21. Major Accidents, Inter-Relationships, Interactions and Cumulative Impacts

21.1 Introduction

As set out in Chapter 1 of this updated EIAR, this is an update to Chapter 19, Major Accidents, Inter-Relationships, Interactions and Cumulative Impacts, of the 2018 EIAR submitted to An Bord Pleanála in October 2018 as part of the application for approval of the proposed N6 GCRR pursuant to Section 51 of the Roads Act 1993 (as amended) (the "Section 51 Application"). It forms part of the response to the request by ABP for further information in December 2023 where ABP (in addition to a number of other requests) requested GCC to "Update the Environmental Impact Assessment Report". This chapter presents the assessment of the vulnerability of the Project to major accidents and/or disaster, the potential interaction/inter-relationship and cumulative impacts for the Project. The assessment of the vulnerability of the Project to major accidents and/or disasters is detailed in Section 21.2. The methodology for the assessment of interactions/inter-relationships and cumulative effects is in Section 21.3 with the assessment of the potential interactions presented in Section 21.4 and an assessment of the cumulative impacts of the Project with other projects in Section 21.5. Potential transboundary impacts are included in Section 21.7 and this chapter concludes with references (Section 21.8).

21.1.1 Vulnerability of the Project to risks of major accidents and/or disasters

Article 3(2) of the EIA Directive as amended by Directive 2014/52/EU requires that:

"The effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from ***the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned****".*

Furthermore, Annex IV (8) (*Information Referred to in Article 5(1) (Information for the Environmental Impact Assessment Report*) of the EIA Directive as amended by Directive 2014/52/EU states that the EIAR *shall contain:*

"A description of the expected significant adverse effects of the project on the environment deriving from the ***vulnerability of the project to risks of major accidents and/or disasters which are relevant to the project concerned****. Relevant information available and obtained through risk assessments pursuant to Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council*[1] *or Council Directive 2009/71/Euratom*[2] *or relevant assessments carried out pursuant to national legislation may be used for this purpose provided that the requirements of this Directive are met.* ***Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies****."*

The Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the EPA Guidelines) (EPA 2022) state that the potential for a project to cause risks to human health, cultural heritage or the environment due to its vulnerability to external accidents or disasters is to be considered where such risks are significant.

The EPA Guidelines (EPA, 2022) elaborate on risk assessment further under Section 3.7.3:

'To address unforeseen or unplanned effects the Directive further requires that the EIAR takes account of the vulnerability of the project to risk of major accidents and / or disasters relevant to the project concerned and

[1] (*) Directive 2012/18/EU of the European Parliament and the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC (OJ L 197, 24.7.2012, p. 1).

[2] (**) Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations (OJ L 172, 2.7.2009, p. 18)'.

that the EIAR therefore explicitly addresses this issue. The extent to which the effects of major accidents and / or disasters are examined in the EIAR should be guided by an assessment of the likelihood of their occurrence (risk)"

Section 21.2 of this chapter presents an assessment of the vulnerability of the Project to risks of major accidents and/or disasters which are relevant to the Project.

21.1.2 Interactions and Inter-relationships

Article 3 (1) of the EIA Directive as amended by Directive 2014/52/EU requires that:

"The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors: (a) population and human health; (b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC; (c) land, soil, water, air and climate; (d) material assets, cultural heritage and the landscape; ***(e) the interaction between the factors referred to in points (a) to (d)***.

The interaction of effects within the Project in respect of each of the environmental factors, listed in Article 3(1) of the EIA Directive, have been identified and addressed in detail in the respective chapters in this updated EIAR. This chapter, however, presents a summary of each assessment of the interaction (inter-relationship) of impacts, from the Project, between the various environmental factors.

Section 21.4 of this chapter presents an assessment of the interaction/inter-relationship of impacts between the various environmental factors as a result of the Project.

21.1.3 Cumulative Impacts

Annex IV (5)(e) of the EIA Directive as amended by Directive 2014/52/EU requires that the EIAR shall contain:

"A description of the likely significant effects of the project on the environment resulting from, inter alia:

(e) the ***cumulation of effects*** *with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;*

Furthermore, Annex IV (5) states that the EIAR shall contain:

"The description of the likely significant effects on the factors specified in Article 3(1) should cover the direct effects and any indirect, secondary, ***cumulative****, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the project. This description should take into account the environmental protection objectives established at Union or Member State level which are relevant to the project".*

Section 21.5 of this chapter presents an assessment of the cumulative impacts of the Project with other projects.

21.2 Major Accidents and Disasters

21.2.1 Introduction

This section presents an assessment of the likely significant adverse effects of the Project on the environment arising from the vulnerability of the Project to risks of major accidents and/or disasters that are relevant to the Project.

As mentioned previously and in the 2018 EIAR, this assessment is necessary following changes to the EU legislation. Article 3(2) of the EIA Directive as amended by Directive 2014/52/EU states the need to assess "*the effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned."*

As per the 2018 EIAR, the underlying objective of the assessment is to ensure that appropriate precautionary actions are taken for those projects which "*because of their vulnerability to major accidents and/or natural disasters, are likely to have significant adverse effects on the environment"*.

Based on the requirements of the EIA Directive, this chapter, as did the 2018 EIAR, answers the following questions:

- To what major accidents and/or disasters could the Project be vulnerable?
- Could these major accidents and/or disasters result in likely significant adverse environmental effect(s) and if so what would these be?
- What measures are in place, or need to be in place, to prevent or mitigate the likely significant adverse effects of such events on the environment?

This assessment is set out as follows:

- **Section 21.2.2** sets out the methodology used, including the process for identifying and screening major accidents and/or disasters for the Project and the classification and categorisation of the risks identified
- **Section 21.2.3** describes the evaluation of each risk identified and its classification. A description of the locations of the nearest Seveso Sites is also provided in this section
- **Section 21.2.4** describes measures to mitigate the likely significant impacts of such events on the environment
- **Section 21.2.5** describes residual impacts

21.2.1.1 Key definitions relevant to this assessment

At the time of undertaking this assessment, there is still no clear definition of the term "major accident and/or disaster" in the context of the EIA Directive. Achieving a common terminology is a challenge as various disciplines have developed specific terminology for the assessment of risks and impacts. Since the 2018 EIAR, the Institute of Environmental Management and Assessment (IEMA) published Major Accidents and Disasters in EIA; A Primer (IEMA 2020) and the following definitions have been adopted from this guidance for this updated EIAR.

Table 21.1 Key definitions adopted from major Accidents and Disasters in EIA; A primer (IEMA 2020)

Key Term	Definition
Disaster	May be a natural hazard (e.g. earthquake) or a man-made/external hazard (e.g. act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident
Reasonable worst-case scenario	A challenging manifestation of the scenario after highly implausible scenarios are excluded.
Major accident	Events that threaten immediate or delayed serious environmental effects to human health, welfare and/or the environment and require the use of resources beyond those of the client or its appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events
Man-made hazards	For example (but not limited to): structural collapse building collapse human error/management failure design error sabotage/arson aircraft/rail/road/sea or river vessel disaster (crash/derailment/ collision/overloading/hull failure) terrorism cyber-attack industrial/ technological accident explosion (chemical, nuclear or other) pollution (oil, chemical or other) fire conflict displaced population crowd violence and disorder
Natural hazards	For example (but not limited to): earthquake flooding dam collapse volcanic eruption avalanche extreme temperature (heat wave, cold snap) fire ground subsidence tropical storm surge landslide animal/insect infestation sandstorm high winds/storm wildfire tsunami/tidal wave drought biological hazard – epidemic, pandemic

Key Term	Definition
Pathway	The route by which the source can reach the receptor
Receptor	The specific component of the environment that could be adversely affected if the source reaches it. Environmental receptor is specifically defined as: features of the environment that are subject to assessment under Article 3 of the EIA Directive, namely population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape
Risk	The likelihood of an impact occurring, combined with the effect or consequence(s) of the impact on a receptor if it does occur
Risk Event	An identified, unplanned event, which is considered relevant to the development and has the potential to result in a major accident and/or disaster, subject to assessment of its potential to result in a significant adverse effect on an environmental receptor
Significant environmental effect (in relation to a major accidents and/or disasters assessment)	Could include the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration
Source	The original cause of the hazard, which has the potential to cause harm
Source-pathway-receptor linkage	For a risk to arise there must be hazard that consists of a 'source' (e.g. high rainfall); a 'receptor' (e.g. people, property, environment); and a pathway between the source and the receptor (e.g. flood routes)
Vulnerability	Describes the potential for harm as a result of an event, for example due to sensitivity or value of receptors. In the context of the EIA Directive, the term refers to the 'exposure and resilience' of the development to the risk of a major accident and/or disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact

21.2.1.2 Data Sources and Consultations

A desktop study of Chapter 19 of the 2018 EIAR along with the environmental assessments undertaken by each of the specialists who contributed to the preparation of this updated EIAR was completed. As per the 2018 EIAR, each environmental specialist considered routine events (those predicted to happen or which are likely to happen) and non-routine events (which 'might' happen) in their assessment of likely significant effects on the environment and provided mitigation measures to eliminate or reduce the risk to the lowest degree possible. The assessment in this chapter makes reference to these assessments where relevant rather than duplicating them. Therefore, this chapter only considers low likelihood but potentially high consequence events.

The screening process to determine low likelihood but potentially high consequence events associated with major accidents and/or disasters is set out below.

As explained in the 2018 EIAR, key to comprehensively understanding the potential consequences of major accidents and disasters in the context of the Project was gaining an understanding of common region-specific accident and/or disasters events. In particular, it was necessary to identify the factors that result in natural disasters. Therefore, emergency service organisations, local authority personnel, and regional authority personnel responsible for responding to and coordinating the response to the fallout of major accidents and/or disasters, and indeed for the future planning of responses to such incidents were consulted to inform the 2018 EIAR.

The following emergency service providers and local and regional authorities were consulted:

- Galway City Council
- Galway County Council
- Galway County Council Fire Department
- An Garda Síochána Traffic Corps

- An Garda Síochána Operations
- Department of Defence
- Health Service Executive – Emergency Management
- Major Emergency Group West Region

The findings from this consultation was reviewed for this updated EIAR and considered still relevant and accurate. The consultation, as expected, highlighted that weather events are the principal hazards encountered with respect to road operation in the region - be it rainfall, wind, or icy conditions and their potential contribution to natural disasters such as landslides and ground subsidence and major accidents such as vehicular collisions.

In conjunction with local, regional, and emergency organisations, means of enhancing the resilience of the Project to major accident and disaster events were discussed. Such discussions focused on the provision of access to the proposed N6 GCRR, the provision of warning systems to warn users of incidents in advance of hazards, and the management and operation of the proposed N6 GCRR.

In addition to the above consultations, the following external plans and assessments have also informed the assessment for this updated EIAR:

- HSE Emergency Management Area 2 Crisis
- Galway County Council Major Emergency Plan (2021)
- Galway City Major Emergency Plan (2015)
- The following Project specific documents have also informed the assessment for this updated EIAR:
    1. CEMP
    2. Flood Risk Assessment

21.2.2 Methodology

21.2.2.1 Introduction

Since the 2018 EIAR new guidance is available to inform the major accidents and disasters assessment, namely the EPA 2022 guidelines and National Risk Assessment for Ireland 2023- Overview of Strategic. As such the presentation of the assessment undertaken for this updated EIAR differs from that of the 2018 EIAR however the findings are unchanged.

The starting point for the scope and the methodology of this assessment is that the Project is designed and will be built and operated in accordance with best practice. Ensuring that the Project is designed safely and will thus operate safely has been to the forefront of the design process. Additionally, at the forefront of the design process was the need to ensure that the Project is capable of being constructed safely and without risk to health, can be maintained safely, and complies with all relevant health and safety legislation.

This approach has allowed all identified risks to be managed such that, where possible, the hazards that result in risks are mitigated (manage hazard source, manage pathway between source and receptor, manage receptor) or eliminated (eliminate source, remove pathway between source and receptor, remove receptor).

The methodology for assessing the vulnerability is a risk analysis-based approach. It covers the identification of potential hazards associated with major accidents and/or disasters, their likelihood, and the potential resulting consequences thereof. The assessment has focused on three main areas:

- Consideration of the vulnerability (exposure and resilience) of the Project to risks of major accidents/and or disasters
- Identification of the types of major accidents and/or disasters that are relevant to the Project and the likelihood of their occurrence

- Description of the expected significant adverse effects of the Project on the environment (environmental factors) arising from the vulnerability of the Project to risks of major accidents and/or disasters

Eliminating, isolating and mitigating identified risks was undertaken during the design and environmental evaluation process for the Project. Design and mitigation measures identified and included to reduce or avoid risks of major accidents and/or disasters are considered to be part of the design, as they reduce the likelihood and consequence of risk events, for the purposes of this assessment. Such measures are detailed below in this chapter in Section 21.2.4.

21.2.2.2 Legislation and Guidelines

The methodology for assessing the vulnerability has been informed by the following legislation and guidelines:

- S.I. No. 299/2007 - Safety, Health and Welfare at Work (General Application) Regulations 2007 as amended (hereafter referred to as the Safety, Health and Welfare at Work (General Application) Regulations)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports – May 2022 (EPA 2022)
- Environmental Impact Assessment of Projects – Guidance on the Preparation of the Environmental Impact Assessment Report (European Commission 2022)
- IEMA Primer (IEMA 2020)
- National Risk Assessment for Ireland 2023- Overview of Strategic Risks (Government of Ireland 2023)
- Guidance on Assessing and Costing Environmental Liabilities (EPA 2014)
- A Framework for Major Emergency Management. Guidance Document 10 (DECLG 2015)
- The Department of Environment, Heritage and Local Government (DEHLG) A Framework for Major Emergency Management. A Guide to Risk Assessment in Major Emergency Management (Department of Environment, Heritage and Local Government (DEHLG 2010)
- Directive 2012/18/EU (control of major-accident hazards involving dangerous substances)

21.2.2.3 Risk Assessment Methodology

The potential for hazards associated with major accidents and/or disasters to result in a significant adverse environmental effect was assessed. The approach adopted considers hazards that may produce environmental consequences, the likelihood of these consequences occurring, considering planned mitigation, and the acceptability of the subsequent risk to the receiving environment. Similar to the 2018 EIAR, the process included:

- Identification and screening of risks / hazards
- Risk classification
- Evaluation of risks

Identification and Screening of Risks / Hazards

Similar to the 2018 EIAR, the assessment of identifying risks was undertaken at a Project-wide level but, where relevant, reflects locations that were considered more vulnerable to risks associated with identified potential major accidents and/or disasters.

The initial stage of the assessment identified potential unplanned risks that the Project may be vulnerable to. An initial list of relevant risks that had the potential to lead to major accidents or disasters was prepared subjected to an initial screening assessment to identify those that met the scoping criteria. Risks were screened out of the assessment according to the following scoping criteria:

- Only risks with a feasible source-pathway-receptor model were considered as part of the appraisal

- Risk events in relation to users of the Project (members of the public, bus users, cyclists, pedestrians) during the Operational Phase, as the scope of this assessment for the Operational Phase relates to the provision of infrastructure only and not to the use of that infrastructure
- Risk events that possess low likelihood/low consequence, as they do not meet the criteria to be brought forward for further consideration (i.e. they do not meet the definition of a major accident and/or disaster), for example the risk of traffic accidents on the wider road network causing delays to Construction or Operational Phase vehicles
- Risk events that possess high likelihood/high consequence, as these would be considered high risk and unacceptable for the development of the Project
- Risk events in relation to existing emergency access arrangements and response plans for facilities along the route of the Project. Emergency accesses along the route of the Project will be retained insofar as is possible throughout the Construction Phase. Where construction works for the Project will interface with emergency access arrangements, the appointed contractor will consult with the affected landowners/site operators and the emergency services to agree, where required, alternative emergency access arrangements and changes to response plans for the duration of the works
- Tunnels proposed as part of the Project are classified as Category C in accordance with *European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).* This limits access to the Project to materials of Class C and lesser thus limiting the unrestricted carriage of classes of dangerous goods
- In terms of the assessment methodology, the following approach has been adopted:
- No additional risk modelling was undertaken for this assessment. Instead, the risk modelling and the analysis completed as part of the design and environmental evaluation of the Project were utilised
- The assessment was completed via a review of available documentation and legal and regulatory requirements
- Where information was not available, reference and regard was had to existing empirical information. For example, regard was had to empirical information regarding collision rates associated with single carriageway and motorway projects. Such information was then utilised to determine safety benefits consequent to the development of the Project

Risk Classification

Following the initial identification and screening process, the remaining risks with potential to lead to major accidents or disasters were evaluated to the likelihood of occurrence and potential impact. The rating criteria followed was adopted from *A Guide to Risk Assessment in Major Emergency Management* guidelines (DEHLG 2010). In accordance with the EPA guidelines (2022), a worst case scenario approach was taken in the classification of potential risks. The rating assumes that proposed mitigation measures and safety procedures have failed to prevent the occurrence of a major accident or disaster.

Table 21.2 classification of Likelihood *(refer Table 2: A Guide to Risk assessment in major Emergency Management)*

Rating	Classification	Impact
1	Extremely Unlikely	May occur only in exceptional circumstances; once every 500 or more years
2	Very Unlikely	Is not expected to occur; no recorded incidents or anecdotal evidence; and/or very few incidents in associated organisations, facilities or communicates; and/or little opportunity, reason or means to occur. May occur once every 100 to 500 years
3	Unlikely	May occur at some time; and/or few, infrequent, random recorded incidents or little anecdotal evidence; some incidents in associated or comparable organisations worldwide; some opportunity, reason or means to occur. May occur once every 10 to 100 years

Rating	Classification	Impact
4	Likely	Likely to or may occur; regular recorded incidents and strong anecdotal evidence. Will probably occur once every one year to 10 years
5	Very Likely	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year

Table 21.3 Classification of Consequence *(refer Table 3: A Guide to Risk Assessment in major Emergency Management)*

Ranking	Classification	Impact	Description
1	Minor	Life, Health. Welfare	Small number of people affected; no fatalities and small number of minor injuries with first aid treatment.
		Environment	No contamination, localised effects
		Infrastructure	<0.5 million
		Social	Minor localised disruption to community services or infrastructure (<6 hours)
2	Limited	Life, Health. Welfare,	Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements
		Environment	Simple contamination, localised effects of short duration
		Infrastructure	0.5-3M Euros
		Social	Normal community functioning with some inconvenience
3	Serious	Life, Health. Welfare,	Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6-24 hours or possibly beyond; up to 500 evacuated. External resources required for personal support.
		Environment	Simple contamination, widespread effects or extended duration
		Infrastructure	3-10M Euros
		Social	Community only partially functioning, some services available.
4	Very serious	Life, Health. Welfare,	5 to 50 fatalities, up to 100 serious injuries, up to 2000 evacuated
		Environment	Heavy contamination, localised effects or extended duration
		Infrastructure	10-25M Euros
		Social	Community functioning poorly, minimal services available
5	Catastrophic	Life, Health. Welfare,	Large numbers of people impacted with significant numbers of fatalities (>50), injuries in the hundreds, more than 2000 evacuated.
		Environment	Very heavy contamination, widespread effects of extended duration.
		Infrastructure	>25M Euros

Ranking	Classification	Impact	Description
		Social	Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support

Risk Categorisations

In accordance with A Guide to Risk Assessment in Major Emergency Management (DEHLG 2010), major accidents and/or disasters events were compared to a risk matrix to determine the level of significance for each event. These have ben grouped according to three categories:

- High Risk – Events that have an evaluation score of 15 to 25, as indicated by the Red Zones in Table 21.4
- Medium Risk – Events that have an evaluation score of 8 to 12 as indicated by the Amber Zones in Table 21.4
- Low Risk - Events that have an evaluation score of 1 to 6 as indicated by the Green Zones in Table 21.4

Table 21.4 Levels of Significance

Likelihood						
	5 – Very Likely					
	4 – Likely					
	3 – Unlikely					
	2 – Very Unlikely					
	1 – Extremely Unlikely					
		1 – Minor	2 – Limited	3 – Serious	4 – Very Serious	5 - Catastrophic
Consequences of Impact						
Significance is defined as Low (Green), Medium (Amber) and High (Red)						

21.2.3 Potential Risks / Hazards

21.2.3.1 Evaluation of Risk / Hazard

As detailed above, the predicted impacts assume the worst case scenario, which does not consider the implementation of mitigation measures or emergency plans which would be put in place to reduce the likelihood of and potential impact of any major accidents and/or disasters.

Table 21.5 Environmental Risk Record

Risk ID	Event	Project Element	Likelihood	Rating	Consequence	Ranking	Resulting Risk Category
Operational Phase							
1	Structural collapse (bridge collapse, tunnel collapse)	Throughout (Especially at River Corrib Bridge, Lackage Tunnel, Menlough Viaduct and Galway Racecourse Tunnel)	Extremely Unlikely	1	Very Serious Potential loss of life and serious injuries Potential damage to surrounding environment including impacts on sensitive habitats	4	Low
2	Ground Collapse – (Excavation of material)	Throughout	Unlikely	3	Serious Potential loss of life and serious injuries	3	Medium
3	Utility Events – Risk of gas explosion due to striking a gas mains or release of trapped gas under pavements that have accumulated due to local gas leaks	Throughout	Unlikely	3	Serious Potential loss of life and serious injuries Potential damage to surrounding environment including impacts on sensitive habitats	3	Medium
4	Utility Events – Risk of exposure to or release of contaminated mains sewers and combined sewers during excavation	Throughout	Unlikely	3	Limited Potential injury Potential disruption of services to residents and businesses Potential release of contaminated material into the environment	2	Low
5	Utilities – Risk of damage to high and medium voltage power lines	Throughout	Unlikely	3	Serious Potential fatalities and injury Potential disruption of services to residents and businesses	3	Medium

Risk ID	Event	Project Element	Likelihood	Rating	Consequence	Ranking	Resulting Risk Category
6	Contamination Event – risk of encountering contaminated material during excavation.	Throughout	Unlikely	3	Limited Potential exposure of personnel to hazardous material Potential release of contaminated material into the environment	2	Low
7	Transport Incident – Major traffic accident involving construction vehicles and public traffic	Throughout	Likely	4	Limited Potential fatalities and injury Potential disruption of services to residents and businesses	2	Medium
8	Bio -Security – event leading to the spread of invasive species during construction works	Throughout (Especially at areas upstream of sensitive habitat and in proximity to Lough Corrib SAC)	Likely	4	Limited Potential release of invasive species into the environment	3	Medium
9	Industrial Incident – Explosion or fire occurring in adjacent properties during construction works	Throughout	Unlikely	2	Very Serious Potential fatalities and injury	4	Medium
Operational Phase							
10	Structural collapse (bridge collapse, tunnel collapse)	Throughout (Especially at River Corrib Bridge, Lackage Tunnel, , Menlough Viaduct and Galway Racecourse Tunnel)	Very Unlikely	2	Serious Potential fatalities and injury Potential disruption of services to residents and businesses Potential release of contaminated material into the environment Potential damage to surrounding environment including impacts on sensitive habitats	3	Low

Risk ID	Event	Project Element	Likelihood	Rating	Consequence	Ranking	Resulting Risk Category
11	Industrial Incident – Explosion or fire occurring in adjacent properties during operation	Throughout	Very Unlikely	2	Serious Potential fatalities and injury Potential disruption of services to residents and businesses Potential release of contaminated material into the environment	3	Low
12	Extreme weather event – Risk of extreme weather events such as prolonged flooding resulting in sediment load runoff and storm damage	Throughout	Very Unlikely	2	Limited Potential for localised damage to infrastructure Potential disruption of services to residents and businesses	2	Low

Table 21.6 Evaluation of Levels of Significance in the Absence of Mitigation

Likelihood						
	5 – Very Likely					
	4 – Likely		[7], [9]	[8]		
	3 – Unlikely		[4], [6], [11], [12]	[2], [3], [5]		
	2 – Very Unlikely		[13]	[10]		
	1 – Extremely Unlikely				[1]	
		1 – Minor	**2 – Limited**	**3 – Serious**	**4 – Very Serious**	**5 - Catastrophic**
Consequences of Impact						
Significance is defined as Low (Green), Medium (Amber) and High (Red).						

Note: Numbers in [x] are the Risk ID number in Table 21.5 above

From examining the plausible risks presented in Table 21.5, Risk ID's 2, 3, 5, 7, 8, and 9 are considered to be above the threshold of significance set for the assessments. These events all rated between 8-12 points, resulting in the Medium Risk Zone and will be brought forward for further consideration and assessment of mitigation measures in Table 21.8.

No events are within the High-Risk Zone. The remaining events are within the Low-Risk Zone and therefore do not require further consideration.

21.2.3.2 Seveso Sites

A review of the location of Upper and Lower Tier Seveso sites and their proximity to the Project was undertaken and presented below. As per the 2018 EIAR, the Project does not fall within the consultation distance for any sites.

Table 21.7 Seveso Sites

Name	Location	Seveso Tier	Distance from Assessment Boundary
Colas Bitumen Emulsion (West) Ltd.	Oranmore, Co. Galway	Upper Tier	3.1km
Circle K Galway Terminal	Galway Harbour Enterprise Park, New Docks, Galway	Upper Tier	3.5km

The closest lower tier Seveso site is located at Tynagh Energy Ltd., Loughrea, Co. Galway which is in excess of 15km from the Assessment Boundary.

21.2.4 Mitigation Measures

Following the assessment of the Project, under the heading of vulnerability to major accidents and/or disasters, it is concluded that no further mitigation measures beyond those already incorporated and described below and elsewhere in this updated EIAR are required.

21.2.4.1 Inherent Design

The design of the Project has developed in compliance with the relevant design standards which include the provisions to reduce risk and likelihood of risk events occurring. The design has progressed through an iterative process ensuring that the Project has been designed and developed to reduce the risk of major accidents/or disasters and reduce the vulnerability of the Project.

21.2.4.2 Plans and Procedures

The plans and procedures outlined within this section have been developed to effectively manage and minimise risk by ensuring that every reasonable effort will be made to ensure that the environmental impacts during construction will be mitigated or reduced where possible.

Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) has been developed, Appendix A.7.5 which details the proposed mitigation measures to be implemented throughout the construction phase of the Project.

The CEMP will be updated by the appointed Contractor to set how environmental protection will be achieved during the Construction Phase of the Project.

The CEMP summarises the overall environmental management strategy that could be adopted and implemented during the Construction Phase of the Project and must be read in conjunction with the construction details outlined in Chapter 7 of this updated EIAR.

Construction and Demolition Resource and Waste Management

Construction and Demolition Resource and Waste Management is addressed in the CEMP to demonstrate how waste arising during the Construction Phase (including) demolition works of the Project will be managed and disposed of in a way that ensures compliance with the provisions of Number 10 of 1996 – Waste Management Act, 1996, as amended. The Construction and Demolition Resource and Waste Management Plan will be developed by the appointed contractor.

Construction Traffic Management Plan

Construction Traffic Management is addressed in the CEMP to demonstrate how the interface between public and construction related traffic could be managed, where practicable, and to control vehicular movements associated with the construction of the Project. The Construction Traffic Management Plan will be updated and implemented by the appointed contractor so that construction traffic will be managed and monitored safely and efficiently throughout the duration of the Construction Phase.

Non-Native Invasive Species Management

Non-Native Invasive Species Management is addressed in the CEMP to provide the strategy that will be adopted during the construction of the Project in order to manage and prevent the spread of non-native invasive plant species. The Non-Native Invasive Species Management Plan will be updated and implemented by the appointed contractor using a suitably qualified ecologist, as necessary.

Sediment, Erosion, Pollution Control Plan

Surface and groundwater protection measures are addressed in the CEMP, summarising the procedures and technical practices for implementing effective sediment, erosion and pollution control that will be adopted during the Construction Phase of the Project. The Sediment, Erosion, Pollution Control Plan will be updated and implemented by the appointed contractor.

Environmental Incident Response Plan

The environmental incident response plan forms part of the CEMP, it summarises the procedures and practices required in the event of an environmental incident occurring during the Construction Phase of the Project. The environmental incident response plan will be updated and implemented by the appointed contractor.

Pest Control Plan

The pest control plan will form part of the CEMP, it outlines the strategy and procedures to avoid and prevent pests on site during the construction of the Project. The Pest Control plan will be updated and implemented by the appointed contractor.

The risks which were assigned in the Medium Risk Zone is brought forward for assessment of mitigation measures in Table 21.8.

Table 21.8 Major Accidents and/or Disasters - Assessment of Mitigation Measures

Risk ID	Event	Pre-Mitigation Risk Score	Mitigation Measures	Post-Mitigation Likelihood	Post-Mitigation Consequence of impacts	Post-Mitigation Risk Score
2	Ground Collapse – (Excavation of material)	Medium	Refer to Appendix A.7.5 CEMP for details on mitigation and monitoring measures proposed during the construction period.	Very Unlikely	Limited	Low
3	Utility Events – Risk of gas explosion due to striking a gas mains or release of trapped gas under pavements that have accumulated due to local gas leaks	Medium	Refer to Appendix A.7.5 CEMP for details on mitigation and monitoring measures proposed during the construction period.	Very Unlikely	Limited	Low
5	Utilities – Risk of damage to high and medium voltage power lines	Medium	Refer to Appendix A.7.5 CEMP for details on mitigation and monitoring measures proposed during the construction period.	Very Unlikely	Limited	Low
7	Transport Incident – Major traffic accident involving construction vehicles and public traffic	Medium	Refer to Appendix A.7.5 CEMP for details on mitigation and monitoring measures proposed during the construction period.	Very Unlikely	Serious	Low
8	Bio -Security – event leading to the spread of invasive species during construction works	Medium	Refer to Appendix A.7.5 CEMP for details on mitigation and monitoring measures proposed during the construction period.	Unlikely	Limited	Low
9	Industrial Incident – Explosion or fire occurring in adjacent properties during construction works	Medium	Refer to Appendix A.7.5 CEMP for details on mitigation and monitoring measures proposed during the construction period.	Unlikely	Limited	Low

Table 21.9 Evaluation of Levels of Significance Post-Mitigation

Likelihood						
	5 – Very Likely					
	4 – Likely					
	3 – Unlikely		[8], [9]			
	2 – Very Unlikely		[2], [3], [4]	[7]		
	1 – Extremely Unlikely					
		1 – Minor	2 – Limited	3 – Serious	4 – Very Serious	5 - Catastrophic

Note: Numbers in [x] are the Risk ID number in Table 21.5 above

21.2.5 Residual Impacts

The potential for a high consequence major accident and/or disaster event remains as extremely unlikely. These events have been considered throughout the design process and measures have been included in the design to reduce the severity and potential consequences of such events.

Following the implementation of mitigation, monitoring and inherent design there are no significant residual impacts.

21.3 Methodology used to assess Interactions and Cumulative Effects

21.3.1 Guidance

As described previously in Section 21.1, the requirement to address interactions of effects and cumulative effects is set out in the EIA Directive as amended by Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment and in the Roads Act 1993, as amended.

This chapter has been prepared in accordance with the following guidance:

- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment. Department of Housing, Planning and Local Government (DoHPLG), (2018)
- European Commission (2017) Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report. (Office for Official Publications of the European Communities 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EIAR). EPA, (2022)
- European Commission (1999) Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, (Office for Official Publications of the European Communities 1999)

21.3.2 Assessment Methodology

At the initial stage of preparing the 2018 EIAR the potential for significant interactions of effects and cumulative effects were examined and any potential effects were identified. These potential effects were considered in the impact assessment studies for each of the relevant environmental factors and were also addressed in the design of the Project. The assessments for this updated EIAR were also reviewed for the potential for significant interactions of effects and cumulative effects and any potential effects were identified.

During the preparation of the 2018 EIAR, there were numerous discussions and communications including workshops and meetings between the environmental specialists and the design team throughout the design process which helped to identify and minimise the potential for significant interactions of impacts and cumulative impacts arising in the first instance. This continuous engagement between the environmental specialists and the design team continued to inform the Project for this updated EIAR.

The interaction of effects within the design of the Project and the mitigation measures relative to those interactions in respect of each of the environmental factors have been identified and addressed in detail in the respective chapters dealing with each environmental factor in this updated EIAR. This chapter presents a summary of each assessment of the interaction (inter-relationship) of potential impacts (from the Project) between the various environmental factors and summarises the mitigation measures relative to those interactions. The matrix and expert opinion approaches, as outlined in the EU Guidelines (1999) and EPA Guidelines (2022), were used in the identification of the potential for significant interactions of impacts. Refer to Table 21.10 for the matrix of potential interactions.

Similarly, cumulative impacts arising from the interaction between the Project and other planned and/or committed projects at an individual level (pairwise) in respect of each of the individual environmental factors have been identified and addressed in detail in the respective chapters dealing with each environmental factor in this updated EIAR. Appendix A.21.1 to this chapter, presents these cumulative assessments with the other planned and/or committed projects and considers the cumulative effect of the entirety of the Project with the other planned and/or committed projects at an individual level considering all environmental factors. A summary of the findings of Appendix A.21.1 is presented in Sections 21.6.1 to 21.6.13. In addition to this pairwise cumulative impact assessment a cumulative assessment of all of the other planned and/or committed projects as identified with the Project is presented in Section 21.6.14.

21.4 Interaction of Effects

21.4.1 Matrix of Effects

All environmental factors are inter-related to some extent, and the relationships can range from tenuous to inextricable. The interactions between the identified environmental effects have already been considered and assessed within the individual chapters of this updated EIAR. Measures to minimise effects have been incorporated into the design of the Project and are also included in all the assessments and the residual effects have been assessed.

For example, where it has been established in Chapter 11, Hydrology that there will be an increase in suspended solids or pollutants during construction arising from earthworks, then Chapter 8, Biodiversity has assessed the effect of that on aquatic flora and fauna. Measures to minimise impacts of suspended solids or pollutants have been designed with consideration to those interactions and have been incorporated into both the hydrology and biodiversity chapters and the residual impacts on both hydrology and biodiversity have been assessed. Similarly, where Chapter 16, Air Quality and Chapter 18, Noise and Vibration have established that there will be air and noise emissions during both the construction and operational phases, Chapter 19, Population and Human Health has assessed the effect of those emissions on human health and Chapter 8, Biodiversity has assessed the effects of those emissions on sensitive flora and fauna. Measures to minimise the air and noise emission impacts have been designed with consideration to those interactions and have been included in the assessments and the residual impacts have been identified.

Table 21.10 presents the potential interactions between the environmental factors in a matrix format. It examines the potential for the environmental factor or issue in the left-hand column to have an impact on the environmental factor listed in the top row of the matrix as a result of the Project. The paragraphs following Table 21.10 present an assessment of the potential interactions of effects, mitigation measures and residual effects. This assessment is based on information contained within this updated EIAR and the outcome of discussions and interactions between the environmental specialists and the design team.

If there is the potential for an effect during construction, this is indicated by a ‘C’. An ‘O’ indicates the potential for an effect during operational and ‘CO’ indicates the potential for an effect during both construction and operation. If it is considered that there will be no potential for an effect, this is indicated by ‘none’.

For example, the construction of the proposed Project will require construction traffic movements (left hand column) which could potentially generate negative impacts (“C”) on a number of environmental factors (top row of table) such as air quality, climate, noise and vibration, biodiversity, population and human health, material assets (both agriculture and non-agriculture) and the risk of major accidents and/or natural disasters. These environmental factors could then in turn result in (secondary/indirect) impacts on other environmental factors. For example, excavation activities will generate material (direct impact on soil and rock resource)

some of which will require transportation (secondary impact on construction traffic) and disposal (secondary impact on resource capacity offsite). Air emissions (secondary impact) arising from this construction traffic could subsequently impact on population and human health. All of these interactions and secondary/indirect impacts have been considered in each of the respective chapters of this updated EIAR.

Table 21.10 Potential Interaction of Effects Matrix (C = Construction, O = Operational, None = No Potential Impact)

Interaction	Traffic	Biodiversity	Soils & Geology	Hydrogeology	Hydrology	Landscape & Visual	Cultural Heritage	Material Assets Agriculture	Material Assets Non-Agriculture	Air Quality	Climate	Noise & Vibration	Population & Human Health	Resource and Waste	Major Accidents and or disasters
Traffic			C	CO	CO	CO	None	CO	CO	CO	CO	CO	CO	CO	CO
Biodiversity	None		None	CO	CO	CO	None	CO	None	CO	CO	None	CO	None	None
Soils and Geology	C	CO		C	C	C	C	C	C	C	C	C	C	C	None
Hydrogeology	C	C	C		C	C	C	CO	CO	None	None	None	CO	None	None
Hydrology	C	CO	CO	CO		CO	CO	CO	CO	None	None	None	CO	CO	None
Landscape & Visual	CO	CO	None	CO	None		CO	CO	CO	O	O	None	CO	None	None
Cultural Heritage	None	C	None	None	None	CO		C	CO	None	None	None	CO	C	None
Material Assets Agriculture	CO	CO	None	None	C	CO	None		None	C	C	None	None	C	None
Material Assets Non-Agriculture	CO	None	None	None	None	CO	CO	None		O	O	None	None	C	None
Air Quality	None	CO	None	None	None	None	None	None	None		CO	None	CO	C	None
Climate	None	CO	None	CO	CO	None	None	None	None	CO		None	CO	CO	None
Noise & Vibration	None	CO	C	C	None	CO	CO	CO	CO	None	None		CO	None	None
Population & Human Health	CO	None	None	None	None	None	None	None	None	None	O	None		None	None
Resource and Waste	None	CO	CO	CO	CO	CO	None	None	None	CO	CO	None	CO		None
Major Accidents and/or Disasters	CO	CO	C	C	CO	C	CO	CO	CO	O	CO	CO	CO	None	

21.4.2 Potential Interactions

All the potential effects arising from the potential interactions were identified at a very early stage in the design process and in the preparation of the 2018 EIAR, which were then updated and reviewed for this updated EIAR. They were therefore addressed in the design of the Project and considered in the impact assessment studies. As a result, the potential effects were either avoided altogether through design measures or they were addressed through specific mitigation measures. This early identification process helped to identify and minimise the potential for significant interactions of effects arising. The potential effects and mitigation measures are discussed further below.

21.4.2.1 Overview of Traffic Interactions

Construction Phase

The construction of the Project will require construction traffic movements which could potentially generate negative impacts on a number of environmental factors such as air quality and climate, noise and vibration, biodiversity, hydrology, population and human health, landscape and visual impact, material assets (both agriculture and non-agriculture) and the risk of major accidents and/or disasters.

The level of construction traffic generation is dependent on the types, intensity and duration of construction activities taking place. For example, if there are significant volumes of excavated material or demolition materials which require disposal offsite or if significant materials are required to be imported on site, these activities have the potential to generate significant construction traffic volumes.

The generation of construction traffic will also result in road diversions and general short-term disruption for people and properties in the area which could potentially negatively impact on material assets. In addition, construction traffic has the potential to negatively impact on biodiversity arising from severance, disturbance and mortality. Finally, there is a potential interaction between construction traffic and the risk of major accidents and/or natural disasters arising from the risk of a major traffic accident occurring during the construction phase.

Operational Phase

Operational traffic and the physical presence of the Project could potentially generate negative impacts on the same environmental factors identified for the construction phase above.

The predicted operational traffic volumes and flows for the Project have been assessed throughout this updated EIAR and there are predicted interactions.

21.4.2.2 Interaction between Traffic and Air Quality

Construction Phase

An air quality assessment of construction traffic impacts was carried out and the results show that all of the predicted concentrations are in compliance with the air quality standards (Chapter 16, Air Quality). Therefore, significant residual impacts from construction traffic on air quality and subsequently population and human health will not arise.

The overall conclusion of the air quality assessment is that with the implementation of such mitigation measures as recommended within this updated EIAR, that there is no significant residual impacts on air quality during the construction phase.

Operational Phase

An air quality assessment during the operational phase of the Project was carried out and the results show that all of the predicted concentrations are in compliance with the air quality standards (Refer to Table 16.20 of Chapter 16, Air Quality).

Therefore, significant residual impacts from traffic on air quality and subsequently on population and human health will not arise.

21.4.2.3 Interaction between Traffic and Climate

Construction Phase

Chapter 17, Climate assesses the potential impacts of the construction materials, construction traffic and activities on greenhouse gas emissions for the Project. Measures are proposed during the construction phase which will have the effect of reducing the generation of embodied carbon, and the greenhouse gas impacts are partially mitigated. Material choice matters, especially in the primary generators of greenhouse gasses such as concrete, steel and pavement, such that specific commitments are made in respect of the concrete composition and level of recycled steel used. Construction traffic and associated emissions are minimised as much as possible with maximum reuse of materials on site, thus reducing unnecessary construction traffic importing construction materials. These measures to reduce construction traffic affect the overall Project emissions which are considered in the climate assessment.

The overall conclusion of the climate assessment is that with the implementation of such mitigation measures as described in Chapter 17, Climate, of this updated EIAR, that there a moderate adverse impact on climate is predicted during the construction phase.

Operational Phase

The climate assessment (Chapter 17, Climate) considers a life cycle assessment of the Project over a 60 year period in accordance with TII standards. As the population is expected to continue to increase, with Galway to grow by 50% in a compact urban form as per NPF, traffic numbers will continue to increase, albeit that it is HGVs to service this population increase that increases more significantly than private car trips due to the forecasted compact growth which is more compatible with active travel and public transport. Increased traffic gives an increase in emissions which is assessed in the climate assessment. It is predicted that there will be a moderate adverse impact on climate throughout the life of the Project as no Project level mitigation measures are proposed (only design-led mitigation).

However, this effect is likely to reduce over time due to the implementation of measures subscribed by the EU Commission and CAP 24, which penalise travel by private car whilst supporting measures which enable and facilitate active travel and public transport and also promote the advancement of non-fossil fuels.

21.4.2.4 Interaction between Traffic and Noise and Vibration

Construction Phase

Construction traffic will generate noise emissions and there is a potential for noise impacts from construction traffic along public roads. A noise and vibration assessment of potential impacts due to construction traffic has been completed and detailed in Chapter 18, Noise and Vibration.

These impacts will be short-term to temporary and the use of best practice noise control measures, hours of operation, scheduling of works within appropriate time periods, will ensure impacts are controlled as far as practicable during the construction phase along public roads. Therefore, significant residual impacts from construction traffic on noise and subsequently population and human health will not arise.

Vibration impacts relating to construction traffic will be limited given the low generation of vibration from vehicles along well-maintained roads. Therefore, significant residual impacts from construction traffic on vibration and subsequently on population and human health will not arise.

Operational Phase

Traffic during the operational phase of the Project will generate new noise emissions. Noise levels will be increased at the majority of noise sensitive locations along the length of the Project.

The noise and vibration assessment (Chapter 18, Noise and Vibration) has taken into consideration the predicated impacts of operational traffic in regard to noise and vibration.

Overall, noise levels will be increased at properties along the route of the Project once operational and a change in the noise environment will occur. The Project, however, has been designed to reduce operational noise levels to within national design guidelines through the incorporation of detailed noise mitigation measures. The number of properties along the route of the Project is relatively low compared to those within

the city centre which are currently exposed to significantly higher noise levels from passing road traffic. The reduction in high volumes of traffic traversing the city centre will result in a moderate to major positive noise impact to an extensive number of noise sensitive properties along the existing road network.

Therefore, significant residual impacts from operational traffic on noise and subsequently population and human health will not arise.

21.4.2.5 Interaction between Traffic and Biodiversity

Construction Phase

The generation of traffic during the construction phase has the potential to negatively impact on biodiversity resulting in temporary severance or disturbance issues. Construction traffic and other construction activities such as watercourse crossings can present as a temporary barrier and/or hazard to mobile species such as otter, bats, badger, and fish potentially resulting in temporary severance and/or mortality. Furthermore, the physical presence of construction traffic can result in temporary disturbance to these species. Mitigation measures have been incorporated into Chapter 8, Biodiversity to address these potential impacts. These include measures such as exclusion zones around badger setts, construction measures for working along watercourses and strict controls on temporary crossing points over watercourses and temporary crossing points for bats. As a result of the implementation of such mitigation measures, significant residual impacts on biodiversity due to construction traffic will not arise.

For consistency with the approach taken by An Bord Pleanála to assess European sites, the potential for construction traffic impacts to arise on the wider road network (specifically along the R458, N67, and M18), have been considered with respect to designated areas for nature conservation.

Operational Phase

The generation of traffic and the physical presence of the Project during the operational phase has the potential to negatively impact on biodiversity resulting in severance, disturbance and mortality issues. Mobile species such as bats, barn owls and other birds could potentially collide with traffic or structures resulting in mortality. The flight paths of bats could also potentially be severed due to the physical presence of the Project. Furthermore, the introduction of lighting in otherwise unlit areas could potentially negatively impact bat activity.

As discussed previously, these types of impact interactions were identified at a very early stage in the design and environmental assessment process. As a result, the potential impacts were either avoided altogether through design measures or they were addressed through specific mitigation measures in the relevant chapters of this updated EIAR. For example, the choice of the design of the River Corrib Bridge included an objective to minimise potential ecological impacts on birds due to collision risks and bats. Mammal underpasses and the Castlegar Wildlife Overpass were all designed with an objective to minimise the barrier effect for bats. Landscape planting has specifically been designed to minimise barn owl and bat mortality arising from collisions with traffic. Further mitigation measures have also been incorporated into Chapter 8, Biodiversity to further address these potential impacts. As a result of the implementation of design measures and other mitigation measures, significant residual impacts on biodiversity due to operational traffic and the physical presence of the Project will only arise in relation to the Peregrine falcon. The presence of the Project has the potential to permanently displace nesting Peregrine falcon from the nest site at Lackagh Quarry Refer to Chapter 8, Biodiversity for further details.

For consistency with the approach taken by An Bord Pleanála to assess European sites, the potential for increased recreational pressure associated with the operation of the Project (and the subsequent possible associated risk of a potential increase in recreational pressure on QIs and SCIs as a result of increased visitor numbers), has been considered with respect to designated areas for nature conservation.

21.4.2.6 Interaction between Traffic, Soils and Geology, Hydrology and Resources and Waste management

Construction Phase

During the construction phase, there is the potential for interaction between Soils and Geology, Hydrology, Resources and Waste management and construction traffic. If excavated materials or demolition materials require disposal offsite or if construction materials are required to be imported, these activities have the potential to generate construction traffic volumes. For example, excavation activities will generate material (direct impact on soil and rock resource) some of which will require transportation (secondary impact on construction traffic) and disposal (secondary impact on resource capacity offsite). Construction traffic may also produce sediment runoff through potential spillage of saturated silts and peat slurry during the haulage of materials. This has the potential to impact on water quality. The interaction of water quality with population and human health and biodiversity is discussed further below.

During the design process, every effort was made to balance the import and export volumes of materials thereby minimising construction traffic generation in the first instance. In addition, the Construction and Demolition Resource Waste Management Plan (as presented in the CEMP in Appendix A.7.5) has been prepared to ensure that waste arising during the construction and demolition phase will be managed and disposed of in a way that ensures compliance with the provisions of the Waste Management Acts 1996-2024 and associated Regulations (1996-2024) to ensure that optimum levels of reduction, re-use and recycling are achieved. Furthermore, the Construction Traffic Management (CTMP) (as presented in the CEMP in Appendix A.7.5) has been prepared to ensure that construction traffic will be managed and monitored safely and efficiently throughout the construction phase. As a result of the implementation of mitigation measures such as the CEMP and the design measures, significant residual impacts from material imports and exports on construction traffic will not arise.

This interaction has been assessed in Chapter 6 Traffic, Chapter 9 Soil and Geology, Chapter 14 Hydrology and Chapter 20, Resources and Waste Management.

Operational Phase

Likewise, during the operational phase of the Project, traffic volumes using the proposed N6 GCRR could interact with the hydrology of the area should an accidental spill occur or a blockage occur in the road run-off treatment systems. Wear and tear will occur due to traffic usage over the lifetime of the Project, and renewal of the Project will generate waste materials. These interactions are all controlled through best practice measures as set out in the CEMP, and significant residual impacts from operational traffic will not arise.

21.4.2.7 Interaction of Traffic with Material Assets

Construction Phase

The generation of construction traffic will result in road diversions and general short-term disruption for properties in the area which could potentially negatively impact on residential, commercial and agricultural areas.

There are two locations where temporary road diversions will be in place in order to construct bridge structures at Ch. 3+300 Aille Road L5384 and Ch. 13+150 School Road, Castlegar L2134 of the proposed N6 GCRR. Temporary night-time closure of existing roads may be required where overbridges are to be constructed at locations such as the Rahoon Road, Letteragh Road, N59 Moycullen Road, Menlo Castle Bóithrín, Bóthar Nua, An Seanbóthar, N84 Headford Road, N83 Tuam Road, Briarhill Business Park Road and R339 Monivea Road. The north end of the Anne Gibbons Road will also be permanently closed with property access to the south maintained.

As detailed in the CEMP (Appendix A.7.5), the Contractor will put in place a Public Communications Strategy which will include procedures to inform members of the community who will be directly affected by the construction phase on schedules for any activity of a particularly disruptive nature which is likely to impinge on their property such as blasting, demolition, road closures and diversions, pile driving and any

mitigating actions that are being taken (shielding, restriction on work hours, etc.) to minimise such disruption.

Furthermore, the Construction Traffic Management (CTMP) (as presented in the CEMP in Appendix A.7.5) has been prepared to ensure that construction traffic will be managed and monitored safely and efficiently throughout the construction phase. Therefore, significant residual impacts will not arise.

Operational Phase

The north end of the Anne Gibbons Road will also be permanently closed with property access to the south maintained. The indirect interaction of traffic with receptors living in these material assets is assessed elsewhere under the heading of air quality, noise and vibration, landscape and visual and population and human health.

The material assets assessment (Chapter 15, Material Assets – Non-Agriculture) has taken the predicted impacts of the Project into consideration. The chapter identifies all impacts on material assets due to changes in traffic from the Project.

21.4.2.8 Interaction between Traffic and Population and Human Health

Construction Phase

Construction traffic will be restricted to the designated haul routes. There will however be a temporary increase in traffic on these routes during construction, affecting the journey amenity of other road users and the general amenity of local residents. There will also be a requirement for some temporary road diversions and night time closures which would mainly result in slight negative impacts on journey time. As a result, there will be a slight impact for some people due to an increase in journey times. The CTMP included in the CEMP in Appendix A.7.5 has been prepared to ensure that construction traffic will be managed and monitored safely and efficiently throughout the construction phase and includes designated traffic routes, timings and parking arrangements to be updated by the contractor prior to the commencement of construction.

The potential for impacts on population and human health arising from air and noise emissions generated from construction traffic have been detailed above in Section 21.4.2.2 and Section 21.4.2.4 and assessed in Chapter 16 Air Quality, Chapter 18, Noise and Vibration and Chapter 19, Population and Human Health. Significant residual impacts from construction traffic on air quality and noise and vibration and subsequently population and human health will not arise.

Employment will be generated during the construction phase and will provide a positive economic impact to the local economy in terms of spending on food and accommodation, although a proportion of workers are likely to reside in Galway. The employment multiplier for similar infrastructure projects has been estimated at 1.5, implying the creation of one additional full-time equivalent job for every two people employed full-time on the construction of the Project.

Social severance of communities will arise during construction due to works such as the movement of construction traffic, although physical connectivity will be maintained with the exception brief temporary restrictions to movement.

Some agricultural properties will also experience severance. Temporary alternative access routes and permanent utility diversions will be required during construction.

Operational Phase

During operation, some commercial properties such as service stations will experience a reduction in passing trade due to the diversion of traffic from some areas in Galway City and its environs.

The Project will alleviate traffic congestion within Galway City and its environs and will therefore have a positive impact on the local and the larger regional population of Galway and the Western Region. This will improve the quality of life of those living within Galway City due to a reduction in traffic volumes and congestion, reduced pollution and reduced social and physical severance. The redistribution of traffic will significantly improve traffic movement in Galway City and its environs overall, thereby making it easier for

people to work and travel through the city. The diversion of traffic from Galway City Centre to the Project and the consequent freeing up of road space for pedestrian, cyclist and public transport use will result in a positive indirect impact on journey times and journey amenity. Along the route of the proposed N6 GCRR, the presence of the road itself will remain a source of social severance, although physical connectivity will be maintained.

This interaction has been assessed in Chapter 6 Traffic and Chapter 19, Population and Human Health.

21.4.2.9 Interaction between Traffic and Risks of Major Accident and/or Disaster

Construction and Operational Phase

The vulnerability of the Project to risks associated with major accidents and/or disasters has been assessed and detailed in Section 21.2 of this Chapter. A major traffic collision was identified as such an event. Although, the consequence of this is 'serious', resulting in mass injury or loss of life, the likelihood is considered to be 'low' following the implementation of mitigation. All possible measures have been included in the design of the Project to reduce the severity and potential consequences of low likelihood but potentially high consequence vehicular accident events. Appropriate precautionary measures have been included in the design of the Project to reduce the severity and potential consequences of vehicular accident events.

21.4.2.10 Overview of Soils and Geology Interactions

Construction Phase

The construction of the Project will include soil activities such as earthworks and excavations. These activities will generate air, noise and vibration emissions and carbon emissions which could potentially create negative impacts on a number of environmental factors such as air quality, climate, noise and vibration, biodiversity, population and human health, traffic and material assets (both agriculture and non-agriculture).

The level of emissions generation is dependent on the types, intensity and duration of construction activities taking place. For example, if there are significant volumes of excavated material or demolition materials which require disposal offsite or if significant materials are required to be imported on site, these activities have the potential to generate construction noise and dust and carbon emissions. These interactions are discussed further below in the interactions of air emissions and noise and vibration emissions and climate emissions.

Earthwork movement and excavations will also create landscape and visual impacts and generate waste materials. These are discussed further below.

The interaction of the predicted impacts of Soils and Geology has been considered throughout this updated EIAR.

Operational Phase

There are no predicted soil activities during the operational phase; therefore, there is no interaction generated by soils and geology with other factors during the operational phase.

21.4.2.11 Interaction between Air Quality and Population and Human Health

Construction Phase

The construction of the Project will require earthworks and demolitions, particularly during site clearance and excavation. These activities have the potential to generate significant air emissions (dust) which could potentially negatively impact on human beings under the environmental topic of both population and human health. In general, any additional airborne concentrations of particulate matter arising from construction would be small and very local to the construction activity (minimising human exposure). Particles generated by most construction activities tend to be larger than 10µm in diameter which are too large to enter the human lungs. An assessment was carried out of the potential dust impacts at locations where the main

construction activities will take place and where the construction compounds will be located (Refer to Chapter 16, Air Quality). The results of the assessment indicate following the implementation of mitigation that there will be no significant adverse effects during the construction phase of the Project on air quality.

Mitigation measures have been designed to minimise the impact of dust and other air emissions during the construction phase. (Refer to Chapter 16, Air Quality). These measures are based on best practice as outlined in the Institute of Air Quality Management (IAQM) 'Guidance on the assessment of dust from demolition and construction', 2024. Furthermore, dust screens will be implemented at locations where there is the potential for air quality impacts during the construction phase as outlined in Chapter 16, Air Quality i.e. at locations where sensitive receptors are located within 100m of the works.

Dust deposition and PM_{10}/$PM_{2.5}$ monitoring shall be carried out to confirm the effectiveness of the mitigation measures. The residual impact on air quality during the construction phase will not be significant following the implementation of mitigation measures.

As noted above, the results of the air quality assessment show that all of the predicted concentrations are in compliance with the air quality standards (Refer to Chapter 16, Air Quality). Therefore, significant residual impacts on air quality and subsequently population and human health will not arise.

Operational Phase

Air emissions from traffic on the Project during the operational phase have the potential to generate negative impacts on population and human health.

The potential impact on air quality during the operational phase was assessed. Pollutant concentrations were provided at the worst-case receptors, i.e. those properties that are closest to the affected links. (Refer to Chapter 16, Air Quality). The pollutants assessed included NO_2, NO_x, PM_{10}, $PM_{2.5}$ and ammonia. The results of the assessment show that the predicted changes in concentration of all the pollutants are in compliance with the air quality standards for human receptors. Therefore, significant residual impacts from operational traffic on air quality and subsequently population and human health will not arise.

Air quality improvements will improve at a number of locations during the operational phase due to decreases in annual average daily traffic (AADT) levels. The reduction in traffic will result in a localised improvement of air quality in these regions, which will be particularly evident where sensitive receptors are adjacent to roadways and traffic reductions are substantial. Refer to Chapter 16, Air Quality for further details. Therefore, positive impacts will arise for population and human health at a number of locations due to the improvement in air quality during the operational phase.

21.4.2.12 Interaction between Air Quality and Biodiversity

Construction Phase

As noted above construction activities such as earthworks, particularly during site clearance and excavation have the potential to generate significant air emissions (dust) which could potentially negatively impact on biodiversity. An assessment was carried out of the potential dust impacts at locations where the main construction activities will take place and where the construction compounds will be located. The results of the air assessment indicate that with standard dust control mitigation measures in place there is still potential for significant soiling effects to arise in ecologically sensitive designated habitats such as Lough Corrib SAC and Moycullen Bogs NHA.

Further mitigation measures have been designed to minimise the impact of dust and other air emissions during the construction phase with a 2m dust screen provided at the locations in the areas of the overlap of the Project and the Lough Corrib SAC.

Dust deposition and PM_{10}/$PM_{2.5}$ monitoring shall be carried out to confirm the effectiveness of the mitigation measures. The residual impact on air quality during the construction phase will not be significant following the implementation of mitigation measures outlined above.

Operational Phase

Air emissions from traffic on the proposed N6 GCRR during the operational phase also have the potential to generate negative impacts on biodiversity.

An assessment was carried out on the potential for air pollution to impact on the Lough Corrib SAC and Moycullen Bogs due to operational traffic under the headings of nitrogen compounds and ammonia. The assessment shows that predicted nitrogen oxide concentrations are in compliance with the Air Quality Standard for the protection of vegetation in both 2031 and 2046. Concentrations of ammonia are predicted to exceed the maximum critical level in 2031 and 2046 at differing distances from the Project. Total nitrogen deposition is predicted to comply with critical loads in 2031 at both Lough Corrib SAC and Moycullen Bogs NHA but predicted exceedances within 10m of the Project in 2046 at the Lough Corrib SAC only. The biodiversity assessment considers the impact of these levels on vegetation in the ecologically sensitive designated habitats and concludes no likely significant effects on biodiversity are likely due to emissions to air during the construction and operational phases following the implementation of mitigation measures, apart from on five receptors, which are detailed in Chapter 8, Biodiversity.

21.4.2.13 Interaction between Noise and Vibration and Population and Human Health

Construction Phase

Construction traffic movements and construction activities such as blasting, rock breaking and general earthworks have the potential to generate significant noise and vibration emissions which could potentially negatively impact on human beings under the environmental topic of both population and human health. A number of examples of locations where blasting and drilling may be required (which have the potential to experience impacts) are provided below.

Construction of the N59 Link Road North involves deep excavation towards the N59 Moycullen Road tie in, therefore a substantial volume of soil and rock excavation will be required which will likely require drill and blasting excavation. The closest noise sensitive locations are approximately 50m from the excavation works. In the absence of specific noise mitigation measures, it is likely that construction noise limits during, day, evening and weekend periods will be exceeded, specifically during the intermittent use of high noise activities (rock drilling, crushing and breaking, if required). The use of specific noise mitigation measures will be applied in this area therefore including scheduling of works, choice of plant and screening.

Construction of the N59 Letteragh Junction involves an extensive area of cutting which will likely require drill and blast excavation. The closest noise sensitive locations are approximately 25m from the excavation works. Whilst excavation works will take place within the cutting area, it is likely that crushing and regrading works will take place within the proposed site compound located along the N59 link Road North which is set back from noise sensitive properties. Notwithstanding the above, given the close distances of excavation works to noise sensitive properties, the use of controlled noise mitigation measures will be required in this area to reduce construction noise levels at the nearest noise sensitive locations.

Construction of the Lackagh Tunnel will be undertaken in an east to west direction using drill and blast techniques. The tunnel portal and main works area will be within the proposed site compound at Lackagh Quarry. The closest noise sensitive properties to the tunnel are over 500m away and hence are well set back from the main excavation works in this area.

Construction of the N84 Headford Road Junction and the cutting on the eastern side of Lackagh Quarry will involve substantial earthworks for both cutting and embankment construction. There will be a large cutting into the eastern face of Lackagh Quarry within the eastern end of this section of the proposed N6 GCRR which is located some 300m from the nearest noise sensitive locations. Construction of the N84 Headford Road Junction will involve extensive engineered fill works to cross the existing N84 Headford Road with an element of cutting required for slip roads. The closest noise sensitive locations are within 40 to 50m from these works and hence there is potential for construction noise levels to exceed daytime, evening and weekend construction noise criteria in the absence of noise mitigation measures.

As detailed previously, these potential impacts were identified at a very early stage in the design and environmental assessment process. As a result, the potential impacts have been addressed through specific mitigation measures in Chapters 9, Soils and Geology and 18, Noise and Vibration and in the CEMP in Appendix A.7.5.

For example, the schedule of commitments specify that the contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and in particular blast design control must comply with the best practice outlined in British Standard BS 5228 – 1: 2009 +A1 2014: *Code of practice for noise and vibration control on construction and open sites – Noise* and the NRA (now TII) guidelines *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes* (National Roads Authority, 2014). Refer also to Chapter 18, Noise and Vibration.

Furthermore, a designated noise liaison officer will be appointed to site during construction works. Clear forms of communication will be established between the contractor and residents in noise sensitive areas in proximity so that residents or occupants of businesses are aware of the likely duration of activities likely to generate higher noise or vibration. All noise complaints will be logged and followed up in a prompt fashion by the liaison officer.

Mitigation measures have also been considered for potential vibration impacts. The TII Guidelines recommend that in order to ensure that there is no potential for vibration damage during construction, vibration from construction activities should be limited to the values set out in Chapter 18, Noise and Vibration.

On review of the likely vibration levels associated with construction activities, it may be concluded that the construction of the Project is not expected to give rise to vibration that is either significantly intrusive or capable of giving rise to structural or cosmetic damage to buildings. Property condition surveys will be offered for all buildings within 50m of the Assessment Boundary and those within 150m of proposed blasting works along the proposed N6 GCRR. Property condition surveys will also be carried out at buildings and structures considered appropriate relative to their proximity to the works. Mitigation measures have also been proposed for vibration sensitive manufacturing facilities within the industrial estates at Parkmore and Ballybrit, refer to Chapter 18, Noise and Vibration for further details.

The results of the construction noise and vibration assessments have been taken into account in the assessment of human health (Refer to Chapter 19, Population and Health) and concludes that significant residual impacts from noise and vibration emissions (arising from construction traffic and other construction activities) on human health will not arise.

Operational Phase

The noise emission sources from the Project during the operational phase will be from traffic. These emissions have the potential to negatively impact on human health. Traffic noise levels have been calculated at many noise sensitive locations along the length of the Project and mitigation has been identified for a number of locations (Refer to Chapter 18, Noise and Vibration). The mitigation measures required to reduce traffic noise levels are specified based on the predicted noise levels for the Design Year of 2046. The results of the modelling exercise show that noise mitigation is required for 79 properties along the route of the proposed N6 GCRR for this Design Year. The difference in those triggering the requirement for mitigation between the 2018 EIAR and this updated EIAR relates to the inclusion of a Low Noise Road Surface (LNRS) as part of the inherent design as it was not standard practice rather than an additional mitigation measure.

Additional measures to reduce operational noise levels along the proposed N6 GCRR include the use of noise barriers to reduce noise levels along the propagation path between the source (proposed N6 GCRR) and the specific receivers (houses, schools, churches etc.). These screens may be constructed as earth bunds, proprietary noise barriers or a combination of both. Chapter 18, Noise and Vibration summarises the noise barrier requirements for the Project.

During the operational phase, noise levels will be increased at the majority of noise sensitive locations along the length of the proposed N6 GCRR. Whilst noise levels of varying increases and impact magnitudes are calculated at the assessment locations, the incorporation of a low noise road surface and the use of noise barriers along the roadside boundary will reduce noise levels to within the design goal of 60dB L_{den} or to the pre-existing Do Minimum noise levels at the vast majority of noise sensitive locations. Residual noise levels at a small number of locations will remain above the design goal but are within 3dB of the design goal or are less than the predicted noise level in the Do-Minimum scenario. The assessment has concluded that changes in road traffic noise levels will be negligible to major in accordance with DMRB guidance, however the

overall impact at the properties taking account of typical population response to the absolute noise levels under consideration across the study area is negligible to moderate.

Overall, noise levels will be increased at properties along the route of the proposed N6 GCRR once operational and a change in the noise environment will occur. The proposed N6 GCRR, however, has been designed to reduce operational noise levels to within national design guidelines through the incorporation of detailed noise mitigation measures. The number of such properties along its route is relatively low compared to those within the city centre which are currently exposed to significantly higher noise levels from passing road traffic. The reduction in high volumes of traffic traversing the city centre will result in a moderate to major positive noise impact to an extensive number of noise sensitive properties along the existing road network.

The results of the operational noise assessments have been taken into account in the assessment of human health (Refer to Chapter 18, Population and Human Health) and concludes that significant residual impacts from noise emissions (arising from operational traffic) on human health will not arise. Equally there will be no significant residual impacts on material assets arising from noise emissions.

21.4.2.14 Interaction between Noise and Vibration and Soils and Geology

Construction Phase

The soils and geology assessment also considered the potential vibration impacts arising from blasting and tunnelling on geology and in particular at the locations described above such as the Lackagh Tunnel. As noted previously, these potential impacts were identified at a very early stage in the design and environmental assessment process. As a result, the potential impacts have been addressed through specific mitigation measures in the Chapters 9, Soils and Geology and Chapter 18, Noise and Vibration and in the CEMP in Appendix A.7.5. For example, ground settlement, horizontal movement and vibration monitoring will be implemented during construction activities to ensure that the construction does not exceed the design limitations.

In situations where the site specific blast design has determined that blasting is not feasible in a particular location due to excessive ground vibrations, alternative extraction methods such as hydraulic breaking, hydraulic splitting, chemical splitting and electrical disintegration may be implemented and monitored. Monitoring will be implemented during blasting, during excavation of cuts, for overburden slopes steeper than 1V:2H (V= vertical slope, H = horizontal slope) and rock slopes steeper than 1V:1.5H.

A geotechnical expert will be appointed by the contractor and will be present to monitor the surrounding ground vibrations near sensitive receptors during blasting works. In the unlikely event that the blast vibration limit at the surface is exceeded, blasting works will cease on site until the basis for the increased vibration is understood. The blast design will then be recalibrated and blasting works will proceed with continued monitoring.

The tunnelling construction methodology at Lackagh Tunnel has specifically considered potential impacts on geology and in particular the Annex I habitats at the surface, namely Limestone pavement and Calcareous grassland. Again, a geotechnical expert will be appointed by the contractor and will be present to monitor the rock mass stability during the construction period. In the unlikely event that instability within the rock mass is observed, additional support measures will be installed to ensure that there is no impact to the surface above. The additional rock support measures comprise ground anchors, rock bolts, rock dowels, rock mesh, shotcrete or a combination of these measures, designed to the relevant design standards and best practice guidance documents. However, based on the conservative design approach it is considered that the risk of instability will be avoided, and additional support measures will not be required.

Furthermore, the geotechnical expert appointed by the contractor will monitor the vibrations at the surface, including the areas of Limestone pavement, during blasting works for the construction of Lackagh Tunnel and its Western Approach. The blast target vibration limit is defined with a 20% conservative buffer, which provides an added factor of safety to the construction works to ensure that blasting will not impact the structural integrity of the Limestone pavement. In the unlikely event that the blast target vibration limit at the surface is exceeded, blasting works will cease on site until it is understood the basis for the increased vibration. The blast design will then be recalibrated and blasting works will proceed with continued monitoring.

Therefore, significant residual vibration impacts from blasting/tunnelling (arising from construction activities) on soils and geology will not arise.

21.4.2.15 Interaction between Noise and Vibration and Biodiversity

Construction Phase

The biodiversity assessment also considered the potential impacts of blasting at the locations identified above including potential impacts on wintering birds at Ballindooley Lough.

These potential impacts were identified at a very early stage in the design and environmental assessment process. As a result, the potential impacts have been addressed through specific mitigation measures in the Chapters 8, Biodiversity, 9, Soils and Geology and 18, Noise and Vibration and in the CEMP in Appendix A.7.5.

For example, blasting associated with the eastern approach to Lackagh Quarry (Ch. 11+800 to Ch. 12+100 of the proposed N6 GCRR) and the cutting at Castlegar (Ch. 12+550 to Ch. 13+650 of the proposed N6 GCRR) will be carried out between the months of April to September (inclusive) to minimise the exposure of wintering birds at Ballindooley Lough to blasting-related disturbance. Refer also to Chapter 8, Biodiversity, Chapter 9, Soils and Geology and Chapter 18, Noise and Vibration.

The biodiversity assessment also considered the potential impacts of disturbance to the Peregrine falcon due to noise. Despite the mitigation measures proposed, a significant residual impact on Peregrine falcon due to noise during construction remains. Refer also to Chapter 8, Biodiversity.

Therefore, the only significant residual impacts from noise emissions (arising from construction traffic and other construction activities) on biodiversity is disturbance to the Peregrine falcon.

Operational Phase

There will be a significant residual impact on Peregrine falcon due to potential noise disturbance from road traffic during the operation of the Project.

The interaction has been considered in Chapter 18, Noise and Vibration and Chapter 8, Biodiversity.

21.4.2.16 Interaction between Biodiversity and Population and Human Health

Construction and Operational Phase

Interactions exist with biodiversity whenever human beings interact with the natural environment. These could be realised in two ways by:

- activities giving rise to impacts on biodiversity
- the presence ecosystem services, with biodiversity at the heart, which have the capacity to regulate and support the natural environment that contributes to human well-being

In the context of the Project, potential impacts arise due to the presence of biodiversity and the benefits that biodiversity provides in terms of amenity or passive enjoyment of the landscape. The design of the Project took cognisance of ecosystem services and sought to protect water quality and air quality and prevent soil erosion. It also sought to maintain local biodiversity which can be enjoyed by human beings.

The River Corrib for example is used by many people for recreational purposes, both on the water (rowing or angling) and along its banks (walking). Many species including Otter and bats, fish including salmonids, and birds utilise this corridor also. Angling is directly reliant on biodiversity. The River Corrib is an important salmonid river and consequently of importance for angling, therefore the protection of river water quality is essential for both biodiversity and amenity of the River Corrib corridor. Equally the presence of the fauna listed above and the flora along the river sides makes it an enjoyable place to walk or row, enhancing a person's recreational experience and contributing to their well-being. The Project does not impact on this ecosystem service, which ultimately contributes to human well-being.

The interaction between biodiversity and human beings has been considered for example in the design of the River Corrib Bridge. Factors such as no piers in the water which would minimise impacts on aquatic biodiversity and amenity use of the river, type of structure to minimise bird collision risk and the aesthetics appearance of the bridge were all considered in the design thus protecting this ecosystem.

The principal focus of amenity activity is the River Corrib corridor, but interaction of biodiversity and human beings and well-being occurs throughout the study area. Some other natural environments, for example wetlands east of the River Corrib in the vicinity of Menlough and Ballindooley, contribute regulating and cultural ecosystem services by moderating water flow and acting as habitat for valued wildlife species. Natural environments such as peatlands and limestone have a role in filtering water quality in the study area with potential economic and health implications, although the role of biological processes is greater in the former. Vegetation such as hedgerows, treelines and woodland also have a role in noise attenuation and air quality regulation. Potential impacts for the above interactions on water quality or soil erosion would apply mainly during the construction phase. Measures have been taken however, to mitigate these through the sediment control and pollution prevention controls described in the CEMP in Appendix A.7.5 and on biodiversity in Chapter 8, Biodiversity.

21.4.2.17 Interaction between Archaeology, Architectural and Cultural Heritage and Biodiversity

Construction and Operational Phase

There is a potential for the archaeological trench testing during the construction along the route of the Project to impact on biodiversity. These potential impacts will be the same as those identified in Chapter 8, Biodiversity as a result of the construction of the Project.

These is also an interaction between architectural and cultural heritage with biodiversity with the design of the River Corrib Bridge. This crossing of the River Corrib, will introduce a dominant new feature into its landscape corridor which will have an impact on the heritage of Menlo Castle. Menlo Castle is also a maternity roost of the Lesser Horseshoe bat. The design of the River Corrib Bridge took cognisance of these constraints and mitigation measures such as additional planting are provided, however significant residual impacts will continue to arise on the lowland landscape valley of the River Corrib, and the setting of Menlo Castle.

21.4.2.18 Interaction between Cultural Heritage and Population and Human Health

Construction and Operational Phase

The Project will impact on cultural heritage features which are of interest and importance to the local people. As noted previously, these potential impacts were identified at a very early stage in the design and environmental assessment process. As a result, the potential impacts have been addressed through specific mitigation measures in a number of chapters such as Chapter 13, Cultural Heritage, Chapter 12, Landscape and Visual and Chapter 19, Population and Human Health. For example, the setting of Menlo Castle provides an area for amenity use. There is a potential for a change in the amenity of this area if there is a change in the setting as a result of the River Corrib Bridge. This is discussed further under the heading of the interaction of landscape and visual with Population and Human Health. Menlo Castle is an important element of this setting. Whilst the proposed mitigation measures will record the current context of Menlo Castle, they will not fully remove the residual impact of the Project on the setting of Menlo Castle – post mitigation the operation of the Project will have an indirect moderate negative impact on the castle.

Other interaction examples include an occupied thatched cottage at Castlegar which is also a protected structure which will be demolished to facilitate the construction of the Project. Prior to demolition, the thatched cottage will be subject to a full measured, written and photographic survey. This will be carried out by a suitably qualified person or team under Ministerial Directions in consultation with the DoHLGH and a TII Project Archaeologist. There is also a mass path located at Parkmore which is of heritage and amenity value for local people. The design of the Parkmore Link Road was revised to maintain access along this mass path. Archaeological testing and a written and photographic record prior to construction will also be carried out. Once the recommended mitigation measures have been applied (to the mass path and thatched cottage), there will be no residual impact on the cultural heritage resource as a result of the construction of the Project.

21.4.2.19 Interaction between Landscape and Visual, Material Assets and Population and Human Health

Construction and Operational Phase

The landscape character and existing views in the area will change during both the construction and operational phases of the Project. This impact has the potential to interact with people, both in terms of landscape and visual impacts where they live, work and their use and "experience" of surrounding amenities.

Lighting impacts both from the Project itself and from traffic using the Project during operation have the potential to impact on people. Similarly, lighting impacts from construction compounds during winter months have the potential to impact on people, depending on where they are situated.

Mitigation measures are proposed to minimise impacts during construction and include the implementation of the CEMP; provision of hoarding; careful location of storage areas to avoid impacting on residential and commercial properties and trees; and the decommissioning and reinstatement of construction compound areas to their pre-construction condition at the end of the construction contract.

The introduction of the Project will change the views and landscape character of the area in varying degrees, some areas will require mitigation planting to screen impacts, other areas will experience views of the Project. These changes have the potential to impact on people, especially in residential areas.

During the operation stage, visual impacts will arise from the physical built presence of the Project, including its significant structures, elevated embankments, deep cuttings, traffic usage and additional illumination both fixed and from vehicles, especially where the Project is on embankment or at junctions and bridging locations. In open views, embankments have the potential for visual obstruction and significant visual intrusion. Deep cuttings can also result in significant change to the visual nature of landscape continuity. These visual impacts have the potential to significantly impact on material assets non-agriculture such as such as residential areas. As discussed previously, these potential interactions of impacts were identified at a very early stage in the design process and many of them have been addressed/minimised through design measures and also through specific mitigation measures in the relevant chapters of this updated EIAR.

For example, measures for the mitigation of potential noise impact will be required at a number of locations along the Project, especially where residential properties are in close proximity to the carriageway. Such noise impacts and mitigation measures are considered in detail in Chapter 18, Noise and Vibration. Mitigation measures will involve the provision of barriers or earth bunds or a combination of such features. While initially these features may increase the visual presence of the Project, they also provide for immediate visual screening of the Project and its associated traffic. In the majority of circumstances these features can also be appropriately incorporated into the proposed landscaping measures.

The Project also includes for realignments/tie-ins to existing national, regional and local roads, together with drainage works and accommodation measures, all of which have potential for localised visual impacts. Local road realignment is important as many residential properties tend to be located along such roads and local direct impacts can arise.

A full schedule and description of visual impacts on properties is set out in the Visual Impact Schedule (VIS) Tables in Appendix A.12.1.

In the pre-establishment stage 72 of the 371 locations (c.19.5%) will have an imperceptible impact. A further 175 locations (c.47%) will have a slight or moderate short-term impact. Ninety-three locations (c.25%) will have significant or very significant short-term visual impact. The remaining 31 locations (c.8.5%) will experience profound short-term negative visual impact associated with the presence and early operational stage of the Project.

As landscape measures establish and mature the level of visual impact will gradually recede so that in the post-establishment stage some 159 locations (c.42.5%) will have an imperceptible impact. A further 153 locations (c.41.5%) will have a slight or moderate medium-term impact. Thirty-six locations (c.9.5%) will have significant or very significant medium-term visual impact. The remaining 23 locations (c.6.5%) will continue to experience profound medium and longer-term negative visual impact associated with the Project. Refer to Figures 12.1.01 to 12.1.15 for locations of properties.

The properties with on-going significant and very significant visual impact are either located in more remote and rural areas and are in proximity to the Project, or are in suburban areas and are located directly adjacent to the Project.

21.4.2.20 Interaction of Landscape and Visual and Biodiversity

Construction and Operational Phase

The construction phase will require site clearance and will result in the removal of a variety of habitats. This biodiversity (and landscape) impact, such as the removal of a woodland area, has the potential to permanently interact with the landscape character and amenity (and biodiversity) of an area. In addition, there is a potential for a change in biodiversity (such as introduction/spread of non-native invasive plant species) to negatively impact on landscape and visual aspects.

These potential interactions of impacts were identified at a very early stage in the design and environmental assessment process and have been addressed through specific mitigation measures, such as planting, in the relevant chapters of this updated EIAR. For example:

- Mitigation measures to avoid the introduction or spread of non-native invasive plant species to Moycullen Bogs NHA during construction or operation have been detailed in the Non-native Invasive Species Management Plan which forms part of the CEMP in Appendix A.7.5
- To minimise the loss of habitat associated with the Project, there are also areas within the Assessment Boundary which are included for mitigation planting where general construction works will not be undertaken. These are shown on Figures 8.23.1 to 8.23.15
- Planting of woodland, hedgerow and grassland habitats along the Project as detailed in the landscape drawings (Figures 12.2.01 to 12.2.15) will provide compensatory habitat for some bird species. In some instances, such as in large areas of improved agricultural grassland with no vegetated field boundaries, this will improve the diversity of bird habitat
- Sections along the Project, will be planted with dense low growing scrub cover (e.g. blackthorn) to discourage Barn owls from foraging near the Project. The planting will be of a density to minimise the lag time between planting and obtaining sufficient ground cover to deter foraging Barn owl
- In areas where there is a high probability that Barn owls regularly attempt to cross the Project (the section of embankment between Ch. 9+600 and Ch. 10+100 of the proposed N6 GCRR), lines of closely spaced (approximately 2m centres) trees, greater than 3m in height, will be planted along the top of the embankments of the proposed N6 GCRR; outside of the safety barrier and clear zone. The understorey will also be densely planted. This is to present a solid vegetated barrier to deflect Barn owl from these high-risk areas and/or force birds to fly over the proposed N6 GCRR above the road traffic
- Specific landscape planting mitigation measures have been proposed to preserve flight paths for bats during both construction and operational phases. The Castlegar Wildlife Overpass is a critical component of the strategy and specific landscape planting has been designed on the approach to and over the overpass. The overpass will allow bats to fly across the proposed N6 GCRR between the roosts and foraging habitats on the north side and Coopers Cave and foraging areas to the south at this location
- An area of habitat enhancement for the purposes of offsetting the loss of suitable bat habitat due to the proposed N6 GCRR within the known core foraging area of the Menlo Castle Lesser horseshoe bat population is included within the Project. Hedgerows in this area will be augmented and thickets of hazel, hawthorn, holly and oak will be provided in several of the fields to create pockets of wood and grassland habitat. Grazing will continue on the lands as it has been shown that this improves the quality of this type of habitat for Lesser horseshoe bats. Connectivity to foraging areas will also be secured through tying the proposed planting strips to hedgerows and woodland edges. Planting of new hedgerows in fields between the Project and Menlo Castle will improve the foraging resources of this core foraging area. Such planting will include additional native hedgerows planted across the existing fields to increase the lengths of hedgerows close to the proposed new roost for Lesser horseshoe bats. The fields will still be grazed and the hedgerows can be fitted with field gates as required providing gaps are kept to a minimum.

The landscape planting mitigation measures proposed will significantly reduce the level of biodiversity residual impact.

21.4.2.21 Interaction between Landscape and Visual and Cultural Heritage

Construction and Operational Phase

There is a potential for a change in the setting of cultural heritage features if there is a change in landscape character or views. For example, the proposed N6 GCRR, including major new c.650m long bridge, high embankments and a c.320m long viaduct will introduce a dominant new feature into its landscape corridor. The new bridge will be prominent along the River Corrib and University of Galway Sports Campus and from Menlo Castle, while the embankments and viaduct on the east of the River Corrib cross a very remote and elevated semi-natural landscape. The bridge and viaduct, and particularly traffic on the structures, will also be visible where elevated vantage points on the west side of the river allow for viewing across the River Corrib valley.

Given the existing environment, and the nature of this section of the Project, integration will be slow and structures such as the bridge and viaduct will permanently influence landscape character. There will be a profound short-term and very significant medium negative impact on local landscape character. In addition, there will be a significant cultural heritage impact on Menlo Castle and its demesne. Mitigation measures such as landscape planting in the vicinity have been proposed to soften the impacts however significant residual landscape impacts will continue to arise on the lowland landscape valley of the River Corrib, and the setting of Menlo Castle.

This interaction has been considered in Chapter 12, Landscape and Visual and Chapter 13, Cultural Heritage.

21.4.2.22 Interaction between Soils and Geology, Hydrology, Population and Human Health and Material Assets

Construction Phase

The construction works will involve considerable earthworks throughout the Project area including cuttings and embankments, tunnels, bridges and viaducts and the movement earthworks materials both within the Assessment Boundary and outside of the Assessment Boundary (quarries, borrow pits etc.). These works and other construction activities have the potential to impact on water quality, water supplies, people and material assets. These potential impacts were considered at a very early stage and pollution control measures have been incorporated into the design and specified in the CEMP.

As detailed in the CEMP in Appendix A.7.5 and in Section 11.6 of Chapter 11, Hydrology, a suite of mitigation measures has been proposed and include an Incident Response Plan (IRP) and Sediment, Erosion and Control Plan (SECP). Stringent mitigation and control of potential polluting activities associated with construction activities is proposed which will significantly reduce pollution risk. Stringent controls are proposed to limit the risk of untreated sediment run-off entering the water body and to minimise the risk of construction spillages of concrete and hydrocarbons into these waters (refer also to the CEMP in Appendix A.7.5). Specifically, there will be no in-stream works at the River Corrib channel associated with the construction of the river bridge crossing that fully spans the River Corrib channel, so as to protect the major downstream drinking water abstraction to the Galway City Water Treatment Plant at Terryland.

Mitigation measures to address impacts on water supplies from wells have also been considered (Refer to Chapter 10, Hydrogeology) and will include measures such as replacement wells, connections to mains supplies or financial compensation for wells which will be lost during the construction phase. Monitoring will also be carried out at some locations and standard mitigation measures and aquifer specific mitigation measures will also be employed for protection of groundwater. These measures will ensure that significant residual impacts on water supplies will not arise

Operational Phase

Potential pollution impacts during the operational phase (such as from operational traffic) on water quality have also been considered. The operational phase presents a potential pollution risk to the Terryland water supply both from accidental spillages and from routine road run-off discharges. However, pollution control

measures have been designed and put in place to significantly reduce the risk. The proposed drainage system design incorporates a range of pollution control features to limit the water quality impact to receiving waters. These include filter drains, grassed surface water channels, petrol and oil interceptors, detention ponds, wetlands and infiltration basins and spillage containment areas. The use of filter drains, and grassed surface water channels are proposed in non-sensitive groundwater areas (granite bedrock areas west of N59 Moycullen Road) where possible and closed (sealed) drainage systems are proposed in the highly vulnerable karst aquifer region east of the N59 Moycullen Road. A treatment wetland will be provided upstream of the attenuation pond at all proposed surface water outfalls and upstream of all infiltration basins outfalling to ground, from the mainline and its associated link roads of the proposed N6 GCRR. Treatment wetlands are designed to capture the first flush rainfall events.

In addition to the treatment wetlands, oil and petrol interceptors along with spillage containment areas will also be placed upstream of all surface water outfalls and groundwater infiltration basins. The oil and petrol interceptor and isolated spillage containment areas provide protection against both minor and major road spillages. An operational spillage assessment for the proposed N6 GCRR was carried out for all outfalls, both surface and groundwater, and the results show low risk of impact from serious accidental spillage involving a HGV. In conclusion, residual water quality impacts on these watercourses will be slight during the operational phase. Therefore, significant negative cumulative impacts will not arise.

21.4.2.23 Interaction between Soils and Geology, Hydrology and Biodiversity

Construction Phase

As noted above, the construction of the Project has the potential to impact on water quality. This in turn has the potential to impact on biodiversity. These potential impacts were considered at a very early stage and pollution control measures have been incorporated into the design and specified in the CEMP.

As noted above a suite of mitigation measures including an IRP and SECP have been proposed which will significantly reduce pollution risk. Stringent controls are proposed to limit the risk of untreated sediment run-off entering the water body and to minimise the risk of construction spillages of concrete and hydrocarbons into these waters. There will be no in-stream works at the River Corrib channel associated with the construction of the river bridge and this will minimise effects on Lough Corrib SAC and European designated sites downstream.

A section of Lackagh Tunnel passes under an area of Qualifying Interest (QI) Annex I habitats, namely Limestone pavement and Calcareous grasslands, within the Lough Corrib SAC. Given the presence of Annex I habitats, the design of the tunnel and its approaches includes measures such as stabilisation of Lackagh Quarry Face around the eastern tunnel portal in order to prevent rock mass instability and slope instability, careful selection of the tunnel construction methodology, retaining systems and blast design limitations.

Furthermore, during the construction of Lackagh Tunnel the supported rock face of Lackagh Quarry Face and retaining walls for the Western Approach will be monitored for movement. A geotechnical expert will be appointed, by the contractor and will be present to monitor the rock mass stability during the construction period for these specific works. In the unlikely event that instability within the rock mass is observed, additional support measures will be installed to ensure that there is no impact to the surface above. The additional rock support measures comprise ground anchors, rock bolts, rock dowels, rock mesh, shotcrete or a combination of these measures, designed to the relevant design standards and best practice guidance documents. However, based on the conservative design approach it is considered that the risk of instability will be avoided and additional support measures will not be required.

The geotechnical expert will also monitor the vibrations at the surface, including the areas of Annex I habitats, during blasting works for the construction of Lackagh Tunnel and the Western Approach. The blast target vibration limit is defined with a 20% more conservative buffer which provides an added factor of safety to the construction works to ensure that blasting will not impact the structural integrity of the Limestone pavement. In the unlikely event that the blast target vibration limit at the surface is exceeded, blasting works will cease on site until it is understood the basis for the increased vibration. The blast design will then be recalibrated and blasting works will proceed with continued monitoring. Therefore, significant residual impacts will not arise.

Potential impacts on biodiversity arising from the introduction of material derived from a different lithology were also identified at an early stage in the design process. Specific mitigation measures have been included to address these impacts (Refer to Chapter 9, Soils and Geology). For example, to prevent impact to the local peatland habitats, described in Chapter 8, Biodiversity, fill limitations at specific locations have been identified (Refer to Chapter 9, Soils and Geology). Therefore, significant residual impacts will not arise.

Operational Phase

Potential pollution impacts during the operational phase (such as from operational traffic) on water quality and biodiversity have also been considered. The interaction assessment outlined above for soil and water with human beings is the same as that for biodiversity and significant negative cumulative impacts will not arise.

During the operational phase, monitoring of the rock mass stability will continue. The rock and overburden retaining systems in Lackagh Quarry and the Western Approach will continue to be monitored as part of the operational maintenance schedule. In the extremely unlikely event that instability within the rock mass is observed additional support measures as outlined above for the construction phase will be installed to ensure that there is no impact to the structural integrity of the Annex I habitats. However, based on the conservative design approach, (the installed composite support system and monitoring during construction) it is considered that the risk of instability will be avoided and additional support measures will not be required.

The measures described above were taken into account in the biodiversity assessment of this updated EIAR and in the updated NIS. The conclusion of the updated NIS was that the construction or operation of the Lackagh Tunnel and approaches will not affect the structural integrity of the rock mass supporting QI habitats in Lough Corrib SAC or affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats and species of Lough Corrib SAC. Therefore, significant negative cumulative impacts will not arise.

Furthermore, during the operational phase of the Project inspection and maintenance will occur to ensure that the infiltration basins continue to operate as intended for the design life of the Project. If karst features and potential pathways are found to be present during inspection, then the Karst Protocol developed for the construction phase will be implemented to ensure that no preferential pathways have formed within the infiltration basin. Therefore, significant residual impacts will not arise.

21.4.2.24 Interaction between Soils and Geology and Climate

Construction and Operational Phase

As outlined in Section 21.4.2.6, Soils and Geology and Climate will interact throughout the construction phase of the Project. Earthworks and land use changes required for the construction of the Project will form part of the total embodied carbon for the Project, which informs the climate assessment, due to the emissions associated with the excavation of the materials as well as the transportation of construction materials. This interaction has been considered within Chapter 9, Soils and Geology and Chapter 17, Climate.

During the operational phase of the Project, there is less likelihood of an interaction between Soils and Geology and Climate.

21.4.2.25 Interaction between Hydrology, Population, and Human Health and Material Assets Non-Agriculture

Construction and Operational Phase

Flooding can effect properties, including dwelling, commercial, industrial and agricultural and can effect journey movements. There are potential impacts on journey connectivity and amenity, residential amenity, economic activity and human health. The Project as part of the design and environmental evaluation process has undergone a detailed Flood Risk Assessment in accordance with the DoEHLG Planning System and Flood Risk Management Guidelines for Planning Authorities. The assessment identified the sources of flood risk to the Project from fluvial, pluvial and groundwater sources, but not from a coastal source as the Project is sufficiently set back and elevated above the coastal zone. Overall the assessment has concluded that the design of the Project minimises flood risk to the Project and is rated as having a low probability of flooding.

A potential significant flood risk impact to lands including residential properties has been identified in the vicinity of the N83 Tuam Road Junction, resulting in the permanent encroachment and loss of some of the flood storage area from this flood risk area. Flood relief mitigation measures involving improved land and road drainage, provision of compensation storage and storm water pumping to the Terryland Basin have been designed, which when implemented will result in providing a residual moderate to significant positive impact by reducing the risk of serious flooding in this area.

The design level of the eastern tunnel entrance plus the porous material in the infill to the quarry are design measures to reduce the potential flood risk for the Lackagh Tunnel to a moderate flood risk. At all other locations along the Project, there will only be slight to imperceptible impacts on flood risk as very minimal encroachment of floodplains occur and design measures in the form of large culverts and stormwater attenuation ponds are included in the design. Residual flood risks exist at the drainage outfalls and their associated attenuation ponds and at the various culverts due to potential blockages. It should be noted however, the culverts have been sized with additional capacity for climate change impacts, controlled overflow systems are in place and there will be a program of regular inspections and maintenance and therefore the risk of blockages is slight.

The interaction has been considered in Chapter 11 Hydrology, Chapter 19, Population, and Human Health and Chapter 15, Material Assets Non-Agriculture.

21.4.2.26 Interaction between Hydrology and Biodiversity

Construction and Operational Phase

The interaction of Hydrology with biodiversity is the same as that presented above for the interaction of Hydrology with population and health and material assets non-agriculture.

The interaction has been assessed in the preparation of Chapter 11, Hydrology and Chapter 8, Biodiversity.

Significant negative impacts will not arise.

21.4.2.27 Interaction between Material Assets Non-Agriculture and Population and Human Health

Construction and Operational Phase

As described in Chapter 15, Material Assets Non-Agriculture, the Project will cross through lands populated by residential and commercial properties on the outskirts of Galway City and include both agriculture lands and lands zoned for development. The Project has been designed to avoid as many properties as possible, but given the distribution of development and the presence of linear type development of the city with housing along most roads radiating out of the city, its construction will unfortunately and unavoidably result in a number of property demolitions or acquisitions with some concentrations in particular areas. As well as the direct negative impact on the householders themselves, this will present a varying negative impact on remaining residents and at a community level depending on the strength of community interaction that has evolved at each location and the sustainability of community facilities such as schools. In several locations, and particularly in Na Foraí Maola and Troscaigh and the vicinity of the N59 Moycullen Road, the N84 Headford Road and in Castlegar, there will be a significant impact on local communities due to the need to acquire or demolish a high proportion of existing properties in these areas. It is important to recognise that the people whose homes will be subject to compulsory purchase across the route of the Project have genuine concerns that their lives will be adversely affected. Many have lived in the area many years, or indeed, all of their lives.

In the event of an approval of the N6 Galway City Ring Road Protected Road Scheme 2018 and N6 Galway City Ring Road Motorway Scheme 2018 and approval under Section 51 of the Roads Act 1993 (as amended), by An Bord Pleanála and subject to the availability of funding, Notice to Treat will be served firstly on owners, lessees and occupiers of the dwelling houses and commercial properties to be acquired, within six months of the scheme becoming operative, unless an application has been made for Judicial Review, in which case the Notice to Treat will be served in accordance with the provisions of Section 217 (6A) of the Planning and Development Act 2000 as inserted by the Compulsory Purchase Orders (Extension of Time Limits) Act 2010. Compensation will be agreed or determined by the property arbitrator as soon as possible after service of Notice to Treat. After compensation has been agreed or determined and satisfactory

title has been produced, part payment can be made while the claimant remains for an agreed period in the property to be acquired. This will facilitate the claimant in removing uncertainty and will facilitate arrangements being made, as early as possible, to secure a replacement property.

This interaction has been assessed in Chapter 15, Material Assets Non-Agriculture and Chapter 19, Population and Human Health.

21.4.2.28 Interaction between Risks of Major Accident and/or Disaster

This chapter has considered potential interactions of the Project across all chapters of this updated EIAR. For example, it considered the risk of impacts on utilities (Chapter 15, Material Assets- Non-agriculture) such as impacts on foul and stormwater pipes. It also assesses the risk associated with other assessments such as spreading non-native invasive species as (Chapter 8, Biodiversity), and potentially encountering contaminated material (Chapter 9, Soils and Geology).

Throughout the design process, the potential vulnerabilities of the Project in respect to each assessment has been considered and risks identified and mitigated against.

21.4.3 Summary

All of the potential effects arising from the potential interactions were identified at a very early stage in the design process and in the EIAR preparation. They were therefore addressed in the design of the Project and considered in the impact assessment studies. As a result, the potential effects were either avoided altogether through design measures or they were addressed through specific mitigation measures which are set out in the individual chapters and summarised in Chapter 22 of this updated EIAR. This early identification process helped to identify and minimise the potential for significant interactions of effects arising. The assessment presented above of the interactions of the potential effects did not identify the need for any additional mitigation measures to those summarised in Chapter 22 of this updated EIAR.

21.5 Cumulative Effects Assessment

21.5.1 Introduction

This section of the chapter presents the assessment carried out to examine whether the Project along with other planned and/or committed projects could result in likely significant cumulative environmental impacts, both positive and negative. The process of identification of potentially relevant other planned and/or committed projects for this cumulative impact assessment is set out in Section 21.5.2.

Using this methodology, the likely significant cumulative impacts between the Project and the other identified planned and/or committed projects of relevance for each of the individual environmental disciplines have been identified and considered and assessed in detail in each of the respective environmental chapters in this updated EIAR.

Appendix A.21.1 of this updated EIAR compiles the list of all of these other planned and/or committed projects assessed cumulatively with the Project and details the pairwise assessment of the Project against each one of the other planned and/or committed projects. Any likely significant cumulative impacts of the Project with each one of the other planned and/or committed projects is set out under the individual environmental disciplines in tabular form in Appendix A.21.1.

Appendix A.21.1 also contains an assessment of likely significant cumulative impacts of all of the planned and/or committed projects listed in Appendix A.21.1 cumulatively with the Project.

Where in Appendix A.21.1 the words ‘Not Applicable’ are used, this represents instances where the individual environmental assessment contained in each of the chapters of this updated EIAR did not identify that particular project in the first instance on their long list as a potential risk for a likely significant cumulative impact with the Project under their discipline assessment. This may be due to the minor scale of the other planned and/or committed project, or the distance of the other planned and/or committed project from the Project or the lack of a pathway to connect the other planned and/or committed project to the Project for that particular environmental discipline. However, for completeness and full visibility of all environmental disciplines, every environmental discipline is repeated in the table outlining the assessment of the Project against each other planned and/or committed project in Appendix A.21.1.

A summary of the conclusions of the pairwise assessments of the individual cumulative assessments of the planned and/or committed projects with the Project is provided in Section 21.6.1 to Section 21.6.13 and a summary of the overall assessment of likely significant cumulative impacts of all of the planned and/or committed projects listed in Appendix A.21.1 cumulatively with the Project is provided for in Section 21.6.14.

21.5.2 Other Planned and/or Committed Projects to be Assessed

A search for other planned and/or committed projects with the potential for likely significant cumulative impacts was carried out (i) within the study area for the Project or the appropriate study area within each discipline and (ii) for projects submitted requiring an EIA up to a distance of 15km were considered.

The Guidance for Planning Authorities on Appropriate Assessments recommends a study area of 15km is applied. However, any Appropriate Assessment to be conducted by the competent authority needs to consider all potential pathways to impacts on European nature conservation sites and therefore the application of an arbitrary distance may not be suitable. Consideration was therefore given to the distance and scales of projects that should be included on the long list for consideration that would be considered for the biodiversity cumulative assessment in this updated EIAR. This has meant that some projects added to the long list were more than 15km from the Project itself. All major and strategic projects that have been (or would be) lodged with An Bord Pleanála within a 15km search area, or otherwise identified by the project ecologists, were included on the 'long list'.

A 'long list' of planned and/or committed projects deemed potentially relevant was initially identified from this search. While the EIA Directive requires the consideration of existing or approved projects, a more expansive approach has been adopted in the cumulative impact assessment for this updated EIAR. In this regard, there is the potential for several other projects to receive imminent approval, which may give rise to likely significant cumulative impacts in combination with the Project and therefore, it was considered appropriate to identify any such projects which, at the time of this assessment, were yet to be approved, but for which a decision and potentially approval is reasonably foreseeable over the likely consenting and construction period anticipated for the Project.

The identification of projects for the 'long list' were considered from the following sources:

- An Bord Pleanála (ABP) website (http://www.pleanala.ie/index.htm) – for details of Strategic Infrastructure Developments (SIDs), Large-Scale Residential Development (LRDs) and Strategic Housing Developments (SHDs) and projects submitted to local authorities which were granted planning by the local authority but were appealed to ABP
- Local authorities (Galway City Council and Galway County Council) for up-to-date planning applications and local development plan designations (Galway City Development Plan 2023 – 2029 and Galway County Development Plan 2022 – 2028)
- Project Ireland 2040, which combines the National Development Plan and National Planning Frameworks (https://storymaps.arcgis.com/stories/7682860c80d64a62b90e8a1ca3d16364)
- Transport Infrastructure Ireland Website – to identify major transport projects and programmes
- The EIA Portal – for applications for development consent requiring an EIAR
- Uisce Éireann – for applications for projects

The types of projects considered:

- Local Planning Applications – those projects for which planning permission is applied for through the local planning authorities themselves and were identified from local authority planning application lists
- Strategic Housing Developments (SHDs) – housing developments of a certain type and scale (e.g., 100 or more houses or student accommodation units) for which applications are lodged directly with An Bord Pleanála
- Large Scale Residential Developments (LRDs) – housing developments of a certain type and scale (e.g., 100 or more houses or student accommodation units comprising 200 bed spaces or more) for which

planning permission is applied for through the local planning authorities. This has recently replaced the SHD application

- Strategic Infrastructure Development (SIDs) - major infrastructure developments by local authorities and others for which applications are lodged directly with An Bord Pleanála

A five-year timeframe was deemed the most appropriate period for these various planning searches as permissions granted more than five years ago would generally be constructed and so form part of the baseline. The initial sift covered a period from 2019 to 2024, and this was tracked throughout 2024 for all new applications up until February 2025, with new applications of relevance added to the list for assessment.

An initial sift of this identified "long list" was carried out to exclude planned and/or committed projects that were not considered to be relevant to be included for further consideration in this cumulative impacts assessment. For instance, this involved excluding planning applications that are either not currently active (i.e. retention, invalid, withdrawn, refused-and not appealed, refused on appeal), and applications of a minor scale such as applications to construct or demolish conservatories, house extensions, loft conversions, change of uses for single or small numbers of buildings, construction of outbuildings, modifications to driveways and retention applications where there was no possibility of the subject matter of those applications having any likely significant cumulative impacts with the Project.

Planned and/or committed projects that were shortlisted for assessment in the cumulative impacts assessment were based on the Zone of Influence "ZOI" as determined by each specialist on the basis of relevant guidelines and professional judgement. Planned and/or committed projects located within the ZOI for each environmental discipline were considered and assessed to determine if there is a potential for significant cumulative impacts when assessed with the Project (the pairwise assessment).

The Climate assessment has considered the cumulative impact of the Project with other projects on a national basis, as per the guidance and approach to the climate impact assessment as outlined in Section 17.7 of Chapter 17, Climate of this updated EIAR.

The assessment for Resource and Waste Management was completed at a regional level assessing the available capacity within the Connaught Ulster Waste Region cumulatively with other projects, as outlined in Section 20.3 of Chapter 20, Waste and Resources of this updated EIAR.

A number of Plans are relevant to the Project, including the Galway Transport Strategy, the Galway City Development Plan and the Galway County Development Plan. Strategic Environmental Assessments (SEA) were completed of all these plans, which assessed the potential cumulative environmental effects of implementing the various policies and objectives contained within these plans. It is not considered appropriate to assess these high level plans as part of a cumulative assessment as relevant guidance refers to the assessment of projects as part of EIA and plans are assessed through SEA.

Theses shortlisted planned and/or committed projects which are set out in Appendix A.21.1 were assessed pairwise with the Project for likely significant cumulative impacts. Further, it should also be noted that the pairwise assessment for likely significant impacts is also set out in the Cumulative Impacts of each of the individual chapters of this updated EIAR dealing with the environmental disciplines.

21.6 Summary of the Conclusions of the Cumulative Impacts Assessments

21.6.1 Biodiversity

Section 8.8 of Chapter 8, Biodiversity of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect on biodiversity.

All the projects listed in Appendix A.21.1 have been assessed for cumulative effects with the Project with respect to biodiversity, noting that those that are not identified in Section 8.8 of Chapter 8, Biodiversity will be marked as Not Applicable.

The potential for other plans or projects to act cumulatively with the Project to adversely affect the integrity of any European sites, is considered in Section 12 of the NIS (termed "in combination effects" in the context of the NIS assessment). This assessment examined whether any other plans or projects have the potential to

act in combination with the Project to adversely affect the integrity of the designated sites where impacts may still have an in combination effect and include the following sites: Lough Corrib SAC, Lough Corrib SPA, Galway Bay Complex SAC, Inner Galway Bay SPA, Inishmore Island SAC, Kilkieran Bay and Islands SAC, Ardrahan Grassland SAC, Castletaylor Complex SAC, Kiltiernan Turlough SAC, Lough Fingall Complex SAC, Rahasane Turlough SPA, Rahasane Turlough SAC, Cregganna Marsh SPA, Maumturk Mountains SAC, The Twelve Bens/Garraun Complex SAC, Connemara Bog Complex SAC, Connemara Bog Complex SPA, Ross Lake and Woods SAC, East Burren Complex SAC, Moneen Mountain SAC, Black Head-Poulsallagh Complex SAC and Gortnandarragh Limestone Pavement SAC, and their associated NHAs and pNHAs, as well as the following isolated NHAs and pNHAs; Moycullen Bog NHA, Furbogh Wood pNHA, Kiltullagh Turlough pNHA, Ballycuirke Lough pNHA, Drimcong Wood pNHA and Turloughcor pNHA.

All other designated sites fall beyond the zone of influence of the Project. Therefore, there is no potential for any other plans and/or projects to act cumulatively or in combination with the Project to adversely affect the integrity of any other designated sites.

The potential for in combination effects to arise in the receiving environment, including River Corrib and Galway Bay, from any existing or proposed land use plans or developments is regulated and controlled by the environmental protective policies and objectives of the Galway City Development Plan 2023-2029 and Galway County Development Plan 2022-2028. Any existing/proposed plan or project that could potentially affect European sites in Galway Bay, or any other European site, in combination with the Project, must adhere to these overarching environmental protective policies and objectives. These policies and objectives will ensure the protection of the European site within the zone of influence of the Project, and include the requirement for any future plans or projects to undergo Screening for Appropriate Assessment and/or Appropriate Assessment to examine and assess their effects on European sites, alone and in combination with other plans and projects.

There are specific objectives and policies in the Galway City Development Plan 2023-2029 and Galway County Development Plan 2022-2028 to protect biodiversity, and specifically European sites. Policies within the Galway City Development Plan 2023-2029 Policy 5.2 (1), Policy 5.2 (2), and Policy 5.2 (11) relate to the protection of European sites, AA and commitments to not permitting projects giving rise to adverse effects on the integrity of European sites without demonstrating there are no alternatives, there are imperative reasons of overriding public interest, and undertaking all compensation measures necessary to ensure the overall coherence of the network of European sites.

Policies within the Galway County Development Plan 2022-2028 NHB 1, NHB 2, and NHB 3 relate to the protection of European sites, AA and commitments to not permitting projects giving rise to adverse effects on the integrity of European sites without demonstrating there are no alternatives, there are imperative reasons of overriding public interest, and undertaking all compensation measures necessary to ensure the overall coherence of the network of European sites.

The Galway City Development Plan 2023-2029 also includes policies for protection of European sites regarding its integrity relating to waters (Policy 5.2 (2), Policy 5.2 (4), Policy 5.2 (7), Policy 5.2 (12), Policy 5.2 (18), Policy 9.2 (6)).

The Galway County Development Plan 2022-2028 also includes policies to protect water quality, wetland sites and peatlands (from pollution via surface and ground water) (WR 1, WR 2, WTWF 1 and P 1).

Although other plans and projects have the possibility to act in combination with the Project to affect air quality locally in the vicinity of the Lough Corrib SAC, considering the land use zonings and objectives that relate to lands in this area in the Galway City Development Plan 2023-2029 (Recreation and Amenity, Agriculture and High Amenity and Agricultural), and the protective policies and objectives included within the Plan to protect air quality and European sites, developments in Galway City will not act in combination with the Project to affect the integrity of any European sites due to impacts on air quality.

Land use plans for the other local authorities (e.g. Clare County Council) whose functional areas include surface water features which drain to the Galway Bay, were examined and analysed and those land use plans also include protective environmental policies to protect European sites and the receiving groundwater, and surface water environments. The potential cumulative impacts on those European sites within the ZoI of the Project from the proposed works in combination with other plans and projects, as identified from Galway

City Council's and Galway County Council's planning e-portals and An Bord Pleanála map viewer are identified and assessed in Appendix R of the updated NIS.

The full assessment of the potential in combination effects of the land use plans presented in Appendix R of the NIS. The full assessment of live and/or approved projects are also detailed in Appendix R of the updated NIS, indicating a sample of the projects, in particular, large projects such as transport infrastructure projects and coastal protection projects which were assessed.

The updated NIS concludes that the Project will not affect the integrity of any European sites including specifically the 22 which fall within the ZoI of the Project and listed above. Furthermore, having considered and assessed the Project in combination with all plans and projects listed in Section 12 of the updated NIS, there is no potential for the Project in combination with other plans and projects to undermine the conservation objectives, or adversely affect the integrity, of any European sites, particularly in light of the mitigation measures included as part of the Project. The Project level mitigation in tandem with the environmental protective policies set out in the overarching land use plans, ensures there is no potential for projects individually (pairwise) or cumulatively with all the other projects or plans as well as with the Project, to act in combination to impact on the conservation objectives of any European sites.

Similarly, for the same reasons, having considered and assessed the Project alongside all plans and projects listed in Appendix A.21.1, there is no potential for the Project to act cumulatively in combination with other plans and projects to significantly affect any pNHA sites, particularly in light of the mitigation measures included as part of the Project. The Project level mitigation in tandem with the environmental protective policies set out in the overarching land use plans, ensures there is no potential for projects individually (pairwise) or cumulatively with all the other projects or plans as well as with the Project, to act in combination to impact on the conservation objectives of any pNHA sites.

The potential for likely significant cumulative impacts to arise are limited to those residual impacts associated with the Project and those effects the Project will have on the receiving environment that are measurable in some way, but themselves will not result in a likely significant residual effect on biodiversity.

The residual impacts associated with the Project relate to the following:

- Habitat loss, including both the permanent loss of Annex I habitats (outside of any European Site) and habitats valued as being of local importance
- The potential loss of a Peregrine falcon nest site due to long-term disturbance/displacement impacts
- The potential for impacts on the Menlo Castle Barn Owl nest site
- Impacts on bats as a result of the construction and operation of the Project

The other impacts associated with the Project that are measurable in some way, but themselves will not result in a likely significant effect on biodiversity, are impacts on the existing hydrological and hydrogeological regimes, impacts on air quality and impacts to species as a result of disturbance or displacement. The land use zonings and environmental protection objectives that relate to this area are contained in the Galway County Development Plan 2022-2028 and the Galway City Council Development Plan 2023-2029. There are also environmental protective policies and objectives in both the Galway City Council Development Plan 2023-2029 and the overarching Galway County Development Plan 2022-2028. Given the zonings and objectives that are in place in these plans, it is considered that there are no other plans or projects that are likely to result in a significant effect on biodiversity, cumulatively with the Project, as a consequence of impacts on surface water and groundwater air quality and disturbance or displacement impacts.

21.6.1.1 Impacts from habitat loss

As outlined in Section 8.5.5, habitat loss to development and land use change has been an ongoing impact locally which may have already had effects on local biodiversity. Those projects listed in Appendix A.8.28, and in Appendix A.21.1 have, or are likely to, result in habitat impacts (including those of a high biodiversity value such as Annex I habitat types) which may also have knock-on effects on fauna species. Therefore, land use change and habitat losses are likely to continue to some degree and the loss and fragmentation of habitat associated with the Project will contribute to this trend locally.

The most notable habitat loss impacts are the losses of areas of internationally or nationally valued habitats: Limestone pavement [*8240], Residual alluvial forest [*91E0], Blanket bog (active) [*7130], Wet heath [4010], Dry heath [4030], Calcareous grassland [6210], *Molinia* meadow [6410] and a Petrifying spring [*7220]. There are also significant areas of habitat types of a local biodiversity value that will be lost: calcareous springs, reed and large sedge swamps, dry-humid acid grassland, poor fen and flush, broadleaved woodland, hedgerows and treelines. Habitat losses, regardless of their own habitat value, also have the potential to have an effect on the local fauna populations that they support. The most significant impact in that regard are the likely effects of habitat loss on the local bat populations; particularly the Menlo Castle Lesser horseshoe bat population (impacts on bats are discussed separately below).

The losses of areas of Annex I habitat associated with the Project are considered to be at the highest level of geographic significance for the habitats involved. In addition, the Project will be contributing to an existing trend of Annex I habitat loss locally. While the cumulative effect of habitat losses would increase the magnitude of the impact, it does not increase the geographic scale of the impact significance associated with the Project. The protective polices in the *Bearna Local Area Plan 2015-2021*[3], the *Galway City Council Development Plan 2017-2023/ 2023-2029* and the *Galway County Development Plan 2015-2021/ 2022-2028* to protect biodiversity will moderate any future impacts on biodiversity, including those related to Annex I habitat types. Where the losses can be compensated for (see Section 8.9, Chapter 8, Biodiversity), this offsets the contribution of the Project to existing losses of the habitat type in question whilst ensuring that there is no potential for other developments to result in a likely significant cumulative impact either pairwise with any other projects or collectively.

In relation to areas of locally important habitats that will be lost, given the habitat types involved and that at any greater geographic scale they are likely to remain in a favourable conservation condition, any cumulative losses of these habitat types are not likely to increase the impact significance already assessed for the Project itself. The protective polices in place in the land use plans will also moderate any future losses of habitats of a biodiversity value. Where habitat losses can be compensated for this would also reduce the impact significance and the potential for any cumulative impacts with any future developments.

Therefore, there are no likely significant cumulative impacts (either pairwise with any other projects or collectively), predicted in addition to the residual impacts for the Project regarding habitat as detailed in Section 8.7 of Chapter 8 of the updated EIAR.

21.6.1.2 Impacts on Peregrine falcon

Due to the potential for long-term disturbance and displacement of the Lackagh Quarry Peregrine falcon pair from the existing nest site, the Project is likely to result in a significant negative residual effect on Peregrine falcon, at the county geographic scale.

The two other Peregrine falcon nest sites that are present locally are likely to continue to support breeding Peregrine falcon. One site is a disused quarry which is zoned for agricultural use and is therefore, not likely to see any increased disturbance from development; the second nest site is a regularly occupied site in an active quarry and the baseline levels of disturbance, to which the resident Peregrine pair are habituated, are likely to remain. Neither of these sites are likely to be affected by any of the projects assessed and detailed in in Appendix A.21.1, given their locations relative to where those strategies/projects will be implemented. Existing pressures at the county level on suitable nest site availability are expected to continue and may act cumulatively at the county geographic scale, but there is not sufficient data available to quantify this. However, any additional pressures on the Peregrine falcon population will not increase the overall significance of the impact of the Project above the county level assessed impact given that the species is currently considered to be of a low conservation concern for its national population.

Therefore, there are no other planned and/or committed projects that are likely to cumulatively act along with the Project (either pairwise with any other projects or collectively), to increase the predicted impact

[3] Bearna Local Area Plan 2015-2021 was incorporated into the Galway County Development Plan, by way of a variation to the Galway County Development Plan 2015-2021. Within the current Galway County Development Plan 2022-2028, the area of Bearna is included in the Galway County Metropolitan Area Settlement Plan (Volume 2, Section 2.6 of the Galway County Development Plan 2022-2028).

significance of the Project on Peregrine falcon from the likely significant negative residual effect, at the county geographic scale.

21.6.1.3 Impacts on bats

The predicted residual impacts on bats include loss of roosts, loss of foraging habitat and the barrier/severance effect posed by roads.

Some proportion of existing roost sites in the vicinity of the Project may deteriorate over time and become unsuitable for bats to use (e.g. derelict structures and old trees). Therefore, the roost sites that will be affected by the Project could potentially contribute to such natural declines in other roost sites locally.

Loss of foraging habitat and barriers to bat movements may result from development of zoned land within the east, northern and northwestern fringes of Galway City. Lands used by bats which are also zoned for development include residential zoning (R) at Letteragh Road, Community and Institutional Zoning (CF) at Merlin University Hospital, and light industrial zoning (C2.1/CI) near the N84 Headford Road and Ballindooley, which may affect the proposed artificial roost via increased light spill. The recreation and amenity zoning at UoG may also interact with the flight paths of bats moving between the Aughnacurra roosts and Menlo Castle and the use of those lands by foraging bats (e.g. where additional lighting may be proposed in the future).

However, all of these impacts would be controlled by the assessment of individual planning applications which would consider the effects on protected species such as bats as part of their appraisal by the competent authority, having regard to the protective environmental policies outlines in the *Bearna Local Area Plan 2015- 2021*, the *Galway City Development Plan 2017-2023/2023-2029*, the *Galway County Development Plan 2015-2021/ 2022-2028* and the *Ardaun Local Area Plan 2018-2024* to protect biodiversity[4].

Therefore, there are no likely significant cumulative impacts (either pairwise with any other projects or collectively), predicted in addition to the residual impacts for the Project regarding loss of foraging habitat or from barriers to bat movement.

21.6.1.4 Overall conclusion of cumulative impacts on Biodiversity

While the potential for cumulative impacts were identified in relation to the residual effects of the Project, alongside other projects, plans, programmes, and strategies, there is no real likelihood of significant cumulative effects on biodiversity that would alter the conclusions of the environmental impact assessment presented in this updated EIAR.

The potential for cumulative impacts has been ruled out for a number of these projects, either due to the low ecological value of many sites or the location, design, or nature of the other projects. There are other applications which have been refused planning consent or have been withdrawn or invalidated and these have not been considered or assessed in this section.

There are no likely significant cumulative impacts (either pairwise with any other projects or collectively), predicted in addition to the residual impacts for the Project regarding habitat loss, Peregrine falcon and loss of foraging habitat or from barriers to bat movement.

21.6.2 Soils & Geology

Section 9.8 of Chapter 9, Soils and Geology of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could result in likely significant cumulative impacts on soils and geology.

Planned and/or committed projects within 250m of the Assessment Boundary have been assessed in order to consider and assess any likely significant cumulative effects (at both construction and operation) from a soils

[4] For example, Policy 4.2 of the *Galway City Council Development Plan 2017-2023* which states

"Protect and conserve rare and threatened flora and fauna and their key habitats, (wherever they occur) listed on Annex I and Annex IV of the EU Habitats Directive (92/43EEC) and listed for protection under the Wildlife Acts 1976-2000."

and geology perspective. A detailed pairwise assessment is presented in Appendix A.21.1, a summary of the assessment is detailed below.

Potential cumulative effects on soils and geology can occur when other planned and/or committed projects in the locality have similar potential effects soils and geology as the Project. Likely significant cumulative impacts have been assessed based on the residual effect of these effects on the planned and/or committed projects, within the soils and geology study area in combination with the Project.

From a soils and geology perspective, most of the planned and/or committed projects which involve new development will result in the loss or damage to topsoils, subsoils and solid geology, where the cumulative magnitude of the loss is considered small adverse and therefore will not result in a likely significant cumulative effect on soils and geology. New developments will also result in effects to the surrounding ground, including excavation of potentially contaminated ground, but the cumulative magnitude of the effect is considered small adverse and therefore will not result in any likely significant cumulative effects on soils and geology during the Construction phase of the Project.

In relation to the pairwise cumulative assessment, given that there are likely significant direct or indirect effects of the Project on soils and geology, then when the Project is assessed cumulatively with each of the other planned and/or committed projects at an individual level on soils and geology, there will be cumulative impacts.

Further, when the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant effects on soils and geology due to the significant/moderate residual effect on Limestone pavement (outside of European designated sites) and significant/moderate residual effect on the county geological heritage area of rock cutting along the N6 in Doughiska. Cumulatively, the significance of these cumulative effects remain as significant/moderate adverse.

21.6.3 Hydrogeology

Section 10.8 of Chapter 10, Hydrogeology of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect on hydrogeology. Other projects have the potential to generate cumulative impacts in terms of deterioration of groundwater quality or changes to groundwater quantity. The residual impacts from the Project relate to areas where drawdown occurs in cuttings along the alignment or where groundwater quality could reduce due to accidental spills. All residual water quality impacts remain within the construction or operation footprint of the Project. However, some drawdown effects may extend outside of the construction and operation footprint.

Planned and/or committed projects within 250m of the Assessment Boundary have been assessed in Section 10.8 of Chapter 10 in order to predict any likely significant cumulative effects (at both construction and operation) from a hydrogeological perspective as this offset of 250m will pick up any overlap of drawdown from the Project.

There is one project (planning reference 24/60270 which is under appeal to ABP) where there may be hydrogeological interaction. This is a housing development that is located adjacent to a road cutting of the proposed Project. The cutting is constructed through the local granite bedrock and there is likely to be a permanent lowering of groundwater level, which is conservatively calculated to extend onto the third-party land and which could give rise to potential for soil settlement and subsidence at the proposed houses if they are constructed in advance of the proposed N6 GCRR. As per the monitoring commitments of the Project, all buildings that lie within 50m of the Assessment Boundary or within 50m of the calculated drawdown extent (whichever is the greater) will be offered a property condition survey. Mitigation will require condition survey and monitoring of ground stability prior to, during and after construction, to protect these houses. Therefore, whilst there is a potential interaction between the housing project and the Project, there is no cumulative effect post mitigation measures.

The pairwise assessment and an assessment of the Project versus all other projects is presented in Appendix A.21.1, a summary of which is detailed below.

In relation to the pairwise cumulative assessment, given that there are likely significant direct effects from the Project, then when the Project is assessed cumulatively with each of the other planned and/or committed projects at an individual level on hydrogeology, there will be cumulative significant effects.

Further, when all the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant hydrogeological effects due to the groundwater lowering below five Annex I habitat and four non-Annex I habitats.

21.6.4 Hydrology

Section 11.8 of Chapter 11, Hydrology of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect on hydrology. This section of Chapter 11 discusses various planned projects which share an interaction with the Project due to consideration of the surface water environment, including hydrodynamics, flood risk and flood impact and sediment transport, salinity and water quality.

A review of planned and/or committed projects identified a substantial number of large residential developments, student accommodation developments, and a number of hotel developments with extensions or new constructions. The majority of the planned and/or committed projects within the Galway City and environs area (which includes Bearna and Oranmore urban areas) connect to the public foul sewer network that ultimately reaches the Mutton Island Waste Water Treatment Plant where it undergoes secondary and tertiary sewage treatment before discharging into Inner Galway Bay c.200m south of Mutton Island via the Mutton Island Marine Outfall. The Mutton Island treatment plant is operated by Irish Water, is subject to a discharge license from the EPA, and has been designed to cater for Galway City population increase in the medium term (c.20 years).

Therefore, none of these developments will individually or cumulatively impact on the hydrological and coastal processes regime of the River Corrib, its estuary or the transitional and coastal waters of Galway Bay including the existing Galway Harbour area and Lough Atalia and Renmore Lough, Salthill and Oranmore and Bearna shoreline areas.

The Project itself involves relatively minor connections to the public foul sewer network associated with the two tunnel sections of the road, the pavilion and stables at Galway Racecourse and will result in minimal to imperceptible contribution to the overall existing foul load on both the public sewerage network and the sewage load to be treated at Mutton Island. There will be insignificant cumulative impact between the Project and all granted, in-construction and planned development in respect to the foul sewer network capacity and the loading on the Mutton Island WWTP and the ultimate discharge of treated effluent into the coastal and transitional waters of Inner Galway Bay off Mutton Island.

The primary impact of such urban developments is the potential generation of greater stormwater runoff rates as a result of increased impervious areas. Water quality impacts associated with increased urbanisation include the release of pollutants (associated heavy metals and hydrocarbons) in the routine storm water runoff from trafficked areas and increase sediment runoff from such impervious surfaces. The Project will also contribute to increased impervious area as identified in the hydrology assessment. The drainage from the impervious area of the Project discharges via storm outfalls either to the local streams and rivers primarily on the west side of the River Corrib, to the groundwater aquifer on the eastern side and a number of connections to the existing public storm water sewer. In keeping with the general National Policy (Dublin City strategic Drainage Study) and with the Galway City and Galway County Development plans the stormwater from the Project will be managed using natural retention measures and SUDs (Sustainable Urban Drainage systems) to limit the storm water runoff rates to greenfield runoff rates and water quality treatment and protection measures in the form of wetland retention ponds, petrol interceptors and infiltration systems have been designed for all of the proposed storm water outfalls. This policy of storm water management applies to all urban developments on greenfield sites and therefore there should be no potential for significant cumulative impacts from storm water drainage on receiving waters, river, estuarine, lake, coastal and groundwater systems. The stormwater management on all other planned and/or committed projects will also ensure that cumulatively these other projects do not increase the flood risk.

A detailed pairwise assessment is presented in Appendix A.21.1, and a summary of the assessment is detailed below.

There are no likely significant direct or indirect cumulative effects of the Project cumulatively with all the other planned and/or committed projects at an individual level on hydrology during the Construction and Operation of the Project.

There are no projects either planned, approved or in construction that would in-combination with this Project or cumulatively with all other projects and this Project give rise to any significant hydrological impact on the surface water environment, including hydrodynamics, flood risk and flood impact and sediment transport, salinity and water quality.

21.6.5 Landscape & Visual

Section 12.8 of Chapter 12, Landscape and Visual of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant landscape and/or visual effect. All planned and/or committed projects listed in Appendix A.21.1 were assessed in relation to landscape and visual. This section of Chapter 12 discusses various planned projects which share an interaction with the Project from a landscape and visual perspective, with projects identified according to the methodology detailed in Section 21.5.2. Thereafter, projects have been scoped for assessment based on relative proximity and potential visual connection between developments.

In this context, further education-related and sports and amenity developments, plus the recent grant of permission for St. Joseph's Patrician Secondary School are likely within the grounds of University of Galway Sports Campus on the west bank of the river. There are some areas of residential zoning at Trusky East, Ballymoneen, Rahoon, Letteragh, Ballindooley and Castlegar and on-going residential and associated open space development is a noticeable feature along sections of the Project. Clusters of residential development are also on-going in the townlands of Ballynahown East/Ballyburke/Ballymoneen Road, Mincloon/Rahoon Road, Letteragh, and at Barnacranny/Upper Dangan. These developments, (as detailed in Table 12.9 of Chapter 12) are located on zoned lands on the existing developed edge of the city or of Bearna and will not give rise to significant landscape and visual impacts or cumulative impacts.

The eastern end of the Project falls within the area covered by the Arduan Local Area Plan (LAP), which includes new residential and commercial developments on c.81 hectares of an overall LAP area of c.164 hectares on the east side of the city. The Galway Transport Strategy (GTS) also envisages further transport-related developments, including public transport and cycleway and greenway measures. The Galway Harbour Port Extension project is at planning stage. However, it is not expected that any significant cumulative landscape or visual effects will arise from these projects that will add to effects of the Project.

A detailed pairwise assessment is presented in Appendix A.21.1, and a summary of the assessment is detailed below.

In relation to the pairwise cumulative assessment, given that there are likely significant direct effects from the Project on landscape and visual, then when the Project is assessed cumulatively with each of the other planned and/or committed projects at an individual level on landscape and visual, there will be cumulative significant effects.

Further, when the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant effects as it is assessed that construction and operation of the Project on its own gives rise to significant, very significant and profound landscape and visual impacts at specific locations. These impacts are generally focused within the immediate corridor of the proposed N6 GCRR on the urban/rural edge of the city.

In summary it is considered that there is limited potential for any significant cumulative impacts with other planned or potential developments and that these will not further increase the adverse or negative impacts associated with the Project.

21.6.6 Cultural Heritage

Section 13.8 of Chapter 13, Cultural Heritage of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect on cultural heritage.

All planned and/or committed projects listed in Appendix A.21.1 have been assessed for cumulative impacts with respect to cultural heritage.

The assessment of cumulative effects from the construction and operational phases of the Project have been assessed in order to predict any cumulative effects (at both construction and operation) upon the cultural heritage resource.

Proposed and permitted developments within a 250m buffer from the Assessment Boundary was considered an appropriate buffer as an impact on the Cultural Heritage can only be considered where there is a physical overlap of the Project Assessment Boundary and the application. Developments that have already been constructed have been screened out, due to the fact that they now form part of the cultural heritage receiving environment. Developments that comprise change of use and internal changes (within existing buildings) are screened out as none of these development types would result in impacts on the cultural heritage resource.

The cumulative assessment of the Project on the cultural heritage resource are detailed in Appendix A.13.13. No significant cumulative impacts have been identified when all planned and/or committed projects are considered.

A detailed pairwise assessment is presented in Appendix A.21.1, and a summary of the assessment is detailed below.

In relation to the pairwise cumulative assessment, there are no likely significant direct or indirect cumulative effects of the Project cumulatively with the other planned and/or committed projects at an individual level on cultural heritage during the construction and operation of the Project.

There are no projects either planned, approved or in construction that would in-combination with this Project or cumulatively with all other projects and this Project give rise to any significant cultural heritage impacts.

21.6.7 Material Assets – Agriculture

Section 14.8 of Chapter 14, Material Assets – Agriculture of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect.

The cumulative impact on agriculture is appraised by assessing the impact of the Project in combination with other planned and/or committed projects, such as the GTS measures, greenways and proposed developments, which could have the potential for cumulative agricultural effects with the Project. Whilst there were a significant number of developments reviewed, some are proposed on plots that are currently non-agricultural and those screened out. The assessment of the remaining planned and/or committed projects with potential for cumulative impacts are detailed in Appendix A.14.2.

The proposed greenway from Galway to Oughterard affects two land parcels affected by land acquisition for the proposed N6 GCRR. The impacts of the Greenway do not add significantly to the impacts of the proposed N6 GCRR on these two land parcels.

The are 23 planned developments located within the agricultural study area for the Project, which result in six significant adverse and two very significant adverse cumulative effects on the individual land parcels affected by those developments. However, the cumulative effects of land loss (approximately 25 hectares) due to the combined 23 planned developments would have a not significant on agriculture within the study area (low magnitude of impact on a low sensitivity baseline). The cumulative effects of land loss (approximately 50 hectares) due to the 55 planned developments located outside the agricultural study area for the Project would have a not significant effect on agriculture within the study area.

Therefore, the Project, either assessed on its own, or in combination with other planned developments, will have a moderate adverse effect on agriculture within the study area – that is to say the other planned developments will not significantly change the overall impact on the agricultural study area.

These recently constructed and planned projects in combination with the Project will require <1% of the agricultural area of County Galway (337,000 ha[5]). When considered along with upward agricultural

[5] Table 2.2 of 2020 Preliminary Census of Agriculture Results available in CSO.ie.

productivity trends[6] the cumulative impact on agriculture in County Galway from the Project in combination with all the existing and planned projects is not significant.

A detailed pairwise assessment is presented in Appendix A.21.1, and a summary of the assessment is detailed below.

In relation to the pairwise cumulative assessment, there are no likely significant direct or indirect cumulative effects of the Project cumulatively with the other planned and/or committed projects at an individual level on agriculture during the construction and operation of the Project.

There are no projects either planned, approved or in construction that would in-combination with this Project or cumulatively with all other projects and this Project give rise to any significant agriculture impacts.

21.6.8 Material Assets – Non-Agriculture

Section 15.8 of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect from a material asset – non-agricultural perspective.

All planned and/or committed projects listed in Appendix A.21.1 have been assessed in relation to material assets non-agriculture.

Planned and/or committed projects within 50m of the Assessment Boundary have been assessed in order to predict any cumulative effects (at both construction and operation) upon the material assets non-agriculture. A 50m buffer from the Assessment Boundary was considered an appropriate buffer as an impact on the material assets non-agriculture can only be considered where there is a physical overlap of the Project Assessment Boundary and the application.

The Project overlaps with several other planned and/or committed projects in the form of overlapping road bed, interaction of services, or overlapping infrastructure where each accommodates the other with matching proposals. The cumulative assessment of the Project on the Material Assets – non-agriculture are detailed in Appendix A.21.1. It is assessed that construction and operation of the Project on its own gives rise to significant, very significant and profound material assets non-agriculture effects impacts at specific locations.

In relation to the pairwise cumulative assessment, given that there are likely significant direct effects from the Project on material assets non-agriculture, then when the Project is assessed cumulatively with each of the other planned and/or committed projects at an individual level on material assets non-agricultural during the construction and operation of the Project, there will be cumulative significant effects.

Further, when the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant effects as it is assessed that construction and operation of the Project on its own gives rise to significant, very significant and profound material assets non-agricultural impacts at specific locations.

21.6.9 Air Quality

Section 16.8 of Chapter 16, Air Quality of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect on air quality.

All planned and/or committed projects listed in Appendix A.21.1 have been assessed for cumulative effects with the Project with respect to Air Quality within a 500m of the Project's Assessment Boundary.

In accordance with the TII Standard, sensitive human receptors located within 250m of the proposed Project Assessment Boundary require an assessment of air quality effects. In order to account for 250m from the

[6] From 2010 – 2020 cattle numbers and sheep numbers increased by 7% and 14% respectively – source CSO Table AAA08 of 2010 census and Table 4.4, 2020 Agri-census Preliminary Results available at https://www.cso.ie/en/releasesandpublications/ep/p-coa/censusofagriculture2020-preliminaryresults/livestock/.

other project, projects which are located outside of 500m from the Project Assessment Boundary were excluded from the assessment of potential construction dust effects.

Following the implementation of mitigation measures provided for the purposes of the Project and the individual projects listed in Appendix A.21.1, no significant adverse cumulative effects are likely to arise at an individual level on air quality during the construction phase.

The operational phase air quality assessment is based on traffic data at the year of opening and at design year which is a further 15 years later. The traffic model includes forecasted growth in population aligned to landuse plans. This alignment with the landuse plans enables prediction of future traffic forecasts as the forecasts include for planned and/or committed projects. The traffic model builds in future traffic growth which relates to other future development (refer to Section 6.2 of Chapter 6 of this updated EIAR for further details). On this basis, the operational phase assessment included in Section 16.5.4 of Chapter 16, Air Quality is inherently cumulative as is based on future traffic forecasts which already account for all future development.

A detailed pairwise assessment is presented in Appendix A.21.1, and a summary of the assessment is detailed below.

In relation to the pairwise cumulative assessment, there are no likely significant direct or indirect cumulative effects of the Project cumulatively with the other planned and/or committed projects at an individual level on air quality during the construction and operation of the Project.

There are no projects either planned, approved or in construction that would in-combination with this Project or cumulatively with all other projects and this Project give rise to any significant air quality impacts as the Project assessment already assesses these cumulatively.

21.6.10 Climate

Section 17.8 of Chapter 17, Climate, of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect on climate.

All planned and/or committed projects listed in Appendix A.21.1 have been assessed in relation to climate.

The assessment of residual effects as described in Section 17.8 of Chapter 17, Climate, considers that the Project is expected to have a permanent moderate adverse effect on climate during over its lifecycle. This level of impact assessment is based on the TII Climate Standard significant criteria which is determined in the context of the Project's alignment to Ireland's trajectory of net zero. The study area for the climate assessment encompasses the Republic of Ireland as the Project is assessed relative to national climate commitments and carbon budgets. Therefore, the assessment of the Project relative to Ireland's national carbon reduction target is inherently cumulative.

The EPA is the Competent Authority with responsibility for developing, preparing and publishing projections of greenhouse gas emissions for Ireland. The EPA produces national greenhouse gas emission projections on an annual basis. These projections are compiled in line with European Union (EU) guidelines to meet EU reporting obligations. In May 2024, the EPA produced its projections for the period 2023 to 2050 EPA-GHG-Projections-Report-2022-2050-May24--v2.pdf. These projections include for emissions associated with the transport sector. Therefore, it is reasonable to assume that carbon emissions are cumulatively accounted for under the EPA projections.

The CAP24 outlines measures to achieve Ireland's climate commitments and carbon budgets on a national level through mitigation. CAP24 sets out measures to reduce carbon emissions in electricity, industry, buildings, transport and agriculture to ensure these commitments are reached. These measures are applied at a national level to cumulatively reduce carbon emissions on a national basis. The implementation of these measures will have the effect of cumulatively reducing the climatic effects of the Project and other plans/projects.

A detailed pairwise assessment is presented in Appendix A.21.1, and a summary of the assessment is detailed below.

In relation to the pairwise cumulative assessment, when each other project is assessed cumulatively with the Project, there are likely significant cumulative effects of the Project with the other planned and/or committed projects at an individual level on climate during the construction and operation of the Project.

Further, when the planned and/or committed projects are all assessed together cumulatively with the Project, there will be a permanent moderate adverse effect on climate.

21.6.11 Noise & Vibration

Section 18.8 of Chapter 18, Noise and Vibration, of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect on noise and vibration.

All planned and/or committed projects listed in Appendix A.21.1 have been assessed in relation to noise and vibration.

Planned and/or committed projects within 300m of the Assessment Boundary were screened to assess for potential cumulative noise impacts. Planned and/or committed projects beyond this distance will not contribute any significant construction noise impacts at NSLs in the vicinity of the Project due to distance attenuation and the calculated construction noise levels at this distance.

Cumulative traffic noise impacts for the opening and design year of the Project have been assessed at each of the receptor locations considered as part of the cumulative assessment. During the Do-Minimum scenario, road traffic flows along the existing road network have been modelled and the cumulative traffic noise level calculated. For the modelled Do-Something scenarios, road traffic along the existing road network coupled with traffic along the proposed N6 GCRR are combined to obtain a cumulative traffic noise level. The assessment takes account of any alignment alterations to the existing roads and junction and the re-distribution of traffic along the existing road network as a result of the proposed N6 GCRR. Operational traffic modelled for the assessment years of the Project has included for significant population growth in Galway City in line with NPF forecasts to include additional residential and planned development.

Whilst works associated with the Project will be the dominant noise and vibration source at any one location in its vicinity, a review of potential cumulative construction noise impacts was undertaken assuming all proposed developments would be under construction at the same time as the Project.

Out of the projects brought forward for assessment, a total of 12 were deemed to have potential cumulative construction impacts with the Project should they be under construction at the same time. Likely cumulative impacts are only predicted if both the Project and the planned and/or committed project undergo excavation activities at the same time. These were assessed and are not deemed to be significant.

No significant post construction cumulative impacts have been identified when all planned and/or committed projects are considered.

A detailed pairwise assessment is presented in Appendix A.21.1, and a summary of the assessment is detailed below.

In relation to the pairwise cumulative assessment, there are no likely significant direct or indirect cumulative effects of the Project cumulatively with the other planned and/or committed projects at an individual level on noise and vibration during the construction and operation of the Project.

There are no projects either planned, approved or in construction that would in-combination with this Project or cumulatively with all other projects and this Project give rise to any significant noise and vibration impacts.

21.6.12 Population & Human Health

Section 19.8 of Chapter 19, Population and Human Health, of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects or plans could cumulatively result in a likely significant effect on population and human health.

All planned and/or committed projects listed in Appendix A.21.1 have been assessed for cumulative impacts in relation to population and human health.

21.6.12.1 Population

The proposed Project will improve accessibility both within and to/from Galway City and connectivity between areas outside of the city including Connemara, the east and northwest. As a result, there are significant potential positive effects which will benefit economic and regional development, including tourism.

The improved accessibility and connectivity provided by the Project will also stimulate new physical residential, commercial or tourism development. Such developments as included in Appendix A.21.1, would be subject to planning assessment given the objectives set out in the Galway City and Galway County Development Plans to consolidate development and to provide for balanced sustainable development and therefore should not add cumulative impacts with the Project.

The Project will also provide an opportunity for the optimal implementation of the GTS and to provide for improved public transport and facilities for pedestrians and cyclists. Once implemented, this will have a very significant effect on safety and the journey amenity of pedestrians and cyclists, and on general environmental quality and potentially reduce carbon emissions if this contributes to a modal transfer from vehicles. The other projects following proper planning assessment will adopt similar principles and overall cumulatively there will be a positive impact with the Project.

The cumulative effects of the projects listed in Appendix A.21.1 in association with the Project are significantly positive from journey amenity and journey characteristics. However, it is assessed that construction and operation of the Project on its own gives rise to significant and very significant impacts at specific locations arising from the demolition of 44 dwellings and further acquisition of 10 dwellings on those involved in the compulsory purchase process but also the integrity of the communities left behind in terms of their identity.

21.6.12.2 Irish Language

Having considered the Project in tandem with other relevant plans or projects identified above, it is considered that no significant negative cumulative impact upon the status of Irish as a community language will occur. The Project itself is expected to have a moderate positive residual impact on the status of Irish as a community language within the Galway Gaeltacht area, and therefore, the cumulative impact assessment of it and other projects is positive.

21.6.12.3 Human Health

It is not considered that there will be any negative cumulative effects on human health, and the assessment is set out in Section 19.8 of this updated EIAR. The distances between the projects assessed in Appendix A.21.1 and the Project results in no cumulative noise or air quality impacts. There is potential that reduced journey times and fewer unforeseen delays could have a potential positive benefit on psychological health. Any projects which make roads safer and reduce the probability of road accidents and fatalities can only be seen in positive terms from a human health perspective. An increase in the number of people cycling will have positive health impacts. In addition, the changes in accessibility for key locations illustrates that, in general, most zones experience a decrease in car journey times. There are however, a small number of zones, mostly in the city centre, which are expected to experience an increase in car journey times to access key sites. This is as a result of the public transport priority measures, such as private vehicle restrictions on Salmon Weir Bridge, which make accessing these areas by car more difficult, but this is expected given the restrictions and will discourage car usage through the city centre. A comparison of these benefits with the deprivation index show that, in general, the benefits of the Project are distributed evenly between disadvantaged and more affluent areas. All other projects also will be assessed at planning on similar principles and will not add significant negative impacts when assessed cumulatively with the Project.

A detailed pairwise assessment is presented in Appendix A.21.1, and a summary of the assessment is detailed below.

In relation to the pairwise cumulative assessment, given that there are likely significant direct effects from the Project, then when the Project is assessed cumulatively with each of the other planned and/or committed projects at an individual level on population, there will be cumulative significant effects both positive and negative.

Further, when all the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant population effects due to the demolition of property.

In relation to the pairwise cumulative assessment, there are no likely significant direct or indirect cumulative effects of the Project cumulatively with the other planned and/or committed projects at an individual level on human health during the construction and operation of the Project.

There are no projects either planned, approved or in construction that would in-combination with this Project or cumulatively with all other projects and this Project give rise to any significant negative human health impacts.

21.6.13 Waste and Resource Management

Section 20.8 of Chapter 20, Waste and Resource Management of this updated EIAR presents the assessment carried out to examine whether the Project along with any other planned and/or committed projects could cumulatively result in a likely significant effect on waste.

The assessment concluded an outcome of a negative, slight, short-term cumulative effect on the capacity of waste management facilities and waste industry trends in Ireland during the construction phase due to an increased demand on waster recovery and/or disposal sites. This is as a result of the potential cumulative effect of the projects that were 'screened in' to the assessment should the construction of the Project proceed in parallel or overlap with the construction of these projects.

As noted in Chapter 20, waste management effects from the Project alone on the capacity of waste management facilities and waste industry trends in Ireland during the construction phase due to an increased demand on waste recovery and/or disposal sites will range from negative, imperceptible to negative, slight. Significant volumes of C&D waste are generated every year, with over 8 million tonnes generated nationally in 2022 in Ireland, noting that the EPA report that Ireland achieved 82% material recovery of construction and demolition waste in 2022. The majority of waste generated during the construction of this Project includes demolition waste and excavation waste as construction waste and municipal waste generation will be minor. Given the high rate of recovery from construction and demolition waste, when combined, these waste types give an overall estimate of less than 1% of the total waste generated nationally per annum.

On this basis, this low level is assessed as not significant at a regional level and no significant adverse cumulative effects during the construction phase due to an increased demand on waste recovery and/or disposal sites are likely to arise on waste because of this Project. As the assessment is conducted at a regional level, noting that the volumes above are relevant to a national level, there are no significant adverse effects when this Project is assessed cumulatively with other projects.

The assessment concluded that there are no likely significant cumulative effects on resource use during the construction phase or resource use and waste management during the operational phase of the Project.

21.6.14 Overall Cumulative Impact Assessment

As set out above, cumulative impact assessments under each environmental discipline for each of the identified planned and/or committed projects listed in Appendix A.21.1 with the Project have been set out in the relevant chapters of this updated EIAR at an individual level. This is the pairwise assessment and a summary of that assessment is provided in Sections 21.6.1 to Section 21.6.12 above. It is also combined in tabular form in Appendix A.21.1.

An assessment of the likely significant direct, indirect and cumulative impacts of the Project in combination with all of the planned and/or committed projects assessed (which as mentioned were also assessed individually against the Project in Appendix A.21.1) was undertaken and is presented in Appendix A.21.1. This has shown that no additional cumulative impacts other than those already identified in the individual assessments will arise.

Instances where the Project when assessed cumulatively with another individual planned and/or committed projects does give rise to cumulative impacts do contribute overall to the overall cumulative impact. The corollary to this is that there are overall cumulative effects in all instances whereby this Project retains a residual significant impact.

Table 21.11 Overall Cumulative Assessment

Reference	Potential Cumulative Impacts on Environmental Factors
Cumulative impact assessment of all the projects listed in Section 21.5 together with the Project	**Biodiversity:** The likelihood of significant cumulative effects to arise on biodiversity with projects as outlined in Appendix A.21.1 will not lead to the increase of significance of the residual impacts of the Project when assessed in isolation.
	Soils and Geology: When the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant effects on soils and geology due to the significant / moderate residual effect on Limestone pavement (outside of European designated sites) and significant / moderate residual effect on the county geological heritage area of rock cutting along the N6 in Doughiska arising from the Project.
	Hydrogeology: When all the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant hydrogeological effects due to the groundwater lowering below five Annex I habitat and four non-Annex I habitats.
	Hydrology: There is no potential for any significant negative direct or indirect cumulative impacts to arise taking the Project in combination with all the other planned and/or committed projects listed in Appendix A.21.1 given the nature and scale of those developments, their location and the mitigation measures included in the proposals.
	Landscape & Visual: When the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant effects as it is assessed that construction and operation of the Project on its own gives rise to significant, very significant and profound landscape and visual impacts at specific locations. These impacts are generally focused within the immediate corridor of the proposed N6 GCRR on the urban / rural edge of the city.
	Cultural Heritage: There is no potential for any significant negative direct or indirect cumulative impacts to arise taking the Project in combination with all the other projects planned and/or committed projects listed in Appendix A.21.1 given the nature and scale of those developments, their location and the mitigation measures included in the proposals.
	Material Assets – Agriculture: Considering the likely significant residual effects on agricultural property predicted in relation to the Project and considering the cumulative impact with all other planned and/or committed projects listed in Appendix A.21.1, there will be no significant cumulative impact on agriculture as a result of the Project in combination with any of the planned and/or committed projects
	Material Assets – Non-Agriculture: When the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant effects as it is assessed that construction and operation of the Project on its own gives rise to significant, very significant and profound material assets non-agriculture impacts at specific locations.
	Air Quality: There is no potential for any significant negative direct or indirect cumulative impacts to arise taking the Project in combination with all the other planned and/or committed projects listed in Appendix A.21.1given the nature and scale of those developments, their location and the mitigation measures included in the proposals.
	Climate: When the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant effects as it is assessed that construction and operation of the Project on its own gives rise to a permanent moderate adverse effect on climate.
	Noise & Vibration: There is no potential for any significant negative direct or indirect cumulative impacts to arise taking the Project in combination with all the other planned and/or committed projects listed in Appendix A.21.1 given the scale of those developments, and the mitigation measures included in the proposals
	Population: When the planned and/or committed projects are all assessed together cumulatively with the Project, there will be significant effects as it is assessed that construction and operation of the Project on its own gives rise to significant and, very significant negative population impacts at specific locations arising from the demolitions,

Reference	Potential Cumulative Impacts on Environmental Factors
	and very significant positive population impacts arising from the improved journey time and journey amenity.
	Irish Language: There is no potential for any significant negative direct or indirect cumulative impacts to arise taking the Project in combination with all the other planned and/or committed projects listed in Appendix A.21.1 given the nature and scale of those developments and their location.
	Human Health: There is no potential for any significant negative direct or indirect cumulative impacts to arise taking the Project in combination with all the other planned and/or committed projects listed in Appendix A.21.1 given the nature and scale of those developments and their location.
	Waste & Resource Management: There is no potential for any significant negative direct or indirect cumulative impacts to arise taking the Project in combination with all the other planned and/or committed projects listed in Appendix A.21.1 given the scale of those developments, and the mitigation measures included in the proposals

An assessment of the likely significant direct, indirect and cumulative impacts of the Project in combination with all of the planned and/or committed projects assessed was undertaken. This has shown that no additional cumulative impacts other than those already identified in the individual assessments will arise which means that cumulatively there are likely to be significant impact on biodiversity, soils and geology, hydrogeology, landscape and visual, material assets non-agriculture, population and climate.

21.7 Transboundary Impacts

Transboundary impacts relate to potential impacts on other Member States, i.e. outside of the Republic of Ireland. Given the location of the Project and extents of its zone of influence no transboundary impacts will arise.

21.8 References

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