Blessington eGreenway

Climate Impact Assessment

Wicklow County Council

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Quality information

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1. Introduction

This report considers the impact of the proposed development of a Greenway shared use path adjacent to Blessington Lake/Poulaphouca Reservoir (herein referred to as the "Proposed Development") on the climate as a result of greenhouse gas emissions (GHGs) that may arise during the construction and operational phases. This report also considers the impact of climate change on the Proposed Development.

The Site of the Proposed Development (herein referred to as "the Site") is located within Blessington, Co. Wicklow, with an approximate elevation of 213 m above sea level[1].The Proposed Development comprises a 3m to 4m wide shared use path (width varies along the path) which will be used by both pedestrians and cyclists. The path will be largely segregated from traffic where the greenway is adjacent to the public road and will have a total length of c.33km. The Proposed Development includes works to existing public car parks to provide bicycle parking, information boards, bins, seating areas, drinking water stations, electric vehicle charging points and CCTV. In addition, the car parks at Knockieran and Russellstown will be extended with provision for 50 additional car parking spaces at each location.

The greenway route will follow the predominantly planted conifer plantation around the lakeshore and for some sections there is an existing trail. The greenway surface construction is proposed to consist of a machine laid, bound pavement. Construction works will require shallow excavation (maximum depth of 200 mm - 300 mm), tree removal and replacement, placement of culverts, single span bridges over larger streams, fencing and minor landscaping.

Full details on the background, Site history and the Proposed Development is provided in Section 2 and 3 of the Planning Statement submitted with the planning application.

1.1 Purpose and Scope

The assessment of climate impacts can be divided into two categories as required by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) and in line with the Institute of Environmental Management and Assessment (IEMA) guidance for climate change mitigation[2] and adaptation[3];

- **Lifecycle GHG Assessment:** assessment of the impact of GHG emissions, arising over the life of the Proposed Development, on the climate.
- **Climate Change Resilience (CCR):** assessment of the vulnerability and resilience of the Proposed Development to the projected impacts of climate change.

Due to the different approach and outputs to the Lifecycle GHG Assessment and CCR Assessment this report keeps the two assessments separate.

[1] Approximate elevation of Blessington: Met Eireann Historical Data.
[2] IEMA (2022).
[3] IEMA (2020).

1.2 Assumptions and Limitations

The assessments presented in this report are subject to the following assumptions and limitations:

- The GHG assessment uses design information including material quantities, estimated fuel usage and transport assessments provided by the project team together with typical data from similar schemes.
- Where assumptions have been made due to a lack of project specific data at this design stage, they will be highlighted in Section 4.3 below. AECOM note that there are limitations in using data from an alternative project.
- Given the design stage of the Proposed Development, limited data was available for construction materials. The construction phase emissions presented in this report therefore reflect this limitation.
- There are inherent uncertainties associated with climate change projections, as detailed in Section 2.4.1. To overcome these, current climate change data and science have been incorporated into the assessment and proven effective approaches undertaken to assess similar project types have been replicated.
- Accuracy of the Climate Change Risk Assessment (CCRA) is somewhat limited by the accuracy of available historical meteorological data. Gaps and uncertainties in this data are detailed in Section 3.1.2.

2. Legislation, Policy and Guidance Context

This section identifies and briefly describes the legislation, policy and guidance of relevance to the assessment of potential impacts associated with the construction and operation of the Proposed Development on the climate and the impacts of climate change on the Proposed Development.

2.1 International Legislation, Policy and Guidance

EIA Directive 2014/52/EU (amended)[4]: An EU Directive on the assessment of the effects of certain public and private projects on the environment. Annex IV specifically requires that EIAs require information to be included on '*the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change*'.

Paris Agreement (Conference of the Parties No. 21, 2016) [5]: A legally binding agreement within the United Nations Framework Convention on climate change which requires all signatories to strengthen their climate change mitigation efforts to keep global warming to below 2°C this century.

Kyoto Protocol[6]: An international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC), which commits its Parties by setting internationally binding emission reduction targets. The current Effort Sharing Decision (ESD) commits Ireland to a 39% reduction in GHG emissions for the period 2021 to 2030.

EU Emissions Trading System (Directive 2003/87/EC (as amended))[7]. The EU's current binding target for 2030 is to cut GHG emissions by at least 40% below 1990 levels. This target is split across the EU Emissions Trading System (ETS) and non-ETS sectors. The ETS is a 'cap and trade' system where an EU-wide limit, or cap, is set for the overall volume of GHG that can be emitted by power plants, industry factories and the aviation sector. The cap is reduced over time so that total emissions fall. It covers about 45% of EU emissions, but only about 29% of total emissions in Ireland[8]. Since 2021, the overall European emissions cap has reduced by an annual rate of at least 2.2%. The trading system is pertinent to this Proposed Development as certain construction materials utilised in the Proposed Development will fall within the traded sector.

European Green Deal[9]: Policy initiatives by the European Commission aiming to improve the quality of life in the EU by making Europe GHG neutral by 2050. Under the European Green Deal a series of ambitious packages have been launched to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net GHG emissions. Amongst these initiatives are the EU Strategy on Climate Adaptation and the EU Taxonomy for sustainable activities.

[4] Official Journal of the European Union (2014).
[5] UNFCCC (2016).
[6] European Commission (2018).
[7] European Commission (2021).
[8] Government of Ireland (2019).
[9] European Commission (2019).

EU Effort Sharing Legislation[10]: Establishes binding annual GHG emission targets for Member States for the period 2021-2030. These targets concern emissions from most sectors not included in the EU ETS, such as transport, buildings, agriculture and waste.

2.2 National Legislation, Policy and Guidance

S.I. No. 93 of 1999[11] European Communities (Environmental Impact Assessment) (Amended) Regulation, 1999. Article 25 (2) (b) of this Regulation specifically requires an environmental impact statement to contain: '*a description of the aspects of the environment likely to be significantly affected by the proposed development, including in particular…climatic factors*'.

Climate Action and Low Carbon Development (Amendment) Act 2021[12]: This Act commits Ireland to move to a climate resilient and climate neutral economy by 2050. The Act brings in a requirement for 5-year carbon budgets to commence in 2021, the first two budgets demonstrating a 51% reduction against a 2018 baseline by 2030.

Climate Action Plan 2024[13]**:** The Climate Action Plan 2024 (CAP24) is the third annual update to Ireland's Climate Action Plan 2019. This plan is prepared under the Climate Action and Low Carbon Development (Amendment) Act 2021, and following the introduction, in 2022, of economy-wide carbon budgets and sectoral emissions ceilings. This plan sets out the roadmap to deliver on Ireland's climate ambition, providing a detailed roadmap to achieve a 51% reduction in GHG emissions by 2030 and achieve net zero emissions by no later than 2050. In order to meet these targets, there must be transformative behavioural and systemic change in the transport sector. The CAP 24 outlines how the growing demand for transport must be met in a sustainable manner by prioritising new public transport schemes, like Cork Area Commuter Rail (CACR), over road projects. Specifically, in relation to the transport sector, key actions include a 20% reduction in total vehicle kilometres, a reduction in fuel usage, and significant increases to sustainable transport trips and modal share.

Table 2-1: Proposed Carbon Budgets[14]

	2021-2025	2026-2030	2031-2035 (Provisional)
Carbon Budget (Mt CO2e)	295	200	151

National Energy and Climate Plan (NECP) 2021-2030[15]: The 2020 NECP incorporates all planned energy and climate policies and measures identified up to the end of 2019. The Plan has been created in part to support the EU's 2050 net zero target and strategy to develop an energy union to provide EU consumers secure, sustainable, competitive and affordable energy through the five dimensions. The five dimensions include:

[10] European Commission (2023).
[11] Irish Statute Books (1999).
[12] Government of Ireland (2021).
[13] Government of Ireland (2024).
[14] DECC (2022).
[15] DCCAE (2020a).

- Security, solidarity and trust.
- A full integrated internal energy market.
- Energy efficiency.
- Climate action, decarbonising the economy.
- Research, innovation and competitiveness.

White Paper Ireland's Transition to a Low Carbon Energy Future 2015-2030[16]: This white paper confirms the need to enhance energy security and to provide a reliable supply of gas to meet demand as part of a sustainable energy transition to a low carbon future.

National Adaptation Framework (NAF)[17]: Prepared under the Climate Action and Low Carbon Development Act 2015, the NAF was launched in January 2018 setting out the national strategy to reduce the vulnerability of the country to the negative effects of climate change and to avail of positive impacts.

Climate Guidance for National Roads, Light Rail, and Rural Cycleways (Offline & Greenways)[18]**.** Published by Transport Infrastructure Ireland (TII) provides guidance on the methodology, scope and processes underlying climate assessment (CA) for National Roads, Light Rail, and Rural Cycleways (Offline & Greenways) projects.

2.3 Local Policy

Wicklow County Council Climate Change Adaptation Strategy 2019[19]: Developed as part of the NAF, the strategy sets out the County Council's approach to climate change adaptation and proposed response to the impacts of climate change. This strategy aims to develop understandings of the key risks and vulnerabilities of climate change, bring forward the implementation of climate resilient actions and set out how climate adaptation considerations are mainstreamed into all plans and policies and integrated into all operations and functions of the local authority.

Wicklow County Development Plan (CDP) 2022-2028[20]**:** Climate Change is addressed throughout the CDP as a cross cutting theme. Chapter 2 sets out climate change as one of the overarching themes of the CDP, recognises the importance of mitigation and adaptation in Climate Change and incorporates climate change mitigation and adaptation into land-use planning, supported by land-use policies and objectives that where relevant incorporate objectives that both mitigate against the source of the causes of climate change and adapt to reduce the impacts of climate change.

2.4 Climate Context

The Intergovernmental Panel on Climate Change (IPCC) have confirmed in their Assessment Reports that the anthropogenic influence on the climate system is clear and growing with impacts observed

[16] DCCAE (2020b).
[17] Government of Ireland (2018).
[18] Transport Infrastructure Ireland (2022)
[19] Wicklow County Council (2019).
[20] Wicklow County Council (2022)

across all continents and oceans[21]. The concentration of CO_2 in our atmosphere has significantly increased due to human activities, with observed levels of global atmospheric CO_2 rising from their pre-industrial levels of 280 parts per million (ppm) up to 421 ppm as of June 2023[22]. Given CO_2 is a GHG that absorbs and radiates heat, these increases have resulted in the warming of Earth's atmosphere. According to an ongoing temperature analysis by NASA, the average global temperature on Earth has increased by at least 1.1 °C since 1880, with the rate of warming since 1981 at roughly 0.18 °C per decade[23].

The IPCC's Fifth Assessment Report (AR5) developed Representative Concentration Pathways (RCPs) to aid understanding of how the global climate may change in the future. RCPs describe four different 21st Century pathways of GHG emissions depending on the level of mitigation action undertaken between now and then[24]. They are based on global research and existing literature and comprise a stringent mitigation pathway (RCP2.6), two intermediate scenarios (RCP4.5 and RCP6.0) and a high emissions scenario (RCP8.5). Figure 2-1 shows the emission trajectories and projected global temperatures up to 2100 in terms of the IPCC's RCPs.

These emission pathways are used for developing climate change projections which can then be used by policymakers, scientists, and other professionals to estimate and plan for climate risks and impacts.

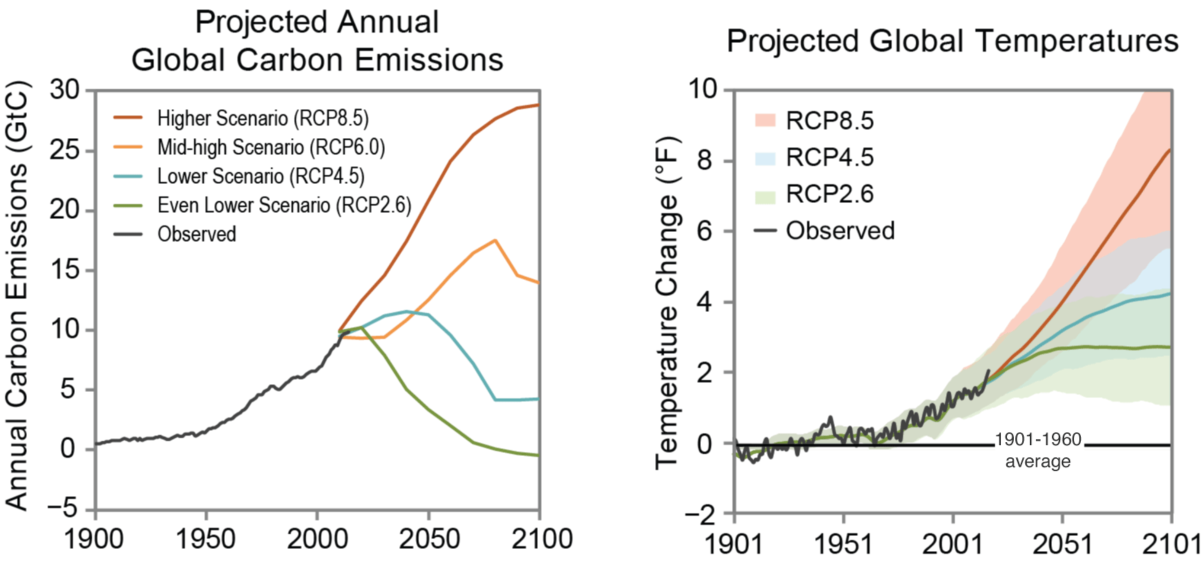

Figure 2-1 Annual Global Historical Temperature with Projected Annual Global Carbon Emissions (left) and Projected Global Temperatures (right)[25]

[21] IPCC (2014).
[22] NASA (2023).
[23] NOAA (2022).
[24] IPCC (2014).
[25] Wuebbles, D.J., *et al.,* (2017).

2.4.1 Climate Change Uncertainty

Climate change projections introduce inherent uncertainty as a result of limitations associated with available measurements and challenges in evaluating causation in complex and multi-component processes. Uncertainty in climate change projections is derived from multiple sources including:

- Uncertainty in how GHG emissions will change overtime due to key unknowns in the drivers of this change. Such drivers include economic and population growth, lifestyle and behavioural changes, associated changes in energy use and land use, technology, and climate policy.
- Variable confidence levels in how well the climate models predict different climate variables. For example, climate models perform less well in their simulation of large-scale precipitation patterns than for surface temperature. The certainty in the IPCC's key assessment findings is expressed as a qualitative level of confidence (from *very low* to *very high*)[26].

Such reasons highlight the importance to use a range of projection scenarios when considering how climate may change in the future, and to allow for the participants in the risk assessment process and the ultimate user of the risk assessment outcomes to be cognizant of the inherent uncertainty.

[26] IPCC (2014).

3. Climate Change Risk Assessment

3.1 Methodology

The methodology in this report has been developed in line with appropriate industry guidance for assessing climate change resilience and adaptation such as IEMA[27] and in accordance with the EU Commission Notice (2021/C 373/01) *Technical guidance on the climate proofing of infrastructure in the period 2021-2027*[28].

The assessment includes all infrastructure and assets associated with the Proposed Development. It assesses the resilience against both gradual climate change *i.e.*, chronic climate-related hazards and the risks associated with an increased frequency of severe weather events *i.e.,* acute events.

3.1.1 Asset Components

When conducting a robust climate change risk and adaptation assessment, it is important to understand the individual components that make up the asset as each may be vulnerable to different climate variables in different ways. The key asset components that have been considered in this climate assessment include:

- Pavements e.g., cycle path, road, car park.
- Earthworks & geotechnical assets.
- Vegetation & landscaping.
- Drainage.
- Signs, light posts, traffic lights, fences.
- Structures e.g., bridges, retaining walls.
- Utilities.
- Human health & safety e.g., staff, visitors.
- Construction equipment.

3.1.2 Climate Change Data

3.1.2.1 Climate Variables

To gain an understanding of the climate hazards relevant to the property locations, the Global Facility for Disaster Reduction and Recovery's (GFDRR) 'ThinkHazard!' tool was used. [29] This tool provides a high-level understanding of the hazards present within a select location. The results of the search for Co. Wicklow, are presented in Table 3-1 below.

[27] IEMA (2020).
[28] European Commission (2021).
[29] Global Facility for Disaster Reduction and Recovery's (GFDRR). 2020. ThinkHazard! Available from: https://thinkhazard.org/en/

Table 3-1: Hazard Level (based on the GFDRR's 'ThinkHazard!' tool)

Hazard type	Hazard level - Wicklow
Coastal flood	*Medium*
Urban flood	*Low*
River flood	*Very Low*
Extreme heat	*Low*
Wildfire	*Low*
Landslide	*No data*
Tsunami	*Low*
Earthquake	*Very Low*
Water Scarcity	*Very Low*
Volcano	*No data*
Cyclone	*No data*

It should be noted that for Ireland, ThinkHazard! only provides data at the county level, and therefore some hazards are more appropriate than others to the town of Blessington, where the Proposed Development is located.

Taking into account the outcomes from ThinkHazard!, the location of the Proposed Development and its proximity to rivers and the coast, and the classification of the asset as a cycleway/footpath; the following chronic and acute variables were identified as relevant for this assessment:

- **Temperature related**: changing air temperature, heat stress, temperature variability, frost days.
- **Wind-related**: changing wind patterns, storms.
- **Water-related**: changing precipitation patterns, drought, heavy precipitation, flood (including pluvial and coastal),
- **Other**: snowfall, frequency and severity of storms.

It should be noted that the climate screening (as per the TII Climate Guidance) was simplified to be proportional to the scale of this environmental assessment.

3.1.2.2 Climate Baseline Data

For the purposes of the CCR assessment, the baseline conditions are based upon historic climate change data. Data was obtained from Met Eireann[30] utilising two meteorological stations chosen based on their availability of data across the baseline period, proximity to the Proposed Development, and similarity in elevation to the Proposed Development.

Casement Weather Station, Co. Dublin, situated approximately 22.2 km from the site and ~91m in elevation, was used to extract data for climate variables including maximum and minimum temperature, wind speeds, and evapotranspiration. Ballymore Eustace Weather Station, Co. Kildare, situated

[30] Met Eireann Historical Data. Available from: https://www.met.ie/climate/available-data/historical-data

approximately 8.9 km from the site and ~172m in elevation was used to extract historical precipitation data.

As precipitation data is highly variable depending on elevation and location, it was important to gather historical precipitation data from a meteorological station located in close proximity to the Proposed Development site. As Ballymore Eustace Weather Station, Co. Kildare, only recorded precipitation data for the baseline period, an additional meteorological station, Casement Weather Station, Co. Dublin, was used to collate data for other climate variables, including temperature and wind speeds.

It should be noted that the historical data set collected by Ballymore, Eustice meteorological station has not recorded 9 whole months of precipitation data. This includes March 1986, May 1986, June 1986, March 1988, May 1988, June 1988, October 1988, November 1988, and September 1993.

Despite this, it was determined that Ballymore, Eustice meteorological station was the most suitable meteorological station to use for the baseline data exercise due to its similarity in elevation to the Proposed Development Site, with neighbouring meteorological stations with complete precipitation data sets largely greater in elevation to the Proposed Development Site. To overcome this issue, an average has been taken for each month of missing precipitation data across the entire baseline period, i.e., the average of all May months between 1981 and 2000 has been used for the missing data of May 1986, the average of all June months between 1981 and 2000 has been used for the missing data of June 1986 etc.

Data was collected for the climate variables described previously for the period 1981-2000. This baseline period was chosen as it matches the baseline period that the available climate change projections were based on.

All calculations on the baseline data range have taken these gaps into consideration. The historical data collected is provided in Table 3-4.

3.1.2.3 Climate Change Projection Data

For this CCR assessment, two climate change scenarios were reviewed to provide decision-makers with a more holistic understanding of the range of potential climate futures possible, which is essential when understanding risk and developing appropriate adaptation measures. These climate change projections were based on RCP 4.5 and RCP 8.5.

RCP 4.5 is an intermediate scenario and represents a less steep decline in GHG emissions than the targets in RCP 2.6. It requires that CO_2 emissions start declining by approximately 2045 to reach half of the levels by 2050 and decline to about 75% of the CH_4 levels of 2040. It also requires that SO_2 emissions decline to approximately 20% of those of 1980-1990.

RCP 8.5 was also used as it represents a worst-case scenario, which is useful in risk and contingency planning. This pathway has the highest emissions concentration and is marked by inadequate policy response and increased potential for physical asset damage.

The climate change projection data used was gathered from Climate Ireland. The data available on this platform is based on Nolan et al, 2020[31]. The Climate Data Explorer provides climate change projection data for a variety of climate variables for the period/s 2041-2060 (compared to a 1981-2000 baseline). The time period/s chosen for this assessment were 2041-2060. This period is relevant as it encompasses the large majority of the design life of the asset. The climate change projection data collected is provided in Table 3-4.

3.1.3 Risk Assessment

Using the climate change projection data gathered (refer to Table 3-4) a series of risks were identified for the climate hazards determined to be relevant to the Proposed Development. For each risk identified, the asset components impacted were noted and the planned or embedded controls identified. In this instance, embedded controls represent measures already included in the design and operation of the Proposed Development that work to mitigate climate risk. With this information, an initial assessment of climate change risk was undertaken based on an analysis of likelihood and consequence. Adaptation measures were then subsequently identified to further reduce risk and increased resilience, after which a residual assessment of risk was performed.

This assessment was informed by the risk framework and the descriptors of likelihood and consequence adopted from EU Technical guidance[32]. The likelihood and consequence descriptors and the risk matrix are provided in Appendix A with the risk matrix also provided in Table 3-2 below. When assessing the consequence of a specific risk, several categories were considered including:

- Asset damage/engineering/operational.
- Safety and health.
- Environmental.
- Social.
- Financial (for single extreme event of annual average impact).
- Reputation.
- Cultural heritage and cultural premises.

[31] Nolan, P., and J. Flanagan, 2020: High-resolution Climate Projections for Ireland – A Multi-model Ensemble Approach. Environmental Protection Agency. http://www.epa.ie/pubs/reports/research/climate/researchreport339/
[32] European Commission (2021).

Table 3-2: Risk Matrix

Likelihood \ Consequence	Insignificant	Minor	Moderate	Major	Catastrophic
Rare	Low (NS)	Low (NS)	Medium (NS)	High (S)	Extreme (S)
Unlikely	Low (NS)	Low (NS)	Medium (NS)	High (S)	Extreme (S)
Moderate	Low (NS)	Medium (NS)	High (S)	Extreme (S)	Extreme (S)
Likely	Medium (NS)	High (S)	High (S)	Extreme (S)	Extreme (S)
Almost certain	High (S)	High (S)	Extreme (S)	Extreme (S)	Extreme (S)

NS – Not significant; S - Significant

3.2 Baseline and Projected Environment

3.2.1 Climate Baseline Data

To effectively use climate change projections for the purpose of a risk assessment, it is necessary to first understand the historical climate conditions experienced at the location. Baseline climate data is provided in Table 3-4 whilst Section 3.2.1.1 provides information on past extreme events experienced at the Site of the Proposed Development.

3.2.1.1 Past Extreme Events

The following events are examples of extreme climatic conditions experienced at the Site location in the past:

- Highest recorded temperature was 29.8°C in July 1983.
- Lowest recorded temperature was -2.9°C in January 1987.
- Highest daily rainfall was 78.3 mm on 5th November 2000.
- Highest ten-minute mean wind speed was 83 knots on 24th December 1997.
- March 2011 flooding: Valleymount, to the south of the Poulaphouca Reservoir experienced flooding. The source of the flood waters was a tributary of the River Liffey. Flooding at the site is infrequent and a result of extreme heavy rainfall. Sections of the lake have been known to flood and there are previous flood events recorded in the western and eastern boundaries of the lake.
- March 2018 snowfall: Weather stations recorded depths of up to 69 cm of snowfall in Glenmacnass (Co. Wicklow), caused by Storm Emma.
- 2020, 2021 & 2022 storms: Ireland experienced a violent run of storms throughout 2020, 2021 and 2022 causing severe damage and violent winds.

3.2.2 Climate Change Projection Data

In understanding how the climate is expected to change in the future it is important to consider broad, qualitative trends as well as location specific, quantitative projection data. Both are presented below.

Qualitative projection data

Future trends for key climate variables in Ireland are summarised below using information available from Climate Ireland's '*Essential Climate Information'*.

Table 3-3: Key Messages - Climate Change Projections Ireland [33]

Climate Variable	Key Trend	Key Message
Surface air temperature	Average surface air temperatures are expected to increase everywhere and across all seasons.	An increase in the intensity and duration of heatwaves is expected.
Precipitation	An increase in seasonality in precipitation can be expected with significant decreases projected for spring and summer and increases for winter.	An increase in the occurrence of extreme rainfall events is likely.
Hydrology	Increasing seasonality in hydrological regimes can be expected with decreased summer and increased winter flows likely.	Flood risk is expected to increase across Ireland while increases in the frequency of drought conditions is also expected.
Windspeed	An increase in the intensity of extreme windstorms is expected.	Projections indicate a decrease in wind speeds for summer and increases for winter.
Sea level rise	Sea levels are expected to increase for all Irish coastal areas.	Projected changes in sea level will magnify the impacts of changing storm surge and wave patterns in coastal areas.
Waves and surges	A decrease in mean and extreme wave heights are expected by the end of the century.	The magnitude and intensity of storm wave heights are expected to increase.

Quantitative projection data

The quantitative climate change projection data for the Site is presented in Table 3-4 alongside the climate baseline data for the study area. As previously discussed in Section 3.1.2.3 the climate change scenarios adopted of this CCR assessment were RCP 4.5 and RCP 8.5.

[33] Climate Ireland (2022). *Essential Climate Information*.

Table 3-4: Climate Change Baseline and Projection Data

Climate Variable	Baseline (1981-2000)	Climate Change Projection RCP4.5 (2041-2060)	Climate Change Projection RCP8.5 (2041-2060)	Projected Change in Likelihood	Climate Projection Source
Temperature					
Mean annual maximum daily temperature (°C)	13.2	+1.2°C (14.4°C)	+1.6°C (14.8°C)	↑	2
Mean summer maximum daily temperature (°C)	18.9	+1.3°C (20.2°C)	+1.7°C (20.6°C)	↑	2
Mean winter minimum daily temperature (°C)	3.4	+1.1°C (4.5°C)	+1.5°C (4.9°C)	↑	2
Number of frost days per annum	36	-39% (22.0)	-53.8% (15.0)	↓	2
Highest temperature for baseline period (°C)	29.8	-	-	-	1
Lowest temperature for baseline period (°C)	-2.9	-	-	-	1
Rainfall					
Mean annual rainfall (mm)	946.3	-4.8% (900.9)	-4.2% (906.6)	↓	2
Mean summer rainfall (mm)	198.7	-6.9% (185.0)	-12.4% (174.1)	↓	2
Mean winter rainfall (mm)	265.6	-3.6% (256.0)	+1.9% (270.6)	↕	2
Wettest month on average (mm)	December	-	-		1
Driest month on average (mm)	July	-	-		1
Wet days >20mm (%)	4.7	+3.4% (4.9)	+1% (4.7)	↑	2
Very wet days >30mm (%)	1.5	+5.8% (1.6)	+2.9% (1.5)	↑	2
Summer dry days (%) (5 consecutive days where daily precipitation <1mm)	-	+20.3%	+23.6%	↑	2
Highest daily rainfall (mm) for baseline period	78.3	-	-	-	1
Other					
Sea level rise (m)[34]	-	+0.21	+0.23	↑	3
Snowfall	-	-48.7	-55.9	↓	2
Potential Evapotranspiration (mm)	1.5	+4.9% (1.6)	+5.7% (1.6)	↑	2

[34] Note: The sea level rise projection differs from the other variables in that it is given for the 2050 decade, rather than the 30-year period that centres around the 2050s (2041-2060). The scenarios used for sea level rise are the IPCC's latest 6th Assessment Report scenarios: SSP2-4.5 (intermediate GHGs) and SSP5-8.5 (very high GHGs). The sea level rise values used were those projected for Dublin, approximately 29.5 km north-east of the Proposed Development site, as it was the closest location and of similar longitude as the study area.

Climate Variable	Baseline (1981-2000)	Climate Change Projection RCP4.5 (2041-2060)	Climate Change Projection RCP8.5 (2041-2060)	Projected Change in Likelihood	Climate Projection Source
Mean wind speed (knot)	11.3	-2.3% (11.0)	-3% (11.0)	↓	2
Storms	The number of very intense storms is projected to increase over the North Atlantic region in the future (2041-2060), under RCP8.5. Projections suggest that the winter track of these storms may extend further south and over Ireland more often. Under RCP4.5, the projections of future intense storm tracks have a similar, but weaker signal.			↑	4

Sources:
Baseline data source: Met Eireann Historical Data, available at: https://www.met.ie/climate/available-data/historical-data
Projection data source: 1. Met Eireann Historical Data: https://www.met.ie/climate/available-data/historical-data
2. Climate Ireland, available at: https://www.climateireland.ie/#!/tools/climateDataExplorer
3. IPCC AR6 Sea Level Projection Tool, available at: https://sealevel.nasa.gov/data_tools/17
4. EPA, available at: https://www.epa.ie/publications/research/climate-change/EPA-159_Ensemble-of-regional-climate-model-projections-for-Ireland.pdf

Table 3-5: Climate Variables Definition [35]

Climate Variable	Definition
Summer dry days	Projected change number of dry periods defined as at least 5 consecutive days on which daily precipitation <1mm
Heatwaves	Periods of at least three consecutive days where maximum temperatures exceed >95% of the normal monthly distribution
Wet days	Projected change (%) in number of days with rainfall >20mm
Very wet days	Projected change (%) in number of days with rainfall >30mm
Frost days per annum	Projected change (%) in the number of days when minimum temperatures are <0°C
Wind speed	Projected change (%) in windspeed at 10m elevation
Sea level rise	Median projections of regional sea level rise, relative to a 1995-2014 baseline
Snowfall	Projected change (%) in the snowfall

3.3 Potential Impacts

3.3.1 Initial Risk Profile

The climate change risk assessment identified 13 risks, 6 related to construction and 7 related to operation. The complete list of climate change risks can be found in the risk register presented in Appendix B. Table 3-6 below highlights the initial risk profile for both climate change scenarios assessed.

[35] Climate Ireland (2022).

Table 3-6: Initial Risk Profile for the Proposed Development

Risk Rating	Moderate emissions scenario RCP 4.5 2040-2060	High emissions scenario RCP 8.5 2040-2060
	Initial risk profile	Initial risk profile
Low	10	10
Medium	3	3
High	0	0
Extreme	0	0

Of the risks identified, 3 were related to extreme temperatures, 4 were related to storms, 4 were associated with extreme rainfall and flooding, 1 related to wildfire and 1 related to snow/ice. The medium risks were associated with storms and extreme rainfall/flooding. This is due to the proximity of the Proposed Development to the Poulaphouca Reservoir and the risk of increased water level and overspill onto the surrounding path, as well as the proximity of surrounding forest vegetation at risk of damage during storm conditions.

3.3.2 Embedded Controls

As previously mentioned, planned or embedded controls represent measures already included in the design and operation of the Proposed Development that work to mitigate the climate risk. These measures are usually included in the design and/or operation of an asset as they represent best practice design or management. The embedded controls adopted for the Proposed Development, contribute to the low initial risk profile (as demonstrated in Table 3-6).

Table 3-7 provides example embedded controls adopted for the Proposed Development, with a complete list included in the risk register in Appendix B.

Table 3-7: Embedded Controls Adopted for the Proposed Development

Project Phase	Example Embedded Controls
Construction Phase	Contractor to monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions.
	Best practice standards, environmental guidelines and mitigation measures will be defined in the CEMP and adhered to in order to avoid impacts on soil quality and displacement.
	Suitable storage and bunding of materials to protect from high rainfall events during construction. Drainage from the bunded area will be diverted for collection and safe disposal. This will be further supported by the Site Emergency Response Plan that will be included as part of the Applicants' Environmental Management System (EMS).
	Flood forecasting to be used to ensure Health and Safety remains a priority in terms of management and operation of the greenway.
	Appropriate surface water drainage and attenuation will be provided for the construction phase to manage the risk of flooding.
Design	Drainage pipes will be used in locations where fill earthworks have the potential of causing ponding for surface water runoff to bring the surface water beneath the greenway to enable continued flow into the reservoir.
	Rock armour utilised in various locations along the shoreline to manage the effects of erosion by the reservoir.

Project Phase	Example Embedded Controls
	Inceptor ditches provided at the top of the cutting slopes where the adjacent ground falls towards the route providing an alternative pathway for overland flows to prevent long-term stability issues occurring on the slope.
	Crossfalls between 1% & 3% chosen across the development to enable surface runoff into the reservoir.
Operational Phase	Tree maintenance undertaken including the clear felling and thinning activities every 2/3 years as routine.
	Operational management of the Greenway will include occasional maintenance activities across the development site.
	Ecological Clerk of Works (ECoW) responsible for attending site as required to monitor the protection of asset, including identifying the potential; risks to wildlife and develop suitable control measures, in accordance with the requirements of relevant legislation, the Ecological Impact Assessment (EcIA) mitigation measures, the construction contract, and the Construction Environmental Management Plan (CEMP).

3.3.3 Cumulative Impacts

With regards to cumulative climate change risks associated with other developments, no cumulative impacts have been identified as there are no other proposed developments within the vicinity of the Proposed Development Site. Therefore, cumulative impacts have not been assessed as part of this climate change study.

3.4 Adaptation Measures

3.4.1 Adaptation Principles

Climate change adaptation for infrastructure projects is the process of adjustment to actual or expected climate and its effect to increase resilience, moderate harm and exploit beneficial opportunities. There are a range of measures or options that are available and appropriate for addressing climate change adaptation often described as either Grey, Green or Soft:

- **Grey Actions** - technical or engineering-oriented responses to climate impacts, for example the construction of a sea wall in response to sea level rise or the consideration of climate change projections in the design of drainage structures.
- **Green Actions** - use nature-based solutions to enhance the resilience of human and natural systems, for example the addition of green spaces to infrastructure projects to counteract urban heat island effect, or the use of drought and heat tolerant species in landscaping.
- **Soft Actions** - alterations in behaviour, regulation, or systems of management such as increased monitoring of climate change impacts during operation, or the consideration of climate risk in asset management plans. They are flexible and inexpensive to implement.

3.4.2 Adaptation Measures Identified

A number of adaptation measures have been identified for consideration during the design, construction and operation of the Proposed Development. Table 3-8 provides example adaptation measures identified for the Proposed Development, with a complete list included in the risk register in Appendix B.

Table 3-8: Measures for Consideration for the Proposed Development

Project Phase	Example Adaptation Measures
Construction	Consider inspection of vulnerable construction assets after a hot day.
	Contractor to implement measures to combat extreme heat conditions (e.g. avoid working on hot summer days, appropriate sun protection, training for identifying heat illness and for working in hot conditions, work in shaded areas, plan major activities for cooler parts of the day, wear loose fitting/breathable clothing).
	Critical construction equipment to be stored at higher ground levels.
	Welfare areas to be assigned to higher ground levels.
	For extreme rainfall forecasts, ensure construction plants are secure and stored at higher ground levels. 3-day warning period allows for the implementation of precaution measures.
Operation	Operational Management Plan of greenway to include clean up and maintenance post storm events.
	Regular monitoring of plantings to check and manage condition of vegetation.
	Operational Management procedures to consider providing warnings on websites, radio and/or variable messaging signs to deter users from using greenway under certain weather conditions.
	Consideration to be given to limiting/stopping the operation of the shuttle service to deter users from using greenway under certain weather conditions.
	Consider gritting (sand, gravel or rock salt) the most frequented parts of the greenway and carpark to prevent slippage.

3.5 Residual Impacts

Residual risk represents the risk profile resulting from the implementation of adaptation measures. The residual risk rating for the Proposed Development, (assuming the implementation of the identified adaptation measures), is summarised in Table 3-9**.**

Table 3-9: Residual Risk Profile Identified for the Proposed Development

Risk Rating	Moderate emissions scenario RCP 4.5 2040-2060		High emissions scenario RCP 8.5 2040-2060	
	Initial risk profile	Residual risk profile	Initial risk profile	Residual risk profile
Low	10	13	10	13
Medium	3	0	3	0
High	0	0	0	0
Extreme	0	0	0	0

As observed, the implementation of the identified adaptation measures results in a reduction in the risk profile with no 'Extreme', 'High' or 'Medium' residual climate risks across both climate change scenarios. This is primarily due to the adaptation measures associated with the operational management of the greenway prior to, during and after heavy rainfall and storm events that limits the safety hazards and the likelihood of damage associated with falling trees and branches and localised flooding. Wicklow County Council should ensure that the adaptation measures discussed in this report are implemented to maintain the residual risk profile presented above.

3.6 Significance

Using the risk matrix in Table 3-2 which includes the significance criteria for climate change risk, the significance of climate change risk for the Proposed Development can be assessed. Both prior and subsequent to the implementation of adaptation measures, the assessment identified there were no 'High' or 'Extreme' risks associated with climate change. Therefore, it can be concluded that climate change risk is '**Not Significant'** for the Proposed Development. Nevertheless, Wicklow County Council should still consider and where appropriate, implement the proposed adaptation measures identified for the Proposed Development to further increase the asset's resilience to climate change.

4. Greenhouse Gas Assessment

4.1 Methodology

The greenhouse gas assessment quantifies the GHG emissions from the project development and throughout its lifetime and contextualises the magnitude of the impact of these emissions against relevant carbon budgets, policy, and targets.

4.1.1 Study Area

The study area for the GHG assessment considers all direct GHG emissions that may arise during construction and operational phases of the Proposed Development. This includes direct emissions arising onsite e.g., from the combustion of fuel used in construction plant as well as indirect emissions from activities offsite, such as the fuel consumed for transportation of materials, workers, and waste to and from site, and the embedded carbon contained within construction materials and products.

The study period is made up of the 18-month construction period and the 25-year operation period.

4.1.2 Sensitive Receptors

The global climate has been identified as a sensitive receptor for the GHG assessment. The effects of GHGs are not geographically constrained and, subsequently, all development has the potential to result in a cumulative effect in terms of GHGs. For the purpose of assessing the impact on this receptor, GHG emissions arising from the Proposed Development have been presented in the context of Ireland's national GHG inventory and carbon reduction targets.

4.1.3 GHG Calculation

A lifecycle approach to calculating the GHGs has been adopted. This approach considers specific timescales and emissions from different lifecycle phases of a proposed development: product phase (construction materials), construction phase and operational phase.

GHG emissions, arising from the construction and operational activities, and embodied carbon in materials of the Proposed Development, have been calculated by multiplying activity data by a relevant emission factor:

Activity data x GHG emissions factor = GHG emissions in mass of CO2e

Activity data is a quantifiable measure of activity, such as operating hours or volumes of fuels used. Emission factors convert the activity data into GHG emissions. Activity data has been sourced from the Applicant, however, where specific data is not available, a mix of assumptions and industry benchmarks have been used to fill data gaps. Where this is not possible, then a qualitative approach to assessing the GHG impacts has been followed, in line with the IEMA guidance[36].

[36] IEMA (2022). Assessing Greenhouse Gas Emissions and Evaluating their Significance.

Emission factors and calculation methods have been sourced from publicly available sources, including Sustainable Energy Authority of Ireland (SEAI), UK Department for Business, Energy and Industrial Strategy (BEIS), National Highways and the Bath University ICE.

In line with the GHG Protocol[37], when calculating GHG emissions, the seven Kyoto Protocol GHGs have been considered, specifically:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Sulphur hexafluoride (SF_6);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- Nitrogen trifluoride (NF_3).

These gases are broadly referred to in this report under an encompassing definition of 'GHGs', with the unit of tCO_2e (tonnes CO_2 equivalent) or $MtCO_2e$ (mega tonnes of CO_2 equivalent).

Table 4-1 outlines the GHG activity sources present and proposed that are potentially relevant to baseline conditions and construction and operational phases of the Proposed Development.

Table 4-1: Potential Sources of GHGs

Phase	Activity	Primary Emissions Sources
Baseline		
Site Enabling and Construction Phase	Pre-construction activity within Site	Fuel consumption from construction plant, vehicles and generators.
	Site clearance works	Loss of carbon stocks.
	Raw material extraction and manufacturing	Embodied GHGs in the materials used for construction of the Proposed Development as a result of the excavation, processing and transportation.
	Transport to Site	Fuel used for transportation of construction materials to Site.
	Construction activity within the Site	Energy (electricity, fuel, etc.) consumption from plant, vehicles, and generators.
	Transport of construction workers	Fuel consumption for transportation of construction workers to/from Site.
	Waste disposal	Fuel used for transportation of waste materials from Site.
Operational Phase	Operation of the Proposed Development car park	Operational energy use in electric vehicle charging at car park facilities (e.g., purchased electricity).
	Maintenance including re-surfacing	Embodied emissions associated with additional materials used as part of maintenance activities, such as re-surfacing materials. Fuel use for maintenance activities.

37 WRI & WBCSD (2004).

Phase	Activity	Primary Emissions Sources
	Maintenance including re-surfacing	Waste generation (volume, method of disposal, destination for disposal).
	Land use change/gain	Proposed planting of new vegetation resulting in sequestration of GHG emissions by new vegetation acting as a carbon sink.

4.1.4 GHG Significance Criteria

The IEMA guidance on GHG states that the following three principles need to be considered when evaluating the significance:

- all project GHG emissions will contribute to climate change;
- climate change has the potential to lead to significant environmental consequences that may affect all topics in the EIA Directive (e.g., Biodiversity, Water, Landscape, Geology, Air Quality, Human Health); and
- GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such that any GHG emissions or reductions from a project might be considered significant.

Based on these principles, the IEMA guidance states that *"the significance of a project's emissions should therefore be based on its net impact over its lifetime, which may be positive, negative or negligible".*

The guidance has identified two major considerations when assessing the significance of a project's GHG emissions: alignment to a trajectory towards net zero by 2050, and mitigation of GHG emissions. It is down to the professional judgment of the practitioner to determine how best to contextualise and assess the significance of a project's GHG impact.

4.1.5 Alignment to 2050 Net Zero Trajectory

The IEMA guidance states that the crux of assessing significance is *"not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050".* The trajectory of GHG emissions associated with the Proposed Development has therefore been factored into the assessment criteria.

4.1.6 GHG Mitigation

The IEMA guidance also emphasises the importance of implementing GHG mitigation measures to help minimise GHG emissions, regardless of the magnitude of emissions, and states that the level of mitigation should be used to assess the significance of GHG emissions. This has therefore been factored into the assessment criteria for the GHG assessment.

Based on the above two considerations, and in line with criteria outlined in the IEMA guidance, the following significance table, as shown in Table 4-2 will be used to assess the significance of GHG emissions arising as a result of the Proposed Development.

Table 4-2: Significance of Effects for GHGs Impact Assessment

Significance Level	Effects	Description
Significant adverse	Major adverse	• The project's GHG impacts are not mitigated; • The project has not complied with do-minimum standards set through regulation, nor provide reductions required by local or national policies; and • No meaningful contribution to Ireland's trajectory towards net zero.
	Moderate adverse	• The project's GHG impacts are partially mitigated; • The project has partially complied with do-minimum standards set through regulation, and have not fully complied with local or national policies; and • Falls short of full contribution to Ireland's trajectory towards net zero.
Not significant	Minor adverse	• The project's GHG impacts are mitigated through 'good practice' measures; • The project has complied with existing and emerging policy requirements; and • Fully in line to achieve Ireland's trajectory towards net zero.
	Negligible	• The project's GHG impacts are mitigated beyond design standards; • The project has gone well beyond existing and emerging policy requirements; and • Well 'ahead of the curve' for Ireland's trajectory towards net zero.
Beneficial	Beneficial	• The project's net GHG impacts are below zero and it causes a reduction in atmosphere GHG concentration; • The project has gone well beyond existing and emerging policy requirements; and • Well 'ahead of the curve' for Ireland's trajectory towards net zero, provides a positive climate impact.

It is suggested that sectoral, local, or national carbon budgets can be used, as available and appropriate, to contextualise a project's GHG impact. IEMA guidance[38] states that the significance of a project should not be determined based on the magnitude of the GHG emissions and whether it will release GHG emissions. It should be concluded by establishing if it will contribute to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero.

4.2 Baseline Environment

The baseline environment or the "Do Minimum" refers to the scenario in which the Proposed Development is not progressed. Future GHG emissions without the proposed project in place are known as the "Do Minimum" scenario and is developed using the current baseline and projections of the future situation without the implementation of the proposed project. The primary source of carbon emissions on the existing Blessington Greenway site derives from the transport of visitor's vehicles to and from the site.

[38] IEMA (2022).

The GHGs that would be associated with the baseline scenario have been calculated using the methodology described in **Section 4.1**, and the results are based upon the assumptions listed below:

- The area consists of a predominantly conifer plantations with minor sections of agricultural lands, broadleaved woodland, and grassland habitat. Urban developments including Blessington town, and smaller villages Valleymount, Ballyknockan and Lacken.
- The existing length of Greenway: 5.6 km.
- The existing length of Greenway to be upgraded: 4.6 km.
- A full traffic assessment of existing visitors to the site is unavailable, so conservatively, all anticipated traffic from visitors to the redeveloped site is assessed as new.

4.3 Potential Impacts

4.3.1 Construction Phase Impacts and Effects

To assess the magnitude of the climate change impacts through GHGs associated with construction of the Proposed Development, the emissions that would be associated with the project activities have been calculated and listed in Table 4-3 based on the assumptions listed below:

- Construction activities will be up to 18 months. The GHG assessment is based on 18 months, with approximately 432 working days). This figure is based on construction activities being undertaken from Monday to Saturday.
- Construction works would typically take place during the hours of 07:00 to 19:00 (Monday to Friday) and 07:00 to 13:00 (Saturday) with the exception of commissioning and specific engineering works (e.g., concrete pours) which could take place outside these hours.
- Approximately 7,265 trees required to be removed across the 174,324m^2 of the Proposed Development Site. Conservatively, it has been assumed that the carbon sequestered within the trees is released immediately. Trees are to be replanted across various areas, this and the carbon impacts of the replanted trees are detailed in the Operational impacts in Section 4.3.2.
- The materials and consumables required during construction have been assumed to be sourced from an average of 50km from Site.
- Electricity usage on site based on three site compounds consuming an average of 15,000 kWh per year.
- Emissions from fuel use estimated based on an average number of plant on-site over the construction period, operating for the duration of construction hours consuming 2.25 litres of gas oil diesel per hour.
- Volumes of materials for the Greenway was estimated based on length and diameter provided and embodied carbon calculated (assumed (dimensions/volumes of materials used)).

- Dimensions of each key component were provided via the planning drawings, submitted with this application:
    - Machine laid, bound pavement (consisting of 20mm surface course)
    - Machine laid, bound pavement (consisting of 40mm - 55mm base course)
    - Machine laid, bound pavement (consisting of 150mm Clause 804 sub-base)
    - Machine laid, bound pavement (Geotextile layer), (exact volume required is dependent on ground condition, scoped out of GHG assessment as even extensive amounts will result in relatively low emissions <1%)
    - General Excavation - Topsoil
    - Imported infill materials such as rock armour
    - Addition of Electric Vehicle (EV) chargers (48 chargers)
    - Concrete retaining walls
- Where weights could not be calculated from the dimensions provided, weights were assumed from proxy projects as directed from the Applicant. This included for the EV chargers, rock armour and picnic tables.
- Emissions from waste were calculated by assuming an additional 5% of all materials (other than items provided as complete units), with standard landfill and recovery proportions based on type of waste applied, and the relevant waste emissions factors utilised.
- Using the above information sources, the assessment captured all significant embodied carbon associated with the Proposed Development. Where any ancillary elements have been excluded, it is not anticipated that this will have a significant impact in the context of the overall footprint.

Table 4-3: Construction GHG Emissions

Lifecycle Phase	Emissions Source	Emissions (tCO_2E)	% Construction Phase Emissions
Product	Removed trees for land clearance	17,753	71%
	Embodied carbon of materials and products	5,771	23%
	Materials and product transport	650	3%
Construction	Electricity usage	99	0%
	Fuel usage onsite	127	1%
	Waste disposal	13	0.1%
	Worker commute	477	2%
	Total	24,890	100%
	Annual	996	

As stated in Section 4.1.3, all emissions are considered **significant**. To contextualise the level of significance, emissions are compared to the Irish carbon budgets. Emissions from the construction of the Proposed Development contribute considerably less than 1% of any carbon budget, refer to Table 4-5**.**

4.3.2 Operational Phase Impacts and Effects

To assess the magnitude of the climate change impacts through GHGs associated with operating and maintaining the Proposed Development, the GHGs that would be associated with the Proposed Development operational activities have been calculated and listed in Table 4-4, based on the assumptions listed below:

- For the purpose of this assessment and based on a similar project elsewhere it was assumed the Greenway will be open for use approximately 365 days per year and will have a nominal design life of 25 years.
- Carbon sequestration will occur as a result of the replanted trees on site and in the surrounding areas. Approximately 4,965 trees are to be replanted in lands directly adjacent to the development site, 2,300 trees are to be replanted at 10m centres alongside the greenway and an additional 3,300 trees to be planted in other parcels of land in the surrounding areas. Replanted trees will be maintained regularly to ensure they reach maturity. The carbon sequestration from the replanted trees has been calculated for the 25 year design life of the Proposed Development, although this will continue on past the lifetime of the Proposed Development and as such, land use change is expected to have an actual overall net impact of zero emissions over the lifetime of the trees. A conservative assumption of 10kgCO2e/tree/year sequestration was taken, this is likely to be higher particularly as the trees mature.
- Tree maintenance is undertaken every 2/3 years as routine including the clear felling and thinning of trees across the Proposed Development Site. 75 to 225 trees are expected to be felled as routine maintenance.
- Using quantitative data from greenways located a similar distance from Dublin, projection data indicates that approximately 300,000 people are expected to visit the Greenway annually, with an average of approximately 5,977 visitors per week, with a peak of approximately 10,042 visitors per week. The Blessington eGreenway Traffic and Transport Assessment (AECOM 2023) details visitor numbers and transport modes fully.
- Emissions associated with maintenance were assessed assuming a single replacement of pavement surfacing and EV chargers throughout the 25-year design life (based on a lifespan of 15 years and 8 years, respectively).
- Electricity consumption from the EV charging on the Proposed Development was assessed assuming 22kW rated chargers being used 8 hours per day.

- Calculated in line with the methodology stated in Section 4.1, the net GHGs (including all GHG avoidance deductions) from operating the Proposed Development over the assumed 25-year nominal design life are estimated to be 103,070 tCO_2e. Annual emissions are expected to be approximately 4,123 tCO_2e, refer to Table 4-4.
- Conservatively, operational emissions are calculated using current grid emission factors and current proportion of EV to petrol/diesel cars due to the uncertainty arising from projections.

Table 4-4: Operational Emissions for the Proposed Development

Lifecycle Phase	Emissions Source	Emissions (tCO_2E) annual	Emissions (tCO_2E) 25-year total	% Operational Phase Emissions
Operational	Visitor Transport	3,115	77,885	76%
	Energy Use	1,081	27,037	26%
	Materials and product transport	32	789	1%
	Carbon sequestration from replanted trees	-106	-2,641	
	Total	4,123	103,070	100%

4.3.3 Decommissioning Phase Impacts and Effects

The impacts of the Proposed Development on the climate during decommissioning activities have been scoped out of this assessment. It is anticipated that decommissioning will require a separate environmental impact assessment. A full climate assessment of the potential impacts will be undertaken at that time. Although, it is unlikely that this Proposed Development will be decommissioned at the end of its design life, but instead become an integral part of the greenways network.

4.3.4 Cumulative Impact

GHG impacts from the Proposed Development have not been considered cumulatively with GHG emissions from any other developments as there are no other proposed developments within the vicinity of the Proposed Development Site. Therefore, cumulative impacts have not been assessed as part of this assessment.

4.4 Significance

In light of Ireland's national climate objective to achieve net zero carbon by 2050, and in line with IEMA guidance on Assessing Greenhouse Gas Emissions and Evaluating their Significance, the GHG impact of the Proposed Development (construction and operational) have been reviewed in line with Ireland’s current carbon budgets to 2035 (Table 4-5), noting that the Proposed Development is anticipated to be operational by the end of 2025 having a nominal design life of 25 years. The Proposed Development’s GHG impact is deemed ‘Minor Adverse’ as it poses good practice in aligning with Ireland’s net zero transition. This therefore categorises the GHG Impact of the Proposed Development as ‘**Not Significant**’ as per the IEMA guidance.

Table 4-5: Significance of Project Emissions in Carbon Budget

Carbon Budget	Total Budget ($MTCO_2e$)	Total Project Emissions within period ($MTCO_2e$)	% of contribution of operational emissions
2021-2025	295	0.02486	0.00843%
2026-2030	200	0.02061	0.01031%
2031-2035	151	0.02061	0.01365%

5. Summary

5.1 Climate Change Risk Assessment

In summary, the climate change risk (CCR) and adaptation assessment presented in this report illustrates that climate change risk does not present a significant risk to the Proposed Development. That is, whilst 13 risks were identified, the embedded controls in the design, construction and operation of the asset meant that the risk profile only contained low and medium risks. Therefore, it can be concluded that climate change risk is '**Not Significant'** for the Proposed Development.

5.2 Greenhouse Gas Assessment

The total GHGs from constructing the Proposed Development are estimated to be 24,890 tCO_{2e}. Although 17,753 tCO_{2e} of this can be attributed to the release of carbon from the trees being removed from site, as all removed trees are being replanted this is anticipated to be recouped throughout the lifetime of the replanted trees. The net GHGs (including all GHG avoidance deductions) from operating the Proposed Development over its (at least) 25-year life are estimated to be 103,080 tCO_{2e}. Annual operational emissions are expected to be approximately 4,123 tCO_{2e}.

As detailed above, the Proposed Development has proportionally small GHG emissions in the context of Ireland's national carbon budget. The project can be said to be 'Not Significant' in this context.

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Appendix A Risk Framework

As detailed in Section 3.1.3 the risk framework adopted for this project is based on the framework detailed in the EU Commission Notice on climate proofing. The risk matrix, likelihood analysis and consequence analysis are provided in Table A-1, Table A-2, and Table A-3 respectively.

Table A-1: Risk Matrix

		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood	**Rare**	Low (NS)	Low (NS)	Medium (NS)	High(S)	Extreme(S)
	Unlikely	Low (NS)	Low (NS)	Medium (NS)	High(S)	Extreme(S)
	Moderate	Low (NS)	Medium (NS)	High(S)	Extreme(S)	Extreme(S)
	Likely	Medium (NS)	High(S)	High(S)	Extreme(S)	Extreme(S)
	Almost certain	High(S)	High(S)	Extreme(S)	Extreme(S)	Extreme (S)

Table A-2: Likelihood Analysis

Term	Qualitative	Quantitative
Rare	Highly unlikely to occur	5%
Unlikely	Unlikely to occur	20%
Moderate	As likely to occur as not	50%
Likely	Likely to occur	80%
Almost certain	Very likely to occur	95%

Table A-3: Consequence Analysis

Risk areas	Insignificant	Minor	Moderate	Major	Catastrophic
Asset damage / Engineering / Operational	Impact can be absorbed through normal activity	An adverse event that can be absorbed by taking business continuity actions	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary / emergency business continuity actions	Disaster with the potential to lead to shut down or collapse or loss of the asset / network
Safety and Health	First aid case	Minor injury, medical treatment	Serious injury or lost work	Major or multiple injuries,	Single or multiple fatalities

Risk areas	Insignificant	Minor	Moderate	Major	Catastrophic
				permanent injury, or disability	
Environment	No impact on baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect. Recovery in one year	Significant harm with local effect. Recovery longer than one year. Failure to comply with environmental regulations / consent	Significant harm with widespread effect. Recovery longer than one year. Limited prospect of full recovery
Social	No negative social impact	Localised, temporary social impacts	Localised, long-term social impacts	Failure to protect poor or vulnerable groups (1). National, long-term social impacts	Loss of social licence to operate. Community protests
Financial (for single extreme event or annual average impact) (**)	x % IRR (***) < 2 % of turnover	x % IRR 2-10 % of turnover	x % IRR 10-25 % of turnover	x % IRR 25-50 % of turnover	x % IRR > 50 % of Turnover
Reputation	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short-term impact on public opinion; negative national media coverage	National, long-term impact with potential to affect the stability of the government
Cultural Heritage and cultural premises	Insignificant impact	Short term impact. Recovery or repair.	Serious damage with wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society

(1) Including groups that depend on natural resources for their income/livelihoods and cultural heritage (even if not considered poor) and groups considered poor and vulnerable (and often that have less capacity to adapt) as well as persons with disabilities and older persons.

(*) The ratings and values suggested here are illustrative. The project promoter and climate-proofing manager may choose to modify them.

(**) Example indicators – other indicators that may be used including costs of immediate / long-term emergency measures; restoration of assets; environmental restoration; indirect costs on the economy, indirect social costs.

(***) Internal Rate of Return (IRR).

Appendix B Climate Change Risk Assessment

1. Climate Change Baseline & Projection Data

Climate Variable	Baseline (1981-2000) *Name of Weather Station* (Source 1)	Climate change projection: Moderate scenario RCP4.5 (*timeframe*)	Climate change projection: Extreme scenario RCP8.5 (*timeframe*)	Projected Trend	Source
Temperature					
Mean annual maximum daily temperature (°C)	13.2	1.2	1.6	↑	2
		14.4	*14.8*		
Mean annual minimum daily temperature (°C)	5.8	1.2	1.6	↑	2
		7	*7.4*		
Mean summer maximum daily temp (°C)	18.9	1.3	1.7	↑	2
		20.2	*20.6*		
Mean winter minimum daily temp (°C)	3.4	1.1	1.5	↑	2
		4.5	*4.9*		
Frost days per annum (days)	36	-39.0%	-53.8%	↓	2
		22.0	*16.6*		
Heatwaves (no.)		5	7.6	↑	2
Highest temperature for baseline period (°C)	29.8				1
Lowest temperature for baseline period (°C)	-2.9				1
Rainfall					
Mean annual rainfall levels (mm)	946.3	-4.8%	-4.2%	↓	2
		900.9	*906.6*		
Mean summer rainfall (mm)	198.7	-6.9%	-12.4%	↓	2
		185.0	*174.1*		
Mean winter rainfall (mm)	265.6	-3.60%	2%	↕	2
		256.0	*270.6*		
Wettest month on average (mm)	December				2
Driest month on average (mm)	July				2
Wet Days (>20mm) (%)	4.7	3.4%	1.0%	↑	2
		4.9	*4.7*		
Very Wet Days (>30mm) (%)	1.5	5.8%	2.9%	↑	2
		1.6	*1.5*		
Summer dry days (5 consecutive days where daily precip <1mm) (%)		20.3%	23.6%	↑	2
Highest daily rainfall (mm) for baseline period	78.3				1
Other					
Snowfall		-48.7%	-55.9%	↑	2
Mean wind speed (knot)	11.3	-2.30%	-3.00%	↓	2
		11.0	*11.0*		
Highest gust (knot)					3
Potential Evapotranspiration (mm)	1.5	4.9%	5.7%	↑	2
		1.6	*1.6*		
Sea level rise (m) *		0.21	0.23	↑	3
Storms	The number of very intense storms is projected to increase over the North Atlantic region in the future (2041-2060), under RCP8.5. Projections suggest that the winter track of these storms may extend further south and over Ireland more often. Under RCP4.5, the projections of future intense storm tracks have a similar, but weaker signal.			↑	4

References

1	Baseline data source: Met Eireann Historical Data, available at: https://www.met.ie/climate/available-data/histor
2	Climate Ireland: https://www.climateireland.ie/#!/tools/climateDataExplorer
3	IPCC AR6 Sea Level Projection Tool: https://sealevel.nasa.gov/data_tools/17
4	EPA: https://www.epa.ie/publications/research/climate-change/EPA-159_Ensemble-of-regional-climate-model-p

Definitions

Summer dry days	Projected change number of dry periods defined as at least 5 consecutive days on which daily precipitation <1mm.

Snowfall	Projected change (%) in snowfall.
Heatwaves	Projected change in the number of heatwave events. Heat wave events are defined as periods of at least three consecutive days where maximum temperatures exceed >95% of the normal monthly distribution
Wet Days (>20mm)	Projected change (%) in number of days with rainfall >20mm.
Very Wet Days (>30mm)	Projected change (%) in number of days with rainfall >30mm.
Frost days per annum	Projected change (%) in number of days where minimum temperatures are <0C.
Wind speed	Projected change (%) in windspeed at 10m elevation.
* Sea level rise	

2. Risk framework

Source: EU Technical guidance on the climate proofing

			CONSEQUENCE				
		Asset damage / Engineering / Operational	Impact can be absorbed through normal activity	An adverse event that can be absorbed by taking business continuity actions	A serious event that requires additional emergency business continuity actions	A critical event that requires extraordinary / emergency business continuity actions	Disaster with the potential to lead to shut down or collapse or loss of the asset / network
		Safety and Health	First aid case	Minor injury, medical treatment	Serious injury or lost work	Major or multiple injuries, permanent injury or disability	Single or multiple fatalities
		Environment	No impact on baseline environment. Localised in the source area. No recovery required	Localised within site boundaries. Recovery measurable within one month of impact	Moderate harm with possible wider effect. Recovery in one year	Significant harm with local effect. Recovery longer than one year. Failure to comply with environmental regulations / consent	Significant harm with widespread effect. Recovery longer than one year. Limited prospect of full recovery
		Social	No negative social impact	Localised, temporary social impacts	Localised, long-term social impacts	Failure to protect poor or vulnerable groups (1). National, long-term social impacts	Loss of social licence to operate. Community protests
		Financial (for single extreme event or annual average impact) (**)	x % IRR (***) < 2 % of turnover	x % IRR 2-10 % of turnover	x % IRR 10-25 % of turnover	x % IRR 25-50 % of turnover	x % IRR > 50 % of turnover
		Reputation	Localised, temporary impact on public opinion	Localised, short-term impact on public opinion	Local, long-term impact on public opinion with adverse local media coverage	National, short- term impact on public opinion; negative national media coverage	National, long-term impact with potential to affect the stability of the government
		Cultural Heritage and cultural premises	Insignificant impact	Short term impact. Possible recovery or repair.	Serious damage with wider impact to tourism industry	Significant damage with national and international impact	Permanent loss with resulting impact on society
		In-combination	The climate change parameter in-combination with the effect of the Proposed Development does not impact the significance of the impact of the Proposed Development on the resource/ receptor, as defined by the topic.	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/ receptor, as defined by the topic, to increase to minor.	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/ receptor, as defined by the topic, to increase from minor to moderate.	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/ receptor, as defined by the topic, to increase from moderate to major.	The climate change parameter in-combination with the effect of the Proposed Development causes the significance of the impact of the Proposed Development on the resource/ receptor, as defined by the topic, to increase from major to catastrophic.
LIKELIHOOD **Qualitative**	**Quantitative**		**Insignificant**	**Minor**	**Moderate**	**Major**	**Catastrophic**
Highly unlikely to occur	5%	**Rare**	Low	Low	Medium	High	Extreme
Unlikely to occur	20%	**Unlikely**	Low	Low	Medium	High	Extreme
As likely to occur as not	50%	**Moderate**	Low	Medium	High	Extreme	Extreme
Likely to occur	80%	**Likely**	Medium	High	High	Extreme	Extreme
Very likely to occur	95%	**Almost certain**	High	High	Extreme	Extreme	Extreme

3. Climate change risk assessment

RISK IDENTIFICATION														RISK ASSESSMENT							ADAPTATION MEASURES							
Risk ID	Climate variable	Risk statement	Direct or Indirect, In-combination	Components impacted									Impact type	Planned Controls	Initial risk rating RCP4.5 (2041 - 2060)			Initial risk rating RCP8.5 (2041 - 2060)			Adaptation Measures	Responsibility	Residual risk rating RCP4.5 (2041 - 2060)			Residual risk rating RCP8.5 (2041 - 2060)		
		Description of impacts		Pavements e.g. cycle path, road, carpark	Earthworks, geotechnical assets	Vegetation & landscaping	Drainage	Signs, light posts, traffic lights, fences	Structures e.g. bridges, retaining	Utilities	Human health & safety e.g. staff,	Construction equipment & site	e.g. Asset damage / engineering / operational, Health and safety, Environmental, Social, Financial, Reputation, Cultural	e.g. controls planned within the current design that mitigate the identified risk	Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating	e.g. additional design or operational measures that can be implemented to further reduce the climate risk		Likelihood	Consequence	Risk Rating	Likelihood	Consequence	Risk Rating
CONSTRUCTION																												
1	Extreme temperature (heat)	Extreme heat event causes overheating of construction equipment resulting in delays, repairs and additional costs.	Direct								●	●	Asset damage, Financial	The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions.	Unlikely	Insignificant	Low	Unlikely	Insignificant	Low	Consider inspection of vulnerable construction assets after a hot day.	Contractor	Unlikely	Insignificant	Low	Unlikely	Insignificant	Low
2	Extreme temperature (heat)	Health and safety risks to the construction workforce during severe weather events including sunstroke and dehydration.	Direct								●		Health & Safety	The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions.	Unlikely	Minor	Low	Unlikely	Minor	Low	Contractor to implement measures to combat extreme heat conditions (e.g. avoid working on hot summer days, appropriate sun protection, training for identifying heat illness and for working in hot conditions, work in shaded areas, plan major activities for cooler parts of the day, wear loose fitting/breathable clothing).	Contractor	Unlikely	Insignificant	Low	Unlikely	Insignificant	Low
3	Extreme rainfall	Extreme rainfall causes displacement of soils during construction resulting in damage to construction equipment, delays and health and safety impacts.	Direct		●						●	●	Asset damage, Financial	Best practice standards, environmental guidelines and mitigation measures will be defined in the CEMP and adhered to in order to avoid impacts on soil quality and displacement. Suitable storage and bunding of materials to protect from high rainfall events during construction. Drainage from the bunded area will be diverted for collection and safe disposal. This will be further supported by the Site Emergency Response Plan that will be included as part of the Applicants' EMS. The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions.	Unlikely	Minor	Low	Unlikely	Minor	Low	No further adaptation measures required.	Contractor	Unlikely	Minor	Low	Unlikely	Minor	Low
4	Extreme rainfall	Extreme rainfall event causes surface water flooding of the construction site and local roads. This affects viability of and access to the site, causing potential delays to construction work and damage to equipment.	Direct	●			●				●	●	Asset damage, Financial	Suitable storage and bunding of materials to protect from high rainfall events during construction. Drainage from the bunded area will be diverted for collection and safe disposal. This will be further supported by the Site Emergency Response Plan that will be included as part of the Applicants' EMS. Appropriate surface water drainage and attenuation will be provided for the construction phase to manage the risk of flooding. The Contractor will monitor weather forecasts and receive Environment Agency flood alerts and plan works accordingly, protecting workers and resources from any extreme weather conditions such as storms, flooding etc.	Unlikely	Minor	Low	Unlikely	Minor	Low	Critical construction equipment to be stored at higher ground levels. Welfare areas to be assigned to higher ground levels. For extreme rainfall forecasts, ensure construction plants are secure and stored at higher ground levels. 3 day warning period allows for the implementation of precaution measures.	Contractor	Unlikely	Minor	Low	Unlikely	Minor	Low

5	Storm events	Storm events (including high winds) make work environments and the use of construction equipment and machinery unsafe resulting in damage to construction equipment and/ or temporary building facilities causing delays or safety risks.	Direct								●	●	Asset damage, Financial	Suitable storage and bunding of materials to protect from high rainfall events during construction. Drainage from the bunded area will be diverted for collection and safe disposal. This will be further supported by the Site Emergency Response Plan that will be included as part of the Applicants' EMS. Materials will be protected and stored within voids or protected by topographical features. The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions. Flood forecasting to be used to ensure Health and Safety remains a priority in terms of management and operation of the greenway.	Unlikely	Minor	Low	Unlikely	Minor	Low	No further adaptation measures required.	Contractor	Unlikely	Minor	Low	Unlikely	Minor	Low
6	Storm events	Inaccessible construction site(s) due to severe weather events associated with storms restricting working hours, delaying delivery of construction materials and equipment, preventing access of construction operatives onto site and delaying operations.	Direct	●							●	●	Financial	The Contractor will monitor weather forecasts and plan works accordingly, protecting workers and resources from any extreme weather conditions.	Unlikely	Insignificant	Low	Unlikely	Insignificant	Low	No further adaptation measures required.	Contractor	Unlikely	Insignificant	Low	Unlikely	Insignificant	Low
OPERATION																												
7	Storm events	Extreme weather events (including extreme rainfall and high winds) may cause damage, uprooting and breakage of vegetation and trees resulting in debris on the Greenway posing a safety hazard to users and potentially causing damage to the Greenway.	Direct	●		●					●		Asset damage, Environmental, Safety	Tree maintenance undertaken including the clear felling and thinning activities every 2/3 years as routine. Assumed behavioural control in that there will be fewer Greenway users during storm events therefore safety hazard will be minimised.	Unlikely	Moderate	Medium	Unlikely	Moderate	Medium	Operational Management Plan of Greenway to include clean up and maintenance post storm events. Regular monitoring of plantings to check and manage condition of vegetation.	Wicklow County Council	Unlikely	Minor	Low	Unlikely	Minor	Low
8	Extreme temperature (heat)	Damage to infrastructure by prolonged high temperatures (heat damage, deformation, cracking and thermal expansion) causing reduced localised useability of sections of the Greenway and increased maintenance.	Direct	●					●				Asset damage, Operational, Financial	Material specifications for pavements would be considered during detailed design. Consideration will be given to materials with increased tolerance to high temperatures where appropriate and practicable. Operational management of the Greenway will include occasional maintenance activities across the development site.	Unlikely	Insignificant	Low	Unlikely	Insignificant	Low	No further adaptation measures identified	Wicklow County Council	Unlikely	Insignificant	Low	Unlikely	Insignificant	Low
9	Storm events (wind)	Severe wind event has higher wind loading than designed, causing stress to infrastructure including lights, fencing, signage, resulting in damage or reduced design life and potential safety hazard.	Direct					●			●		Asset damage, Operational, Financial, Safety	In accordance with standards, foundation designs for signage etc. will account for windstorm projections through the relevant wind loading requirements. Sign faces would be vulnerable to high wind speeds but consideration of the types of fastenings to be used and additional mitigation would take place during detailed design.	Unlikely	Minor	Low	Unlikely	Minor	Low	Operational Management procedures to consider providing warnings on websites, radio and/or variable messaging signs to deter users from using Greenway under certain weather conditions.	Wicklow County Council	Rare	Insignificant	Low	Rare	Insignificant	Low

10	Extreme rainfall	Extreme rainfall event results in increased surface runoff and elevated water levels of the Poulaphouca Reservoir risking overspill onto surrounding path development leading to localised flooding, infrastructure damage (particularly at watercourse crossing locations) or safety hazards and reduced useability of the Greenway.	Direct	●			●				●		Asset damage, Operational, Financial, Safety	A hydrological study will be undertaken as part of the culvert and structure design process to establish the extent of any floodplain and to adequately size the drainage structures. Suitable interception measures and, if necessary, additional overland flow culverts, will be included as part of the design to prevent flooding from overland flows. If the scheme is on embankment across a topographic depression, interceptor ditches will be provided on the upstream side and, if necessary, additional overland flow culverts will be provided to ensure overland flow does not pond. Watercourse crossings will also be subject to Section 50 Approvals from OPW. Drainage pipes will be used in locations where fill earthworks have the potential of causing ponding for surface water runoff to bring the surface water beneath the greenway to enable continued flow into the reservoir. New gullies and connections provided to maintain the existing drainage system. Rock armour utilised in various locations along the shoreline to manage the effects of erosion by the reservoir. Inceptor ditches provided at the top of the cutting slopes where the adjacent ground falls	Moderate	Minor	Medium	Moderate	Minor	Medium	Operational Management procedures to consider providing warnings on websites, radio and/or variable messaging signs to deter users from using Greenway under certain weather conditions. Consideration to be given to limiting / stopping the operation of the shuttle service to deter users from using Greenway under certain weather conditions. Operational Management Plan of Greenway to include clean up and maintenance post storm events.	Wicklow County Council	Unlikely	Minor	Low	Unlikely	Minor	Low
11	Extreme rainfall	Extreme rainfall events results in increased slope instability leading to subsidence and landslides, particularly within eastern locations of the proposed development where the slope gradient is great. This results in reduced useability of the Greenway, increased maintenance and a possible safety hazard.	Direct	●	●						●		Asset damage, Operational, Health & Safety	Consideration shall be given to groundwater level and ground saturation to prevent excessive overland flow and associated scouring and mobilisation of suspended solids.	Rare	Minor	Medium	Rare	Minor	Medium	Operational Management procedures to consider providing warnings on websites, radio and/or variable messaging signs to deter users from using Greenway under certain weather conditions. Operational Management Plan of Greenway to include clean up and maintenance post storm events.	Wicklow County Council	Rare	Minor	Low	Rare	Minor	Low
12	Wildfire	Potential of wildfire in surrounding vegetation to move onto path causing damage to infrastructure, vegetation and causing a potential health and safety hazard.	Direct	●		●					●		Asset damage, Operational, Environment, Health & Safety	Tree maintenance undertaken including the clear felling and thinning activities every 2/3 years as routine. Ecological Clerk of Works (ECoW) responsible for attending site as required to monitor the protection of asset, including identifying the potential; risks to wildlife and develop suitable control measures, in accordance with the requirements of relevant legislation, the EcIA mitigation measures, the construction contract, and the CEMP.	Rare	Minor	Low	Rare	Minor	Low	Operational Management procedures to consider providing warnings on websites, radio and/or variable messaging signs to deter users from using Greenway under certain weather conditions.	Wicklow County Council	Rare	Minor	Low	Unlikely	Minor	Low
13	Snow / Ice	Extreme cold temperatures result in snow or ice on the Greenway causing a slippage hazard and potential associated injuries for Greenway users.	Direct	●							●			Assumed behavioural control in that there will be fewer Greenway users during storm events therefore safety hazard will be minimised.	Rare	Minor	Low	Rare	Minor	Low	Operational Management procedures to consider providing warnings on websites, radio and/or variable messaging signs to deter users from using Greenway under certain weather conditions. Consideration to be given to limiting / stopping the operation of the shuttle service to deter users from using Greenway under certain weather conditions. Consider gritting (sand, gravel or rock salt) the most frequented parts of the Greenway and carpark to prevent slippage. Regular maintenance of Greenway to keep clear of debris (especially prior to forecasted snow and extreme cold temperatures).	Wicklow County Council	Rare	Insignificant	Low	Rare	Insignificant	Low