emissions or 4.13 Mt CO2e (million tonnes of carbon dioxide equivalent). Emissions from manufacturing combustion decreased by 4.6% or 0.20 Mt CO_2e in 2023 compared to 2022 (EPA, 2023).

The non-metallic minerals related emissions latest data was of 1.09 Mt CO2e which is 26.3% for the manufacturing and industry sector.

The concrete related emissions for the proposed Greenway result in 643 tCO_2e which would be 0.06% of the non-metallic emissions for the sector.

At a county level, according to the LCCC CAP 2024-2029, commercial and manufacturing emissions were 391,858 tCO_2e. Considering the concrete related emissions of the greenway project, they would account for 0.16% of the total emissions for this sector at a County scale.

Under the With Existing Measures scenario, emissions from manufacturing combustion are projected to decrease 12% from 4.3 to 3.8 Mt CO_2e between 2022 and 2030. Under the With Additional Measures scenario, emissions from manufacturing combustion are projected to decrease by 32% between 2022 and 2030 to 2.9 Mt CO_2e. This scenario assumes further rollout of energy efficiency programmes, the use of biomethane for heat and an increase in carbon-neutral heating in low and high temperature heat in manufacturing.

10.5.5.2 Transport sector

Between 1990 and 2023, the transport sector shows the greatest overall increase of GHG emissions at 129.2%, from 5,143.3 kt CO2e in 1990 to 11,790.8 kt CO2e in 2022, with road transport increasing by 133.6%. Fuel combustion emissions from Transport accounted for 9.3% and 21.4% of total national greenhouse gas emissions in 1990 and 2023, respectively.

This sector accounts for emissions from the combustion of fuel for all transport activity. In 2023, transport GHG increased by 0.3% from 2022. with road transport accounting for 94.7% of all transport emissions. Road transport resulted in 11.2 Mt CO2e in 2022.

Considering fuel combustion from machinery during plant use, transportation of construction materials and construction waste, and commuting for the proposed Greenway, total emissions for these activities were calculated to be 393.17 tCO_2e which represents 0.004% of total road transport emissions.

Locally, at county level, emissions related to the transport sector for Limerick added to 493,548 tCO_2e. The greenway project emissions would account for 0.08% of the total emissions for the sector. And in the long-term it would reduce car related emissions and provide a more sustainable transport mode.

Transport emissions are expected to decrease over the period 2022-2030 by 5% with a total of 11.2 Mt CO_2e under the WEM scenario while the WAM scenario projects a decrease by 26% in that same period, assuming an increase in electric vehicles and biofuels.

10.5.5.3 Energy

This sector accounts for emissions from fuels combusted in electricity generation, waste to energy incineration, oil and natural gas refining, briquetting manufacture as well as fugitive emissions from oil and gas production, transmission and exploration.

Sectoral emissions show a decrease of 21.6% in 2023 which is attributable to reductions in coal, fuel oil and natural gas use. In 2023 renewables accounted for 40.7%.

Energy industries emissions in 2023 accounted for 7.85 Mt CO_2e of which public electricity and heat production were the most emission intensive sectors.

The energy use calculated for the proposed Greenway is associated with the operation phase and related to public lighting along the route. This accounts for 472.74 tCO_2e which represents 0.006% of the total emissions for the energy sector.

Considering energy consumed at a residential level in Limerick County, which were recorded to be 434,519 tCO_2e (LCCC CAP 2024-2029), the energy related emissions for the greenway project would represent a 0.1% of the total emissions at a county level.

10.5.6 Carbon Saving Opportunities

Several strategies can be employed to reduce embodied carbon, including using low-carbon, carbon neutral or even carbon-storing materials. Most carbon-storing materials are plants (wood, hemp, straw, bamboo, algae) that have sequestered carbon during their growth before being transformed into a building material. Additionally, using recycled materials or reclaimed materials can reduce the emissions associated with manufacturing new materials.

By following the World Green Building Council on how the construction industry can reduce embodied carbon emissions, the proposed Greenway design applies the following steps aiming to reduce its overall carbon footprint:

- Measure carbon emissions across all the project's stages;
- Establish a baseline to set reduction targets and set a pathway in line with net zero emissions;
- Adopt best practices by disclosing material selection based on lowest embodied carbon, adoption of Environmental Product Declarations (EPD) from material manufacturers to be used in the selection process;
- Design with a low carbon approach for all the project stages; and
- Lead by example by working towards low carbon and net zero embodied carbon projects.

The best way to reduce embodied carbon is through prevention. Avoiding construction can eliminate the potential for embodied carbon. Through alternative strategies such as increased utilisation of existing assets by renovation or re-use, it can be possible to deliver the same function as a new build and thus eliminating the embodied carbon emissions associated with it. However, if renovation and re-use is not

an option, other principles can help reduce embodied carbon during various stages of a building or infrastructure project.

The development of tools and data for calculating embodied carbon are becoming increasingly available and accessible. This includes life cycle assessment-based design tools and product labelling such as Environmental Product Declarations. Using such innovations, it is now possible to calculate embodied carbon upfront and use low embodied carbon materials to 'reduce and optimise' these emissions.

Reducing embodied carbon can be achieved through various approaches and initiatives.

Reduce the embodied carbon of materials

- Use the best available low carbon cement as per government policy;
- Consider alternatives to cement stabilisation of groundworks (lime and fly ash mix);
- Specify materials with Environmental Product Declarations (EPD) to encourage manufacturers to measure, report and reduce their carbon footprint.

Use resources efficiently over their design life

- Efficient design (measure then reduce the governing utilisation ratio of materials);
- Design to reduce waste and apply circular economy principles;
- Design for durability and adaptability.

Opportunities to reduce embodied carbon of materials come from initiatives that include material selection and manufacturing processes that use alternative raw materials and methods that can cut down the overall greenhouse gas emissions over a project's life cycle.

10.5.6.1 Carbon saving for the Limerick City Greenway

The design of the proposed Limerick City Greenway (UL to NTP) was constructed based on European, national and local policies objectives that aim to reduce GHG emissions to mitigate the effects of climate change through the transition to more sustainable transport modes.

Major potential for modal shift exists amongst commuters with daily journeys of 5 km or less. Ireland's Transport for Net Zero's target is to increase sustainable transport journeys by 500,000 per day. To meet this target 261,218[2] people need to shift from other transport modes, especially cars, to cycling or walking. This adds to 3,696 km per commuter (16.8km per day for 220 working days/year), and a total of 965 million passenger/km (pkt) per year. The avoided greenhouse gas emissions considering this data is reflected in Table 10.12.

Table 10.12 Avoided carbon due to a modal shift considering Ireland's target

Mode of transport	Embodied carbon of trip (gCO_2e/km)	Average occupancy	Carbon emissions of trip (gCO_2e/pkt)
Car	170	1.5	113
Bicycle	21	1	21
Avoided carbon (gCO_2e/km)			92
Avoided carbon (tCO_2e/million pkt)			92

[2] CSO 2022 data on commuting to work by transport modes.

Avoided carbon (tCO_2e) if Ireland's targets are met	88,780

If Ireland's modal transport shift objectives are met, cycling could result in approximately 3% reduction of the total kilometres travelled by car[3], which also contributes to Ireland's overall 20% reduction in total vehicle kilometres travelled relative to business-as-usual (CAP, 2024).

Considering an average of 115 commuters per day (Manton et.al., 2014), over a 20 year lifetime or the proposed Greenway, the total passenger/km would reach 8.5 million (pkt). This could result in a total carbon saving of 782 tCO2e. This would be equivalent to reducing the emissions from over 300,000 litres of fuel consumed and over 100 cars driven in one year.

Both vehicle kilometres and fuel reductions are part of the Climate Action Plan 2024 KPI "*Reduction in Total Vehicle Kilometres and Fuel Usage, and Increase in Sustainable Transport Trips*".

The proposed planting scheme includes 305 trees planted along the greenway route and in areas where planting is possible, at a 5:1 ratio. According to the Tree Council a ten-year-old evergreen tree absorbs 14 kg of CO_2 per year. Ireland's forests remove over 6 million tonnes of CO_2 every year.

On average trees can absorb approximately 10 kg of CO_2 per year for the first 20 years (FLR Carbon Storage Calculator). By taking this average, the first 20 years could potentially sequester 61 tCO_2 over that time period[4]. Note that different species grow at different rates depending on their location and environmental factors and have different capacities to absorb carbon dioxide over their lifetime.

In terms of materials, as was seen in the calculations above, concrete is one of the most carbon intensive materials. However, the adoption of precast concrete can reduce carbon emissions. For 1m3 of concrete, the use of precast concrete can result in a c. 10% reduction of carbon emissions (Dong, et.al., 2015).

The Limerick City Greenway (UL to NTP) aids to achieve Ireland's objectives to carbon neutrality though careful consideration of carbon saving opportunities during its design and by promoting an important shift towards more sustainable transport modes and reduce the overall GHG emissions locally, regionally and nationally.

10.6 Likely Significant Effects and Associated Mitigation Measures

The classification of impacts in this EIAR will follow the definitions provided in the Glossary of Impacts contained stated in the '*Guidelines on the Information to be contained in Environmental Impact Statements*' (EPA, May 2022) as described in Chapter 1 – Section 1.6.2 of this EIAR.

10.6.1 'Do-Nothing'

If the proposed Greenway were not to proceed, no changes would be made to the current land use practice.

If the proposed Greenway were not to proceed, greenhouse gas emissions (carbon dioxide, carbon monoxide and nitrogen oxides) associated with construction vehicles and activities would not arise. However, the opportunity to further significantly reduce emissions of greenhouse gas to the atmosphere would be lost. The opportunity to contribute to Ireland's commitments under the Paris Agreement and the EU law would also be lost, as there would be no contribution to grow the sustainable transport network and reduce traffic associated emissions. This would be a **long-term slight negative impact.**

[3] CSO 2021 road traffic volumes
[4] 305 trees*10kg/tree/year = 3050 kg/year or 3.05t/year. 3.05t/year*20 years = 61 tonnes

10.6.2 Construction Phase

The construction of the greenway, site roads and all associated infrastructure is a potential source of carbon emissions to the atmosphere. The carbon footprint of a greenway can be divided into[5]:

- Embodied carbon of materials;
- Transport to site;
- Machinery: site preparation and construction; and
- Loss of carbon from carbon sink.

Construction materials comprise the most embodied carbon of the greenway, therefore the design process is fundamental to avoid these type of emissions. The second source of emissions is transport, followed by construction machinery but these impacts will not be significant as they will be restricted to the duration of the construction phase.

Construction traffic will give rise to some CO2 and N2O emissions during the construction phase of the proposed Greenway. As these emissions will only be associated with the construction phase of the development which will be ongoing for a period of seven months, the impact will be temporary in nature. As specified in Chapter 13 Material Assets, the estimated peak daily volume of construction traffic is 28/day. The increase in greenhouse gas emissions due to the proposed Greenway will result in a potential temporary imperceptible impact on climate.

As set out in Chapter 4 Description, the proposed works have been designed to minimise habitat disturbance and limit tree removal. Approximately 61 trees will undergo tree removal along the Greenway, making sure mature trees are avoided. Tree planting is proposed in existing greenfield sites to compensate for the loss due to tree felling along the route as a direct replacement of the trees and vegetation cleared along that section of the Greenway. Approximately area 305 trees will be planted along the travel path.

During construction, in the absence of mitigation, the risk of flooding of the works area and subsequent risk of sediment transport to surface waters from a flood event presents a potential short term significant negative impact due to flooding as a result of climate change. Mitigation measures are presented in Chapter 8.

OPW National Flood Hazard Mapping shows that almost the entire footprint of the proposed Greenway is within Flood Zone A and several historical flood events have been recorded in the area. However, on review of the Planning System and Flood Risk Management Guidelines for Planning Authorities, a Greenway, cycle path or active travel path falls under the category of development classified as "Amenity, open space, outdoor space and recreation" and is considered a flood compatible development. Considering the local topography, which slopes towards the River Shannon for the extent of the Proposed Works Area, and the designed surface slope of 2.5deg to the river, it is unlikely that surface water would pond on the Proposed Works Area and would discharge to the River Shannon. In addition, there will be shallow drains on the landward side of the greenway to capture surface water and transfer it into drainage culverts under the proposed path towards the river.

Flood risk from surface water to the Proposed Works Area is therefore considered to be low because the path surface will utilise a porous tarmacadam material, and positive drainage channels will be constructed to existing water bodies to manage surface water away from the proposed path. The

[5] Manton, et.al. (2014). Carbon costs and savings of Greenways: Creating a balance sheet for the sustainable design and construction of cycling routes.

proposed path has been designed so possible flood events would result in minimal damage to the local infrastructure. This resilience will be especially important in a climate altered future.

Therefore, it is considered that the construction phase of the Greenway will have **short-term slight negative impact.**

10.6.2.1 Mitigation Measures

- Construction vehicles and plant will be maintained in good operational condition while onsite, minimising any emissions that arise;
- Reuse any excavated soil and demolition waste when possible in the surface layers of the greenway;
- Materials for the construction of the greenway will be obtained from local sources. This will significantly reduce the distance that delivery vehicles will have to travel, therefore reducing the amount of emissions associated with construction traffic; and
- Use of existing road infrastructure where possible, to avoid and reduce the construction of auxiliary roads which contribute to the overall carbon footprint of the proposed Greenway.

10.6.2.2 Residual Impact

Short-term imperceptible negative impact on climate as a result of greenhouse gas emissions.

10.6.2.3 Significance of Effects

Based on the assessment above there will be no significant direct or indirect effects to climate change related to the construction of the proposed Greenway.

10.6.3 Operational Phase

The proposed Greenway will promote sustainable travel modes, such as walking and cycling. The proposed Greenway will displace GHG emissions associated with fossil fuel-based traffic. It will assist in reducing overall emissions that would otherwise arise from the usual commuting traffic to University of Limerick and its surrounding areas. This translates into a **long-term moderate positive effect.**

10.6.3.1 Mitigation measures

To reinforce the importance of the greenway and the sustainable travel that it supports the following measures are proposed:

- Promote the greenway once constructed to ensure large usage and modal shift; and
- Encourage modal shift from high carbon releasing transport modes to cycling, walking and public transport.
- Access to these greenways by public transport and provision of bicycle hire on site can further improve their carbon efficiency by reducing trips by car.

10.6.3.2 Residual Impact

Long-term moderate positive impact on climate as a result of reduce greenhouse gas emissions due to the transport modal shift to more sustainable options.

10.6.3.3 Significance of Effects

Based on the assessment above, there will be long-term, moderate positive effects.

It is worth noting that given an assumed deign life cycle of 20 years for a greenway, 115 commuters travelling an average of 10km/day (Manton et.al., 2014) per year would be required to shift from the car to the bicycle in order to cancel out the carbon footprint of a 10km greenway.

As mentioned in Section 10.5.6 the potential carbon saving for the proposed Greenway over a 20-year lifetime period would be of 782 tCO2e. The proposed Greenway also aligns with Ireland's Climate Action Plan 2024, by reducing the vehicle travelled kilometres and fuel consumption.

Considering that the proposed Limerick City Greenway (UL to NTP) is less than half this daily distance and that it is one of the main connections from Limerick city centre to the University campus, and National Technology Park, it is expected that the minimum commuter number of 115 will be exceeded.

10.7 CUMULATIVE AND IN-COMBINATION EFFECTS

The proposed Greenway will likely overlap during the construction period. Impact on air quality and climate during the construction period are not expected to be significant in nature and therefore do not give rise to significant cumulative effects.

Potential in combination effects on air quality and climate between the proposed Greenway and other projects in the surrounding area were also considered as part of this assessment.

During the construction phase of the proposed Greenway, there will be emissions from construction plant and machinery and potential dust emissions associated with the construction activities of other projects, referenced in Chapter 13 of this report, adjacent to the proposed greenway. Of the most recent projects, three were granted permission in 2022 and one sought permission in Q4 of 2022. Once the mitigation proposals are implemented during the construction phase of these projects, there will be no cumulative negative effect on climate.

Emissions of greenhouse gases during the operation of the planned projects will be related to maintenance operations and activities, lighting and energy consumption. There will be no measurable negative cumulative effect of other projects on air quality and climate.

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11 THE LANDSCAPE

11.1 INTRODUCTION

The Landscape and Visual Impact Assessment (LVIA) prepared by CSR was informed by a desktop study and several surveys of the site and receiving environment in February and July 2022 and a final visit in February 2024. The assessment is in accordance with the methodology prescribed in the Guidelines for Landscape and Visual Impact Assessment, 3rd edition, 2013 (GLVIA) published by the UK Landscape Institute and the Institute for Environmental Management and Assessment.

The report identifies and discusses the landscape and visual constraints effects in relation to the proposed development of the site starting at the Groody River bridge, running along the southern bank of the River Shannon, and alongside University Road and McLaughlan Road, to Plassey Park Road.

11.1.1 Statement of Authority

This assessment has been carried out by Evelyn Sikora BA, MA, MILI, is a qualified Landscape Architect with a BA degree from Edinburgh College of Art (2006). She also holds a master's degree in planning and Sustainable Development (UCC, 2010) and is a Corporate member of the Irish Landscape Institute. Evelyn has over ten years' experience in Landscape and Visual Assessment (LVIA) and has experience in a range of projects throughout Ireland. These include a number of infrastructural projects including road schemes, flood relief projects, telecommunications, quarry developments, wind farms, solar farms, recreation, residential and commercial development, in both rural and urban contexts.

11.2 METHODOLOGY

Ireland is a signatory to the European Landscape Convention (ELC). The ELC defines landscape as 'an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe, 2000). This definition is important in that it expands beyond the idea that landscape is only a matter of aesthetics and visual amenity. It encourages a focus on landscape as a resource in its own right - a shared resource providing a complex range of cultural, environmental, and economic benefits to individuals and society.

It is also important to note that this definition of landscape applies not only to all types of rural landscape, marine and coastal landscapes (seascapes) but also to the landscape of villages, towns and cities (Section 2.5, LI, IEMA, 2013).

11.2.1 Guidance

The *Guidelines for Landscape and Visual Impact Assessment* 2013 (abbreviated to GLVIA 2013) notes that as a cultural resource, the landscape functions as the setting for our day-to-day lives, also providing opportunities for recreational and aesthetic enjoyment and inspiration. It contributes to the sense of place experienced by individuals and communities and provides a link to the past as a record of historic socio-economic and environmental conditions. As an environmental resource, the landscape provides habitat for fauna and flora. It receives, stores, conveys, and cleans water, and vegetation in the landscape stores carbon and produces oxygen. As an economic resource, the landscape provides the raw materials and space for the production of food, materials (e.g. timber, aggregates) and energy (e.g. carbon-based fuels, wind, solar), living space and for recreation and tourism activities.

The GLVIA (2013) notes that landscape is not unchanging. Many different pressures have progressively altered familiar landscapes over time and will continue to do so in the future, creating new landscapes. For

example, within the receiving environment, the environs of the proposed development have altered over the last thousand years, from wilderness to agriculture and settlement or townscape .

Many of the drivers for change arise from the requirement for development to meet the needs of a growing population and economy. The concept of sustainable development recognises that change must and will occur to meet the needs of the present, but that it should not compromise the ability of future generations to meet their needs. This involves finding an appropriate balance between economic, social and environmental forces and values.

The reversibility of change is also described as an important consideration. If change must occur to meet a current need, can it be reversed to return the resource (in this case, the landscape) to its previous state to allow for development or management for future needs.

Climate change is one of the major factors likely to bring about future change in the landscape, and it is accepted to be the most serious long-term threat to the natural environment, as well as economic activity (particularly primary production) and society. The need for climate change mitigation and adaptation, which includes the management of water and more extreme weather and rainfall patterns, is part of this.

11.2.1.1 Key Guidance Documents

Landscape and Visual Impact Assessment (LVIA) is a tool used to identify and assess the significance of and the effects of change resulting from development on both the landscape as an environmental resource in its own right and on people's views and visual amenity.

The methodology for assessment of the landscape and visual effects is informed by the following key guidance documents, namely:

- *Guidelines for Landscape and Visual Impact Assessment, 3rd Edition*. Landscape Institute and the Institute of Environmental Management and Assessment (2013) (hereafter referred to as the GLVIA 2013).
- *Guidelines on the Information to be Contained in Environmental Impact Statements*. (EPA, 2022)

This guidance is authored by the Landscape Institute in the UK and the IEMA, which contains a network of members in UK and Ireland and internationally. The guidance was prepared within the parameters of relevant EU directives at the time and is updated, where necessary, by Landscape Institute bulletins online. The GLIVA 2013 is used internationally and is the industry standard for LVIA in Ireland.

The EPA guidance (2022) refers to the use of topic specific guidance and specifically references the GLVIA 2013 in relation to professional judgement. It recognises (at para 3.72) that:

> "*Some uncertainty is unavoidable in EIA, especially about matters that involve an element of judgement, such as assigning a level of significance to an effect. Such judgements should be explicit and substantiated rather than presented as objective fact. This is best done using agreed referable approaches, e.g. the Guidelines on Landscape and Visual Impacts Assessment provide guidance on what constitutes a severe visual effect*".

References are also made to the '*Landscape and Landscape Assessment – Consultation Draft of Guidelines for Planning Authorities*' document, published in 2000 by the Department of Environment, Heritage and Local Government.

11.2.1.2 Policy Documents

Other documents referred to include:

- Limerick City and County Development Plan 2022-2028
- Limerick Shannon Metropolitan Area Transport Strategy

11.2.2 Landscape and Visual Assessment Process

The GLVIA 2013 outlines the assessment process, which combines judgements on the sensitivity of the resource, and the magnitude of the change as a result of the proposed development. These are then combined to reach an assessment of the significance of the effect.

Another key distinction to make is that in the GLVIA methodology, a distinction is made between landscape effects and the visual effects of a proposed development.

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

Views and 'visual amenity' refer to the interrelationship between people and the landscape. The GLVIA 2013 prescribes that effects on views and visual amenity should be assessed separately from landscape, although the two topics are inherently linked. Visual assessment is concerned with changes that arise in the composition of available views, the response of people to these changes and the overall effects on the area's visual amenity.

11.2.2.1 Establishment of Baseline

The process set out in the GLVIA 2013 and in the EPA (2022) involves the preparation of the baseline or receiving environment characteristics. This includes two stages, which are a desk-based study and site visit/field study. These allow the assessor to establish the existing receiving environment and key landscape and visual characteristics and their sensitivities.

<u>The desk-based study includes:</u>

- Review of preliminary proposals and identification of preliminary study area
- Review of current Development Plan(s) within the study area, and any other plans as appropriate, to identify relevant national and local designations and polices.
- This may include designations such as scenic routes, protected views and other landscape designations including any Landscape Character Assessments International designations such as UNESCO designations would also be relevant here, if present.
- Other information that may be consulted include aerial imagery, OSI Discovery series mapping, historic (6-inch and 25 inch) mapping and CORINE Landcover Maps (2018).

A site visit was then carried out to review and confirm the findings of the desk-based study and provide a more detailed description of the landscape and visual character of the study area. Based on both the desk

study and site visit, the assessor identifies landscape and visual receptors and their relative sensitivity. Several site visits were carried out in February and July 2022 and a final visit in February 2024.

11.2.2.2 Assessment of Effect

Once the Baseline is established, and the proposed development drawings and descriptions reviewed, the assessment process is commenced, as outlined in Section 10-5.

Use of "Impact" and "Effect"

Section 1.16 of the GLVIA (referring to the EIA Directive), advises that the terms 'impact' and effect' should be clearly distinguished and consistently used in the preparation of an LVIA.

'Impact' is defined as the action being taken. In the case of the proposed development, the impact would include the construction of the proposed Greenway and associated works.

'Effect' is defined as the change or changes resulting from those actions, e.g. a change in landscape character, or changes to the composition, character and quality of views in the receiving environment. This report focusses on these effects.

11.2.2.3 Methodology for Landscape Assessment

In Section 11.5 of this report, the landscape effects of the proposed development are assessed. The nature and scale of changes to the landscape elements and characteristics are identified, and the consequential effect on landscape character and value are discussed. Trends of change in the landscape are taken into account. The assessment of the significance of the effects takes account of the sensitivity of the landscape resource and the magnitude of change to the landscape, which resulted from the proposed development.

Definitions and descriptions of sensitivity, magnitude of change and quality and longevity of effects are derived from the GLVIA (2013). The GLVIA does not set out specific definitions of descriptions used but contains widely used principles and case studies / examples that are intended to inform a professional's methodology, supported by their experience and judgements in relation to landscape and landscape change. These descriptions expand and complement the EPA guidelines as intended, in relation to topic-specific guidance.

Sensitivity of the Landscape Resource

Sensitivity is a combination of Landscape Value and Landscape Sensitivity:

- Landscape values can be identified by the presence of landscape designations or policies, which indicate particular values, either on a national or local level. In addition, a number of criteria are used to assess the value of a landscape. These are described further below, in Section 11.4.9.
- Landscape susceptibility is defined in the GLVIA as, "*the ability of the landscape receptor to accommodate the proposed development without undue consequences for the maintenance of the baseline scenario and/or the achievement of landscape planning policies and strategies.*" Susceptibility is a function of its land use, landscape patterns and scale, visual enclosure and distribution of visual receptors, scope for mitigation, and the value placed on the landscape. Susceptibility also relates to the type of development – a landscape may be highly susceptible to certain types of development but have a low susceptibility to other types of development.

It includes consideration of landscape values as well as the susceptibility of the landscape to change.

With regard to landscape effects, a proposed development has the potential to improve the environment as well as damage it. In certain situations, there might be policy encouraging a type of change in the landscape, and a particular development may achieve this.

Landscape Sensitivity ranges from Low to Very High as outlined in Table 11-1.

Table 11-1: Categories of Landscape Sensitivity

Sensitivity	Description
Very High	Areas where the landscape exhibits a very strong, positive character with valued elements, features and characteristics that combine to give an experience of unity, richness and harmony. The character of the landscape is such that its capacity for accommodating change in the form of development is very low. These attributes are recognised in landscape policy or designations as being of national or international value and the principal management objective for the area is protection of the existing character from change
High	Areas where the landscape exhibits strong, positive character with valued elements, features and characteristics. The character of the landscape is such that it has limited/low capacity for accommodating change in the form of development. These attributes are recognised in landscape policy or designations as being of national, regional or county value and the principal management objective for the area is conservation of the existing character.
Medium	Areas where the landscape has certain valued elements, features or characteristics but where the character is mixed or not particularly strong. The character of the landscape is such that there is some capacity for change in the form of development. These areas may be recognised in landscape policy at local or county level and the principal management objective may be to consolidate landscape character or facilitate appropriate, necessary change
Low	Areas where the landscape has few valued elements, features or characteristics and the character is weak. The character of the landscape is such that it has capacity for change; where development would make no significant change or would make a positive change. Such landscapes are generally unrecognised in policy and where the principal management objective is to facilitate change through development, repair, restoration or enhancement.
Negligible	Areas where the landscape exhibits negative character, with no valued elements, features or characteristics. The character of the landscape is such that its capacity for accommodating change is high; where development would make no significant change or would make a positive change. Such landscapes include derelict industrial lands or extraction sites, as well as sites or areas that are designated for a particular type of development. The principal management objective for the area is to facilitate change in the landscape through development, repair or restoration

Magnitude of Landscape Change:

The magnitude of change is a factor of the scale, extent and degree of change imposed on the landscape with reference to its key elements, features and characteristics (also known as 'landscape receptors'). Five categories are used to classify magnitude of landscape change.

For the purpose of assessment, five categories are used to classify the landscape sensitivity of the receiving environment, from Very High sensitivity to Negligible. These categories are defined in Table 11-2.

Table 11-2: Magnitude of Landscape Change

Magnitude of Change	Description
Very High	Change that is large in extent, resulting in the loss of or major alteration to key elements, features or characteristics of the landscape and/or introduction of large elements considered totally uncharacteristic in the context. Such development results in fundamental change in the character of the landscape
High	Change that is moderate to large in extent, resulting in alteration or compromise to key elements, features or characteristics, and/or introduction of large elements considered uncharacteristic in the context. Such development results in a moderate to large change to the character of the landscape
Medium	Change that is moderate in extent, resulting in partial loss or alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that may be prominent but not necessarily uncharacteristic in the context. Such development results in moderate change to the character of the landscape.
Low	Change that is limited in extent, resulting in minor alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that are not uncharacteristic in the context. Such development results in minor change to the character of the landscape
Negligible	Change that is very limited in extent, resulting in no alteration to key elements, features or characteristics of the landscape, and/or introduction of elements that are characteristic in the context. Such development results in minimal change to the character of the landscape.

11.2.2.4 Methodology for Visual Assessment

In Section 11.6 of this report, the visual effects of the proposed development are assessed. Visual assessment considers the sensitivity of the viewers (i.e. groups of people) and the magnitude of the changes to the composition and character of views. The assessment is made for a number of viewpoints selected to represent the range of visual receptors in the receiving environment. The significance of the visual effects experienced at these locations is assessed by measuring the visual receptor sensitivity against the magnitude of change to the view resulting from the proposed development.

Sensitivity of Visual Receptor

Visual receptor sensitivity is a function of two main considerations:

- Susceptibility of the visual receptor to change. This depends on the occupation or activity of the people experiencing the view, and the extent to which their attention or interest is focussed on the views or visual amenity they experience at that location.

Visual receptors most susceptible to change include residents at home, people engaged in outdoor recreation focused on the landscape (e.g. trail users), and visitors to heritage or other attractions and places of community congregation where the setting contributes to the experience.

Visual receptors less susceptible to change include travellers on road, rail and other transport routes (unless on recognised scenic routes which would be more susceptible), people engaged in outdoor recreation or sports where the surrounding landscape does not influence the experience, and people in their place of work or shopping where the setting does not influence their experience.

- Value attached to the view. This depends to a large extent on the subjective opinion of the visual receptor but also on factors such as policy and designations (e.g. scenic routes, protected views), or the view or setting being associated with a heritage asset, visitor attraction or having some other cultural status (e.g. by appearing in arts).

For the purpose of assessment, five categories are used to classify visual receptor sensitivity. These categories range from Very High to Negligible and are described in Table 11-3.

Table 11-3: Categories of Visual Receptor Sensitivity

Sensitivity	Description
Very High	Viewers at iconic viewpoints - towards or from a landscape feature or area - that are recognised in policy or otherwise regarded as being of very high value or national value. This may also include residential viewers whose primary view is of very high value.
High	Viewers at viewpoints that are recognised in policy or otherwise designated as being of high value, or viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and are valued by the local community. This would include tourist attractions, and heritage features of regional or county value, and viewers travelling on scenic routes.
Medium	Viewers at viewpoints representing people travelling at slow or moderate speed through or past the affected landscape in cars or on public transport, where they are partly but not entirely focused on the landscape, or where the landscape has some valued views. The views are generally not designated, but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquillity or some rare element in the view.
Low	Viewers at viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in similar activities such as shopping, etc. The view may present an attractive backdrop to these activities but there is no evidence that the view is valued, or that it is regarded as an important element of these activities. Viewers travelling at high speeds (e.g. motorways) may also be considered of low susceptibility.
Negligible	Viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in similar activities, such as shopping, where the view has no relevance or is of poor quality and not valued.

Magnitude of Change to the View

Classification of the magnitude of change takes into account the size or scale of the intrusion of the proposed development into the view, relative to the other elements and features in the composition(i.e. its relative visual dominance), the degree to which it contrasts or integrates with the other elements and the general character of the view, and the way in which the change will be experienced (e.g. in full view, partial or peripheral, or glimpses). It also takes into account the geographical extent of the change, the duration and the reversibility of the visual effects.

Five categories are used to classify magnitude of change to a view. These range from Very High to Negligible and are defined in Table 11-4.

Table 11-4: Magnitude of Visual Change

Sensitivity	Description
Very High	Full or extensive intrusion of the development in the view, or partial intrusion that obstructs highly valued features or characteristics, or the introduction of elements that are completely out of character in the context, to the extent that the development becomes dominant in the composition and defines the character of the view and the visual amenity
High	Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, or introduction of elements that may be considered uncharacteristic in the context, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity
Medium	Partial intrusion of the development in the view, or introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity
Low	Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity.
Negligible	Barely discernible intrusion of the development into the view, or introduction of elements that are characteristic in the context, resulting in slight change to the composition of the view and no change in visual amenity.

In this case, a number of tools are used to assist in the assessment of visual effects. These include Photomontages, which are produced from selected viewpoints. Initial viewpoints for photomontages are selected during the desk study with the exact location confirmed in the field during the site visit. The completed photomontages are also used to assist in the assessment of visual effects.

Significance of Effects

In order to classify the significance of landscape and visual effects, the predicted magnitude of change is measured against the sensitivity of the landscape/viewpoint. The definitions used by the EPA (2022) provide a useful scale to describe the significance of the effects.

There are seven classifications of significance, namely: (1) imperceptible, (2) not significant, (3) slight, (4) moderate, (5) significant, (6) very significant, (7) profound.

The relationship between the magnitude of change and sensitivity of the receptor with the varying classifications of Significance is illustrated on the below extract from the EPA (2022) Guidelines (with labels amended and simplified based on GLVIA (2013 (guidance):

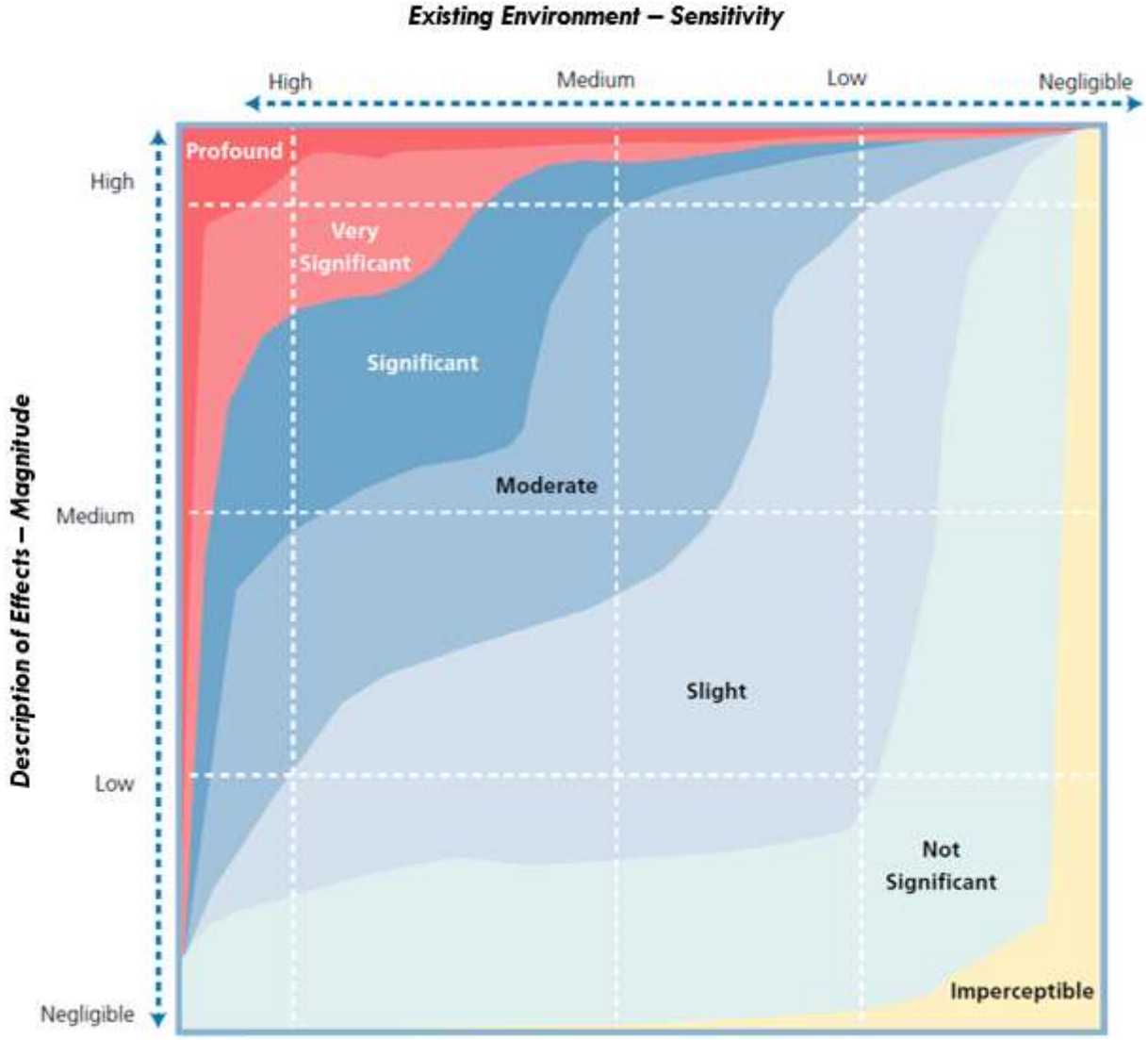

Figure 11-1: Significance of Effect (Source: EPA 2022)

Note: This graphic is a guideline only, and an element of professional judgment is also applied. The assessor also uses professional judgement informed by their expertise, experience and common sense, to arrive at a classification of significance that is reasonable and justifiable.

The GLVIA 3rd Edition recognises (at para 2.23) that:

"professional judgement is a very important part of LVIA. While there is scope for quantitative measurement of some relatively objective matters, much of the assessment must rely on qualitative judgements."

Table 11-6: Quality of Effect *(Source: CSR based on GLVIA 2013)*

Quality	Description
Adverse Effect	Scheme at variance with landform, scale, pattern. Would degrade, diminish or destroy the integrity of valued features, elements or their setting or cause the quality of the landscape(townscape)/view to be diminished;
Neutral Effect	Scheme complements (or does not detract from) the scale, landform and pattern of the landscape(townscape)/view and maintains landscape quality
Beneficial Effect	Improves landscape(townscape)/view quality and character, fits with the scale, landform and pattern and enables the restoration of valued characteristic features or repairs / removes damage caused by existing land uses.

Impacts/effects are also categorised according to their longevity or timescale as in Table 11-7.

Table 11-7: Duration of Effect (Source: EPA 2022)

Duration	Description
Temporary	Impacts lasting one year or less
Short-term	Impacts lasting one to seven years
Medium-term	Impacts lasting seven to fifteen years
Long-term	Impacts lasting fifteen to sixty years
Permanent	Impacts lasting over sixty years

11.2.3 Statement of Difficulties Encountered

None encountered.

11.3 Landscape and Visual Characteristics of the Proposed Development

Full details of each element to be constructed are included in Chapter 4 Description of the proposed development. However, elements of the proposed development that are particularly relevant to the Landscape and Visual assessment include the following:

- Construction of a new 3.5-4.0m wide path for cyclists and pedestrians, and widening of an existing path, along the River Shannon from the existing riverside path at the Groody River bridge west of UL Boathouse, to the northern extents of University Road and McLaughlan Road.
- Construction of new 2.0m wide cycle lanes and 1.8-2.0m wide footpaths along University Road and McLaughlan Road.
- The path is to be built up to retain mature trees and surfaced with a permeable asphalt between the Groody River and Kilmurry Village (areas within the UL grounds).
- Removal of vegetation and trees – including sections of relatively young tree groups, as well as some more mature trees, to facilitate path construction and widening.
- Removal and replacement of four bridge decks (one on path east of UL Boathouse, two near Plassey Mill, and one east of Plassey Beach).
- Construction of a proposed 12.9m long bridge near the Plassey Beach.

- Construction of a 20m long concrete retaining wall with an integrated seating and planting at the Plassey Beach.
- Construction of a fully accessible 20m long concrete ramp at a 3% slope at the Plassey Beach to provide access from the proposed Greenway to the beach for all users.
- Four proposed concrete box culvert bridges; one east of Groody Bridge, two east and west of the existing hump bridge along the existing path west of UL Boathouse, and one west of the UL Boathouse.
- 26 No. locations where new culvert pipes will be constructed as part of the drainage infrastructure for the proposed path, directing surface water to the River Shannon.
- Proposed rest areas at Plassey Mill and the Plassey Beach.
- Four temporary construction compounds are proposed; one west of the UL Boathouse, one south of the Fisherman cottages and east of Plassey Mills, one on open grassland east of the Kilmurry Student Village, and one at the end of McLaughlan Road.
- Replacement tree planting is proposed along the route at several locations (including south of Fisherman Cottages, north of Dromroe Student village, east of Cook Medical campus).

11.4 RECEIVING ENVIRONMENT

11.4.1 Site Context and Landscape Character

The proposed Greenway is located along the southern bank of the River Shannon where it runs through the grounds of the University of Limerick from the River Groody Bridge to the end of McLaughlan Road, with a spur to the east of Kilmurry Student Village that connects to University Road. A gravel path or desire line is extant along the majority of the proposed route. There are footpaths along McLaughlan Road, but there are neither footpaths nor cycle lanes along University Road. Figure 11.2 below shows the location of the study area, which lies to the east of Limerick City, within the grounds of the University of Limerick along the River Shannon, and through part of the National Technology Park.

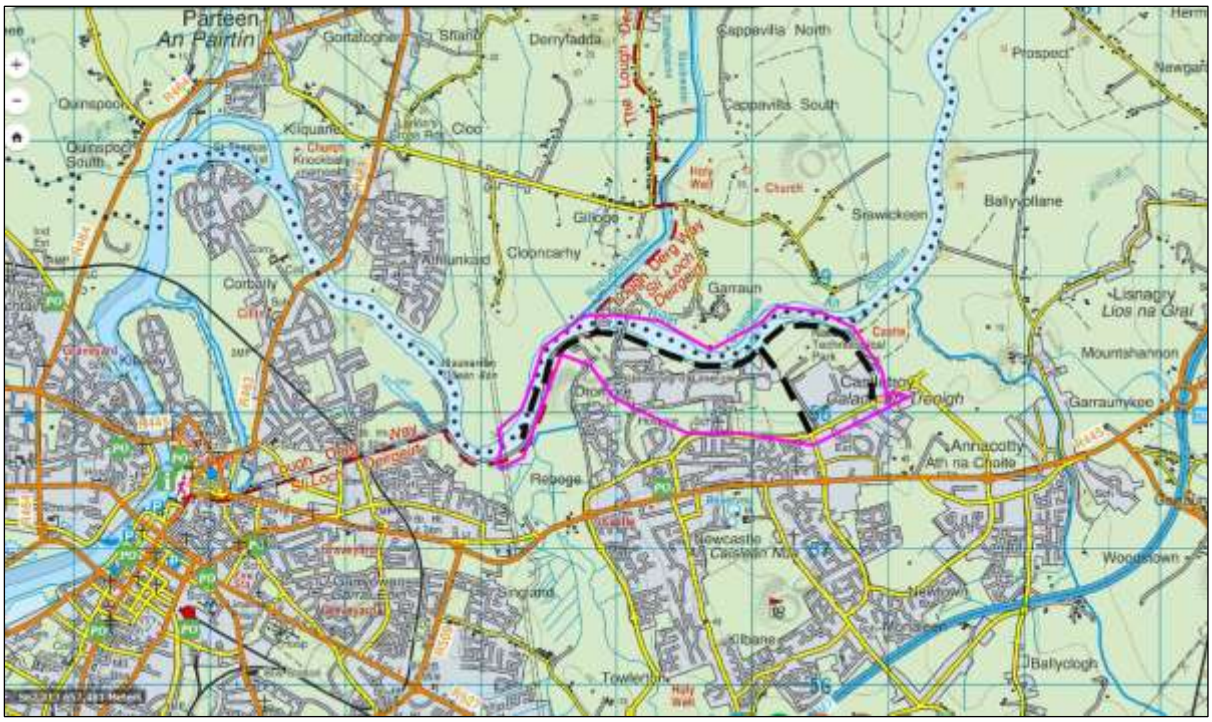

Figure 11-2: ***The study area is illustrated by a magenta line, with proposed path indicated by a dashed black line.***

The study area includes the visual corridor of the River Shannon on the northern and southern banks, as well as extending some way further south from the existing path on the southern side of the Shannon as far as Plassey Park Road. Two spurs from the path connect south to Plassey Park Road, namely University Road and McLaughlan Road. The study area therefore includes part of the University of Limerick Campus which is close to the proposed route and to the existing walkway, as well as the lands to the east which connect to Plassey Park Road. The study area for Landscape and Visual Effects remains relatively close to the proposed pathway as the majority of potential effects are likely to be in the immediate vicinity of the proposed works.

The Landscape Character of the site is described below under several headings, including landform and landcover, land use, cultural heritage, recreation and amenity and settlement and transport. An initial site visit was carried out in February 2022, following by site visits in July 2022, and February 2024.

11.4.2 Landform - Topography and Drainage

The landform of the site is generally level as it borders the river corridor, with the area immediately along the rivers generally at or below 10m OD, with some areas above 10m but less than 20m.

The majority of the proposed path lies along the southern bank of the River Shannon.

There are localised changes in level along the existing trail, with some areas close to the level of the river Shannon, as seen near the Plassey Mill ruins, as shown in Plate 11.1.

Plate 11-1: Existing path close to the water's edge near UL Boathouse.

Localised changes in the level of the existing path occur, as in the area near the 'Island' where the path is slightly elevated, with a mill race to the south and the river to the north, as seen in Plate 11.2.

Plate 11-2: Path is raised with mill race to the right-hand side

Other slight changes in level were observed in areas where there are small interventions such as grass mounding, or localised changes in topography of the University in the vicinity of the Sports arena.

Three bridges (two of which are in use) connect the University campus to the campus on the north side of the Shannon, and these afford elevated views of the river corridor. The Plassey Bridge or Black Bridge is located furthest to the west and listed on the NIAH – the bridge is pedestrian but no longer in use.

East of Plassey Bridge, the next bridge is a road and pedestrian bridge which is connected to the riverside path by steps as shown in Plate 11.3 below. A pedestrian only bridge (the Living Bridge) lies further east.

Plate 11-3: Steps lead from the riverside path to the to the road bridge near Dromore student village

11.4.3 Land Cover

Wider landscape

While the land cover of the wider study area (incorporating the pedestrian riverside walkway, and part of the UL campus to the south) contains a mosaic of built form and open space, the immediate River Shannon corridor is primarily dominated by tree cover. Immediately adjacent to the river corridor and existing walkway, there are some formal grassed open spaces, such as those near Dromroe and Kilmurry villages and to the front of Plassey House. Several pitches are evident in the vicinity of the Sports Arena and one east of Kilmurry village.

South of the proposed walkway/cycleway, the University campus is a mosaic of large areas of built form interspersed with considerable areas of open space, tree lined roads and parking areas. The Sport Arena includes a number of sports facilities and pitches. Further east in the study area, the University buildings give way to several large-scale facilities in the IDA technology park, including the Johnson and Johnson, Cook Ireland and Troy Studio buildings.

Site and immediate surroundings

A formal riverside pathway, with some hard surfacing in sections, is evident from the Groody River bridge to the UL Boathouse (which connects to Limerick City at Lock Quay) to just south of Kilmurry student village. Past this point, the path becomes an informal track, through open fields, woods and young tree groups as far as the Castletroy. The path ranges in width but is in places little more than 1 metre in width and generally less than 2m.

A shore area known as the 'Beach' is located near Kilmurry village, which is a distinctive area where there is a small shore providing access to the river and is a popular recreational area in summertime.

Away from the river, pedestrian footpaths from the riverbank connecting to and traversing through Kilmurry village are circuitous and navigation can be difficult. A network of paths along University Road and a path along part of McLaughlan Road are also evident, while pedestrian and cycle tracks are evident along Plassey Park Road. Representative images of the different sections of the path are included below where the Landover of the study area is described form west to east in two sections – Groody River Bridge to Castletroy, and from Kilmurry/McLaughlin Road to Plassey Park Road.

Groody River Bridge to Castletroy

Tree cover is a conspicuous feature of the landcover in the immediate vicinity of the proposed path. The River Shannon corridor has considerable bankside trees and vegetation, some of which include mature trees of high quality.

The Tree Survey includes an Arboricultural Assessment for the Preliminary Design (contained in the EIAR Part III - Appendices) which includes further detail of such trees and tree groups and incudes a Tree Classification Drawing (21537_T_101).

The Assessment notes that the western section beginning at the River Groody bridge and extending east which is mainly within the UL campus grounds contains trees of high quality:

The path servicing the western portion of the route located in the University of Limerick campus is a well-defined and maintained bound gravel surface, averaging 1.8m in width and is raised above the adjoining river on top of the embankment. This section of the route can be described as high-quality riverside woodland with a broad age profile from large veteran trees to self-regenerating saplings and other understory species. Natural riparian tree species such as Willow, Alder and Ash dominate however a number of other species such as Beech and Oak are also present, which are of an age that suggest they were probably planted by the original estate owners prior to the development of the University on these lands.

The Arboricultural Assessment categorises trees according to their quality, which is as follows;

***Category A**: Trees of high quality with an estimated remaining life expectancy of at least 40 years.*

*(A **Sub-category A1** is as follows: Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)*

***Category B:** Those trees of moderate quality with an estimated remaining life expectancy of at least 20 years.*

***Category C:** Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm.*

U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years.

As shown in Drawing 21537_T_101, a high proportion (41 out of a total of 80) of the trees along the River Shannon corridor mainly within the UL grounds, between the Groody River bridge and Kilmurry Village are Category A1. The majority of the remainder (32) are Category B trees, with just 6 Category C trees and 1 Category U tree. The trees therefore along the river Shannon corridor are of high quality and of high value.

There are also several large tree groups in this section, TG21 which extends along the existing path and riverbank between the Groody River and the UL Boathouse, and TG 22 which is a large tree group in the vicinity of the Plassey Mills and Fisherman's cottages, both of which are Category B.

TG4 is another large tree group (Category B) located inland between the Living bridge and the Dromroe student village.

Tree Groups 12-20 lie along the riverbank between Kilmurry Village and Castle Troy. All are categorised as Category B.

Mature trees of high quality are evident particularly from the UL Boathouse to just east of Kilmurry Student village. Plate 11.4 below shows mature trees just east of the UL boathouse, while Plate11.5 shows woodland along the path leading away from the river, near Plassey Mills.

Plate 11-4: Hard surfaced path with mature bankside trees east of UL boathouse

Plate 11-5: Mature trees line path close to Plassey Mills

A remarkable stand of trees (mostly Beech) is found adjacent to the riverside path near the Dromroe student village as shown in Plate 11.6. These add considerably to the character of the area, and the setting of the student village also. The adjacent grass space has been mounded in places with some young tree planting also. A pollinator friendly maintenance regime is evident also in relation to the grassland.

Plate 11-6: Mature Beech trees (Category A) along path close to Dromroe village, with adjacent open space

To the east of Dromroe village, the walkway traverses underneath a pedestrian bridge (living bridge), and beyond this, the path is lined with mature trees, and the mill race is on the south of the path, creating a distinctive area as the path is lined by trees and water on both sides, creating a tranquil and atmospheric walkway. This is illustrated in Plate11.7.

Plate 11-7: Trees line the path (unsurfaced) with Mill race to right, east of the Living Bridge

Plate 11-8: Bankside trees at 'The Shore' or 'Beach' area (seen here at high water level in winter)

East of Kilmurry village, tree cover continues along the riverbank, but the existing path runs slightly inland, as shown below in Plate 11.9, and through some open spaces.

Plate 11-9: Open space and trees along existing informal path east of Kilmurry village

Beyond this, as one travels east, the path winds through fields with tree groups. The tree cover here varies from a dense canopy in certain areas, such as shown above near Castle Troy.

Plate 11-10: Dense undergrowth east of Kilmurry village towards Castle troy

Kilmurry Village to McLaughlin Road

A spur runs from Kilmurry Village to University Road. A series of paths and open grassed spaces interspersed with tarmac parking areas run through Kilmurry student accommodation village, which is accessed by University Road. There are some trees to the west of Kilmurry village as shown in Plate 11-11 below.

Plate 11-11: Grass, tarmac and some younger trees in Kilmurry Village

The areas of University Road and McLaughlan Road are similar in character, relatively wide roads with footpaths on both sides, with some grass and trees.

As set out in the Tree Classification Drawing, Tree Group 23 extends from east of Kilmurry Village along University Road, all of which are considered Category B in the Tree Classification drawing.

More mature trees are evident along McLaughlan Road, all categorised either Category B or Category C.

Plate 11-12: Path, grassed areas and trees along McLoughlan Road

McLoughlan Road and University Road join Plassey Park Road, the main road south of the UL campus. This is a wide road with footpaths and cycle paths on both sides, grass strips and mature tree planting as shown in Plate 11-13.

Plate 11-13: Existing cycle and pedestrian paths along tree lined Plassey Park Road

While tree cover is the dominant feature of the land cover, and particularly the riverside pathway, within the UL campus, the study area also includes smaller areas of grassland, including rough grassland or amenity grassland, mainly within the campus, and some to the east of the scheme between McLaughlin Road and Kilmurry Village.

11.4.4 Land Cover – Built Form

Features of built form within the study are generally lie further inland – south of the rivers. To the western extent of the proposed scheme, – but a small terrace of cottages are found to the west of the study area, near Plassey bridge, and lend a distinctive character to this riverside area as shown in Plate 11.14.

Plate 11-14: Boatmen's cottages with Plassey Mills remains in the background

Other elements of built form are mainly university buildings, including the student 'villages ' of Dromroe and Kilmurry, and Plassey Park house itself, which display various types of buildings many of which are set within large areas of open space. Buildings are generally set back along Plassey Park Road and are larger scale and industrial in nature.

11.4.5 Cultural Heritage, Recreation and Amenity

There are several elements of cultural heritage interest along the proposed route. At the western end, the remains of Plassey Mill is visible to the south of the existing path, a relatively tall stone structure seen amongst the trees, and the fisherman's cottages close by. This is depicted in Plate 11-14.

Further west there is the Plassey Bridge, a pedestrian bridge (listed on the NIAH) which is now blocked to pedestrians and appears unused. Plassey House itself is visible from the walkway, which is now part of the University.

Plate 11-15 Plassey House, set in mature trees, seen from the existing walkway

Several other large houses and gardens were formerly located within the study area, some of which remain. These include a house and gate lodge at Milford, and a house called Shannon Park, which remain today, south of Plassey House and Mills. Also shown on the map, but which do not remain today, are the houses and gardens of Roselawn and Willlowbank, which were in the area of the Kilmurry student village and the lands to the east, to the rear of Troy studios.

A house called Castle Troy House is shown in the 6-inch map in Figure 11-3, to the west of Castle Troy. Other features such as the Mill Race. Mill Dam and several Eel weirs are also shown on this map.

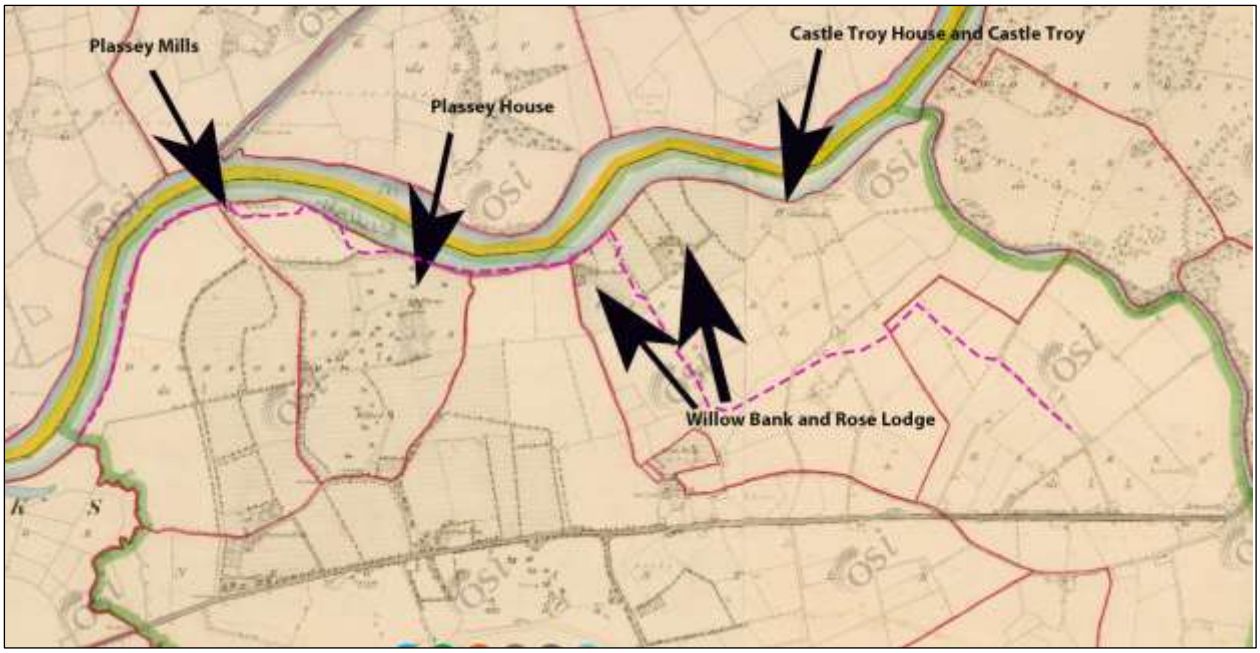

Figure 11-3: Cultural Heritage within the western study area (Source: Historic Environment Viewer)

In terms of recreation, part of the existing trail is on the Lough Derg Way. The Lough Derg Way is a long-distance walkway which begins at the Riverside Walkway in Limerick City, close to Sarsfield House. This walkway is parallel to the Abbey River for a short stretch, and at Lock Quay, leaves the city centre and follows the canal as far as the UL boathouse. The path is wider near Lock Quay, and a narrow strip of grass runs along the middle to divide pedestrians and cyclists as shown in Plate 11.16 below.

Plate 11-16: the Lough Derg Way path east of Lock Quay in Limerick City

The waymarked trail continues along the existing path in the study area, past the Groody River Bridge to the UL boathouse to Plassey Bridge, and the mapped trail follows the bridge and is parallel to the Blackwater River and then follows the Ardnacrusha Headrace canal northeast to Cloonlara and on to O'

Briensbridge. Therefore, the proposed cycleway/walkway includes part of the Lough Derg Way as shown in Figure 11-4.

Figure 11-4: Lough Derg Way (blue) with indicative Greenway route (red)

11.4.6 Land Use

The immediate vicinity of the proposed pathway itself is already an existing recreational facility which is well-used. Other recreational facilities exist on campus for both formal and informal recreation, including the Sports Arena and related facilities The University campus has educational but also adjacent are commercial/enterprise activities, with several large enterprises located in the IDA National Technology Park in the eastern part of the study area. There are a small number of open fields to the east of the study area,

11.4.7 Settlement and Transport

The existing path runs along the southern riverbank of the River Shannon. The spurs to the south of the riverside path at UL connecting to Plassey Park Road are University Road (south of Kilmurry Village) and along McLaughlin Road and along currently paved roads as shown in Plates 11.17 and 11.18.

Plate 11-17: McLaughlan Road

Plate 11-18: University Road (from Kilmurry student village to Plassey Park Road) with trees, parking and grass verges

The University of Limerick Campus has a number of roads traversing the campus, with the University campus accessed off the main Plassey Park Road which travels east west and denotes the southern boundary of the campus. It was noted on the site visits that while orientation is straightforward when following the existing riverside path, the campus has a high number of internal roads and roundabouts, and in some areas,

particularly in the Kilmurry Student village and environs, this can be disorienting and with poor legibility. In contrast, the riverbank walk with in the UL grounds is easily navigated.

11.4.8 Summary of Landscape Character

Overall, the character of the western part of the study area is strongly influenced by the setting of the existing walking path close to the river, particularly the section on the banks of the River Shannon, and the high proportion of mature trees which area a feature of the existing riverbank walk and of the wider UL campus grounds. Some of these trees are likely associated with the grounds of Plassey House which lies near the riverbank. Several other large houses and grounds are shown on the historic maps (25-inch, 6 inch and Cassini Maps).

The landscape character can be divided in two areas:

- **University of Limerick Campus – River Groody Bridge to Kilmurry Village:** The existing riverbank walk from the River Groody Bridge through the UL campus
- **IDA National Technology park to Plassey Park Road:** The riverbank to the rear of the IDA National Technology Park, and the section which traverses the existing routes at University Road, McLaughlin Road and Plassey Park Road.

Within the UL campus, the mature trees, clusters of buildings and open spaces and areas along the riverbank is distinctive. However, the campus contains a high proportion of buildings, and as noted above, internal roads and roundabouts. The river corridor which includes the proposed Greenway is somewhat set apart from the main campus, is a quieter and tranquil area. Apart from Plassey House, other historic structures also lend a particular character to the area. The Plassey Mills remains also add character, as do some of the other structures, such as the Mill Race leading to Plassey Mills, the stone bridge and the Plassey Bridge near the boatmen's cottages.

The landscape character along the river to the rear of the IDA lands along the riverbank (east of Kilmurry Village) is more remote, with areas of open fields followed by more dense woodland as one approaches Castle Troy. The landscape character along the main routes to the east of Kilmurry Village including the spurs at University Road and MacLaughlin Road and Plassey Park Road have a different character, which is that of a route along relatively wide, tree-lined roads most of which have footpaths, grass verges and trees. Plassey Park Road is distinctive with much of the road having separated footpaths and cycleways.

11.4.9 Landscape Value

The GLVIA Guidelines sets out the methodology for assigning landscape sensitivity. This is based on combining judgements on landscape value, and landscape susceptibility which relates to the type of development proposed. Landscape sensitivity is addressed in Section 11.5, along with the assessment of effects however landscape values are discussed here.

Landscape values are derived from both indications of value as seen in national and local policy, as well as other indications that a landscape or landscape element, is valued. These values can further be categorised in two ways – values which should be conserved, and those that provide opportunity for enhancement.

Landscape value, as referred to above, can be identified by the presence of landscape designations or policies which indicate particular values, either on a national or local level. These include international designations (such as UNESCO World Heritage sites) national designations, and local designations such as scenic routes, scenic views or amenity designations which are included in County Development Plans.

Important tourism, cultural heritage or recreational areas are also indicative of value. In addition, where landscapes do not have designations, a number of criteria are used to assess the value of a landscape. For undesignated landscape in the vicinity of the site, these criteria include:

- Landscape Quality/Condition
- Cultural Heritage/Conservation value
- Aesthetic/Scenic Quality
- Rarity or Representativeness
- Public Accessibility and Recreation Value
- Sense of naturalness

Based on the above criteria, we can describe the landscape values of the site and immediate vicinity, and the wider landscape. These are best described with reference to the landscape character areas:

University of Limerick Campus – Groody River Bridge to Kilmurry Village

The landscape value of the site and immediate vicinity within the University of Limerick grounds (UL boathouse to Kilmurry Village) is considered **High.** The landscape can be described as of high quality and in good condition, with a high number of mature trees which are classed as Category A or B (High or Moderate value) semi natural areas and a number of well- maintained open spaces, both informal and formal. The presence of the River Shannon also contributes to good landscape quality. The Section above has identified several features of cultural heritage value which are a link to the history of the site and add to its quality. This area has high aesthetic qualities, with many areas of high-quality scenery, with a strong sense of naturalness, especially those views towards the river, riverbank and areas of mature trees. The 'Shore' areas also has high scenic qualities. Some of the mature trees can be described as features of rarity but this is also within the Lower River Shannon SAC. The area is publicly accessible and has a high recreation value, as a location popular for walking and which is partly along the Lough Derg Way, a waymarked trail which connects form the existing river path, along the river to Limerick City.

IDA National Technology park to Dublin Road

East of the UL Campus, the study area includes the open lands and riverbank east of Kilmurry village, to the rear of the National Technology Park, as well as several roads within the Technology Park. This area is considered of **Medium** value. The vicinity of the riverbank contains some open fields, and though some parts of the path are relatively wide, there are many sections which are several quite overgrown areas where the landcover includes tree groups and scrub but with some mature trees. The landscape quality is not as high as the neighbouring area within UL, with several overgrown areas and invasive species observed, an overall the areas is not as easily accessed. Overall the aesthetic value is considered Medium, with less of a connection to the river and some areas where vegetation restricts views. This area is still within the SAC. While publicly accessible, this access is less formal than that on the UL grounds and certain parts are overgrown and remote. The area however has a remote feel and a strong sense of naturalness.

The proposed route will traverse more formal areas include the roads University Road, McLaughlan Road and Plassey Park Road. These are of lower landscape value, being existing road corridors, relatively quiet cul-de-sac roads in the case of University Road and McLaughlin Road, while Plassey Park Road is a busier road. Landscape quality here is Low-Medium.

11.4.10 Visual Receptors

Visual Receptors are those people, or more commonly groups of people who will experience views of the proposed development in certain locations.

The GLVIA (2013) Guidelines note that the types of viewers (or visual receptors) who will be affected by the development, and the places they will be affected, should be identified. People have differing responses to changes in views and visual amenity, and this is known as susceptibility. The susceptibility of a viewer, therefore, depends on the context such as the location, as well as their activity, or reason for being in a particular place. A person may be involved in recreation, or be a resident, at work, passing through a landscape, on roads or other means. Certain activities or locations in the landscape may be specifically associated with the experience and enjoyment of the landscape, such as the use of waymarked trails, tourist trails or scenic routes. Therefore, when combined with the value of the view, visual receptor sensitivity is described for all viewpoints and is an important component of the viewpoint selection.

As set out in Table 11.4, visual receptor sensitivity can range from Very High to Negligible.

In the case of the proposed development, viewers likely to experience the changes as a result of the proposed development which are considered of higher sensitivity include :

- Recreations users – those using the existing pathway for walking, running and cycling, and accessing the UL Boat Club, UL Beach/Shore area, and those engaged in waterside activities - where they are likely to be focussed on the surrounding landscape and on particular views
- Viewers at Cultural Heritage/Scenic locations: Viewers in the vicinity of Cultural heritage sites along the walkway
- Viewers at areas where there are pleasant or scenic view of the riverbank, river and other features
- Residents close to the proposed Greenway as well as students resident on campus

Viewers which are considered of Lower (Low or Negligible) sensitivity, as their focus is not on the outside and the surroundings, include:

- Those working and studying inside buildings where the setting is not important to the quality of the working environment
- Those engaged in sporting activities which do not involve appreciation of the landscape/surroundings

Following the site visits and a review of the proposals, a list of potential viewpoints was drawn up. This includes a number of locations where sensitive visual receptors would have views of the proposed development, as well as areas where landscape features of high value (as discussed in Section 11.4.9) are located. Viewpoints from within the buildings on the campus were reviewed but viewers here will generally experience very little change, and viewers of one of the most obvious historic buildings, Plassey House, would not observe any change to the setting of the house with its lawns and trees.

The selection of viewpoints also includes locations where large number of viewers would experience a change in view. The two different character areas within the study area- Groody River bridge to Kilmurry village (UL Campus) area, the IDA Technology Park and Plassey Park Road, are all represented. These viewpoints are listed in Section 10.5.2.

11.5 LANDSCAPE PLANNING CONTEXT

Limerick Development Plan 2022-2028

The relevant landscape planning context for the area is the Limerick (City and County) Development Plan 2022-2028. The Plan includes both City and Rural areas.

Landscape Character

Policy EH P8 Landscape Character Areas:

> *"It is a policy of the Council to promote the distinctiveness and where necessary safeguard the sensitivity of Limerick's landscape types, through the landscape characterisation process in accordance with the 'Draft Guidelines for Landscape and Landscape Assessment' (2000) as issued by the Department of Environment and Local Government, in accordance with the European Landscape Convention (Florence Convention) and with 'A National Landscape Strategy for Ireland – 2015- 2025'. The Council shall implement any relevant recommendations contained in the Department of Arts, Heritage and the Gaeltacht's National Landscape Strategy for Ireland, 2015 – 2025."*

The Limerick Development Plan includes the Landscape Character Areas from the 2010-2016 Plan (as extended) as well as a number of Landscape Character Areas in the City.

A number of the Landscape Character Areas fall within the study area. These are illustrated in Figure 11-5.

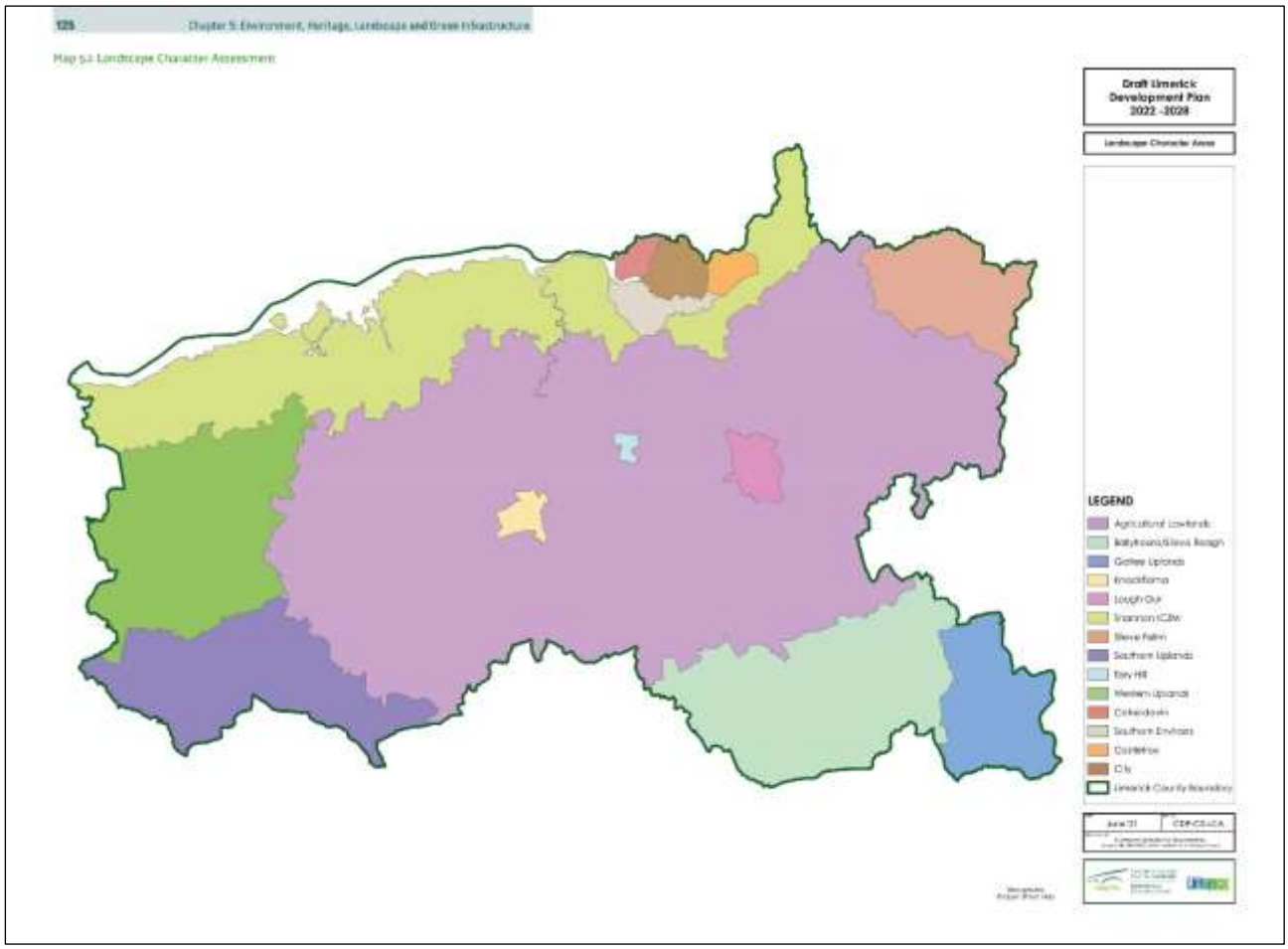

Figure 11-5: Landscape Character Areas Co. Limerick

Landscape Character Areas within the study area include:

- City LCAs (shaded brown) including areas of Caherdavin, City and Castletroy and the Southern Environs. The site and study area are located within the Castletroy area of the City LCA.

The LCAs within the City are described as follows, numbered UCA01-04, each with a number of Specific Urban Character Area Objectives in Section 3.4.2.5 as follows:

***UCA O3 Castletroy**:*

> *"A substantial character area is the University of Limerick campus. The campus is expansive at over130 hectares and located both north and south of the River Shannon in Counties Limerick and Clare. The campus is largely self-contained and is substantially enclosed. Its presence has attracted technology companies to the area, with the National Technology Park located to the east."*
>
> Specific Objectives include:
>
> *a) Infill and brownfield development patterns to be favoured.*
>
> *b) River Groody Green Wedge to be retained.*
>
> *c) Building Height Strategy to inform design of higher buildings, in particular:*
>
> *– Any proposed buildings of height must be balanced with the need to maintain the status of the University rather than the creation of a high building cluster;*
>
> *– A modest increase in building height at important intersections/nodes and street corners may be required to enhance legibility and sense of place*

Views and Prospects

Views and Prospects are identified within the County and the within the City area as illustrated on Figure 11-6, and illustrated on Map 5.2 in the LDP.

Section 5.4.2 of the Plan refers to Views and Prospects, and identifies important prospects in Limerick County, including views of prominent landscapes or views of special amenity value. These include views in the south of the County (as shown in Figure 11-6 below) which are routes near Galbally, Ardpatrick and Ballylanders, close to the Ballyhoura mountains, as well as Lough Gur and Tory hill views and prospects.

In the city, the Plan notes the many views of significance in the city, including riverscapes, townscapes and landscapes and the importance of landmark buildings such as King John's Castle.

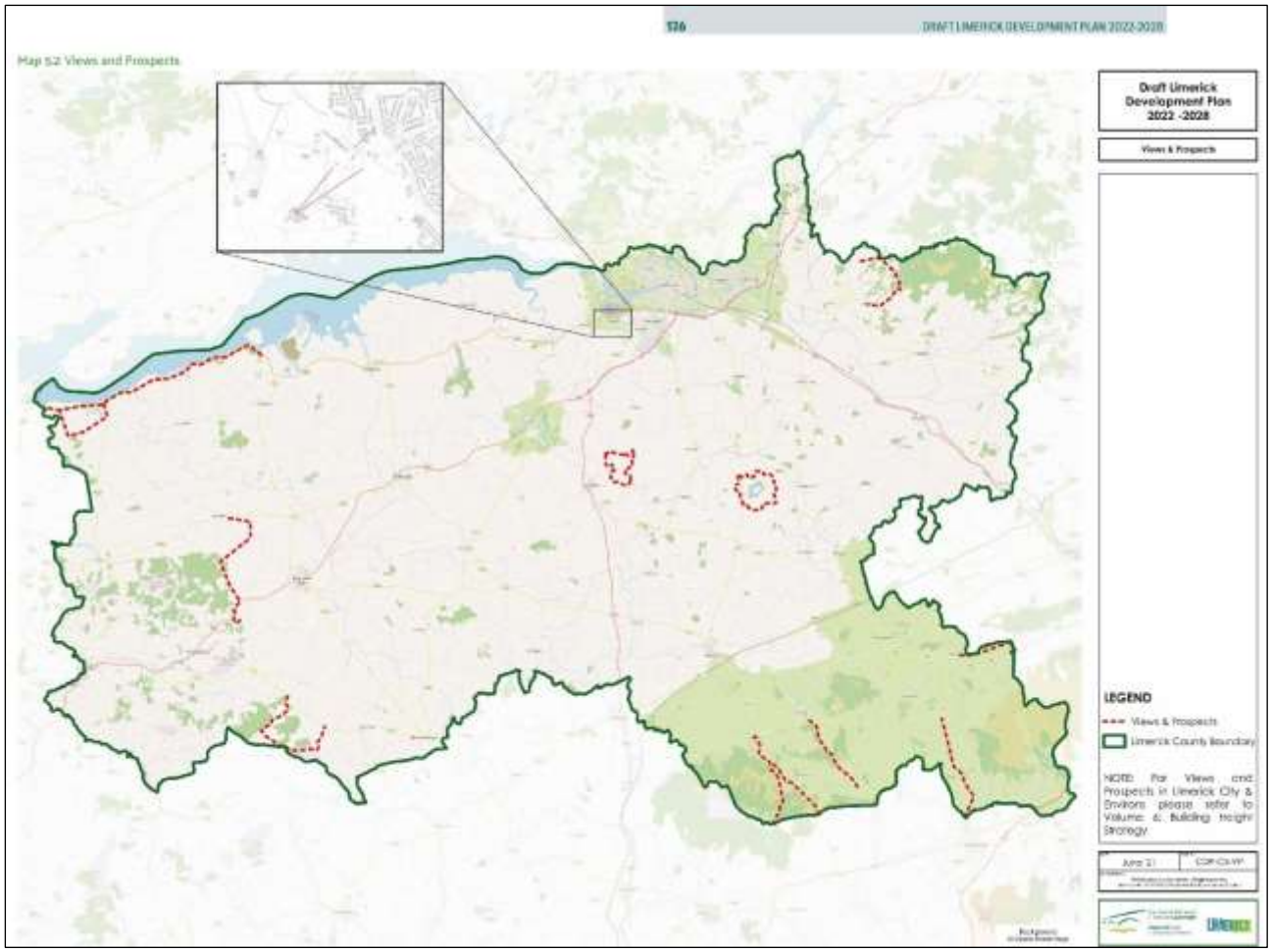

Figure 11-6: Views and Prospects in Co. Limerick (Source: LDP)

The inset area of Figure 11-6 indicates the protected views and prospects near the City are four short range views of the Monastic Site in Mungret, to the southwest of the City.

The proposed development will not affect these protected views.

While other important views and prospects are also referenced within the City area, these are not categorised as protected views. In the accompanying *Building Height Strategy for Limerick City*, Section 3 Urban Analysis contains information regarding 'Significant Views and Landmarks (p49). Views within the city are categorised, as follows:

Linear Views of Landmark Buildings, the City Walls & City Skyline

Linear Views occur when a single landmark building (e.g. King John's Castle) is the main point of focus within the view path. Views tend to be framed within relatively narrow viewing corridors. The city skyline is a combination of elements - the general scale of buildings, streets and spaces from area to area, major landmarks on the skyline, other individual higher buildings, higher building groups and landscape elements.

River Prospects

The Plan states that River Prospects are usually (though not exclusively so) experienced while crossing a bridge. While many bridge crossings allow opportunities to pause and appreciate views, many of these views can also be enjoyed in motion as a viewer moves across a bridge. River Prospects in this instance refer to the ability to see landmark building(s) from bridges.

The study area contains some pleasant views from bridges that cross the Shannon within the study area, with the road bridge having glimpses of Thomond Park and of Troy castle in the winter months, and of the nearby wind turbine.

A third category of 'Approach Road views' refers to views entering the city from the north, south, east and west however these are indicative in location.

No protected views in Limerick City will be affected.

Landscape and Natural Heritage Related Policies

Policies relating to the natural heritage, including the rivers and specifically the River Shannon tree and hedgerow protection and riparian buffers are included below.

Chapter 1 of the Plan includes a Strategic Vision for Limerick. This includes four Key Ambitions, one of which relates directly to the Shannon:

> *"Limerick will provide room for people to enjoy the River Shannon/Estuary. The animation of the waterfront will increase public access and create new recreational opportunities for residents and visitors."*

Other landscape related policies are found in Chapter 6 Environment, Heritage, Landscape and Green Infrastructure.

Objective EH O18 Riparian Buffers

> *"It is an objective of the Council to maintain riverbank vegetation along watercourses and ensure protection of a 20m riparian buffer zone on greenfield sites and sites are maintained free from development. Proposals shall have cognisance of the contents of the Inland Fisheries Ireland document Planning for Watercourses in Urban Environments."*

Objective EH O10 Trees and Hedgerows

"It is an objective of the Council to:

a) *Retain and protect amenity and biodiversity value of the County and City by preserving as far as possible trees, woodlands and hedgerows, having regard to the significant role that trees and hedgerows play in local ecology, climate change and air quality and their contribution to quality place making and the associated health and wellbeing benefits.*

b) *Require, in the event that mature trees, or extensive mature hedgerow is proposed to be removed, that a comprehensive tree and hedgerow survey be carried out by a suitably qualified tree specialist to assess the condition, ecological and amenity value of the tree stock/hedgerow proposed for removal and to include mitigation planting and a management scheme. The Council will seek in all cases to ensure when undertaking development, or when permitting development, that the loss of, or damage to, existing trees is minimised.*

c) *Require the planting of native trees, hedgerows and vegetation and the creation of new habitats in all new developments and public realm projects. The Council will avail of tree planting schemes administered by the Forest Service, in ecologically suitable locations, where this is considered desirable.*

d) To identity and prepare TPO's where trees of exceptional amenity, cultural or environmental value are identified which warrant a high level of protection.

e) To implement the Limerick City and County Tree Policy when completed and review as appropriate."

Chapter 7 of the Development Plan (Sustainable Mobility and Transport) contains policies relating to sustainable transport including walking and cycling, as well as a policy relating to the Limerick Northern Distributor Road.

Objective TR O8 Walking and Cycling Infrastructure

It is an objective of the Council to:

a) Improve and provide clear, safe and direct pedestrian linkages, cycle networks, including the greenways and primary segregated cycle routes, between the employment zones, shopping areas and residential areas throughout Limerick;

b) Maintain and expand the pedestrian route network, infrastructure and where possible, retrofit cycle and pedestrian routes into the existing urban road network, to provide for accessible safe pedestrian routes within Limerick.

Objective TR O9 Limerick Cycle Network

"It is an objective of the Council to implement in full, the Cycle Network, which will be set out in the final LSMATS with priority given in the short term to delivering the primary cycle network and cycle routes serving schools."

Objective TR O36 Limerick Northern Distributor Road

It is an objective of the Council to:

a) Support the development of the Limerick Northern Distributor Road, which will connect the Coonagh to Knockalisheen Road Scheme to the existing R445 (old N7) and adjoining road network to the east of Limerick City, which will incorporate Smarter Travel measures, in accordance with all environmental and planning assessments.

The Northern Relief Road though not in the planning process, is illustrated indicatively in Map 7.1 of the LDP.

Zoning

Volume 2 of the Plan contains a zoning map, Map 3 (*Limerick City and Suburbs (in Limerick), including Mungret and Annacotty - Zoning Map*), in which the zoning for the study area includes University zoning on the University lands, and High Tech/Manufacturing Campus zoning to the east of the lands which include the National Technology Park as well as some open fields.

Limerick Shannon Metropolitan Area Transport Strategy

Section 8 refers to walking, with Section 8.3.7 specifically referring to amenity walks in the study area and surrounds:

Amenity walks within and through Castletroy offer significant potential for tourism development, particularly along the River Shannon, Groody and Mulcair.

Section 9 of the Strategy refers specifically to cycling. This includes several types of cycling strategy, and in Section 9.1.7, specifically mentions the study area in the context of the Greenway Cycle Network:

Greenway Networks correspond to traffic free or low-trafficked routes and typically comprise of

repurposed derelict railway lines, routes through parks or alongside rivers. As many of these routes are quite rural and nature-focussed, they can serve *both an amenity and commuter function. The Greenway Network proposed for LSMA has been developed on the basis of an existing network of Greenway routes and the upgrade of existing paths to provide a comprehensive cycling network. Proposed Greenway Routes include extension of the Shannon Fields Greenway to UL along the banks of River Shannon to the NTP and Annacotty;*

11.5.1 Summary of Development Plan Policies

- The LDP includes policies on landscape character of the city and county. Specific Objectives relating to UCA 3 Castletroy do not mention specifics of the campus landscape, such as the mature trees, however tree related policies are covered elsewhere in the Plan. Protected views in the City and County are identified, none of which will be affected by the proposed Greenway development.

- Policies on Rivers and the Shannon Estuary reflect the importance of this river and the intention to increase opportunities for the public to enjoy the river. Policies relating to the retention of trees and hedgerows as well as the maintenance of riparian buffers are set out in the Plan. Tree surveys and mitigation planting are required in certain cases. It is noted that a tree survey has been carried out as part of this EIAR.

- Policies relating to promoting walking and cycling opportunities in the City and County are included which include identification of existing walkway/cycleway connections along parts of Plassey Park Road and parts of the riverbank walk in the UL campus.

11.6 Description of Predicted Effects

This section described the predicted landscape and visual effects on the existing landscape receptors the landscape from sensitive receptors. Mitigation measures are not considered in the calculation of potential impacts.

The main landscape and visual effects of the proposed development are described under the headings of Sensitivity, Magnitude of Change and Significance of Effect.

11.6.1 Construction Phase

11.6.1.1 Predicted Landscape Effects

Landscape Sensitivity

Section 11.3 above described the landscape character and value of the study area. There are two distinct character areas within the study area, each with their corresponding landscape value as described in Section 11.4.9, which feeds into the judgement on landscape sensitivity.

Landscape values are combined with susceptibility to the changes as a result of the proposed development, to arrive at an overall Landscape sensitivity. Based upon a review of the proposed development in each of these character areas, the Landscape Sensitivity of these areas is as follows:

- **University of Limerick Campus – Groody River bridge to Kilmurry Village: High** Landscape Sensitivity. As noted in Section 11.4.9, this area is considered High Value and has a high proportion of highly valued mature trees along the riverbank path, (as well as on the opposite bank) which contribute to a distinctive character. There are also number of elements of cultural heritage along

and near to the path including the Plassey Mills, Plassey Bridge, Plassey House, fishermen's cottages and the Plassey Mill Race. Plassey Beach is another distinctive area of high sensitivity and special character. The proposed Greenway follows the majority of the existing path and therefore is in close proximity to some of these elements.

- **IDA/National Technology Park grounds – Plassey Park Road** : **Medium** Landscape Sensitivity. This area is considered of Medium value, and in this location the path is partly defined and informal in other parts. Areas of higher value include some wooded areas, the vicinity of Troy/Black Castle and some areas of open grassland, young woodland and scrub have a pleasant character and are considered Medium. The area which includes the proposed route at Kilmurry Village and along University Road, and Plassey Park Road is considered of Low-Medium sensitivity.

Magnitude of Change

During the construction phase, expected to last for 3 months per section, the following activities will be carried out:

- Vegetation clearance: Vegetation and trees will be removed to facilitate path widening and, in some locations, creation of a new path. This will involve vegetation clearance and removal and in areas of grassland, stripping and stacking of turf on one side of the proposed Greenway, which will be re-seeded. Tree branches will be chipped on site and used as mulch.
- Bridge removal: 4 no. concrete bridge decks are to be removed. This will involve the breaking up of the bridge decks and the removal of the aggregate for use elsewhere on the site. Removal of a number of metal gates, and concrete and wooden fences will also be carried out.
- Earthworks: the construction of the path will involve machinery removing material as well as bringing material to the location of the proposed path and laying the surface, as well as installation of public lighting, seating, etc.
- Four temporary construction compounds and one temporary working area are proposed and there will be haul roads constructed between the compounds and paved roads. The locations of the construction compounds (measuring 40mx40m) were selected to avoid trees and vegetation. This is particularly important in the case of the Kilmurry Student Village and south of the Fisherman Cottages compounds which are in the vicinity of relatively mature trees.

The construction phase will result in localised changes in parts of the UL Campus, particularly around the compounds. The movement of machinery in these areas and along the proposed route of the Greenway during the Construction phase will result in a magnitude of change ranging from Medium to High along the proposed Greenway route within the UL grounds. The tranquil landscape character with its sense of remoteness will be temporarily affected by the construction works.

A High magnitude of change is likely along the riverbank section east of Kilmurry Village, as there will be a temporary compound in the open field just east of the village, and some vegetation clearance in the vicinity of Castle Troy however this will avoid the area in the immediate vicinity of the Black/Troy Castle and is routed to minimise tree removal as it connects to McLaughlan Road. The changes in the vicinity of Plassey Park Road will be less pronounced as these are already busy routes with construction work ongoing in sections of Plassey Park Road/University Road junction.

Significance of Effect

University of Limerick Campus – UL Boathouse to Kilmurry Village: Moderate-Significant, adverse, temporary Landscape Effect during the construction phase. This will be a localised effect, confined to the

immediate vicinity of the proposed Greenway and the areas around the construction compounds, and not throughout the wider campus.

- **IDA National Technology park to Plassey Park Road**: Slight-Moderate, adverse, temporary landscape effect. This will be localised, as the majority of this area is slightly more remote and is further away from buildings and other routes, however the requirement for more vegetation clearance will result in a considerable temporary effect on the landscape character.

11.6.1.2 Predicted Visual Effects

Viewpoints were identified to represent a range of visual receptors, in particular sensitive visual receptors, which include residents, those engaged in recreation or appreciation of cultural heritage. The selection of viewpoints also include views representative of locations visited by larger numbers of people, and locations of particular scenic qualities as well as viewpoints in the vicinity of cultural heritage sites along the route. Views from each of the tree character areas identified have been included.

The selected viewpoints are listed in Table 11-8 and illustrated on Figure 11-7.

Table 11-8: Viewpoint Locations

Viewpoint No	Description
1	View from beginning of trail at Groody River Bridge
2	View from trail near Plassey Mills looking towards bridge
3	View from existing path looking towards Plassey Mills
4	View approaching tree lined trail at Dromroe Student village (looking east)
5	View from trail underneath the 'Living Bridge' (looking west)
6	View from tree-lined trail approaching Plassey Bridge looking east)
7	View from trail adjacent to Plassey Beach
8	View from shore at Plassey Beach
9	View from gates opposite entrance to Kilmurry Village
10	View from grass area at Kilmurry
11	View from Kilmurry at proposed northern end of path
12	View from Kilmurry looking south along University Road
13	View from end of path at McLaughlin Road

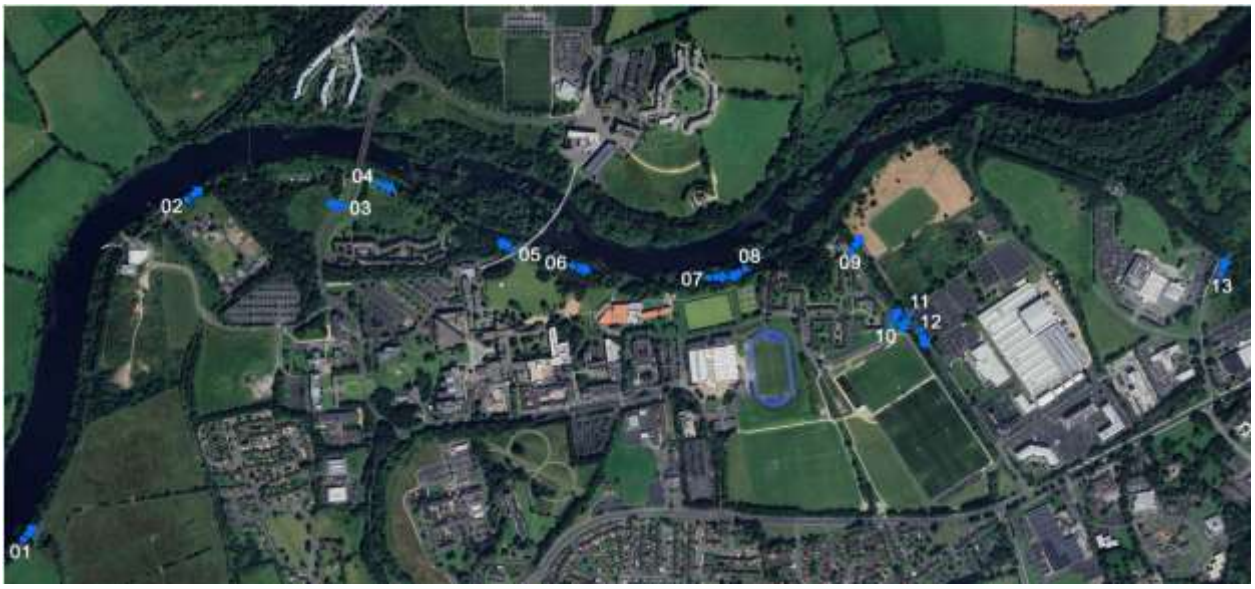

Figure 11-7: Viewpoint Location Map (Source : Innovision)

Visual Effects at the construction phase are likely to be primarily associated with vegetation and tree removal, visibility of the temporary construction compounds and of construction machinery on the site.

While the photomontages and the accompanying detailed descriptions describe the main changes which will take place and the effects at the Operational Phase, Table 11.9 below summarise the visual effects at the construction phase for each of the viewpoints.

The visual effects during construction are in this case, more pronounced than at the Operational phase. Depending on the view, viewers will see actions such as removal of trees and vegetation, breaking up and removing of some existing hard surfaces and topsoil stripping, construction of the proposed path and railings, and machinery entering and exiting the site. The visual effects tend to be adverse as the finished pathway will not be visible, and the view is of a construction activity and the temporary loss of the pleasant tranquil character which many of the views represent.

The duration of the effects in the Table 11.9 below are all temporary in duration.

Table 11-9: *Viewpoint Assessment Summary: Construction Phase*

Viewpoint No	Description	Magnitude of Change	Significance of Effect
1	View from beginning of trail at Groody River Bridge	Medium	Slight-Moderate, adverse
2	View from trail near Plassey Mills looking towards bridge	Medium	Moderate, adverse
3	View from existing path looking towards Plassey Mills	Medium	Slight-Moderate, adverse
4	View approaching tree lined trail at Dromroe Student village (looking east)	Medium	Moderate, adverse
5	View from trail underneath the 'Living Bridge' (looking west)	Medium	Moderate-Significant, adverse
6	View from tree-lined trail approaching Plassey Bridge looking east)	Medium	Moderate, adverse

Viewpoint No	Description	Magnitude of Change	Significance of Effect
7	View from trail at Plassey Beach	High	Significant, adverse
8	View from water's edge at Plassey Beach	High	Significant, adverse
9	View from gates opposite entrance to Kilmurry Village	Low	Slight, adverse
10	View from grass area at Kilmurry	Low	Slight, adverse
11	View from Kilmurry at proposed northern end of path	Low	Slight, adverse
12	View from Kilmurry looking south along University Road	Low	Slight, adverse
13	View from end of path at McLaughlin Road	Low-Medium	Slight, adverse

There will be visual effects also at the four locations where the temporary construction compounds are located. The most pronounced are likely to be in the vicinity of the Dromroe student village where the compound will be easily visible and by a number of visual receptors (those on the path, approaching and form the Dromroe village itself, and some from the bridge to the west). the compound just east of Kilmurry student village is also likely to be highly visible and both are considered to give rise to Moderate, adverse temporary visual effects. The compound at the western end, near the Wastewater treatment plan is likely to be less easily visible, as is that at McLaughlin drive, which are considered Slight, adverse, temporary visual effect.

11.6.2 Operational Phase

11.6.2.1 Predicted Landscape Effects

Landscape Sensitivity

This is described in Section 11.4.9 and remains the same for both the Construction and Operational Phase.

Magnitude of Change

The main elements undergoing change are the loss of some mature trees, tree groups and vegetation, and some elements removed, as well as path widening and other elements. More pronounced effects occur in several areas such as the Plassey Beach area, where a proposed bridge, ramp and retaining wall and railings are proposed. Other areas undergoing slightly more change are the wooded areas which the route will traverse near Plassey Mills, near Troy Castle, and in the vicinity of the Living Bridge, with vegetation clearance necessary in these areas.

Loss of Trees and Bankside Vegetation: Within the UL Campus section, the proposed route follows the existing path, and the existing path is widened along the majority of the route. The exceptions are the areas where the proposed Greenway diverts off the existing path to avoid effects on mature trees, north of Dromroe student village as well as some woodland between Dromroe and the Living Bridge. Tree removal due to path construction is also proposed between Plassey Mills and the Fishermen's cottages, where the path is proposed to traverse a wooded area to minimise effects on the privacy of the dwellings. Both the widening of the of the existing path and the creation of new sections of path result in some removal of mature trees.

These are indicated on the Tree Survey (Constraints Drawing) Tree Survey as T7, T49/50, T51 all of which are Category B trees. The removal of some younger trees and vegetation will also be necessary at several locations, resulting in the removal of the tree groups TG1,TG8,TG11 and the trees mentioned above north and east of Dromroe village. Removal of Category A trees, of which there are 41 in this section, has been avoided.

As the Tree Survey notes (described in Section 11.4.3), a high proportion (41 out of a total of 77) of the trees along the River Shannon corridor are Category A1. 74 of these trees are within the UL Campus, and only three mature trees are to be removed in this area, along with the tree groups noted above. This then is a very small proportion of the total number of trees, and the vast majority of the mature and all of the Category A (High Quality) trees are retained. Though there is removal of some tree groups this is relatively small scale within the Campus.

Between Kilmurry student village and Troy (Black) Castle parts of the path are relatively open but certain sections are much more overgrown. Removal of some scrub vegetation and trees from larger tree groups is indicated on the Drawings in the Tree Survey Report. As the drawings show, the Category B tree groups along the route of the path are largely retained with small proportions of Tree Groups 12,13,14,19,20,21,22 to be removed. Refer to EIAR Part III - Appendices.

The amendments to the path which is routed away (inland) from the existing narrow bridge near the Plassey Beach area, will result in some vegetation and tree removal (as illustrated in Viewpoint 7).

This, taken with the proposed ramp and particularly the retaining wall and railings at the Beach will result in a change in character to this area. It should be noted that this area was the subject of several design iterations, with the aim of minimising the visual effects on this area, with the extent of the retaining wall considerably reduced as the design process evolved.

The beach is a unique area in the campus with a strong sense of naturalness and a distinctive character. The proposal will increase the amount of hard surface and of 'man-made features' in a view which is relatively naturalistic. However, the reduction in the length of the railing (as part of the iterative design process) has reduced vegetation removal as well as the visual effects from the shore itself. While some key trees are removed on the shore, the majority of trees in the area have been retained.

The ramp will provide access for all to the shore, and the extensive railing and wall all result in a medium magnitude of change to the character of the area, which is naturalistic and a scenic and pleasant part of the campus, the beach being a notable feature.

Rest areas along the route are proposed near Plassey Mills, incorporating the existing stone walls into the feature. The stone bridge near Plassey Mills is to be retained and a 10m long single span steel bridge constructed adjacent to it. These proposals will result in small scale changes to the character.

Other works include bank stabilisation near Plassey Mill Race. Replacement tree planting is proposed along the route at several locations, including to the rear of the fishermen's cottages and to the front of the student residence at Dromroe village.

In summary –

- **Groody River Bridge to Kilmurry Village**: This area is expected to undergo a **Medium** magnitude of change in certain areas – in particular the Plassey Beach area, and the Plassey Mills area. These will undergo an increase in hard surfacing, vegetation removal and a localised change in character will occur. Some tree and vegetation is proposed along the route, but the majority of the trees and all of the Category A trees are to be retained, with removal of 7 no. individual trees only, some

younger trees and trees within larger tree groups proposed. New sections of path in front of (north) and east of Dromroe village are proposed to avoid important mature trees. The remaining areas however, such as those in Kilmurry village and along the path between the Groody River bridge and the Plassey Mills will undergo a **Low** magnitude of change.

- **IDA Technology Park – Plassey Park Road** : The magnitude of landscape change is considered to range from **Low** The creation of a more formal and wider pathway along the majority of the route will result in a Low magnitude of change. The change will be noticeable and will include the proposed path in open grassy areas as well as a considerable clearance of understorey vegetation. The Tree Survey drawings (included in EIAR Part III - Appendices) depict large groups of trees considered to be Class B, and tree removal to facilitate the path is relatively limited.

Significance of Effect

- **University of Limerick Campus – River Groody bridge to Kilmurry Village**
  The majority of the areas where the proposed Greenway traverses the UL campus are expected to undergo Not Significant to Slight landscape effects, which are neutral in quality, where the path is simply widened and re-surfaced with some small-scale vegetation loss.

  Slight to Moderate, adverse effects result in certain areas– the woodland east of Dromroe village and west of the Living Bridge, where some tree removal is necessary to facilitate an alternative route. However over time, as the vegetation along the path route recovers and the ground layer re-establishes, the effects will reduce. The Plassey Mills rest area, which is located at the end of the disused Plassey Bridge, will also undergo a localised change in character, but this will be less pronounced and considered a Moderate, neutral, localised effect, as there are already some elements (a wider path, stone walls) which render this change less obvious.

  The area around Plassey Beach will undergo the most noticeable change, considered of Medium-magnitude. This is a High sensitivity landscape and, in this location, the effects on the localised landscape character of the shore would be considered Moderate, and adverse. Through the shore is a small area (geographically) and the effects do not extend to the wider landscape, the small size of the shore area means it has a lower capacity to absorb new elements and the ramp, retaining wall and railings and removal of several distinctive mature trees, and the widened and hard surfaced path adjacent to the shore, will result in a changed character, as no part of the shore is unaffected. The effect is considered Moderate and range from Long Term/Permanent. Some limited re-vegetation is likely to occur over time once the railings and ramp are in place.

  The landscape effects will be very localised to the immediate vicinity of the path, and not perceptible from the wider UL campus landscape.

- **IDA Technology Park-Plassey Park Road**: The landscape effects are considered overall to be overall Slight. The removal of mature trees is likely to be limited, in particular between the Kilmurry village area to just east of the Black/Troy Castle, where the majority of the Tree Groups (classified as B value in the Tree Survey) are retained and thus the wooded character of much of this part of the path will remain.

Along with this, the very dense undergrowth (with its somewhat oppressive character) along this part of the study area will be removed, considerably opening up the character of the path and creating a more inviting atmosphere for the user.

Some tree removal occurs at the end of McLaughlin Road where the path connects to the riverbank and this is not indicated on the Tree Survey, but tree removal was minimised by avoidance of the semi-mature street trees which are adjacent to the road. The proposed Greenway 'spurs' along University Road and the existing McLaughlin Road are considered to result in Not Significant, neutral landscape effects.

11.6.2.2 Predicted Visual Effects

The main visual effects will be evident at the Operational Phase. For each viewpoint, the visual assessment consists of a description of the existing view, the magnitude of the change, and the significance of the visual effect. The viewpoints are assessed in Table 11-10.

Table 11-10 Assessment of Viewpoints

Viewpoint No 1: View from beginning of trail at Groody River Bridge
Existing View This view shows the hard surfaced path, with timber fencing on both sides. Trees line the path on both sides to the left of the view, with a small tree and undergrowth in the field in the centre of the view. To the right of the view there is a view to an open field.
Visual Receptor Sensitivity Visual receptors in this location would be recreational users the path, where there is a pleasant character primarily created by the trees. Viewers here are considered to be of **High sensitivity** as per the criteria in Table 11-4: '*…viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and views which are valued by the local community*'
Proposed View The proposed view shows the existing path is retained, but bollards restrict access. To the right of the view, a new path is visible, with timber fencing defining the new path from the field. Metal railings separate the two pathways.
Magnitude of Change The magnitude of change is considered Low, as per the criteria set out in Table 11.4: "*Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity*" There is some change shown in the proposed photomontage to the composition of the view, due to minor removal and the introduction of a new cycle path, timber fencing and a short section of metal railing. A more open view to the fields is evident due to the vegetation removal. However the existing tree lines path and view to the open field remains the same and the change is considered of Low magnitude.
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a High visual receptor sensitivity, and a Low magnitude of change results in a Moderate effect. However this is a guide only and using professional judgement, the visual effect is considered **Slight, and neutral**. The quality of the effect is considered neutral, as while it does increase the hard surface, however the view still has a high

Viewpoint No 1: View from beginning of trail at Groody River Bridge
proportion of vegetation, and the character is slightly more open which (depending on the viewer) can be perceived as a slightly safer environment.

Viewpoint No 2: View from trail near Plassey Mills looking towards bridge
Existing View This view shows the existing relatively narrow path, with timber fencing on both sides. Low-level vegetation is encroaching on the path in the foreground, and in the middle ground, a low concrete parapet wall is visible. Trees overhang the path on the right-hand side, while on the left the trees are further back form the path. In the distance, curving stone walls (leading to Plassey Bridge) are just visible, along with a steel gate.
Visual Receptor Sensitivity Visual receptors in this location would be recreational users the path, where there is a pleasant character primarily created by the trees. Viewers here are considered to be of **High sensitivity** as per the criteria in Table 11.4: '*…viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and views which are valued by the local community*'
Proposed View The proposed view shows a much wider tarmacadam path, with higher steel railings replacing the timber fence. The concrete bridge parapet is replaced by steel railings. These railings are higher; however they are coloured so as to be less obtrusive than the existing steel gate in the background. and contrast sharply with views of the curved stone walls in the distance, which are retained. Some of the trees to the left of the path are removed as well as some overhanding branches. In the distance, the steel gate is replaced by dark green metal fencing.
Magnitude of Change The magnitude of change is considered Low, as per the criteria set out in Table 11.4: "*Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity*" While there is some change in the proposed photomontage to the composition of the view, due to vegetation removal, the wider path and the introduction of higher railings, the pleasant, tree-lined character of the path and the view largely remains the same.
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a High visual receptor sensitivity, and a Low magnitude of change results in a Moderate effect. However this is a guide only and using professional judgement, the visual effect is considered **Slight, and neutral**. The quality of the effect is considered neutral, as while it does increase the extent of hard surface, however the view still has a high proportion of vegetation, and the character is slightly more open which (depending on the viewer) can be perceived as a slightly safer environment.

Viewpoint No 3: View from existing path looking towards Plassey Mills

Existing View

This view is taken from the existing path, looking towards a grassed area, with a glimpse of the fishermen's cottages through the deciduous trees which form the backdrop to the view.

Visual Receptor Sensitivity

Visual receptors in this location would be recreational users the path, where there is a pleasant character primarily created by the trees and open grassed area. Viewers here are considered to be of **Medium sensitivity** as per the criteria in Table 11.4:

…views are generally not designated, but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquillity or some rare element in the view.

Proposed View

The proposed view shows the proposed Greenway path traversing the grassed area, leasing towards the trees. The path is lined by a timber fence to the left, and by shrubs to the right. To the right of the path, additional tree planting is shown, while the wet grassland to the left of the path is retained.

Magnitude of Change

The magnitude of change is considered Low-Medium, as per the criteria set out in Table 11.4:

Low is considered:

"Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity"

Medium is considered:

'…introduction of elements that may be prominent but not necessarily uncharacteristic in the context, resulting in change to the composition but not necessarily the character of the view or the visual amenity'

While there is some change in the proposed photomontage to the composition of the view, due to the proposed path, and planting of shrubs and trees, the view towards the distant trees over a grassed area remains. The proposed tree planting adds to the quality and visual interest of the view.

Significance of Effect

The significance of effect, as outlined in Table 11.3, resulting from a Medium visual receptor sensitivity, and a Low-Medium magnitude of change results in a **Slight-Moderate** effect. The quality of the effect is considered neutral to beneficial, as while it does introduce some hard surface, the view still has a high proportion of vegetation, and this is increased by the tree and shrub planting.

Viewpoint No 4: View approaching tree-lined trail at Dromroe Student village (looking east)

Existing View

This view shows a loose gravel path adjacent to a large area of amenity grass, and in the middle ground the path runs under line of very mature trees, the main element of the view, which occupy much of the left-hand side of the view. To the right, smaller scattered trees are visible among the grassland. This is a pleasant view with a sense of naturalness, and a character reminiscent of parkland. A glimpse of the timber-clad Dromroe village buildings is seen to the right of the image. (Note – the avenue of mature trees is possibly more striking when the tree trunks are visible in the wintertime).

Visual Receptor Sensitivity

Visual receptors in this location would be recreational users of the path, where there is a pleasant, parkland character, primarily created by the mature trees and grassland. Viewers here are considered to be of High sensitivity as per the criteria in Table 11.4:

Viewpoint No 4: View approaching tree-lined trail at Dromroe Student village (looking east)

'…viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and views which are valued by the local community'

Proposed View

The proposed view shows that the existing path under the mature trees remains, and that a wider hard surfaced path is shown to the right of the view, in the grassland, avoiding the mature trees as well as the smaller trees. Bollards are shown restricting access to the existing path, while lighting columns are also shown along the proposed cycle path to the right of the view. A timber fence divides the cycle path from the open grassland. Additional tree planting is shown to the right of the view, screening the views of the Dromroe buildings.

Magnitude of Change

The magnitude of change is considered Low-Medium, as per the criteria set out in Table 11.4:

"Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity"

The new path to the right of the view is the main change in the proposed photomontage, resulting in a slight reduction in the expanse of grassland in the view, and therefore a slight change in the to the composition of the view. The introduction of several elements of 'street furniture' which include bollards, a timber fence and lighting standards contribute to a more urban character to what is currently a view of open parkland with a striking mature tree avenue. However, the main element of the view, the mature tree avenue, remains, as does the expanse of grassland and scattered trees.

Significance of Effect

The significance of effect, as outlined in Table 11.3, resulting from a High visual receptor sensitivity, and a Low magnitude of change results in a Moderate effect. However this is a guide only and using professional judgement, the visual effect is considered **Slight, and adverse to neutral.** While the proposed path at a wider of 3.5m does increase the hard surface in the view, the elements of street furniture give an urban feel to a view which has strong semi-natural parkland quality. However the main elements which are the mature Beech trees and the overall of the character of the view remain.

Viewpoint No 5: View from trail underneath the 'Living Bridge' (looking west)

Existing View

This view shows an existing, relatively narrow, path which passes underneath the 'Living Bridge'. Informal vegetation is seen to either side, with the path entering an area of woodland in the middle ground. Overhanging trees prevent any long-distance views along the path. The character of the view is pleasant but not highly scenic.

Visual Receptor Sensitivity

Visual receptors in this location would be recreational users of the path, where there is a pleasant but not particularly scenic view. Viewers here are considered to be of Medium sensitivity as per the criteria in Table 11.4:

…views are generally not designated, but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquillity or some rare element in the view.

Proposed View

The proposed view shows that the existing path under the mature trees remains, and that a wider hard surfaced path is shown to the left of the view, through the woodland, and while tree removal is evident,

Viewpoint No 5: View from trail underneath the 'Living Bridge' (looking west)
trees remain on both sides of the proposed path. The existing path in the foreground and the proposed new path are both lined with timber fencing, and a bollard restricts access to the existing path after is passes under the bridge.
Magnitude of Change The magnitude of change is considered Low, as per the criteria set out in Table 11.4: *"Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity"* The widening of the existing path, and a new path to the left of the view is the main change in the proposed photomontage, resulting in an opening in the woodland to the left of the view, therefore a slight change in the to the composition of the view. The timber fencing and bollards restrict the open character of the existing view and give the impression that the woods are 'fenced off'. However, the main element of the view, the bridge and wooded areas, remain.
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a Medium visual receptor sensitivity, and a Low magnitude of change results in a **Slight effect**. The visual effect is considered **Slight, and neutral**. The quality of the effect is considered neutral, as while it does increase the hard surface in the view, and there is some tree removal to facilitate the path, , the main elements and the overall of the character of the view remain. However the fencing and bollards change the open character of the view.

Viewpoint No 6: View from tree-lined trail approaching Plassey Bridge looking east)
Existing View This view shows an existing, relatively narrow, raised path which is lined by mature trees on both sides, the path is in close proximity to large mature tree-trunks. The mature trees provide a dense canopy overhead, creating a strong sense of enclosure which is distinctive. The grounds slopes to the right (to the Plassey Mill Race) and to the left slopes towards the riverbank, which also makes the path distinctive. These features combine to create a unique character in this view.
Visual Receptor Sensitivity Visual receptors in this location would be recreational users of the path, and at this location the view is considered highly scenic and of unique character. Viewers here are considered to be of High sensitivity as per the criteria in Table 11.4: '*viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and views which are valued by the local community*''
Proposed View The proposed view shows that the existing path under the mature trees remains, and that a wider hard surfaced path is shown to the left of the view, which weaves around the trees. One small tree and one mature tree are removed.
Magnitude of Change The magnitude of change is considered Low , as per the criteria set out in Table 11.4:

Viewpoint No 6: View from tree-lined trail approaching Plassey Bridge looking east)
"Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity" The proposed path to the right of the view along will be noticeable as the main focus of the viewer here will be on the trees and the intimate woodland setting. with the removal of a mature tree
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a High visual receptor sensitivity, and a Low magnitude of change results in **Slight-Moderate** The quality of the effect is considered adverse , as it does introduce a new elements, that of a hard surface in the view, and one of the four mature trees clearly visible in the view is removed.

Viewpoint No 7: View from trail at Plassey Beach
Existing View This view shows an existing, narrow section of path bordered by trees on the right-hand side, and by low ground cover vegetation on both sides. To the left of the view, the ground slopes towards the riverbank, creating a 'shore' area. One multi-stemmed tree is visible to the left of the bank. In the distance, the path crosses over a bridge but this is difficult to discern in the view. The character is a pleasant view, with elements of water, riverbank 'shore' and woodland, which has a strong sense of naturalness, and scenic qualities.
Visual Receptor Sensitivity Visual receptors in this location would be recreational users of the path, and at this location the view is considered scenic, and the view of Plassey Beach is a unique feature. Viewers here are considered to be of High sensitivity as per the criteria in Table 11.4: '*viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and views which are valued by the local community*''
Proposed View The proposed view shows that the existing path under the trees has been widened considerably, and a steel railing is seen to the left and right of the path, restricting the view to the shore. A viewing area is visible to the left of the view, extending out over the riverbank. A larger paved hard surface is seen in the foreground of the view (a seating area is proposed to the rear of the viewer) and to the right, the path continues on into the woods, also bordered by steel railing. Some tree removal is evident to both the left and the right of the view and the multi-stemmed tree to the left of the view along the shore is removed. The railings also remove the open access to the riverbank or 'shore'.
Magnitude of Change The magnitude of change is considered High , as per the criteria set out in Table 11.4: *Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, or introduction of elements that may be considered uncharacteristic in the context, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity.* There is a considerable increase in hard surface, which occupies a medium proportion of the view. The tarmacadam extends across the whole extent of the view, compared to a narrow earthen path, tree

Viewpoint No 7: View from trail at Plassey Beach
removal also reduce the strong natural quality of the view and coupled with the extensive railings this results in a change to the composition and character of the view, becoming more urban.
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a High visual receptor sensitivity, and a medium magnitude of change results in a Significant effect. The significance of effect, as outlined in Table 11.3, the combination of a High visual receptor sensitivity and a High magnitude of change results in a Very Significant visual effect. With professional judgement applied this may be reduced to **Significant.** The effect is considered **adverse** in quality.

Viewpoint 8: View from Plassey Beach
Existing View This view shows a view along the Beach, with the river, a narrow shore which gently slopes up to the existing path and tree line. Some grassy vegetation is evident along the upper slopes of the shore area, and mature trees extend along the full width of the view, in the background. A mature multi-stemmed tree is seen to the right of the view along the shore. The view has a strong sense of naturalness and tranquillity.
Visual Receptor Sensitivity Visual receptors in this location would be recreational users of the Beach area , and at this location the view is considered very scenic, with elements of water, beach, grasses and trees - the Beach itself is a unique feature. Viewers here are considered to be of High sensitivity as per the criteria in Table 11.4: *'viewpoints that are highly valued by people that experience them regularly (such as views from houses or outdoor recreation features) and views which are valued by the local community''*
Proposed View The proposed view shows that a concrete retaining wall with a steel fence extends along the length of the shore, and the grassy vegetation has been removed. A new seat will be attached to the ramp wall and the ramp extending to the shore is visible in the background. The large multi-stemmed tree in the background has been removed.
Magnitude of Change The magnitude of change is considered High , as per the criteria set out in Table 11.4: *Extensive intrusion of the development in the view, or partial intrusion that obstructs valued features, or introduction of elements that may be considered uncharacteristic in the context, to the extent that the development becomes co-dominant with other elements in the composition and affects the character of the view and the visual amenity.* There is a pronounced change in the character and composition of the view. The concrete retaining wall, ramps and railings are uncharacteristic elements in the view, and their presence which remove the sense of naturalness, created by the gradual slope form path to the shore and the river. The wall and railings are visually intrusive and cut off the viewer from the path. The removal of the mature tree contributes to the change in the natural character of the shore area.
Significance of Effect The significance of effect, as outlined in Table 11.3, the combination of a High visual receptor sensitivity and a High magnitude of change results in a Very Significant visual effect. With professional judgement applied this may be reduced to **Significant.** The effect is considered **adverse** in quality.

Viewpoint No 9: View from gates opposite entrance to Kilmurry Village
Existing View This view shows a view through a steel mesh fence, beyond which a building is visible to the left of the view, with a tree line to the right, and hard surfaced yard in the foreground and middle ground.
Visual Receptor Sensitivity Visual receptors in this location are currently those walking in Kilmurry village, and not recreational users of the path. At this location the view is not considered of scenic value. Viewers here are considered to be of Low sensitivity as per the criteria in Table 11.4: '*Viewers at viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in activities such as shopping, etc.*'
Proposed View The proposed view shows the fence is removed, and a coloured hard surfaced path is located adjacent to the existing treeline and kerb. Other elements in the view remain.
Magnitude of Change The removal of the fence and introduction of a coloured surfaced path are the only changes. The magnitude of change is considered Negligible, as per the criteria set out in Table 11.4: *Barely discernible intrusion of the development into the view, or introduction of elements that are characteristic in the context, resulting in slight change to the composition of the view and no change in visual amenity.*
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a Low visual receptor sensitivity, and a Low magnitude of change results in a **Not Significant** visual effect. The quality of the effect is considered beneficial, as the path is a minor element in the view and is suitable in terms of scale. The main elements of the view are unchanged, and removal of the fence opens up the view.

Viewpoint No 10: View from grass area at Kilmurry
Existing View This view shows a view over a grassed area in the foreground, with a road in the middle ground and a row of mature trees and shrubs beyond. To the right of the view, entrance gates are evident, and the road and carpark are visible beyond this gate, with trees lining the road in the background.
Visual Receptor Sensitivity Visual receptors in this location are currently those walking in Kilmurry village, on the grassed areas, and not recreational users of the path. At this location the view has some limited scenic value, primarily as a result of the mature tree planting, viewers here are considered to be of Low-Medium sensitivity as per the criteria in Table 11.4: Low is described as: '*Viewers at viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in activities such as shopping, etc.*' Medium sensitivity as per the criteria in Table 11.4: '*…views are generally not designated, but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquillity or some rare element in the view*'
Proposed View

Viewpoint No 10: View from grass area at Kilmurry
The proposed view shows that a paved path is visible to the left of the view and runs to the rear of some of the shrubby vegetation, crossing the road on the far side of the entrance gates.
Magnitude of Change The magnitude of change is considered Negligible, as per the criteria set out in Table 11.4: *Barely discernible intrusion of the development into the view, or introduction of elements that are characteristic in the context, resulting in slight change to the composition of the view and no change in visual amenity.*
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a Low-Medium visual receptor sensitivity, and a Negligible magnitude of change results in an **Imperceptible visual effect**. The quality of the effect is considered **neutral**.

Viewpoint No 11: View from Kilmurry at proposed northern end of path
Existing View This view shows the vehicular entrance to Kilmurry student village. A gate denoted the entrance and allows views into the buildings, while mature trees are visible to the left and right of the entrance.
Visual Receptor Sensitivity Visual receptors in this location are currently those walking towards Kilmurry village or at the end of University Road. At this location the view is not considered of scenic value. Viewers here are considered to be of Low-Medium sensitivity. Low is defined as per the criteria in Table 11.4: '*Viewers at viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in activities such as shopping, etc.*' Medium sensitivity as per the criteria in Table 11.4: '*…views are generally not designated, but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquillity or some rare element in the view*'
Proposed View The proposed view shows a raised traffic table on the road in front of the entrance gates. This connects to a path to the right and left of the view. Very limited vegetation removal is visible to the right of the view, but barely noticeable due to the retention of existing trees. A short section of fence is included to the right of the view.
Magnitude of Change The magnitude of change is considered Negligible as per the criteria set out in Table 11.4: '*Change that is limited in scale, resulting in no alteration to landscape receptors, and introduction of elements that are characteristic of the context. Such development results in no change to the landscape character, quality or perceived value.*'
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a Low-Medium sensitivity and Negligible magnitude of change is an **Imperceptible visual effect.** The quality of the effect is considered **neutral.**

Viewpoint No 12: View looking south along University Road
Existing View

Viewpoint No 12: View looking south along University Road
This view looks along University Road from the Kilmurry village and Troy Studios entrances. The road is visible in the centre of the view, with a grass verge to the left, and a partial grass verge to the right, with several hard surfaced lay-by areas for car parking. Mature trees line the road to the left and the right.
Visual Receptor Sensitivity Visual receptors in this location are considered of Low sensitivity: '*Viewers at viewpoints reflecting people involved in activities not focused on the landscape e.g. people at their place of work or engaged in activities such as shopping, etc.*'
Proposed View The proposed view shows a new pavement to the right of the view, extending along the road, with a segregated cycle and pedestrian path, the cycle path surface coloured red. Some minor vegetation removal is evident to the right of the view to facilitate the pathway; however the trees are retained, and the overall view remains similar.
Magnitude of Change The magnitude of change is considered Low as per the criteria set out in Table 11.4: "*Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity*"
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a Low sensitivity and Low magnitude of change is a **Slight visual effect**. The quality of the effect is considered **neutral.**

Viewpoint No 13: View from end of path at McLaughlin Road
Existing View This view shows the view looking along McLaughlan Road. In the foreground, the road curves around to the left, with a row of trees adjacent to the road. In the foreground, a path to the right of the view leads towards a field gate, with trees beyond. To the left, a grassed area with some individual trees is visible.
Visual Receptor Sensitivity Visual receptors in this location are considered of Medium sensitivity: '*…views are generally not designated, but which include panoramic views or views judged to be of some scenic quality, which demonstrate some sense of naturalness, tranquillity or some rare element in the view*' There are some pleasant qualities to the view, and viewers would include those walking on the existing path which is used for recreation. In addition, the gate leads to an informal track which connects to a riverside path.
Proposed View The proposed view shows a new pavement to the right of the view, extending along the road, with a grade-segregated cycle and pedestrian path, the cycle path surface coloured red. The gate is removed, and bollards are visible, with a pavement extending to the rear of the main band of tree planting. Some limited tree removal is seen to the right of the view. In the foreground, a raised traffic table and pedestrian crossing is visible.
Magnitude of Change The magnitude of change is considered Low as per the criteria set out in Table 11.4:

Viewpoint No 13: View from end of path at McLaughlin Road
"Minor intrusion of the development into the view, or introduction of elements that are not uncharacteristic in the context, resulting in minor alteration to the composition and character of the view but no change to visual amenity"
Significance of Effect The significance of effect, as outlined in Table 11.3, resulting from a Medium sensitivity and Low magnitude of change is a **Slight** visual effect. The quality of the effect is considered **neutral.**

Table 11-11: Visual Assessment Summary: Operational Phase

Viewpoint No	Description	Magnitude of Change	Significance of Effect
1	View from beginning of trail at Groody River Bridge	Low	Slight neutral
2	View from trail near Plassey Mills looking towards bridge	Low	Slight neutral
3	View from existing path looking towards Plassey Mills	Low-Medium	Slight -Moderate neutral to beneficial
4	View approaching tree lined trail at Dromroe Student village (looking east)	Low-Medium	Slight, neutral to adverse
5	View from trail underneath the 'Living Bridge' (looking west)	Low	Slight, neutral
6	View from tree-lined trail approaching Plassey Bridge (looking east)	Medium	Slight -Moderate, adverse
7	View from Plassey Beach	High	Significant, adverse
8	View from trail at Plassey Beach	High	Significant, adverse
9	View from gates opposite entrance to Kilmurry Village	Negligible	Not Significant, beneficial
10	View from grass area at Kilmurry	Negligible	Imperceptible, neutral
11	View from Kilmurry at proposed northern end of path	Negligible	Imperceptible, neutral.
12	View from Kilmurry looking south	Low	Slight, neutral
13	View from end of path at McLaughlin Road	Low	Slight, neutral.

The Operational Phase visual effects vary from Imperceptible and neutral (in one viewpoint,10), to Significant and adverse (in two viewpoints). Of the thirteen viewpoints, two are considered Imperceptible (Viewpoints 10, 11), one Not Significant (Viewpoints 9), six Slight (1,2,4,5,12,13,) two Slight-Moderate (3,6), and two Significant (7,8). The quality of the effects range from neutral to adverse, with nine of the 12 viewpoints considered neutral, three considered adverse and View 3 considered neutral to Beneficial and view 9 Beneficial. Neutral effects occur in the majority of the viewpoints, and these are views where the proposed changes are of a scale and character which fit in well with the existing elements in the view. Adverse effects result in views where extensive tree removal is evident, and which alters adversely the character of the view, or where extensive areas of hard surface and fencing are introduced and are

uncharacteristic creating an urban character. While design and construction methods were adapted to maximise tree retention, in particular along the River Shannon, some tree removal is proposed.

University of Limerick Campus – Groody River Bridge to Kilmurry Village

Visual effects in the UL section of the Greenway, are represented by Viewpoints 1-10. This area is considered of the highest landscape value, and the existing riverside walk represents viewers of High sensitivity at a number of locations. With the exception of the Plassey Beach area, visual effects range from Not Significant to Slight-Moderate, with the majority Slight in quality.

Beneficial changes are illustrated in Viewpoint 3 which shows increased accessibility to an area of trees and increased tree planting. Adverse effects in certain locations such as the narrow section of path between the River Shannon and the Mill Race (Viewpoint 6) which has a unique quality that a hard surfaced path (wider in some cases) and tree removal will affect, while the other adverse effects are at the UL Beach/Plassey Beach.

The UL Beach/Plassey Beach area is one of two areas of the Greenway scheme where more pronounced visual effects will result. One is the Plassey Beach area (represented by viewpoints 7 and 8) and is one of the areas undergoing a more pronounced visual change, with visual effects ranging from Moderate to Significant, and neutral to adverse in nature. The views show an increase in the hard surface due to the proposed path and new bridge alignment; however it is the proposed concrete retaining wall, ramp and railing that result in the most pronounced adverse effects. This both visually and physically cuts off the shore area from the existing path, but more importantly, the naturalistic character of this unique area is permanently changed. The removal of two of the multi-stemmed trees currently growing along the Shore also contributes to the adverse visual effects.

Viewpoints 9-11 represent the area around Kilmurry village which the Greenway traverses, which is of lower sensitivity than the riverbank area. Here, the visual effects range from Imperceptible to Slight and neutral in quality.

IDA National Technology park to Dublin Road

Viewpoints 12 and 13 represented the limited changes along the two 'spurs' which connect form the riverbank to the Plassey Park Road (University Road and McLaughlin Road), which are Imperceptible and Slight respectively.

11.7 PROPOSED MITIGATION MEASURES

11.7.1 Construction Phase

- Avoidance of trees/vegetation removal: A qualified Arborist to be on site to assist in marking out appropriate locations for temporary compounds, and to determine path alignment in certain locations – including the proposed Greenway front of Dromroe, where it avoids the mature Beech tree avenue, and through the wooded area between Dromroe village and the Living Bridge.
- Ground protection measures will be required for temporary construction compounds and Haul routes, these if passing within RPA's on nearby trees. A geo-membrane and a root protections system (e.g. Cellweb, or equivalent) is proposed for use in these areas, and they can be lifted and removed on completion with appropriate measures (to be specified) in the vicinity of the Compounds. The temporary compounds and haul routes will be removed after the sections they serve is completed. The ground will be ripped, top and sub soil replaced, and the area will be reseeded. However,

where specified by an Ecologist, and in areas where the grass is being let grow to encourage pollinators, areas may be left to naturally re-vegetate.

- The Haul route between Kilmurry village and McLaughlan Road will be along the route of the proposed Greenway.

11.7.2 Operational Phase

Avoidance: The following design features of the scheme are integral to the design, and the priority was to avoid issues identified in the constraints:

- One of the key features of the site's landscape and visual character are the mature trees on the site, along the river corridor, and in particular the River Shannon corridor, some of which are likely to be associated with Plassey House. The design evolved as potential effects on certain mature trees (classified during the Tree Survey) particularly Category A trees, were identified. To avoid any removal of these trees, the path route was amended to avoid a significant stand of Category A Beech trees north of Dromroe student village. A path diversion is also proposed east of Dromroe village to avoid other mature trees.
- Several parts of the path are narrow, and the path passes immediately close to mature Category A and B trees. In these areas, special construction methods will be used to avoid damage to tree roots and to build up the path rather than excavate. This allows the retention of these important trees and of the character of these areas.
- A qualified Arborist is to be on site to assist in the setting out of certain parts of the path where the proposed route is close to existing trees to avoid as many trees as possible. Some tree removal will be necessary as outlined in Drawing 21537_T_102 and the Preliminary Design drawings but, as far as possible, this is confined to mainly younger or trees of lesser value and mature trees, especially Category A trees are to be avoided.

Further ameliorative, remedial or reductive measures proposed are as follows:

- Re-planting of trees is proposed in certain locations (e.g. to the rear of the fishermen's cottages and in front of the student residences at Dromroe). These species will include native Oak (*Q. robur*), Birch (*B. pubescens*) which are also found in the campus, and which are also compatible with the tree found in the vicinity of the University Campus and Plassey House. It is likely that natural regeneration of trees such as Willow (*Salix sp*), Alder (*Alnus*) will occur in certain areas once the Greenway is completed.

11.8 RESIDUAL IMPACTS

The residual impacts are the impacts that the development is most likely to have on the receiving environment having regard to the proposed mitigation measures.

11.8.1 'Do Nothing' Scenario

It should be noted that if the above works were not carried out, the study area would remain as it is. It is likely that the section east of Kilmurry student village would continue to become overgrown, making access difficult, if not well maintained.

11.8.2 Construction Phase

Predicted impacts at construction stage are likely to be as per the potential impacts described in Section 11.6.1.1 and 11.6.1.2.

11.8.3 Operational Phase

It is anticipated that the impacts will be largely as predicted in section 11.6.2. The mitigation measures are aimed at ensuring that the works are controlled to the greatest possible extent and that there is no unintended damage to vegetation to be retained or other landscape features.

The adherence to the mitigation measures at the construction stage in relation to the construction methods in relation to works close to mature trees is essential, to ensure that they are retained as depicted on the Tree Survey, and as set out in Section 11.4.3.

11.9 Assessment of Cumulative and In-Combination Impacts

11.9.1 Cumulative Impact Assessment

As set out in Chapter 14 of this EIA report, Cumulative effects may arise from:

- The interaction between the various impacts within a single project;
- The interaction between all of the different existing and/or approved projects in the same areas as the proposed project.

This section initially discusses the interaction between several existing and approved projects in the area.

A number of projects were identified in close proximity to the proposed development. These are in two main locations – several works near the western end of the proposed scheme, near the UL Boathouse, and several works near the Kilmurry Student Village/University Road area.

A proposed Wastewater treatment plant upgrade was given permission which is directly adjacent to the proposed Greenway near the UL boathouse, however the planning drawings indicate that the vegetation along the existing path will not be affected and vegetation to the east and west of the plant will be retained. Landscape Effects are considered Not Significant and neutral. Visual effects would be considered Not Significant and neutral.

A nearby application related to the UL boathouse pontoon 22281. The works involve the replacement of the existing decking and the installation of a security gate at the entrance to the pontoon and this work has been carried out. The location of the pontoons however is unchanged. At the time of the initial site visit (2022), access was restricted via temporary site fencing which resulted in some visual clutter. This has been removed, and the new access gate is a slightly incongruous element in the otherwise simple riverside walkway. The combination of this change with the proposed development (a widened hard surfaced path with some tree removal) would result in some relatively minor (Not Significant and adverse) visual effects. These effects will be very localised. The open views and access from the slipway will remain.

An application for a single storey, Golf Academy Building (15697) was approved and Extension of Duration granted in 2021. This proposal lies directly adjacent to the existing riverside path and the proposed path adjacent to the UL Boathouse. Should this development proceed, the proposal shows tree planting (Effects TBC) inside the development boundary which is immediately adjacent to the existing riverside path. However the removal of a considerable area of scrub/emerging woodland and replacement with amenity grassland, combined with the very limited tree removal as a result of the proposed development will result in Slight and adverse landscape effects both at Construction and Operational stage. Construction and Operational phase visual effects are possible where the proposed buildings (and floodlights) are likely to be visible through the trees at certain times of the year and are considered Slight and adverse.

There are several projects (both nearing completion and those which have planning permission) in the vicinity of the Kilmurry student village and University Road area.

Planning Ref no 18252 (c) proposed '*widening of Plassey Park road for the length within the National Technology Park from the Annacotty roundabout to the vicinity of the junction of Plassey Park road with Milford road. (d) Addition of cycle lanes on Plassey Park road. (e) also as part of the proposed works are new boundary fences, footpaths, pedestrian crossings, relocation of affected public lighting columns, landscaping and all associated site works and services.*

These works have been carried out.

A recent application (208003) proposed upgrades to the existing walking and cycling facilities on both Plassey Park Road & Plassey Road, in conjunction with upgrades to minor road junctions, bus stops, new road surfacing, installation of LED public lighting & surface water drainage works.

This development also proposed cycle lanes and footpaths along the southern half of University Road, which is nearing completion, as well as a pedestrian crossing. The proposed Limerick City Greenway development will dovetail with these works to provide a continuous pedestrian and cycle facility along the length of University Road and connecting to Kilmurry student village. Visual and landscape effects are considered Not Significant and neutral, while the recently completed GAA pitches and associated facilities in Maguire's Field, west of University Road, along with the proposed development is likely to result in an overall Not Significant to Slight, neutral cumulative landscape and visual effect in the area. Visual effects as a result of the use of floodlighting in the pitch is not considered to be as noticeable as the pedestrians will be walking in an urban are with existing lighting poles along Plassey Park Road and University Road.

Closer to the river Shannon, and east of Kilmurry Village, the proposed Limerick City Greenway runs through green space slightly inland from the river's edge. Adjacent to this there is a permitted development (2360712) which consists of two pitches, a rugby pitch and a training pitch, a small changing building to the west. North of the pitches, several biofiltration ponds are connected by a swale. Tree planting is proposed adjacent to the north of to the pitches. The northern site boundary appears to run immediately adjacent to the existing informal pedestrian path, but no works are proposed here, and the tree clumps appear to be retained. An alternative linked path runs through the existing /meadow' area, which is adjacent to the proposed Limerick City Greenway, and adjacent to the biofiltration ponds, connecting with the Greenway on the western side.

These two proposals will add a more formal layout to what is currently an informal pitch area, and a more informal area with clumps of shrubs and several trees nearer the water's edge. Elements introduced include hard surfacing, wider path and a building in the form of changing rooms.

No floodlighting is proposed and therefore is considered that Cumulative visual effects are Not Significant to Slight and adverse to neutral, and landscape effects are Not Significant and neutral. The inclusion of additional planting (native and some of native provenance) and the managing of the existing meadow is considered neutral to beneficial. Visual effects are likely to be adverse and temporary during construction and should both features be under construction at the same time, effects are likely to be Slight, temporary and adverse.

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APPENDICES

Appendix 1: Itemised Table of Built Heritage (BH) Features Assessing Significance, Effects & Mitigation

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Appendix 3: Summaries of Previous Archaeological Excavations in the vicinity (extracts from www.excavations.ie)

Abbreviations used in this Chapter	Full Title
DoHLGH	Department of Housing, Local Government & Heritage
NMS	National Monuments service
RMP	Record of Monuments & Places
SMR	Sites & Monuments Record
ZoN	Zone of Archaeological Notification - Statutory
ASI	Archaeological Survey of Ireland
RPS	Record of Protected Structures
ACA	Architectural Conservation Area
NIAH	National Inventory of Architectural Heritage
AAP	Area of Archaeological Potential - Assessed
LCCDP	Limerick City / County Development Plans
LAP	Local Area Plan - Castletroy
DMS	Development Management Standards
OS	Ordnance Survey
ITM	Irish Transverse Mercator (Co-Ordinate Grid Reference)
BH	Built Heritage
EIA	Environmental Impact Assessment
ITM	Irish Transverse Mercator
NMI	National Museum of Ireland
TII	Transport Infrastructure Ireland
UNESCO	United Nations Educational, Scientific and Cultural Organization

12 CULTURAL HERITAGE

12.1 INTRODUCTION

This chapter assesses the impacts of the proposed Limerick City Greenway (UL to NTP) on the Archaeological, Built and Cultural Heritage resources in the area and has been completed in accordance with the guidance set out by the Environmental Protection Agency in '*Guidelines on Information to be contained in Environmental Impact Statements*' (EPA, 2022). This study aims to assess the baseline heritage environment, to evaluate the likely effects and impacts that the proposed development may have on this environment and to recommend mitigation measures in accordance with the policies and guidelines of the Dept. of Housing, Local Government & Heritage (DoHLGH), Limerick City & County Council (LCCC) and relevant legislation and best practice.

This chapter addresses Cultural Heritage under various headings:

- Archaeology,
- Architectural/ Built Heritage
- Industrial Heritage
- Navigation & Riverine Heritage
- Intangible Cultural Heritage

In accordance with EPA guidelines, the context, character, significance and sensitivity of each heritage asset, was evaluated. The significance of the impact is then determined by consideration of the significance of the asset and the predicted magnitude of impact. The assessment has been carried out according to best practice and guidelines relating to archaeological and architectural heritage assessment.

This chapter quantifies any potential direct and/or indirect significant effects relating to cultural heritage. It identifies the measures required to avoid, reduce and mitigate likely significant effects and assesses any residual effects that remain following implementation of mitigation. Identification of effects and prescribed mitigation has been derived following a collaborative approach working with a multi-disciplinary team of specialist consultants. The results of the initial cultural heritage constraints report was used to inform the cultural heritage assessment and informed the design of the proposed development, thereby minimising potential effects on sensitive heritage receptors.

Using the comprehensive assessment of the existing baseline heritage receptors, it has been possible to predict the likely direct and indirect significant effects of the proposed development on cultural heritage and correctly assign significance to various receptors.

Where detrimental effects have been identified, detailed and specific mitigations have been developed. These measures have been incorporated into the proposed development as part of the avoidance and environmental? cultural heritage protection strategy.

The information provided in this EIAR chapter accurately and comprehensively describes the baseline cultural heritage environment; provides an accurate prediction of the likely effects of the proposed project and prescribes mitigation as necessary. The background research, field inspections, mapping analysis and reporting have been undertaken in accordance with the appropriate guidelines as fully described in the methodology section.

12.2 PROJECT DESCRIPTION

12.2.1 Route of Project

The proposed Limerick City Greenway (UL to NTP) will be 4.25km long and will consist of a 3.3km long and 3.0-4.0m wide shared path on existing paths or in green fields (refer to the orange and green lines on Figure 0 1), and 0.9km of separated 1.8m wide footpaths and 1.8-2.0m wide cycle lanes alongside the eastern and western sides of University Road and McLaughlan Road (refer to the blue lines on Figure 0 1). The proposed Greenway will extend between the River Goody bridge and Plassey Park Road.

The proposed route is located along the southern bank of the River Shannon within the grounds of the University of Limerick, and IDA lands. The route is partially located within the Lower River Shannon SAC, interspersed with pockets of alluvial woodland along its banks. Refer to Figure 12-1.

The proposed Greenway path will be located along existing tarmac and gravel pathways and through a greenfield area. Details of construction access routes and site compounds are provided in Chapter 4 and are assessed in Section 12.12 of this chapter.

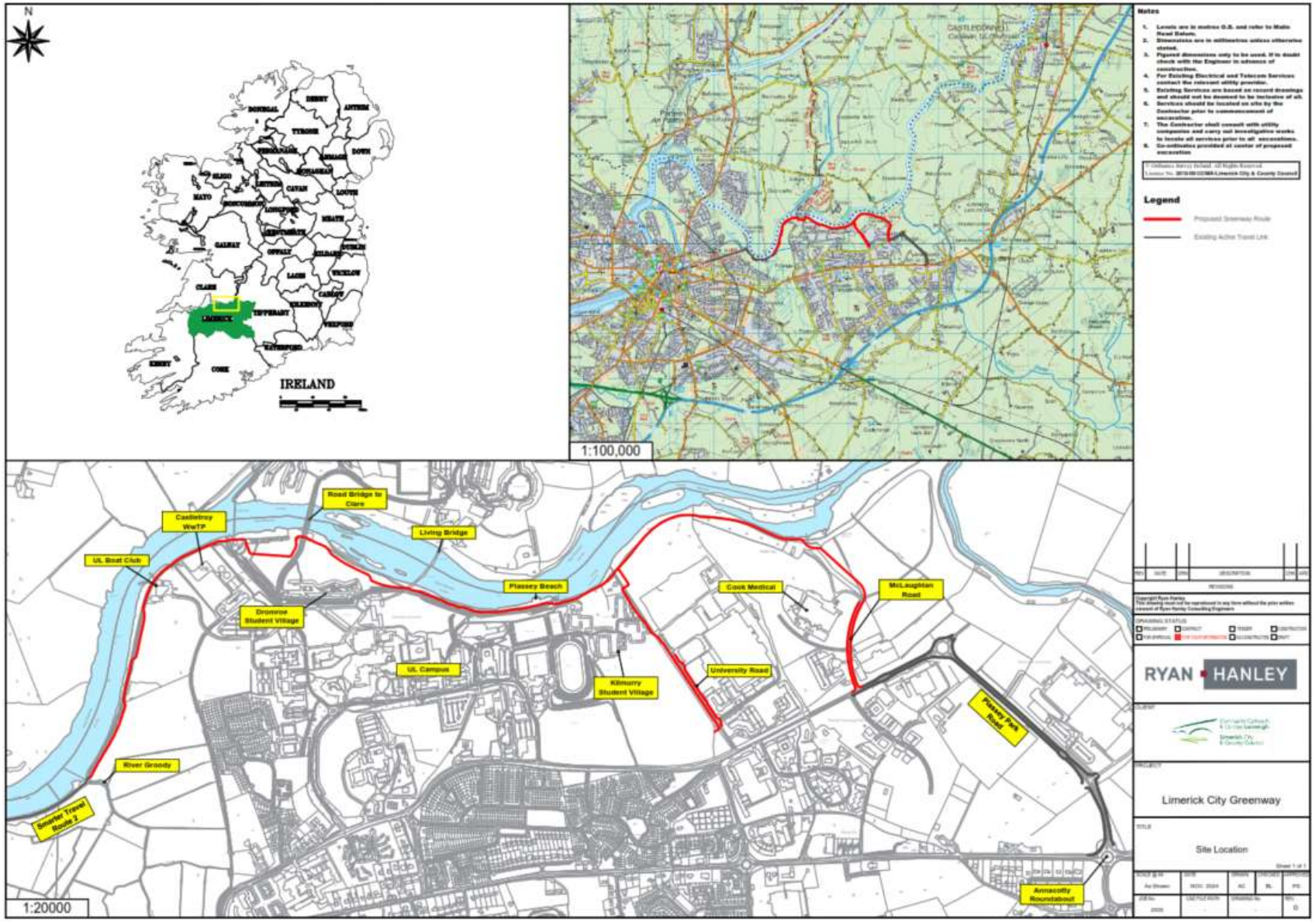


Figure 12-1: Route Location Map

12.2.1.6 Development Context

The proposed Limerick City Greenway (UL to NTP) forms part of an Active Travel Route running alongside the River Shannon and the City Canal, connecting Castletroy to the City Centre Colbert Station Transport Hub via the National Technology Park (NTP) at Plassey and the University of Limerick (UL), as outlined in the Limerick Shannon Metropolitan Area Transport Strategy (LSMATS). It will extend from the already constructed Limerick Smarter Travel, Route 2, which involved the upgrade of an existing pathway, 1.5km in length between University of Limerick and the Guinness Bridge along the bank of the River Shannon, which connects directly to the city centre.

12.2.1.7 Defining the Project Boundaries

The project boundary is approximately 8m wide along the 4.25km length but this width is subject to the river edge, the Plassey Mill Race stream, mature trees, existing structures and fences, embankments, and road verges. All construction works will take place within this boundary. The temporary boundary for the project also includes four construction compounds, one temporary working area, and temporary haul routes to link between the public/private roads, the compound areas, and the working areas. The temporary haul routes, working area, and construction compounds will be removed following construction of the Greenway, and the ground will be reinstated.

12.2.1.8 Proposed Works

The proposed works for the Limerick City Greenway (UL to NTP) will comprise the following:

- Site investigation;
- Site clearance (tree removal and earthworks);
- Set up of temporary site compounds, haul routes, and working areas;
- Construction of temporary access roads;
- Traffic management;
- Relocation of existing utilities/services;
- Construction of proposed Greenway path;
- Construction of new bridges and culvert crossings;
- Construction of concrete retaining wall;
- Construction of disabled access ramp;
- Construction of drainage infrastructure (open drains and culverts);
- Installation of Public Lighting;
- Installation of wooden and metal parapet fencing;
- Interfaces with roads (Toucan lighting, safety barriers, dipped kerbs, and safety barriers);
- Ancillary and amenity (fencing, signage, bike racks, benches etc);
- Landscaping; and,
- Reinstatement works.

Groundwork elements which may impact on the archaeological resource of the area include the construction of upgrades to the existing route, construction in greenfield areas, particularly in the vicinity of recorded archaeological heritage, and ground clearance for installation of construction compounds and access haul roads.

12.3 ASSESSMENT OBJECTIVES & METHODOLOGY

12.3.1 Guidelines Informing Methodology

The methodology used for this assessment is based on the following guidelines:

- Environmental Protection Agency (EPA), 2022, Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- EPA, 2003, Advice Notes on Current Practice in the Preparation of Environmental Impact Statements;
- Department of Arts, Heritage and the Gaeltacht, 2005a, Frameworks and Principles for the Protection of the Archaeological Heritage;
- Policy for the Protection of the Archaeological Heritage (Department of Arts, Heritage, Gaeltacht and the Islands 1999)
- Department of Arts, Heritage and the Gaeltacht, 2005a, Architectural Heritage Guidelines;
- Department of Arts, Heritage and the Gaeltacht 1999 Frameworks and Principles for the Protection of the Archaeological Heritage
- National Roads Authority (NRA), 2005, Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes; and
- National Roads Authority (NRA) 2005, Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes.
- Institute of Archaeologists (IAI) Code of Conduct for Archaeological Assessment Excavation
- *Architectural Heritage Protection: Guidelines for Planning Authorities* published by the Department of Arts, Heritage and the Gaeltacht (2011).
- Archaeology in the Planning Process, OPR and Department of Housing, Local Government and Heritage (2021)This report is presented in two parts:
- The Historical Background of the area, Receiving Environment, summary of statutory protections afforded to the recorded heritage resource and results of the desktop study and fieldwork.
- Assessment of effects and potential impacts of the proposed development on the heritage resources of the area and mitigation measures.

This chapter follows the development of an initial baseline study compiled in June 2020, and site walkover surveys carried out on 14/05/2021 and 4/12/2023 in dry, bright conditions. It assesses the impact potential of the proposed project across three stages:

- Pre-construction phase – Planning, design (including site investigations).
- Construction phase.
- Operational phase.

12.3.2 Desktop Study Methodology

A desktop review of all available published written, cartographic and visual sources pertaining to Archaeological and Built Heritage and relevant to a 100m corridor either side of the proposed development area. The corridor extent has been determined by the nature of the project, a proposed greenway which would be unlikely to have much physical or visual impact outside of the works and as built areas

The principal documentary sources reviewed for this assessment of the known archaeological resource were the Sites and Monuments Register (SMR) and the Record of Monuments and Places (RMP) for County

Limerick. These provide comprehensive lists of the known archaeological sites and monuments. The legislative basis associated with the protection of these site is outlined in section 12.3.5 of this chapter.

The Record of Protected Structures (RPS) and the National Inventory of Architectural Heritage (NIAH) were the main sources referenced for assessing the existing built heritage resource. Additionally, the following sources were consulted:

- Topographical files of the National Museum of Ireland.
- HeritageMaps.ie - a web-based spatial data viewer which focuses on the built, cultural and natural heritage around Ireland and offshore. Layers for all previous excavations in the vicinity, location of find spots, shipwrecks, canals, heritage surveys etc were consulted.
- Cartographic Sources The detail on cartographic sources can indicate past settlement and land use patterns in recent centuries and can also highlight the impact of modern developments and agricultural practices. This information can aid in the identification of the location and extent of unrecorded, or partially levelled, features of archaeological or architectural heritage interest. The cartographic sources examined for the study areas include the 1st, 2nd and 3rd edition of the 6-inch OS maps (surveyed and published in the 1830s-40s) and the 25-inch OS maps (surveyed and published 1887-1913).
- Aerial Imagery – aerial imagery on the Historic Environment Viewer is consulted, as well as various historic aerial imagery on the Ordnance Survey Geohive database, Lidar imagery where available is also consulted through the GSI Open Topographic Data Viewer
- Database of Irish Excavation Reports – The Database of Irish Excavation Reports contains summary accounts of all archaeological excavations carried out in Ireland (North and South) from 1970 to 2014.
- Archaeological Reports compiled for neighbouring developments accessed through Limerick County Council online planning files.
- https://irishwaterwayshistory.com
- Local historical sources relevant to Castletroy and Annacotty area
- Placenames Database of Ireland – The Placenames Branch (Department of Arts, Heritage and the Gaeltacht) provides a comprehensive management system for data, archival records and placenames research conducted by the State. Its primary function is to undertake research in order to establish the correct Irish language forms of the placenames of Ireland and to publish them on a public website (www.logainm.ie).
- Development Plans – The local authority development plan relevant to the study area was consulted as part of this assessment. These plans outline the local authorities' policies for the conservation of the archaeological and architectural heritage resource and include the Record of Protected Structures (RPS) and any designated 2017-2030 (ACAs). The relevant plan to the area under assessment is the Limerick County Development Plan 2022-2028.
- In addition to the gathering of comprehensive baseline information, a site visit and walkover was undertaken on the 15th March and 4th December 2023, in order to determine if any previously unidentified cultural heritage assets existed within the scheme area, and to assess the current condition of known heritage assets. Site visit also evaluated potential interactions between proposed development and receiving environment.

In accordance with best practice as outlined in the EPA 2022 Guidelines all the following elements have been carefully considered and documented in compiling this report

- Cultural Heritage

- Archaeology
- Known archaeological monuments
- Areas of archaeological potential (including unknown archaeology)
- Underwater archaeology
- Architectural heritage
- Designated architectural heritage
- Other significant architectural heritage
- Folklore and history
- Designations or sensitivities

Cultural heritage' is a broad term that now has come to include a wide range of tangible and intangible cultural considerations that are bound up in cultural memory and associations, belief, traditions, past knowledge, traditional and arcane practices, craft and building skills, and the oral tradition of local populations. It encompasses aspects of archaeology, architecture, history, landscape and garden design, folklore and tradition and topography.

For example, cultural heritage can be expressed in physical ways as:

- Settlements
- Designed landscapes
- Natural resources of economic value (e.g. mining sites, quarries, caves, mills weirs, fish passes etc.)
- Buildings & structures (outside of NIAH and RPS)
- Infrastructural features (coach roads, military roads etc.).

and it is also expressed in non-physical ways, for example:

- in folklore
- as inherited tradition (pilgrim paths, pattern day routes, historical county fairs or long-established sporting activities and traditional country pursuits);
- in history/ historical events (e.g. battle sites);
- in townland names, placenames and language.

By identifying and articulating these sensitive values they may be considered, respected and protected in the context of change in the future. Any items of interest made known by local inhabitants during the course of site work was duly considered, recorded and assessed in the impact assessment. Site work was augmented by an examination of local publications and historic map sources, namely Ordnance Survey six-inch maps, and previous archaeological reports relating to the industrial heritage.

Information gathered from these sources were incorporated into a GIS (Geographical Information System) database and plotted in relation to the proposed Greenway, allowing a preliminary evaluation of the potential impacts on identified cultural heritage assets that may arise as a result of the scheme.

12.3.3 Field Inspection Methodology

The primary purpose of a field inspection is to assess local topography in order to identify any potential low-visibility archaeological and/or historical sites that are not currently recorded, and which may be impacted upon negatively by the proposed development.

It is also the purpose of the field inspection to survey any known monuments or sites and to consider the relationship between them and the surrounding landscape, all of which need to be considered during the assessment process.

The methodology used during the field inspection involved recording the present land use as well as the existing topography for the entire area comprising the proposed development site. A photographic record and written description were compiled for any known and/or potential sites of archaeological, architectural and/or cultural significance. Field inspections of the assessment area were carried out by John Olney on 14/04/2021, and by Angela Wallace on 15/03/2023 and 04/12/2023.

12.3.4 Identifying Cultural Heritage Receptors

Using the various sources identified within the desktop study in combination with several phases of field inspection and subsequent mapping all Cultural Heritage Receptors identified within the project area were assigned numbers. Built Heritage (BH) features were given project specific numbers, described and tabulated (BH1-BH13). Areas of Archaeological Potential (AAP) were also given project specific numbers, described and tabulated. All identified Built and Archaeological Receptors were subjected to the following:

- Identification of any potential impacts to those Receptors,
- Assessment of the significance of effects resulting from these impacts, and
- Formulation of mitigation measures for adverse effects, and enhancement measures where possible in accordance with EIA and planning requirements

Table 12-1: Baseline Receptors and Dimensions of the study area

Receptor	Study Area
Recorded Archaeological Monuments and National Monuments	Within 100m of the proposed route
Protected Structures and/or their curtilage	Within 100m of the proposed route
Architectural Conservation Areas	Within 100m of the proposed route
Structures Recorded in the NIAH	Within 100m of the proposed route
Unregistered features of Cultural Heritage	Within 100m of the proposed route
Townland Boundaries	Traversed by the proposed development
Areas of Archaeological Potential	Along the area of the route
Previous Excavations	Within 100m of the proposed route
Topographical Files	Within any townland traversed by the route

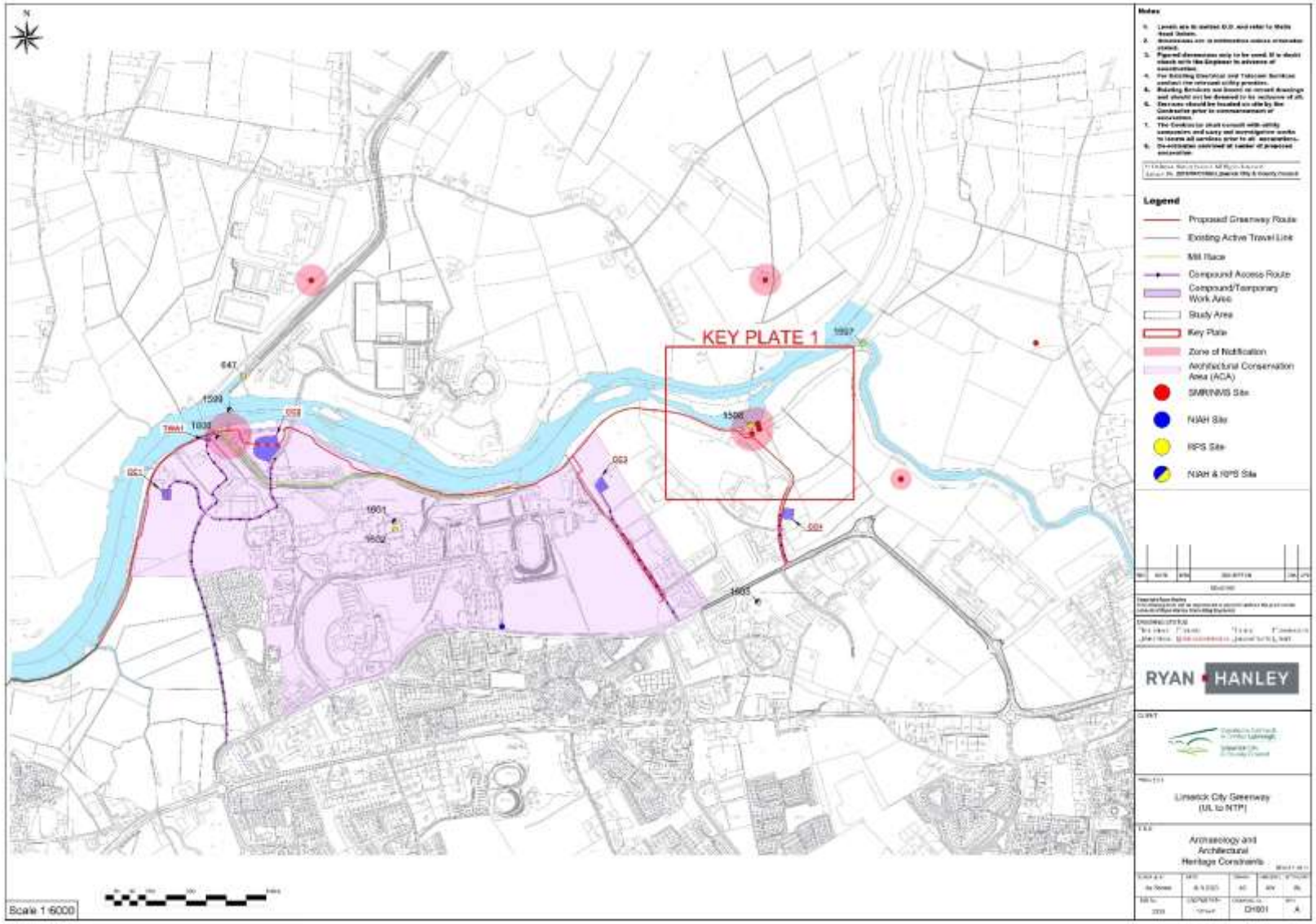


Figure 12-2: Proposed Greenway route in relation to various recorded heritage sites identified in the immediate environs.

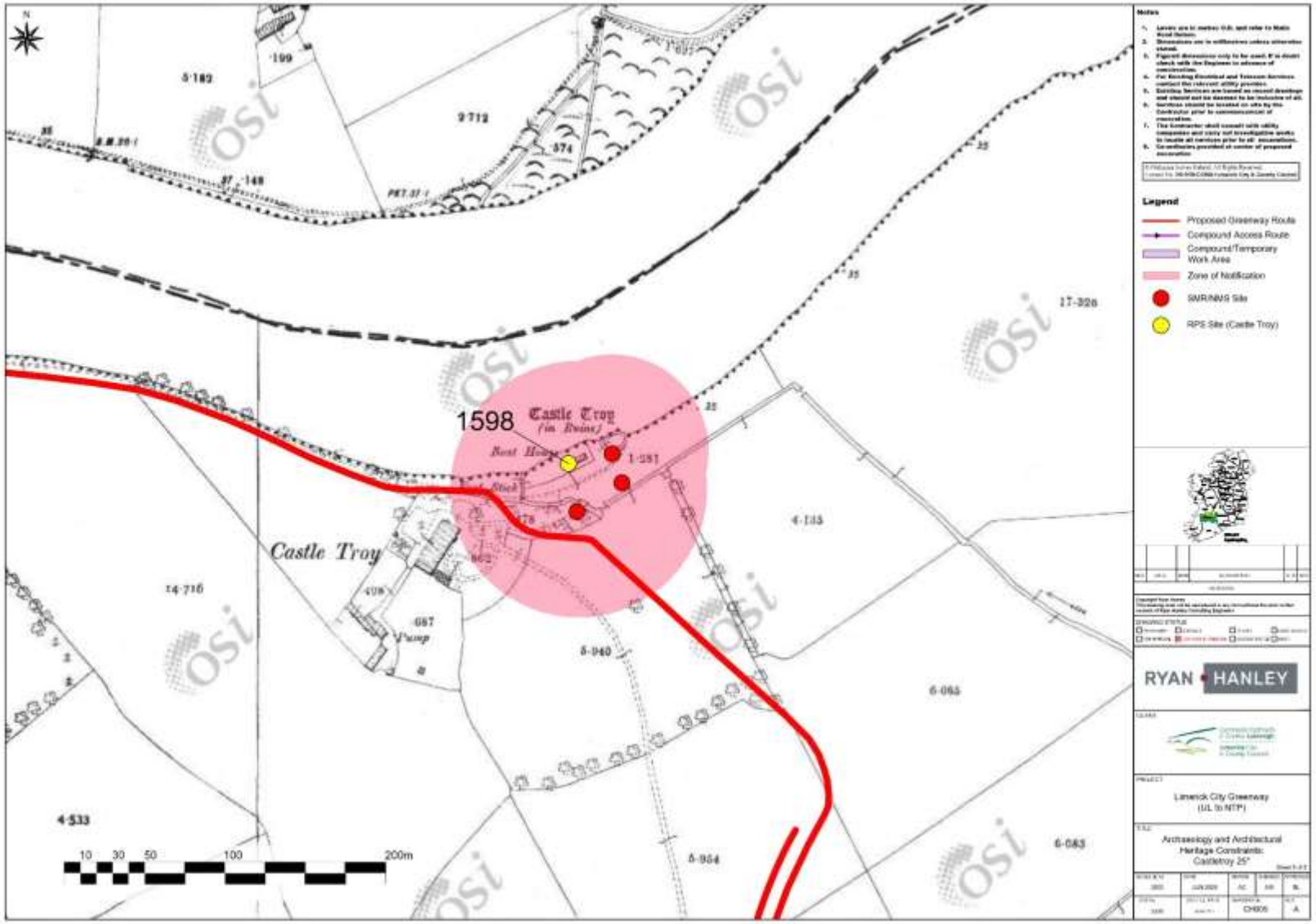


Figure 12-3: Key Plate 1 focus on area around Castle & Bawn at Castletroy

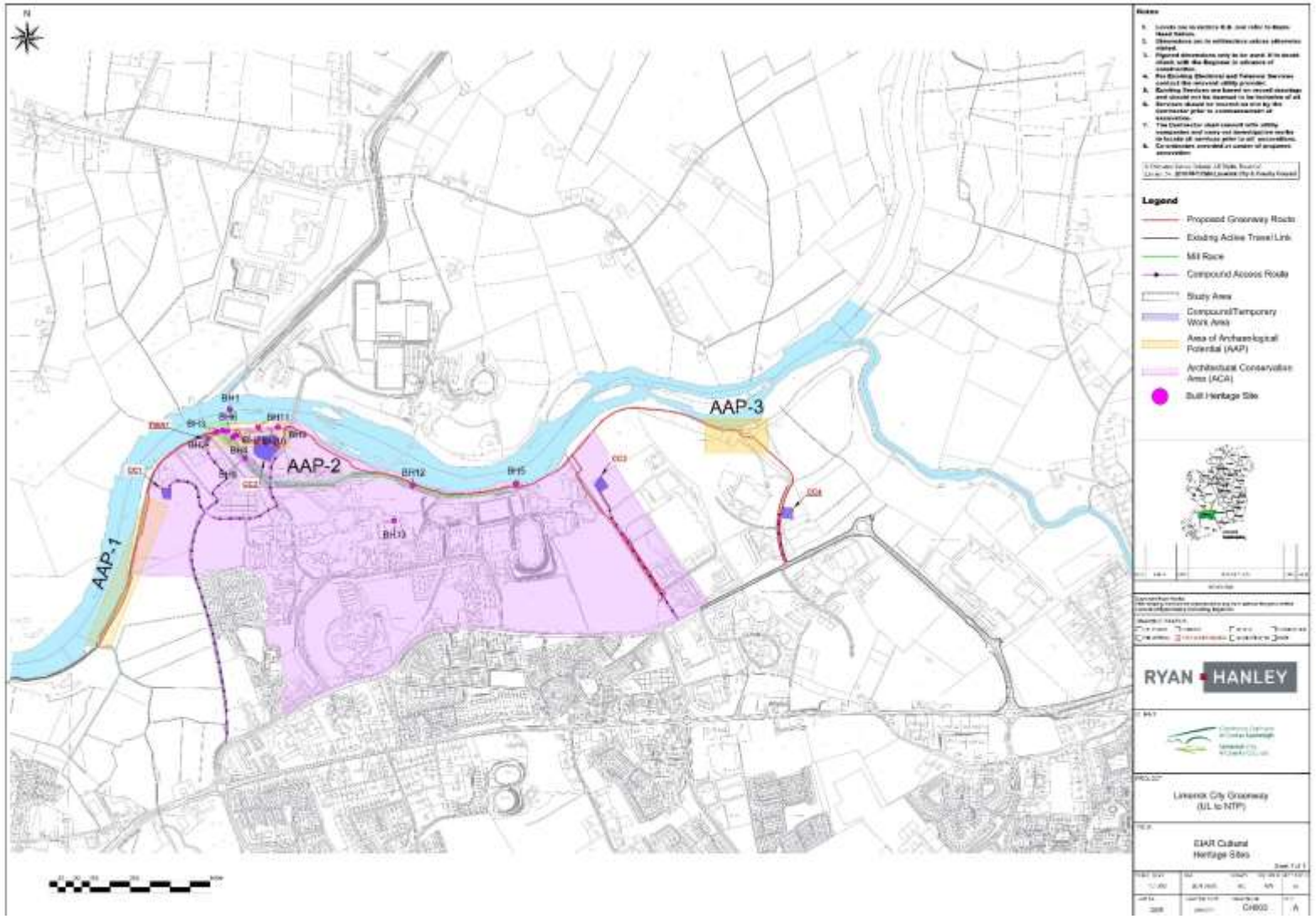


Figure 12-4: Proposed route in relation to various identified heritage receptors. Three distinct Areas of Archaeological Potential (AAP 1-3) and Castletroy Architectural Conservation Area are indicated.

12.3.5 Legislative Background & Statutory Protections

The management and protection of cultural heritage in Ireland is achieved through a framework of international conventions, EU legislation and national laws and policies. This is undertaken in accordance with the provisions of the European Convention on the Protection of the Archaeological Heritage (Valletta Convention of 1992) as ratified by Ireland in 1997. The archaeological resource includes both recorded and unrecorded sub-surface sites and monuments dating from the prehistoric period to modern times.

12.3.6 Archaeology

The National Monuments Acts 1930 to 2004, the Heritage Act 1995 and relevant provisions of the National Cultural Institutions Act 1997 are the primary means of ensuring the satisfactory protection of archaeological remains, which are deemed to include all man-made structures, of whatever form or date, except buildings habitually used for ecclesiastical purposes.

A National Monument is described as 'a monument or the remains of a monument, the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (Section 2, National Monument Act, 1930). Works in relation to a National Monument require Ministerial Consent under Section 14 of the national Monument Act, 1930),

The Record of Monuments and Places (RMP) was established under Section 12 (1) of the National Monuments (Amendment) Act, 1994 and replaced the earlier Sites and Monuments Record (SMR). It comprises of lists and maps of archaeological monuments and relevant places in respect of each county in the State. All sites recorded on the RMP are afforded statutory protection under the National Monuments (Amendment) Act 1994 and any work proposed in the vicinity of such sites requires submission of notification to the Minister of Housing, Local Government & Heritage. A 2-month consultation period follows submission of notification, and the Minister may respond with appropriate mitigation requirements to ensure the protection of the archaeological resource is maintained.

The statutory and administrative framework of development control within zones of archaeological potential or in proximity to recorded monuments has two main elements:

(a) Archaeological preservation and licensing under the National Monuments Acts.

(b) Development plans and planning applications under the Planning Acts.

Currently an archaeological monument is assigned statutory protection in one of four ways:

- It is recorded in the Record of Monuments and Places (RMP).
- It is registered in the Register of Historic Monuments (RHM).
- It is a national monument subject to a preservation order (or temporary preservation order).
- It is a national monument in the ownership or guardianship of the Minister for Culture, Heritage and the Gaeltacht or a Local Authority.

Section 12(1) of the National Monuments (Amendment) Act, 1994 provides that the Minister for Culture, Heritage and the Gaeltacht shall establish and maintain a record of monuments and places where the Minister believes there are monuments, such record to be comprised of a list of monuments and relevant places and a map or maps showing each monument and relevant place in respect to each county of the State. This is referred to as the 'Record of Monuments and Places' (RMP), and monuments entered into it are referred to as 'Recorded Monuments'.

Section 12(3) of the National Monuments (Amendment) Act 1994 provides for the protection of monuments and places in the record, stating that:

"When the owner or occupier (not being the Minister) of a monument or place which has been recorded under subsection (1) of this section or any person proposes to carry out, or to cause or permit the carrying out of, any work at or in relation to such monument or place, he shall give notice in writing of his proposal to carry out the work to the Minister and shall not, except in the case of urgent necessity and with the consent of the Minister, commence work for a period of two months after giving the notice."

RMP designation is the most widely applied provision of the National Monuments Act.

12.3.7 Architectural/Built Heritage

12.3.7.6 Record of Protected Structures

The Heritage Act, (1995) provides protective measures for all heritage buildings owned by a local authority. The Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999, requires the Minister to establish an inventory to be known as the National Inventory of Architectural Heritage (NIAH).

The Planning and Development Acts (2000-2013) affords protection to buildings and groups of buildings, including streetscapes and townscapes, of special architectural, historical, archaeological, artistic, scientific, social or technical interest.

The Planning and Development Act, 2000 as amended (the "2000 Act") requires all Planning Authorities to keep a 'Record of Protected Structures' (RPS). A protected structure is defined in the Local Government (Planning and Development) Act 2000 as any structure or specified part of a structure, which is included in the planning authorities' Record of Protected Structures (RPS).

Section 57 (1) of the 2000 Act states that "…the carrying out of works to a protected structure, or a proposed protected structure, shall be exempted development only if those works would not materially affect the character of (a) the structure, or (b) any element of the structure, which contributes to its special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest.

- **Record of Protected Structures (RPS)**: Planning Authorities must maintain an RPS for structures of special interest (architectural, historical, archaeological, artistic, cultural, scientific, social, or technical). Structures listed in Development Plans as of January 1, 2000, are automatically protected.
- **Protected Structures**: Defined as any structure or part of a structure listed in the RPS. Works on these structures are exempt from needing planning permission only if they do not materially affect the structure's character.
- **Curtilage and Attendant Grounds**: The protected status extends to the land within the curtilage (immediate surroundings) and attendant grounds (associated lands outside the curtilage) of the structure. The attendant grounds of a structure are lands outside the curtilage of the structure but which are associated with the structure and are intrinsic to its function, setting and/or appreciation. The attendant grounds of a country house could include the entire demesne, or pleasure grounds, and any structures or features within it such as follies, plantations, lakes, etc.

The notion of curtilage is not defined by legislation, but according *to Architectural Heritage Protection Guidelines for Planning Authorities* (2004) it can be taken to be the parcel of land immediately associated with that structure and which is (or was) in use for the purpose of the structure.

- **Development Control**: County Development Plans and planning controls under the Planning Acts provide the framework for protecting architectural heritage. Each Development Plan must include policies to protect structures of special interest.
- **National Inventory of Architectural Heritage (NIAH)**: Established to fulfil Ireland's obligations under the Granada Convention, categorizing architectural heritage into Monuments, Groups of Buildings, and Sites. Inclusion in the NIAH does not confer protected status but must be considered for the RPS.
- **Obligations and Powers**: Owners must ensure protected structures are not endangered. Planning Authorities have powers to enforce protection, including requiring works to prevent endangerment, restoring character, or acquiring the structure if necessary.

The National Inventory of Architectural Heritage (NIAH) survey for Limerick was published in 2005 (www.buildingsofireland.ie). Inclusion of a building, structure or feature on the NIAH alone does not confer 'Protected Status'. A planning authority is obliged to consider any buildings rated as being of Regional, National or International importance by the NIAH for inclusion in its Record of Protected Structures and also to give consideration to include structures rated of local importance (Section 2.1.1 of the "*Architectural Heritage Protection: Guidelines for Planning Authorities*" (DAHG 2011).

The obligation to ensure that a Protected Structure or any element of a Protected Structure is not endangered extends to causing harm, decay or damage, whether over a short or long period, through neglect or through direct or indirect means.

The Planning Authority has greater powers under the Planning & Development Act 2000 (As Amended) to enforce the protection of structures entered on the Record of Protected Structures.

These powers are generally only used in exceptional circumstances when all other avenues have failed. The Planning Authority may:

- Require an owner or an occupier of a Protected Structure to carry out works if it considers that the structure is endangered.
- Require an owner or occupier of a Protected Structure to carry out works if it considers that the character of the structure ought to be restored.
- Acquire, by agreement or compulsorily, a Protected Structure if it considers that this is desirable or necessary in relation to the protection of the structure.

Where a Local Authority requires works to be carried out to prevent a Protected Structure from becoming or continuing to be endangered, the owner or occupier concerned may be eligible for a grant through the schemes available for the conservation of Protected Structures.

Works to a Protected Structure

The effect of the designation of Protected Structure status is to ensure that any changes or alterations to the character of the building are carried out in such a way that the existing special character is retained and enhanced.

Therefore, works which would, in the opinion of Limerick City and County Council, have a material effect on the character of the structure require planning permission.

Under the planning system, many minor works to structures do not normally require planning permission. These works are known as exempted development. However, for a protected structure, such works can

be carried out without planning permission only if the works would not affect the character of the structure or any element of the structure that contributes to its special interest.

Depending on the nature of the structure, planning permission could, for example, be required for interior decorating such as plastering or painting previously unpainted exteriors. A Declaration may be sought from the Council to obtain guidance as to the type of works which would or would not materially affect the character of the structure. See below for further information.

Section 57 of the Planning & Development Act 2000 (As Amended), allows for the owner or occupier of a Protected Structure to make a written request to the Planning Authority seeking a declaration as to the type of works which it considers would or would not materially affect the character of the structure or any element of the structure, thereby clarifying which works would be considered exempted development.

12.3.8 Architectural Conservation Areas

The Planning and Development Act, 2000 as amended (the "2000 Act") also provides planning authorities the statutory power to define Architectural Conservation Areas (ACA), which are defined as "*a place, area, group of structures, taking account of building lines and heights, that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or that contributes to the appreciation of a protected structure, and whose character it is an objective of a development plan to preserve*" (Architectural Heritage Protection: Guidelines for Planning Authorities, p.41 and Section 81(1) of the 2000 Act (As Amended).

The aim of designating areas is to protect their special characteristics and distinctive features from inappropriate actions. It is a mechanism, which aims to identify and protect areas of special significance and promote an awareness of this significance.

Buildings falling within the boundaries of an ACA can be both protected structures and non-protected structures. There are certain implications for development within an ACA - protection generally relates to the external appearance of structures and features of the streetscape. It does not prevent internal changes or rearrangements provided that these changes do not impact on the external appearance of the structure.

Generally, any works that may have a potential impact on the exterior would require planning permission, such as changes to the original roofing material, windows, boundary walls, etc. The aim of ACA designation is not to prevent development, rather to guide sensitive, good quality development, which will enhance both the historical character of the area and the amenity of those who enjoy it.

For the purposes of this project the only ACA which may be impacted is the area within the Castletroy Architectural Conservation Area.

For the purposes of this report, the definition of "Cultural Heritage" is derived from the "*UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage*" (1972), ratified by Ireland in 1991, which considers the following to be cultural heritage:

- Monuments: architectural works, works of monumental sculpture and painting elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal value from the point of view of history, art or science;

- Groups of buildings: groups of separate or connected buildings which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science;
- Sites: works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view.

12.3.9 Consultation with Statutory Authorities

12.3.9.6 Archaeology

Once it was identified certain areas of the scheme were likely to impact on Zones of Notification around Recorded Archaeological Monuments contact was made with the relevant parties. During the initial compilation of this report contact was made via email on 6th March 2023 to the National Monuments Service around proposals near Castletroy Castle. Response indicated NMS were happy to delegate communication on this project to LCCC Archaeologist if she has already been advising on it.

Emails outlining sensitive archaeological areas along the route were sent to LCCC Archaeologist Sarah McCutcheon on 24th February 2023 and on 1st March 2023 a follow up phone call was arranged. Once route was further refined further communication in the form of a draft table of effects and impacts on Archaeological Heritage were submitted to LCCC Archaeologist in September 2024. Feedback was received and incorporated within recommendations and mitigation measures. Location of proposed construction compound at Rivers townland was revised as a result to avoid impacts on potential sub-surface archaeology identified in pre-development works for Planning Reference LCCC 21309999 and ABP 307014 (Licence 17E0450)

LCCC Archaeologist also requested consideration was given to extending the route to incorporate the area around Castletroy Castle. It is not currently feasible to extend the route to this location, but this can be considered for incorporation into other greenway projects.

12.3.9.7 Built Heritage

Once it was determined the settings of various items on the Record of Protected Structures and the Castletroy Architectural Conservation Area or ACA were likely to be impacted contact was initiated with LCCC Architectural Conservation Officer. An on-site meeting was held between the consultant's design engineer, archaeologist and LCCC Architectural Conservation Officer Tom Cassidy at the outset of the project to discuss Plassey Mills complex and various built heritage elements on the proposed route. Follow up communication was arranged as the scheme design was refined. A detailed table of all Built Heritage items likely to be impacted during the works was submitted to new LCCC Architectural Conservation Officer Shona O'Keefe in August 2024. Detailed feedback was received and incorporated into recommendations and mitigation measures for the project.

12.4 Receiving Archaeological Environment

The landscape in which this project is proposed comprises a primarily riverine environment located primarily along the southern bank of the River Shannon, and along University Road and McLaughlan Road. Refer to Chapter 11 Landscape & Visual Impact for full description.

The receiving archaeological environment contains evidence of human activity and settlement from at least the Bronze Age and the River Shannon has been a primary thoroughfare and focus of settlement for millennia.

Extant sites of note within the study area include the industrial heritage complex around Plassey Mills which may also represent the possible medieval site of Sreelane Castle (RMP: LI005-0052) and the substantial ruins of the tower house and associated bawn at Castletroy (RMP: LI006-017001- to 017003-).

The topographical files and records of previous archaeological assessments and underwater assessments indicate a rich riverine and terrestrial environment for cultural heritage adjacent to the proposed route.

12.5 Archaeological & Historical Context

The following provides a summary of the main phases of the Irish archaeological record with reference to the study area. The date ranges used are based on those published by the National Monuments Service.

12.5.1 Prehistoric Period

The earliest recorded evidence for human settlement in Ireland dates to the Mesolithic period (7000–4000 BC) when groups of hunter-gatherers arrived on the island. The timber houses built by these Mesolithic settlers do not leave any above ground traces and their presence in an area can often only be identified by the presence of scatters of worked flints in ploughed fields or through the discovery of sub-surface traces of house foundations during excavation works.

To date, no Mesolithic artefacts or cultural material have been found in the vicinity of Greenway's route. Within the wider riverine environment of the Shannon, the internationally significant Mesolithic site at Hermitage outside Castleconnell, approx. 4kms from the project area, was excavated during advance works for the Castleconnell Rising Main. Three cremation pits were excavated together with the remains of a funerary pyre and associated artefacts. These have been dated to approx. 9,500 B.P. and represent an important addition to the very small corpus of Mesolithic burials from Ireland. Not alone are they the oldest burials from the country but they also demonstrate that our earliest hunter-gather ancestors practiced a relatively sophisticated means of disposing of their dead[1]. Much of the evidence for Mesolithic activity in Ireland identified to date has been in close proximity to water. Riverine and coastal environments provided access to the widest range of wild foods and would have facilitated the easiest mode of transport, via dugout canoes, in an otherwise densely wooded landscape.

The Neolithic period (4000-2400 BC) began with the arrival and establishment of agriculture as the principal form of economic subsistence, which resulted in more permanent settlement patterns. As a consequence of the more settled nature of agrarian life, new site-types, such as more substantial rectangular timber houses and various types of megalithic tombs, begin to appear in the archaeological record during this period. While there is archaeological evidence for a widespread settlement pattern within the wider region during the Neolithic period, there are no recorded sites or finds from the period within the assessment area.

Metalworking arrived in Ireland with the advent of the Bronze Age period (c. 2400–500 BC). This period was also associated with the construction of new monument types such as standing stones, stone rows, stone circles and fulachta fiadh. The development of new burial practices saw the construction of funerary monuments such as cairns, barrows, boulder burials and cists.

[1] http://irisharchaeology.ie/2013/03/a-mesolithic-cemetery-irelands-oldest-burials/ (accessed 11th March, 2022.

While some communal megalithic monuments, particularly wedge tombs continued to be used, the Bronze Age is characterised by a movement towards single burial and the production of prestige items and weapons, suggesting that society was increasingly stratified and warlike. Several cremations were excavated to the south of the proposed Greenway area in Castletroy.

Fulachta Fiadh, which may consist of crescent shaped grass covered mounds, are composed of burnt and fire cracked stones associated with a pit or trough. They may have functioned as cooking places, sweat-houses or as brewing mash tuns. They are a common site type throughout the country and many more are identified each year. The majority of these sites date from the Bronze Age.

The later first millennium BC and the early centuries AD comprise the Irish Iron Age, which was considered until relatively recently to be the most obscure period in the Irish archaeological record. While there is general agreement that the introduction of an iron technology was a significant factor in the eventual demise of bronze working on a large scale, the how, why and when this came about in Ireland is far from clear. While there is archaeological evidence for a widespread settlement pattern within the wider region during the Bronze Age and Iron Age periods, there are no recorded sites from the period within the assessment area.

12.5.2 Early Medieval Period

This period began with the introduction of Christianity in Ireland and continued up to the arrival of the Anglo-Normans during the 12th-century (c. 400–1169 AD). The establishment of the Irish church was to have profound implications for political, social and economic life and is attested to in the archaeological record by the presence of church sites, associated places for burial and holy wells. The early medieval church sites were morphologically similar to ringforts but are often differentiated by the presence of features such as church buildings, graves, stone crosses and shrines. This period saw the emergence of the first phases of urbanisation around the large monasteries and the Hiberno-Norse ports. However, the dominant settlement pattern of the period continued to be rural-based in sites such as ringforts, which comprise roughly circular enclosures delimited by earthen banks formed of material thrown up from the construction of the external ditch or ditches. Ringforts are one of the most common monuments in the Irish landscape with up to 60,000 examples in the country, most dating to between 550-900AD. The early medieval terms for these sites (rath/lios/dun) still form some of the most common place-name elements in the country. Archaeological excavations indicate that the majority of ringforts were early medieval farmsteads with internal timber buildings and were often surrounded by associated field systems.

Most of the Castletroy area is in the medieval civil parish of Kilmurry. Many of the surviving archaeological monuments are enclosures, which are likely to date from early medieval period. The medieval past of the Castletroy area is represented through such buildings as New Castle and Castle Troy, which gives its name to the area.

12.5.3 Late Medieval Period

The arrival and conquest of large parts of Ireland by the Anglo-Normans in the late 12th-century broadly marks the advent of the Irish late medieval period, which continued up until the beginning of the post-medieval period in c.1550. Within the late medieval period, towns, markets and fairs were established and change and reforms attempted in the Irish church. By the 15th century, the native Irish chieftains and lords began to establish tower houses and smaller castles as centres of territorial control. Towns which had been first established by the Vikings, such as Limerick, were expanded and new towns and villages developed.

The mill at Sreelane – Plassey Mills may have been built on the site of an earlier mill dating to this period as illustrated in Figure 12-5. The tower house at Castletroy likely dates to the 15th -century and another example of this site type was recorded at Sreelane in the Down Survey of 1654-56, although its precise location is now unknown.

12.5.4 Post Medieval to Modern Era

12.5.4.6 Cartographic Sources

The detail on historic cartographic sources can indicate past settlement and land use patterns over centuries and can also highlight the impacts of modern development and agricultural practices. This information can be an aid in the identification of the location and extent of unrecorded or levelled features of archaeological or vernacular heritage interest.

A comparison of the OS maps can also sometimes provide stark evidence of the effects of the famine in the 19th -century, particularly in rural areas.

Where available, the Ordnance Survey letters, compiled as the first map survey was in progress in the mid-19th century, can be a valuable source of information on local heritage.

The cartographic sources consulted for this study include the Down Survey of 1654-56, 1st edition Ordnance Survey 6" map (surveyed in 1840/41; published 1842), the 2nd edition 25" OS map (Surveyed 1897 – 1903; published 1903) and available revisions of same. Additionally, the Engineering Collection of drawings relating to the development and maintenance of Ireland's waterways was consulted as part of this assessment[2].

Of note on the Down Survey excerpt (Figure 12-5) is the presence of a mill and fortified house or castle at Sreelane. The mill was a pre-cursor to the development of Plassey Mills and it is thought the castle may have been removed during landscaping works within the Plassey estate in the 18th -century. An extant fragment of battered wall to the east of the Fisherman's Cottages at Plassey Bank may represent a surviving element of that structure but this cannot be verified.

[2] https://archive.waterwaysireland.org/collections/5/engineering-collection

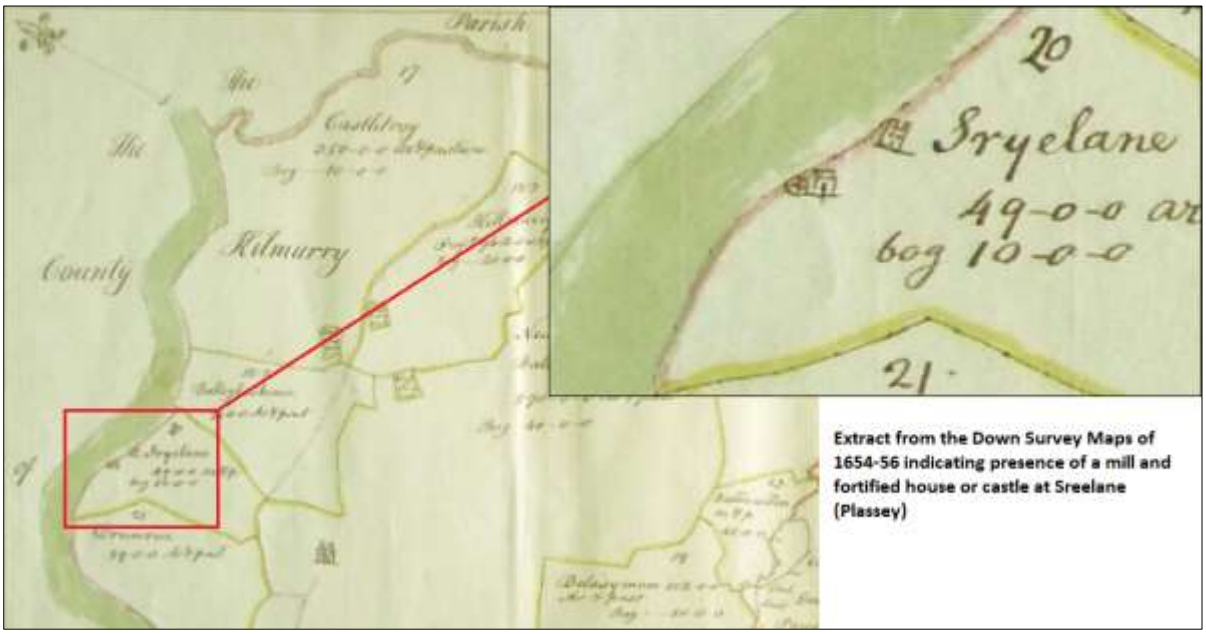


Figure 12-5: Extract from the post-Cromwellian invasion Down Survey of 1654-56

12.5.4.7 Demesne Landscapes and Historic Gardens

Demesne landscapes and historic gardens appear as shaded areas on the OSI first edition mapping. This assessment consulted OSI first edition mapping and the NIAH Garden Survey to evaluate all demesne landscapes and historic gardens within 100m of the proposed corridor development.

In the 18th and 19th centuries, the rolling farmland formed parkland for the houses of landed gentry and merchant families. Several named properties with surrounding landscape elements are depicted within the townlands of Castletroy, Newcastle, and Sreelane on the Ordnance Survey Historic maps.

Castletroy House is shown c.100m south-west of Castle Troy Castle (In Ruins), small gardens are shown and linked pathways towards the castle, a nearby pump and Boat House are also shown. A tree lined avenue or driveway is depicted extending c.600m to the west towards the Mulkear River.

Further west is Roselawn House which has very elaborately laid out gardens, a tree lined driveway and Gate House depicted. Willow Bank House is located further west again and is located east of the townland boundary between Castletroy and Newcastle. This has some surrounding pathways and small garden/orchard and outbuildings depicted.

Plassy House is the townland of Sreelane is located at the western end of the proposed greenway and 100m south of the river edge. This is the most substantial house and demesne shown within the immediate area of the project. Elaborate formal laid out gardens are shown to the south of the property, an Ice House is shown 200m to the north west near the edge of the Mill Race.

A laneway can be seen extending to the west of the house which then veers south along the edge of Sreelane townland boundary where it is depicted as tree lined, with a gate lodge located at its terminus where it meets the townland boundary with Newcastle. Milford House, gardens and gate lodge are located within the south-east area of Sreelane townland. Refer to Figure 12-6.

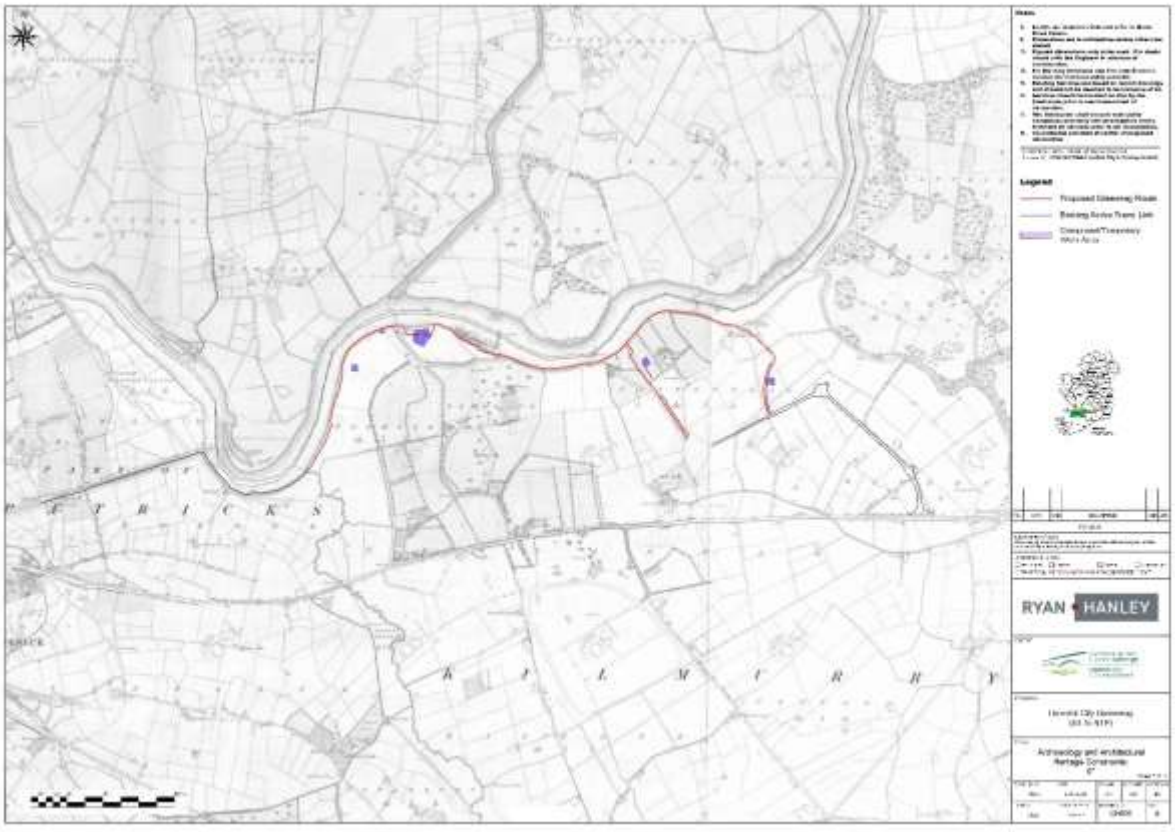


Figure 12-6: Extract from 1st edition OS 6" map surveyed in 1840/41, illustrating demesne landscapes in the study area.

12.5.4.8 Riverine Heritage

The project area is a riverine environment with alluvial woodland and open greenfield areas. Rivers have historically provided transport, food resources, and mechanisms for industry, such as milling. Previous archaeological works in the River Shannon have uncovered boat timbers and Roman coins. The industrial heritage includes mill infrastructure and buildings like millraces, bridges, and weirs, contributing to the area's visual aesthetics.

A review of the relevant historic OS maps illustrates that the natural and built landscape within the proposed riverside development corridor has changed little in the last 180 years. A riverside pathway is evident on the 25" OS map (Figure 12-7) and this may have been in part a tow-path associated with the supply of goods to markets in Limerick City and of grain to the local milling industry. The wider landscape has changed considerably with the development of University of Limerick around Plassey House and estate and the development of Castletroy.

There are two eel fisheries (weirs) recorded in the Shannon close to the project area which may be medieval in origin and were in use until at the least the mid-19th -century. Additionally, rivers have excellent preservative qualities for organic material due to their low aerobic conditions and archaeological evidence for past movement of people is frequently encountered in the form of boats, jetties, harbours and fish-traps dating from the Neolithic to Modern Periods (c.4000 BC to date).

Rivers and streams running through the terrain provided power for various milling industries. Plassey Mills are located along the edge of the river 700m north-west of Plassey House. An extensive mill race is

shown extending 200m south-east/north-west and then veering roughly east for a further distance of c.700m or more before it rejoins the river.

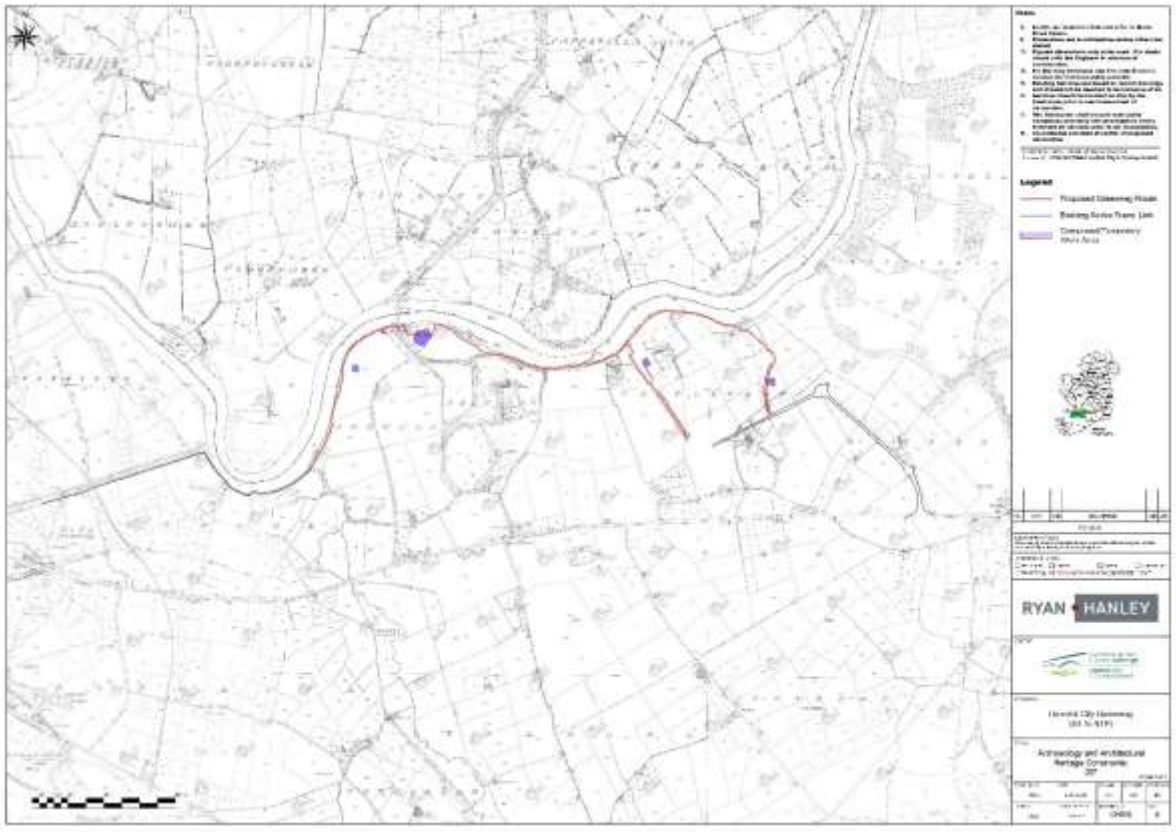


Figure 12-7: Extract from 2nd edition 25" OS map (Surveyed 1897 – 1903), illustrating demesne landscapes in the study area.

River Shannon Navigation at Plassey/Newcastle/Castletroy

There are two canals either side of the Shannon near Plassey Mills, directly on the opposite side of the river, adjacent to the River Blackwater the Killaloe or Plassey Erina Canal extends north-east up towards Cloonlara. The Park Canal is located c.1.3km south-east of Plassey Mills on the southern side of the river and linked the River Shannon with the Abbey River.

The Limerick Navigation project was proposed as a means of transporting goods and people safely on the Shannon River to and from the port of Limerick. Its purpose was described as connecting the western part of Ireland with Dublin and giving the opportunity for trade and emigration to Liverpool and onwards. The history of the canal is chequered and seems to have been beset by problems from the beginning according to documentation from the time. While the Limerick section was the first to be completed, the section from the cutting below O'Brien's Bridge to Plassey was problematic and the whole project took years to complete.

An excellent account of the history of navigation on this section of the river is provided on the website for Irish Waterways History[3]:

Jacques-Louis de Bougrenet de la Tocnaye wrote in 1797:

The Shannon is not navigable, properly speaking, above Limerick; its course is thereafter often interrupted by rocks and cascades through which a plank could hardly pass in safety. To make navigation possible there have been cut, lately, certain canals making connection between those parts of the river which are deep enough for boats.

The Limerick Navigation Company was set up in 1767, the first traffic was not until 1799, and that was only ten boats, carrying 15–20 tons each of non-urgent cargoes including corn, slate and turf. No towing-path was provided at first; boats were man-hauled on the Park Canal (as it is now called) and sailed, rowed or poled on the river sections.

The Park Canal was constructed in 1757-1758, linking the River Shannon with the Abbey River. In its heyday it was an invaluable transport system for heavy goods, particularly Guinness from the former Guinness warehouse close to Lock Quay. The goods were transported from Limerick to Shannon, and from there to Dublin via the Grand Canal. It took four days for the goods to reach Dublin, which was considered an ideal time for the Guinness to mellow. With the modernisation of transport and the building of the hydroelectric power station at Ardnacrusha in 1929, the canal soon became defunct and fell into disrepair.

The difficulty of crossing the Shannon at Plassey was recognised. It seems that John Brownrigg, engineer to the Directors-General of Inland Navigation, had considered laying a chain across the river so that crews could haul their boats over; Francis Trench, in a report in 1805, did not consider this a satisfactory solution, but he did praise Brownrigg for having turned the course of the River Blackwater (which joins the Shannon alongside the Plassey–Errina Canal) so that it no longer created shoals at the entrance to the canal. The OSI map of 1840 shows some buoys in the river; they may have been used in getting boats across the river.

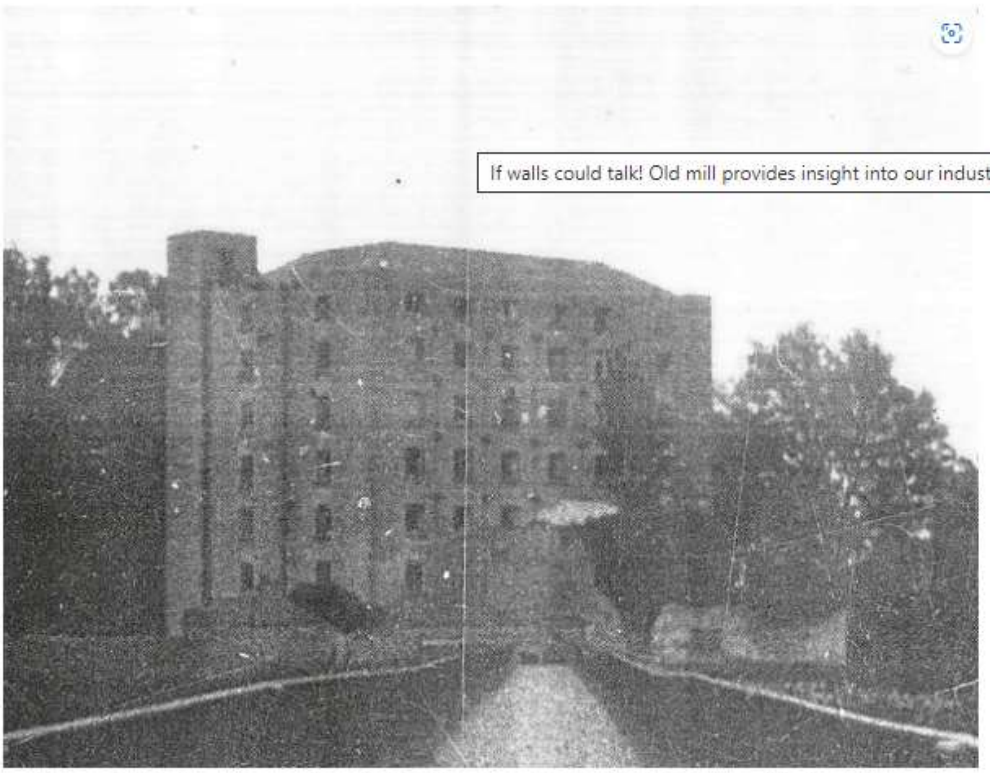
12.5.4.9 Plassey Mills

Much of the surviving built heritage relates to Plassey Mills and navigation on the Shannon. The Plassey Millrace, weirs, lock, and original millrace bridge structures fall under the RPS designation ref; 1600 in the NIAH.

Plassey Mill, located on the Shannon's banks north of Limerick, was built between 1823 and 1824 by the Hedges-Maunsell family. The reliable water source was a primary consideration for its location. In the mid-19th century, Richard Russell modernized the mill, making it one of the Shannon's most significant mills.

In February 1841 the mill was ravaged by a fire, it was owned by the Harveys at the time, but this was soon repaired and the mill passed through the hands of the likes of Reuben Harvey and Richard Russell. Richard Russell was of the son of John Norris Russell who operated the Lock Mill, and he operated the Plassey Mill from 1857. It had fallen into disuse by the late nineteenth century. The mill stood derelict for many years until 1957 when all but the corner tower were demolished.

[3] https://archive.waterwaysireland.org/collections/5/engineering-collection



Passey Mills viewed from the Black Bridge (pre-1957) | PICTURE: Limerick Local Studies

Figure 12-8: Image of Plassey Mills pre-1957

Contemporary photographs of the mill show a large building of at least six bays and six storeys with a tall stair tower at the north-corner[4]. The remains lie immediately adjacent to Plassey Bridge opposite the entrance to the Errina section of the Limerick Killaloe navigation. It is constructed of squared limestone rubble with red brick inclusions. The west wall of the tower has been demolished and the remains of the stone spiral staircase are visible.

The millrace constructed to power the site was long and wide in order to make the most of the 3 metre (10 ft) drop in the river between Bohogue and Drominveg (Rynne 1999, 3). For most of its length it runs through the grounds of the University of Limerick and is faced in well-cut stone where it re-enters the Shannon below the mill.

Previous excavation work was carried out by Flor Hurley in 2006 on the pump house linked to Plassey Mills. This work was carried out under Licence No.06E1138 for Planning Ref 06/1260 on behalf of Plassey Campus Developments Ltd.

The floodplain of the river forms a level riverside meadow in Dromroe and Sreelane with the millrace from Plassey Mill separating the site from the remainder of Sreelane to the north. The River Shannon forms several large meanders in this general area. There is a network of footpaths along by the millrace and the river. This forms the Plassey Bank, a popular walking amenity along the river bank. It developed from the towpath used by horses and men pulling barges along the river from the 1820s. A metal

[4] If walls could talk! Old mill provides insight into our industrial heritage of Limerick city - Limerick Live (limerickleader.ie) Accessed 03/10/2024

footbridge, Plassey Bridge known locally as the Black Bridge near the mill allows people to cross the Shannon into Clare.

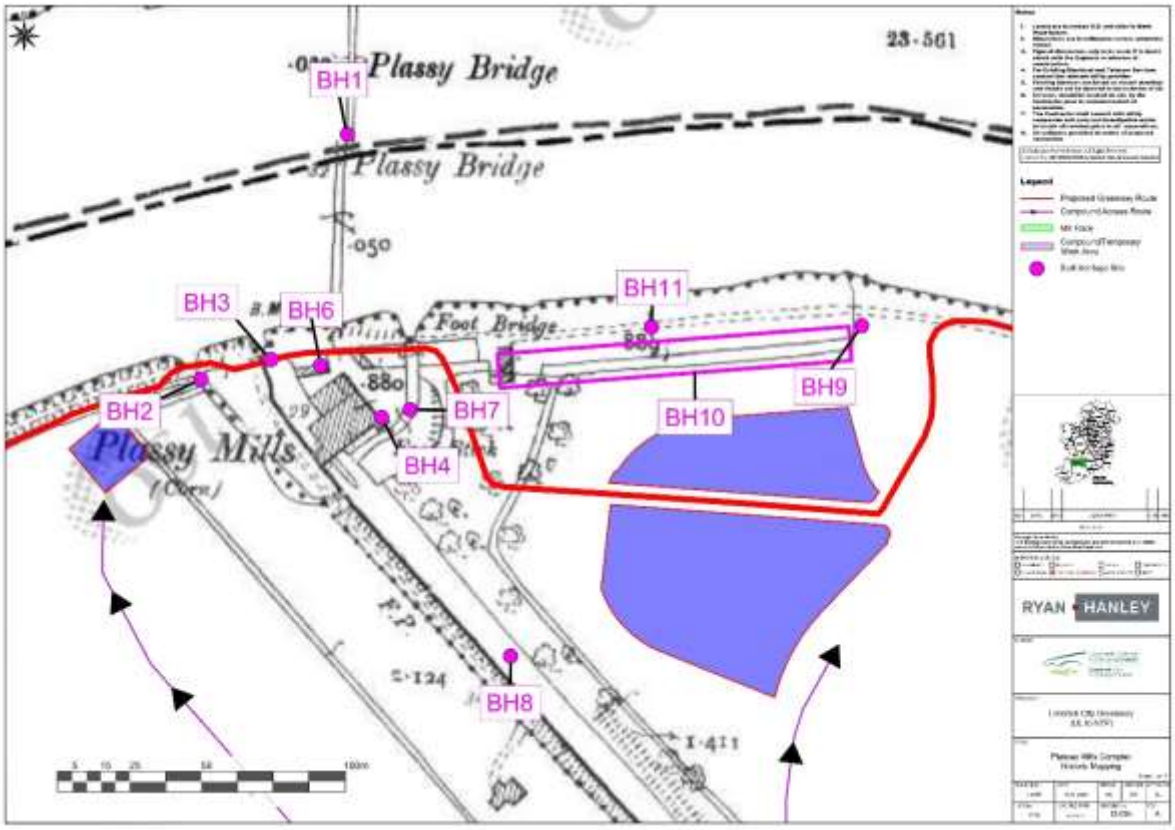


Figure 12-9: Extract from 2nd edition 25" OS map (Surveyed 1897 – 1903), illustrating Plassey Mills Complex (Built Heritage or BH No.'s have been allocated at various locations where route crosses the complex – refer to Section 12.10 for descriptions of each Built Heritage receptor here).

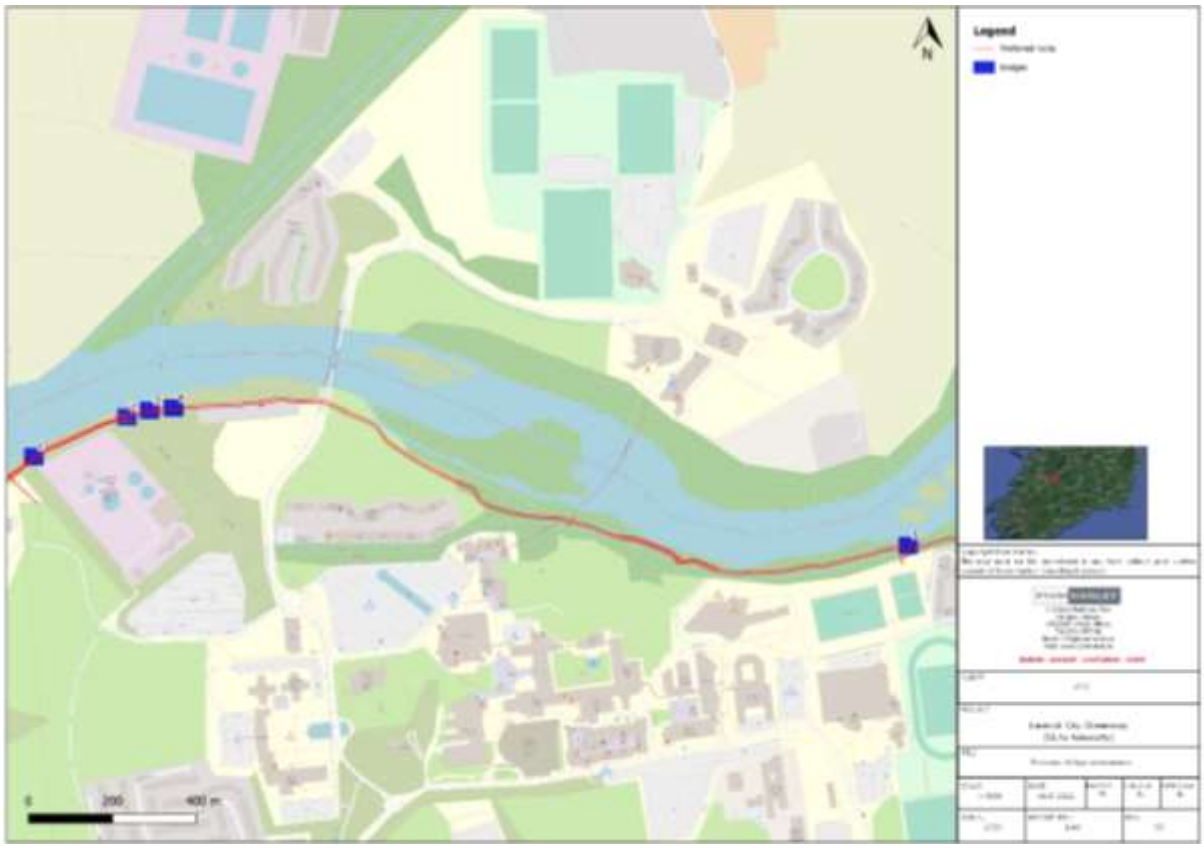


Figure 12-10: Overview of assessment area with proposed bridge/deck replacements indicated

12.5.4.10 Topographical Dictionary of Ireland

Samuel Lewis' *Topographical Dictionary of Ireland* was published in 1837 and describes the island of Ireland as he witnessed it in his travels. He describes the parish of Kilmurray, in which the proposed development is located, thus:

"…KILMURRY, a parish, in the county of the city of LIMERICK, and province of MUNSTER, 2- miles (E.) from Limerick, on the southern bank of the Shannon ; containing 1803 inhabitants. It comprises 3277 statute acres, as applotted under the tithe act, besides 14- acres of glebe and about 35 acres of bog. The soil is very fertile, and the land is mostly meadow or pasture, and is well planted near the Shannon. Limestone is quarried at Newcastle and other places in the parish. There are a paper and an oil mill at Ballyclough, a paper-mill at Annacotty, and flour-mills at Ballysimon. The prin-cipal seats are Newcastle, the residence of M. O'Brien, Esq. ; Plassy, of R. Harvey, Esq. ; Milford, of T. Fitzgerald, Esq. ; Shannon View, of T. Kelly, Esq. ; Willow Bank, of Capt. Hickey ; Shannon Cottage, of G. McKern, Esq. ; Killonan Cottage, of H. Rose, Esq. ; and Bally clough, of P. Cudmore, Esq. ….On the banks of the Shannon, boldly situated on a basaltic rock, are the ruins of Castle Troy, which was erected by Dermot O'Brien in the reign of Hen. III. ; above it is a modern gazebo, and not far distant are the ruins of the ancient church of Killonan or Killowen…."

12.6 ARCHAEOLOGICAL INVENTORY

There are 11 previously recorded individual monuments/areas of archaeological sensitivity located within a 100m corridor in the immediate vicinity of the proposed project, as listed in Table 12-2. These monuments are listed in the RMP for Co. Limerick and their locations are illustrated in Figure 12-12.

Table 12-2: Recorded Monuments within a 100m corridor of the proposed project

RMP No.	Site Type	Townland	ITM	Distance from Development	Potential Impact (Direct/Indirect)
LI006-17003	Gateway	Castletroy	562730, 658617	15m north	Potential direct negative impact if mitigation measures not implemented
LI006-17002	Bawn	Castletroy	562757, 658634	30-70m north	Potential direct negative impact if mitigation measures not implemented Impact
LI006-17001	Castle-Tower House	Castletroy	562751, 658652	70m north	No Impact
LI005-116	Medieval Water Mill	Sreelane		0-50m Exact location unknown. Located between Plassey House & Mills	Potential direct negative impact if mitigation measures not implemented
LI005-052	Castle-Tower House	Sreelane		0-50m No physical evidence. Same as above	Potential direct negative impact if mitigation measures not implemented

A check was carried out on whether there are any monuments with Preservation Orders in the environs, none were identified[5], checks were also carried out to identify if there are any National Monuments in the environs of the route, none were identified.[6]

The following abbreviations/codes are used in relation to

Table 12-3.

- **RMP No:** Individual number assigned to site in the Record of Monuments and Places and afforded statutory protection under the National Monuments Act 1930-2014. Each is assigned

[5] https://www.archaeology.ie/sites/default/files/media/publications/po19v1-all-counties.pdf

[6] https://www.archaeology.ie/sites/default/files/media/pdf/monuments-in-state-care-limerick.pdf

a Zone of Archaeological Notification (ZoN) within which any works must be notified to the Department of Housing, Local Government & Heritage.

- **ITM:** International Transverse Mercator Grid Reference (centre point of monument).
- **Class & Description:** Brief synopsis of the archaeological site type as listed in the RMP.

Table 12-3:Archaeological Inventory: Sites & Monuments listed in the RMP within the Study Area

RMP/RPS No(s)	Townland/s	Centred on ITM Easting	Centred on ITM Northing
RMP: LI006-017001- (Castle) **RPS:** 1597	CASTLETROY	562750	658653
Classification & Description			
Castle – Tower House The castle of Caladh an Treoigh [Castletroy] stands on the S bank of the River Shannon and was described by Westropp (1906-7, 86) as following; '1197 H. Troy was first provost of Limerick; the family is often named. T. Troy, bailiff of Limerick, witnessed Edm. Wyndebald's will, 1361 (Arthur MSS., Len. 62). 1583 W. Bourke held Vill of Castlellane Trylane, C[astle]. of Callatroo (Des. R., 37, Peyton 257). 1610 Held by Mac Keough of Clonkeen, and 1655 the ruined C[astle], eel weir, &c, of Callahintroy, by Lord Brittas (C.S. xxix., p. 8). 1666 Granted to Duke of York. 1688 Shown as standing in the Shannon (Trustees' Map, 22). 1703 Sold to Hollow Blades Company'. The 1654-56 Civil Survey of Limerick recorded that in 1640 Theobald Lord Baron of Brittas was the proprietor in 'Callaghltroy' of a 'ruined castle an orchard & an Eele weare upon it' (Simington 1938, 465). The castle standing on the S bank of the River Shannon is depicted on the late 17th century map Hibernia Delineatio. Castle described in 1840 as following; 'In the townland of Castle-Troy on the southern bank of the Shannon there is a castle which gave name to the townland. Its east and north sides are in tolerable preservation, but the other two are nearly destroyed, only ten feet [3m] of the west and six feet [1.8m] of the south wall remaining. It measures on the inside thirty one feet six inches [9.6m] by twenty one feet two inches [6.45m], and the walls are seven feet six inches thick [2.3m] and the sides, which are perfect, about seventy feet [21.3m] in height, and contain windows for five floors (stories)' (OSL Kilmurry parish). Castle remains described by Salter (2004, 78) as following; 'The 18m high east end of this 10.4m wide tower of the MacKeoughs of Glenkeen [Clonkeen] is built out as a prow containing the spiral staircase with a tier of sizeable vaulted rooms behind it, whilst other passages and small rooms lay over the SE facing entrance doorway. The result is a very rare five-sided building with a greatest length of 16.5m. The SE corner has an angle-loop at second storey level and corbels for a bartizan containing a chamber at fourth storey level. The main part of the tower further west contained rooms about 6m square, the lowest level being vaulted and the second level having a fireplace on the north, but this part is much ruined by the loss of the SW corner and most of the south wall. On the NW corner this part also had a room in a bartizan at fourth storey level'.			
RMP	Townland/s	Centred on ITM Easting	Centred on ITM Northing
LI006-017002- LI006-017003-	CASTLETROY	562757 562728	658635 658616
Classification & Description			

Bawn & Gate

In 1991 an archaeological survey carried out by Celie O'Rahilly as part of an environmental impact report recorded the possible presence of a levelled bawn defending the castle (LI006-017001-) at Castletroy. The levelled bawn was described by O'Rahilly as following; 'Immediately around the structure [Castle Troy] is raised ground, to the east, south and west, which may be the remains of the bawn. In the adjoining north-south running field boundary, to the east of the bawn is an elaborate gate feature which may relate to an entrance feature although its axis, east-west is at variance with an access to the bawn (Which should be north-south). This consists of two arched walls on either side of the modern gate with rebates into which the gate is fixed by spud stones' (SMR File). This gateway may be related to Castletroy House located 70m to W'.

The 1654-56 Civil Survey of Limerick recorded that in 1640 Theobald Lord Baron of Brittas was the proprietor in 'Callaghltroy' of a 'ruined castle an orchard & an Eele weare upon it' (Simington 1938, 465). The 'orchard' described in the 1654-56 Civil Survey may have been the walled garden or bawn attached to the medieval castle of Castletroy.

RMP	Townland/s	Centred on ITM Easting	Centred on ITM Northing
LI005-052---- Part of RPS: 1600	SREELANE	560778	658610

Classification & Description

Plassey Mills - Possible site of 'Sreelane Castle' as described by Westropp (1906-07)
An Archaeological Impact Statement[7] prepared in 2014 for a related University walk & cycleway route from Sreelane (Plassey Mills) to Limerick City states that:
"LI005-052— (information from Denis Power, ASI)
This was originally classified as a Mill but is now changed to Tower House as this is the location of Sreelane Castle (Westropp 1906-7, p86 no 31) which had the number LI005-060---- and was an 'unlocated' castle. A note in the file states that the mill includes some features of a tower house."
This is not indicated on the Historic Environment Viewer but is marked on the statutory RMP for Limerick – Sheet No. 5 (1997)
https://webservices.archaeology.ie/arcgis/rest/services/NM/RMP/MapServer/0/1035/attachments/993

[7] Archaeological Impact Statement for a City Centre to University walk and cycle route in Limerick City, Coyne, F. (Aegis Archaeology), 2014. Internal ref; 482-06

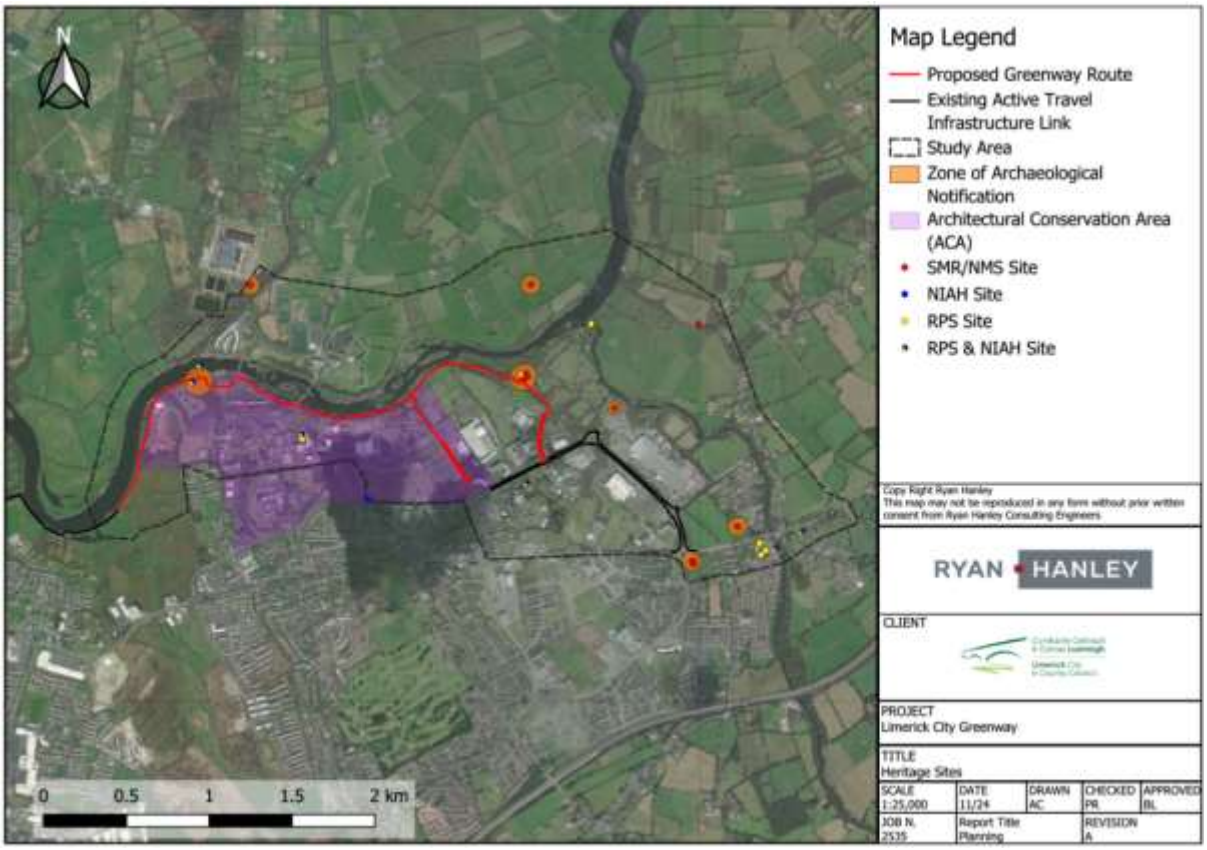


Figure 12-11: Recorded Monuments within the environs of the proposed route

12.7 ARCHAEOLOGICAL ARTEFACTS

Records of the locations and frequency of stray archaeological finds uncovered through farming practices, antiquarian pursuits and chance finds over the past 200 years can give an indication as to the archaeological potential within a geographic area. The National Museum of Ireland maintains paper records and a database of all stray archaeological finds in its possession.

A review of available online and published sources produced three results for townlands within or adjacent to the study area. Of note is the discovery of 2 no. Roman era coins on the southern bank of the Shannon at Sreelane. Details of each find are provided in Table 12-4.

Table 12-4: Stray Archaeological Finds – National Museum of Ireland Files

Find	Description
2no. coins – Roman or contemporary forgeries	Material: Copper. Antoninianus of Tetricus I, 270 - 273 AD. O/ Bust, radiate crowned, with beard, facing r. Edges worn into inscription. Bronze disease on l. half. R/ Bronze disease, edges worn into inscription. Found at Bank of River Shannon at Sreelane, Plassy. Possibly contemporary British forgery.

Find	Description
Ship Timber – Unknown provenance or date	Found during an underwater survey of the River Shannon at Plassey in 2000.
Cross (wood)	NMI ref; 1941:1048

12.8 Previous Archaeological Investigations

The Excavations Database (www.excavations.ie) contains summary accounts of all archaeological excavations carried out in Ireland (North and South) between 1970 and 2018. Additionally, results of excavations conducted in advance of road schemes in the Republic of Ireland are available for review in the TII Digital Heritage Collections. A review of the relevant database entries indicate a total of none previous investigations in areas within a 100m corridor of the route.

Two underwater surveys were carried out along the stretch of the River Shannon adjacent to the proposed greenway. The first was located c.100m east of the Plassey Mills complex near the Water Treatment Plant.

In 2000 an underwater assessment and survey (Licence No.00D0605) was carried out in advance of a new bridge scheme across the Shannon at Plassey over an area c. 30m upstream and c. 30m downstream of the development site. A single item of archaeological interest was observed. It was a ship's timber measuring 1.9m long that was made from the bough and branch of the same tree. It is probably a portion of a stem timber. The timber was an isolated find that would have been washed downstream. It was relocated downstream of the proposed works area. (Brady, N. 2000)

A second dive survey and investigation was carried out in 2006 in advance of a new bridge to the west of Plassey Mill complex. No archaeological or historical features were identified.

A comprehensive survey and excavation (Licence No. 06E1138) of a Pump House was carried out in advance of construction of a new language building on the UL Campus just south of the Plassey Mill Race. Records of this are not currently on the excavations database and information on this project was located through files for Planning Ref: 06/1260 Limerick County Council.

Two previous archaeological assessments were carried out in the immediate vicinity of O'Haloran Road, Licence No. 03E180 by Avril Hayes and no archaeology was found. A second assessment under Licence No. 02E1787 in the vicinity of SMR05:34 ZAP for a holy well and a possible burial ground, SMR 5:3401-02 identified 8 pits, 5 with cremated bone and 2 with Bronze Age Pottery c.150m SW of O'Haloran Road.

Table 12-5: Relevant licenced archaeological excavations listed within a 100m corridor of the route

Ref.	Type	Status	ITM	License Holder	Distance from Scheme
00D0605	Underwater Assessment	Ship Timber identified	560599 658560	Location of moved timber not available	Within river channel adjacent to area of scheme

Ref.	Type	Status	ITM	License Holder	Distance from Scheme
06D042	Underwater Assessment	No Archaeology	561690, 658551	Eoghan Kieran	Within river channel adjacent to area of Scheme
06E1138	Excavation	Excavation of Pump House linked to Plassey Mill Race	561193, 658418	Flor Hurley	c.100m south of scheme
03E1801	Testing SMR05:17	No Archaeology	561960, 658551	Avril Hayes	Within Area of Scheme (line of O'Haloran Road)
98E0539	Vicinity SMR06:19 Enclosure	No Archaeology	563528, 658089	C.McCutcheon	c.100m NE of scheme (footprint of Johnson & Johnson site)
02E1787	Vicinity SMR05:34 ZAP for a holy well and a possible burial ground, SMR 5:3401-02	8 pits, 5 with cremated bone and 2 with Bronze Age Pottery	562516, 658324	Avril Hayes	c.150m SW of O'Haloran Road

12.9 Toponomy/ Placename Review

Townlands are the smallest unit of land division in the Irish landscape and many represent early Gaelic territorial boundaries and ancient land practices that pre-date the Anglo-Norman conquest. Others are a direct reflection of Anglo-Norman and later influences from the 12th-century onwards. The boundaries and nomenclature of the Irish townlands were recorded and standardised by the Ordnance Survey in the 19th-century. The Irish roots of townland names often refer to natural topographical features but some name elements may also be an indicator of past human activity in an area; e.g. dun, lios or rath indicate the presence of a ringfort while temple, saggart, termon or kill record an association with a church site.

The names of a number of the townlands within the study area indicate past land-use and ownership. Interestingly, the placename '*Castletroy*' is unlikely to relate to the tower house in that townland and is more likely to refer to a jetty or harbour on the southern bank of the River Shannon. 6 provides details for the townlands within the assessment area.

Table 12-6: Placename Details

PLACENAME	ORIGINAL/ COLLOQUIAL	MEANING	DERIVATION
DROMROE	AN DROM RUA	'The Red Ridge'	Descriptive of geology/vegetation.
SREELANE	SRAOILLEÁN	Meaning uncertain but likely relates to 'Sreath Leathan' – 'A Broad Mill-Race'	Descriptive of past industry/land-use.
CASTLETROY	CALADH AN TREOIGH/ CALADH UÍ THROIGHTHIGH	The riverside meadow/jetty of An Treoch/O'Trehy (from Anglo-Norman surname '*De Troye*')	May relate to a ferry operated in the area by a member of the Troy family. 12th century references to Troy as 1st provost of Limerick and between then and 15th century there were 21 individual Troys who held the office of Mayor or Sherriff of Limerick.
NEWCASTLE	AN CAISLEÁN NUA	-	After Newcastle Clanwilliam (1583)

12.9.1 Townland Boundaries

The route crosses the townland boundaries of Dromroe and Sreelane. The mill race linked to Plassey Mills (west of the mill) defines the townland boundary at this location. Mitigation measures at this location include recording and conservation of any historic masonry linked to the mill race and bridge. The route also crosses the boundary between Sreelane and Newcastle townlands, the boundary on historic maps was defined by the eastern edge of the grounds of Plassey House and planting was evident. This boundary is no longer in existence due to the development of the UL Campus here. The same is the case for the boundary between Newcastle and Castletroy, this area has been developed as part of the Plassey Business Campus.

12.10 Built Heritage

12.10.1 Record of Protected Structures

Protecting architectural heritage is a function of the planning authority through its Development Plan and the primary means of achieving this is to include a Record of Protected Structures (RPS) for the functional area within the plan. When considering proposals for works to a protected structure or proposed protected structure, local authorities have regard to the Architectural Heritage Protection Guidelines for Planning Authorities 2004 (DEHLG) and the Architectural Heritage Protection for Places of Public Worship Guidelines for Planning Authorities 2003 (DEHLG) which set out best practice conservation principles.

A planning authority is obliged to consider for inclusion in its Record of Protected Structures any buildings rated as being of Regional, National or International importance by the NIAH and give consideration to structures rated of local importance.

The inclusion of a building, feature or structure on the National Inventory of Architectural Heritage alone does not confer 'Protected' status.

A protected structure, unless otherwise stated in the RPS, includes the interior of the structure, land lying within the curtilage, any other structures lying within that curtilage and their interiors, plus all fixtures and features which form a part of the interior or exterior of any of these structures.

A review of the Record of Protected Structures in the LDP and the National Inventory of Architectural Heritage (NIAH) produced four results within the assessment area. Descriptive details of each are provided in Table 12-7.

Table 12-7: Record of Protected Structures and/or NIAH listed structures

RPS No.	NIAH Reg. No	Name	Townland
1599	21900503	Plassey Bridge	SREELANE
Description	Bridge Multiple-arch pedestrian bridge over the River Shannon, built c.1840. Cast-iron handrail, balustrades and stringcourse with scrolled iron consoles. Tapering limestone parapet walls at both ends. Carriageway resurfaced with tarmacadam and preformed concrete pylon supports replacing earlier supports. Appraisal Plassey Bridge is an interesting example of an early nineteenth-century cast-iron and concrete bridge erected by the Shannon Commissioners. It was constructed on the site of the horse ferry which dated to 1830. The current bridge forms a group with the nearby Plassey Mills.		
RPS No.	NIAH Reg. No	Name	Townland
1600	21900504	Plassey Mills	SREELANE
Description	Mill Complex Detached L-plan multiple-bay six-storey former corn mill, built in 1824, with extension to west. Now in ruins. Dressed limestone walls having cast-iron patris plates, limestone quoins and red brick flue. Square-headed window openings with cut limestone label mouldings and sills. Pointed arch window openings to south elevation with limestone hoodmoulding to ground floor opening. Cross loop openings to east and west elevations, having limestone surrounds. Remains of internal round-headed door opening to north elevation with brick voussoirs, now partially blocked up. Cut limestone internal spiral staircase. South elevation partially rebuilt c. 1970. Appraisal These striking remains of Plassey Mills, situated on the banks of the River Shannon, was built by Major Robert Hedges Maunsell and later taken over in the 1830s by the Russell family, who were the most prominent millers in Munster at the time. The mill was rebuilt after a major fire in 1841and further developed over the following decades. The main building was given a faux-fortified appearance with the addition of mock battlements and an armorial plaque, originally from Mungret Gate in Limerick City and bearing the city arms, a dedication to Charles I, Peter Creagh (mayor) and the date 1643, was built into the riverside front of the building. The building was partly demolished by explosives in 1956, in an attempt to make the area safer and the plaque was blown into the river where it likely remains.		

	This large former corn mill was built of high-quality materials, as illustrated by the limestone dressings such as the label and hoodmouldings, quoins and sills. Prominently sited, the mill presents a striking silhouette within the Limerick landscape and forms a group with the nearby Plassey Bridge. The mill continued in use until the early 20th -century but the general decline in milling and increased competition together with a fire and worker dissatisfaction led to it's closure. This mill complex represents an important component of the industrial heritage of Limerick City. All associated features including millrace, sluices, gates, etc. are afforded protection under RPS designation 1600. Also possible site of '*Sreelane Castle' RMP: LI005-052----*:

RPS No.	NIAH Reg. No	Name	Townland
1601	21900505	Plassey House	SREELANE
Description	**Country House** – now part of UL campus Detached L-plan multiple-bay two-storey country house, built c. 1770, comprising three-bay front block with pedimented shallow breakfront having single-storey portico. Rebuilt in the 1870s. Recessed two-bay three-storey block to west with two-bay two-storey extension. Recent extensions to rear. Hipped slate roofs with bracketed eaves course and rendered chimneystacks. Rendered walls having quoins and plinth courses. Square-headed openings to first floor with two-over-two pane timber sliding sash windows, render entablatures, sills and continuous sills course. Those to west block having pedimented architraves. Square-headed openings to ground floor having two-over-two pane timber sliding sash windows with flanking Corinthian style pilasters and render sills. Portico comprising Corinthian style columns supporting entablature with render cornice. Square-headed opening having glazed overlight over half-glazed double-leaf timber panelled doors with flanking sidelights. Ornate cornicing to interior. Appraisal Plassy House, a notable example of a Georgian villa style country house, was rebuilt in the Italianate style. Originally the estate was owned by Robert Clive who renamed it Plassey after his victory in India. He later became Lord Clive of Plassey. The Russell family extended it in the 1860s, the work was purportedly carried out by the architect William Fogarty. The Russells owned the nearby Plassey Mills. Prominently sited close to the River Shannon and within the campus of the University of Limerick, the house forms a pleasing focal point for the surrounding area.		

RPS No.	NIAH Reg. No	Name	Townland
1601 (Part of)	21818001	Plassey House	NEWCASTLE
Description	Demesne walls/gates/railings Forms part of curtilage of Plassey House (RPS: 1601) Pair of painted, square-profile, monolith limestone piers, built c. 1890. Comprising carved rounded caps with recessed panels, recessed panels to piers and acanthus-headed cast-iron railings terminating in carved limestone piers. Appraisal These imposing and ornate gates, formerly an entrance to Plassey House, are well designed and executed. The monolith piers are finely carved, forming a strong focal point, which is		

	complimented by the ornate cast-iron gates with acanthus leaf motifs. They provide important context to the locality and form an attractive roadside feature.

12.10.2 Vernacular Heritage

There is an extensive stock of historic buildings and structures, dating mainly from the 18th, 19th and early 20th centuries, throughout Co. Limerick. These modest cottages, houses, shops, farm complexes, outbuildings, mills, factories and forges were the homes and workplaces of the ordinary people built by local people using local materials and techniques.

While many are not included on the Record of Protected Structures, they are nonetheless of merit, making a positive contribution to the character of the landscape and to the distinctive character of a particular area. Damage to the vernacular building stock occurs through the loss of whole structures but can also be as a result of the gradual erosion of architectural details such as the replacement of roof coverings and windows with modern materials, removal of external render, inappropriate repointing and the addition of unsuitable extensions. Alterations to individual buildings can have a significant and cumulative effect on streetscapes and landscapes.

Within the Greenway's area, a series of fisherman's huts are located on the southern riverbank at Plassey (centred on ITM co-ords 560887E, 658625N). These remain in use and have their origins in the early 20th -century. They represent an important example of the vernacular, built heritage which is unique to the area. A milestone is located at approx. 560909E, 658637N. Erected c.1814, this served as a marker for navigation on the river when the tow-path was in use. It predates the construction of Plassey Bridge when towing horses and goods were transported across the Shannon on a winched raft.

12.10.3 Castletroy Architectural Conservation Area (ACA)

This ACA is identified in the Limerick Development Plan 2022-2028: Volume 3: Architectural Conservation Areas. It is numbered as ACA 9 Castletroy – Dromore.

The Planning and Development Act, 2000 as amended (the "2000 Act") also provides planning authorities the statutory power to define Architectural Conservation Areas (ACA), which are defined as "*a place, area, group of structures, taking account of building lines and heights, that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or that contributes to the appreciation of a protected structure, and whose character it is an objective of a development plan to preserve*" (Architectural Heritage Protection: Guidelines for Planning Authorities, p.41 and Section 81(1) of the 2000 Act (As Amended).

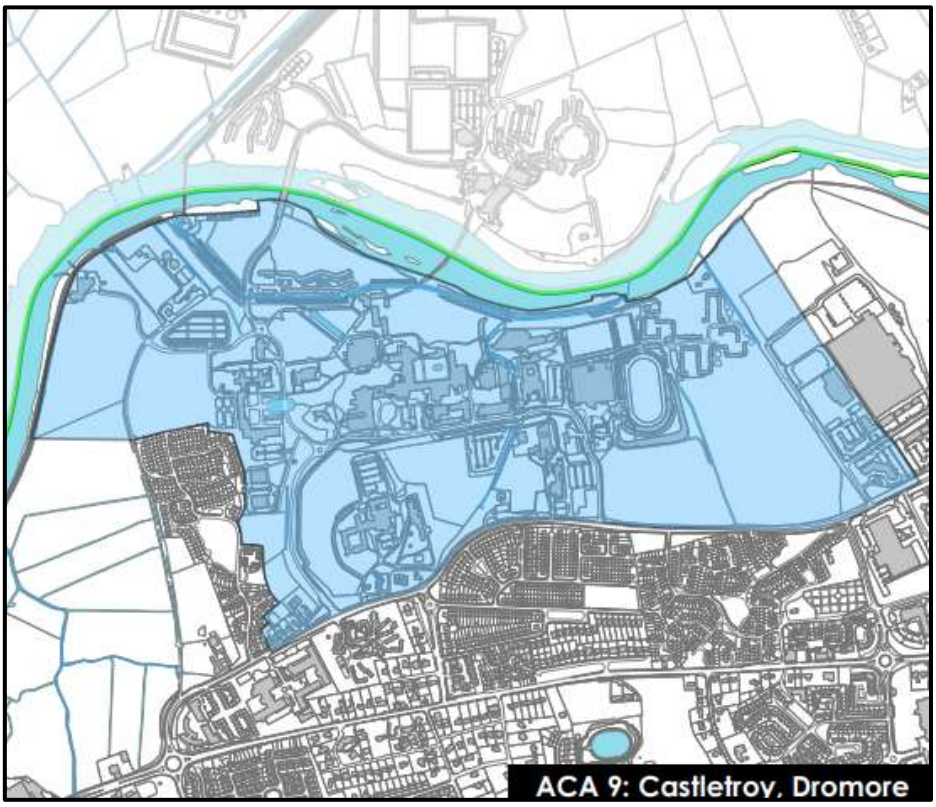


Figure 12-12: Overview of the Castletroy-Dromore Architectural Conservation Area (ACA)

The following characteristics are outlined in the ACA 9 Castletroy – Dromore in the Limerick Development Plan 2022-2028: Volume 3: Architectural Conservation Areas 8

This ACA provides a mix of architectural styles from the classical Georgian Plassey House on the University of Limerick Campus to the many examples of recent contemporary architecture including the Living Bridge, the Medical and Music Schools, the extension to the library and other buildings and public art associated with the University. Proposals for development within the ACA shall:

a) Safeguard the parklands associated with Plassey House in order for the evolved university complex to retain significant tree cover, green areas and vistas down to the River Shannon;
b) Safeguard views out from, or in toward the University's principal buildings;
c) Safeguard elements associated with the historical evolution of the site such as waterways and water control mechanisms such as sluices or pumps;
d) Ensure that the University's setting and amenities are safeguarded from unauthorised works and insensitive developments;
e) Reflect and respect the scale and form of existing structures within the ACA in proportioning, overall scale and use of material and finishes and seek to contribute to or enhance the character of the ACA;
f) Seek to retain/incorporate/replicate exterior features which contribute or enhance the character of the ACA;
g) Ensure priority is given to the pedestrian, to inclusive access, and to facilitate the improvement of the quality of the public realm.

[8] https://www.limerick.ie/sites/default/files/media/documents/2021-06/volume-3-architectural-conservation-areas.pdf Accessed 03/10/2024

12.11 FIELD INSPECTION

Site walkover surveys were carried out in dry, bright conditions on 14/05/2021, 15/3/2023, and 04/12/2023. These involved a walkover and visual inspection of the proposed route and the interaction of same with recorded areas of archaeological sensitivity and built heritage sensitivity. Additionally, previously undeveloped areas were examined for evidence of archaeological potential. The area of the route was divided up into Areas 1-4 commencing with Area 1 at the westernmost end of the route.

Area 1

The westernmost end of the route commences in the townland of Dromroe in the south-west area of the townland, immediately north of point where the Groody River meets the River Shannon. The proposed route in this area is through poorly drained pastureland, along the edge of the River Shannon for approx. 600m.

No evidence for any above ground archaeological or historic features were observed in this area. Given that ground here appears to have had little previous disturbance, location adjacent to the River Shannon and surrounding archaeological and historic sites in the vicinity there is a moderate-high risk of previously unknown subsurface archaeological features in this area and it is considered an Area of Archaeological Potential (AAP1). Advance archaeological test trenching was recommended at this location.

Plate 12-1: Aerial View of AAP1 and location of proposed Archaeological Test Trenches

Area 2

This consists of the area extending from University of Limerick Boat Club to road bridge connecting UL Campus to Thomond Village north of the river. The route along this area is adjacent to the River Shannon also but skirts along the built up area of the University of Limerick campus in the townland of Sreelane. A riverside pathway potentially a former tow-path is located all along the river edge here. This path is evident on the Historic 25" OS map and may have been in part a tow-path associated with the supply of goods to markets in Limerick City and of grain to the local milling industry.

Plate 12-2: Plassey Bridge or 'Black Bridge' (RPS No. 1599). Looking NE

Plate 12-3: Entrance feature onto Plassey Bridge with steel fencing

The wider landscape immediately south of route has changed considerably in the 20th century with the development of University of Limerick campus grounds around Plassey House and estate.

The main area of interest along this section is the Plassey Mills complex NIAH 21900504; RPS No. 1600. The main item recorded on the NIAH database is the upstanding ruined tower, which represents only a

small part of the original building. There are some surrounding masonry walls with various phases of repair and ruins of outbuildings in the immediate environs of surviving tower portion of mill building.

Plate 12-4: Remains of Plassey Mill Building with outbuildings and surrounding wall adjacent to tow path

Plate 12-5: Overgrown Ruins north of Plassey Mill tower and south of tow path.

Plate 12-6: Section of historic wall east of Plassey Mills along existing towpath

The mill is interlinked with a complex network of surrounding channels and contemporary bridges. The Plassey millrace extends over 1.77km from the main inlet control sluice at the east to the tail race outlet to the west of the Mill. For approximately 470m the millrace is contiguous with the River Shannon, following a steep escarpment running westwards through the grounds of Plassey House. It then turns abruptly to the southwest, presumably to maintain the gradient of the channel bed, and some 887m from its main inlet sluice the channel turns to the northwest towards the millworks. The area where mill race traverses the surrounds of Plassey House and current campus has been heavily modified, mill race channel still survives but there is no associated historic masonry walls either side, it has been replaced with new shallower enclosing walls and capstones.

The historic millrace adjacent to the mill building is very overgrown and at time of inspection the channel was dry. Masonry walls are evident through gaps in vegetation. Trees are growing in areas of the channel and root systems are likely impacting on masonry walls of former channel. It is difficult to determine condition and extent of historic masonry at this location.

Plate 12-7: Mill Race immediately east of Plassey Mill tower. Masonry walls either side very overgrown

Plate 12-8: Mill Race immediately east of Plassey Mill tower. Masonry walls either side very overgrown.

Proposed route will cross through this area and may impact on the masonry walls of former channel.

Immediately east of the Plassey Mills complex facing onto the towpath are a series of fisherman's huts, located on the southern riverbank at Plassey (centred on ITM co-ords 560887E, 658625N). These remain

in use and have their origins in the 19th and early 20th -century, cottages are shown on historic Ordnance Survey maps and may originally have been linked with mill complex. They represent an important example of the vernacular, built heritage which is unique to the area. A milestone is located at approx. 560909E, 658637N. Erected c.1814, this served as a marker for navigation on the river when the towpath was in use. It predates the construction of Plassey Bridge when towing horses and goods were transported across the Shannon on a winched raft.

The route will be located to the rear of the Fishermens Huts in a green area, this area may have been subject to previous landscaping during development of UL Campus grounds, however it does not have the appearance of heavy landscaping. Given that there may not have been any previous disturbance at this location and proximity to former location of Sreelane Castle (area is within the Zone of Notification for Zones of Notification for LI005-052 Sreelane Castle (Site of) advance archaeological geophysical survey and test trenching is recommended in this area as its currently accessible for these investigations.

Plate 12-9: Fisherman's Huts at Plassey Bank with Milestone to foreground. Looking SW

Area 3

This covers the area from towpath East of the Fishermens Cottages as far as Bridge 5, this section of the route is contiguous with the main river channel for the River Shannon and incorporates Plassey Beach.

Plate 12-10: Small elongated islands are evident within the River here, in close proximity to the tow path. Masonry evident along the side of this feature and ruins of a shack

Plate 12-11: Several small islets within the river channel adjacent to the tow path

Further to the east where the millrace is parallel to the tow path there is good visibility of the mill race and substantial masonry walls either side of the channel in some sections. The course of the millrace has been preserved but the mill race itself has been heavily modified where it enters the UL Campus grounds.

Plate 12-12: Former historic millrace through UL Campus grounds adjoining historic millrace

Plate 12-13: Historic Mill Race adjacent to tow path to the west of Bridge 5.

Plate 12-14: Mill Race channel and masonry walls adjacent to tow path with Plassey House visible in the background.

Plate 12-15: Mill Race as it passes beneath footbridge into University of Limerick campus. Very shallow here and no evidence for any masonry walls along this section.

Plate 12-16: Mill Race visible to the right adjacent to towpath

Areas 1-3 Bridges linked to Plassey Mills Complex

At the area to the west of Plassey Mills a small humpback bridge (Bridge 2) is evident along the pathway just east of the water treatment plant. The cap stones are missing off the parapet wall on the northern side, large masonry blocks have collapsed into the stream beneath. The southern parapet wall is intact but has considerable vegetation growth. The abutment walls of the bridge also have tree roots and vegetation impacting on the masonry fabric of the structure.

Plate 12-17: Bridge 2 looking East, parapet wall to the south with missing masonry & capstones

Plate 12-18: Bridge 2 from north side showing vegetation around abutment walls

Bridge 3 is located to the east of Bridge 2 and crosses a well-defined mill race with substantial deep walls of fine cut stone masonry either side of the channel. There are curving abutment walls either side to the south of bridge deck. The deck of Bridge 3 itself is a later intervention laid across the mill race channel and resting on the abutment walls. The deck consists of two metal beams (rolled steel joists) which support precast concrete slabs, with an in-situ concrete parapet.

One of the parapets has collapsed into the stream and has been replaced with metal crowd control barrier fencing.-The vegetation on abutment walls is causing some damage to the masonry, the tree roots are having a detrimental impact on the corner of the curving section on the south-east side.

Plate 12-19: Bridge 3 showing vegetation around abutment walls and collapsed parapet

Bridge 5

Plate 12-20: View of Bridge 5 from the east showing deck resting on historic masonry

Plate 12-21: Historic masonry linked to mill dam and entrance to mill race from the main river channel

Plate 12-22: Mill Race channel immediately west of Bridge 5

Area 4

This incorporates the area from Bridge 5 over to Castle Troy Castle ruins. The towpath starts to gradually peter out as route progresses eastwards, it consists mainly of a rough mud track and is further back from the river edge. The track passes through the edge of rough playing pitches and there is vegetation obscuring view of river to the north.

Plate 12-23: Muddy track at the edge of playing pitches going towards Castle Troy ruins

The area where the proposed route passes near Castle Troy complex is quite overgrown with vegetation and it's difficult to identify any archaeological features at ground level without further survey and investigation. The route will not be impacting on immediate environs of castle tower. The tower structure has considerable evidence for anti-social behaviour and vandalism. There have also been some inappropriate modern interventions to the structure. Overall surviving walls are in a reasonably good state of preservation, the tower has some very interesting features and would be worthy of long-term conservation. Given location and historical significance it has the potential to be a strong focal point on any future phases linked to the proposed project.

Plate 12-24: Castletroy Castle Ruins and surrounds

12.12 Assessment of Effects & Impacts

The type, value, quality, extent, probability and significance of impacts on the Archaeological & Built Heritage resources are based on TII *Guidelines for the Assessment of Archaeological/Architectural Heritage Impacts of National Road Schemes* (NRA, 2005, 54/21). These assessment criteria are further supplemented by the EPA Guidance (2022) and presented here under the following headings:

Impact Type which may comprise of:

- ***Direct Impact*** – where a cultural heritage site is physically located within the footprint of the development, which will result in its complete or partial removal.
- ***Indirect Impact*** – where a cultural heritage site or its setting is located in close proximity to the footprint of the development.
- ***No predicted impact*** – where the potential development will not adversely or positively affect a cultural heritage site.

Qualitative Assessment

- ***Negative Impact*** **-** Where a change that will detract from or permanently remove a site of cultural heritage interest from the landscape.
- ***Neutral Impact*** **-** Where a change does not affect the cultural heritage site.
- ***Positive Impact*** **-** Where a change improves or enhances the setting of a site of cultural heritage interest.

A ***significance*** rating for these impacts is then applied; whether profound, significant, moderate, slight, or imperceptible:

- A ***profound*** impact applies where mitigation would be unlikely to remove adverse effects that arise where a cultural heritage site is completely and irreversibly destroyed by a proposed development.
- A ***significant*** impact applies when an impact, by its magnitude, duration or intensity, alters an important aspect of the environment. It applies where part of a cultural heritage site would be permanently impacted upon, leading to a loss of character, integrity and data about the feature/site.
- A ***moderate*** impact applies when a change to a cultural heritage site is proposed that, though noticeable, does not compromise the integrity of the site and which is reversible. This arises where a cultural heritage site can be incorporated into modern day development without damage and where all procedures used to facilitate this are reversible.
- A ***slight*** impact causes changes in the character of the environment which are not significant or profound and do not directly impact or affect a cultural heritage site.
- An ***imperceptible*** impact applies where an impact is capable of measurement but does not carry noticeable consequences.

Duration of Impact

The duration of impacts criteria as employed to assess many elements of environmental impact assessment are not relevant to assessing impacts on the archaeological heritage resource. Any measurable impact on this finite and non-renewable resource must be considered to be permanent, regardless of the duration of that impact. Where the potential for negative impact has been identified, mitigation measures will be employed as set out in Table 12-8 of this chapter.

Duration of impacts are applicable in assessing impacts on the built heritage resource and range from **temporary** to **permanent**.

12.13 Assessment of Impacts, Effects & Mitigation on Identified Cultural Heritage Receptors

All desktop data gathered, and results of field inspection were collated and tables and maps were compiled of all areas of Cultural Heritage where there may be impacts from construction of the route (refer Table 12-8). Effect and Impacts at each individual site have been considered and mitigation measures outlined.

12.13.1 Summary of Construction Phase Effects on Built Heritage Receptors

12.13.1.1 Plassey Mills

The main items of Built Heritage likely to be impacted by the route relate to the various features of the Plassey Mills Complex which have been numbered, items BH2 (Bridge 2); BH3 (bridge 3); BH5 (Bridge

5); BH6 (Block & Masonry Walls at layby area beside Plassey mill tower); BH7 (Mill race overflow channel); BH8 (Main Mill race channel); BH12 (Plassey Beach Section of Mill race).

RPS 1600 is identified as of regional significance on NIAH. In isolation it may not necessarily have significance, however the mill race channel forms an important component to the overall Plassey Mills industrial heritage complex at this location. The complex is also located within an Architectural Conservation Area. It is considered of medium asset value.

If mitigation measures to stablise masonry with no repairs are implemented the likely significant effects on the majority of elements within this complex are as follows: Permanent Neutral Direct Moderate/Significant Effects. Impacts are considered of medium magnitude and significance.

If conservation and masonry repairs are incorporated effects would be Permanent Positive Direct Moderate/Significant Effects. Incorporating interpretive signage and conservation works would be considered a positive impact of high magnitude and significance.

Any risks of collapse or damage to historic masonry would potentially lead to a negative effect.

Figure 12-13: Built Heritage Items identified around Plassey Mills Complex in relation to proposed route and compound areas

Impacts: If appropriate mitigation measures are implemented during construction phase the impacts are assessed as direct impacts of medium magnitude & significance during construction and operation.

Table 12-8: Built Heritage Receptors subject to impacts along the proposed route

Built Heritage			
As designs and materials are refined around all protected structures and works inside the Castletroy ACA further consultation with LCCC Architectural Conservation Officer is required pre-construction phase to ensure all is in keeping with best conservation practice. Areas directly impacted and not approved for masonry repairs will require advance condition assessments and suitable measures to stabilise historic masonry fabric.			
	Description	Legal Status	Mitigation Measures
BH1	Plassey Bridge & Associated Features	NIAH & RPS 1599 Listed Structure & Curtilage has legal protection	Proposed fencing sensitive to bridge design and setting. Fencing to be reversible. Conservation Expertise required.
BH2	Small Bridge & abutment walls over Mill Race west of Plassey Mill Tower	Part of Curtilage of NIAH & RPS 1600 Listed Structure. Structure & Curtilage has legal protection	Masonry repairs in line with conservation best practice. Advance detailed surveys and stabilisation of masonry.
BH3	Small bridge & abutment walls over Mill Race east of Plassey Mill Tower	Part of Curtilage of NIAH & RPS 1600 Listed Structure. Structure & Curtilage has legal protection	Masonry repairs in line with conservation best practice. Advance detailed surveys and stabilisation of masonry
BH4	Plassey Mill Tower	NIAH & RPS Listed Structure 1600 & SMR Zone (refer AAP2) Structure & Curtilage has legal protection	Conservation expertise for proposed fencing along adjacent route to ensure its sensitive to setting. Fencing to be reversible.
BH5	Small Bridge over the start of Mill Race where it adjoined Mill Dam on main River Shannon	Part of Curtilage of NIAH & RPS 1600 Listed Structure. Structure & Curtilage has legal protection.	Masonry repairs approved. All to be completed in line with conservation best practice.
BH6	Outbuilding Ruins & Walls around Plassey Mill Tower	Part of Curtilage of NIAH & RPS Listed Structure 1600 & SMR Zone (refer AAP2) Structure & Curtilage has legal protection	Advance pre-construction surveys & assessment after vegetation removal. Modern block walling has no heritage significance.
BH7	2 Short Sections of Curving Mill Race east of tower, and Small Bridge over channel	Part of Curtilage of NIAH & RPS 1600 Listed Structure & SMR Zone Structure & Curtilage has legal protection	Recommend masonry repairs where feasible in line with conservation best practice.
BH8	Section of Mill Race West of Tower (linked to BH2)	Part of Curtilage of NIAH & RPS Listed Structure 1600 & SMR Zone (refer AAP2) Structure & Curtilage has legal protection	Masonry repairs in line with conservation best practice. Advance detailed surveys and stabilisation of masonry
BH9	Isolated Section of historic wall along tow path	Part of Curtilage of NIAH & RPS 1600 Listed Structure & SMR Zone (refer AAP2) Structure & Curtilage has legal protection	No impact
BH10	Fishermens Cottages	Undesignated Built Heritage - Vernacular Cottages shown in 19th century maps.	No impact
BH11	Milestone along towpath near Fishermens Cottages	Undesignated Built Heritage – Historic Waymarker	No impact

Built Heritage			
BH12	Linear section of mill race adjacent to tow path. Runs along area of Plassey Beach, in front of Plassey House & terminates at Bridge 5 (BH5)	Part of Curtilage of NIAH & RPS 1600 Listed Structure Structure & Curtilage has legal protection	Masonry repairs in line with conservation best practice. Advance detailed surveys and stabilisation of masonry
BH13	Plassey House	NIAH & RPS listed structure.	Visible from the route, no direct impacts. Former demesne features linked to this structure may be uncovered during works. Archaeological Monitoring during works.

Mitigation measures to ensure that construction impacts and effects do not cause masonry collapse will be required. Masonry repairs and conservation of walls in line with conservation best practice[9][10][11][12] is recommended, in the event this cannot be accomodated stabilisation of historic masonry will be required during the works using measures such as temporary propping, temporary boxing of features to be protected, and monitoring of vibrations due to construction activity etc. In the event conservation repairs are not progressed advance vegetation removal at areas where works are to be carried out under archaeological/built heritage supervision and detailed inspections, digital survey and written record to be compiled to ensure preservation by record in the event of any collapse during works.

The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location.

[9] DRAFT Guidance on Repointing Rubble Masonry in Historic Structures 2024 Department of Housing, Local Government and Heritage

[10] Donnelly J. 2010 Ruins: the conservation and repair of masonry ruins

[11] The Royal Institute of the Architects of Ireland 2021 The RIAI Guidelines for the Conservation of Buildings

[12] *Architectural Heritage Protection Guidelines for Planning Authorities* Dept of Arts, Heritage and the Gaeltacht 2011.

Table 12-9: Summary of Impacts and Effects on Built Heritage Receptors during construction phase

Potential Impacts and Effects									
	Effects				Asset Value	Impact			
	Duration	Quality	Type	Significance		Potential	Phase	Magnitude	Significance
BH1: Plassey Bridge NIAH 21900503; RPS 1599	Permanent	Neutral	Indirect	Moderate	Medium	Indirect, potentially negative if fencing is not appropriately designed	Construction	Medium	Medium
BH2: Plassey Mills Curtilage: Bridge 2 NIAH 21900504 RPS1600	Permanent	Neutral	Direct	Moderate/ Significant	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
BH3: Plassey Mills Curtilage: Bridge 3 & Mill Race walls NIAH 21900504 RPS1600	Permanent	Neutral	Direct	Moderate/ Significant	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
BH4: Plassey Mill Tower NIAH 21900504 RPS1600	Permanent	Neutral	Indirect	Moderate/ Significant	Medium	Indirect, potentially negative if fencing is not appropriately designed	Construction	Medium	Medium
BH5: Plassey Mills Curtilage: Bridge 5 NIAH 21900504 RPS1600	Permanent	Positive	Direct	Moderate/ Significant	Medium	Direct positive effect. Removal of later concrete deck & masonry repairs	Construction	Medium	Medium
BH6: Plassey Mills Curtilage: Outbuilding Ruins & Walls around Plassey Mill Tower NIAH 21900504 RPS1600	Permanent	Neutral	Direct	Moderate	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
BH7: Plassey Mills Curtilage: Overflow Mill Race Channel and small bridge East of Tower	Permanent	Neutral	Direct	Moderate/ Significant	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium

Potential Impacts and Effects									
	Effects				Asset Value	Impact			
	Duration	Quality	Type	Significance		Potential	Phase	Magnitude	Significance
Structure. NIAH 21900504 RPS1600									
BH8: Plassey Mills Curtilage: Main Mill Race Channel West of Tower Structure. NIAH 21900504 RPS1600	Permanent	Neutral	Direct	Moderate/ Significant	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
BH9: Isolated Section of historic wall along tow path	Permanent	Neutral	Indirect	Imperceptible	Medium	Neutral effect. Route avoids this area.	Construction	Negligible	Imperceptible
BH10: Undesignated Cultural Heritage Complex of Vernacular Cottages.	Permanent	Neutral	Indirect	Imperceptible	Medium	Neutral effect. Route avoids this area.	Construction	Negligible	Imperceptible
BH11: Milestone Marker. Undesignated Cultural Heritage Feature.	Permanent	Neutral	Indirect	Imperceptible	Medium	Neutral effect. Route avoids this area.	Construction	Negligible	Imperceptible
BH12: Linear section of mill race adjacent to tow path. Contiguous to Plassey Beach, & Plassey House & terminates at Bridge 5	Permanent	Neutral	Direct	Moderate/ Significant	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
BH13: Plassey House NIAH 21900505 RPS1601	Permanent	Neutral	Indirect	Imperceptible	Medium	Neutral effect. Route avoids this area.	Construction	Negligible	Imperceptible

12.13.2 Construction Phase Effects, Impacts and Mitigation Measures for Areas of Archaeological Potential

There are three areas where route will impact within Zones of Notification around Recorded Monuments.

12.13.2.1 Zone of Notification (ZoN) for LI005-052 Sreelane Castle

Advance Archaeological Geophysical Surveys & Archaeological Testing under licence to National Monuments Service recommended to the rear of Fishermens Cottages accessible greenfield area and nearby compound (CC2). All works in this area including Site Investigations will require advance notification to the National Monuments Service under Section 12 of the National Monuments Act. Outcome of this to determine construction phase mitigations.

Effects on the majority of elements within this complex cannot be fully assessed in advance of the mitigation measures, at present effects are evaluated as follows: Permanent Neutral Direct Moderate/Significant Effects. Impacts are considered of medium magnitude and significance.

The **mitigation measures** for this area overlap to some extent with those for the Plassey Mills complex. The vegetation overgrowth around areas of impact and nearby ruins at Plassey Mills makes it difficult to assess if there are any potential traces of medieval masonry at this location. Pre-construction archaeological supervision of vegetation clearance, advance pre-construction surveys & investigations recommended. This will facilitate further assessment and determine if any further mitigation measures are required.

12.13.2.2 Zone of Notification (ZoN) for Castletroy RMP: LI006-017001; LI006-017002 Bawn; LI006-017003 Gateway.

Possible impact on gateway or earthworks associated with the castle. It wasn't possible to access the report referred to in the Historic Environment Viewer Record where it states "In 1991 an archaeological survey carried out by Celie O'Rahilly as part of an environmental impact report recorded the possible presence of a levelled bawn defending the castle (LI006-017001-) at Castletroy". The area where route passes in close proximity to Castletroy Castle is currently covered in dense vegetation making it difficult to determine if there are any earthworks or outlying features linked to the castle complex at this location (see Figs. 12-14 & 12-15 below). This is the most archaeologically sensitive area identified along the route.

Effects are evaluated as follows: Permanent Neutral Direct Moderate/Significant Effects. Impacts are considered of medium magnitude and significance. Effect and impacts cannot be fully assessed until preliminary pre-construction mitigation has taken place.

Mitigation in the form of archaeological supervision of vegetation clearance here and pre-construction advance geophysical/topographical surveys & advance archaeological test trenching under licence to National Monuments Service is recommended 12-18 months before construction phase to allow for any further mitigation required. The area of Construction Compound 4 located c.150m to the south-east (see Fig 12-14 below) should also be included within any advance surveys and text excavations at this location. All works in this area including Site Investigations will require advance notification to the National Monuments Service under Section 12 of the National Monuments Act

Figure 12-14: Zone of Notification (ZoN) for Castletroy RMP: LI006-017001- 003 in relation to proposed route

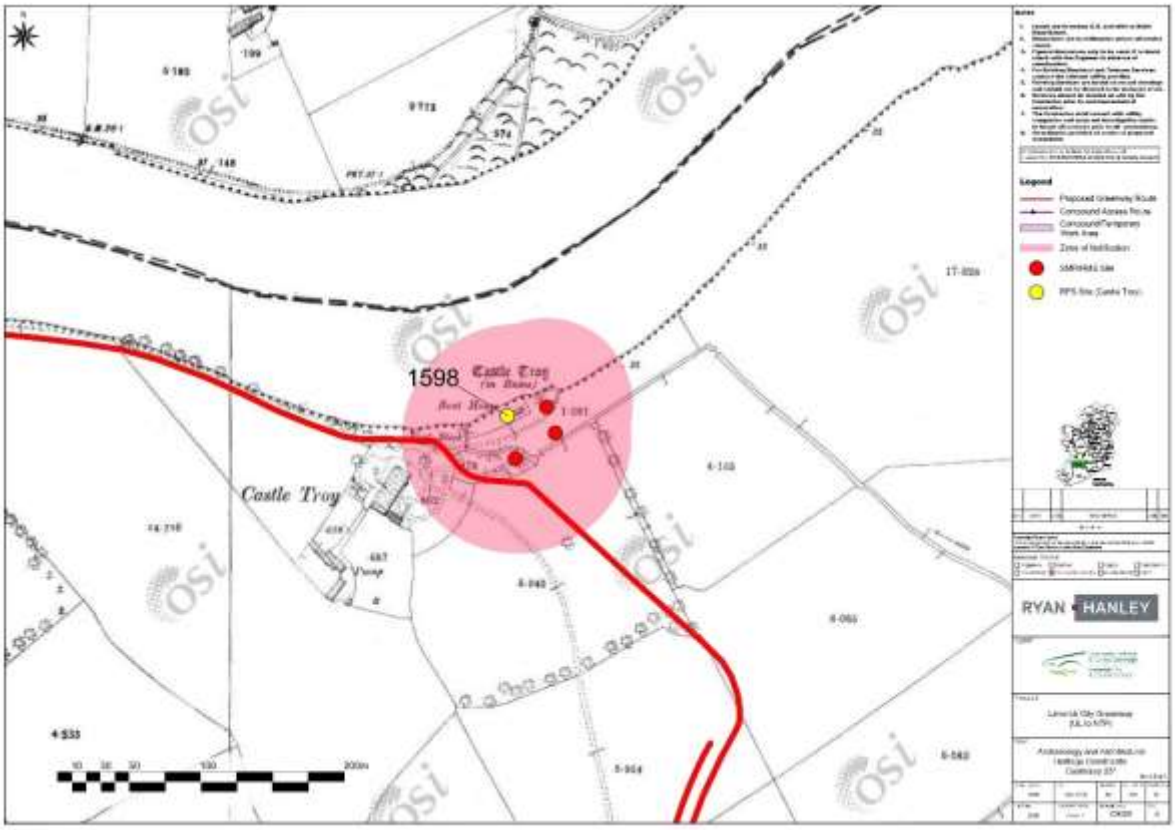


Figure 12-15: Zone of Notification (ZoN) for Castletroy RMP: LI006-017001- 003 on Historic 6 inch map in relation to proposed route

12.13.2.3 Zone of Notification (ZoN) for LI006-063 Enclosure at Rivers townland

This monument is located to the south of the route, all recorded archaeology at this location is sub-surface and has been identified from aerial imagery and several phases of archaeological testing and excavation in advance of nearby road schemes and proposed developments. All archaeological features are located in the northwest corner of a field of rough pasture which slopes from south to north, adjacent to the Annacotty roundabout junction R445 and L1165. Remains consist of an oval-shaped enclosure defined by a ditch identified by Celie O'Rahilly from examination of OSi 1:10,000 aerial photographs (OS 3/9195 taken 13/09/1985) prior to the construction of the Limerick ring road. This monument is not indicated on any edition of the OS maps. No surface remains visible of this extant enclosure site the precise location of which has now been identified by archaeological test trenching (Tobin 2018).

Where the route passes close to this monument all works will be on the verge of the existing road and there is a high likelihood works will be within areas of previously disturbed ground (see Fig. 12-16). Given possible risk of sub-surface archaeology advance pre-construction archaeological testing along the line of the route and monitoring of any site investigation works is recommended.

Effect and impacts cannot be fully assessed until preliminary pre-construction mitigation has taken place.

12.13.2.4 AAP1-3 & Construction Compounds 1-4

Where previously undisturbed areas will be impacted by construction works; advance geophysical surveys, archaeological testing and archaeological monitoring, will ensure that previously unrecorded archaeological deposits are identified, and that appropriate mitigation is employed in advance of and during construction phase. Area all along the river and green field areas throughout the project pose a higher potential for archaeological discoveries. It is recommended licensed archaeological monitoring and metal detecting is undertaken at all these areas during construction phase.

Effect and impacts cannot be fully assessed until preliminary pre-construction mitigation has taken place.

12.13.2.5 Greenfield & Riverine portions of the route.

Area all along the river and green field areas throughout the project pose a higher potential for archaeological discoveries. It is recommended licensed archaeological monitoring and metal detecting is undertaken at all these areas during construction phase.

Table 12-10: Areas of Archaeological Potential & Mitigation Measures

EIAR Cultural Heritage Items	Details	Archaeology Mitigation	Built Heritage Mitigation
AAP1	Greenfield area adjacent to river in Dromroe Td at west end of scheme	Advance pre-construction Archaeological Geophysical Surveys & Testing recommended. Outcome of this to determine construction phase mitigations.	
AAP2	Area around Plassey Mills/Possible former location of Sreelane Castle inside Zone of Notification (ZoN) for LI005-052 Sreelane Castle. (**Recorded Monument, all works require Section 12 Notification to NMS and licensed archaeological monitoring**).	Advance Archaeological Geophysical Surveys & Archaeological Testing recommended to the rear of Fishermens Cottages accessible greenfield area and nearby compound (CC2). Outcome of this to determine construction phase mitigations. Archaeological monitoring also required during works around Plassey Mills as inside ZoN and to check if there is any evidence for former Sreelane Castle.	Pre-construction archaeological supervision of vegetation clearance advance pre-construction surveys & investigations recommended on areas of mill races. Any risk of direct negative impacts will require a detailed built/industrial heritage survey record in advance of construction works. All masonry to be checked for any medieval features linked to Sreelane Castle.
AAP3	Area around Castletroy RMP: LI006-017001 LI006-017002 Bawn LI006-017003 Gateway (Recorded Monument, all works require Section 12 Notification to NMS and	Proposed route to the west of castle structure. Possible impact on gateway or earthworks. Archaeological supervision of vegetation clearance here and pre-construction advance geophysical/topographical surveys & advance archaeological test trenching recommended 12-18 months before	

EIAR Cultural Heritage Items	Details	Archaeology Mitigation	Built Heritage Mitigation
	licensed archaeological monitoring).	construction phase to allow for any further mitigation required.	
Construction Compounds 1-4	All compounds are located in greenfield areas and present a risk of having sub-surface archaeological deposits.	Advance Archaeological Geophysical Surveys & Testing recommended. Outcome of this to determine construction phase mitigation.	
Greenfield & Riverine portions of the route.	All greenfield areas and areas along riverbank	Area all along the river and green field areas throughout the project pose a higher potential for archaeological discoveries. It is recommended licensed archaeological monitoring and metal detecting is undertaken at all these areas during construction phase.	
Pre-construction site Investigation works	All pre-construction site Investigation works within AAPs, Construction Compounds and along edge of riverbank will require licensed archaeological monitoring		

No in-channel works are anticipated, however where bank stabilization works are proposed and installation of bridge and platform structures there is moderate potential to impact on the underwater archaeological resource. Finalised designs and construction measures required at these locations to be further archaeologically assessed in advance of works.

It is important to note that if future works incorporate instream works, then there is potential for a direct impact on riverine underwater cultural heritage and advance consultation with the Underwater Archaeological Unit of the National Monuments Service will be required. Suitable mitigation options such as licensed underwater archaeological dive surveys would need to be considered in this scenario.

All recommendations/mitigation measures are subject to the approval of the National Monuments Service, Dept. of Housing, Local Government & Heritage, National Museum of Ireland and LCCC Archaeologist & Architectural Conservation Officer.

Table 12-11: Summary of Impacts and Effects on Areas of Archaeological Potential

(this can only be indicative until mitigation measures for further surveys and archaeological testing have been completed pre-construction).

Impacts and Effects on Areas of Archaeological Potential									
	Effects				Asset Value	Impact			
	Duration	Quality	Type	Significance		Potential	Phase	Magnitude	Significance
AAP1 Greenfield Area in Dromroe (effects & impacts can only be fully determined after geophysical survey and archaeological testing)	Permanent	Neutral	Direct	Moderate	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
AAP2 Plassey Mills – Sreelane Castle	Permanent	Neutral	Direct	Moderate/ Significant	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
AAP3 Area around Castletroy RMP: LI006-017001 LI006-017002 Bawn LI006-017003 Gateway	Permanent	Neutral	Direct	Moderate/ Significant	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
Construction Compounds 1-4	Permanent	Neutral	Indirect	Moderate	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium
Greenfield & Riverine portions of the route.	Permanent	Neutral	Indirect	Moderate	Medium	Direct, potentially negative if mitigation measures not implemented	Construction	Medium	Medium

12.13.3 Operational Phase Impacts

Predicted Impact: Significant Direct Positive Impact

As the purpose of the project is to improve and enhance the existing amenity of the area, there will be a predicted significant direct positive impact on the Cultural Heritage resource when the project is in operation.

The recorded Archaeological Monuments and Protected Structures within the proposed development area will benefit from the project and public awareness and appreciation of the Cultural Heritage resource will be increased.

The project has potential to enhance a sense of place and community, of which the river and associated Cultural Heritage resource form an integral part.

There are no predicted negative impacts to the recorded cultural heritage resource during operational phase.

There will be a predicted significant direct positive impact to the recorded cultural heritage resource during operational phase.

12.13.4 Cumulative and In-combination Impacts

Predicted Impact: **No Impact**

There are no predicted cumulative impacts to the Cultural Heritage resources by combined elements of this project or with other planned developments in the area. Past grants of planning, current projects at design or construction stages and current planning applications were reviewed to assess the potential of in-combination effects. The combination of these plans would not give rise to a significant change in the landscape and thus would have a negligible bearing on the archaeological and built heritage resources of the area.

The Interaction of Impacts is assessed in Chapter 14 of this EIAR.

Landscape and Visual Impacts are assessed in Chapter 11 of this EIAR.

12.13.5 Residual Impacts

Predicted Impact: **No Impact**

Any changes to the hydrological regime that may have potential to impact on the Cultural Heritage resource are assessed in detail in Chapter 8 of this EIAR.

12.13.6 Do Nothing Scenario

Should the proposed development not proceed there would be no impact on the Cultural Heritage resource of the area.

12.13.7 Legal Requirements

Any works within the Zones of Notification around LI005-052 Sreelane Castle; Castletroy RMP: LI006-017001; LI006-017002 Bawn; will require Section 12 Notification to National Monuments Service and/or advanced licensed archaeological testing and monitoring.

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Guidelines

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https://www.riai.ie/discover-architecture/building-conservation#:~:text=The%20RIAI%20Guidelines%20for%20the%20Conservation%20of%20Buildings.%20These%20Guidelines

DRAFT Guidance on Repointing Rubble Masonry in Historic Structures 2024 Department of Housing, Local Government and Heritage

TII Guidelines for the Assessment of Archaeological/Architectural Heritage Impacts of National Road Schemes (NRA, 2005, 54/21).

https://www.epa.ie/publications/monitoring--ssessment/assessment/EIAR_Guidelines_2022_Web.pdf

https://www.gov.ie/en/publication/0937a-architectural-heritage-protection-guidelines-for-planning-authorities/

https://www.opr.ie/wp-content/uploads/2022/10/framework-and-principles-for-protection-of-archaeological-heritage.pdf

https://www.riai.ie/discover-architecture/building-conservation

Online Resources

Open Topographic Data Viewer (arcgis.com)
https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b7c4b0e763964070ad69bf8c1572c9f5 Accessed 1/03/2023

GeoHive Map Viewer https://webapps.geohive.ie/mapviewer/index.html Accessed 1/03/2023

The Engineering Collection of Waterways Ireland (accessed on 11/03/2022): *https://archive.waterwaysireland.org/collections/5/engineering-collection*

https://archive.waterwaysireland.org/history-of-the-waterways/13/the-history-of-the-shannon Accessed 1/03/2023

The History of the Shannon - History of the Waterways | Waterways Ireland Archive Portal Accessed 1/03/2023

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Appendix 1: Itemised Table of Built Heritage (BH) Features Assessing Significance, Effects & Mitigation

EIAR Built Heritage (BH) Features Identified along Proposed Route			
EIAR BH No. 1 NIAH 21900503 RPS 1599 Plassey Bridge		 Any permanent fencing to be in keeping with character of existing and in line with best Conservation practice. Construction traffic to be mindful of this area? Potential for older features linked to former ferry crossing around this location.	
NIAH Rating: Regional **Categories of Special Interest:** Architectural, Artistic, Technical **NIAH Description:** Multiple-arch pedestrian bridge over the River Shannon, built c. 1840. Cast-iron handrail, balustrades and stringcourse with scrolled iron consoles. Tapering limestone parapet walls at both ends. Carriageway resurfaced with tarmacadam and preformed concrete pylon supports replacing earlier supports. **NIAH Appraisal** : Plassy Bridge is an interesting example of an early nineteenth-century cast-iron and concrete bridge erected by the Shannon Commissioners. It was constructed on the site of the horse ferry which dated to 1830. The current bridge forms a group with the nearby Plassy Mills.			
Description: Although overall reasonably intact, elements of this structure are no longer suitable for pedestrian use without considerable upgrade and conservation works. This footbridge forms a very distinctive landmark along the existing route and will be a prominent feature along the new route also. It would have formed an attractive and convenient pedestrian crossing across the River Shannon when in use. It is closely intertwined with surrounding industrial and engineering heritage and local sentiment would like to see it conserved and re-opened as a novel crossing point. There is no scope for this within current greenway proposal and it is hoped this can be addressed in future programs of work. During and following construction it is necessary to ensure secure fencing at the entrance onto the bridge to avoid health & safety concerns.			
Assessing Importance: This feature is classified as of Regional importance by the NIAH. Given that this bridge is linked with numerous features incorporated within the Plassey Mills industrial heritage complex and surrounding built heritage, all forming part of the Castletroy ACA it is considered of medium asset value.			

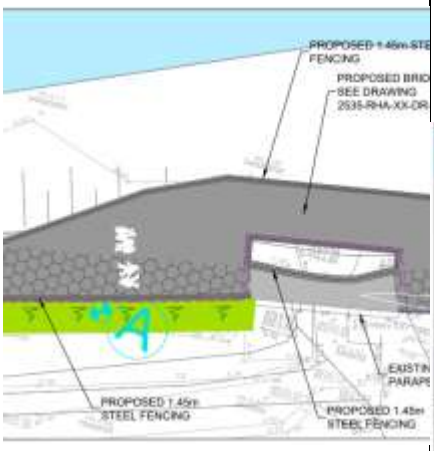
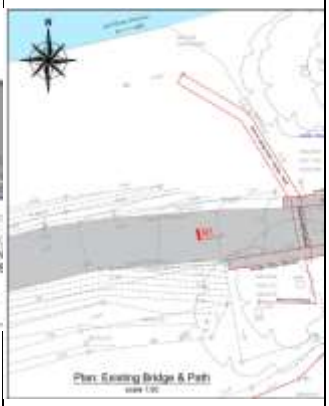
Amenity Value – This feature has high visibility and major potential and forms an attractive and novel element along the existing and proposed relevant section of the route. It is interlinked with past use of the Plassey Canal on the north side of the river.

Likely Significant Effects & Impacts

Temporary Neutral Indirect Moderate Effects: Construction work along existing pathway. No direct works on this bridge. All construction personnel to be advised to avoid impacts on curving walls forming part of entranceway onto bridge and structure itself here. Existing unattractive steel fencing prevents access onto the footbridge. It is unsafe to access in current condition. It is recommended any plans for medium to long term new fencing erected here is in keeping with the existing character of the bridge and the Plassey Mill Complex. Conservation Expertise to be sought in advance of finalising fencing materials here. Fencing should be free standing and not fixed into historic fabric (i.e. reversible) to avoid any long-term impacts.

Potential for permanent direct positive effects in the creation of information panels and signage linked to the history of this bridge. The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location.

Impacts - Creation of fencing - Potential direct impacts of medium magnitude & significance during construction and operation.

EIAR BH No. 2 NIAH 21900504 RPS 1600 Plassey Mills Curtilage: Bridge 2		Proposed Plan 	Existing Plan 

Forming part of curtilage of Plassey Mills (RPS 1600)

Description: Small historic humpback footbridge (Bridge 2) along the existing pathway over the mill race channel to the west of mill ruins. The cap stones are missing off the parapet wall on the northern side, large masonry blocks have collapsed into the stream beneath. The southern parapet wall is intact but has considerable vegetation growth. The abutment walls of the bridge also have tree roots and vegetation impacting on the masonry fabric of the structure. Fine cut stone masonry visible forming part of the bridge, abutment walls and mill race channel.

Assessing Importance: This feature linked to Plassey Mills RPS forms part of the curtilage. RPS 1600 is identified as of regional significance on NIAH. In isolation it may not necessarily have significance, however the bridge & abutment walls over the main mill race channel form an important component to the overall Plassey Mills industrial heritage complex at this location. It is considered of medium asset value.

Amenity Value – This feature has high visibility and fine cut stone masonry where visible forms an attractive historic element along the existing and proposed relevant section of the route.

Likely Significant Effects & Impacts

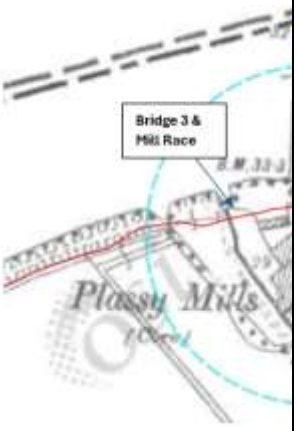
Permanent Neutral Direct Moderate Effects. Construction work along existing pathway. Direct works proposed on this bridge include repointing of stone and a new parapet which will respect and highlight the historical significance of the low parapet for tow ropes. All construction personnel to be advised to avoid impacts on abutment walls, mill race and bridge structure itself here. Proposed new bridge here to respect footprint of original bridge. Surrounding design and finish to be in keeping with the existing character of the bridge and the Plassey Mill Complex.

A) Masonry repairs to joints in stones would be a positive impact.
B) No repairs but construction can avoid direct impacts – neutral physical impact, some visual impact.
C) Construction impacts leading to potential for further masonry collapse – negative impact

Mitigation measures to ensure that construction impacts do not cause masonry collapse will be required and should be included in the construction management plan. This may include measures such as temporary propping, temporary boxing of features to be protected, and monitoring of vibrations due to construction activity etc.

The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location.

If appropriate mitigation measures are implemented during construction phase the impacts are assessed as direct impacts of medium magnitude & significance during construction and operation.

EIAR BH No. 3 NIAH 21900504 RPS 1600 **Plassey Mills Curtilage:** Bridge 3 & Mill race masonry walls		Bridge Deck to be replaced with new steel deck. It is recommended that repair works are carried out on masonry for abutment walls/mill race channel. 	

Description: Mill Race Crossing point, at the time of site inspection an unstable modern concrete platform was evident sitting on abutment walls and embankments either side of mill race overflow channel. This bridge deck has since been removed and replaced with a temporary deck. The abutment walls either side of the channel show fine cut stone masonry work and are overall in reasonable condition. Some tree roots and vegetation impacting on the masonry fabric of the structure on the southern side.

Assessing Importance: This feature linked to Plassey Mills RPS forms part of the curtilage. RPS 1600 is identified as of regional significance on NIAH. In isolation it may not necessarily have significance, however the fine cut masonry of the abutment walls along the mill race channel form an important component to the overall Plassey Mills industrial heritage complex at this location. It is considered of medium asset value.

Amenity Value – This feature has high visibility and fine cut stone masonry where visible forms an attractive historic element along the existing and proposed relevant section of the route.

Likely Significant Effects & Impacts

Permanent Neutral Direct Moderate Effects.

Construction work along existing pathway. Direct works will be required for the Mill Race channel abutment walls to remove trees growing through them, and to repoint walls so a new concrete beam can be added to support the proposed steel deck for the replacement bridge. All construction personnel to be advised to avoid impacts on

abutment walls and mill race itself here. Proposed new bridge deck to respect existing historic walls and will follow footprint of original bridge. Surrounding design and finish to be in keeping with the existing character of the bridge and the Plassey Mill Complex. The new deck itself will be a positive impact. The impact on underlying abutment walls is as follows:

A) If vegetation currently impacting the masonry and abutment walls is removed and masonry repairs carried out this would be a positive impact.
B) No repairs but construction can avoid direct impacts/existing masonry stabilised during construction works– neutral impact
C) Construction impacts leading to potential for further masonry collapse – negative impact

Mitigation measures to ensure that construction impacts do not cause masonry collapse will be required and should be included in the construction management plan. This may include measures such as temporary propping, temporary boxing of features to be protected, and monitoring of vibrations due to construction activity etc.
The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location.
If appropriate mitigation measures are implemented during construction phase the impacts are assessed as direct impacts of medium magnitude & significance during construction and operation.

EIAR BH No. 4 NIAH 21900504 RPS 1600 Plassey Mills	Tall section of original mill structure standing. Only this single element of what was once a large mill building survives. Ruins of various outbuildings and later walls surround it. 		 New route proposed 15-20m east of tower structure. New fencing to be located along western perimeter. Any permanent fencing to be in keeping with character of existing and in line with best Conservation practice. Construction traffic to be mindful of this area?

NIAH Rating: Regional
Categories of Special Interest: Architectural, Technical
NIAH Description: Detached L-plan multiple-bay six-storey former corn mill, built in 1824, with extension to west. Now in ruins. Dressed limestone walls having cast-iron patris plates, limestone quoins and red brick flue. Square-headed window openings with cut limestone label mouldings and sills. Pointed arch window openings to south elevation with limestone hoodmoulding to ground floor opening. Cross loop openings to east and west elevations,

having limestone surrounds. Remains of internal round-headed door opening to north elevation with brick voussoirs, now partially blocked up. Cut limestone internal spiral staircase. South elevation partially rebuilt c. 1970.

NIAH Appraisal : These striking remains of Plassey Mills, situated on the banks of the River Shannon, was built by Robert Hedges Maunsell and later taken over in the 1860s by the Russell family, who were the most prominent millers in Munster at the time. This large former corn mill was built of high quality materials, as illustrated by the limestone dressings such as the label and hoodmouldings, quoins and sills. Prominently sited, the mill presents a striking silhouette within the Limerick landscape and forms a group with the nearby Plassey Bridge

Description: Single corner tower of original building Plassey Mill building is a distinctive feature in the landscape here. Some fine cut stone evident in the remaining tower. Some evidence for mill race around it but very overgrown here. Area around the tower structure is covered in dense vegetation and there are some ruins to the north near existing path. It is difficult to determine former function of single storey ruins around the tower and their function and relationship with the main mill building. Modern concrete block wall and fencing at current path nearby. Attempts have been made to block access into an unsafe structure, however these have been tampered and its clear the space attracts anti-social activity. Some graffiti and rubbish dumping evident around the site.

Assessing Importance: The tower feature is the only surviving portion of the original large Plassey Mills Structure. It forms a distinctive landmark at this location. This central protected feature forms an integral component to the overall Plassey Mills industrial heritage complex at this location. Given that channel is linked with the Plassey Mills complex and a series of surrounding built/industrial heritage features, all forming part of the Castletroy ACA it is considered an asset value of medium importance.

Amenity Value – This feature has high visibility and fine cut stone masonry where visible and forms an attractive historic element along the existing and proposed relevant section of the route.

Likely Significant Effects & Impacts

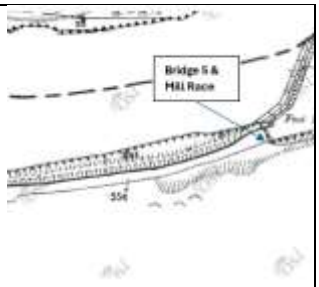
Permanent Neutral Indirect Moderate/Significant Effects: Construction work along existing pathway. No direct works on this structure. All construction personnel to be advised to avoid impacts on structure itself and surrounds here. It is unsafe to access in current condition. It is recommended any plans for medium to long term new fencing erected here is in keeping with the existing character of the Plassey Mill Industrial Heritage Complex. Conservation Expertise to be sought in advance of finalising fencing materials here. Fencing should be reversible to avoid any long term impacts.

Route will be located 15-20m to the north of this tower and 20-25m to the west. Construction work along existing and newly proposed pathway. No direct works proposed on the structure so impact is on setting only. Surrounding design and finish to be in keeping with the existing character and setting.

Design of any secure fencing proposed to prevent access needs to be sensitive to visual character of the area. A long term plan for future stabilisation of the tower and interpretation panels at this location would provide context for the entire Plassey Mills complex. The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location. Future interpretation panels on industrial heritage at this location would be a positive effect.

Mitigation measures to ensure that construction impacts do not cause masonry collapse will be required and should be included in the construction management plan. This may include measures such as temporary fencing, clearly demarcated exclusion zones to prevent accidental ingress and monitoring of vibrations due to construction activity etc.

If appropriate mitigation measures are implemented during construction phase the impacts are assessed as indirect impacts of medium magnitude & significance during construction and operation.

EIAR BH No. 5 NIAH 21900504 RPS 1600 **Plassey Mills Curtilage:** Bridge 5 & Mill race masonry walls		The River Shannon side of the cut stone pier extends for 20m or so downstream of the cutwater. The cut stone pier would be approx. 20m long and varying in width from 4m down to 2m at the upstream end.	
Description: Entrance or inlet into the head race for Plassey Mills direct from the River Shannon. Extensive tall masonry abutment walls in reasonable condition evident here. Modern concrete platform bridge sitting on top of historic walls. This is to be removed and replaced. External river side of walls have been subject to wear and tear and have been impacted by vegetation growth.			
Assessing Importance: Given that channel is linked with the Plassey Mills complex and a series of surrounding built/industrial heritage features, all forming part of the Castletroy ACA it is considered an asset value of medium importance. Amenity Value – This feature has high visibility and fine cut stone masonry and forms an attractive historic element along the existing and proposed relevant section of the route.			
Likely Significant Effects & Impacts Permanent Positive Direct Moderate Effects. Removal of existing later concrete deck and replacement will be a positive effect. Repair works to walls and enhanced access and conservation of stone work will be a direct positive effect. Design of a modern seating area at this location and enhanced access a positive. Surrounding design and finish to be in keeping with the existing character and setting of the Plassey Mills complex. Mitigation measures to ensure that construction impacts do not cause any surrounding masonry collapse on mill race walls outside working area will be required and should be included in the construction management plan. This may include measures such as temporary propping, temporary boxing of features to be protected, and monitoring of vibrations due to construction activity etc. The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location. Interpretation panels on industrial heritage at this location would be an additional positive effect. If appropriate mitigation measures are implemented during construction phase the impacts are assessed as direct impacts of medium magnitude & significance during construction and operation.			

EIAR BH No. 6 NIAH 21900504 RPS 1600 Plassey Mills Curtilage: Boundary Walls	Outbuilding Ruins & Walls around Plassey Mill Tower	 

Description: A combination of modern block wall and cut masonry walls visible around Plassey Mill tower here. Various phases evident, mainly appears modern. Vegetation evident along one section of wall. Some ivy clad ruins visible to the north of this area. Possible outbuildings linked to milling complex.

Assessing Importance: Most of these walls appear modern and unrelated to original historic fabric of the mill complex so are therefore of little heritage value. The ruins behind walls are possibly contemporary with the mill structure and would require further vegetation removal and survey to fully assess significance. The walls visible along existing pathway are considered an asset value of slight to moderate significance.

Likely Significant Effects & Impacts

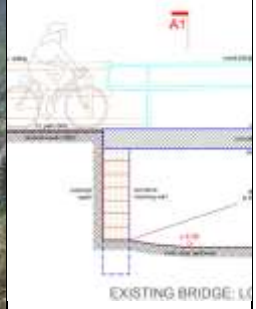
Permanent Positive Direct Moderate Effects

Surrounding design and finish to be in keeping with the existing character and setting. Lay-by area here with new seating and secure fencing proposed to prevent access to unsafe tower (BH No.6) needs to be sensitive to visual character of the area. Conservation expertise advised for any new fencing design at this location to ensure no negative impacts on the visual setting and character of the Plassey Mills Industrial Heritage Complex.

Mitigation measures to ensure that construction impacts do not cause any surrounding masonry collapse on mill tower, outlying ruins and nearby mill race walls outside working area will be required and should be included in the construction management plan. This may include measures such as temporary fencing and exclusion zones, propping, temporary boxing of features to be protected, and monitoring of vibrations due to construction activity etc.

The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location. linterpretation panels on industrial heritage at this location would be an additional positive effect.

If appropriate mitigation measures are implemented during construction phase the impacts are assessed as direct impacts of medium magnitude & significance during construction and operation.

EIAR BH No. 7 NIAH 21900504 RPS 1600 **Plassey Mills Curtilage:** Overflow Mill Race Channel East of Tower Structure, Bridge 4.	 	 Bridge Deck to be replaced with new. Repair works proposed to masonry on abutment walls/mill race channel. Heavy vegetation along mill race channel here. Difficult to determine condition of masonry.	

Description: Area of overflow Mill Race channel (s) immediately east of Plassey Mills. Only one channel was obvious during site inspection. Mill Race Crossing point, modern concrete slab and rails crossing abutment walls and embankments either side of mill race overflow channel. Abutment walls either side of the channel overgrown with vegetation here so difficult to determine condition of cut stone masonry. Dense vegetation here makes it difficult to fully determine historic features, identified channel was dry at the time of inspection. Some evidence of historic masonry along channel here, badly impacted by tree roots and ivy.

Assessing Importance & Amenity Value This feature linked to Plassey Mills RPS forms part of the curtilage. RPS 1600 is identified as of regional significance on NIAH. In isolation it may not necessarily have significance, however the mill race channel forms an important component to the overall Plassey Mills industrial heritage complex at this location. It is considered of medium asset value.

Given that channel is linked with the Plassey Mills complex and a series of surrounding built/industrial heritage features, all forming part of the Castletroy ACA it is considered an asset value of medium importance. This channel has been more compromised than others due to years of neglect and established overgrowth. In order to fully assess importance and amenity value and to mitigate against adverse impacts an advance phase of vegetation clearance under archaeological supervision is recommended and surveys of any industrial heritage & archaeological features likely to be impacted. There may be a requirement for detailed digital scanning, surveying, recording and excavation of any features to be directly impacted.

Amenity Value – This feature has high visibility and fine cut stone masonry where visible forms an attractive historic element along the existing and proposed relevant section of the route.

Likely Significant Effects & Impacts

Permanent Neutral Direct Moderate/Significant Effects

Surrounding design and finish to be in keeping with the existing character and setting. This channel has been more compromised than others due to years of neglect and established overgrowth.
Construction work along existing pathway. Direct works proposed on this bridge include replacement of existing deck. All construction personnel to be advised to avoid impacts on abutment walls and mill race and bridge structure itself here. Surrounding design and finish to be in keeping with the existing character of the Plassey Mill Complex.

A) Masonry repairs to underlying mill race walls would be a positive impact.
B) No repairs but construction can avoid direct impacts – neutral physical impact, some visual impact.
C) Construction impacts leading to potential for further masonry collapse – negative impact

Mitigation Measures: In order to fully assess importance and amenity value and to mitigate against adverse impacts, an advance phase of vegetation clearance under archaeological supervision is recommended and advance surveys of any industrial heritage & archaeological features likely to be impacted. There may be a requirement for detailed digital scanning, surveying, recording and excavation of any features to be directly impacted. Some flexibility at construction phase to conserve integrity of the mill race channel where it intersects with route if feasible at this location. Design of pathway and fencing here needs to be sensitive to visual character of the area. Conservation expertise advised at this location to ensure no negative impacts on the visual setting and character of the Plassey Mills Industrial Heritage Complex.
The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location. Future interpretation panels on industrial heritage at this location would be an additional positive effect. If appropriate mitigation measures are implemented during construction phase the impacts are assessed as direct impacts of medium magnitude & significance during construction and operation.

EIAR BH No. 8 NIAH 21900504 RPS 1600 **Plassey Mills Curtilage:** Main Mill Race Channel West of Tower Structure.			

Description: Area of Mill Race channel (s) immediately west of Plassey Mills. Evidence of historic masonry along channel here, a lot of vegetation along the edges likely impacting on masonry either side of channel. New route will be adjacent to this channel.

Assessing Importance: Given that channel is linked with the Plassey Mills complex and a series of surrounding built/industrial heritage features, all forming part of the Castletroy ACA it is considered an asset value of medium importance. This section of channel is very visible all along the route. Historic masonry in sections of channel here has been compromised in areas due established vegetation.

Amenity Value – This feature forms an attractive historic element along the existing and proposed relevant section of the route.

Likely Significant Effects & Impacts

Permanent Neutral Direct Moderate/Significant Effects.

Proposed route runs alongside mill race channel in this area and there is likely to be minor impact. Some slope stabilisation work may be required. Surrounding design and finish to be in keeping with the existng character and setting. This channel has been compromised to some extent due to established vegetation within masonry fabric.

Mitigation Measures: Design of pathway here needs to be sensitive to visual character of the area. Conservation expertise advised at this location to ensure no negative impacts on the visual setting and character of the Plassey Mills Industrial Heritage Complex. Mitigation measures to ensure that construction impacts do not cause any surrounding masonry collapse on mill race walls outside working area will be required and should be included in the construction management plan. This may include measures such as temporary fencing and exclusion zones, propping, temporary boxing of features to be protected, and monitoring of vibrations due to construction activity etc.

The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location.

If appropriate mitigation measures are implemented during construction phase the impacts are assessed as direct impacts of medium magnitude & significance during construction and operation.

EIAR BH No. 9 NIAH 21900504 RPS 1600 **Plassey Mills Curtilage:** Isolated Section of historic wall along tow path			

Description: Isolated Section of historic wall along tow path near Fishermens Cottages. Thick rubble masonry wall with slight batter at the base. Gateway along existing pathway incorporated into south side of wall. There are outbuildings linked to Plassey Mills complex shown on historic maps around this location, wall may have originally linked into this complex. There are no distinctive masonry features to date this section of wall, there is a possibility it may have been linked to the now demolished Sreelane Castle.

Assessing Importance & Amenity Value: Given that wall is linked with the Plassey Mills complex and a series of surrounding built/industrial heritage features, all forming part of the Castletroy ACA it is considered an asset value of medium importance.

Amenity Value – This feature forms an attractive historic element along the existing section of the route.

Likely Significant Effects & Impacts

Permanent Neutral Indirect Imperceptible Effect.

Works have been designed to avoid any effects or impacts on this area.

Mitigation Measures: Works are unlikely to impinge on this area. Mapping in CEMP showing an exclusion zone around this feature to ensure no accidental ingress during construction phase.

If appropriate mitigation measures are implemented during construction phase the impacts are assessed as negilible impacts of imperceptible significance during construction and operation.

EIAR BH No. 10 No NIAH or RPS Undesignated Cultural Heritage Complex of Vernacular Cottages.	Plassey Fishermen's Huts/Cottages No direct impacts on this area. New route will be diverted to the rear or south of these vernacular cottages. Some fishing boats evident nearby forming elements of local riverine heritage.		 Small fishing boats nearby along the river edge. Route has been diverted away from this section of the existing path.

Description: Several small vernacular fishermens cottages. These cottages are shown on the 6 inch first edition maps. They are well maintained and in use today. The presence of the cottages and nearby boats moored on the river are indicative of a strong local fishing tradition here on the River Shannon.

Assessing Importance: These dwellings form an attractive vernacular element linked to traditional fishing practice here and are considered an asset value of medium importance

Likely Significant Effects & Impacts

Permanent Neutral Indirect Imperceptible Effect.

There will be no or very little impact or effects on these buildings as proposed route will be avoiding existing pathway here and has been diverted to the rear of the fishermens cottages. The impact on this area will be neutral as it will be left as is.

Mitigation Measures: Works are unlikely to impinge on this area. Mapping in CEMP showing an exclusion zone around this complex to ensure no accidental ingress during construction phase.

If appropriate mitigation measures are implemented during construction phase the impacts are assessed as negilible impacts of imperceptible significance during construction and operation.

EIAR BH No. 11 No NIAH or RPS Undesignated Cultural Heritage Feature.		
Description: Small distinctive milestone marker near Plassey Fishermen's Huts/Cottages located along the existing path. This was in use as a former tow path along the river. Milestone is an attractive historic feature here. **Assessing Importance**: These is an interesting historic feature pointing to the busy industrial heritage along the towpath here. It is considered an asset value of medium importance. Likely Significant Effects & Impacts Permanent Neutral Indirect Imperceptible Effect. There will be no or very little impact or effects on this feature as proposed route will be avoiding existing pathway here and has been diverted to the rear or south of the Fishermens Cottages. The impact on this area will be neutral as it will be left as is. **Mitigation Measures:** Works are unlikely to impinge on this area. Mapping in CEMP showing an exclusion zone around this feature to ensure no accidental ingress during construction phase. If appropriate mitigation measures are implemented during construction phase the impacts are assessed as negilible impacts of imperceptible significance during construction and operation.		
EIAR BH No. 12 NIAH 21900504 RPS 1600 **Plassey Mills Curtilage:** Section Mill Race Channel parallel to river		 Existing View of towpath adjacent to Plassey Beach
		Proposed footpaths will be widened by constructing a new retaining wall & rails.

		 Mill Race to the west of Bridge 5	 Mill Race in front of Plassey House

Description: Area of Mill Race channel adjacent to river and tow path along Plassey Beach and terminates at Bridge 5 (BH5), where part of the River Shannon is diverted into the mill race at this location. Evidence of historic masonry walls along channel here in parts. Some sections better preserved than others. Runs in front of Plassey House &. Mill race along this area is in various states of repair. Some sections very shallow with no masonry evident (i.e., near Living Bridge footbridge). Section west of Bridge 5 and in front of Plassey house has reasonably well preserved masonry walls either side.

Assessing Importance: Given that channel is linked with the Plassey Mills complex and a series of surrounding built/industrial heritage features, all forming part of the Castletroy ACA it is considered an asset value of medium importance. This section of channel is very visible all along the route. Historic masonry in sections of channel here has been compromised in areas due established vegetation.

Amenity Value – This feature forms an attractive historic element along the existing and proposed relevant section of the route.

Likely Significant Effects & Impacts

Permanent Neutral Direct Moderate/Significant Effects.

Proposed new route is located approximately 1m south of this section of channel. Current path will be widened to the south. There may be some potential impacts during construction works along this area. Some stabilisation works/repairs may be required in advance of or during construction phase. Some slope stabilisation work may be required. Surrounding design and finish to be in keeping with the existing character and setting. This channel has been compromised to some extent due to established vegetation within masonry fabric.

Mitigation Measures: Design of pathway here needs to be sensitive to visual character of the area. Conservation expertise advised at this location to ensure no negative impacts on the visual setting and character of the Plassey Mills Industrial Heritage Complex. Mitigation measures to ensure that construction impacts do not cause any surrounding masonry collapse on mill race walls outside working area will be required. These mitigation measures should be included in the construction environmental management plan. This may include measures such as temporary fencing and exclusion zones, propping, temporary boxing of features to be protected, and monitoring of vibrations due to construction activity etc.

The development of a wider and more accessible greenway along this route will potentially open up access to a wider audience and have a positive effect in developing awareness and appreciation for industrial heritage at this location.

If appropriate mitigation measures are implemented during construction phase the impacts are assessed as direct impacts of medium magnitude & significance during construction and operation.

EIAR BH No. 13 NIAH 21900505 RPS Plassey House	The present building in Victorian Italianate style, was built in 1863 for the Russell family. It is believed to incorporate part of the late 18th century house built by the Maunsell family, Rihcard Maunsell was Mayor of Limerick in 1734, High Sheriff in 1743, and M.P. for the city between 1740 and 1761.		Plassey House itself will not be impacted by proposed works, there will be some visual effects along proposed route around the area to the north of the house and adjacent to the Mill Race channel in front of the property.

NIAH Rating: Regional

Categories of Special Interest: Architectural, Artistic

NIAH Description: Detached L-plan multiple-bay two-storey country house, built c. 1770, comprising three-bay front block with pedimented shallow breakfront having single-storey portico. Rebuilt in the 1870s. Recessed two-bay three-storey block to west with two-bay two-storey extension. Recent extensions to rear. Hipped slate roofs with bracketed eaves course and rendered chimneystacks. Rendered walls having quoins and plinth courses. Square-headed openings to first floor with two-over-two pane timber sliding sash windows, render entablatures, sills and continuous sills course. Those to west block having pedimented architraves. Square-headed openings to ground floor having two-over-two pane timber sliding sash windows with flanking Corinthian style pilasters and render sills. Portico comprising Corinthian style columns supporting entablature with render cornice. Square-headed opening having glazed overlight over half-glazed double-leaf timber panelled doors with flanking sidelights. Ornate cornicing to interior.

NIAH Appraisal : Plassy House, a notable example of a Georgian villa style country house, was rebuilt in the Italianate style. Originally the estate was owned by Robert Clive who renamed it Plassey after his victory in India. He later became Lord Clive of Plassey. The Russell family extended it in the 1860s, the work was purportedly carried out by the architect William Fogarty. The Russells owned the nearby Plassey Mills. Prominently sited close to the River Shannon and within the campus of the University of Limerick, the house forms a pleasing focal point for the surrounding area.

Description: Plassey House visible in the background from current pathway. Mill Race (BH No.12) visible in the foreground. It is located approx. 150m south of proposed route. Significant architectural structure forming a focal point within the modern UL campus and the overall Castetroy Archiectural Conservation Area. The house is well maintained and in regular use..

Assessing Importance rated as of regional significance on NIAH listing .Forming part of the Castletroy ACA it is considered an asset value of medium importance. Forms an attactive 19th century built heritage feature within the current modern campus grounds. Links with the industrial heritage of Plassey Mills and the vista over the river.

Original surrounding demesne landscape as shown on historic mapping has now been altered to accommodate modern campus.

Amenity Value – This feature forms an attractive historic element.

Likely Significant Effects & Impacts

Permanent Neutral Indirect Imperceptible Effect.

There will be no or very little impact or effects on this structure as proposed route is located 150m south of the route. The upgraded path may bring more positive awareness and attention to this historic structure. Potential for future interpretive signage around Plassey House & former demesne grounds.

Mitigation Measures: Works are unlikely to impinge on this area. Mapping in CEMP showing an exclusion zone around this structure to ensure no accidental ingress during construction phase.

Appendix 2: Limerick County Development Plan 2022-2028 – Extracts

Extract of Relevant Sections

5.5 Archaeology and Built Heritage

5.5.1 Archaeological Heritage

Limerick is extremely rich in the diversity and quality of the archaeological monuments and landscapes within the city and county. There is a high rate of survival of rural monuments, which is largely due to the pastoral nature of farming. To date there are over 7,000 sites and individual monuments recorded in Limerick. These range from isolated pits to the inspiring ruins of the friary at Askeaton and the majestic King John's Castle in the city. They include the graves, homes, farmsteads and towns of our ancestors. They are an intrinsic part of the landscape, they form our immediate environment and shape our experience and outlook and they are part of what makes Limerick unique. They are also, however, a fragile and irreplaceable resource. Limerick City and County Council is dedicated to safeguarding the archaeological heritage of Limerick.

The location of each archaeological monument is provided in the Record of Monuments and Places, which is maintained and up-dated by the Archaeological Survey of Ireland. Hard copies are available for public consultation in the Council's Planning Department and in all the libraries. Under the provisions of Section 12 of the 1994 National Monuments Act Amendment, any person proposing any works (this includes exempted development) 'at or in relation to such a monument' has to give two months' notice to the National Monuments Service. Sites continue to be discovered, some of those found subsequent to 1997 have been included in the Site and Monuments Database which is available on the website archaeology.ie

There is a stated preference under National Policy for preservation in situ. Consequently, the Planning Authority recommends that issues of archaeological heritage be addressed as early as possible by potential developers, through consultation with the relevant agencies, the Planning Department and the Local Authority Archaeologist. The Planning Authority will request potential developers to carry out archaeological assessments, in areas adjacent or in the vicinity of Recorded Monuments. Proposed developments can have a visual as well as a physical impact on the archaeological remains and developers are advised to respect the setting of the monuments in the wider landscape, when considering areas for development potential. The Planning Authority will refer all proposed developments likely to impact on the archaeological heritage to the National Monuments Service.

Archaeological remains are also to be found in riverine, lacustrine and in estuarine and marine-foreshore, inter-tidal and underwater environments. There is the potential for previously unknown and unrecorded underwater archaeological sites and artefacts to exist. Where there is potential impact to Underwater Archaeology, the Council will require a licensed Underwater Archaeological Impact Assessment. The results are to be amalgamated with the terrestrial assessment to provide the overall archaeological heritage of the particular study area. Section 3 of The National Monuments (Amendment) Act, 1987 provides for the protection of sites of historic wrecks and lists of known wrecks are available on the website data.gov.ie/dataset/national-monuments-service-shipwreck-inventory-of-ireland

There are certain sites in Limerick in State ownership or guardianship or that have been served with temporary preservation orders. These sites are included in Volume 5. Under the 2004 Amendment to the National Monuments Act, any of these sites or sites deemed National Monuments in the care or guardianship of the Local Authority, will require Ministerial Consent for works in their vicinity. The main Recorded Monuments in Local Authority ownership are the older churches and graveyards. The Local Authority is committed to the preserving these heritage assets as funding permits. The effect of climate change on masonry structures has made the need for consolidation works even more urgent.

Industrial Archaeology is an important facet of our shared past, particularly but not exclusively in our urban centres where it advanced development. The Council will expect proper recording of such buildings and associated infrastructure and will encourage incorporation of remains in future developments.

Archaeological objectives are also included in the Heritage Plan 2017-2030 and the Council is committed to supporting these actions. The Council is also committed to working with local communities to enhance understanding of, access to and protection of locally important sites.

5.5.2 Special Control Areas

The Planning Authority is fully committed to preserving the site and setting of our archaeological heritage. Since the adoption of the first Development Plan in 1967, the then Limerick County Council recognised the archaeological landscape at Lough Gur, creating an area of Special Development Control around the archaeological landscape. Other areas of Special Development Control have been established at archaeologically important settings around the county and further areas may be proposed during the lifetime of the Draft Plan. Special Control Areas are applied to preserve and enhance the setting of these landscapes and sites. In the land-use zoning matrix, generally no use is permitted.

The Special Control Areas within Limerick are as follows:

- Special Control Area at Mungret Monastic Complex, (See City and Environs Zoning Map, Volume 2) incorporating all national monuments and protected views, including:

  1) View from Mungret College northeast to the Monastic Complex and;

  2) Views northwest across the Monastic Complex (See Map 5.2);

- School House Road, Castletroy (See City and Environs Zoning Map, Volume 2);
- Lough Gur (See Map 5.3);
- Abbey in Askeaton (area identified in the Local Area Plan);
- Collegiate Church and Priory, Kilmallock (area identified in the Local Area Plan);
- Croom Castle (area identified in the Local Area Plan);
- The Motte in Kilfinane (See Map in Volume 2 – Kilfinane Zoning Map);
- Special Control Area in Ballingarry (See Map in Volume 2 – Ballingarry Zoning Map).

Objective EH 033 - Special Control Areas - It is an objective of the Council to protect and maintain the integrity of the Special Control Areas. Continue to zone important archaeological areas as appropriate as Special Control Areas where no development is permitted, other than possibly sensitively designed access.

Objective EH O34 - Special Control Areas Mungret - It is an objective of the Council to protect and maintain the integrity of the Special Control Areas at Mungret Monastic Complex incorporating all national monuments and protected views including:

1) View from Mungret College northeast to the Monastic Complex and;

2) Views northwest across the Monastic Complex.

Development within this area will be prohibited with the exception of leisure facilities and moderate extensions to existing dwellings, which will not adversely impact on the character or setting of the complex. The Council will facilitate the provision of interpretative panels and directional signage for Mungret Monastic Complex and park, will be considered in consultation with local community groups.

.. **Objective EH O35 - Preservation of the Archaeological Heritage -** It is an objective of the Council to seek the preservation of all known sites and features of historical and archaeological interest. This is to include all the sites listed in the Record of Monuments and Places as established under Section 12 of the National Monuments (Amendment) Act 1994. The preferred option is preservation in situ, or at a minimum preservation by record.

Objective EH O36 - Preservation of unrecorded/newly discovered Archaeological Heritage - It is an objective of the Council to protect and preserve the preservation in situ (or at a minimum by record) of all sites and features of historical and archaeological interest, discovered subsequent to the publication of the Record of Monuments and Places.

Objective EH O37 - Preservation of the Underwater Archaeological Heritage - It is an objective of the Council to seek the preservation (in situ, or at a minimum, preservation by record) of all known and all previously unrecorded sites and features of historical and archaeological record in wetland, riverine, lacustrine, estuarine and or marine environments.

Objective EH O38 - Protection of the setting of Archaeological Monuments- It is an objective of the Council to ensure that no development shall have a negative impact on the character or setting of an archaeological monument.

Objective EH O39 - Proper procedures during the planning process -

It is an objective of the Council to:

a. Ensure early engagement at pre-planning stage in undertaken with the Local Authority Archaeologist to promote the 'preservation in situ' of archaeological remains and settings in development.
b. Adopt a policy of archaeological monitoring on developments where the scale and nature of such developments may, in the opinion of the Planning Authority, have a negative impact on previously unknown archaeological features/artefacts.
c. Require the preparation of an Archaeological Heritage Assessment in cases where it is deemed that Archaeological Heritage would be affected by a proposed development (due to their location, size or nature). The report shall be prepared by a suitably qualified archaeologist on the archaeological implications, if any, of the proposed development either prior to a decision on a planning application or prior to commencement of development on site.

Objective EH O40 - Archaeological Monuments in Local Authority ownership/guardianship - It is an objective of the Council to preserve and enhance as appropriate and as funding allows monuments vested in the Local Authority.

Objective EH O41 - Town Defences and Layout - It is an objective of the Council to protect town defences and plot layout, carry out the objectives of the Conservation and Management Plans for Limerick City and Kilmallock and support the work of the Irish Walled Towns Network. Review the potential for surviving medieval and historic fabric within the standing buildings in our medieval urban cores.

Objective EH O42 - Industrial Archaeology - It is an objective of the Council to:

a) Seek the preservation of buildings and infrastructure associated with former industrial sites;

b) Ensure detailed recording of these remains; promote knowledge and interpretation of these sites among the general public;

c) Support the work of the Interreg Atlantic Coast Area project, (MMIAH) *The recovery and valorisation of Maritime Military and Industrial Heritage.*

Objective EH O43 - Lough Gur - It is an objective of the Council to protect the unique archaeological landscape at Lough Gur and to support the archaeological objectives in the Lough Gur Environment and Management Study 2009.

Objective EH O44 - Raise public awareness and encourage active participation - It is an objective of the Council to generally raise public awareness of the archaeological and historic heritage and to assist and encourage active participation by the public, following consultation with National Monuments Service, in the conservation, consolidation and presentation of landmark sites, where this is appropriate and subject to available resources.

Objective EH O45 - Heritage Plan 2017-2030 - It is an objective of the Council to support the archaeological objectives in the Heritage Plan.

Objective EH O46 - Increase access to Archaeological Monuments - It is an objective of the Council to facilitate public access to National Monuments in State or Local Authority care.

Objective EH O47 - Assessment and Recognition of Archaeological Landscapes - It is an objective of the Council to designate archaeological landscapes as part of an ongoing appraisal for Historic Landscape Characterisation of Limerick.

5.5.4 Architectural Heritage

Limerick has diverse architectural heritage that is reflected in the significant number of areas of special character, which are defined as Architectural Conservation Areas - and the very high number of Protected Structures. Limerick's built environment legacy stretches back over 5,000 years and more. Scattered throughout the landscape are the remains of deserted medieval settlements, as at Abington and Tomdeeley, near Askeaton. However, it is in towns such as Kilmallock and Newcastle West, Adare and Askeaton, as well as Limerick City itself that the richest physical remains of the medieval past can be found. These range from town walls through to religious foundations, to castles and more modest houses.

Other features, such as the pigeon house at Adare, can be found in both urban and rural locations. The historic built environment makes a significant contribution to the economic prosperity of an area by attracting investment, providing direct and indirect employment, as well as sustaining a traditional skills base.

Part IV of the Planning and Development Act 2000 (as amended) provides the legislative basis for the protection of architectural heritage. To complement this, the Department of Arts, Heritage and the Gaeltacht issued 'Architectural Heritage Protection Guidelines for Planning Authorities' (2011). These offer assistance and advice to owners and occupiers of Protected Structures and buildings within Architectural Conservation Areas, in addition to offering guidance to Planning Authorities.

The Planning and Development Act 2000 (as amended) requires each Planning Authority to include in their Development Plan objectives for the protection of structures, or parts of structures, which are of, special architectural, historical, archaeological, artistic, cultural, scientific, technical or social interest. These buildings and structures are compiled on a register referred to as the Record of Protected Structures (RPS). The R PS for Limerick City and County currently as listed in Volume 3 includes 2,126 structures, with a further 348 structures proposed for addition.

A Protected Structure, unless otherwise stated, includes the interior of the structure, the land lying within the curtilage of the structure, any other structures lying within that curtilage and their interior and all fixtures and features which form part of the interior or exterior of that structure. The protection also extends to any features specified as being in the attendant grounds including boundary treatments.

Objective EH O48 - Work to Protected Structures - It is an objective of the Council to:

a) Protect structures included on the RPS from any works that would negatively impact their special character and appearance.

b) Ensure that any development proposals to Protected Structures, their curtilage and setting, shall have regard to the 'Architectural Heritage Protection Guidelines for Planning Authorities' published by the Department of the Arts, Heritage and the Gaeltacht.

c) Ensure that all works are carried out under the supervision of a qualified professional with specialised conservation expertise.

d) Ensure that any development, modification, alteration, or extension affecting a Protected Structure and/or its setting, is sensitively sited and designed and is appropriate in terms of the proposed scale, mass, height, density, layout and materials.

e) Ensure that the form and structural integrity of the Protected Structure is retained in any redevelopment and that the relationship between the Protected Structure and any complex of adjoining buildings, designed landscape features, or views and vistas from within the grounds of the structure are respected.

f) Respect the special interest of the interior, including its plan form, hierarchy of spaces, architectural detail, fixtures and fittings and materials.

g) Support the re-introduction of traditional features on protected structures where there is evidence that such features (e.g. window styles, finishes etc.) previously existed.

h) Ensure that new and adapted uses are compatible with the character and special interest of the Protected Structure.

i) Protect the curtilage of protected structures and to refuse planning permission for inappropriate development within the curtilage and attendant grounds, that would adversely impact on the special character of the Protected Structure.

j) Protect and retain important elements of built heritage including historic gardens, stone walls, entrance gates and piers and any other associated curtilage features.

k) Ensure historic landscapes and gardens associated with Protected Structures are protected from inappropriate development.

Objective EH O49 - Energy Efficiency of Protected Structures - It is an objective of the Council to have regard to the Department of Environment, Heritage and Local Government's publication on Energy Efficiency in Traditional Buildings (2010) and the Irish Standard IS EN 16883:2017 Conservation of Cultural Heritage – Guidelines for Improving the Energy Performance of Historic Buildings (2017) and any future advisory documents in assessing proposed works on Protected Structures.

The Department of Culture, Heritage and the Gaeltacht is responsible for carrying out surveys of the architectural heritage on a county by county basis. Following the publication of the National Inventory of Architectural Heritage (NIAH) of Limerick and any subsequent Ministerial recommendations, the Council will consider further amendments to the Record of Protected Structures. The NIAH survey may be consulted online at buildingsofireland.ie

Objective EH O50 - National Inventory of Architectural Heritage (NIAH) - It is an objective of the Council to review and update the RPS on foot of any Ministerial recommendations including the NIAH and any future updates. The Ministerial Recommendations, made under Section 53 of the Planning Act, will be taken into account when the Planning Authority is considering proposals for development that would affect the historic or architectural interest of these structures.

5.5.5 Architectural Conservation Areas

Limerick City and many of the towns and villages of Limerick contain areas which exhibit a distinct character and intrinsic qualities based on their historic built form and layout. These are afforded special protection given their contribution collectively to the historical streetscape in areas designated as Architectural Conservation Areas (ACA). A full list Limerick's ACAs can be found in Volume 3. Whether an individual building, or a constituent part in an assemblage, each element contributes enormously to our understanding of past society and our knowledge of past building practices. This is a valuable contributor to the character of the places where we live and work and providing areas of atmosphere and ambience for visitors to Limerick. The Planning and Development Act 2000 (as amended) defines an ACA as a place, area, group of structures or townscape, that is of special architectural, historical, archaeological, artistic, cultural, scientific, technical, social interest or value, or contributes to the appreciation of Protected Structures. An ACA may consist of groupings of buildings and streetscapes and associated open spaces.

The protected status afforded by inclusion in an ACA only applies to the exteriors of structures and features of the streetscape. It does not prevent internal changes or rearrangements, provided that these changes do not impact on the external appearance of the structure. These areas do not preclude development, but the development permitted must be of a high standard and complement the surviving architectural styles.

Objective EH O51 - Architectural Conservation Areas - It is an objective of the Council to:

a. Protect the character and special interest of an area, which has been designated as an Architectural Conservation Area (ACA) as set out in Volume 3.
b. Ensure that all development proposals within an ACA be appropriate to the character of the area having regard to the Character briefs for each area.
c. Ensure that any new development or alteration of a building within an ACA or immediately adjoining an ACA, is appropriate in terms of the proposed design, including scale, height, mass, density, building lines and materials.
d. Seek a high quality, sensitive design for any new development(s) that are complementary and/or sympathetic to their context and scale, whilst simultaneously encouraging contemporary design which is in harmony with the area. Direction can also be taken from using traditional forms that are then expressed in a contemporary manner, rather than a replica of a historic building style.
e. Seek the retention of all features that contribute to the character of an ACA, including boundary walls, railings, soft landscaping, traditional paving and street furniture.
f. Seek to safeguard the Georgian heritage of Limerick.

Objective EH O52 - Shopfronts within an ACA - It is an objective of the Council to:

a) Ensure that all original and traditional shopfronts, which contribute positively to the appearance and character of a streetscape, within an ACA are retained and restored.

b) Ensure that new shopfronts are well-designed, through the sympathetic use of scale, proportion and materials

Appendix 3: Summaries of Previous Archaeological Excavations in the vicinity (extracts from www.excavations.ie)

1.	Excavations Ref. Licence/Consent No. River Shannon, Plassey	2000:0605 00D056 River Shannon, Plassey, Co. Limerick
	In advance of a new bridge scheme across the Shannon at Plassey, underwater assessment and survey were carried out over an area c. 30m upstream and c. 30m downstream of the site. A single item of archaeological interest was observed. It was a ship's timber measuring 1.9m long that was made from the bough and branch of the same tree. It is probably a portion of a stem timber. The timber was an isolated find that would have been washed downstream. It was relocated downstream of the proposed works area.	
2.	Excavations Ref. Licence/Consent No. Location & Description	2006:251/ 2006:1310 06D042, 06R0076 Garraun, Co. Clare/Sreelane, Co. Limerick
	An underwater assessment was carried out at the site of a proposed pedestrian bridge crossing of the River Shannon between Sreelane, Co. Limerick, and Garraun, Co. Clare. The work was undertaken on 12 May 2006. The desktop assessment noted that, although the river has been used as a thoroughfare since earliest times, only two Roman coins were recovered from the area. These artefacts were found on the riverbank in the townland of Sreelane, on the southern bank. Cartographic analysis showed how an eel weir depicted on the first-edition OS map of 1837 appeared to be located in the vicinity of the development, but it did not appear in the second edition. There was no trace of this feature noted in the survey. The site survey recorded that, in the area of the development, the river was divided into two channels by a series of small vegetation-covered islands. The riverbed was comprised of medium to coarse gravel with overlying stones and varied vegetative cover. The underwater and metal-detection surveys did not uncover any archaeological remains or features in the development zone.	
3.	Excavations Ref. Licence/Consent No. Location & Description	2003:1148 02E1787 Fields I-III, Kilbane II, Castletroy, Co. Limerick
	Monitoring took place of topsoil-stripping associated with a housing development, realignment of a distributor road and associated site works at Kilbane, Castletroy, Co. Limerick. The development is located within the zones of potential for a holy well and a possible burial ground, SMR 5:34(01, 02). Monitoring was undertaken subsequent to testing across the three fields of the development. Features were encountered in each of the fields and were subsequently excavated by hand. Stripping in Field 1 uncovered eight pits and one deposit. Five of the pits contained cremated bone and two pits contained fragments of Bronze Age pottery. Stripping in Field 3 revealed four areas containing varying quantities of archaeological features. These comprised a number of cremations, with one bowl furnace. Fragments of pottery were also recovered from the excavation. Stripping in Field 2 revealed a large circular ditched enclosure, measuring 40m in internal diameter, with an inner ditch also noted. This site was cordoned off and was not excavated.	
4.	Excavations Ref. Licence/Consent No. Location & Description	2003:1172 03E1801 O'Halloran Road, Castletroy, Co Limerick
	Testing was undertaken in advance of the construction of three apartments. Two trenches were excavated at this site, with a mini-digger. Both were 1.5m wide and were excavated to a depth of c. 1.5m. Nothing of an archaeological nature was noted during the testing.	
5.	Excavations Ref. Licence/Consent No. Location & Description	1998:411 98E0539 Rivers, Co. Limerick
	The surface water drainage scheme was close to an enclosure. Dúchas requested an assessment of the impact of the scheme on the known and potential archaeology of the site. On foot of this assessment all topsoil-stripping was monitored.	

	The scheme was sited in the fields to the north and east of the enclosure, which slope gently towards the Mulcair River. They consist of poor waterlogged ground that is under pasture with reeds and generally marshy growth. The corridor was on average 12m wide to incorporate the trench and a drag road. A track machine with a toothed bucket carried out the topsoil removal. Sod and topsoil were thin, less than 0.1m. The subsoil was light brown with flecks of oxidised clay that appears to originate in the topsoil, as there was no evidence of in situ burning. This flecking was concentrated to the east and west of a fence line. Modern china and fragments of red brick occurred, which became more frequent closer to the road and the farmyard. No archaeological remains were uncovered or disturbed during the course of the works	
6.	Excavations Ref. Licence/Consent No. Location & Description	1998:385 97E0350 Ballymackeogh-Mulkear, Co. Limerick
	This project was carried out by the engineering services of the OPW and involved the embanking of a portion of the Mulkear River and its tributaries, from its confluence with the River Shannon near Annacotty, Co. Limerick, northward to Newport, Co. Tipperary. The scheme began in May 1997 and continued until December 1998. During the scheme all bridges were repaired, new sluices were constructed, drains were deepened and widened, the rivers were embanked at places prone to flooding and a stretch of the Newport River was dredged. During this time all the works were monitored by the project archaeologist, who was appointed to the scheme in August 1997. An Environmental Impact Survey (EIS), which detailed all features of archaeological and cultural heritage significance along the route of the scheme, was carried out in 1996. These included fording points, limekilns, bridges and enclosures. During the scheme the works came close to the EIS sites, but none was negatively affected by it. Several of the sites identified in the EIS document, such as the fords, were found to have been replaced with modern bridges, and none of the limekilns was encountered. An underwater survey of a bridge at Bunkey and a weir at Annacotty, Co. Limerick, was undertaken before their demolition. The portion of the Newport River that was dredged and embanked during the scheme was monitored, with the spoil being deposited and spread on the banks and metal-detected before being made into embankments. During the monitoring of the scheme and the metal-detection survey, despite the works being in close proximity to several known archaeological sites, nothing of an archaeological nature was discovered. It was noted during the scheme that a sandstone trough and the upper portion of a rotary quernstone were in the possession of a farmer at Killeenagarriff, Co. Limerick, and were reported to the National Museum of Ireland	
7.	Excavations Ref. Licence/Consent No. Location & Description	2005:952 05E1251 Rivers, Annacotty, Co. Limerick
	Test excavation was carried out within a greenfield area adjacent to and south of the N7 Limerick–Dublin road. The proposed development consists of a retail scheme measuring 7761m2 of gross floor area. The site retains a monument along its north-western boundary, identified by aerial photography. It is possible that it had previously been impacted upon by the construction of the roundabout at the north-west corner of the site. The excavation achieved depths of up to 0.6m, consistent with the surface of the underlying, naturally occurring, subsoil. No materials or artefacts were encountered in the course of testing that could be absolutely related to the monument. However, six individual features were identified as being archaeological or retaining archaeological potential. Three possible ditches/field boundaries retain the potential for some antiquity since available cartographic data does not appear to indicate their presence. F1 is consistent with fulacht fiadh structures. Its burnt-stone material, in particular sandstone, further emphasises this hypothesis. F2 is consistent with a	

	kiln structure; its apparent lack of artefactual material may indicate a corn-drying kiln. Similar to F1, its location would suggest possible association with the SMR site. When both F1 and F2 are considered in their setting and proximity to 6:63, this provides for strong indications of a site complex with multiple outlying activities. C7 further emphasises this. Its material is consistent with the residue of redug pits associated with fulachta fiadh.	
8.	Excavations Ref. Licence/Consent No. Location & Description	2017:283 17E0450 Rivers, Co. Limerick
	In advance of planning and development an archaeological assessment of this site in Rivers Townland, Annacotty, Co. Limerick was carried out. The site contains 4 RMP sites: LI006-063 (Enclosure), LI006-094001 (Burnt Mound Activity), LI006-094002 (Corn Drying Kiln) and LI006-094003 (Excavation – miscellaneou)s. This assessment included a documentary review, preliminary site visit and test trench excavations to determine the archaeological potential of the site, if any. A geophysical survey of the site was carried out in late July 2017 as part of this assessment (Licence ref: 17R0144). The site was initially inspected on 10 June 2017 and test trenching was carried out over the site on 9 October 2017. To assess the site, nine test trenches were proposed. A further six trenches were excavated on 19 December 2017 under an extension to Licence Ref: 17E0450. The Enclosure site (LI006-063) was identified, in the north-west corner of the field, from an OSI aerial photograph (1985) and initially listed as 'Potential site – Air Photo'. A test excavation was carried out on the site in 2005 (Licence Ref: 05E1251). This excavation identified the other listed RMP sites all of which were located in the north-west corner of the field. It was felt that these could not be definitively related to the Enclosure site. At this time, it was felt that the construction of the roundabout on the R445 had obliterated the Enclosure. The geophysical survey did not identify the Enclosure site or any of the other RMP sites identified in 2005. Test trenching in October 2017 identified archaeological material in the north-west corner of the field. The density of this material in addition to the features recorded in 2005 makes a solid argument for the continued existence of the Enclosure, but it did not identify the Enclosure ditch. Using a copy of the original OSI photograph and overlaying it on current OSI mapping, it was possible to demonstrate that the Enclosure was not destroyed but remained extant in the north-west corner of the field. To confirm this the outline of the Enclosure was marked on the landscape and six further trenches targeted on the line of the Enclosure ditch. These trenches confirmed the location of the Enclosure ditch in 5 out of the 6 trenches. It is likely that the Enclosure suffered some damage during the roadworks to the north and west of the field	
9.	Excavations Ref. Licence/Consent No. Location & Description	1991:087 N/A Castletroy, Co. Limerick
	A one-week preliminary excavation began on 1st July 1991 on the recommendation of an E.I.S. report prior to the proposed EuroTechnopole Park development. The 1 .3m high x 2m wide linear bank produced 18th and 19th-century pottery and is of little archaeological significance. The excavation was funded by Shannon Development.	
10.	Excavations Ref. Licence/Consent No. Location & Description	2002:1145 02E1402 Newcastle, Castletroy, Co. Limerick
	During an impact assessment for a proposed mixed development, a mound of archaeological potential was noted. This site was subsequently tested. Three trenches were dug by machine. It was quickly realised that the mound was a natural feature. However, in the longest trench a spread of stony burnt material was discovered, along with two circular pits, which were also filled with the burnt material. These features were interpreted as the remains of a burnt mound, perhaps a fulacht fiadh, with two associated pits, which may have functioned as troughs.	
11.	Excavations Ref. Licence/Consent No.	N/A 06E1138

	Location & Description	Plassey Campus, University of Limerick, Sreelane, Co. Limerick
	As part of the development of the UL campus, a building was constructed adjacent to the Millstream Courtyard Building. There were two archaeological features of 19th -century date in the immediate vicinity of the development site – Plassey Millrace channel and a pump house. As a condition of the grant of planning, an archaeological excavation of the pumphouse was undertaken to reveal the full extent of the structure. Three subterranean chambers were encountered containing a gear wheel and water turbine and part of a pump mechanism	
12.	Excavations Ref. Licence/Consent No. Location & Description	2003:0115 16135 15870 UL North Campus, Garraun, Co. Clare
	Testing was carried out in advance of the construction of the North Campus Spine Road at Garraun, Clonlara, Co. Clare. The road runs roughly parallel to the River Shannon, where a new bridge is being constructed which will link the main body of the campus of the University of Limerick with lands in Co. Clare. Testing was carried out by excavating a continuous trench along the centre-line of the road with offsets alternating on each side. Thirteen shallow linear features were revealed. Five of these were 19th/20th-century field drains. The remainder were the remains of furrows. A small amount of modern pottery and brick was found in these	
13.	Excavations Ref. Licence/Consent No. Location & Description	2003:0114 02E1216 UL North Campus, Garraun, Co. Clare
	Monitoring of topsoil-stripping associated with the construction of the Thomond student village (also known as the '4th village') took place at Garraun, Clonlara, Co. Clare. The development forms part of the north campus of the University of Limerick and is one of a number of projects being undertaken on the north bank of the Shannon. A permanent road bridge is also being constructed linking the campus to the main body of the university. A temporary bridge was put in place to facilitate construction. Extensive topsoil-stripping took place in 2002 on the site of the student village and on the Limerick and Clare ends of the temporary and permanent bridges (Excavations 2002, No. 166). All of this work was monitored. The only features uncovered were the remains of two brick clamp kilns. The area that was monitored in 2003 lies between the largest kiln and the landfall of the temporary bailey bridge on the Clare side of the river. The only features uncovered were a series of furrows aligned north–west/south–east and two land drains running parallel to the furrows. One of these was visible as a shallow linear depression in the field prior to stripping. These features extended over a distance of c. 60m. Fragments of broken brick were found in both the drains and to a lesser extent in the furrows. This is not surprising, as the nearest clamp kiln is c. 25m away to the west. This indicates that they post-date the kiln, which is thought to be of mid- to late 18th- or early 19th-century date and may be associated either with the construction of the nearby Errina Canal in the 1750s or Plassey Mill in the 1820s. An examination of the riverine material removed from the pile shafts of the permanent bridge was also undertaken. No archaeological material was found.	
14.	Excavations Ref. Licence/Consent No. Location & Description	2002:0167 02E1561 Garraun, Co. Clare
	Monitoring was carried out here. No archaeological material was recovered.	
15.	Excavations Ref. Licence/Consent No. Location & Description	2010:098 10E0132 North Campus, Garraun, Co. Clare

	The University of Limerick is constructing four sports pitches, a sports pavilion incorporating changing rooms, offices and associated facilities and a restaurant, together with access roads, car-parking and landscaping, as part of their northern campus at Garraun, Clonlara, Co. Clare. A substantial part of the preparatory groundworks will involve the raising of the ground levels across the whole site by approximately 1.25m to protect the proposed pitches against future extreme flooding events. Also associated with these measures is the construction of an earthen bund around the northern, western and southern sides of the site. The development site covers 9.8ha. A series of 29 test-trenches were excavated by machine under supervision. No archaeological material was uncovered during the testing. All of the material uncovered was of 19th- or 20th-century date.	
16.	Excavations Ref. Licence/Consent No. Location & Description	2010:097 09E0550 North Campus, Garraun, Co. Clare
	As part of continuing development of their campus, the University of Limerick is constructing a medical school in the town land of Garraun, on the northern (Clare) side of the university campus. To facilitate the students of this faculty, three accommodation blocks will be built adjacent to the Medical School. Much of the site of the development was disturbed in recent years by construction works of the Cappavilla Student Village east of the site and the erection of the bungalow on the site of a 19th-century farm complex. No archaeological material was uncovered during the monitoring of the site development works.	
17.	Excavations Ref. Licence/Consent No. Location & Description	1991:087 N/A EuroTechnopole Park, Castletroy, Co. Limerick
	A one-week preliminary excavation began on 1st July 1991 on the recommendation of an E.I.S. report prior to the proposed EuroTechnopole Park development. The 1 .3m high x 2m wide linear bank produced 18th and 19th-century pottery and is of little archaeological significance. The excavation was funded by Shannon Development.	
18.	Excavations Ref. Licence/Consent No. Location & Description	2002:1250 02E1347 Rivers, Co. Limerick
	This feature was excavated before the laying of the Newcastle to Clareville rising main, at Rivers, Stradbally. The feature was an irregular spread of charcoal material measuring 2.1m east–west by 0.8m. It overlay undulating, natural clay. A sherd of post-medieval pottery was recovered from the charcoal fill.	
19.	Excavations Ref. Licence/Consent No. Location & Description	2002:1124 02E1348 Ballyvollane, Co. Limerick
	The site, at Ballyvollane, Stradbally, was uncovered and excavated during monitoring of topsoil-stripping for the Clareville to Newcastle rising main. The fulacht fiadh survived as a low mound of burnt stone in a charcoal-rich soil matrix. It lay in a low-lying marshy area close to a stream. The deposit was roughly circular, 10m in diameter, and 0.5m at its deepest. There was no obvious trough under the deposit, but a roughly circular cut lay under the south-west quadrant of the fulacht material. It was filled with burnt material. The burnt material overlay an undulating, grey, clay subsoil. No finds were recovered.	
20.	Excavations Ref. Licence/Consent No. Location & Description	2002:1125 02E1403 Ballyvollane, Co. Limerick
	This site did not have an above-ground register before removal of topsoil, which was monitored by Avril Hayes (No. 1146 below, 01E1069) before construction of a pipeline. This revealed a spread of burnt and fire-cracked stones covering an area measuring 12m north–south by 4m. The stone deposit had an average depth of 0.3m. Excavation of this material revealed a series of pits and natural hollows, all filled	

	with similar fire-shattered stone and charcoal. One of these pits produced a sherd of Beaker pottery and a piece of worked timber, tentatively interpreted as a wooden scoop or shovel. This may have been used to move the burnt stones and appeared to have been broken and abandoned in antiquity. A shallow rectangular pit was also identified, c. 10m to the east of the burnt spread. It measured 1.4m east–west by 0.9m and was cut into sand to a depth of 0.1m. It was also filled with burnt stone and occasional charcoal flecks. Part of an animal tooth was recovered from the fill of the pit. Its association with the main spread of burnt stone is unclear.	
21.	Excavations Ref. Licence/Consent No. Location & Description	2001:748 01E0416 Ballyvollane/Prospect/Newgarden North/Hermitage/Stradbally North/Coolreiry/Derreen/Lacka/Coolbane/Cloon/Commons, Limerick
	Castleconnell Sewerage Scheme works include 850m of 200mm (diameter) rising main; 6100m of 250mm rising main; 5300m of 200mm water main; 4326m of 225mm sewer; 3000m of 300mm sewer; 483m of 450mm sewer; and 170m of 525mm sewer. The works are largely centred on the road network of the village of Castleconnell, which is contained in the townlands of Cloon, Commons and Coolbane and the surrounding townlands of (north to south) Lacka, Derreen, Coolreiry and Stradbally North. The 250mm-diameter rising main continues south-westwards along the bank of the River Shannon through the townlands of Ballyvollane, Prospect, Newgarden North, Hermitage and Castletroy. Topsoil-stripping through the greenfield areas in Ballyvollane, Prospect, Newgarden North, Hermitage, Stradbally, North, Coolreiry, Derreen and Lacka began in May and was completed in August. The remains of a burnt spread were uncovered behind the primary school in Coolreiry. It was possible for the trenching works to avoid the spread and when it had been recorded it was protected with geotextile material. The work is now centred on the townlands of Coolbane, Cloon and Commons in Castleconnell village. Advance testing also took place in the townlands of Hermitage (01E0319), Prospect (01E0317) and Stradbally North (01E0318) (see below, Nos 762, 793 and 803). Apart from this, no other archaeological remains have been uncovered during the course of the works to date (2001).	

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13 MATERIAL ASSETS

13.1 INTRODUCTION

The Assessment area, for the purposes of this Chapter, refers to the area in which works are proposed for the Limerick City Greenway (UL to NTP) as described in Chapters 3 & 4 of the EIAR.

This chapter assesses the impacts of the scheme, hereafter referred to as the proposed development, under the heading of Material Assets on the Assessment area during both construction and operational phases.

Material Assets are generally considered to be the physical resources in the environment, which may be of man-made or natural origin and have intrinsic value to an area. These resources can be assigned economic value based on their significance within the overall socio-economics of an area. The impact of the proposed development on transport infrastructure, traffic, sub-surface infrastructure and management of waste are assessed in this chapter.

The EPA's *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (May, 2022) states that Material Assets can be "taken to mean built services and infrastructure". Given this, "Land Use" is additionally discussed under Chapter 7 "Land Use, Soils & Geology". This assessment will identify the existing material assets in the assessment area, determine the impacts, if any, that the proposed development may have on these resources, and as necessary, detail proposed mitigation measures.

Material Assets are additionally appraised in a number of other Chapters within this EIAR Report as follows:

Natural Resources:

- Chapter 7: Land Use, Soils & Geology
- Chapter 8: Water Quality

Cultural Heritage:

- Chapter 12: Cultural Heritage

Towns and settlements:

- Strategic & Statutory Planning Context within Chapter 1
- Chapter 5: Human Beings, Population & Human Health

A number of documents were consulted in the preparation of this assessment, including:

(i) Limerick Development Plan (2022 - 2028)
(ii) Limerick Shannon Metropolitan Area Transport Study (LSMATS)
(iii) Southern Region Waste Management Plan 2015 – 2021 (as implemented through the Local Authority Development Plans)
(iv) EPA Wastewater Discharge Licence Applications database
(v) EPA, Guidelines on the information to be contained in Environmental Impact Statements
(vi) EPA, Guidelines on the information to be contained in Environmental Impact Assessment Reports, 2022
(vii) Guidance for the Control and Management of Traffic at Road Works, Department of Transport, 2010
(viii) Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects, EPA, 2021.

13.2 Assessment Methodology

This assessment is based on a desktop study with details of major utilities taken from information supplied by Limerick City & County Council (LCCC) and various utilities providers. It includes plans and drawings of existing utilities along with data provided by site investigations. The data collection is in line with the requirements of the EPA advice notes and guidelines on the production of Environmental Impact Assessment Reports (2022).

This chapter sets out a baseline of the existing infrastructure and lands on which the development is proposed, assesses the potential for impacts that the proposed development may have on those lands and infrastructure and identifies mitigations that will be employed to minimise those impacts.

An analysis of land quality, sensitivities and use together with an assessment of impacts of the proposed development on land is provided in Chapter 7 of this EIAR.

13.3 Assessment of Impacts

This section is based on criteria and best practice guidance contained in the '*Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)*'[1] and under EU legislation contained in EIA Directive (2014/52/EU) as adopted by Ireland in 2014.

Impacts are assessed using the following criteria:

- Duration of Effect – ranging from Brief (<1day) to Permanent.
- Quality of Effect – Neutral/Negative/Positive.
- Type of Effect – Direct/Indirect.
- Value of Receptor – ranging from Negligible to High.
- All above contribute to an assessment of the Significance of Effect – ranging from Imperceptible to Profound.

13.4 Receiving Environment – Infrastructure

The proposed development, as described in Chapter 4, comprises the construction of approximately 4.25 km of Greenway extending from the River Groody bridge, past the University of Limerick, and eastwards to the National Technology Park (NTP) at Castletroy.

The works involve the upgrade of an existing gravel and paved pathway and undeveloped amenity parklands along the southern bank of the River Shannon, turning towards McLaughlan Road, with one spur turning south to run past Kilmurry student village then along University Road to join Plassey Park Road.

Subject to agreement the proposed works will impact on the existing footpaths within the NTP and along McLaughlan Road.

Subject to agreement, construction traffic will pass by Dromroe student village and Kilmurry student village, and through a private road (for LCCC/Uisce Éireann (UE) network operations use) within the UL Campus.

Due to the linear nature of the proposed works, the construction of the proposed Greenway will be divided into five sections, each serviced by separate temporary construction compounds and haul routes, to facilitate sequencing of works, as illustrated in Figure 13-1. This sectional approach will mean that one section of the

1 EPA, 2022

proposed Greenway can be constructed while the adjacent sections are kept in use for both cyclists and pedestrians.

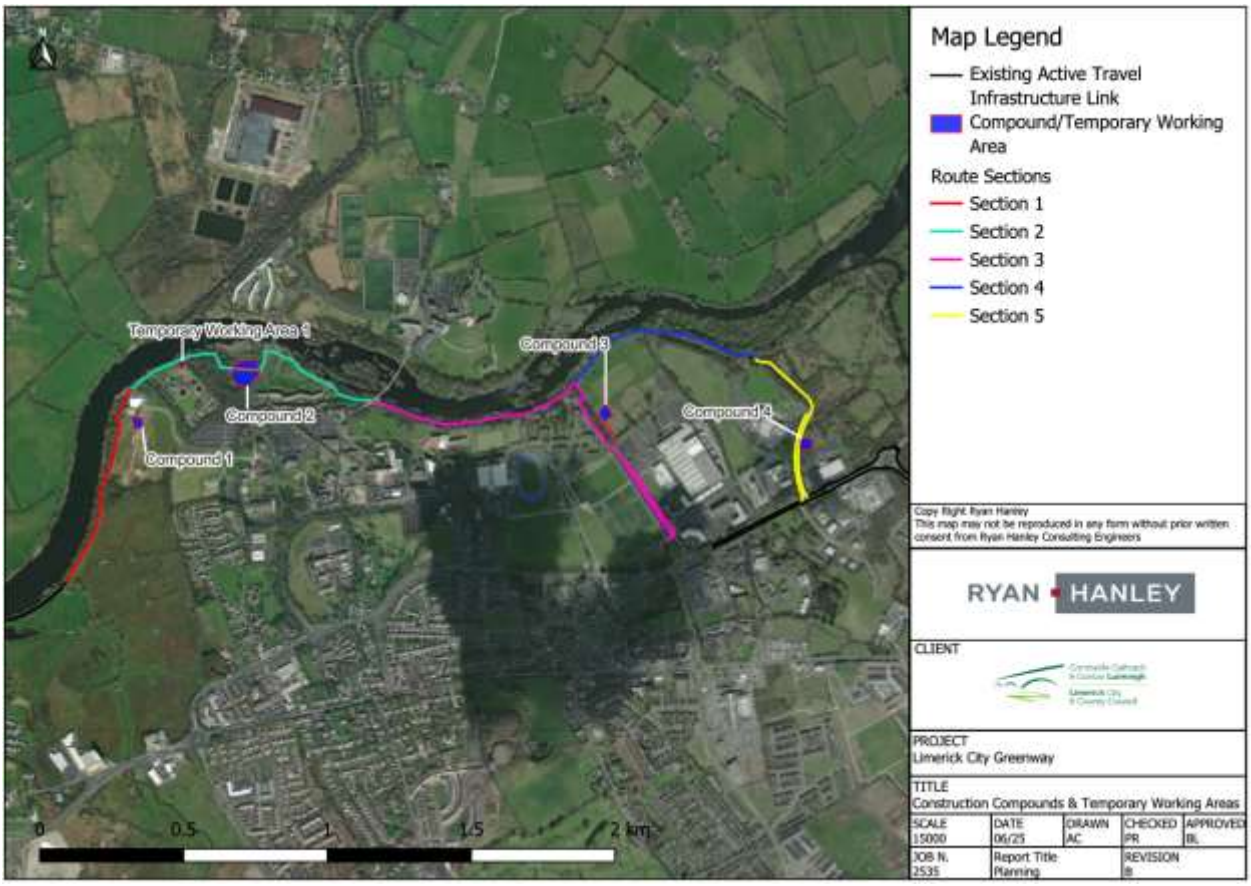

Figure 13-1: Schematic of construction sections and compounds

Potential impacts to Material Assets are restricted to the defined areas where works are proposed and areas that may be impacted during the construction of the proposed development.

Proposed Construction Methodologies are detailed in Section 4.1 of Chapter 4 and will comprise:

- Site investigation;
- Site clearance (tree removal and earthworks);
- Set up of temporary working areas and site compounds;
- Construction of temporary access roads;
- Traffic management;
- Relocation of existing utilities/services;
- Construction of Greenway;
- Construction of new bridges and culvert crossings;
- Construction of concrete retaining wall;
- Construction of access ramp;
- Construction of concrete steps;
- Construction of drainage infrastructure (Swales and culverts);
- Installation of Public Lighting;
- Installation of wooden and anti-climb fencing along path;
- Interfaces with roads (beacon lighting, safety barriers, dipped kerbs, and safety barriers);

- Ancillary and amenity (fencing, signage, bike racks, park benches); and,
- Reinstatement works.

The development location is primarily set within both a rural, riverside amenity area and suburban, residential area. The existing pathway developed from a 19th -century towpath built as part of the Shannon Navigation programme. Parts of the Greenway will diverge from the riverside pathway to facilitate access and egress to UL campus, NTP and the wider Castletroy residential areas. In some locations the proposed greenway route will also diverge from the existing riverside pathway to avoid mature trees and roosting habitat.

The proposed Scheme will have potential to impact on the following:

- Transport Infrastructure - including Roads & Traffic;
- Waste Management;
- Water Distribution Network
- Drainage Network; including Foul & Storm Water;
- Bord Gáis Distribution Network;
- Electricity Network - including public services, street lighting, etc;
- Broadband Network - Fibre & Satellite; and
- Telecommunications Network - including cable & mobile;

These elements are further assessed in Chapter 5 – Human Beings, Population & Human Health and Chapter 8 – Water.

13.4.1 Transport Infrastructure – Roads & Traffic

Road and transportation infrastructure in the townlands of Dromroe, Sreelane, Newcastle and Castletroy comprise Regional, Local Primary, Local Secondary and Local Tertiary roads. All public roads works in the assessment area are overseen by LCCC Roads Department and any works within the University of Limerick campus are maintained by that institution. Table 13-1 provides details of the relevant existing road network in the assessment area:

Table 13-1: Existing road network within the assessment area

Name/Descriptive Location	Road Title (LCCC)	Class
M7	M7	Motorway
Dublin Road	R445	Regional
Plassey Park Road	-	-
University Road	-	-
McLaughlan Road	-	-
Castletroy WWTP Access Road/Harvard Close	-	Private – LCCC/UÉ access

The primary haulage routes are anticipated to be the M7 and R445 for primary access to the assessment area. Within the assessment area, haulage routes will utilise a series of Local Roads including Plassey Park Road, McLaughlan Road, University Road and several unnamed roads within the UL campus.

13.4.1.1 Existing Traffic and Transport Network

TII maintain two traffic counters on the M7 and the Dublin Road (R446). LCCC was consulted in March 2024 and it is understood that no traffic counters or relevant data for the Castletroy and environs area exist. Data is presented in Table 13-2.

Table 13-2: TII and Limerick City and County Council AADT data

Road Class	Road Number	Road name & Location	Count Date	AADT	Count Type
Motorway	M7	East & South of UL	January to March 2024	30,866	Traffic Counter
Regional	R445	Dublin Road	January to March 2024	17,703	Traffic Counter

Relevant data compiled by TII for AADT and percentage of Heavy Goods Traffic (%HGV) on the R445 road and M7 Southern Ring Road are presented in Table 13-3 and Table 13-4.

Table 13-3: Traffic Flow data for the R445 Regional Road between Castletroy & Annacotty Roundabouts *(Source: TII - https://trafficdata.tii.ie)*

Year	ADT	% HGV	Coverage
2024*	17,703	1.0%	20.0%
2023	17,788	1.3%	100.0%
2022	16,751	1.2%	100.0%
2021	13,450	1.5%	100.0%
2020	14,748	1.5%	99.7%

Table 13-4: Traffic Flow data for the M7 Between Jn28 Castletroy and Jn29 M7/N24 Ballysimon, Castletroy, Co. Limerick (Source: TII. *(Source: TII - https://trafficdata.tii.ie)*

Year	ADT	% HGV	Coverage
2024	30,866	6.8%	20.0%
2023	31,619	6.9%	99.0%
2022	29,645	7.2%	100.0%
2021	25,367	8.3%	100.0%
2020	22,277	8.9%	100.0%

The area under assessment is served by the following bus links:

- Bus Éireann Route 323, City Centre - Castleconnell
- Bus Éireann Route 304, Ballycummin - UL
- Bus Éireann Route 304A, Raheen UHL - UL
- Eurobus Route 307, William Street - Cappavilla.
- Eurobus Route 308, William Street – University (Stables).
- Dublin Coach M7, Arthur's Quay via University (Stables) – Dublin City.

The area under assessment is not served by a rail link.

13.4.1.2 Potential Impact on Road Infrastructure

Construction Phase: ***Potential Temporary Slight to Moderate Negative Impact***

Operational Phase: ***Potential Permanent Significant Positive Impact***

The proposed development will involve construction of a path along an existing route which will be approx. 4.25km in length. The proposed route is detailed in Chapter 3 and illustrated in the Preliminary Design drawings. Cumulative impacts of these closures and/or diversions are assessed in Chapter 5: Human Beings, Population & Human Health.

Construction Phase:

The potential impacts of the proposed development on the road network, due to works being carried out on and in the vicinity of the road network, are as follows:

- Temporary moderate negative impact where road re-profiling and re-kerbing
- Temporary moderate negative impact during haulage of materials such as quarried imports and other deliveries
- Temporary slight negative impact during site clearance and preparation of temporary works compounds.
- Temporary slight negative impact during construction of culverts and installation of bridges and decking along route.
- Temporary slight negative impact during construction of drainage and lighting infrastructure.
- Temporary moderate negative impact during construction of road crossings.

The temporary traffic management plans that would be in place during the construction stage are included in the Design Process Traffic Management Plan in Appendix A.

Operational Phase:

- Permanent significant positive impact during operational phase due to increased usage of route and enhancement of amenity value of area.

13.4.1.3 Potential Impact of Construction on Traffic

Construction Phase: ***Potential Short-Term Slight to Moderate Negative Impact***

Operational Phase: **No Impact**

Construction Phase

An additional short-term slight to moderate negative impact on traffic as a result of the proposed development will be a short-term increase in traffic volumes as a result of construction activity. This section assesses this impact on existing traffic volumes in the assessment area and Section 13.6 of this chapter details mitigation measures to be implemented in advance of and during construction phase.

Some localised traffic disruption is likely to occur at locations of proposed works on, or in the immediate vicinity of the road network due to construction works and traffic entering and exiting the works areas as well as along the proposed haulage routes.

Table 13-5 details the predicted average construction traffic volumes across the road network including the main routes into and out of construction sites/compounds within the assessment area. To determine the impact on existing traffic, a peak value of 28. No round trips per day was used to calculate the impact potential. This is assuming a worst-case scenario based on the maximum predicted number of round trips per day in a works area. This scenario is unlikely to occur routinely during the construction phase.

Vehicles used in construction phase will not be using the road network at the same times for all sites. Certain vehicles, plant and materials will be required to be delivered once only and then transported within the works area. Additionally, delivery and removal of any materials will occur intermittently over specified and staggered time periods. The impacts across the road network will be minimised with the phasing and spread of works as detailed in Table 13-5. The programme indicates that all the works will be completed in sections and all plant and materials for each task delivered in the required time. The table below indicates traffic at peak volumes to allow for maximum impact determination.

Chapter 4, Section 4.3 outlines the predicted duration and sequencing of the works. Delivery of plant and materials will not have a long-term negative impact to existing traffic.

LCCC Roads, Traffic & Transportation section were consulted, and it is understood that no traffic counters or current data exist within the Castletroy area. It is expected that during construction Plassey Park Road, University Road, McLaughlan Road and the Castletroy WWTP Access Road will experience an increase in traffic volumes during construction, however it is not anticipated that this will result in notable traffic congestion.

It is predicted that the Dublin Road (R445) will have the largest increase in traffic volumes during the construction phase of the proposed project however it is not anticipated that this will result in notable traffic congestion.

Table 13-5: Break down of estimated trips for proposed Limerick City Greenway (UL to NTP)

	LOCATION	Soil Exported (m^3)	GRAVEL IMPORTED (m^3)	MACADAM IMPORTED (m^3)	CELL-WEB (m)	GEOTEXTILE (m)	PRE-CAST PIPES (#)	CONCRETE TRUCKS (Total #)	MISC DELIVERIES (Total #)	WORKFORCE TRIPS (Total #)	Movements (Total #)
SECTION 1/COMPOUND 1											
Compound Set Up and Operations No. 1		0	392	0	0	327	0	0			
Site clearance		0	0	0	0	0	0	0			
Installation of haul road		0	487	0	0	464	0	0			
Construction of cycle path		0	451	0	0	0	0	0			
Surfacing of path		0	0	193	0	0	0	0	38	752	945
Bank stabilisation		0	129	0	0	0	0	0			
Utilities/Services/Lighting		0	0	0	0	0	0	0			
Construction of drainage infrastructure		0	261	0	0	0	2	0			
Installation of root protection CellWeb		0	0	0	737	0	0	0			
SECTION 2/COMPOUND 2 + TEMPORARY WORK AREA 1											
Compound Set Up and Operations No. 2 + Temporary Working Area 1		0	2040	0	0	1700	0	0			
Site clearance		0	0	0	0	0	0	0			
Installation of haul road		0	641	0	0	611	0	0			
Construction of Bridge 1, 2, 3 & 4		0	366	7	0	0	0	11			
Construction of cycle path		0	614	0	0	0	0	0			
Surfacing of path		0	0	264	0	0	0	0	51	1027	1448
Bank stabilisation		0	173	0	0	0	0	0			
Utilities/Services/Lighting		0	0	0	0	0	0	0			
Construction of drainage infrastructure		0	343	0	0	0	3	0			
Installation of root protection CellWeb		0	0	0	991	0	0	0			
SECTION 3											
Compound Set Up and Operations		0	0	0	0	0	0	0			
Site clearance		0	0	0	0	0	0	0			
Installation of haul road		0	92	0	0	88	0	0			
Construction of Bridge 5		0	0	0	0	0	0	20			
Construction of cycle path		0	1043	0	0	0	0	0			
Surfacing of path		0	0	478	0	0	0	0	88	1766	2027
Bank stabilisation		0	174	0	0	0	0	0			
Utilities/Services/Lighting		0	0	0	0	0	0	0			
Construction of drainage infrastructure		0	50	0	0	0	0	0			
Installation of root protection CellWeb		0	0	0	996	0	0	0			
SECTION 4/COMPOUND 3											
Compound Set Up and Operations No. 3		0	510	0	0	425	0	0			
Site clearance		0	0	0	0	0	0	0			
Installation of haul road		0	25	0	0	24	0	0			
Construction of cycle path		0	444	0	0	0	0	0			
Surfacing of path		0	0	190	0	0	0	0	37	740	884
Bank stabilisation		0	127	0	0	0	0	0			
Utilities/Services/Lighting		0	0	0	0	0	0	0			
Construction of drainage infrastructure		0	13	0	0	0	0	0			
Installation of root protection CellWeb		0	0	0	724	0	0	0			
SECTION 5/COMPOUND 4											
Compound Set Up and Operations No. 4		0	480	0	0	400	0	0			
Site clearance		0	0	0	0	0	0	0			
Installation of haul road		0	298	0	0	283	0	0			
Construction of cycle path		0	553	0	0	0	0	0			
Surfacing of path		0	0	264	0	0	0	0	47	935	1130
Bank stabilisation		0	50	0	0	0	0	0			
Utilities/Services/Lighting		0	0	0	0	0	0	0			
Construction of drainage infrastructure		0	159	0	0	0	1	0			
Installation of root protection CellWeb		0	0	0	284	0	0	0			

Table 13-6: Peak Daily Construction Traffic as a Percentage of Existing Traffic on Anticipated Construction Traffic Routes

Road Name	Annual Average Daily Traffic	Construction Traffic	
		Peak Daily Construction Traffic (Round Trips)	As a Percentage of Existing Traffic
M7	30,866	28	0.091%
Dublin Road (R445)	17,703	28	0.158%

It is predicted based on available data that the R445 will have the largest increase in traffic volumes during the construction phase of the proposed Greenway, however again it is not anticipated that this will result in notable traffic congestion. Based on Table 13-6, construction traffic is predicted to have a **short-term minimal to moderate impact** on traffic during the construction phase.

Operational Phase:

There will be **no predicted negative impact** due to construction traffic during Operational Phase of the proposed development.

There will be a **predicted significant positive impact** on traffic flows where the proposed works will increase Greenway users connecting to the various residential, educational, commercial and industrial, areas.

13.4.1.4 Potential Impact of Road Closures on Traffic

Potential Temporary Slight to Moderate Impact

Existing traffic, together with access for businesses and local property owners, will have to be facilitated along Harvard Close, Dromroe & Kilmurry Student Villages within the University of Limerick Campus, Plassey Park Road.

It is expected that some temporary road closures and lane closures will be required to facilitate the construction the proposed Greenway.

Road opening licences will be submitted to LCCC six weeks in advance of works. A Traffic Management Plan will be implemented, and the works will be planned to minimise disruption to the UL campus, NTP and residential areas. Details will be specified in the any Road Opening Licences in liaison with LCCC.

It is possible that extended working hours or night-time works could be used to minimise the impact on traffic flows in the locality. University exam times will have to be taken into consideration for working hours in detailed planning of the works. Design parameters are provided in Tables below and proposed road closure locations and details are further described in the Traffic Management Plan.

University Road

Construction traffic will use University Road to access Compound No. 3 and the Magenta and Purple sections of the proposed path.

It is planned that the western lane of University Road will be temporarily closed during the works to permit construction of the works associated with the Greenway (cycle path & pedestrian path). The proposed cycle path will be situated in the existing grassed verge area to the west of the road. The proposed pedestrian path will occupy the western extent of the existing parking bays.

The existing footpath on the eastern side of the road will remain in use during the works. It will be the responsibility of the PSCS to maintain the footpaths for the duration of the works. The requirements of clause 8.3.11 of 'Traffic Signs Manual (Chapter 8 – Temporary Traffic Measures and Signs for Roadworks)' must be adhered to.

Once work has been complete on the western side, it will reopen to allow pedestrian access during construction of the eastern path. At which point the eastern lane of University Road will be temporarily closed during the works to permit construction of the works associated with the Greenway (cycle path & pedestrian path).

A shuttle system shall be adopted to enable traffic to pass through the works using one lane. This may be operated by two methods, Stop and Go and Temporary Traffic Signals.

McLaughlan Road

Construction traffic to Compound No. 4 and the Yellow Section of the proposed path will use McLaughlan Road.

It is planned that the eastern lane on McLaughlan Road will be temporarily closed during the works to permit construction of the proposed combined cycle and pedestrian path. The proposed combined cycle and pedestrian path will be situated along the easter and western extent of the existing road in place of the existing footpaths and verge.

The existing footpath on the western side of the road will remain in use during works on the eastern cycle and pedestrian path and vice versa. It will be the responsibility of the PSCS to maintain the footpaths for the duration of the works. The requirements of clause 8.3.11 of 'Traffic Signs Manual (Chapter 8 – Temporary Traffic Measures and Signs for Roadworks)' must be adhered to.

A shuttle system shall be adopted to enable traffic to pass through the works on one lane. This may be operated by two methods, Give & Take and Priority (Yield Sign)

13.4.2 Red Section

During construction along the Red section of the proposed path, cyclists and pedestrians will use the existing path for much of its length between the River Groody and Construction Compound 1 because the red section diverts of the existing path in many locations. In areas between the River Groody and Construction Compound 1 where the proposed route overlaps the existing towpath, a pedestrian route shall be maintained during the works. Once pedestrians reach Construction Compound 1, they will be diverted away from the Red Section and towards south and east of the UL Boat House and rejoin the existing riverside path as long as Section 2 (cyan) is open.

13.4.3 Cyan Section

During construction along the Cyan Section of the proposed path, cyclists and pedestrians will be diverted away from the tow path at the UL Boat House and continue past the entrance of Castletroy WwTP until reaching the Tierney Building. They will then head north for a short distance until travelling through Dromroe Student Village and to the Foundation Building. From here they will continue past the White House and rejoin the tow path at the Magenta section via an existing footbridge at the back of the PESS building.

13.4.4 Magenta Section

During construction along the Magenta Section of the proposed path, cyclists and pedestrians will be diverted away from the tow path at Dromroe Student Village and be diverted to the Foundation Building. From here they will continue past the White House and behind the PESS building, all weather pitch and tennis court until reaching Kilmurry Student Village. Pedestrians will then use the existing pathway from Kilmurry Student Village which runs between the Acres Maguires Pitches until reaching Plassey Park Road.

13.4.5 Purple Section

During construction along the Purple Section of the proposed path, cyclists and pedestrians will be diverted away from the tow path at Kilmurry Student Village and be diverted along University Road until reaching Plassey Park Road.

13.4.6 Yellow Section

During construction along the Yellow Section of the proposed path, cyclists and pedestrians will be diverted away from the tow path at Kilmurry Student Village and be diverted along University Road until reaching Plassey Park Road.

13.4.7 Harvard Close

It is proposed that construction traffic will access proposed construction Compound 1 and Temporary Works Area 1 along the red section of the proposed path via Harvard Close. The road is normally only used by maintenance and operations vehicles accessing the WwTP. Adequate signage will be required along this route during construction works to ensure the safety of existing users. Flagmen will be required to manage construction traffic at junctions and where construction vehicles will join Plassey Park Road.

13.4.8 Dromore Village Road

It is proposed that construction traffic will access a proposed Construction Compound 2 along the Cyan Section of the proposed path via the road to the west of Dromroe Student Village on the UL campus. The road is normally used to access Dromroe Student Village, the North UL Campus including Thomond Student Village and Cappavilla Student Village, and Parteen via the road bridge over the River Shannon. Pedestrian and Cycle lanes are present on both the west and east lane of the road. Flagmen will be required to manage construction traffic where vehicles will access Dromore Village Road from the construction compound.

13.4.9 University Road

It is proposed that construction traffic will access construction Compound 3 along the Magenta and Purple Sections of the proposed path via University Road. The works along University Road will operate in all flow and visibility conditions and will remain in position for a duration of more than 24 hours, it is anticipated that the class of the roadworks will be 'Type A'.

Refer to Table 13-7 for details. Adequate signage will be required along this route during construction works to ensure the safety of existing users.

Table 13-7: Road and Traffic Management details along University Road

Works Class	Speed Limit (kph)	Footpath	Road Width	Hazard	Traffic Management Layout	Notes
A	Assumed 50 - 60	Existing along eastern side of road to remain operational throughout the works	Varies, approx. 7-12m	Existing road traffic, pedestrians, construction traffic accessing Compound 3.	One lane closure with stop and go, or traffic lights	Provision must be maintained for pedestrian use of footpath. The proposed pedestrian path will occupy approx. 50% of the width of the parking bays at the western side of the road. Parking bays will remain functional post construction.

13.4.10 McLaughlan Road

It is proposed that construction traffic will access proposed construction Compound 4 along the Yellow Section of the proposed path via McLaughlan Road. It is proposed to facilitate existing traffic, and pedestrian walkway, along the section of McLaughlan Road.

The works along McLaughlan Road will operate in all flow and visibility conditions and will remain in position for duration of more than 24 hours, it is anticipated that the class of the roadworks will be 'Type A'. Works along the entrance and exit to the car park of Cook Medical, Greentech Plastics Ltd will be temporary and it is anticipated that the class of the roadworks in will be 'Type B'. Refer to Table 13-8 for details.

Table 13-8: Road and Traffic Management details along McLaughlan Road

Works Class	Speed Limit (kph)	Footpath	Road Width	Hazard	Traffic Management Layout	Notes
A	Assumed 50 - 60	Existing along both sides of road. Path along one side of road to remain operational throughout the works	Varies, 5 -10m	Existing road traffic, pedestrians, construction traffic accessing Yellow Section of proposed route and Compound 3	One lane closure with stop and go, or traffic lights	Provision must be maintained for pedestrian use of footpath

B	Assumed 50 - 60	Existing along both sides of road. Path along one side of road to remain operational throughout the works	Approx. 7m	Existing road traffic, pedestrians, construction traffic accessing Yellow Section of proposed route and Compound 3	One lane closure with stop and go, or traffic lights	Provision must be maintained for pedestrian use of footpath

13.4.11 Plassey Park Road

Works related to the end of the pedestrian and cycle path on McLaughlan Road, will be carried out at the junction of McLaughlan Road and Plassey Park Road. The proposed path will merge onto Plassey Park Road and connect to existing active travel infrastructure at this location.

It is proposed to facilitate existing traffic, and pedestrian walkways, along Plassey Park Road. The works will operate in all flow and visibility conditions and will be temporary, it is anticipated that the class of the roadworks will be 'Type B'. Refer to Table 13-9 for details.

Table 13-9: Road and Traffic Management details along Plassey Park Road

Works Class	Speed Limit (kph)	Footpath	Road Width	Hazard	Traffic Management Layout	Notes
B	60	Existing along both sides of road. Path along southern side of road to remain operational throughout the works	Approx. 8m	Existing traffic, existing pedestrian and cyclist traffic	Works at a Junction in addition to 'Stop and Go' or 'Temporary Traffic Signals'	Provision must be maintained for pedestrian use of footpath

13.4.12 Road Closures & Diversionary Measures

Where temporary road closures are required, diversionary measures will require to be implemented which are detailed below. The proposed works will impact on the existing footpaths within UL, University Road, and McLaughlan Road. Construction traffic will pass by Dromroe and Kilmurry Student Villages and through Harvard Close, a private road (for LCCC/UÉ network operations use) within the UL Campus.

There will likely be some disruption in journey times for road users on some roads mainly within the campus area. Some road closures will be required when it is not possible to operate a one lane system (e.g.: when works are being carried out on particularly narrow stretches of road). However, it is expected that these periods will be minimal and phased so that any road closures will not occur concurrently.

Full descriptions of proposed diversion routes are provided in the Traffic Management Plan. These routes will be assessed by the contractor prior to the development of detailed traffic management plans.

The primary area for disruption are as follows:

- Traffic Control measures in the form of a static lane closure will be required on University Riad, to facilitate construction works on the west and east greenway lanes, parking bay and along the footpath to the edge of the road and construction of the proposed raised table.
- Traffic Control measures in the form of a static lane closure will be required on McLaughlan Road to facilitate construction works on the west and east greenway lanes
- Out of hours work is needed at the entrance and exit to Greentech Plastics Ltd, accessed via McLaughlan Road while construction works are ongoing for the cycle lane passing along the entrance and exit of the organisation's car park.
- Traffic Control measures in the form of a static lane closure will be required on Plassey Road, at the junction with McLaughlan Road, to facilitate construction works connecting the proposed cycle and pedestrian path with existing active travel infrastructure.
- Cycle and pedestrian traffic diversions for the duration of works will be carried out along the proposed path where required.
- Flagmen should be positioned at the entrances to the construction site to control construction traffic entering and leaving the site.
- Where traffic control measures are required their impact on roads and footpaths is to be minimised. The Contractor shall inform local businesses/education facilities and the public in advance of the works by means of written communications, local signs and Variable Message Signs (VMS) boards as well as detailing construction from "start date" to "end date".
- Temporary safety barriers placed around the working area should be clearly defined by temporary road markings, signage and coning as specified in the Traffic Signs Manual. The Project Supervisor Construction Stage (PSCS) shall carry out a risk assessment before commencing any works on site, to determine the type of barriers and cones most suitable for the works.
- The appropriate level of signage and temporary traffic measures required for a static lane closure is detailed in the Traffic Management Plan. Following lane closure design, the PSCS shall develop a suitable method of controlling vehicular/cycle/pedestrian traffic passing the works

sites. The factors affecting the choice of traffic control method are summarised in Traffic Management Plan. The PSCS shall consult Limerick City and Council's Roads Department, The University of Limerick, The NTP, and the Garda Siochána prior to implementing traffic control measures on site

Based on the above, there will be slight levels of traffic disruption during construction phase of the proposed development and not anticipated that these levels will result in any notable traffic congestion.

There will be a predicted **temporary moderate negative impact** on Traffic and Transport during the Construction Phase of the project in the absence of mitigation.

13.4.13 Water Distribution Network

The following presents a description of the existing water distribution network within the assessment area and assesses the potential impacts that the proposed development may have on that network.

Distribution watermains are present in the vicinity of the proposed Greenway at the following locations:

- At UL Boat House and Castletroy WwTP (100mm uPVC);
- At University Bridge and Drumroe Student Village into UL Campus (200mm DI), structures within the campus were unsurveyed;
- At Kilmurry Village structures remain unsurveyed but there are records of watermains for distribution;
- Within the grounds of The National Technology Park (ranging from 75mm to 150mm uPVC).

All information is sourced from UÉ GIS records and is to serve as an indication of the **approximate location** of the underground distribution main network. Refer to Figure 13-2.

The existing network is entirely sub-surface, comprising pipelines of various dimensions and materials which provides for fire hydrants, air valves, sluice valves and scour valves at various locations throughout the assessment area.

Additionally, groundwater well card data produced by the Geological Survey of Ireland (GSI) indicates that there are 3. No boreholes within the assessment area. These are used primarily for agricultural and commercial water supply purposes. The yield from these wells has been determined as poor to moderate and the mapping indicates that the wells were bored in the 1960's and 1970's and likely have limited usage in the present today.

13.4.13.1 Potential Impact on Water Distribution Network

Construction Phase:

There is potential for **temporary moderate negative impact** on underground services during Construction Phase works. These impacts may include disruption to the water supply due to accidental damage during excavation works.

Operational Phase:

There are **no predicted negative impacts** to the existing watermain infrastructure during Operational Phase.

Table 13-15: Locations of Impacts on the potable water distribution network

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
Potable Water	561016.2	658634.55	Section 2 Chainage: 1340m	Temporary moderate negative impact	No Impact
	562135.1	658367.16	Section 3 Chainage: 203_C m	Temporary moderate negative impact	No Impact
	562133.9	658355.56	Section 3 Chainage: 220_C m	Temporary moderate negative impact	No Impact
	562229.9	658252.11	Section 3 Chainage: 353_C m	Temporary moderate negative impact	No Impact
	562361.4	658048.9	Section 3 Chainage: 603_C m	Temporary moderate negative impact	No Impact
	562380.6	658019.86	Section 3 Chainage: 644_C m	Temporary moderate negative impact	No Impact
	562397.4	657994.34	Section 3 Chainage: 672_C m	Temporary moderate negative impact	No Impact
	562865.2	658417.58	Section 5 Chainage: 3506m	Temporary moderate negative impact	No Impact
	562842.6	658370.75	Section 5 Chainage: 3558m	Temporary moderate negative impact	No Impact
	562846.1	658368.59	Section 5 Chainage: 3559m	Temporary moderate negative impact	No Impact
	562851.6	658365.44	Section 5 Chainage: 3560m	Temporary moderate negative impact	No Impact
	562829	658274.18	Section 5 Chainage: 3658m	Temporary moderate negative impact	No Impact
	562835.2	658274.24	Section 5 Chainage: 3658m	Temporary moderate negative impact	No Impact
	562829	658272.42	Section 5 Chainage: 3660m	Temporary moderate negative impact	No Impact
	562835.1	658272.4	Section 5 Chainage: 3660m	Temporary moderate negative impact	No Impact
	562826.5	658262.18	Section 5 Chainage: 3670m	Temporary moderate negative impact	No Impact
	562837.1	658262.76	Section 5 Chainage: 3670m	Temporary moderate negative impact	No Impact
	562836.2	658252.02	Section 5 Chainage: 3682m	Temporary moderate negative impact	No Impact
	562837.4	658232.97	Section 5 Chainage: 3701m	Temporary moderate negative impact	No Impact
	562839	658220.47	Section 5 Chainage: 3712m	Temporary moderate negative impact	No Impact

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
	562862.37	658138.53	Section 5 Chainage: 3804m	Temporary moderate negative impact	No Impact
	562865.56	658133.14	Section 5 Chainage: 3807m	Temporary moderate negative impact	No Impact
	562872.56	658134.07	Section 5 Chainage: 3813m	Temporary moderate negative impact	No Impact
	562848.59	658121.51	Section 5 Chainage: 3812m	Temporary moderate negative impact	No Impact

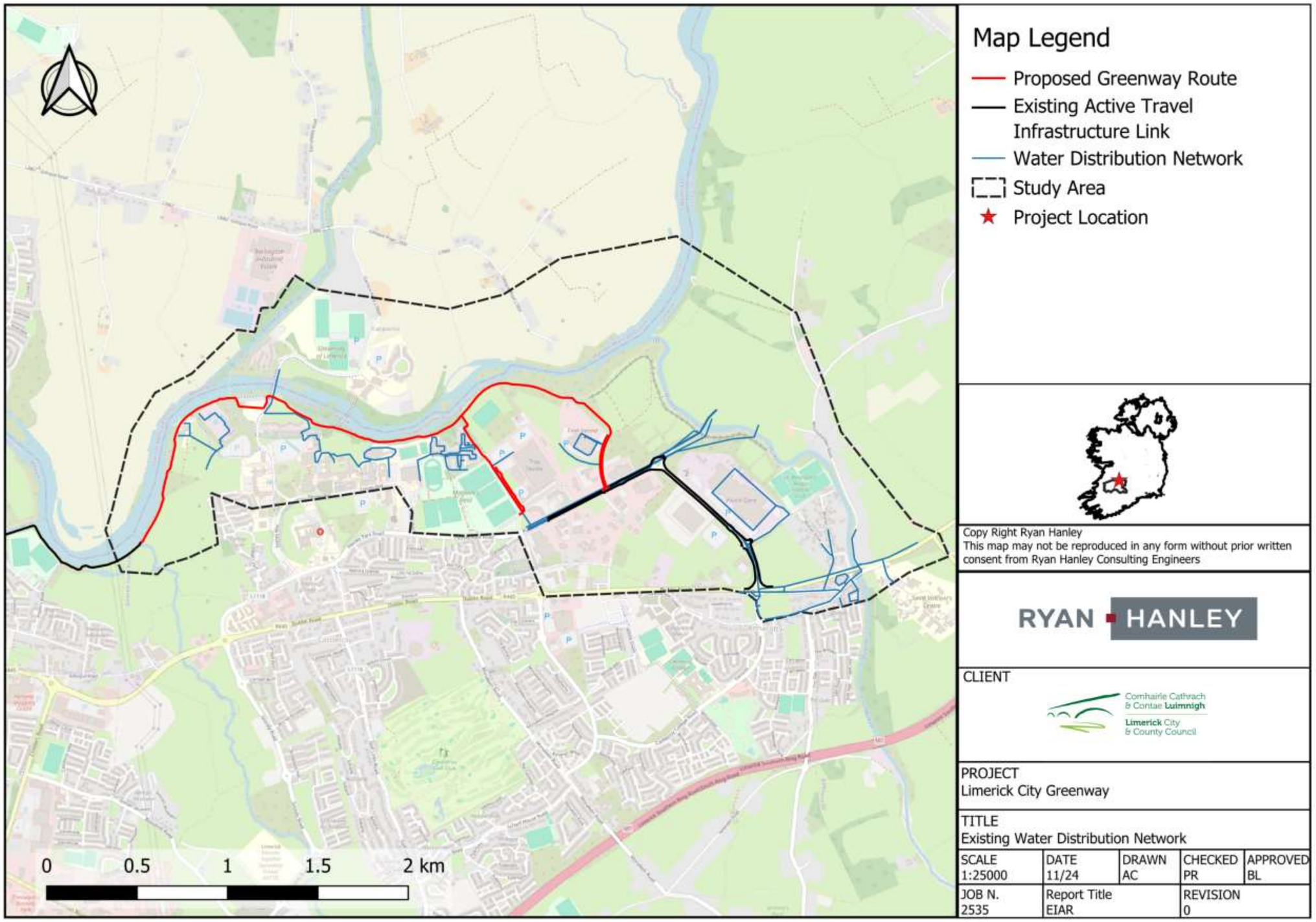

Figure 13-2: Schematic of existing water distribution network within assessment area & environs

13.4.14 Drainage Network

An existing foul and storm water system exists throughout the Greenway assessment area. The surface water collection system within the assessment area comprises a combined system some of which conveys water to Castletroy WwTP and storm water systems which discharge to the River Shannon. Using existing drainage datasets, a model of the main branches of both the storm and foul sewerage network within the assessment area was constructed.

13.4.14.1 Storm Water

The existing storm water network is shown in Figure 13-3. The route of the Greenway is not anticipated to interact with existing storm water however, where points of the Greenway transect with the existing stormwater drainage network, due care should be taken during construction works to ensure that network remains undisturbed.

13.4.14.2 Potential Impact on Drainage – Storm Water

Construction Phase:

There will be a predicted **temporary minimal negative impact** to the existing storm water drainage infrastructure within the scheme area during construction phase. The route of the proposed Greenway and additional measures will interact with the existing storm sewer at approx. 13 no. locations as detailed in Table 13-16. These impacts may include accidental damage during excavation works.

Table 13-16: Predicted Impacts on existing storm water drainage network

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
Storm Water	562051.51	658522.77	Section 3 Chainage: 2484m	Temporary minimal negative impact	No Impact
	562085.28	658470.42	Section 3 Chainage: 80_C m	Temporary minimal negative impact	No Impact
	562194.38	658301.82	Section 3 Chainage: 291_C m	Temporary minimal negative impact	No Impact
	562398.12	657995.37	Section 3 Chainage: 671_C m	Temporary minimal negative impact	No Impact
	562602.24	658634.14	Section 4 Chainage: 3120 m	Temporary minimal negative impact	No Impact
	562885.16	658446.29	Section 5 Chainage: 3472 m	Temporary minimal negative impact	No Impact
	562865.64	658417.37	Section 5 Chainage: 3506 m	Temporary minimal negative impact	No Impact
	562824.98	658271.58	Section 5 Chainage: 3661 m	Temporary minimal negative impact	No Impact
	562827.45	658260.93	Section 5 Chainage: 3670m	Temporary minimal negative impact	No Impact
	562828.13	658253.20	Section 5 Chainage: 3680m	Temporary minimal negative impact	No Impact

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
	562828.70	658246.71	Section 5 Chainage: 3686m	Temporary minimal negative impact	No Impact
	562830.44	658226.75	Section 5 Chainage: 3707m	Temporary minimal negative impact	No Impact
	562834.01	658185.95	Section 5 Chainage: 3748m	Temporary minimal negative impact	No Impact

There will be a predicted **temporary minimal negative impact** to the storm water drainage infrastructure during Construction Phase where works are proposed in areas where existing services are located.

Operational Phase:

There are **no predicted negative impacts** to the existing stormwater infrastructure during Operational Phase.

There would be no significant change to the existing environment in the absence the proposed development.

13.4.14.3 Foul/Combined Sewerage Network

A foul sewer network extends throughout the assessment area. Castletroy Wastewater Treatment Plant (WwTP) (D0019-01) is located on the banks of the River Shannon on the western extent of the proposed Greenway area directly adjacent to the University of Limerick Boat House. The WwTP has a PE design capacity of 45,000 PE.

13.4.14.4 Potential Impact on Drainage Network - Foul/Combined

Construction Phase: There will be a predicted **temporary minimal negative impact** on the foul/combined sewer infrastructure within the assessment area. The proposed works have potential to impact on the existing foul/combined sewer network where the linear scheme works traverse areas that the existing network is located.

Impacts may take the form of accidental disruption of the existing services. There would be no significant change to the existing environment in the absence the proposed development.

Table 13-17: Predicted Impacts on existing foul sewer network

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
Foul	561630.58	658384.08	Section 3 Chainage: 2024m	Temporary minimal negative impact	No Impact
	561762.81	658400.13	Section 3 Chainage: 2158m	Temporary minimal negative impact	No Impact
	561845.72	658413.14	Section 3 Chainage: 2241m	Temporary minimal negative impact	No Impact
	561847.25	658413.02	Section 3 Chainage: 2243m	Temporary minimal negative impact	No Impact
	561872.94	658419.31	Section 3 Chainage: 2272m	Temporary minimal negative impact	No Impact

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
	561911.55	658430.55	Section 3 Chainage: 2312m	Temporary minimal negative impact	No Impact
	561916.24	658429.95	Section 3 Chainage: 2315m	Temporary minimal negative impact	No Impact
	561916.81	658430.05	Section 3 Chainage: 2316m	Temporary minimal negative impact	No Impact
	561941.94	658442.39	Section 3 Chainage: 2345m	Temporary minimal negative impact	No Impact
	562068.23	658519.86	Section 3 Chainage: 11_C m	Temporary minimal negative impact	No Impact
	562695.98	658605.56	Section 5 Chainage: 3220m	Temporary minimal negative impact	No Impact
	562880.03	658463.64	Section 5 Chainage: 3457m	Temporary minimal negative impact	No Impact
	563734.05	657561.13	Section 6 Chainage: 75m	Temporary minimal negative impact	No Impact
	564151.48	657564.86	Section 4 Chainage: 511m	Temporary minimal negative impact	No Impact
	564154.84	657574.10	Section 4 Chainage: 516m	Temporary minimal negative impact	No Impact
	564224.65	657637.85	Section 4 Chainage: 614m	Temporary minimal negative impact	No Impact
	564236.34	657634.53	Section 4 Chainage: 624m	Temporary minimal negative impact	No Impact

Operational Phase:

There are **no predicted negative impacts** to the existing foul/combined sewer network Operational Phase.

There would be no significant change to the existing environment in the absence the proposed development.

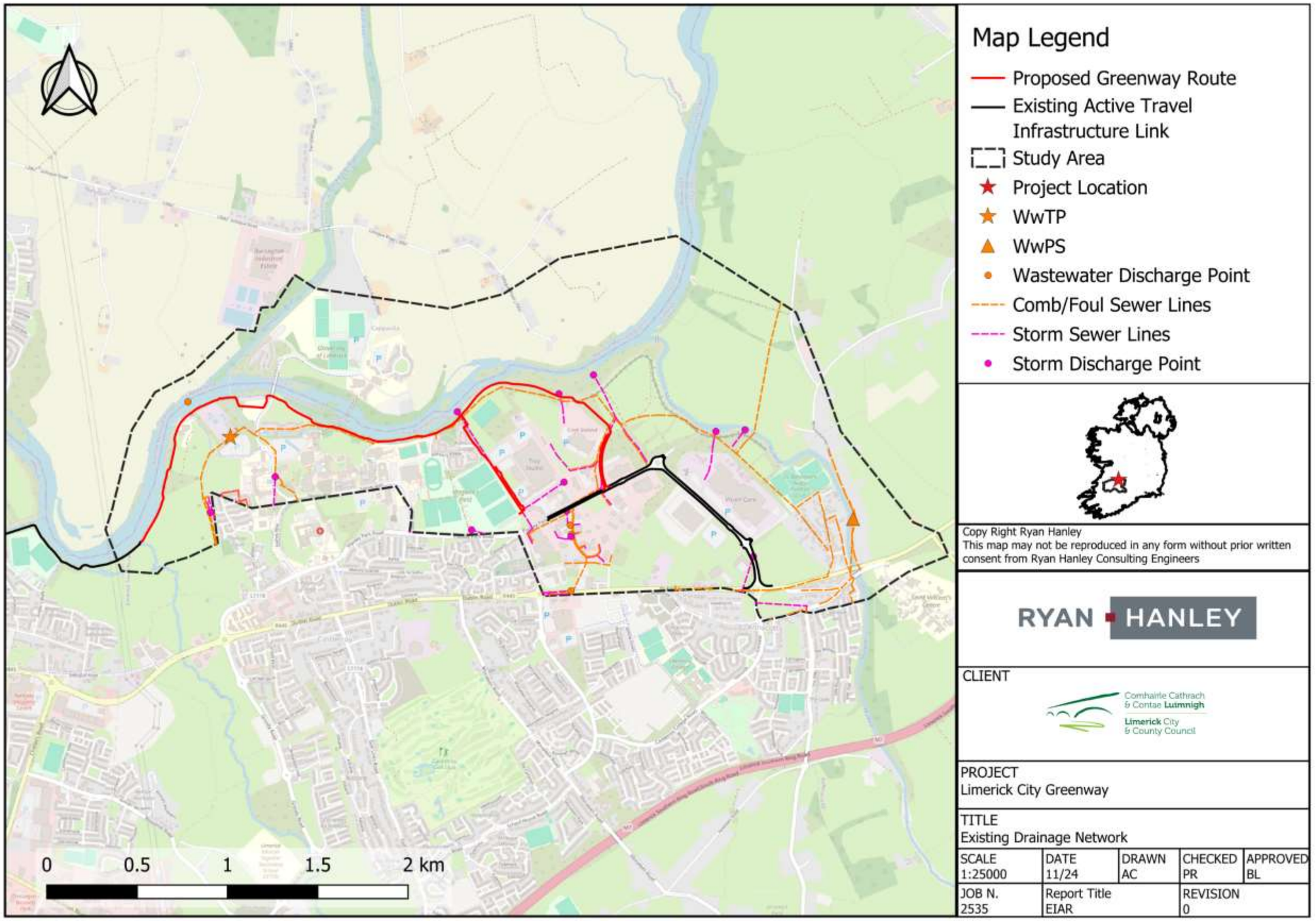

Figure 13-3: Schematic of existing drainage network within assessment area & environs

13.4.15 Gas Network

Gas distribution services are present along the route at the following locations:

- At the existing road bridge crossing the River Shannon,
- Along Plassey Park Road,

All information is sourced from Gas Networks Ireland records and is to serve as an indication of the **approximate location** of underground Gas services. Refer to Figure 13-4.

13.4.15.1 Potential Impact on the Gas Network

Construction Phase:

Proposed Construction Phase works will have a predicted **temporary minimal negative impact** on existing gas services at 1 no. location as detailed in Table 13-18. Impacts may include accidental damage to unmarked shallow services which could result in explosions and risk of serious injury or death.

Operational Phase:

There will be **no predicted negative impacts** on the existing electricity supply network during operational phase.

Table 13-18: Predicted Impacts on existing gas network

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
Gas	561019.99	658632.87	Section 2 Chainage: 1345m	Temporary minimal negative impact	No Impact

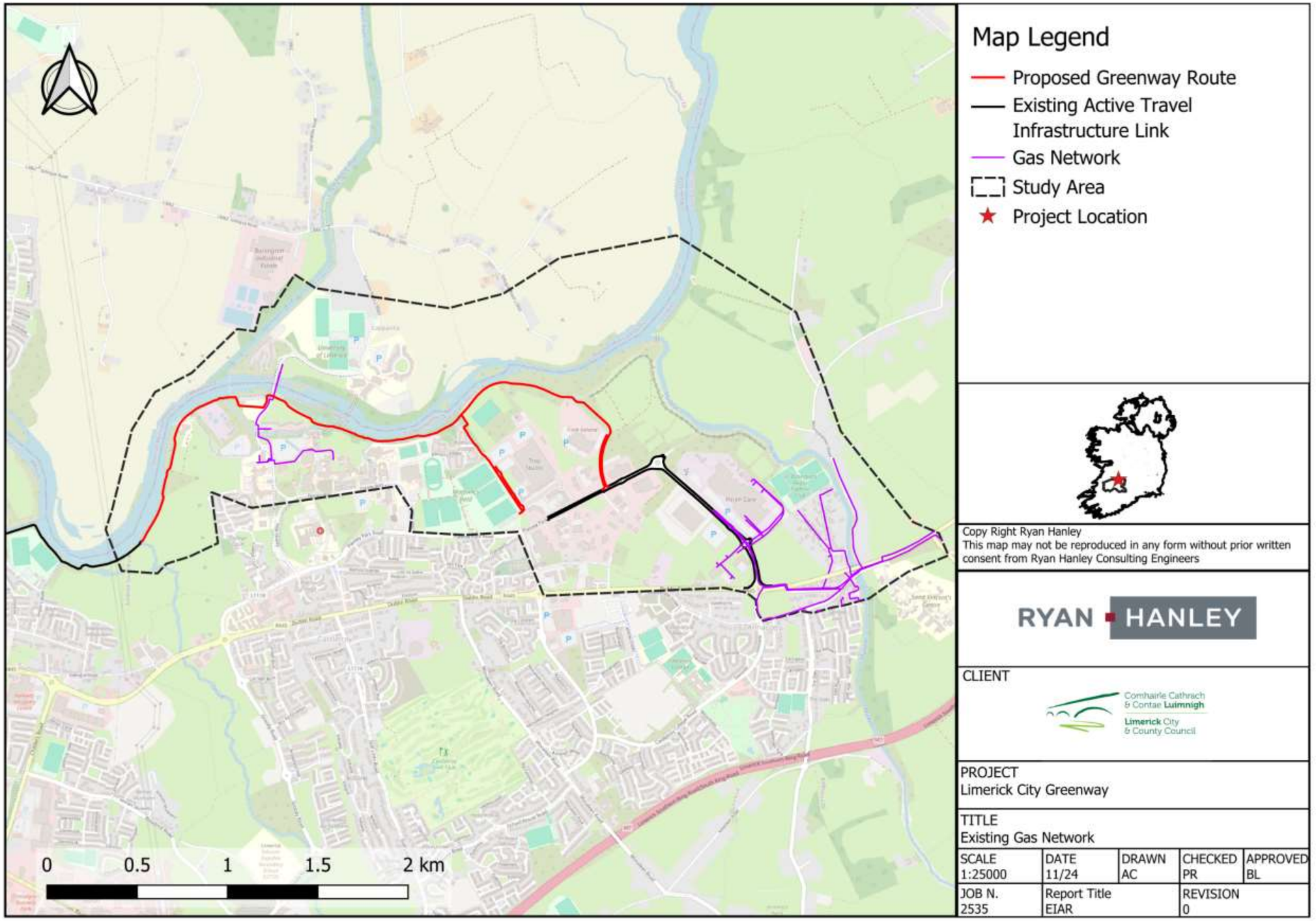

Figure 13-4: Schematic of existing gas network within assessment area & environs

13.4.16 Electricity Network

There is an extensive electricity supply network within the assessment area comprising both overhead power lines and underground services. Refer to Figure 13-5.

13.4.16.1 Potential Impact on the Electricity Network

Construction Phase:

Proposed Construction Phase works will have a predicted **temporary slight to moderate negative impact** on existing overhead services at 4 no. locations and on underground services at 12 no. locations as detailed in Table 13-19. Impacts may include accidental damage to overhead and/or underground electricity cables which could result in power outages and risk of serious injury or death.

Operational Phase:

There will be **no predicted negative impacts** on the existing electricity supply network during operational phase.

Table 13-19: Predicted Impacts on existing electricity network

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
Electricity (Overhead)	560568.56	658545.45	Section 2 Chainage: 797m	Temporary slight to moderate negative	No Impact
	562169.59	658657.55	Section 4 Chainage: 2663m	Temporary slight to moderate negative	No Impact
	562273.24	658709.08	Section 4 Chainage: 2779m	Temporary slight to moderate negative	No Impact
	562347.96	658703.44	Section 4 Chainage: 2852m	Temporary slight to moderate negative	No Impact
	560982.87	658618.64	Section 2 Chainage: 1297m	Temporary slight to moderate negative	No Impact
	561008.58	658636.80	Section 2 Chainage: 1335m	Temporary slight to moderate negative	No Impact
	561996.76	658469.22	Section 3 Chainage: 2406m	Temporary slight to moderate negative	No Impact
	562019.74	658484.95	Section 3 Chainage: 2435m	Temporary slight to moderate negative	No Impact
	562095.45	658575.00	Section 4 Chainage: 2552m	Temporary slight to moderate negative	No Impact
	562145.46	658633.80	Section 4 Chainage: 2630m	Temporary slight to moderate negative	No Impact
	562881.07	658460.78	Section 5 Chainage: 3457m	Temporary slight to moderate negative	No Impact
	562830.70	658211.88	Section 5 Chainage: 3721m	Temporary slight to moderate negative	No Impact
	562830.74	658201.66	Section 5 Chainage: 3732m	Temporary slight to moderate negative	No Impact

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
Electricity (Underground)	562833.51	658188.23	Section 5 Chainage: 3745m	Temporary slight to moderate negative	No Impact
	562848.34	658140.26	Section 5 Chainage: 3796m	Temporary slight to moderate negative	No Impact
	562852.55	658125.58	Section 5 Chainage: 3811m	Temporary slight to moderate negative	No Impact

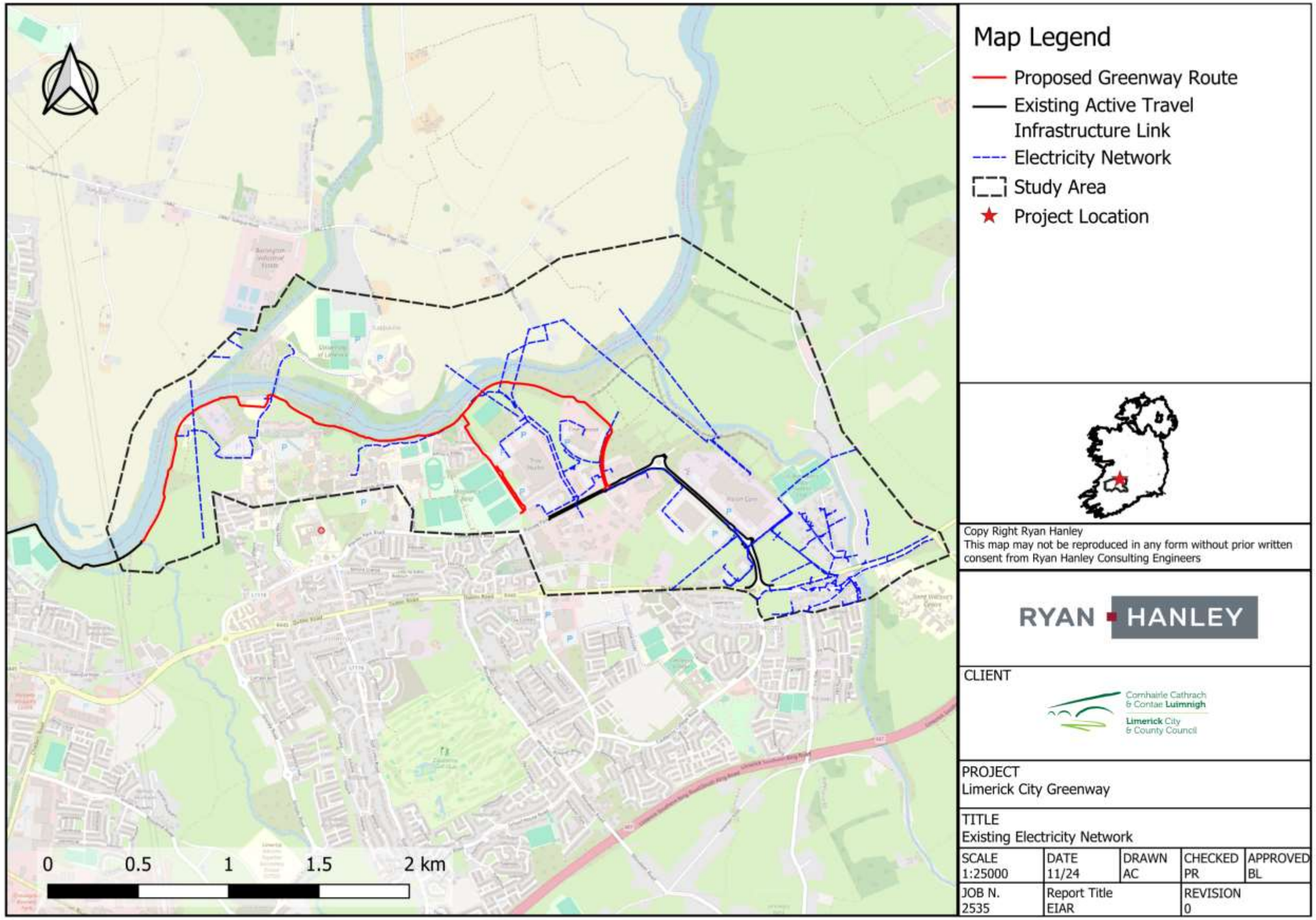

Figure 13-5: Schematic of existing electricity network within assessment area & environs

13.4.17 Telecommunications & Broadband Network

Telecommunications & Broadband within the assessment area are currently provided by seven suppliers:

- Eir;
- Vodafone;
- Sky;
- Pure Telecom;
- Regional Braodband;
- Virgin Media;
- Digiweb;

Eir have primary responsibility for sub-surface cabling (including fibre-optic) and overhead lines and maintenance of same. Refer to Figure 13-6.

13.4.17.1 Potential Impacts on the Telecommunication & Broadband Network

Construction Phase:

There will be a predicted **temporary significant negative impact** on the overhead and underground communications network where proposed works are located in proximity to existing services. Impacts may include accidental damage to overhead and underground telecommunications & broadband cables which could result in outages and thus loss of vital communications such as to emergency services. Locational details are provided in Table 13-20. There will be **no predicted negative impacts** on satellite services within the assessment area during Construction Phase.

Operational Phase:

There are **no predicted negative impacts** on the existing Telecommunication & Broadband network during Operational Phase.

There are **no predicted negative impacts** on **satellite** services within the assessment area during Operational Phase.

There would be no significant change to the existing environment in the absence of the proposed development.

Table 13-20: Predicted Impacts on existing telecommunication and broadband network

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
Eir	561016.41	658634.47	Section 2 Chainage: 1341m	Temporary significant negative impact	No Impact
	562866.11	658417.14	Section 5 Chainage: 3506m	Temporary significant negative impact	No Impact
	562839.83	658348.10	Section 5 Chainage: 3582m	Temporary significant negative impact	No Impact
	562845.65	658345.98	Section 5 Chainage: 3582m	Temporary significant negative impact	No Impact
	562825.01	658266.55	Section 5 Chainage: 3666m	Temporary significant negative impact	No Impact

Utility	Greenway crossing (itm)		Description	Construction phase impact	Operational phase impact
	562827.05	658260.77	Section 5 Chainage: 3672m	Temporary significant negative impact	No Impact
	562836.06	658263.52	Section 5 Chainage: 3670m	Temporary significant negative impact	No Impact
	562827.56	658253.64	Section 5 Chainage: 3679m	Temporary significant negative impact	No Impact
	562836.31	658252.09	Section 5 Chainage: 3680m	Temporary significant negative impact	No Impact
	562837.73	658232.51	Section 5 Chainage: 3701m	Temporary significant negative impact	No Impact
	562839.25	658220.76	Section 5 Chainage: 3714m	Temporary significant negative impact	No Impact
	562830.32	658203.76	Section 5 Chainage: 3730m	Temporary significant negative impact	No Impact
	562854.95	658130.40	Section 5 Chainage: 3807m	Temporary significant negative impact	No Impact
	562865.83	658132.97	Section 5 Chainage: 3808m	Temporary significant negative impact	No Impact
Enet	561001.39	658638.54	Section 2 Chainage: 1326m	Temporary significant negative impact	No Impact
	562831.75	658196.76	Section 5 Chainage: 3737m	Temporary significant negative impact	No Impact
	562842.19	658157.93	Section 5 Chainage: 3777m	Temporary significant negative impact	No Impact
Virgin Media	562832.92	658191.12	Section 5 Chainage: 3743m	Temporary significant negative impact	No Impact
	562842.46	658157.12	Section 5 Chainage: 3778m	Temporary significant negative impact	No Impact

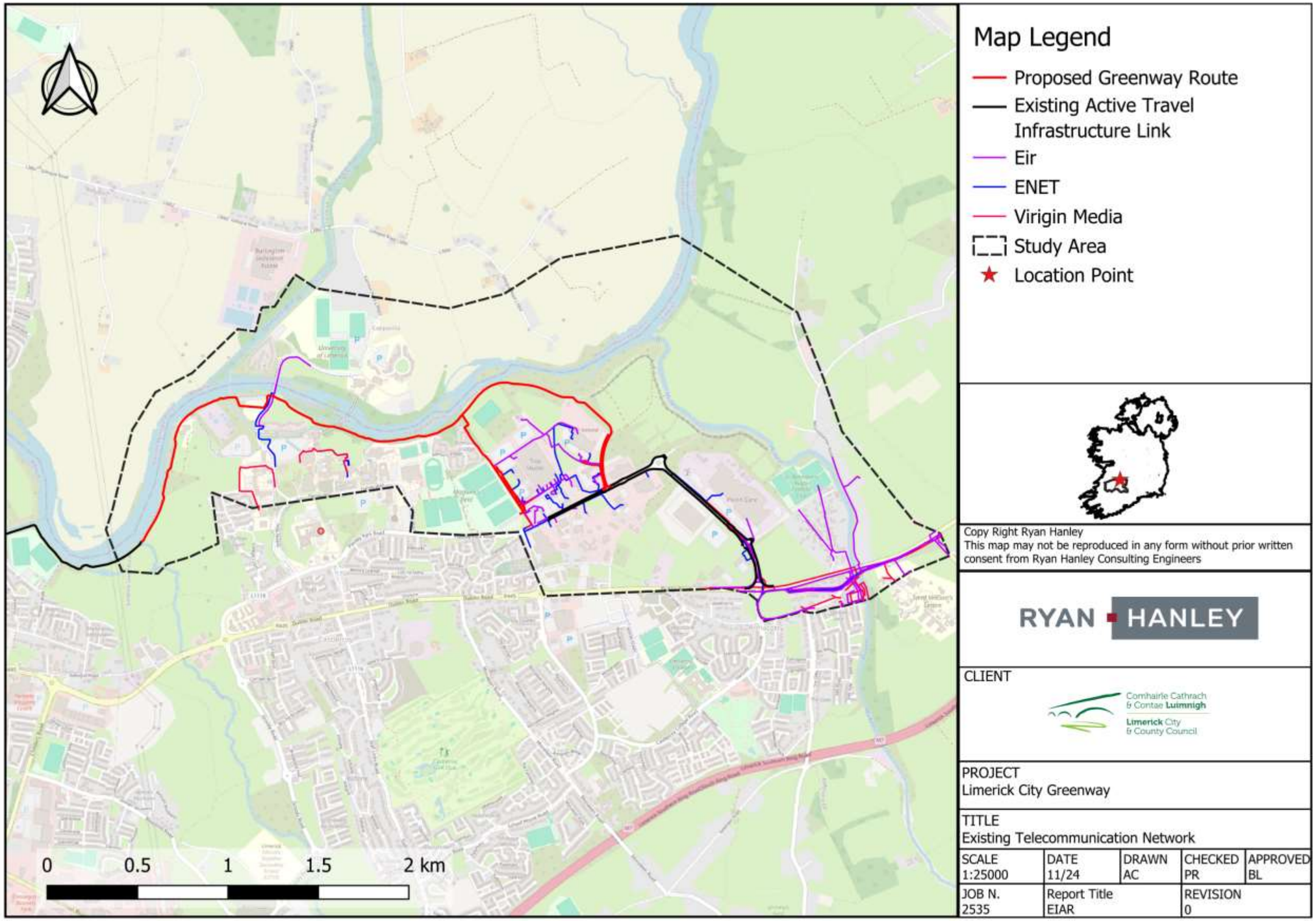

Figure 13-6: Schematic of existing telecommunications network within assessment area & environs

13.5 WASTE MANAGEMENT DURING CONSTRUCTION

The Limerick City Greenway (UL to NTP) will produce a significant volume of excavated material during the construction phase. This section examines the potential impacts associated with this waste and any mitigation measures required.

13.5.1 Background Information

'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects' (2006) were published by the DoEHLG. These Guidelines outline the issues that need to be addressed at the pre-planning stage of a development all the way through to its completion.

Best Practice Guidelines sets thresholds to ascertain which projects require the preparation of construction & demolition (C&D) plans. The proposed development, exceeds the following threshold and therefore requires a C&D Waste Management Plan;

- Civil Engineering projects producing in excess of 500 m^3 of waste, excluding waste materials used for development works on the site.

A Waste Management Plan is included in the Construction Environmental Management Plan (CEMP) appended to this EIA report. As outlined in Chapter 7, no soil will be exported off site and excavated material will be reused on site as much as practicable. Where this is not possible, the recycling rates for the C&D waste produced throughout the construction of the Greenway should be maintained at or above 85%, if possible, as outlined in the Waste Management (Planning) Regulations 1997.

13.5.2 Classification of Waste

Excavations for the proposed scheme, pedestrian/road crossings and road works will give rise to a surplus volume of material during the construction phase of the proposed scheme. The excavated material will be reused as a subbase layer and/or edge grading. It is anticipated that no soil will require exporting off site.

The European Waste Codes (EWC) for typical waste materials that may possibly be generated during the construction phase are outlined in Table 13-21.

Table 13-21: Applicable List of Waste (LoW) Code

Waste Material	LoW
Soil, stones and dredged spoil	17 05
Bituminous mixtures, coal tar and tarred products	17 03
Concrete, Bricks, Tiles and Ceramics	17 01
Metals (including their alloys)	17 04
Waste Hydraulic Oils*	13 01
Wastes of Liquid Fuels*	13 07
* Denotes Hazardous Materials	

The estimated construction and demolition waste resulting from the proposed scheme is provided in Table 13-22. There will be Bitumous Material and Concrete arising from existing road/footpath surfaces on University Road, and McLaughlan Road.

Table 13-22: Estimated C&D Waste resulting from the proposed scheme

Origin of Waste	LoW Code	Estimated Tonnage of Waste
Red Section	17 05/17 03	0
Cyan Section	17 05/17 03	
Magenta Section	17 05/17 03	897
Purple Section	17 05/17 03	
Yellow Section	17 05/17 03	
Miscellaneous	17 01, 17 04, 13 01, 13 07	746
	Total	**1643**

Himalayan balsam and Giant Hogweed were identified during walkover surveys and are listed as invasive plants under the EC (Birds and Natural Habitats) Regulations 2011 (S.I. 477/2011). These regulations prohibit the introduction and dispersal of these species. Any soil removed from any effected areas must be managed in accordance with the Invasive Species Management Plan (ISMP) and the Outline Construction Environmental Management Plan (OCEMP) as appended to this EIAR.

13.5.3 Potential Impact during Construction Phase

Potential Permanent Moderate Negative Impact

As detailed in Chapter 7, most surplus material will be generated during the construction of active travel sections along the Magenta, Purple, and Yellow Sections, primarily consisting of concrete and Bituminous mixtures. It is expected that miscellaneous fill materials generated will include some small amounts of bitumen tarmacadam.

Poor management of waste has the potential to cause nuisance and an adverse environmental impact, particularly due to the presence of Himalayan balsam and Giant Hogweed in the proposed working areas. Mismanagement of soil removed from these areas could lead to the spreading of invasive alien species in other areas. Waste that is not managed and stored appropriately on site may result in water and ground pollution on or in the vicinity of the site. Litter and debris may be generated from leftover construction materials, packaging from materials and mixed waste produced by the site staff.

Poor management of excavated waste could lead to the disposal of waste deemed unsuitable for reuse or recycling in facilities that do not carry the appropriate licenses.

In addition, if waste is not managed and stored correctly on site, it has the potential to cause nuisance and environmental impact. Litter may be generated from packaging taken from materials, mixed waste produced by the construction workers (lunches, cigarette waste, etc.), or from debris from leftover/damaged construction materials. Poor management of waste may also result in water and ground pollution on the site or adjacent to the site.

Fuels and hydraulic oils/lubricants that will be used during the construction phase are classed as hazardous. There will be fuels stored on site for plant, machinery and construction vehicles along with oils and lubricants. Should any spillages, waste or surplus liquids be disposed of incorrectly it could cause serious harm to the surrounding environment.

The potential impacts of construction and demolition waste on the environment are predicted to be temporary and moderate.

13.5.4 Potential Impact during Operational Phase

Potential Temporary Slight Negative Impact

The operational phase of the proposed Greenway is unlikely to produce any waste of significant volume. Periodic maintenance of the route by LCCC will be required mainly in the areas of general maintenance of scheme and vegetation. Such maintenance could generate very small volumes of litter and dog waste, that, if not disposed of correctly, could adversely affect the local environment.

13.6 MITIGATION MEASURES - INFRASTRUCTURE

The following provides details of proposed mitigation measures designed to offset predicted potential impacts on identified Material Assets.

13.6.1 Transport Infrastructure – Roads & Traffic

Localised traffic disruptions during the construction phase of the proposed development will be mitigated through the use of industry standard traffic management measures. These measures should be designed in accordance with the '*Guidance for the Control and Management of Traffic at Roadworks – Second Edition*' (Dept. of Transport; Road Safety Authority of Ireland – 2010).

- Construction works will be sequenced so as to avoid unnecessary interruption to road users insofar as is practicable.
- All residents and interested parties shall be consulted when planning anyroad disruptions to optimise the timing of same.
- A complete schedule of road disruptions will be published in advance of the works commencing to facilitate residents in making alternative arrangements where necessary.

A Traffic Management Plan (TMP) will be developed in advance of the construction phase incorporating road disruptions, diversions and/or closures where necessary. Local access will be maintained where possible throughout construction phase of the various sections of the Greenway with diversionary routes as specified in Section 13.4.1. Any Increased vehicular activity during construction phase will be managed by the Traffic Management Plan.

It is proposed that the site construction hours will be as per standard site working hours – 07.00 am – 19.00 pm on weekdays and 08.00 am –13.00 pm on Saturdays with no works on Sundays or Bank Holidays. It may on occasion be necessary during certain stages of construction to work outside of the permitted working hours. In the event that these hours need to be extended, consultation will be undertaken and agreement sought from LCCC in advance. Any road disruption/closures will be localised and confined to specified proposed works areas. All excavations in the sectioned areas will be reinstated immediately - as per the following guidance:

- Guidelines for Managing Openings in Public Roads (April 2017) – for Local and Regional Roads.
- Requirements for the Reinstatement of Openings in National Roads (TII, May 2019) – for National Roads.

Any road closures will be agreed in advance with LCCC and implemented as per conditions set out in Traffic Management Plans and Road Opening Licences.

The following mitigation measures will also be required:

- Road signage on the public road network must comply with the Department of the Transport's Traffic Signs Manual "Chapter 8 - Temporary Traffic Measures and Signs for Roadworks".
- The contractor shall provide general condition and structural surveys of all transport infrastructure (roads, bridges, access tracks) on all routes, including haulage routes, that may be impacted as a result of the proposed scheme before works commence on site and after completion and provided to the relevant PSDP engineer.
- Site entrance locations from public roads may require a durable bound surface.
- Secure and visible junctions must be developed between access roads and public roads.
- A durable bound surface is required on access roads for a minimum distance of 10m from the public road.
- Adequate drainage to be maintained at all times to ensure that no surface water from the site or site access discharges to the public roads.
- Cleaning regime for plant to be implemented in order to minimise mud/dust or other contaminants on public roads.

13.6.2 Water Distribution Network

The installation and location of the Greenway has been designed to avoid, where possible, any interference with the existing potable water distribution network in the area. As identified in Section 13.4.21, the proposed development has the potential to impact on the existing water distribution mains during the construction phase.

It is not expected that interference will occur however any temporary service diversions will be agreed with Uisce Éireann and LCCC and implemented in advance of and during the construction phase of the proposed scheme.

All possible precautions will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works areas, and the implementation of robust procedures when undertaking works in the around known infrastructure services.

Service disruptions impacting the surrounding educations, residential, social and commercial properties shall be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions shall be given to all impacted properties. This shall include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties shall be undertaken prior to any proposed disruptions.

A CEMP will be prepared and implemented by the works contractor in consultation with LCCC and their Environmental Clerk of Works.

There will be no interference with, or impact on, the existing UÉ potable water supply during the Operational Phase of the proposed development.

13.6.3 Electricity Network

Locations of overhead lines, pole-sets and underground cabling will be fully identified and considered during project design, in consultation with ESB networks and in development of Traffic Management

Plans. Works will be carried out in accordance with best practice policies and guidelines[2], in particular HSA (2019) ESB Networks Code of Practice for Avoiding Danger from Overhead Electricity Lines. As identified in Section 13.4.24, the proposed scheme will transverse the the existing electricity supply network under overhead services at 11 no. locations and over underground services at 31 no. locations.

Temporary service diversions if required or permanent re-alignment will be agreed with ESB and implemented prior to and during the construction phase of the proposed scheme.

All possible precautions will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works areas, and the implementation of robust procedures when undertaking works in the around known infrastructure services.

Service disruptions impacting the surrounding educational, residential, social and commercial properties shall be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions shall be given to all impacted properties. This shall include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties shall be undertaken prior to any proposed disruptions.

A CEMP will be prepared and implemented by the nominated contractor in consultation with LCCC and their Environmental Clerk of Works.

There will be no predicted interference with, or impact on, the existing electricity supply network during the Operational Phase of the proposed development.

13.6.4 Telecommunications & Broadband Network

Locations of all underground and overhead services will be identified and considered during Project Design and avoided during Construction Phase in accordance with best practice as outlined by HSA Construction Codes of Practice [3] .

As identified in section 13.4.25, it is not expected that the proposed works will impact on the existing telecommunication & broadband network locations.

Any temporary service diversions or permanent re-alignment if required will be agreed with the service providers and implemented prior to and during construction of the proposed development.

All possible precautions will be taken to avoid unplanned disruptions to any services during the proposed works. This will include thorough investigations to identify and reconfirm the location of all utility infrastructure within the works areas, and the implementation of robust procedures when undertaking works in the around known infrastructure services.

Service disruptions impacting the surrounding educational, residential, social and commercial properties shall be kept to a minimum, only occurring where unavoidable. Prior notification of disruptions shall be given to all impacted properties. This shall include information on when disruptions are scheduled to occur and the duration of the disruption. Consultation with relevant neighbouring parties shall be undertaken prior to any proposed disruptions.

[2] https://www.esbnetworks.ie/tns/publications/-in-category/categories/publications/safety
[3] https://www.hsa.ie/eng/Publications_and_Forms/Publications/Construction

A CEMP will be prepared and implemented by the nominated contractor in consultation with LCCC and their Environmental Clerk of Works.

There will be no predicted interference with, or impact on, the existing electricity supply network during the Operational Phase of the proposed development.

13.6.5 Waste Management

All current and applicable waste management legislation will be applied and adhered to. Contractors that are engaged in the transport of waste off-site will comply with the provisions of the Waste Management Act (1996) (as amended), associated Regulations and the Waste Management Plan prepared in accordance with 'Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (2021)'. The Contractor must handle, transport, and dispose of waste in a manner that ensures that no adverse environmental impacts occur as a result of any of these activities. A waste collection permit to transport the waste which has been issued by the National Waste Collection Permit Office must be held by the relevant contractor.

Waste receiving facilities must also be appropriately licensed or permitted for the waste being received. Operators of such facilities cannot receive any waste, unless in possession of a waste permit granted by the Local Authority under the 'Waste Management (Facility Permit & Registration) Regulations 2007' (as amended) or a waste license granted by the EPA. The permit/license held will specify the type and quantity of waste able to be received, stored, sorted, recycled and/or disposed of at the specific site. The contractor shall provide details of all proposed waste facilities to the Contract Administrator before works commence on site. It has been confirmed that there are appropriate facilities in the area available to receive and process waste material.

The construction compounds for the proposed works will have a dedicated Waste Storage Area (WSA) for any construction waste generated. Receptacles/skips or bays will be provided for relevant recyclable material.

13.6.5.1 Bedrock, Block and Concrete

Minimal excavation works are expected along sections of the Red, Cyan, and Magenta Sections which are located on the existing towpath. It is reasonable to assume that gravels and some bedrock may be encountered during the excavation along these sections alongside the existing towpath. Excavations will be required along the desire line in the purple section and waste material arising will be used to build up the ramps adjacent to the proposed path.

Made ground is likely to be encountered in areas where works occur at junctions and where existing carriageways and footpaths will be remodelled. Any material which is not reused will be separated out and sent to the appropriate recycling facility or waste facility if deemed unsuitable for recycling.

During and installation of bridge structures, decking and culverts, access roads and kerbing; it is reasonable to assume that there will be some waste concrete and blocks generated. This waste will be adequately contained and stored within the construction compounds. It will then be disposed of to a permitted or licensed facility.

13.6.5.2 Soil/Subsoil

All works carried out in areas where Himalayan balsam and Giant Hogweed have been identified will be managed in accordance with the measures set out in the ISMP.

Soils generated from excavations which are not in a Giant Hogweed or Himalayan Balsam infested area will be stored separately and will be managed in accordance with the Invasive Species Management Plan.

Although it is not foreseen, if contaminated soils are encountered, they will be stored separately to inert material. Samples will be taken and tested to appropriately classify the material as non-hazardous or hazardous to establish the criteria for the acceptance of waste at landfills. These materials will then be transported to an appropriately licensed facility by permitted contractors.

13.6.5.3 Scrap Metal

Precast concrete bridge decks and precast concrete culverts are to be used as part of the construction of bridges and culverts along the route. As such it is reasonable to assume that only a small amount of scrap metal will be generated.

Existing concrete decks for bridges and parapet railings will generate scrap metal arisings. Scrap metal is highly recyclable and as such it will be segregated from other waste and recycled accordingly.

13.6.5.4 Timber

A small amount of timber waste may also be generated from hoarding around works areas, plywood, pallets etc. It is likely that this timber can be reused for different functions throughout the construction phase, however, a small amount of waste will be generated, and the timber as a whole could be disposed of as the construction phase comes to a close.

Timber that is uncontaminated, i.e. free from paints, preservatives, glues etc, will all be recycled. Should any timber be deemed to be contaminated it will be collected by an appropriately permitted specialist contractor and disposed of in an appropriately licensed facility.

13.6.5.5 Hazardous Materials

Where hazardous materials are used/encountered on site, i.e. bituminous mixtures containing coal tar, timber with paint; a specialist contractor will be engaged to carry out an environmental clean-up to remove all traces of contaminated material from site. It is not anticipated that there will be any Asbestos material encountered during the construction works. The specialist contractor will be licensed under the 'Waste Management (Collection Permit) Regulations, 2007' (as amended). All contaminated materials will be disposed of at an appropriately licensed facility.

In order to avoid any hazardous materials (if encountered) infiltrating the ground water or surface water during construction works, there will be a bunded area constructed within site compounds with sufficient volume to contain any spills. All plant refuelling, maintenance or washing will be carried out within the bunded areas. Spill kits will also be available at these areas to facilitate the quick and effective cleaning of any substances.

<u>Documentation</u>

Waste will be weighed, either by weighing mechanism on the truck or at the receiving facility, and these records will be kept by the contractor (both hard and soft copies).

A copy of all waste collection permits, for all waste contractors will be kept by the Waste Manager, working on behalf of the Contractor, on-site.

If any waste is being transported to another site, a copy of the waste permit or EPA Waste License for that site must be provided and kept by the Waste Manager. If the waste is being shipped abroad, a copy of the Transfrontier Shipping (TFS) document must be obtained from Dublin City Council (as the relevant authority on behalf of all local authorities in Ireland) and kept on-site along with details of the

final destination (permits, licenses etc). A receipt from the final destination of the material will be kept as part of the on-site waste management records.

All information will be entered into the waste management system to be maintained on site.

13.7 Assessment of Residual & Cumulative Impacts

With mitigation in place there will be no predicted **negative residual impacts** on the Water Distribution, Drainage, Electricity & Telecommunications networks within the proposed Greenway route area.

There will be a predicted **negative minimal residual impact** on Traffic with mitigations in place.

There will be a predicted **significant positive cumulative impact** on Roads and traffic within the scheme area due to the nature of the proposed development.

There will be a predicted **neutral residual impact** on Waste Management where mitigation measures are implemented during the construction phase of the proposed development.

The Limerick Development Plan 2022-2028 and planning register were consulted to identify developments which could cause cumulative impacts with the proposed project. No significant industrial/housing/commercial developments are planned for the area within the envisaged works period.

The Limerick City Greenway (UL to NTP) has been determined to have a **permanent positive impact** if all issues raised in the EIAR are adequately addressed.

Past grants of planning, current projects at design or construction stages and current planning applications were reviewed as part of the assessment. The combination of these plans would not give rise to a significant change in the Material Assets of the area.

Overall, there will be a **positive significant residual impact** on Material Assets within the Greenway area.

REFERENCES

Department of Environment, Heritage and Local Government (2021). Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects.

Department of Transport (2021). Traffic Signs Manual (Chapter 8 – Temporary Traffic Measures and Signs for Roadworks.

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EPA Waste Water Discharge Licence Applications database.

EPA (2015), 'Advice Notes on Current Practice in the preparation of Environmental Impact Statements' (Draft).

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Health and Safety Authority. Construction Codes of Practice.

Limerick Development Plan (2022 - 2028).

National Transport Authority, Limerick Shannon Metropolitan Area Transport Strategy (LSMATS)

S.I. No. 821/2007 - Waste Management (Facility Permit and Registration) Regulations 2007

Southern Region Waste Management Plan 2015 - 2021(as implemented through the Local Authority Development Plans).

Transport Infrastructure Ireland (2019). Requirements for the Reinstatement of Openings in National Roads.

Waste Management Act (1996) (as amended).

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14 SUMMARY OF INTERACTIONS OF THE FOREGOING

14.1 INTRODUCTION

The preceding Chapters 5 to 13 of this EIAR identify the potential environmental impacts may occur during the construction and operational stages of the proposed Greenway with regards to Human Beings, Population & Human Health, Biodiversity, Land Use, Soils & Geology, Water, (including Hydrology and Hydrogeology), Air / Noise & Vibration, Climate, Landscape & Visual, Cultural Heritage and Material Assets (including Traffic), as a result of the proposed development.

All of the potential impacts of the proposed development and the measures proposed to mitigate these have been outlined in the preceding sections of this report. However, for any development with the potential for significant environmental impact there is also the potential for interaction between these impacts. The result of interactive impacts may either exacerbate the magnitude of the impact or ameliorate it.

This Chapter identifies the principal interactions between the potential impacts of the environmental factors identified in Chapters 5 to 13, inclusive, for the Limerick City Greenway (UL to NTP). The principal interactions are summarised in Table 14.1, and further discussed in **Section 14.2** of this Chapter. The predicted impacts identified in Chapters 5 to 13 have considered the principal interactions listed below and associated mitigation measures.

Cumulative and in-combination effects arising from the interaction of impacts identified below are outlined in **Section 14.3** of this Chapter.

Table 14.1: Matrix of Interactions between Environmental Factors

Environmental Topic → / ↓	Human Beings, Population & Human Health	Biodiversity	Water (inc. Hydrology & Hydrogeology)	Land Use, Soils & Geology	Air Quality /Noise Vibration	Landscape & Visual	Climate	Material Assets including Traffic	Cultural Heritage
Human Beings, Population & Human Health		✓	x	✓	✓	✓	x	✓	x
Biodiversity	x		✓	✓	✓	✓	x	x	x
Water (inc. Hydrology and Hydrogeology)	x	✓		✓	x	✓	✓	x	x
Land Use, Soils & Geology	x	✓	✓		x	✓	x	x	x
Air Quality /Noise & Vibration	✓	✓	x	x		x	x	✓	x
Landscape & Visual	✓	✓	x	✓	x		x	x	x
Climate	x	x	✓	x	x	x		✓	x
Material Assets including Traffic	✓	x	✓	x	✓	✓	✓		x
Cultural Heritage	x	x	x	x	x	✓	x	x	

14.2 INTERACTIONS

14.2.1 HUMAN BEINGS, POPULATION & HUMAN HEALTH

Population and Human Health interacts with other environmental factors as outlined in Chapter 5 of this EIAR. These are summarised as follows: -

- Biodiversity - Potential impacts on the receiving biodiversity could result in associated population and human health impacts in the context of a loss of amenity and ecosystem services. However, impact on biodiversity is not significant and no biodiversity risk habitats used for amenity will be lost. The mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 6: Biodiversity will ensure that these are suitability mitigated. These measures will enhance the ecosystem services for the surrounding communities.
- Land Use, Soils and Geology – Potential impacts, as identified in Chapter 7, on the receiving land, soils and geology could also result in associated impacts on human beings due to changes in land use, excavation and movement of soils and stone, and temporary loss of artificial surfaces during construction of additional measures. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 7: Land Use, Soils & Geology will ensure that these are suitably mitigated. These mitigations include on-site storage and re-use of excavated materials and suitable re-instatement of all artificial surfaces as appropriate.
- Air Quality / Noise & Vibration – Potential impacts on the receiving air quality and climate could also result in associated population and human health impacts as a result of change to air quality in the local area. There is potential for air quality impact on, and nuisance to the local community during construction phase as a result of increased dust emissions and increased exhaust emissions from construction related traffic. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 9: Air Quality / Noise & Vibration will ensure that these are suitably mitigated.
- Traffic – Potential impacts on the receiving transport environment could also result in associated population and human health impacts due to nuisance and disturbance during both construction and operation. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 13: Material Assets will ensure that these are suitably mitigated.
- Noise and Vibration – Potential impacts on the receiving noise and vibration could also result in associated population and human health impacts involving nuisance and noise disturbance during construction phase. Specific construction activities are assessed in Chapter 9 as potentially having a temporary to short-term impact in duration and moderate to significant negative impacts in qualitative terms. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 9: Air Quality, Noise & Vibration will ensure that these are suitably mitigated. These mitigations include noise level monitoring, limitation of permitted working hours, appointment of a designated responsible person on-site specific to noise levels and establishing clear and transparent channels of communication between all involved parties.

- Landscape – Potential impacts on the receiving landscape and visual amenity could also result in associated population and human health impacts involving loss of visual amenity during construction and operational phases. Landscape impacts are assessed in Chapter 11 as potentially having temporary to short-term, slight to significant negative impacts. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 11: Landscape will ensure that these are suitably mitigated. These measures include advance specialist arboricultural input, erection of hoarding where required and restriction of plant movements within sensitive areas during construction phase. Additionally, operational phase mitigation measures include re-instatement of vegetation, as a compensation measure to achieve no net loss of trees and the species they hold.
- Material Assets – Potential impacts on material assets including traffic, services (electricity, water, telecoms) and waste management may be disrupted during construction phase of the development and could result in human being impacts. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 13: Material Assets will ensure that these are suitably mitigated. Such measures during construction phase include implementation of a Traffic Management Plan (TMP) and Construction Environmental Management Plan (CEMP), advance notification of services disruptions, advance scheduling and sequencing of construction works as appropriate, maintenance of local access and consultation with residents and interested parties as required. Mitigation measures during operational phase, such as for maintenance, will align with those applied during construction.

14.2.2 BIODIVERSITY

Biodiversity interacts with other environmental factors as outlined in Chapter 6 of this EIAR. These are summarised as follows:

- Water, Hydrology and Hydrogeology – Potential impacts on the receiving hydrology and hydrogeological environment could also result in associated biodiversity impacts. This will be temporary short term in nature and confined to the construction phase. Upon completion, aquatic habitat, flora and fauna within the affected lengths of channel should recover and re-colonise from adjacent sources resulting in a temporary slight-moderate negative effect. Impact on water quality and smothering of aquatic habitats as a result of sediment runoff during construction or operations and release of suspended solids and contamination as a result of accidental hydrocarbon or cement spillage during construction and or operations are assessed in Chapter 6. However, It is unlikely that construction works would significantly impact watercourses, because they will be confined and set back along the route of the existing path. Therefore, no long-term negative impacts on habitats, species and water quality are foreseen. The mitigation measures described in Chapter 6: Biodiversity and Chapter 8: Water, Hydrology and Hydrogeology will ensure that negative impacts are suitably mitigated. These measures comprise the use of sediment barriers to trap sediment to prevent its transport into the river, install a silt fence on all sides of temporary site compounds, conduct works in accordance with best practice Guidance for Pollution Prevention. These measures will be consolidated by physical monitoring during construction phase. The ECoW will also be on-site to monitor construction works and adjacent environments.

- Land Use, Soils and Geology – Potential impacts on the receiving land, soils and geological environment could also result in associated biodiversity impacts with direct loss of habitats on land within the footprint of the project. Impacts on agricultural land are assessed in Chapter 7 as being potential short-term in duration and negative in qualitative terms. However, the mitigation measures described in Chapter 6: Biodiversity and Chapter 7: Land Use, Soils & Geology will ensure that these are minimised and are suitably mitigated.
- Air Quality and Climate – Potential impacts on the receiving air quality and climate could also result in associated biodiversity impacts as a result of nitrogen and carbon emissions. However, the mitigation measures described in Chapter 6: Biodiversity and Chapter 9: Air Quality, Noise & Vibration and Chapter 10: Climate will ensure that these are suitably mitigated.
- Noise and Vibration - Potential impacts on the receiving noise and vibration environment could also result in associated biodiversity impacts because of disturbance to species. However, the mitigation measures described in Chapter 6: Biodiversity and Chapter 9: Air Quality /Noise and Vibration will ensure that these are suitably mitigated.
- Landscape – potential impacts associated with the loss of treelines could also result in associated biodiversity impacts. However, the mitigation measures described in Chapter 6: Biodiversity will ensure that these are minimised and are suitably mitigated.

14.2.3 LAND USE, SOILS & GEOLOGY

Land Use, Soils and Geology interacts with other environmental factors as outlined in Chapter 7 of this EIAR. These are summarised as follows:

- Water, Hydrology and Hydrogeology – Potential impacts on the receiving hydrological and hydrogeological environment could also result in associated land, soils and geological impacts with changes to ground water conditions. However, the mitigation measures described in Chapter 7: Land Use, Soils & Geology and Chapter 8: Water, Hydrology and Hydrogeology will ensure that these are suitably mitigated.
- Landscape– Potential impacts on the receiving Land, Soils and Geology as a result of loss or movement of soil and to a lesser extent bedrock could also result in associated landscape impacts by causing a visual change in the landscape. However, the mitigation measures described in Chapter 7: Land Use, Soils & Geology and Chapter 11: Landscape Assessment will ensure that these are suitably mitigated.
- Biodiversity– Potential impacts on the receiving Land, Soils and Geology could also result in associated biodiversity impacts with movement of soil and bedrock and changes in Land Use potentially resulting in loss of habitats and species. Movement of bedrock may also result in changes to the hydrogeological environment thereby having an effect on groundwater-dependant habitats. However, the mitigation measures described in Chapter 7: Land Use, Soils & Geology and Chapter 6: Biodiversity will ensure that these are suitably mitigated.

14.2.4 WATER, HYDROLOGY AND HYDROGEOLOGY

Water, Hydrology and Hydrogeology interact with other environmental factors as outlined in Chapter 8 of this EIAR. These are summarised as follows:

- Land Use, Soil and Geology – Potential impacts on the receiving hydrology and hydrogeology environment through the removal and movement of materials could also result in associated land, soils and geology impacts such as changes in water groundwater volumes and quality. However, the mitigation measures described in Chapter 7: Land Use, Soils & Geology and Chapter 8: Water, Hydrology and Hydrogeology will ensure that these are suitably mitigated.
- Landscape– Potential impacts on the receiving landscape could also result in associated water impacts by altering the natural flow of surface water in the area. However, the mitigation measures described in Chapter 8: Water, Hydrology and Hydrogeology and Chapter 11: Landscape Assessment will ensure that these are suitably mitigated.
- Biodiversity – Potential impacts on the receiving hydrological and hydrogeological environment could also result in associated biodiversity impacts with changes in the hydrology of rivers potentially resulting in loss of habitats and species. Changes to the hydrogeological environment may also result in changes to groundwater-dependant habitats. There may be impacts on water quality and smothering of aquatic habitats as a result of sediment runoff during construction and release of suspended solids and contamination as a result of accidental hydrocarbon or cement spillage during construction. However, the mitigation measures described in Chapter 6: Biodiversity and Chapter 8: Water, Hydrology and Hydrogeology will ensure that these are suitably mitigated.

14.2.5 AIR QUALITY / NOISE & VIBRATION

Air Quality / Noise & Vibration interact with other environmental factors as outlined in Chapter 9 of this EIAR. These are summarised as follows:

- Traffic – Potential impacts of the proposed development on transport could also result in associated impacts on the receiving air quality and climate due to an increase in the volume of vehicles and machinery and therefore increased emissions including dust, and increased noise and vibration during construction phase. However, the mitigation measures described in Chapter 13: Material Assets and Chapter 9: Air Quality, Noise & Vibration will ensure that these are suitably mitigated. These measures comprise inspection, cleaning and maintenance of all roads within construction works areas and site boundaries, watering of roads as appropriate during periods of dry or windy weather, speed limits and suitable protective covering on vehicles transporting materials with dust emission potential, coordinating and sequencing of plant and vehicular movements as well as excavation, spreading and removal of surplus material off site. During construction, noise limits, noise control measures, hours of operation and selection of plant items will be considered in relation to disturbance of fauna. Plant machinery will be turned off when not in use. These measures will be consolidated with regular reviews and inspections.
- Biodiversity – Potential impacts on the receiving air quality and climate could also result in associated biodiversity impacts as a result of nitrogen deposition. Additionally, site activity during the construction phase could give rise to noise that could cause disturbance to fauna. All construction activities will be temporary in nature with limited interaction with sensitive habitats and will progress sequentially across the works area of the entire project, minimising the duration of works in any one area. The mitigation measures described in Chapter 6: Biodiversity and Chapter 9: Air Quality, Noise & Vibration will ensure that these

are suitably mitigated. These measures include those set out in the previous paragraph (Traffic).

- Population & Human Health – Potential impacts on the receiving air quality and climate could also result in associated population and human health impacts as a result of change to air quality in the local area during construction phase. There is potential for air quality impact on the local community during construction phase as a result of increased dust and exhaust emissions. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 9: Air Quality, Noise & Vibration will ensure that these are suitably mitigated.

14.2.6 TRAFFIC (ASSESSED WITHIN MATERIAL ASSETS)

Traffic interacts with other environmental factors as outlined in Chapter 13 of this EIAR, these are summarised as follows:

- Noise and Vibration - Potential impacts as a result of traffic could also result in associated noise and vibration impacts due to an increase in the volume of vehicles and machinery and therefore noise and vibration during construction phase. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health, Chapter 13: Material Assets and Chapter 9: Air Quality, Noise & Vibration will ensure that these are suitably mitigated.
- Landscape – Effects on landscape were considered in design of the proposed development and are deemed to be low impact. Mitigation measures have been proposed in Chapter 11 – Landscape & Visual in the form of construction vehicle avoidance of sensitive areas, retention of vulnerable trees and hedgerows, reinstatement of boundaries and hedgerows and additional appropriate planting.
- Population & Human Health – Potential impacts as a result of traffic could also result in associated population and human health impacts due to nuisance and disturbance during construction phase. However, the mitigation measures described in Chapter 5: Human Beings, Population & Human Health and Chapter 13: Material Assets will ensure that these are suitably mitigated.
- Air Quality, Noise & Vibration and Climate – Potential impacts as a result of traffic could also result in associated impacts on the receiving air quality and climate due to an increase in the volume of vehicles, plant and machinery and therefore an increase in emissions during construction phase. Potential impacts as a result of traffic could also result in associated impacts on the receiving environment due to an increase in noise and vibration during construction phase. However, the mitigation measures described in Chapter 13: Material Assets, Chapter 9: Air Quality, Noise & Vibration and Chapter 10: Climate, will ensure that these are suitably mitigated.

14.2.7 CLIMATE

Climate interacts with other environmental factors as outlined in Chapter 10 of this EIAR, these are summarised as follows:

- Population and Human Health – Increased traffic and construction activities during the construction phase can result in an increase of greenhouse gas emissions and other pollutants

that can have an adverse effect on human health of the community directly surrounding the construction area. These works will be temporary and localised in nature. The mitigation measures proposed in Chapter 5: Human Beings and Population, Chapter 9: Air Quality, Noise & Vibration, Chapter 10: Climate and Chapter 13: Material Assets, will ensure that these potential impacts are suitably mitigated.

- Water, Hydrology and Hydrogeology - The impacts of climate change are considered as part of the flood risk assessment, summarised in Chapter 8: Water, Hydrology and Hydrogeology and Chapter 10: Climate, of this report, as a result of extreme weather events in future climate scenarios.
- Air Quality - Potential impacts on air quality can result from an increase of greenhouse gas emissions during the construction works due to plant use, machinery, traffic and other auxiliary works. Mitigation measures proposed in Chapter 9: Air Quality, Noise & Vibration, Chapter 10: Climate and Chapter 13: Material assets will ensure that the potential impacts are mitigated.
- Material Assets and Traffic – There in an interaction between climate and material assets as the amount of material to be imported, and waste generated during the construction of the proposed greenway, influences the embodied carbon, assessed in Chapter 10: Climate. The redistribution of traffic associated with the traffic management during construction, will also generate GHG emissions during the construction stage. However, during its operation, the greenway will result in an overall reduction of GHG emissions associated with road travel, as it will promote more sustainable travel modes, supporting the decarbonisation path locally and nationally.

14.2.8 LANDSCAPE AND VISUAL IMPACT

During the construction phase, construction activities and traffic are likely to have an impact on the landscape and visual elements surrounding the greenway.

- Cultural and Built Heritage: The proposed greenway has the potential to cause visual impacts on archaeological and cultural heritage features. Construction impact interactions relate to introduction of construction compounds, stockpiling, cranes and other machinery and construction traffic into the scenic environment of the River Shannon. The evolution of the design of the proposed development has recognised the archaeological and cultural heritage and landscape and visual interactions from the outset, including through the constraints and route selection stages as well as the preliminary design, to ensure that the greenway results in the minimum intrusion on the landscape as much as possible. The photomontage produced as part of the landscape and visual assessment have been used to determine visual intrusion of the proposed greenway on key archaeology and cultural heritage features.
- Biodiversity: The mitigation measure to address the landscape and visual impacts arising from the works have the potential for interaction with biodiversity by of the nature and extent of the proposed planting. To support biodiversity and ensure no net loss, appropriate planting is required in the landscape design and has been considered as part of the mitigation measures. The planted species, location and extent of planting will have operational interactions with potential positive effects on biodiversity.

Chapter 11: Landscape and Visual and Chapter 12: Cultural Heritage assess the potential impacts on the landscape features. It also interacts with other environmental factors as outlined in Traffic (Material Assets), Land Use, Soil and Geology.

Mitigation measures proposed across the EIAR chapters will ensure that all potential impacts are suitably mitigated.

14.2.9 Cultural Heritage – Archaeology & Built Heritage

As with Landscape and Visual above, the proposed development has the potential to cause visual and physical impacts on archaeological/built heritage features due to change in the character of the historic environment.

A number of features also have shared heritage value in terms of overlap between the Archaeological & Cultural Heritage and Architectural Heritage assessments, as in:

- Landscape and Visual: The potential interactions between cultural heritage elements and landscape and visual elements are outlined above in Section 14.2.8.
- Biodiversity: During pre-construction site enabling works, archaeological testing will be undertaken along the proposed greenway route. Terrestrial and aquatic surveys have been undertaken and if needed, should be repeated, to secure all biodiversity receptors.

14.2.10Material Assets

Material Assets interact with other environmental factors as outlined in Human Beings, Population and Human Health, Hydrology and Hydrogeology, and Climate above.

14.3 Summary of Cumulative and In-Combination Impacts

Where cumulative and in-combination impacts are considered to arise, these are outlined in the relevant Chapters of this EIAR. The below sections outline the cumulative and in-combination impacts as raised in each relevant Chapter.

14.3.1 Human Beings, Population & Human Health

There are no large-scale developments proposed in the vicinity of the Greenway project that would together have potential to give rise to in-combination effects on the health and socio-economics of the local population. No potential for significant in-combination cumulative effects on population and human health in the area are anticipated.

14.3.2 Biodiversity

The potential for the proposed development to result in cumulative effects on biodiversity when considered in combination with a number of other relevant plans and projects was assessed in Chapter 6. Each element of the proposed Greenway was considered both cumulatively and in-combination with other plans and projects and no additional effects or potential for cumulative adverse effects on biodiversity were identified. The proposed Greenway will not result in significant effects on any biodiversity when considered on its own or with other plans or projects.

Chapter 6: Biodiversity, Chapter 8: Water, Hydrology and Hydrogeology and Chapter 15: Schedule of Mitigation Measures detail the appropriate mitigations which have been identified and will be put in place during construction and operational phases.

14.3.3 Land, Soils & Geology

An assessment of the cumulative impacts on Land, Soils & Geology is detailed in Chapter 7 of this report. Based on the assessment of all elements of the proposed project, no significant cumulative effects are anticipated.

It is considered that the design of the proposed Greenway, the scale of the works and the implementation of effective mitigation and best practice will ensure, when considered in its entirety, will minimise, as much as possible, significant effects on land, soils and geology.

Chapter 3 and Chapter 7 identify where other plans, projects and associated activities have potential to contribute to in combination effects. It is considered that there is no potential for significant in combination or cumulative effects on land, soils and geology.

14.3.4 Water, Hydrology and Hydrogeology

The impacts of the proposed development on Water, Hydrology & Hydrogeology has been assessed in Chapter 8 as being moderate to significantly positive overall.

The proposed development represents a standalone project relating to the improvement of the current path, which is not part of a broader scheme of physical modifications by others to manage flooding that are planned on the banks of the River Shannon and River Mulkear.

However, it is important to note that the River Mulkear is part of the Arterial Drainage Act 1945 and has routine annual monitoring to ensure that adequate flood drainage is in place throughout the watercourse. These monitoring and maintenance actions involve removal of features that may interfere with the design conveyance of a channel. These activities may act on a range of species and habitats within the River Mulkear, with subsequent downstream impacts within the River Shannon.

Chapters 8 Water, Hydrology and Hydrogeology and Chapter 15 Schedule of Mitigation Measures detail the appropriate mitigations which have been developed and will be put in place during the construction and operational phases of the proposed development.

14.3.5 Air Quality, Noise & Vibration

An assessment of the cumulative impacts on climatic factors, air quality, noise & vibration is detailed in Chapter 9 of this EIAR.

The potential cumulative effects on air quality, climate, noise and vibration between the proposed Greenway and other projects in the vicinity, as presented in Chapter 3 of the EIAR, were assessed.

During the construction phase of the proposed Greenway, there will be potential dust emission from construction activities and minor emissions from construction vehicles and machinery. There will also be a short-term increase in noise and vibration in the vicinity of the proposed development during the construction phase as a result of machinery use, plant movements and construction activities. However, once the outlined mitigation measures have been implemented, there will be no cumulative negative effect on air quality, noise or vibration.

The proposed project has been assessed to have a negligible impact on air quality, noise and vibration following construction and therefore there will be no measurable negative in-combination effects with other projects on air quality, climate, noise and vibration during the operation phase of the Greenway.

An assessment of the cumulative noise & vibration impact from construction activities on the development site is detailed in Chapter 9 of this report. In summary, there is potential for the development to result in temporary slight to significant noise impact (dependent on specific construction activities as detailed in Chapter 9) at the closest residential receptors during daytime working hours. Mitigations are detailed in Chapter 9.

There are no other proposed developments in the receiving environment that will add to noise or dust emissions. Therefore, there will be no predicted negative in-combination effects from noise, vibration and dust emissions on the receiving environment.

14.3.6 CLIMATE

An assessment of the cumulative and in-combination impacts of the proposed Greenway on climate, is detailed in Chapter 10 of this report.

The climate assessment has been considered on a national basis and not confined to a specific study area, as the drivers and impacts of climate change operate on a wider scale.

During the construction phase, there will be an increase in greenhouse gas emissions attributable to construction materials, traffic and activities such as embodied carbon of cementitious materials, plant use, fuel and electricity use, vegetation clearance, tree felling among others. However, these emissions will be offset during the operational lifetime of the greenway which promotes sustainable travel modes (cycling, walking) away from fuel-based transportation.

The Greenway achieves the objectives of supporting the delivery of a low carbon and climate resilient transport mode, which supports the objectives of LCCC's and Ireland's emissions reduction targets.

14.3.7 LANDSCAPE AND VISUAL IMPACT

An assessment of the cumulative and in-combination impacts of the proposed Greenway on landscape and visual amenity is detailed in Chapter 11 of this report.

The review of the Limerick City & County Council planning register documented relevant general development planning applications in the vicinity of the proposed greenway, most of which relate to the provision and/or alteration of one-off housing and other structures. The Castletroy WwTP Upgrade Project was granted permission by An Bord Pleanála in 2023. Should the construction programmes overlap there is potential for cumulative impacts on the local landscape and its surrounding area. However, mitigations detailed in Chapters 11 & 15 of this report will ensure that these potential cumulative impacts are minimised.

14.3.8 CULTURAL HERITAGE

An assessment of the cumulative impacts on Cultural Heritage is detailed in Chapter 12 of this EIAR.

The main potential cumulative impact is related to the upgrade of the Castletroy WwTP which was granted permission in 2023. Construction works related impacts from the greenway, as detailed in section 14.2.9, might result in cumulative impacts on the Plassey Mill complex as its zone of notification is <15 meters from the WwTP boundary.

The mitigation measures detailed in Chapter 12: Cultural Heritage of this report will ensure that the potential cumulative impacts are suitably mitigated.

14.3.9 MATERIAL ASSETS (INCLUDING TRAFFIC)

An assessment of the cumulative impacts on Material Assets, including impacts on and increased volumes of Traffic, is detailed in Chapter 13 of this EIAR.

The construction phase of the project will give rise to some temporary road closures and restrictions of traffic movements during the construction phase of the project. This will create some short-term inconvenience for road users. By ensuring that these impacts occur at times and locations provided for in a traffic management plan, this will be mitigated in so far as is possible.

The movement of construction vehicles within, to and from the works areas has the potential to give rise to noise and dust nuisance impacts during the construction phase of the project. The transportation of construction material to and from site has the potential to affect the embodied carbon of the project and this has the potential to affect climate by increasing the GHG emissions to the atmosphere during. Material transport required during the operational phase will not be significant enough to have a detectable effect on climate. Furthermore, the operation of the greenway will contribute to the reduction of GHG emissions by promoting more sustainable transport modes at a local scale. These effects and the measures that are in place to avoid any cumulative or interactive effects are fully described in Chapters 3, 9, 10, 13 & 15 of this EIAR.

Poor management of waste has the potential to cause nuisance to human beings and an adverse impact on water, soils and biodiversity, particularly due to the presence of Japanese Knotweed and Himalayan Balsam in the vicinity of the proposed working areas. These effects and the measures that are in place to avoid any cumulative or interactive effects are fully described in Chapters 3, 6 & 13 of this EIAR.

Following a detailed assessment of the potential for any further impact when considered in combination with any or all of the plans and projects set out in set out in Chapter 3, the proposed Greenway, with mitigation measures in place, was found to have no potential for significant in-combination cumulative effects on material assets.

Overall, there will be a **positive significant residual impact** on Material Assets, including roads, water distribution network and drainage within the Study Area.

15. SCHEDULE OF MITIGATION MEASURES

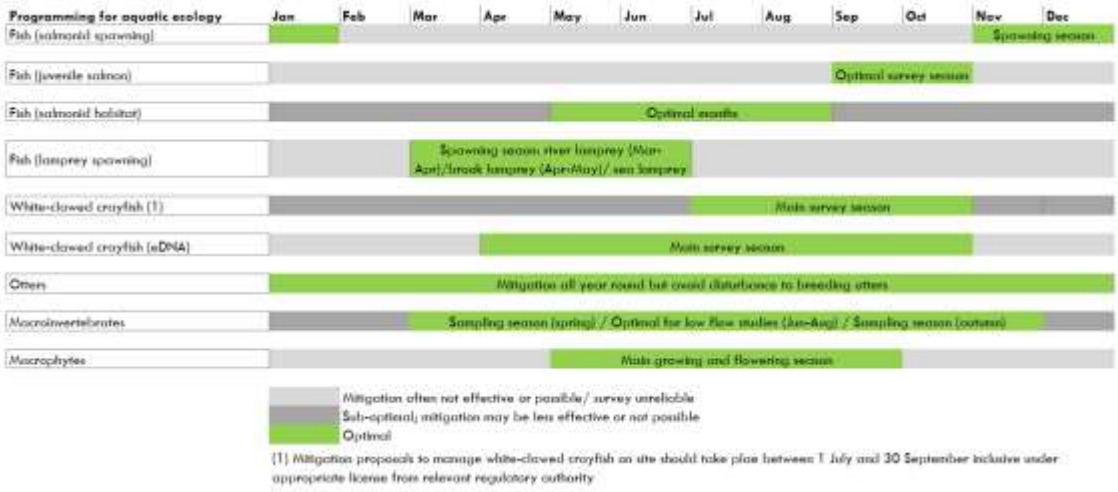
All mitigation measures for the proposed Greenway are set out in the relevant chapters of the EIAR submitted as part of the assessment.

These mitigation measures that will be implemented during the various phases are outlined in Table 15.1. The mitigation measures for the construction phase have been grouped together according to their environmental field/topic and are presented under the following headings:

- Construction management
- Flora and Fauna
- Soils, subsoils and bedrock
- Water
- Air quality/Dust
- Climate
- Noise and Vibration
- Landscape and visuals
- Cultural Heritage
- Traffic

The mitigation and monitoring proposals are set out in separate tables in the CEMP (EIA Part 3 - Appendices) for clarity and tracking of the pre-commencement survey requirements.

The **Mitigation timing - ecological calendar** below will be applied and followed to ensure protection of habitats and species during construction and operational phases of the greenway. In general, the construction works should be planned during the 'green' periods in the calendar year, as long as appropriate mitigation measures are implemented. The exception to this is Fish (salmonoid spawning) because foreshore works (including preparatory work) beside all watercourses supporting salmonids shall be undertaken from May to October (inclusive) and in consultation with Inland Fisheries Ireland (IFI) to avoid accidental damage or siltation of spawning beds.



Where particular monitoring proposed is considered to be a measure of mitigation, it has been included in the consolidated table for all mitigation measures. The mitigation proposals in the below format provides an easy to audit list that can be reviewed and reported on during the proposed works.

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		Pre-Commencement Phase		
MM.1	EIAR Ch 5	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's '*Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2013 (Updated)*'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan.		
MM.2	EIAR Ch 6	A pre-construction invasive species survey will be undertaken at the site of the proposed scheme.		
MM.3	EIAR Ch 6	Prior to any works a multi-disciplinary walk over survey will be undertaken by a suitably qualified ecologist to identify classified and protected habitats and species within the study area of the proposed scheme.		
MM.4	EIAR Ch 6	Prior to construction, dedicated surveys for bats, birds, badgers, otters and invasive species will be undertaken by qualified ecologists to identify potential signs and sights of these species as well as their habitats.		
MM.5	EIAR Ch 6	It is recommended that prior to any works commence, a target lamprey and white-clawed crayfish should be undertaken at the Mill Race and in the vicinity of any proposed riverbank works.		
MM.6	EIAR Ch 6	All personnel involved with the project shall be informed of the requirement for protection of designated habitats including aquatic environment (Lower River Shannon SAC) and best practice methodologies to be employed via toolbox talks or formal presentation by the ECoW		
MM.7	EIAR Ch 6	The following measures will be put in place to promote biodiversity through the construction and operation of the proposed development: ▪ Trees scheduled for retention will be protected from damaging construction activities and where possible vegetation will be replaced and reinstated. Semi-mature trees are proposed to be planted along the Greenway. ▪ Treelines and hedgerows shall be retained where possible. ▪ To avoid impacting nesting sites, the vegetation removal within the defined working area will not be carried out during the peak bird nesting season of March to August, prior to the onset of works.		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
MM.8	EIAR Ch 12	During the site preparation archaeological mitigation measures will be applied to ensure that an adequate record is made of the unknown cultural heritage resource were encountered within the impact footprint. A programme of Archaeological testing will be undertaken in advance of construction within the development's footprint.		
MM.9	EIAR Ch 13	A Traffic Management Plan (TMP) will be developed in advance of the construction phase incorporating road disruptions, diversions and/or closures where necessary.		
MM.10	EIAR Ch 13	A Construction Environmental Management Plan (CEMP) will be prepared and implemented by the nominated contractor in consultation with LCCC and their Environmental Clerk of Works.		
Construction Management				
MM.11	EIAR Ch 4	A temporary construction compound will comprise the following: ▪ Segregation of worksite and non-worksite/public roadside vehicle areas to prevent cross contamination of invasive species and construction arisings (i.e. soils); ▪ temporary site offices, portaloo toilets, lighting, canteen and facilities for staff and car-parking areas; ▪ storage areas for construction materials; ▪ bunded containment areas for plant refuelling, maintenance, washing and for the storage of fuels, oils, lubricants, solvents and site generators; ▪ a dedicated waste storage area for any construction waste generated. Skips or bays will be provided for recyclable material; ▪ wheel wash area for construction and delivery vehicles or road cleaning to be carried out as an alternative; and ▪ a designated wash out tank for wash out of concrete trucks following concrete pours.		
MM.12	EIAR Ch 5	A traffic management plan will be prepared and implemented for the duration of the works in order to ensure that any impacts on traffic mobility are minimised.		
MM.13	EIAR Ch 13	Good communication between the Works Contractor's Public Liaison Officer and the landowners/stakeholders during the construction phase will prevent undue disturbance		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		due to noise, dust and to minimise difficulties caused by the restrictions of access to some roads.		
MM.14	EIAR Ch 6	An ecology calendar for surveys and mitigations will be made available to project manager, site manager and ECoW to make sure construction activities are undertaken during the right periods to avoid impacts on the local fauna and flora.		
Flora and Fauna				
MM.15	EIAR Ch 4	Reinstatement of the temporary working area and construction compounds will involve ripping, levelling, raking, reuse/reinstate subsoil and topsoil which will be seeded and spread to depth of 300mm along the temporary working area.		
MM.16	EIAR Ch 6	Clearance of vegetation should be undertaken as early as possible to prevent bird nesting.		
MM.17	EIAR Ch 4/ Ch 6	A tree planting scheme will be carried out during the months of August-November. The tree planting will be carried out as follows: ▪ Isolation of works area; ▪ Any waste generated will be removed from the site and disposed in accordance with the Waste Management Regulations.		
MM.18	EIAR Ch 6	The following mitigation measures will be considered for species that can potentially be found within the area of the proposed works: ▪ Avoid badgers entering the site or spoil heaps; ▪ Visual inspection of trees that might need to be removed to facilitate construction works, to identify potential bat roosts; ▪ Reconnection of linear features for commuting corridors; ▪ Lighting required for construction will be as low a wattage as possible; ▪ Noise limits, noise control measures, hours of operation and selection of plant items will be considered in relation to disturbance of birds; ▪ Generators or other sources of noise, vibration and emissions should not be located with 50m of the existing woodland habitat throughout the site, when possible. ▪ Bank slopes along River Shannon should be protected, ensuring riparian vegetation is always available for otters.		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		▪ Otter holts must be protected during construction with a minimum exclusion zone of 150m.		
MM.19	EIAR CH 6	A suitable qualified Ecological Clerk of Works (ECoW) shall be appointed for part time attendance for the full duration of the works and will supervise all aspects of the construction of the Greenway. ▪ The ECoW will hold a minimum University degree in Environmental Science, (NFQ Level 8); Minimum of 5 years' post-graduate experience in ecological assessment, appraisal techniques and mitigation monitoring; ▪ The ECoW will be responsible for biodiversity monitoring elements and providing toolbox talks; and ▪ The ECoW will be responsible for monitoring water quality throughout the works duration. Alarmed sondes will be employed to measure turbidity in the main channel upstream and downstream of the works area during the construction stage. Sondes will be employed within the River Shannon to determine a baseline Nephelometric Turbidity Unit (NTU) value. During the construction period, alarms will trigger where there is a 20% difference between the NTU value recorded in the upstream and downstream Sondes when NTU is above its baseline value. All works will cease immediately until the source is identified and rectified (if caused by the construction works). If the increase is not attributed to the construction works, works will proceed.		
MM.20	EIAR Ch 6	General protective measures will be carried out in areas where there are trees with Potential Roosting Features for bats: ▪ Any trees requiring removal to facilitate construction works must be subject to a visual inspection to identify potential for bat roosting. ▪ Linear features that act as corridors such as hedgerows and treelines should be reconnected where possible using native species. ▪ Lighting will be avoided and/or as low a wattage as possible.		
MM.21	EIAR Ch 6	All Himalayan balsam and Giant Hogweed within and surrounding the site of the proposed works will be subject to the Invasive Species Management Plan. The following measures will be implemented in order to mitigate against the risk of moving contaminated soil:		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		▪ A pre-construction survey for invasive species will be conducted at the earliest stage possible to update and inform on the status of invasive plant species in or near the works area. ▪ In relation to invasive species located on site to date, it has been advised in the ISMP to carry out advanced treatment of identified stands prior to the commencement of works. ▪ The treatment and control of invasive alien species will follow Guidelines for the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads (NRA 2010), and any other best practice guidance which may become available in the interim. ▪ All plant machinery and construction related vehicles arriving and leaving site will be checked for the presence of plant material e.g. leaves roots and rhizomes from non-native invasive species. Installation of a dedicated footwear and vehicular wheel wash down facility, into a contained area by the entrance and exit points of the construction site and in the biosecurity zones, away from drains and watercourses. ▪ Vehicles leaving the site to be inspected for any plant material and will be washed down into a dedicated wastewater contained storage area then tinkered off site to a licenced waste facility. ▪ Where there is potential for cross-contamination on site (machinery or personnel moving from one biosecurity zone to another or from the biosecurity zone to other areas on site), consideration should be given to designating vehicles or machinery to specific sites to prevent spread. ▪ Contaminated material will be stockpiled off site. The area will be clearly marked, lined with a root barrier membrane and be of sufficient size to hold all the material to be excavated. ▪ Seeds may survive in the excavated material for up to 18 months. A two-year programme of control, which will extend beyond the works period will be required. ▪ For any material entering the site, including all fill material, the supplier must provide an assurance that it is free of non-native invasive species.		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		▪ Should any invasive plant species be encountered, the infested areas will be clearly demarcated accounting for potential underground rhizome spread, creating an exclusion zone. ▪ Ensure all site users are aware of invasive species management plan and treatment methodologies. This can be achieved through "toolbox talks "before works begin on the site. ▪ Adequate site signage should be erected in relation to the location and management of non-native invasive plants relative and relevant to the works area.		
MM.22	EIAR Ch 8	To reduce disturbance to fish, works/ construction activities should be confined to standard daylight hours.		
Soils, subsoils and bedrock				
MM.23	EIAR Ch 7	Any excavated topsoil will be mounded alongside where the soil is excavated. Mounds will be fenced off with silt fencing to prevent run off. Soil mounds will be seeded.		
MM.24	EIAR Ch 7	Any excavated subsoil will be mounded alongside where the soil is excavated. Mounds will be fenced off with silt fencing to prevent run off. Soil mounds will be seeded.		
MM.25	EIAR Ch 7	Where it is necessary to remove existing concrete or bedrock to facilitate construction of the proposed development, the material shall be removed and transported to the closest temporary construction compound for breaking and storage. It shall be reused during construction of the haul roads and as a base for the greenway path.		
MM.26	EIAR Ch 7	Works undertaken on the banks should be fully consolidated to prevent scour and run off of silt. Consolidation shall include use of protective and biodegradable matting (coirmesh) on the banks and sowing of grass seed on bare soil.		
MM.27	EIAR Ch 7	In order to reduce the risk of soil contamination as a result of accidents, spills, leaks or flooding the following measures will be implemented: ▪ Fuels, chemicals, liquids and solid wastes will be stored on impermeable surfaces. Regular inspections will be implemented. ▪ Plant refuelling shall be undertaken on hard standing at designated areas, and not within 30 metres of any watercourse, in accordance with best practice guidelines.		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		▪ Plant shall be inspected regularly for any leaks ▪ A lock system will be fitted on all taps, nozzles or valves associated with refuelling equipment ▪ All hydrocarbons and other potential contaminants will be stored within suitably constructed bunds in accordance with best practice guidelines. ▪ Spill kits will be provided at refuelling areas and at high risk/sensitive areas ▪ Large volumes of excavated material will not be allowed to accumulate within the temporary working areas. ▪ There will be no storage of materials, machinery or soil in areas that are susceptible to flooding or within 20m of any drain or watercourse. Preferably these will be stored in compound areas. ▪ Any contaminated soil if encountered will be stored separately from non-hazardous waste in bunded areas before being collected by an authorised waste contractor and transported to an approved waste facility for treatment and safe disposal		
Water				
MM.28	EIAR Ch 6	Guidelines for minimising impacts on water quality and fisheries in relation to Construction shall be implemented including, but not limited to, CIRIA C532 "Control of water pollution from construction sites - Guidance for consultants and contractors", Inland Fisheries Ireland guidelines and TII guidelines.		
MM.29	EIAR Ch 6	No abstraction from any watercourses will be permitted to facilitate the works.		
MM.30	EIAR Ch 6	Storage tanks shall have secondary containment provided by means of an above ground bund to capture any oil leakage irrespective of whether it arises from leakage of the tank itself or from associated equipment such as filling and off-take points, sighting gauges, etc., all of which should be located within the bund. Bund specification should conform to the current best practice for oil storage (Enterprise Ireland, BPGCS005).		
MM.31	EIAR Ch 6	Concrete pouring will be planned for dry weather where possible following weather forecast.		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
MM.32	EIAR Ch 8	Sediment barriers such as silt curtains /sediment netting/ fences or silt traps should be used to temporarily trap sediment to prevent sediment transport into the river, at all interfaces of the works area with a waterbody in advance of construction works on the banks of the river.		
MM.33	EIAR Ch 8	Works at Plassey Beach and for the proposed abutment adjacent to Bridge 2 should be undertaken at times of good weather and low flow in the River where there is no potential for the works area to become inundated with water and no potential for significant volumes of surface water runoff from the works area.		
MM.34	EIAR Ch 8	All works undertaken at Plassey Beach and for the proposed abutment adjacent to Bridge 2 should be fully consolidated to prevent scour and run off of silt. Consolidation may include use of protective and biodegradable matting (coirmesh) on the banks and also the sowing of grass seed on bare soil.		
MM.35	EIAR Ch 8	A silt fence should be erected on all sides of the temporary site compounds to prevent any runoff from the perimeter of the compounds.		
MM.36	EIAR Ch 8	To prevent pollution by leakage or spillage of water contaminants: ▪ There will be no refuelling of machinery near the river channel. Refuelling will take place at designated locations in the ttemporary construction compound on an impermeable surface at distances of greater than 20 metres from a watercourse. ▪ No vehicles will be left unattended when refuelling and a spill kit including an oil containment boom and absorbent pads will be on site at all times. ▪ Any fuel that is stored on the site will be in a double skinned, bunded container that will be located within a designated site compound at a location that is removed from the river. ▪ All construction materials and plant will be stored in the site compounds. Compounds shall be located on ground that is not prone to flooding, i.e. Flood Zone C areas. The site compounds will be surfaced with a hard standing to prevent generation of mud. A silt fence will be erected on all sides of the compounds to prevent any runoff from the perimeter of the compounds. ▪ All vehicles should be regularly maintained and checked for fuel and oil leaks.		
MM.37	EIAR Ch 8	It is recommended that signage is utilised to identify areas of potential flood risk and advise users not to cycle or walk through water should the river flood, the signage could		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		also recommend users check the Met Eireann flood warnings website https://www.met.ie/warnings/today.		
Air Quality and Dust				
MM.38	EIAR Ch 5	In periods of extended dry weather, dust suppression may be necessary within and around the site to ensure dust does not cause nuisance. Shade cloths will act as dust curtains and they will be installed near watercourses, at locations where excavation works will occur, along construction trenches, and around bridges and culverts to catch any dust arising before it can settle on smaller watercourses and the River Shannon		
MM.39	EIAR Ch 9	Speeds shall be restricted on hard surface roads and vehicles transporting materials with dust potential must ensure that the material is always enclose or covered with tarpaulin.		
MM.40	EIAR Ch 5	Mitigation measures will be implemented in relation to exhaust emissions during the construction phase switching machinery off when not in use, maintaining all construction vehicles and plant in good operational order and sourcing material which will be required in large volumes such as aggregates locally where possible to recue potential emissions.		
MM.41	EIAR Ch 9	A record of all dust and air quality complaints will be maintained, along with details of the cause of emissions and the measures implemented to reduce emissions. All records will be made available to Limerick City and County Council.		
MM.42	EIAR Ch 9	The dust mitigation measures put in place will be strictly monitored and assessed throughout the construction phase to ensure their effectiveness as identified in the CEMP.		
Noise and Vibration				
MM.43	EIAR Ch 5	Noise control measures that will be employed include: ▪ Selection of plant with low inherent potential for generation of noise and/or vibration. ▪ Erection of enclosures as necessary around noisy processes and items such as generators, heavy mechanical plant or high duty compressors. ▪ Placing noisy/vibratory plant as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary.		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
MM.44	EIAR Ch 9	It is proposed that various best practices be adopted during construction for the control of noise, including: ▪ Where noise levels at NSLs are anticipated to exceed the daytime noise criteria, hoarding extending to a height of 2.4 m will be erected at the works boundary between the works area and the NSL. If such measures are installed, the construction operations are expected to meet or be less than the 70 dB $L_{Aeq(1hr)}$ criterion. ▪ Limiting the hours during which site activities likely to create high levels of noise or vibration are permitted. ▪ Establishing channels of communication between the contractor/developer, Local Authority and residents. ▪ Appointing a site representative responsible for matters relating to noise. ▪ Monitoring typical levels of noise during critical periods and at sensitive locations.		
MM.45	EIAR Ch 9	The following survey methodology will be employed for attended noise monitoring: ▪ Measure LAeq, LAMax, LAMin, LA10 and LA90 over a sample period of 15 minutes. ▪ Detailed notes will be taken in relation to primary noise sources, weather and prevailing winds. ▪ Measurements will be conducted at various locations on a cyclical basis over the course of a typical day. Noise monitoring will be conducted in accordance with ISO 1996: 2007: *Acoustics – Description, measurement and assessment of environmental noise*.		
MM.46	EIAR Ch 5	Open lines of communication with local residents with regards to work schedules, programme and a reassurance of the temporary nature of the works generating noise and nuisance as well as adhering to agreed hours of construction.		
MM.47	EIAR Ch 9	For control of vibration, the following practices will be adapted during construction: ▪ Establishing channels of communication between the contractor/developer, Local Authority and residents. ▪ Appointing a site representative responsible for matters relating to vibration.		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		▪ Monitoring typical levels of vibration during critical periods and at sensitive locations. Furthermore, a variety of practicable vibration control measures will be employed. These will include: ▪ Selection of plant with low inherent potential for generation of vibration. ▪ Placing of vibratory plant as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary. During the proposed works, vibration monitoring will be conducted during construction activities that may give rise to vibration.		
Climate				
MM.48	EIAR Ch. 10	To mitigate against greenhouse gas emissions, mitigation measures will comprise of: ▪ Periodic maintenance of construction vehicles and plant, minimising emissions associated to construction machinery; ▪ Reuse material from excavation works; ▪ Materials for the construction of the greenway will be obtained from local sources. ▪ Environmental Product Declarations should be required for construction materials when possible and available to opt for the least carbon intensive materials on the market. ▪ Use existing road infrastructure to avoid the construction of new auxiliary roads which will result in an increase of the development's overall carbon footprint.		
Landscape and Visuals				
MM.49	EIAR Ch 11	Avoidance of trees/vegetation removal: A qualified Arborist to be on site to assist in marking out appropriate locations for temporary compounds, and to determine path alignment in certain locations		
MM.50	EIAR Ch 11	Ground protection measures will be required for temporary construction compounds and Haul routes. A geomembrane and Cellweb are proposed.		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
MM.51	EIAR Ch 11	Avoidance of mature trees will be a requirement for the Works Contractor.		
MM.52	EIAR Ch 11	Special construction methods will be used in areas close enough to Class A and Class B trees, building up the path rather than using excavation techniques.		
MM.53	EIAR Ch 11	Re-planting of removed trees with native Irish species at a ratio of 5:1 new trees for every tree that is removed is proposed along the proposed Greenway.		
Cultural Heritage				
MM.54	EIAR Ch 12	A detailed survey of any walls that will be impacted by the Construction works shall be undertaken by a suitably qualified and experienced archaeologist in order to compile a full record of the extant structures in written, drawn and photographic format.		
MM.55	EIAR Ch 12	Masonry repairs and conservation of the walls will be applied in line with conservation best practice where required. If conservation repairs are not progressed, advanced vegetation removal will be carried out under archaeological/built heritage supervision.		
MM.56	EIAR Ch 12	For works within Zones of Notification, archaeological supervision of vegetation clearance will be needed and pre-construction advance geophysical/topographical surveys & advance archaeological test trenching under licence to National Monuments Service is recommended 12-18 months before construction.		
Material Assets and Traffic				
MM.57	EIAR Ch 13	Construction works will be sequenced so as to avoid unnecessary interruption to road users insofar as is practicable. Any road and lane closures will be timed to minimise the impact to the flow of traffic, and if possible, work will be carried out at off peak times to reduce the impact, particularly on heavy goods vehicles. All residents and interested parties shall be consulted when planning these road closures to optimise the timing. A complete schedule of road closure will be published in advance of the works commencing to facilitate the residents in making alternative arrangements where necessary.		
MM.58	EIAR Ch 13	All possible precautions will be taken to avoid unplanned disruptions to any services during the proposed works. This will include GPR surveys to reconfirm the location of utility infrastructure within the works areas, and the implementation of robust procedures		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		when undertaking works in the around known infrastructure services to prevent impact upon the utility/service.		
MM.59	EIAR Ch 13	Waste management will comply with the provision of the Waste Management Act (1996), associated regulations and the Waste Management Plan prepared in accordance with the "Best Practice Guidelines for the Preparation of Waste Management Plans for Construction and Demolition Projects (2006)". All waste collection records and permits will be kept by the Waste Manager and maintained on site.		
Post-construction/ Reinstatement				
MM.60	EIAR Ch 6	▪ Where opportunity exists, enhancement measures may be employed. ▪ Bat boxes and bird boxes should be installed on mature trees, overseen by an experienced ecologist. ▪ Bug hotels will be constructed using appropriate construction waste material and tree branches/saplings. ▪ All plant and machinery will be removed. The adjacent grasslands to the site will be left to regenerate naturally or reinstated to its original condition and site fencing will be removed. ▪ Any reinstatement of breaches in hedgerows and tree lines will be carried out in consultation with a suitably qualified ecologist. Local strains of native species shall be planted, and hedge management shall reflect local traditional styles. ▪ Riparian habitat will be restored which will provide shading to regulate water temperature and improve water quality through natural filtering processes. ▪ A Landscape Plan will be implemented to promote biodiversity net gain in line with the National Biodiversity Action Plan and All Ireland Pollinator Plan.		
Operation and Maintenance				
MM.61	EIAR Ch 5	A maintenance and monitoring schedule will be put in place by LCCC to ensure that the proposed Greenway is operating to the appropriate design standard. Repairs will be made as necessary.		
MM.62	EIAR Ch 6	The following mitigation measures are proposed to be implemented during the operational phase of the proposed greenway for biodiversity receptors:		

Reference No.	Reference	Mitigation Measure	Audit Result	Action Required
		▪ Maintain native vegetation along the greenway corridor, including regular mowing and pruning, while ensuring that invasive species are controlled. ▪ Use pollinator-friendly plants along the greenway to support local pollinator populations. ▪ Where necessary, restore habitats, particularly along watercourses and riparian zones. ▪ Implement a maintenance programme for bridges and culverts to maintain habitat connectivity and reduce wildlife fragmentation. This will allow for safe movement of species. ▪ Install clear signage that creates awareness for users about wildlife and biodiversity conservation. ▪ Provide adequate waste disposal facilities and ensure regular cleaning and maintenance to prevent litter accumulation. ▪ Continue monitoring and treatment of invasive alien plant species along the greenway. ▪ Where appropriate, install fences or barriers to prevent wildlife from accessing dangerous areas such as roadways or areas with high human activity. ▪ Engage local communities, environmental groups, and stakeholders in the ongoing management of the greenway, raising awareness on protected species and their habitats.		
MM.63	EIAR Ch 10	To reinforce the importance of the greenway and sustainable travel, the following measures are proposed during the operational phase: ▪ Promote the greenway once constructed to ensure large usage and modal shift. ▪ Encourage modal shift from high carbon releasing transport modes to cycling, walking and public transport. ▪ Access to these greenways by public transport and provision of bicycle hire on site can further improve their carbon efficiency by reducing trips by car.		
MM.64	EIAR Ch 6	A three to five year programme of invasive plant species control will be required to extend beyond the works period.		