SECTION 8: Air Quality and Climate

8.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) assesses the impact of the Castletroy Wastewater Treatment Plant Upgrade on air quality and climate during the Construction and Operational Phases.

This air quality and climate impact assessment has been prepared to assess the potential air quality and climate impact of the Proposed Development on the sensitive residential and educational receptors in the vicinity of the Proposed Development site.

The construction and operational activities of the Proposed Development have been examined to identify those that have the potential to give rise to dust and air pollutant emissions and a suitable risk assessment has been undertaken. As appropriate, construction mitigation measures have been outlined.

The assessment and evaluation of the potential air quality and climate impact arising from the Proposed Development involved the following:

- Review of background ambient air quality in the vicinity of the Proposed Development site using reference data available from the Environmental Protection Agency (EPA);
- Identification and assessment of potential air quality and dust emissions released from the construction of the Proposed Development;
- Identification and assessment of potential air quality and climate emissions released from the operation of the Proposed Development; and
- A recommendation of appropriate construction and operational mitigation measures.
- Assessment of construction and operational phase (approximated) greenhouse gas (GHG) emission levels:
- Comparison against the EPA`s projected GHG emissions for both the non-Emission Trading Scheme[2] (ETS) sector and total emissions for 2030.

8.1.1 Study Area

The Castletroy Wastewater Treatment Plant (WwTP) is located within the Dromroe townland, immediately northwest of the University of Limerick (UL). It is located on the banks of the Lower River Shannon and is accessed via the road system that traverses through the university campus, off Plassey Park Road.

The nearest sensitive receptors are located as follows:

- Properties to the north-east of the WwTP site, at a distance of approximately 130m – 200m from the WwTP site boundary;
- At Dromroe Student Village (Rowan House) to the east of the WwTP site, at a distance of approximately 130m from the WwTP site boundary;

[2] All greenhouse gas emissions that are not from companies in the Emissions Trading Scheme. Non-ETS emissions include greenhouse gas emissions from homes, cars, small businesses and agriculture.

- At Thomond Village (Heron House) to the north-east of the WwTP site, at a distance of approximately 280m from the WwTP site boundary;
- At Stanford Close to the south of the WwTP site, at a distance of approximately 275m from the WwTP site boundary;
- The nearest non-residential receptors to the WwTP site are UL Western Carpark 25m south of the WwTP and UL Boathouse approximately 60m west of the WwTP. Various University of Limerick educational buildings are located in excess of 175m to the south-east from the WwTP site boundary; and
- The Castletroy WwTP site area is approximately 3.166 ha.

8.1.2 Relevant Guidelines, Policy and Legislation

Construction Impact – Dust Deposition Guidelines

Dust particles can be classified into those that are easily deposited and those that remain suspended in the air for long periods. This division is useful as deposited dust is usually the coarse fraction of particulates that causes dust annoyance, whereas suspended particulate matter is implicated more in exposure impacts. Airborne particles have a large range of diameters, from nanoparticles and ultrafine particles (diameters less than 0.1 microns (µm)) to the very large particles with diameters up towards 100µm. There is no clear dividing line between the sizes of suspended particulates and deposited particulates, although particles with diameters >50µm tend to be deposited quickly and particles of diameter <10µm (PM_{10}) have an extremely low deposition rate in comparison. Therefore, the size of suspended and deposited dust particles affects their distribution and as such requires two very different approaches to sampling these fractions. PM_{10} is the fraction of airborne (suspended) particulates which contains particles of diameter less than 10µm. $PM_{2.5}$ is the fraction of airborne (suspended) particulates which contains particles of diameter less than 2.5µm. PM_{10} and $PM_{2.5}$ particles can penetrate deep into the respiratory system increasing the risk of respiratory and cardiovascular disorders. Total Suspended Particles (TSP) is the term used when referring to larger particles which do not have a specified size limit. It is common for TSP to be measured alongside PM_{10} and $PM_{2.5}$ particularly at industrial sites when dust monitoring is undertaken.

Particulate matter can emanate from natural and anthropogenic sources. Natural sources include sea salt, forest fires, pollen and moulds. Natural sources are unregulated and harder to control. Anthropogenic sources can be regulated and understanding the sources of particulate matter is very important. PM_{10} is most commonly associated with road dust and construction activities. Wear and tear of brakes and tyres on vehicles and crushing activities at construction sites can all contribute to a rise in PM_{10}. $PM_{2.5}$ is associated with fuel burning, industrial combustion processes and vehicle emissions. Larger particles (100µm diameter) are likely to settle within 5-10m of their source under a typical mean wind speed of 4-5 metres per second (m/s), and particles between 30-100 µm diameter are likely to settle within 100m of the source. Smaller particles, particularly those <10 µm in diameter, i.e. PM_{10}, have a greater potential to have their settling rate impeded by atmospheric turbulence and to be transported further from their source. Dust emissions are exacerbated by dry weather and high wind speeds. The impact of dust therefore, also depends on the wind direction and the relative location of the dust source and receptor.

Currently no Irish statutory standards or limits exist for the assessment of dust deposition and its tendency for causing nuisance. Similarly, no official air quality criterion has been set at a European or World Health Organisation (WHO) level, although a range of national 'yardstick' criteria from other countries is found in literature.

In England and Wales, a *'custom and practice'* limit of 200 milligrams per metres squared per day ($mg/m^2/day$) is sometimes referenced using Frisbee-type Deposition Gauges. This value was derived by multiplying a historical, typical UK median background by 3.5 (which was the ratio of the 95th percentile to the median). It should be noted that because background dust levels can vary significantly from place to place and with season, the authors Vallack and Shillito (Suggested Guidelines for Deposited Ambient Dust (Vallack & Shilito 1998)) were clear that the preferred approach is to calculate a bespoke site-specific "complaints likely" dust guideline, where sufficient local baseline monitoring data is available (at least 12-months) based on 3.5 times the median background level. However, such bespoke local baseline data is often not available and in such cases the authors recommended using as a fall-back the 95th percentile of typical UK background data. It is important that the limitations of the 200 mg/m^2/day benchmark are appreciated: firstly, it is simply a custom and practice yardstick and it was never based on actual dose-response data; secondly, in deriving this default "complaints likely" guideline, the authors used a dataset that was quite old and not necessarily indicative of today's background levels.

The German TA Luft Regulations, "Technical Instructions on Air Quality Control" (Verein Deutscher Ingenieure (VDI) 2002) state that total dust deposition (soluble and insoluble, measured using Bergerhoff type dust deposit gauges as per German Standard Method for determination of dust deposition rate, VDI 2119) should not exceed a dust deposition rate of 350mg/m^2/day (when averaged over a 30+/-2 day period). The use of this limit value is appropriate to minimise the impact of airborne dust levels on the receiving environment beyond the site boundary. The German TA Luft criteria for '*possible nuisance'* and *'very likely nuisance'* are 350 mg/m^2/day and 650 mg/m^2/day, respectively.

Criteria from other countries that can be referred to include:

- In the USA, Washington has set a state standard of 187 mg/m^2/day for residential areas;
- Western Australia also sets a two-stage standard, with '*loss of amenity first perceived'* at 133 mg/m^2/day and '*unacceptable reduction in air quality*' at 333 mg/m^2/day; and
- The Swedish limits promoted by the Stockholm Environment Institute, and used regularly in Scotland, range from 140 mg/m^2/day for rural areas to 260 mg/m^2/day for town centres.

These go some way to addressing the view that the annoyance impact (and hence potential for complaints) depends on the worsening of dust levels above existing background levels.

In 2005, the UK Highways Agency (Now National Highways) released an Interim Advice Note 61/05 Guidance for Undertaking Environmental Assessment of Air Quality for Sensitive Ecosystems in Internationally Designated Nature Conservation Sites and SSSIs (UK Highways Agency 2005) as a supplement to the Design Manual for Roads and Bridges (DMRB) Guidelines. This interim guidance states that dust or particles falling onto plants can physically smother the leaves affecting photosynthesis, respiration and transpiration. The literature suggests that the most sensitive species appear to be affected by dust deposition at levels above 1,000 mg/m^2/day which is considerably greater than the level at which most dust deposition may start to cause a perceptible nuisance to humans. As such, once dust deposition rates are maintained within the guidelines for human nuisance the impact of dust deposition on sensitive ecosystems is considered negligible. Therefore, the following dust deposition limits are typically recommended:

- Dust Deposition Rate limit = 350 mg/m^2/day (averaged over a 30+/-2 day period using Bergerhoff Gauge Method);
- Dust Deposition Rate limit affecting sensitive ecological receptors = 1,000 mg/m^2/day;

- PM_{10} 24 Hour Mean concentration limit = 50 microns per metre cubed (µg/m^3) not to be exceeded more than 35 times a calendar year;
- PM_{10} Annual Mean concentration limit = 40 µg/m^3; and
- $PM_{2.5}$ Annual Mean concentration limit = 25 µg/m^3.

Air Quality Standards

In order to protect our health, vegetation and ecosystems, EU directives set down air quality standards in Ireland and the other member states for a wide variety of pollutants. These rules include how we should monitor, assess and manage ambient air quality. The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was published in May 2008. It replaced the Framework Directive and the first, second and third Daughter Directives. The fourth Daughter Directive (2004/107/EC) will be included in CAFE at a later stage. The limit and target values for both Directives are outlined below. The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). It replaces the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and S.I. No. 33 of 1999. The fourth Daughter Directive was transposed into Irish legislation by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009).

Table 8.1–Table 8.6set out the limit values or target values specified by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) **& CAFE Directive 2008/50/EC**.

Table 8.1: Limit Values of Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) & CAFE Directive 2008/50/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value	Basis of Application of the Limit Value
SO_2	Protection of human health	1 hour	350	Not to be exceeded more than 24 times in a calendar year
	Protection of human health	24 hours	125	Not to be exceeded more than 3 times in a calendar year
	Protection of vegetation	calendar year	20	Annual mean
	Protection of vegetation	1 Oct to 31 Mar	20	Winter mean
NO_2	Protection of human health	1 hour	200	Not to be exceeded more than 18 times in a calendar year
	Protection of human health	calendar year	40	Annual mean
NOx	Protection of ecosystems	calendar year	30	Annual mean
PM_{10}	Protection of human health	24 hours	50	Not to be exceeded more than 35 times in a calendar year
	Protection of human health	calendar year	40	Annual mean
$PM_{2.5}$ - Stage 1	Protection of human health	calendar year	25	Annual mean
$PM_{2.5}$ - Stage 2	Protection of human health	calendar year	20	Annual mean
Lead	Protection of human health	calendar year	0.5	Annual mean

Carbon Monoxide	Protection of human health	8 hours	10,000	Not to be exceeded
Benzene	Protection of human health	calendar year	5	Annual mean

Table 8.2: Alert Thresholds for Sulphur Dioxide & Nitrogen Dioxide (the Public Must be Informed if the Following Thresholds are Exceeded for Three Consecutive Hours)

Pollutant	Averaging Period	Limit Value
Sulphur Dioxide	1 hour	500 μg/m^3
Nitrogen Dioxide	1 hour	400 μg/m^3

Table 8.3: Target Values of Directive 2004/107/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value (nanogram per metre cubed (ng/m^3))	Limit Value Attainment Date
Arsenic	Protection of human health	calendar year	6	31 Dec 2012
Cadmium	Protection of human health	calendar year	5	31 Dec 2012
Nickel	Protection of human health	calendar year	20	31 Dec 2012
Benzo (a) pyrene	Protection of human health	calendar year	1	31 Dec 2012

The ozone daughter directive is different from the previous two in that it sets target values and long term objectives for ozone levels rather than limit values. They are as follows:

Table 8.4: Target Values for Ozone from 2010

Objective	Parameter	Value
Protection of human health	Maximum daily 8 hour mean	120 μg/m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years
Protection of vegetation	AOT 40 calculated from 1 hour values from May to July	18000 μg/m^3-h averaged over 5 years

Table 8.5: Long Term Objectives for Ozone from 2020

Objective	Parameter	Value
Protection of human health	Maximum daily 8 hour mean	120 μg/m^3
Protection of vegetation	AOT40 calculated from 1 hour values from May to July	6000 μg/m^3-h

Table 8.6: Information and Alert Thresholds for Ozone (the Public Must be Informed if Ozone Levels Exceed the Following Thresholds)

Objective	Parameter	Threshold
Information Threshold	1 hour average	180 μg/m^3

Alert Threshold	1 hour average	240 µg/m^3

Air Quality Impact Assessment Guidelines

In terms of the 'Significance of Potential Environmental Effects' the magnitude (scale of change) has been determined by considering the impacts of the Proposed Development on air quality with reference to the baseline conditions and environmental assessment criteria.

Describing the Impact

The rationale for describing the impact of the Proposed Development is derived from the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) guidance Land-Use Planning & Development Control: Planning for Air Quality (EPUK & IAQM 2017). There is a two-stage process to be followed in the assessment of air quality impacts:

- A qualitative or quantitative description of the impacts on local air quality arising from the development; and
- A judgement on the overall significance of the effects of any impacts.

The suggested framework for describing the impacts is set out in *Table 8.3 of the EPUK & IAQM guidance document* and is shown in Table 8.7. The term Air Quality Assessment Level (AQAL) has been adopted as it covers all pollutants, i.e. those with and without formal standards. AQAL is used to include air quality objectives or limit values where these exist. The UK Environment Agency uses a threshold criterion of 10% of the short term AQAL as a screening criterion for the maximum short-term impact. The EPUK & IAQM guidance adopts this as a basis for defining an impact that is sufficiently small in magnitude to be regarded as having an insignificant effect.

Table 8.7: Impact Descriptors for Individual Receptors

Long term average Concentration at Receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Moderate
103-109% f AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Explanation

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

2. The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as Negligible.

3. The Table is only designed to be used with annual mean concentrations.

4. Descriptors for individual Receptors only; the overall significance is determined using professional judgement (see Section 7). For example, a 'moderate' adverse impact at one Receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.

8. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.

7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

Assessing Significance:

The rationale for the assessment of significance is derived from the EPUK & IAQM Guidance (paragraphs 7.1-7.12 referring to Table 8.3) and relates to Table 8.7.

Impacts on air quality, whether adverse or beneficial, will have an effect on human health that can be judged as 'significant' or 'not significant'. An 'impact' is the change in the concentration of an air pollutant, as experienced by a Receptor. This may have an 'effect' on the health of a human Receptor, depending on the severity of the impact and other factors that may need to be taken into account. The impact descriptors set out in Table 8.7 are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual Receptors. Whilst it may be that there are 'slight', 'moderate' or 'substantial' impacts at one or more Receptors, the overall effect may not necessarily be judged as being significant in some circumstances.

Any judgement on the overall significance of effect of a development will need to take into account such factors as:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

Other factors may be relevant in individual cases.

Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in 1997 (United Nations, 1997), (Framework Convention on Climate Change, 1999). For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, Ireland agreed to limit the net anthropogenic growth of the six greenhouse gases (GHGs) under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012 (Environmental Resource Management, 1998). The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emission Trading and burden sharing. The most recent Conference of the Parties to the Convention (COP23) took place in Bonn, Germany from 06 to 17 November 2017 and focussed on advancing the implementation of the Paris Agreement. The Paris Agreement was established at COP21 in Paris 2015 and was an important milestone in terms of international climate change agreements. The "Paris Agreement", agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5 °C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption of countries to deal with the impacts of climate change onto the same level as action to cut and curb emissions.

The EU, on the 23/24 October 2014, agreed the "2030 Climate and Energy Policy Framework" (European Union (EU), 2014). The European Council endorsed a binding EU target of at least a 40% domestic reduction in GHG emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the emissions-trading-system (ETS) and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

The Climate Action Plan 2021 provides a detailed plan for taking decisive action to achieve a 51% reduction in overall greenhouse gas emissions by 2030 and setting us on a path to reach net-zero emissions by no later than 2050, as committed to in the Programme for Government and set out in the Climate Act 2021. The 2021 Climate Action Plan, published in November 2021, outlines the current status across key sectors including electricity, transport, built environment, industry and agriculture and outlines the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2021 CAP also details the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Advisory Council and greater accountability to the Oireachtas. The purpose of the 2021 Climate Act is to provide for the approval of plans 'for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050'.

Data Collection and Collation

A site visit was undertaken to assess the proximity of the nearest residential properties as arranged with J.B. Barry and the operators of the site. Baseline air quality data was referenced from the nearest EPA air quality stations.

8.2 Assessment Methodology

8.2.1 Assessment of Construction Dust Impacts

As prescribed within Land-use Planning & Development Control: Planning for Air Quality (EPUK & IAQM 2017) the Proposed Development has been assessed in accordance with Guidance on the Assessment of Dust from Demolition and Construction (IAQM 2014). This guidance has been referenced to assess the potential impact of the construction, vehicle movements and the earthworks phase of the proposed works. Good practice construction mitigation measures are recommended to be implemented to minimise emission quantities during construction.

8.2.2 Assessment of Air Quality Impacts

The Proposed Development will not give rise to any significant air quality and climate impacts.

Receptors

The following receptors are located in proximity to the Castletroy WwTP. All other receptors in the wider area surrounding the Castletroy WwTP site will experience a lower air quality impact. These locations are shown in Figure 8-1. SR1 – SR15 represent residential receptor locations. SR16 – SR19 represent University of Limerick receptor locations.

Table 8.8: Nearest Sensitive Receptor Locations to the Castletroy WwTP

Receptor Reference	ITM Grid Reference		Distance to Nearest Site Boundary (m)
	X (m)	Y (m)	
SR1	560847.5	658623.5	130m
SR2	560865.9	658624.4	142m
SR3	560883.9	658620.5	152m
SR4	560899.3	658625.2	165m
SR5	560919	658626.9	183m
SR6	560946.8	658630.4	202m
SR7	560872.4	658806.8	268m
SR8	560934.1	658781.5	295m
SR9	560981.9	658789.1	338m
SR10	560957.1	658487.4	130m
SR11	560954.5	658443.3	130m
SR12	560782.3	658095.2	275m
SR13	560680.8	658086.9	280m
SR14	560101.5	658848.1	580m
SR15	560145.8	658929.4	585m
R16 (Car park to south)	560799.9	658379.2	30m
R17 (UL Boathouse)	560556.9	658466.3	75m
R18 (Nexus Innovation Centre)	560950.6	658317.2	170m
R19 (UL Building)	560917.5	658244.7	210m

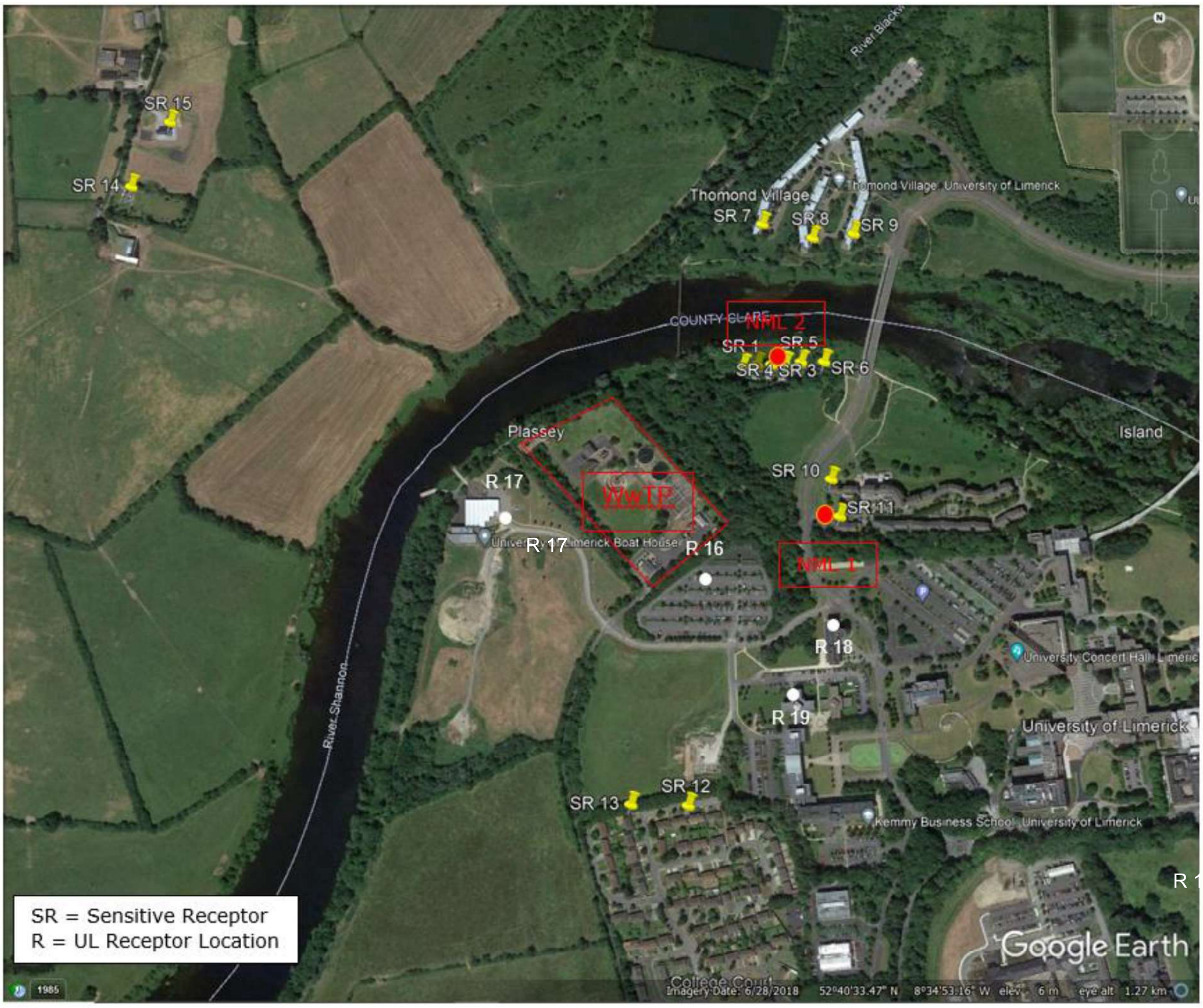

Figure 8-1: Nearest Sensitive Receptor Locations to the Proposed Development

8.2.3 Assessment of Climate Impacts

Sensitivity of the Proposed Development to Climate Change

The sensitivity of the Proposed Development to climate change relates to increasing stormwater flow to the WwTP from the sewer network and increased risk from flooding of the Lower River Shannon. The effects of flooding on the site and mitigation recommendations are outlined in the Flood Risk Assessment (FRA), available in **Appendix 14 B**. Details of design allowances and mitigation measures relating to climate change effects, are outlined in **Part A, Section 3** and Construction Strategy **Part A, Section 4**.

Effects of the Proposed Development on Climate Change

A climate impact assessment was carried out in order to determine the likely significant effects of greenhouse gas emissions (Mt CO2 equivalent) predicted due to the construction and operational phases of the proposed development, relative to Ireland's projected baseline for 2020, as reported by the EPA.

8.3 Baseline Conditions

8.3.1 Baseline Air Quality

There are four EPA air quality stations in Limerick. Two national ambient air quality monitoring stations are located southwest of the Proposed Development works and two local network monitoring stations are located in Castletroy and on O'Connell Street.

The closest national ambient air quality monitoring station is on Henry Street (Grid Ref 52.6613°N, -8.6316°E), This station commissioned in June 2021, is located approximately 3.63 km south-west of the Proposed Development works. Automatic, provisional results are available here for nitrogen dioxide, ozone, and particulate matter (PM10 and PM2.5).

The closest local network monitoring station is in Castletroy (Grid Ref: 52.6631°N, -8.5404°E), located approximately 3km southeast of the Proposed Development works. This station monitors Particulate Matter (PM10 and PM2.5). Monitoring locations relative to Castletroy WwTP are shown in Figure 8-2.

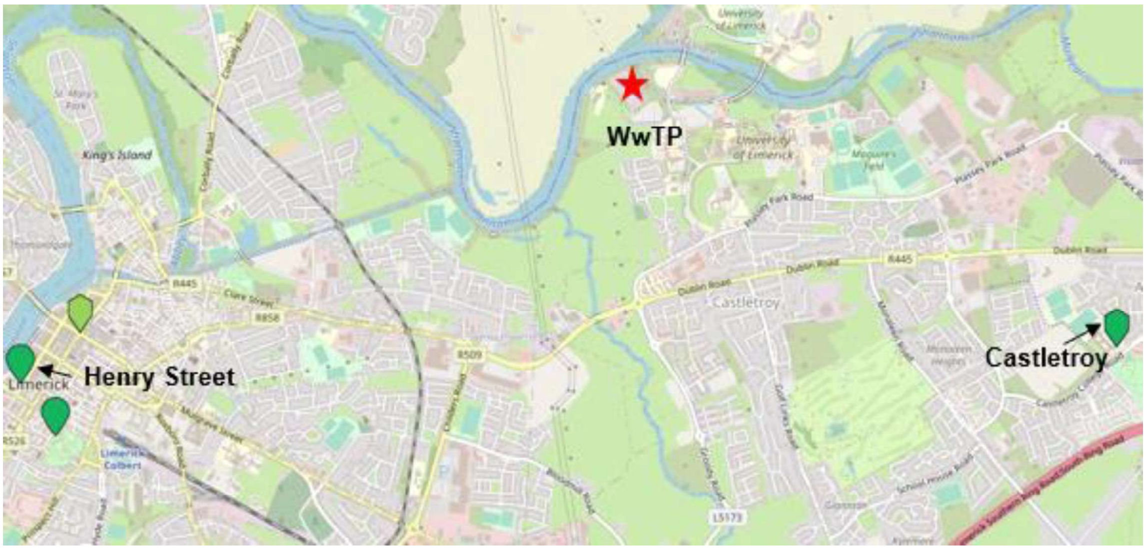

Figure 8-2: EPA Air Quality Stations, Limerick City (Source: EPA 2022)

Table 8.9 shows the average Ozone (O_3), Nitrogen Dioxide (NO_2,) and Particulate Matter (PM_{10} and $PM_{2.5}$) concentrations for each month from May 2021 to April 2022 (EPA 2022) for the Air Quality Stations at Henry Street (National Network) and Castletroy (Local Network);

Table 8.9: Air Quality Levels at Henry Street and Castletroy Stations, Limerick City (May 2021 – April 2022)

Monitoring Location	Month	NO_2 µg/m^3	O_3 µg/m^3	PM_{10} µg /m^3	$PM_{2.5}$ µg /m^3
Henry Street	July 2021	11.25	49.76	10.07	5.28
	August 2021	10.08	49.94	9.13	5.25
	September 2021	12.28	52.45	10.08	5.82
	October 2021	13.48	50.30	8.43	4.84
	November 2021	22.79	43.65	14.11	8.15

	December 2021	19.84	44.85	15.39	11.07
	January 2022	23.23	43.10	23.37	18.21
	February 2022	14.99	64.84	14.22	7.94
	March 2022	20.28	58.74	22.40	15.15
	April 2022	15.67	64.00	13.23	7.64
Castletroy	May 2021			5.04	3.92
	June 2021			5.40	3.95
	July 2021			4.66	3.29
	August 2021			4.94	4.00
	September 2021			8.37	4.04
	October 2021			5.67	3.54
	November 2021			9.20	3.84
	December 2021			8.88	3.90
	January 2022			11.37	4.80
	February 2022			8.47	4.86
	March 2022			3.97	2.05
	April 2022			17.44	10.71
Annual Mean Limit Value		40 μg/m^3		40 μg/m^3	20 μg/m^3
Maximum daily 8 hour mean Limit Value			120 μg/m^3		

Table 8.9 shows that the limit values for Ozone (O_3), Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10} and $PM_{2.5}$) have not been exceeded from May 2021 to April 2022.

8.3.2 Baseline Climate

'Ireland, National Inventory Report 2022' as published by the EPA states that in 2020, total emissions of greenhouse gases including indirect emissions from solvent use (without LULUCF) in Ireland were 57,716.1 kt CO2 equivalent, which is 6.1%higher than emissions in 1990 as presented in Figure 8.3 National Total GHG Emissions (excluding LULUCF) 1990 - 2020.

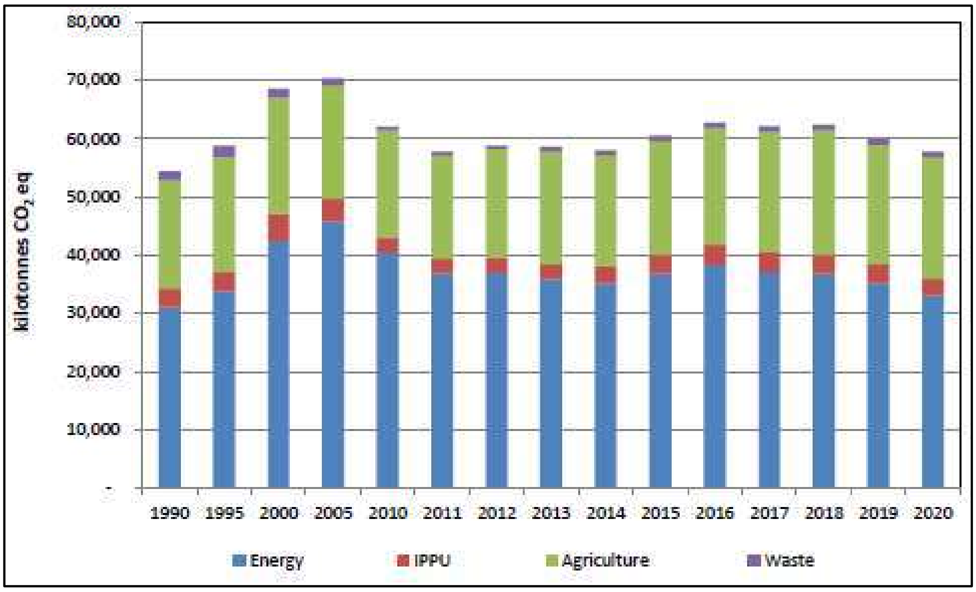

Figure 8-3: National Total GHG Emissions (excluding LULUCF) 1990 - 2020

'Irelands National Inventory Report 2022' states that solid waste disposal in landfill sites, biological treatment of solid waste, waste incineration and wastewater treatment are the main activities that give rise to greenhouse gas emissions in the Waste sector, Figure 8.4.

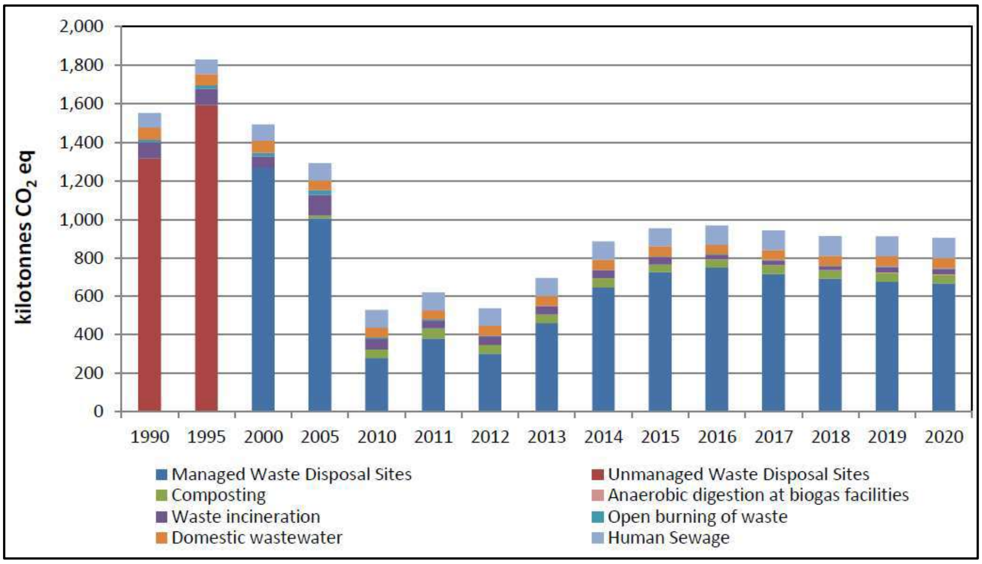

Figure 8-4: Total Emissions from Waste by Sector. 1990-2020.

In 2020, methane and nitrous oxide emissions from domestic wastewater treatment accounted for 53.1 kt CO2eq and 107.1 kt CO2eq respectively. This accounts for 17.7% of the 905.7 kt CO2eq emitted from Waste in 2020 and 0.277% of the total 57,716.1 kt CO2eq emitted in 2020.

Furthermore, Ireland's ESR emissions annual limit for 2021 was 43.48 Mt CO2 eq. Ireland's provisional 2021 greenhouse gas ESR emissions were 46.19 Mt CO2 eq, this was 2.71 Mt CO2 eq more than the annual limit for 2021. This indicates that Ireland was not in compliance with its 2021 Effort Sharing Regulation annual limit, exceeding the allocation by 0.80 Mt CO2 eq after using the ETS flexibility.

In 2022, the EPA[3] reported emissions from Commercial Services and Public Services decreased by 3.0% and 3.8% respectively in 2021. Natural gas use in both sectors decreased by 5.0% with oil also reducing by 3.1% within Public Services.

8.3.3 Climate & Weather in the Existing Environment

Ireland has a temperate, oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Shannon Airport, Co. Clare, is the nearest weather and climate monitoring station to the Proposed Development site that has meteorological data recorded for the 30-year period from 1981 – 2010. The Shannon Airport monitoring station is located approximately 25 kilometres west of the site. The wettest months are October to January, and April to July usually the driest. July is the warmest month with an average temperature of 16.4°C. the mean annual temperature recorded at Shannon Airport was 10.7°C.

[3] (EPA, 2022) Ireland's Provisional Greenhouse Gas Emissions Report, 1990-2021

The recent weather patterns and extreme weather events recorded by Met Éireann have been reviewed. A noticeable feature of the recent weather has been an increase in the frequency and severity of storms with notable events including Storm Darwin in February 2014, Storm Emma in March 2018, and Storm Ophelia in October 2018. The sensitivity of the Proposed Development to climate change relates to increasing stormwater flow to the WwTP from the sewer network and increased risk from flooding of the Lower River Shannon has been assessed in light of these extreme weather events.

The site was flooded severely in November 2009 due to the Lower River Shannon bursting its banks following unprecedented rainfall. More recent flooding from the Lower River Shannon occurred in 2015 which resulted in water levels rising to the door entrance of the main control building.

The Limerick Development Plan 2022-2028 sets out the approach to flooding, flood risk management and water management in 'Chapter 9 Climate Action, Flood Risk and Transition to Low Carbon Economy'. The Flood Map for Limerick City and Suburbs shows Castletroy WwTP to be partially located within Flood Zone A and B. The Flood Zones are defined in The Planning System and Flood Risk Management, Guidelines for Planning Authorities issued by the Department of Housing, Local Government and Heritage.

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 year for river flooding or 0.5% or 1 in 200 for coastal flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 100 year and 1% or 1 in 1000 year for river flooding and between 0.1% or 1 in 1000 year and 0.5% or 1 in 200 year for coastal flooding); and
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding).

Shannon Catchment Flood Risk Assessment and Management (CFRAM) Study mapping also shows the site to be partially located within the 0.1% and 1% AEP flood extents of the Lower River Shannon. The study provides modelled flood levels of the Lower River Shannon in the vicinity of the proposed development site during the 1% and 0.1% AEP fluvial events. There are 2 nodes to the north of the site which are equidistant to the site boundary and the flood levels at the nodes are presented in Table 8.10 below.

Table 8.10: Fluvial Flood Levels at the Site

Node	1% AEP Flood Level	0.1% AEP Flood Level
09LSH00000	+6.36 mOD	+6.92 mOD
09LSH0082u	+6.38 mOD	+6.94 mOD

The location of these nodes and further assessments are outlined in the Flood Risk Assessment (FRA), available in **Appendix 14 B**.

Table 8.11: Summary of Met Éireann meteorological data at Shannon Airport, recorded for the 30-year period from 1981 to 2010

Shannon Airport 1981–2010 averages														
TEMPERATURE (degrees Celsius)		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mean daily max		8.8	9.2	11.1	13.3	16.0	18.3	19.8	19.6	17.7	14.3	11.1	9.0	14.0
mean daily min		3.2	3.2	4.5	5.7	8.2	10.9	12.9	12.7	10.8	8.2	5.5	3.6	7.4
mean temperature		6.0	6.2	7.8	9.5	12.1	14.6	16.4	16.2	14.2	11.2	8.3	6.3	10.7
absolute max.		14.8	15.5	18.3	23.5	27.2	30.2	30.6	29.8	26.1	22.3	17.6	15.3	30.6
min. maximum		-2.4	0.9	3.5	5.4	8.0	11.8	13.8	13.0	11.1	7.0	0.8	-6.0	-6.0
max. minimum		11.8	12.3	11.7	13.0	15.3	17.8	19.4	19.3	17.8	16.3	13.4	12.9	19.4
absolute min.		-11.2	-5.5	-5.8	-2.3	0.2	3.6	6.7	4.4	1.7	-2.0	-6.6	-11.4	-11.4
mean num. of days with air frost		5.3	5.1	2.1	0.7	0.0	0.0	0.0	0.0	0.0	0.5	2.3	4.8	20.8
mean num. of days with ground frost		13.7	12.6	11.0	8.3	3.3	0.3	0.0	0.1	1.2	3.8	9.5	12.5	76.3
mean 5cm soil		4.5	4.6	6.3	8.9	12.7	15.9	17.2	16.4	13.8	10.2	7.1	5.2	10.2
mean 10cm soil		4.8	4.8	6.3	8.5	12.1	15.1	16.6	16.1	13.6	10.3	7.4	5.5	10.1
mean 20cm soil		5.5	5.6	7.0	9.2	12.3	15.1	16.8	16.6	14.5	11.4	8.4	6.3	10.7
RELATIVE HUMIDITY (%)														
mean at 0900UTC		87.1	87.0	85.0	79.8	76.3	76.8	80.0	82.1	84.7	87.0	88.9	88.4	83.6
mean at 1500UTC		80.5	74.6	70.5	64.4	63.3	65.1	68.0	68.2	69.2	75.2	80.5	83.1	71.9
SUNSHINE (hours)														
mean daily duration		1.6	2.3	3.2	5.1	5.8	5.2	4.5	4.5	3.9	2.9	2.0	1.4	3.5
greatest daily duration		8.1	10.2	11.0	13.6	15.6	15.8	15.7	14.4	12.2	10.1	8.3	7.1	15.8
mean no. of days with no sun		9.2	6.4	5.7	2.4	1.9	2.0	2.4	2.3	2.9	5.5	7.8	11.1	59.8
RAINFALL (mm)														
mean monthly total		102.3	76.2	78.7	59.2	64.8	69.8	65.9	82.0	75.6	104.9	94.1	104.0	977.6
greatest daily total		38.2	29.4	28.1	40.2	25.0	40.6	39.5	51.0	52.3	36.9	26.9	41.2	52.3

mean num. of days with >= 0.2mm		20	16	19	16	16	15	16	18	16	20	20	19	211
mean num. of days with >= 1.0mm		16	12	14	11	12	11	12	13	12	16	15	15	159
mean num. of days with >= 5.0mm		8	5	5	4	4	4	4	5	4	7	6	7	63
WIND (knots)														
mean monthly speed		10.3	10.2	10.0	9.0	8.9	8.5	8.5	8.2	8.4	9.2	9.1	9.4	9.1
max. gust		75	80	65	62	59	51	52	55	62	71	66	83	83
max. mean 10-minute speed		52	46	44	40	37	37	38	35	40	47	41	57	57
mean num. of days with gales		1.7	0.9	0.8	0.3	0.2	0.1	0.0	0.1	0.1	0.6	0.7	1.2	6.7
WEATHER (mean no. of days with)														
snow or sleet		2.3	2.3	1.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.3	8.0
snow lying at 0900UTC		0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.9
hail		3.6	3.3	3.4	2.2	1.2	0.1	0.1	0.1	0.3	0.9	1.1	2.4	18.6
thunder		0.9	0.5	0.4	0.3	0.5	0.5	0.8	0.4	0.2	0.4	0.4	0.5	5.7
fog		3.3	2.0	2.1	1.9	1.5	1.4	1.4	2.0	2.9	2.9	3.9	4.2	29.6

8.4 Characteristics of the Proposed Development

Details of the Proposed Development are provided in the EIAR **Part A , Section 4**.

8.5 Likely Significant Effects

8.5.1 'Do Nothing' Scenario

The 'Do Nothing' scenario will result in the existing Castletroy WwTP continuing to operate without any changes to air quality or climate.

8.5.2 Construction Phase – Dust

An assessment of the potential impact on air quality during construction is outlined below. The main impact on air quality during the construction phase will be due to potential dust emissions. It is estimated that the duration of the Construction Phase will be approximately from Quarter 1 in 2024 to Quarter 4 in 2026.

The guidance document Land-Use Planning & Development Control: Planning For Air Quality (EPUK & IAQM 2017), from Environmental Protection UK and the Institute of Air Quality Management, outlines that there is a requirement for a change of HGV flows of more than 100 AADT to be an "indicative Criteria to Proceed to a detailed Air Quality Assessment". The actual change in average daily traffic (AADT) flows per day during the construction phase will be well below the threshold when considered against the IAQM and EPUK criteria. Therefore, the construction of the Proposed Development will include for significantly less than 100 additional HGV traffic flows per day. Therefore, there will be no construction traffic impact on local air quality or climate.

Step 1: Screening the Need for a Detailed Assessment

An assessment will normally be required where there is:

- A 'human receptor' within:
  - 350m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

- An 'ecological receptor' within:
  - 50m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

Step2: Assess the Risk of Dust Impacts

The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (STEP 2A); and
- The sensitivity of the area to dust impacts (STEP 2B), which is defined as low, medium or high sensitivity.

These two factors are combined in STEP 2C to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and track out). More than one of these activities may occur on a site at any one time. Where appropriate, the site can be divided into 'zones' for the dust risk assessment.

Step 2A: Define the Potential Dust Emission Class

Table 8.12 describes the potential dust emission class criteria for each outlined construction activity.

Table 8.12: Criteria Used in the Determination of Dust Emission Class

Activity	Criteria used to Determine Dust Emission Class		
	Small	**Medium**	**Large**
Demolition	▪ Total building volume <20,000m³ ▪ Construction material with low potential for dust release (e.g. metal cladding or timber ▪ Demolition activities <10 m above ground level ▪ Demolition during wetter months	▪ Total building volume 20,000m³ - 50,000m³ ▪ Potentially dusty construction material. ▪ Demolition activities 10-20 m above ground level	▪ Total building volume >50,000m³ ▪ Potentially dusty construction material (e.g. concrete) ▪ On-site crushing and screening, ▪ Demolition activities >20 m above ground level
Earthworks	▪ Total site area <2,500m² ▪ soil type with large grain size (e.g. sand), ▪ <5 heavy moving earth vehicles active at any one time ▪ formation of bunds <4 m in height ▪ Total material moved <20,000 tonnes	▪ Total site area 2,500 – 10,000m² ▪ Moderately dusty soil type (e.g. silt) ▪ 5-10 heavy moving earth moving vehicles active at any one time. ▪ formation of bunds 4m - 8m in height, ▪ Total material moved 20,000 – 100,000 tonnes	▪ Total site area >10,000m² ▪ potentially dusty soil type (e.g. clay) ▪ >10 heavy earth moving vehicles active at any one time. ▪ formation of bunds >8m in height ▪ Total material moved >100,000 tonnes
Construction	▪ Total building volume <25,000m³ ▪ Construction material with low potential for dust release	▪ Total building volume 25,000 – 100,000m³ ▪ Potentially dusty construction material (e.g. concrete) ▪ On-site concrete batching	▪ Total building volume >100,000m³ ▪ On-site concrete batching ▪ Sandblasting
Trackout	▪ <10 outward HGV trips in any one day	▪ 10 - 50 outward HGV trips in any one day ▪ moderately dusty surface material	▪ >50 outward HGV trips in any one day ▪ potentially dusty surface material

	▪ surface material with low potential for dust release, ▪ Unpaved road length <50m	(e.g. high clay content), ▪ Unpaved road length 50-100m	(e.g. high clay content ▪ Unpaved road length >100m

The potential dust emission magnitudes for the proposed works were determined using the criteria detailed in Table 8.12.

Table 8.12: Criteria Used in the Determination of Dust Emission Class. The potential for dust emissions is assessed for each activity that is likely to take place. Obviously, if an activity is not taking place, e.g. demolition, then it does not need to be assessed.

Assessment Procedure:

Demolition:

Demolition covers any activity involved with the removal of an existing structure (or structures). There is no demolition intended as part of this proposal.

Therefore, the dust emission magnitude for demolition is not assessed.

Earthworks:

Earthworks covers the processes of soil-stripping, ground-levelling, excavation and landscaping. The following assumptions have been used to determine dust emission magnitude:

- New Odour Control Unit (North of Sludge Dewatering Plant House) ~56 m^2
- New Picket Fence Thickener Tank ~125 m^2
- Proposed Sludge Tank Lay-by ~ 950 m^2
- Proposed Stormwater Tank and Storm Return Pump Station ~ 975 m^2
- Proposed Sludge Thickening Tank ~65 m^2
- 2. No new chemical tanks on concrete plinth ~ 65 m^2
- New Odour Control Unit ~35 m^2
- 3 No. New and Relocate 1 No. Filter ~ 70 m^2
- Proposed New Pump Station ~65 m^2
- Pipework ~ 20 m^2
- Therefore, total site area <2,500m^2;
- Soil type with large grain size (e.g. sand)
- <5 heavy moving earth vehicles active at any one time;
- Total material moved <20,000 tonnes.

Therefore, the dust emission magnitude for earthworks was defined as **Small**.

Construction:

Construction covers any activity involved with the provision of a new structure (or structures), its modification or refurbishment. The following assumptions have been used to determine dust emission magnitude:

- New Odour Control Unit (North of Sludge Dewatering Plant House) ~170 m^3
- New Picket Fence Thickener Tank ~375 m^3
- Proposed Sludge Tank Lay-by ~ 2850 m^3

- Proposed Stormwater Tank and Storm Return Pump Station = 3,500 m^3
- Proposed Sludge Thickening Tank ~195 m^3
- 2. No new chemical tanks on concrete plinth ~ 40 m^2
- New Odour Control Unit ~105 m^3
- 3 No. New and Relocate 1 No. Filter ~ 100 m^3
- Proposed New Pump Station ~1975 m^3
- Total building volume <25,000 m^3; and
- Construction material with medium potential for dust release, i.e. tanks will be constructed of concrete

Therefore, the dust emission magnitude for construction was defined as **Medium** on account of concrete being use in construction of tanks.

Trackout:

Trackout covers the transport of material that may generate dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy goods vehicles (HGVs) leave the construction / demolition site with dusty materials, which may then spill onto the road, and/or when HGVs transfer dust and dirt onto the road having travelled over muddy ground on site. The following assumptions have been used to determine dust emission magnitude:

- <10 outward HGV trips in any one day;
- surface material with low potential for dust release and
- Unpaved road length 50-100m.

Therefore, the dust emission magnitude for trackout was defined as **Medium**.

Step 2B: Define the Sensitivity of the Area

The sensitivity of the area takes account of a number of factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

The criteria for determining the sensitivity of receptors is detailed in Table 8.13 for dust soiling effects and health effects of PM_{10}.

Table 8.13: Criteria for Determining Sensitivity of Receptors

Sensitivity of Receptor	Criteria for Determining Sensitivity	
	Dust Soiling Effects	Health Effects of PM_{10}
High	Dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms	Residential properties, hospitals, schools and residential care homes
Medium	Parks, places of work	Office and shop workers not occupationally exposed to PM_{10}
Low	Playing fields, farmland, footpaths, short-term car parks and roads	Public footpaths, playing fields, parks and shopping streets

The criteria detailed in Table 8.14 and Table 8.15 were used to determine the sensitivity of the area to dust soiling effects and human health impacts.

Table 8.16: Sensitivity of the Area to Ecological Impacts was used to determine the sensitivity of the area to ecological impacts.

Table 8.14: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20m	<50m	<100m	<350m
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 8.15: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Conc	Number of Receptors	Distance from Source (m)				
			<20m	<50m	<100m	<200m	<350m
High	>32 µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Table 8.16: Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Sensitivity of Receptors

Table 8.17 outlines the range of numbers of properties within specific distance bands from the proposed construction activities to determine the receptor sensitivity of the area to Dust Soiling Effects on People and Property.

Table 8.17: Cumulative Number of Sensitive Receptors within 20m, 50m, 100m, 200m and 350m of the Site

Parameter	Number of Receptors within Distance from Site (m)				
	<20m	<50m	<100m	<200m	<350m
No. of receptors in proximity to Site	0	1	1	12	25
Receptor Sensitivity	Low	Low	Low	Low	Low

Sensitivity of People to Dust Soiling

- Earthworks and Construction: The nearest sensitive receiver is UL Western Carpark Although its ~13m from entrance to the site it is >20m from main areas of works of the Proposed Development (~25m). The nearest residential receivers are north of the site, at Plassey Water Mill, Blackridge at ~150m. Dromroe Student Village is located east of the site, with the closet property here (Rowan House) located ~130m from the Proposed Development works. Additional properties and car parks are accounted for in Table 8.16. Therefore, the sensitivity of the area is **Low**; and
- Trackout: As general guidance, without site-specific mitigation, trackout impacts may occur from roads up to 200m from the entrance to medium sites (as determined in Step 2A). As shown in Table 8.16, the sensitivity of the area is **Low**; in terms of potential trackout dust impacts.

Sensitivity of the Area to Human Health Impacts

The background air quality in the WwTP site area is recognised to be of good quality and the site is located in the 'Zone C – Other Cities and Large Towns' area, as denoted by the EPA. The EPA has divided the country into zones for the assessment and management of air quality. The zones adopted in Ireland are Zone A, the Dublin conurbation; Zone B, the Cork conurbation; Zone C, comprising 21 large towns in Ireland with a population >15,000; and Zone D, the remaining area of Ireland.

The EPA's Air Quality Index for Health (AQIH) provides a scaled number from one to ten that identifies the air quality currently in a region and whether or not this might affect human health. A reading of ten means the air quality is very poor and a reading of one to three inclusive means that the air quality is good. The AQIH indicates that the area surrounding the WwTP site is in an area of good air quality (3 Good).

The nearest EPA national ambient air quality monitoring station in Limerick is in Henry Street (Grid Ref 52.6613°N, -8.6316°E), ~ 3.6km south-west of WwTP site, monitors nitrogen dioxide (NO_2), Ozone (O_3) and particulate matter (PM_{10} and $PM_{2.5}$). The average PM_{10} for the month of April 2022 is 13.23 µg/m^3 and $PM_{2.5}$ is 7.64 µg/m^3 (EPA 2022).

The closest local network monitoring station is in Castletroy (Grid Ref: 52.6631°N, -8.5404°E), located approximately 3km southeast of the Proposed Development works. This station monitors Particulate Matter (PM_{10} and $PM_{2.5}$). The average PM_{10} for the month of April 2022 is 17.44 µg/m^3 and $PM_{2.5}$ is 10.71 µg/m^3 (EPA 2022).

Therefore, the annual mean PM_{10} concentration at the site is below the relevant air quality limit value of 40 µg/m^3. As shown in Table 8.13 the sensitivity of the Area to Human Health Impacts is **Low**; in terms of potential construction, earthworks and trackout dust impacts.

Sensitivity of the Area to Ecological Impacts

Dust deposition due to earthworks, construction and trackout has the potential to affect sensitive habitats and plant communities. The Proposed Development is in close proximity to the Lower River Shannon Special Area of Conservation (SAC) (Site Code: 002165).

The proposed odour control unit to be installed at the Sludge Building will be located <50m from the SAC. The Final Effluent Inspection Chamber is located <20m from the SAC. The works are proposed with the walls of the existing Final Effluent Inspection Chamber to be increased to 500mm above the design flood level. The top of wall is at a level of 8.55m OD which is below the design flood level.

This can be considered a High sensitivity receptor (Box 8, IAQM 2014). Therefore, the sensitivity of the area to ecological impacts is **High** in terms of construction, earthworks and trackout.

The sensitivity of the area to dust soiling, human health impacts and ecological impacts for each activity is summarised in Table 8.18**.**

Table 8.18: Outcome of Defining the Sensitivity of the Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Low	Low	Low
Human Health	N/A	Low	Low	Low
Ecological Impacts	N/A	High	High	High

Step 2C: Define the Risk of Impacts

In accordance with the IAQM Guidance, the dust emission magnitude (Step 2A) and sensitivity of the area (Step 2B) have been combined and the risk of impacts from earthworks, construction and trackout determined (before mitigation is applied). The risk of dust soiling, impact on human health and ecological impact before mitigation, is summarised in Table 8.19**.**

Table 8.19: Summary Dust Risk to Define Site-Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Negligible	Low Risk	Low Risk
Human Health	N/A	Negligible	Low Risk	Low Risk
Ecological	N/A	Low Risk	Medium Risk	Medium Risk

Therefore, appropriate construction dust mitigation measures have been outlined for the Proposed Development site.

Step 3: Site-Specific Mitigation

In accordance with the IAQM Guidance, for proposed mitigation measures, the medium risk category should be applied. Therefore, the mitigation measures applicable to a **Medium-Risk site** should be applied. Appropriate Construction dust mitigation measures have been outlined in **Section 8.6.1**

Step 4: Determine Significant Effects

Construction dust control measures and good construction site management and practice is capable of effectively mitigating the potential for significant impact of fugitive dust emissions. Therefore, the potential for fugitive dust emission effects at the nearest sensitive receptors will be controlled to ensure dust impacts are of negligible significance.

The IAQM Guidance recommends that significance is only assigned to the effect after considering the construction activity with mitigation measures in operation. Together with the proposed construction mitigation measures (outlined in **Section 8.6.1**) and the existing low background particulate (PM_{10}) concentrations, the Construction Phase activities on the WwTP site will not cause an exceedance of the air quality objectives at receptor locations.

Table 8.20: Summary of Significance of Impact including Site-Specific Mitigation

Potential Impact	Significance			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Negligible	Negligible	Negligible	Negligible
Human Health	Negligible	Negligible	Negligible	Negligible
Ecological	Negligible	Negligible	Negligible	Negligible

Using the IAQM methodology for the assessment of air quality impacts from construction activities, including the recommended Construction Phase dust mitigation measures (outlined in Section 8.6.1) has indicated the following level of risk:

- Dust soiling impacts => **low risk**;
- Impacts on human health => **low risk**; and
- Ecological impacts => **low risk**.

Table 8.21: Summary of Predicted Construction Phase Impacts

Assessment Topic	Predicted Impact
Construction Dust	Negative, Negligible and Short-Term

8.5.3 Construction Phase – Climate

An assessment of the potential impact on climate during construction of the Proposed Development is outlined below. The estimated GHG emissions arising as a result of the construction materials of the Proposed Development are outlined in Table 8.22.

Table 8.22: Greenhouse Gas Emissions Associated with the Construction of the Proposed Development

Source	Estimated Quantity of Materials (tonnes)	CO_{2eq} / tonne	Total CO_{2eq} (tonnes)
Quarried Minerals	2,000	0.005	10
Timber	750	0.45	300
Concrete & Cement	10,000	0.11	1,100
Metals	2,000	1.45	2,900
Total CO_{2eq} (tonnes)			4,310

As outlined in **Section 8.3.2**, 'Ireland, National Inventory Report 2022' as published by the EPA states that in 2020, total emissions of greenhouse gases including indirect emissions from solvent use (without *LULUCF*) in Ireland were 57,716.1 kt CO_2 equivalent (eq), and the EPA reported in 2022 that total national greenhouse gas emissions were estimated to be 61.53 Mt CO_{2eq} in 2021. Greenhouse gas emissions for non-ETS sectors were recorded to be 46.19 MtCO_{2eq} in 2021. The GHG emissions produced during the construction phase of the Proposed WwTP development are miniscule in terms of Ireland's EU 2020 target at 4,310 tonnes CO_{2eq}. This is <0.007% of Ireland's total CO_{2eq} production in 2021. The transport of construction materials to the site, which will occur on specified routes only, will potentially give rise to greenhouse gas emissions associated with the transport vehicles. The construction phase constitutes a short-term imperceptible negative impact in terms of air quality and climate.

This likely significant effect is considered to be an imperceptible on climate. This impact rating is based on EPA guidelines which defines an imperceptible impact as an effect capable of measurement but without significant consequences.

Despite the insignificance of the calculated result, Uisce Éireann are committed to reducing carbon emissions and protecting the environment in a cumulative effort to support national objectives for climate change mitigation and to meet our obligations under the National Climate Change Adaptation Framework. Therefore, in the procurement process tenderers will be incentivised to include GHG emission reduction measures throughout the design and construction methodology.

To protect the proposed development to flooding from the Lower River Shannon, all highly essential infrastructure will be constructed at an elevation higher than the 1% AEP flood level with a suitable freeboard and an allowance for climate change. The proposed development is expected to cause minimal loss of flood plain storage during the 1% AEP event and will be compensated for elsewhere on the site. The location of these nodes and further assessments are outlined in the Flood Risk Assessment (FRA), available in **Appendix 14 B**.

8.5.4 Operational Phase - Air Quality

The existing Castletroy WwTP does not have a significant impact on local air quality as there is no significant source of air pollutants on the Castletroy WwTP site. The Proposed Development will not have a significant impact on local air quality as there is no significant source of air pollutants in the Proposed Development.

The operations of the existing Castletroy WwTP generates less than 20 vehicle movements per day to the Castletroy WwTP site. The operations of the existing Castletroy WwTP may include occasional intake of sludges for treatment during daytime operations only. This process accounts for less than 10 HGV deliveries per day to the Castletroy WwTP site. This will remain unchanged with the Proposed Development. The guidance document Land-Use Planning & Development Control: Planning for Air Quality (EPUK & IAQM 2017), from Environmental Protection UK and the Institute of Air Quality Management, outlines the following for consideration of air quality impacts due to generated traffic flows within the land-use planning and development control processes.

Table 8.23: Extract from EPUK / IAQM Guidance 2017: Indicative Criteria for Requiring an Air Quality Assessment

The development will:	Indicative Criteria to Proceed to an Air Quality Assessment:
1. Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV = cars and small vans)	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
2. Cause a significant change in Heavy goods vehicle (HGV) flows on local roads with relevant receptors. (HGV = goods vehicles + buses >3.5t gross vehicle weight).	A change of HGV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.

Therefore, the actual change in traffic flows (annual average daily traffic (AADT) flows per day) has been considered against the IAQM and EPUK criteria. When operational the Proposed Development will include for no additional traffic flows. Therefore, there will be no operational impact on local air quality.

As the Proposed Development will not include any significant source of air pollutants, the Proposed Development will not result in any impact on nearby sensitive ecological habitats.

8.5.5 Operational Phase - Climate

With the implementation of energy efficient design measures, as outlined in **Section 8.6.2**, there will be little or no increase in GHG emissions during the operational phase of the Proposed Development compared to the existing situation. Therefore, the significant effect of the Proposed Development on climate in the operational phase is imperceptible.

Table 8.24: Summary of Predicted Operational Phase Impacts

Assessment Topic	Predicted Impact
Air Quality	No impact
Climate	No impact

8.6 Mitigation Measures and Monitoring

8.6.1 Construction Phase

In accordance with the IAQM Guidance, for proposed mitigation measures, the highest risk category should be applied. Therefore, the mitigation measures applicable to a Medium-Risk site have been outlined in the following sections.

General Measures

Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager / engineer or the site manager; and
- Display the head or regional office contact information.

Dust Management

- Develop and implement a Dust Management Plan (DMP), which will include measures to control other emissions, approved by the Local Authority. The DMP may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- Make the complaints log available to the local authority when asked;
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook; and
- Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport / deliveries which might be using the same strategic road network routes.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100m of the site boundary, with cleaning to be provided if necessary;
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked;
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; and
- Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

Preparing and Maintaining the Site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- Avoid site runoff of water or mud;

- Keep site fencing, barriers and scaffolding clean using wet methods;
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicle / Machinery and Sustainable Travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles;
- Avoid, where possible, the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- Impose and signpost a maximum-speed-limit of 15 miles per hour (mph) on surfaced and 10 mph on unsurfaced haul roads and work areas;
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and,
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- Ensure an adequate water supply on the site for effective dust / particulate matter suppression / mitigation, using non-potable water where possible and appropriate;
- Use enclosed chutes and conveyors and covered skips;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- No bonfires or burning of waste materials.

Measures for Specific Works

The IAQM Guidance Mitigation Measures applicable to the specific works undertaken are outlined in the following sections.

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas / soil stockpiles to stabilise surfaces as soon as practicable;
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- Only remove the cover in small areas during work and not all at once.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces) if possible;
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;

- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
- Record all inspections of haul routes and any subsequent action in a site logbook;
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits; and
- Access gates to be located at least 10m from receptors where possible.

Air Quality & Climate Mitigation Measures

- All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise;
- Construction materials will be transported to the site on specified routes only, unless otherwise agreed with the Planning Authority; and
- When stationary, delivery and on-site vehicles will be required to turn off engines. Users of the site will be required to ensure that all plant and vehicles are suitably maintained to ensure that emissions of engine generated pollutants is kept to a minimum.

8.6.2 Operational Phase

In terms of the air quality impact of the Operational Phase of the Proposed Development there are no specific mitigation measures to be applied to the proposed design.

In relation to climate, the use of energy efficient design throughout the WwTP will offset CO_2 emissions during the operational phase of the proposed development. Key energy and resource efficiency measures incorporated include:

- Soft start pumps/efficient pump selection will be utilised throughout;
- On-site renewable energy in the form of PV panels that use solar energy have been incorporated into the plant design to optimise the generation and use of renewable energy at the WwTP;
- The buildings on the WwTP site will be naturally ventilated where possible, with heating limited to mitigate the effects of frost and condensation in the Inlet Works and Process Building only. Occupied spaces would have heat recovery ventilation systems. The combination of these HVAC elements would minimise associated energy use in the building during operation; and

- Lighting will be upgraded to lower energy usage bulbs. Running time of the lights will be reduced from full power throughout the night to dim safety lighting with motion sensor task lighting.
- Lighting will be upgraded to lower energy usage bulbs. Running time of the lights will be reduced from full power throughout the night to dim safety lighting with motion sensor task lighting which will provide significant energy savings;
- The landscaping plan proposes planting in excess of 75 new trees and other wetland species which will sequester carbon by capturing CO_2 from the atmosphere and transforming it into biomass through photosynthesis. In one year, a mature tree will absorb more than 21kg CO_2 from the atmosphere and release oxygen in exchange; and
- Use of sustainable materials in the construction phase will deliver an operationally sustainable WwTP. Building with alternatives to Portland Cement such as ground granulated blast furnace slag (ggbs), ground limestone and/or recycled aggregates, will ensure structures are sustainable throughout their lifecycle during the operational phase.

8.7 Residual Effects

8.7.1 Construction Phase

No residual or cumulative air quality impacts were identified as a result of the Construction Phase of the Proposed Development.

8.7.2 Operation Phase

No significant residual or cumulative impacts were identified after implementation of the Proposed Development.

8.8 References

Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) (2017). Land-Use Planning & Development Control: Planning for Air Quality

Environmental Protection Agency (EPA) (2021). Air Quality Website [www.airquality.ie]

Institute of Air Quality Management (IAQM) (2014). Guidance on the Assessment of Dust from Demolition and Construction

Institute of Air Quality Management (IAQM) (2018). Guidance on the Assessment of Odour for Planning

UK Highways Agency (2005). Interim Advice Note 61/05 - Guidance for Undertaking Environmental Assessment of Air Quality for Sensitive Ecosystems in Internationally Designated Nature Conservation Sites and SSSIs

Vallack, H.W. & Shilito, D.E. (1998). Suggested Guidelines for Deposited Ambient Dust. In: Atmospheric Environment, Vol. 32, No. 16, pp. 2737-2744

Verein Deutscher Ingenieure (VDI) (2002) German TA Luft Regulations – Technical Instructions on Air Quality Control

Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011)

Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (The CAFÉ Directive)