11 AIR QUALITY AND CLIMATE

11.1 Air Quality

11.1.1 Introduction

This chapter assesses the impacts to air quality associated with the proposed development. It should be read in conjunction with the site layout plans and characteristics of the project (**Chapter 5**).

Impacts to air quality, such as from the generation of dust and road traffic, will arise during both the construction and operation phases of the proposed development. The proposed development has been examined to identify those that have the potential for air emissions. Where applicable, a series of suitable mitigation measures have been listed.

The proposed development will give rise to emissions from road traffic and dust deposition similar to the existing development. Each of these sources has been identified and emissions have been quantified using standard procedures.

11.1.2 Assessment Methodology

11.1.2.1 Baseline Air Quality

As the site is located with air quality Zone D (Rural Ireland), baseline air quality has been determined from the data available from the EPA monitoring Zone D network to determine compliance with relevant ambient air legislation.

In addition to the EPA monitoring, IMS carry out a series of ambient air quality monitoring tests within the landownership boundary. Monitoring is undertaken as a condition of the EPA Waste Licence (W0129-02) and is required biannually at four locations. The monitoring undertaken in Quarter 2 2015 to date at each location (as shown in **Figure 11-1**) are employed in this assessment to identify the dust impact of the current and future operations.

11.1.2.2 Construction and Operational General Dust Emissions

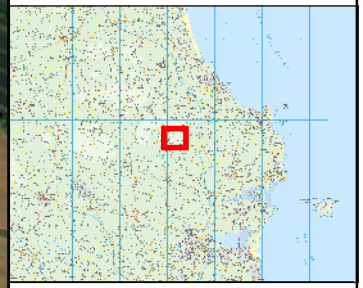
Dust dispersion has the potential to cause local impacts through dust nuisance at the nearest sensitive receptors and also to sensitive ecosystems. The potential for dust generation associated with the proposed development will be assessed on the basis of a review of the proposed methodologies and the proximity of these activities to sensitive receptors.

The infilling works such as waste importation, excavation, earth moving and backfilling may generate quantities of dust, particularly in dry weather conditions. The extent of any dust generation depends on the nature of the dust (soils, peat, sands, gravels, silts etc.) and the nature of the infilling works. In addition, the potential for dust dispersion and deposition depends on local meteorological factors such as rainfall, wind speed and wind direction.

The potential for dust emissions from the proposed development is addressed qualitatively in accordance with the NRA Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (Rev. 1) (NRA 2011; referred to hereafter as the TII Guidelines).

Legend

- Dust Monitoring Stations
- Site Boundary



Client

Integrated Materials Solutions (IMS) Limited Partnership

IMS Hollywood 2022 Update

Title

Figure 11-1: Air Monitoring Locations and Sites Boundaries

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Issue Details

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11.1.2.3 Operational Phase Metal Dust Emissions

In addition to general dusts as outlined in the previous section, the proposed importation, maturation and infilling of incinerator bottom ash (IBA) at the site has potential for the generation of dusts with a greater air quality risk. IBA is generated when the non-combustible fraction of municipal solid waste charged to the furnace in waste to energy plants forms a residue (ash).

IBA consists mainly of non-combustible inert aggregates such as sand, stone, glass, porcelain and ceramics with similar properties to soil and stone. But IBA also contains some low levels of ferrous and non-ferrous metals at concentrations higher than other wastes proposed at the site. IBA typically contains circa 10-12% ferrous metals and 2-5% non-ferrous metals (predominately Aluminium but also Copper, Lead and Zinc).

The potential for impacts on human health from these dusts is undertaken in accordance with the TII Guidelines, as above.

11.1.2.4 Road Traffic

A prediction of the local impact of traffic-derived pollution during the operation phase was carried out using the local assessment model in the Design Manual for Road and Bridges (DMRB) as per the TII guidelines for assessment of impacts to air from road transport. Traffic data was provided in the form of Annual Average Daily Traffic (AADT) for the existing operation and the future operational year with the site operating at full infill capacity of 500,000 tonnes per annum and with additional leachate tankering.

11.1.2.5 Odour

The main potential odour from any works associated with waste handling and/or a landfill derive from the handling, storage and decomposition of wastes. The Waste Licence for the proposed development only accepts non-bio-degradable inert waste materials that do not have negative odour issues. Wastes that cause odour issues (domestic or putrescible wastes) are not licenced for acceptance at the site so the site currently poses a very low odour risk and the site has not received any odour related complaints to the EPA on the current operation.

This application seeks to continue the infilling of non-bio-degradable waste materials and hence, the odour risk at the site will remain very low.

In short, there are no likely significant odour impacts associated with the proposed operation. Mitigation measures are not required as the inert materials to be landfilled will not cause and odour impact.

11.1.3 Assessment Criteria

11.1.3.1 Dust

During construction and the proposed infilling of wastes, dust is considered the principal risk of pollution to the atmosphere. The relevant limits for dust at the site are the German Government TA Luft limits which are specified in B.5 Dust Deposition Limits of the Waste Licence (W0129-02). Under this limit the infilling operations are required to maintain monthly dust levels below the guideline of 350mg/m^2/day as an annual average at sensitive receptors. Condition 4 of the Waste Licence requires that the dust from the activities proposed shall not give rise to elevated deposition levels.

11.1.3.2 Metals

There are ambient air quality target values for certain metal compounds as defined in S.I. 58 of 2009 and S.I. 180 of 2011. These target values are presented in **Table 11-1**. Other metals such as Aluminium (which is the main metal constituent of IBA) has no statutory limit applied as this metal has a lower health impact than those listed in **Table 11-1**.

Table 11-1 Limits as Specified in Air Quality Standards Regulations for metals

Pollutant	Criteria	Target Value
Arsenic	Target vale for the protection of human health for the total content in the PM_{10} fraction averaged over a calendar year	6 ng/m^3
Cadmium		5 ng/m^3
Nickel		20 ng/m^3
Lead	Annual limit for protection of human health	500 ng/m^3

11.1.3.3 Odours

Like dust, there is no legislative limit for odours in Ireland and standard industry guidelines are typically applied. The Odour Impact Assessment Guidance for EPA Licensed Sites (AG5) is a procedure that offers a consistent and systematic approach to the assessment of odours on and in the local area of facilities and installations licenced by the EPA. This sensory assessment is used to determine if an odour has potential to cause nuisance.

11.1.3.4 Combustion Gases/Particulates (such as from road traffic)

In May 2008, all previous European Directives on air quality were replaced with a revised Directive on ambient air quality and cleaner air for Europe (2008/50/EC) which has been transposed into Irish legislation as the Air Quality Standards Regulations 2011 (S.I. 180 of 2011). These Regulations are presented in **Table 11-2** and represent the main assessment criteria for the operation phase of the proposed development.

The 2011 Regulations specify limit values in ambient air for sulphur dioxide (SO_2), lead, benzene, particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x). These limits are mainly for the protection of human health and are largely based on review of epidemiological studies on the health impacts of these pollutants. In addition, there are limits that apply to the protection of the wider environment (ecosystems and vegetation). All predicted concentrations from the operation of the proposed development are compared to the air quality limits to determine the extent of any impact on residential or ecological receptors.

The TII Guidelines specify the significance criteria for determining air quality impacts. The predicted increases or decreases from road traffic pollution may been utilised to determine the significance of any impact in relation to the TII criteria as presented in **Table 11-3**, **Table 11-4** and **Table 11-5**.

In addition to the statutory limits for the protection of human health listed in Air Quality Standards Regulations (S.I. 180 of 2011), the World Health Organisation (WHO) has published a set of air quality guidelines for the protection of human health. The key publication is the '*Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide Global Update 2021*'. The WHO guidelines are particularly pertinent in relation to the statutory limits for the protection of human health as presented in **Table 11-2**. The WHO guidelines are based on reducing the risk to human health and in some cases the levels differ from the statutory limits as these limits are based on balancing health risks with technological feasibility, economic considerations and various other political and social factors in the EU.

The 2021 Air Quality Guidelines (AQG) and interim targets recommended by the WHO are presented in **Table 11-6**. These guidelines are not legally binding, however, they do provide WHO Member States with an evidence-informed tool to inform legislation and policy. The levels are presented as an ultimate guideline as well as a series of interim targets which are proposed as incremental steps in a progressive reduction of air pollution and are intended for use in areas where pollution is high. The EPA has called for movement towards the adoption of these stricter WHO guidelines as the legal standards across Europe and in Ireland.

Table 11-2 Limits as Specified in Air Quality Standards Regulations 2011 (S.I. 180 of 2011)

Pollutant	Criteria	Value
Nitrogen Dioxide	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3 NO_2
	Annual limit for protection of human health	40 µg/m^3 NO_2
	Annual limit for protection of vegetation	30 µg/m^3 NO + NO_2
Benzene	Annual limit for protection of human health	5 µg/m^3
Carbon Monoxide	Maximum daily 8-hour running mean	10 mg/m^3
Lead	Annual limit for protection of human health	0.5 µg/m^3
Sulphur dioxide	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	350 µg/m^3
	Daily limit for protection of human health - not to be exceeded more than 3 times/year	125 µg/m^3
	Annual limit for protection of vegetation	20 µg/m^3
Particulate Matter PM_{10}	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3 PM_{10}
	Annual limit for protection of human health	40 µg/m^3 PM_{10}
Particulate Matter $PM_{2.5}$	Annual target value for the protection of human health	20 µg/m^3 $PM_{2.5}$

Table 11-3 Definition of Impact Magnitude for Changes in Ambient Air Pollutant Concentrations (Source: NRA, 2011)

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. of Days with PM_{10} Concentration greater than 50µg/m^3	Annual Mean PM
Large	Increase/decrease ≥4µg/m^3	Increase/decrease >4 days	Increase/decrease ≥2.5µg/m^3
Medium	Increase/decrease 2 - <4µg/m^3	Increase/decrease 3 of 4 days	Increase/decrease 1.25 - <2.5µg/m^3
Small	Increase/decrease 0.4 - <2µg/m^3	Increase/decrease 1 or 2 days	Increase/decrease 0.25 - <1.25µg/m^3
Imperceptible	Increase/decrease <0.4µg/m^3	Increase/decrease <1 day	Increase/decrease <0.25µg/m^3

Table 11-4 Air Quality Impact Descriptors for Changes in Annual Mean Nitrogen Dioxide Concentrations at a Receptor (Source: NRA, 2011)

Absolute Concentration in Relation to Objective/Limit Value	Changes in Concentration		
	Small	**Medium**	**Large**
Increase with Proposed Project			
Above Objective/Limit Value with development (≥40μg/m^3 of NO_2 or PM_{10}) (≥25μg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with development (36-<40μg/m^3 of NO_2 or PM_{10}) (22.5-<25μg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with development (30-<36μg/m^3 of NO_2 or PM_{10}) (18.75-<22.5μg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with development (<30μg/m^3 of NO_2 or PM_{10}) (<18.75μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decreased with Proposed Project			
Above Objective/Limit Value with development (≥40μg/m^3 of NO_2 or PM_{10}) (≥25μg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value with development (36-<40μg/m^3 of NO_2 or PM_{10}) (22.5-<25μg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value with development (30-<36μg/m^3 of NO_2 or PM_{10}) (18.75-<22.5μg/m^3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value with development (<30μg/m^3 of NO_2 or PM_{10}) (<18.75μg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Table 11-5 Air Quality Impact Descriptors for Changes in Number of Days with PM_{10} Concentrations Greater than 50µg/m^3 at a Receptor (Source: NRA, 2011)

Absolute Concentration in Relation to Objective/Limit Value	Changes in Concentration*		
	Small	Medium	Large
Increased with Proposed Project			
Above Objective/Limit Value with development (≥35days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value with development (32-<35days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value with development (26-<32days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value with development <26 days)	Negligible	Negligible	Slight Adverse
Decrease with Proposed Project			
Above Objective/Limit Value with development (≥35days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value with development (32-<35days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value with development (26-<32days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value with development <26 days)	Negligible	Negligible	Slight Beneficial

Table 11-6 WHO Recommended Air Quality Guideline (AQG) levels and interim targets (2021)

Pollutant	Averaging Time	Interim Target				AQG
		1	2	3	4	
$PM_{2.5}$ (µg/m^3)	Annual	35	25	15	10	5
	24-hour	75	50	37.5	25	15
PM_{10} (µg/m^3)	Annual	70	50	30	20	15
	24-hour	150	100	75	50	45
O_3 (µg/m^3)	Annual	100	70	-	-	60
	24-hour	160	120	-	-	100
NO_2 (µg/m^3)	Annual	40	30	20	-	10
	24-hour	120	50	-	-	25
SO_2 (µg/m^3)	24-hour	125	50	-	-	40
CO (mg/m^3)	24-hour	7	-	-	-	4

11.1.3.5 Potential for Cumulative Impacts

There are related projects within Hollywood, Co. Dublin that have potential for cumulative impacts with the activities of the proposed development. These are described in the following paragraphs along with a description of the related developments.

Section 5.12 identifies a sand and gravel pit (Ref. AA191263) and a waste facility (Ref. W0265-01) which have the potential for cumulative air quality impacts. These developments are circa 4km north west of the Hollywood site and at that distance, the potential for cumulative dust impact is negligible. Furthermore, the traffic for those developments will employ a separate haul route to that for the

proposed development at Hollywood and hence there is negligible potential for cumulative impacts to air quality from road traffic for the community on the haul route for the proposed development.

11.1.4 Existing Environment

11.1.4.1 Receiving Environment

The site of the proposed development is approximately 14km north of Dublin Airport and 3km west of the M1. The site is bounded to the north by the Ballough Stream, the remaining boundaries are made up of agricultural land employed for a mixture of pasture and tillage uses.

There are various sensitive receptors (houses, commercial operations) located in the area and these receptors vary in distance from the proposed development. These receptors may experience a change in air quality and the extent of these changes in air quality is identified in this assessment. The nearest sensitive residential receptors to the proposed development are the residential dwellings on the LP-1080 (south), LP-1090 (west), Tooman Road (east) and Rowans Road (north).

There is a primary school (Hedgestown National School) located circa 3km east of the site at the Five Roads but this is located circa 40 metres from the existing haul routed employed with additional buildings being constructed at the school as part of a recent planning permission (F19A/0216).

A small number of commercial operations are within the proposed developments vicinity including some waste operators. The nearest commercial receptors include various operations along the LP-1080 and LP-1090.

The nearest Natura 2000 site to the proposed development is the Rogerstown Estuary SAC (Site Code 000208) and SPA (Site Code 004015) which lie circa 8km from the site. The nearest Nationally designated site is the Bog of the Ring pNHA (Site Code 001204) which lies circa 2.5km from the site (refer **Chapter 8** Biodiversity). There are no other habitats or species located within the vicinity of the proposed development that may be adversely impacted by air quality emissions from the proposed development. As such, this interaction is not addressed further within this assessment.

11.1.4.2 Existing Sources in the Area

The main existing sources of pollution in the vicinity of the site are from road traffic, dust dispersion and odour.

The road network around the proposed development is predominantly composed of local roads (L-roads) including the LP-1090 to the west and the LP-1080 to the south that connects the R108 to the R132 and subsequently the M1 motorway that links to the GDA. The local and regional roads serve HGVs entering and leaving the M1 for the existing operations at the site.

The on-going soil and stone transport and infilling operations will give rise to dust dispersion and deposition around the proposed development. The dust dispersion in the area is dependent on the amount of road traffic and the HGVs used at the proposed development and the surrounding operations.

The waste operations in the area can give rise to odour nuisances to the receptors in the area. There are three facilities in the surrounding area that are licenced by the EPA:

- W0129-02 – The Hollywood Landfill operated by IMS, currently accepting a maximum of 500,000 tonnes per annum of inert waste but as noted the site poses a low odour risk with no odour complaints recorded for the site;
- W0231-01 – The proposed Fingal Landfill development, the Waste Licence has been granted but is not yet in operation. The proposed landfill would initially accept a maximum of 500,000 tonnes per annum of wastes, this will be reduced to 300,000 tonnes per annum following proposed commencement of waste to energy facilities in the region; and
- W0265-01 – The Clashford Recovery Facility Ltd accepts a maximum of 170,000 tonnes per annum of waste.

11.1.4.3 Baseline Air Quality

Air quality legislation in Ireland deals with air quality by the means of 'zones' based on population. For Ireland, four zones are defined and the main areas defined in each zone are:

- Zone A: Dublin Conurbation;
- Zone B: Cork Conurbation;
- Zone C: Other cities and large towns comprising Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Letterkenny, Celbridge, Newbridge, Mullingar, Balbriggan, Greystones, Leixlip and Portlaoise; and
- Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B and C.

The proposed development is located in Hollywood, north Co. Dublin in the jurisdiction of Fingal County Council. As such, the site lies within EPA Air Quality Zone D (Rural Ireland). The EPA air quality monitoring network for Zone D has been reviewed and suitable representative data is presented to identify the background air quality in the area of the proposed development.

A summary of the EPA monitoring carried out in Zone D (Rural Ireland) is presented in the following sections. The EPA monitoring networks in Zone D includes a number of Rural Ireland locations (i.e. Emo Court, Kilkitt, Mace Head, Castlebar, etc.).

There are a wide number of stations in Rural Ireland tested for various pollutants and there is variation each year regarding the locations and pollutants monitored at these locations. Presented in this section are the annual averages of all stations in Zone D (Zone C, if Zone D data is not available). The averages are considered representatives of the rural north Co. Dublin area and the site of the proposed development.

Nitrogen Dioxide (NO_2)

Nitrogen Dioxide (NO_2) is classed as both a primary and a secondary pollutant. As a primary pollutant NO_2 is emitted from all combustion processes (such as a gas/oil fired boiler or a car engine). As a secondary pollutant NO_2 is derived from atmospheric reactions of pollutants that are themselves, derived mainly from traffic sources.

The results of the EPA network monitoring for the recent years are presented in **Table 11-7**. The average results indicate compliance with the limits for the protection of human health. The compliance level is to some extent a result of Ireland's location in western Europe where there is a strong prevailing westerly wind, high rainfall levels and low sunshine levels that allows for the rapid dispersion of pollutants and generally good air quality. In addition, at EU level there is legislation driven improvements to vehicles in terms of both engine performance and fuel specification (known as the Auto Oil Program) which has also helped in the reduction of pollutants over the past three years.

It is noted that levels are also below the WHO guideline for the protection of human health (annual average). An increase was observed in 2020 which is largely attributed to a variance in work practices and transport during the Covid-19 pandemic.

It is noted that the EPA released a stand-alone report 'Urban Environmental Indicators: Nitrogen dioxide levels in Dublin' in July 2019. This report is separate to the annual reports as outlined above and focussed on NO_2 only in Dublin City. In the report the EPA present the findings of a 10 month survey of diffusion tubes around the city in 2017 and includes details of dispersion modelling of NO_2 in Dublin. The modelling results are virtual predicted results rather than actual monitoring results but does indicate that while the majority of the city is well below the annual EU limit for NO_2, there are some areas which show modelled exceedances above this limit – including the M50 corridor and the exits to the Port tunnel. While outside the zone of influence of the proposed development this report and its findings are noted.

Table 11-7 Results of NO_2 monitoring carried out by the EPA in Zone D

Year	Annual Mean NO_2 ($\mu g/m^3$)	Annual # of NO_2 Values Exceeding Hourly Limit for Protection of Human Health >200$\mu g/m^3$	Annual Mean NOx ($\mu g/m^3$)
2015	6	0	6
2016	6	0	10
2017	4	0	6
2018	5	0	7
2019	6	0	8
2020	8	0	16
Limit	**40 Annual Limit for Protection of Human Health**	**18 No of samples not to exceed the year)**	**30 (Annual limit for protection of vegetation)**
WHO Air Quality Guideline (AQG)	**10**	**-**	**-**

Particulate Matter (PM_{10} and $PM_{2.5}$)

Particulate Matter (PM_{10} and $PM_{2.5}$) may be emitted as a primary pollutant from road vehicle exhausts, which is the main source in urban areas. In rural areas, sources will include traffic, agricultural activities and natural processes such as sea salt aerosol. Also, point sources such as combustion, i.e. domestic fires, industrial boilers etc. are primary sources of PM_{10}. PM_{10} may also be formed as secondary pollutants from the condensation or reaction of chemical vapours in the atmosphere. Particulate Matter ($PM_{2.5}$) has similar effects on health as PM_{10}, however, $PM_{2.5}$ is a better indicator of anthropogenic (man-made) emissions.

The results of the EPA network for the most recent years are presented in **Table 11-8**. As with NOx, the PM_{10} and $PM_{2.5}$ data for Zone D shows compliance with the human health limits presented in **Table 11-2**. All sites in the Rural Ireland have been in full compliance with the human health limits for the past six years. However, it is noted that the levels of PM_{10} are only marginally below the new WHO Guidelines in recent years and the levels of $PM_{2.5}$ are above the WHO Guideline for all years since 2015. The EPA record that the primary source of these emissions is from solid fuel burning for space heating.

Table 11-8 Results of PM_{10} and $PM_{2.5}$ monitoring carried out by the EPA in Zone D

Year	Annual Mean PM_{10} ($\mu g/m^3$)	Average no. of PM_{10} Values Exceeding 24 Hour Limit for Protection of Human Health >50 $\mu g/m^3$	Annual Mean $PM_{2.5}$ ($\mu g/m^3$)
2015	12.5	3	8
2016	11.8	2	9
2017	9.9	0.7	7.4
2018	11.8	0	9.4
2019	14.3	2.6	9.3
2020	11.2	1.0	7.8
Limit	**40 (Annual Limit for protection of human health)**	**35 (No. of Samples not to exceed per year)**	**25 (Annual target value for the protection of human health)**
WHO Air Quality Guideline (AQG)	**15**	**–**	**5**

Sulphur Dioxide (SO_2)

The largest sources of SO_2 emissions are as a primary pollutant from fossil fuel combustion at power plants and other industrial facilities. Smaller sources of SO_2 emissions include industrial processes such as extracting metal from ore, and the burning of high sulphur containing fuels by locomotives, large ships, and non-road equipment. SO_2 is linked with a number of adverse effects on the respiratory system.

The levels in SO_2 in Rural Ireland in recent years are presented in **Table 11-9**. The levels are low and less than 20% of the limit for the protection of human health. These levels are decreasing annually and are low, largely as a result of the ban on smoky coal under the Air Pollution Act, 1987 (Marketing, Sale and Distribution of Fuels) Regulations (1998-2011).

In addition, the sulphur content of fuels for road, non-road and marine fuels are heavily regulated through the following:

- SI 155 of 2011 - European Communities Act, 1972 (Environmental Specifications for Petrol, Diesel Fuels and Gas Oils for use by non-road mobile machinery, including inland waterway vessels, agricultural and forestry tractors, and recreational craft) Regulations 2011;
- SI 119 of 2008 - Sulphur Content of Heavy Fuel Oil, Gas Oil and Marine Fuels; and
- SI 156 of 2011 - European Communities Act 1972 (Sulphur Content of Heavy Fuel Oil, Gas Oil, and Marine Fuels) (Amendment) Regulations 2011.

Table 11-9 Results of SO_2 monitoring carried out by the EPA in Zone D

Year	Annual Mean SO_2 ($\mu g/m^3$)	Annual # of SO_2 Values Exceeding 24 Hour Limit for Protection of Human Health >125$\mu g/m^3$	Annual # of SO_2 Values Exceeding 1 Hour Limit for Protection of Human Health >350$\mu g/m^3$
2015	2	0	0
2016	2	0	0
2017	2	0	0
2018	3	0	0
2019	3	0	0
2020	4	0	2
Limit	**20 (Annual limit for the protection of vegetation)**	**3 (No of samples not to exceed per year)**	**24 (No of samples not to exceed per year)**
WHO Air Quality Guideline (AQG)	**20**	**-**	**-**

Volatile Organic Compounds (VOCs)

VOCs, such as benzene (a known human carcinogen), are emitted directly from petrol fuelled vehicles. Other VOCs are also emitted from petrol exhausts (toluene, ethylbenzene, xylenes). VOCs have varying sources and properties and only benzene has a limit for the protection of human health in the legislation (**Table 11-2**). The EPA monitor for benzene and other VOCs in Kilkenny (Zone C) and the results are presented in **Table 11-10**. Kilkenny (Zone C) has been used as Zone D data is not available from the EPA. Benzene levels in Kilkenny are low and well below the limit for the protection of human health and have remained low for the last five published years of data. Levels of the other VOCs in Kilkenny have also remained stable in the last five years but there is no limit for the protection of human health. Existing sources of VOCs from the current operations at the Hollywood Landfill include road traffic.

Table 11-10 Results of VOC monitoring carried out by the EPA in Zone C

Year	Annual Mean Benzene (µg/m^3)	Annual Mean Toluene (µg/m^3)	Annual Mean Ethylbenzene (µg/m^3)	Annual Mean m/p-Xylene (µg/m^3)	Annual Mean o-Xylene (µg/m^3)
2015	0.13	0.15	0.00	0.02	0.01
2016	0.2	0.28	0.01	0.06	0.00
2017	0.18	0.26	0.02	0.09	0.01
2018	0.16	0.14	0.02	0.04	0.14
2019	0.12	0.25	0.06	0.25	0.11
2020	0.04	0.07	0.06	0.09	0.10
Limit	**5 (Annual limit for protection of human health)**	**N/A**	**N/A**	**N/A**	**N/A**

Metals

The EPA monitor for metals in Kilkitt and Castlebar (Zone D) and the results are presented in **Table 11-11**. The results indicate that ambient levels of all metals monitoring in the Zone D rural area are very low and all pollutants detected are less than 5% of the relevant limit.

Table 11-11 Results of Metal monitoring carried out by the EPA in Zone D

Year	Annual Mean Lead (ng/m^3)	Annual Mean Arsenic (ng/m^3)	Annual Mean Cadmium (ng/m^3)	Annual Mean Nickel (ng/m^3)
2015	1.70	0.40	0.30	0.40
2016	2.38	0.10	0.09	0.32
2017	2.97	0.08	0.06	0.18
2018	2.05	0.15	0.10	0.35
2019	9.25	0.05	0.80	0.69
2020	9.25	0.20	0.80	0.70
Limit	**500**	**6**	**5**	**20**

General Dusts

The current EPA Waste Licence (W0129-02) sets out conditions under which IMS, as the licensee, must operate and manage the facility. Schedule D of Waste Licence W0129-02 requires the biannual monitoring of dust emissions. This dust monitoring assess the ongoing levels of dusts generation at the site with respect to the existing operations including cell construction, waste infilling, capping as well as other activities such as the concrete recovery (end of waste) activities undertaken. Currently, IMS have four dust deposition monitoring locations, these are displayed in **Figure 11-1** and listed in **Table 11-12**.

Table 11-12 Dust monitoring locations

Reference	Location
D1	Car park adjacent to garage building
D2	The north eastern corner of the site
D3A	The south of the site; above the deep *rock cell*
D5A	In the south east of the facility

The data for the four dust deposition monitoring locations between 2016 and 2021 are displayed in **Table 11-13**. The results of all but one of the monitoring events are below the TA Luft Guideline for dust nuisance throughout this period which would indicate that dust levels are not causing an adverse impact. Only the Q4 2019 result at D2 exceeded the limit out of 48 measurements. Over the six year period average levels at the site equate to 79mg/m^2/day which is circa 23% of the EPA limit (350mg/m^2/day) indicating that dust at the facility is not currently causing any adverse impact.

Table 11-13 Results of dust deposition monitoring undertaken at the proposed development (2016 – 2021)

Dust Monitoring Location	Units	Dust Deposition Limit	2016		2017		2018		2019		2020		2021	
			Q4	Q4	Q4	Q2	Q3	Q3	Q4	Q2	Q2	Q4	Q1	Q4
D1	mg/m^2 /day	**350**	8.2	130.4	167.0	63.2	300.1	4.1	11.6	11.6	54.8	1.1	23.4	41.3
D2	mg/m^2 /day	**350**	24.6	12.8	**877.4**	39.3	134.6	8.1	12.5	197.3	29.4	21.6	13.2	15.7
D3A	mg/m^2 /day	**350**	45.4	212.1	220.4	51.3	88.4	9.1	8.1	25.3	134.5	9.5	12.7	77.4
D5/D5A	mg/m^2 /day	**350**	59.1	17.9	200.7	84.2	38.2	106	3.8	46.7	42.6	18.4	33.5	34.7

*Exceedances marked in bold

11.1.5 Impact Assessment

11.1.5.1 'Do-Nothing' Impact

Under such a scenario, the existing operation would remain unchanged and the baseline levels of dust and traffic in the area would continue in the short to medium term up to 2035 when permission for the current operation ceases.

11.1.5.2 Construction and Operation Dust

As the proposed construction phase of the new infrastructure elements will run in parallel with the ongoing infilling operation, the two phases are assessed cumulatively within this analysis to provide a robust assessment. In accordance with the TII Guidelines, where there are operations at a construction site there is a risk that dust may cause an impact at sensitive receptors in close proximity to the source of the dust generated. These distances are presented in **Table 11-14** (source: TII Guidelines, May 2011 Revision).

Table 11-14 TII Assessment Criteria for the Impact of Dust Emissions from Construction Activities, (with standard mitigation in place)

Source		Potential Distance for Significant Effects (Distance from Source)		
Scale	**Description**	**Soiling**	**PM_{10}**	**Vegetation Effects**
Major	Large Construction sites, with high use of haul routes.	100m	25m	25m
Moderate	Moderate Construction sites, with moderate use of haul routes.	50m	15m	15m
Minor	Minor Construction sites, with minor use of haul routes.	25m	10m	10m

It is important to note at the outset that one of the principle factors affecting dust generation and dust deposition relates to moisture content. Moisture increases the mass of a dust particle meaning particles are less friable and hence, less prone to dust dispersion. In most construction and infilling projects, the principal means of dust suppression is through maintaining a high moisture level on dust particles.

The proposed development is described in **Chapter 5** of this EIAR and includes the details of the main tasks. In summary, the following are the main activities with relevance to dust impact:

- Construction of the attenuation pond and the leachate tanks and area;
- Operations - cell construction and capping;
- Operations - infilling and restoration of a quarry with waste at a maximum rate of 500,000 tonnes per annum;
- Operations - vehicle movements within the site on unpaved roads and at the access to the site reception and deposit area;
- Operations - IBA handling and maturation;
- Operations – aggregates processing operation; and
- Operations - Crushing and screening of waste concrete to generate by-product aggregate.

Given the scale of the site the area of the proposed development is categorised as 'major' and hence, as per the TII Guidelines, any receptor within 100 metres of the site has the potential for adverse effects from dust, there are properties located within this 'impact zone'.

The infilling activities will not have a significant impact on the existing dust levels at the site (refer **Table 11-13**) given that the operations will remain unchanged and the same dust management will remain in place. The site will continue to operate and be controlled in the appropriate manner under EPA supervision through the enforcement of the revised IE Licence (W0129-04) which will impose a

similar dust management and monitoring regime. A dust minimisation plan has been prepared for the site and is included as part of the EMS.

In summary, dust impact from the proposed development is predicted to continue to be 'negligible' during the combined temporary construction phase and the medium term to long term (25 years) operation phase.

11.1.5.3 Metals

The potential for the generation and dispersion of metal dusts is dependent on the nature of the wastes being infilled, the activities being undertaken and the weather conditions at the time of infilling. In much the same was as general dusts, dispersion of metal dusts can be actively controlled at source by good working practices.

IBA is the primary source of potential metal dust at the proposed development. IBA typically contains circa 10-12% ferrous metals and 2-5% non-ferrous metals (predominately aluminium but also copper, lead and zinc). The Best Available Techniques (BAT) Reference Document for Waste Incineration (December 2018, draft) presents the typical chemical composition of IBA from the incineration of MSW and this detail is presented in **Table 11-15**. The data shows that IBA is predominately made up of general iron, silica, calcium and aluminium dusts with trace levels of heavy metals.

Table 11-15 Chemical composition of IBA from the incineration of MSW

Parameter	Average
Chromium (ppm)	648
Nickel (ppm)	215
Copper (ppm)	2,151
Zinc (ppm)	2,383
Lead (ppm)	1,655
Al_2O_3 (%)	8.5
SiO_2 (%)	49.2
Fe_2O_3 (%)	12.0
CaO (%)	15.3

Proposed infilling of IBA at the site will be in line with the following procedure:

- Transport from the source waste to energy facilities by road by means of 20 tonne HGVs with all trailers suitably covered. All transport will be undertaken using permitted hauliers with the appropriate EWC codes. The covering of trucks will be mandatory to ensure no fugitive emissions along the haul routes.
- Once through the site weighbridge, the IBA will be temporarily stored in a series of maturation stockpiles laid out within the storage enclosure as required. All IBA maturation will be carried out within the enclosure. No IBA maturation or storage will be undertaken outside the enclosure.
- The stockpiles may be artificially wetted, if required, using a sprinkler or hose system in order to prevent dust formation and emissions and to favour the leaching of salts and carbonation if the IBA stockpiles are not sufficiently wet.
- Any drain water from this process will be collected, stored and tinkered to the leachate tanks prior to being tankered off-site to a suitably licenced waste water treatment plant under agreement with Irish Water. Alternatively, the collected water may be used to humidify the stockpiles if the leachate quality is suitable.
- The stockpiles may be turned regularly to ensure the homogeneity of the processes that occur during the ageing process and to reduce the residence time. The typical residence time within the stockpiles will be circa 6-10 weeks.
- Following maturation, the IBA will be brought to the active non-hazardous cell (Cells 9 to 13) where the trailers will be tipped at designated areas prior to compaction by mobile plant. As required, water misting sprays and bowsers will be employed to mitigate dust generation.

- All active faces will be maintained to the smallest possible areas and will be subjected to daily cover to create a barrier to mitigate potential for generation of dust.

Based on the above procedure, the risk of dust generation from this operation is low and the scale of the IBA operation is moderate. This distance between the maturation enclosure and the nearest sensitive residential receptor is circa 100 metres at the nearest point. As this operation is classed as a 'moderate' scale construction site, the distance is such that this operation would pose a negligible risk to sensitive receptors in the area with the above controls.

11.1.5.4 Odour

There is a low potential for odour generation and nuisance to occur during the operations on the site. The current Waste Licence only permits the acceptance of inert materials to be landfilled that will not cause an odour impact. No odour impacts have been recorded during the operation of the current Waste Licence.

This application and the requirements of any revised IE licence will continue to only accept non-biodegradable wastes as per the existing operation, therefore, no additional odour issues associated with the proposed development will arise.

A specialist software system is in use at the weighbridge. The software system checks the visual appearance and odour of each load, only if both these characteristics are satisfactory can the transaction be complete and delivered to a landfill cell.

The nature of the waste significantly limits the generation of odour impacts therefore, the impact of odour is considered 'negligible' and no mitigation measures are required.

11.1.5.5 Road Traffic

Road traffic from the proposed development can impact directly on local air quality and any sensitive receptors that are located adjacent to the local road networks may experience the impacts to local air quality. Traffic on the road network is predicted to increase from the baseline levels as a result of the site operating at full waste intake capacity, the tankering of leachate off site and the export of aggregates off site. Given the main traffic routes on the existing network and the locations of residential areas along these routes, the following receptor has been assessed using the DMRB local model:

- R1: The nearest of the Residential Properties along the LP-1080 to quantify the impacts for properties along the road that links the R108 to the R132 and subsequently the M1. The link will also be assessed as it is the road of the proposed new site entrance.

The results of the analysis for this receptor along the existing haul route are presented in **Table 11-16**. The results indicate that all levels of pollutants are predicted to remain within the limits for the protection of human health and the WHO guidelines along the proposed haul route even with the full predicted growth in traffic by 2036. Using the TII significance criteria (as outlined in **Table 11-3, Table 11-4** and **Table 11-5**) the predicted increases associated with the proposed development relative to the baseline scenario is classed as 'imperceptible'. While the levels remain below the relevant limits these increases and air quality impact from this traffic are classed as 'negligible'.

Table 11-16 Local impact to air quality as a result of road traffic

Property Group	Scenarios	Nitrogen Dioxide (µg/m³)	Particulates (PM_{10}) (µg/m³)	
		Annual Average NO_2	Annual Average PM_{10}	No. of days > 50 µg/m³
R1 LP-1080	Background	6	12	0
	2020 (Base Year)	6.95	12.12	0.00
	2021 (Opening Year)	7.34	12.17	0.00
	2026 (Opening Year +5 Years)	7.38	12.18	0.00
	2036 (Design Year + 15 Years)	7.45	12.19	0.00
Statutory Limits		**40**	**40**	**25**
WHO Guideline		**10**	**15**	**-**

11.1.6 Mitigation Measures

11.1.6.1 Dust and Metals

The potential for dust to be emitted depends on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The implementation of a dust minimisation plan during the operation of the project will includes measures such as:

- The physical characteristics of the site, this is the overriding dust mitigation method. As the majority of the site is below ground level, it acts as a natural barrier, containing the dust within the void and preventing nuisance to the surrounding landscape;
- Biannual monitoring and reporting to the EPA, as per licence requirements. The dust level was exceeded in Quarter 2 of 2019, subsequently a road sweeper was introduced on internal haul roads and on intermediate approach roads to the facility;
- Active tipping area or landfill cell will be restricted in location and area;
- Dust control equipment to be used to control dust levels;
- A road sweeper will be used on site to mitigate against dust on and around the site;
- Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary;
- All vehicles exiting the site shall make use of a wheel wash facility prior to entering onto public roads to ensure mud and other wastes are not tracked onto public roads;
- Wheel washes should be self-contained systems that do not require discharge of the wastewater to water bodies;
- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions (also applies to vehicles delivering material with dust potential), a mobile water bowser is on site for deployment during dry weather periods;
- Concrete surfaces will be used at the site entrance to minimise dust generation in these areas;
- A sprinkler system is in place at the entrance/reception to suppress dust;
- All vehicles which present a risk of spillage of materials, while either delivering or removing materials, will be loaded in such a way as to prevent spillage onto the public road; and
- The contractor will be required to ensure that all vehicles are suitably maintained to ensure that emissions of engine generated pollutants is kept to a minimum.

In order to ensure that any dust nuisance is minimised, a series of mitigation measures have been listed and a dust minimisation plan is included in the site EMS. Once operations adhere to good working practices and dust mitigation measures, the levels of dust generated are assessed to be minimal and are unlikely to cause an environmental nuisance. Dust deposition is not likely to cause a problem as a result of the proposed development, as it will continue to be controlled in the appropriate and adequate manner (under the supervision of the EPA, through the enforcement of the IE Licence).

Ongoing monitoring will be undertaken for dust deposition at the site as per the existing operations as listed in **Table 11-12.** The dust deposition samples will also be tested for metals during the drier months (March to September) and levels will be compared to the relevant TA Luft metal deposition limits as per **Table 11-17**.

Table 11-17 Metal deposition guidelines (TA Luft)

Parameter	Limit	Averaging Period
Arsenic	4µg/m^2/day	1 year
Lead	100µg/m^2/day	1 year
Cadmium	2µg/m^2/day	1 year
Nickel	15µg/m^2/day	1 year

11.1.6.2 Odour

No emissions are expected therefore, no mitigation measures are required. Non-conforming and/or fly-tipped waste will be removed off site to an approved facility.

11.1.6.3 Road Traffic

Mitigation of road traffic emissions are mainly achieved through EU legislation driven improvements in fuel and engine technology resulting in a gradually reducing emissions per vehicle profile. The collection of EU Directives, known as the Auto Oil Programme, have outlined improved emission criteria which manufacturers are required to achieve from vehicles produced in the past and in future years. This is a trend which has been in operation for many years and is destined to continue in future years for both cars and heavy duty vehicles. The introduction of the National Car Test (NCT) has also helped to reduce transport emissions by ensuring that all vehicles on Irish roads over four years old undergo an emissions test.

The waste acceptance for the proposed development remains the same (500,000 tonnes per annum) as the existing Waste Licence (W1029-02), therefore, maximum traffic will not increase. Traffic will be controlled on site with the use of signage, speed restrictions and a one-way system to limit the varying speeds of traffic that negatively impacts air quality. All vehicles must use the wheel wash facility before leaving the site.

As outlined in the prediction model findings, when the proposed development becomes operational, compliance with all the relevant limit values will be achieved at the nearest sensitive receptors regardless of the above local mitigation. There are no specific remedial or reductive measures apparent for road traffic, however, there will be a contribution towards potential deterioration of surrounding pavement conditions.

11.1.7 Residual Impacts

With the proposed mitigation in place there are no predicted residual impacts.

11.2 Climate

11.2.1 Introduction

This section assesses the impact to climate associated with the proposed development. It should be read in conjunction with the site layout plans and characteristics of the project (**Chapter 5**). The proposed development is considered a major long-term infrastructure project and, as such, it is most likely vulnerable to progressively more significant climate change.

11.2.2 Methodology

11.2.2.1 Baseline Climate

Existing climate data for the study area have been derived from the Met Éireann 30 year averages (1981 – 2010).

11.2.2.2 Mitigation

The climate assessment was carried out to identify sources and quantify total Greenhouse Gas (GHG) emissions generated from the activities associated with the proposed development. This assessment was carried out using the carbon calculator for construction activities developed by the Environmental Agency in the UK. The carbon calculator calculates the embodied carbon dioxide (CO_2) of materials plus CO_2 associated with their transportation. It also considers personal travel, site energy use and waste management.

11.2.2.3 Adaption

In addition to GHG generation as described above, the adaptability of the proposed development has also been assessed. In particular, the impacts of flooding (addressed through consultation with the CFRAM mapping for the area and the Fingal County Council Development Plan), wind, rainfall and large-scale climatic events (i.e. storms, snow etc.). The details of the flood risk assessment are discussed in **Chapter 10 Water** of this EIAR.

11.2.3 Assessment Criteria

CO_2 emissions have a global climate warming effect. This is regardless of their rate of release, location or the weather when they are released into the atmosphere. This is unlike pollutants that affect local air quality where the rate of release, location and prevailing weather, as well as the amount of pollutant, determines the local concentrations and the impact. Local ambient concentrations of CO_2 are not relevant and there are no limits or thresholds that can be applied to particular sources of carbon emissions – any amount of CO_2 released into the atmosphere will contribute to climate warming, the extent of which is determined by the magnitude of the release. Although CO_2 emissions are typically expressed as kilogrammes or tonnes per year, there is a cumulative effect of these emissions because CO_2 emissions have a warming effect which lasts for 100 years or more.

It is difficult to assess the scale and significance of any adverse (increased) changes in CO_2 emissions resulting from the proposed development in a similar way to other impacts within this EIAR. The effect – the term used to describe an environmental response resulting from an impact, or series of impacts – is not possible to assess for individual CO_2 emissions. However, commentary and context to the calculated CO_2 emissions reported is provided with reference to historic and projected national emissions in Ireland.

The National Policy Position on Climate Action and Low Carbon Development was published on the 23rd April 2014. The policy sets a fundamental national objective to achieve transition to a competitive, low-carbon, climate-resilient and environmentally sustainable economy by 2050. The policy states that GHG mitigation and adaptation to the impacts of climate change are to be addressed in parallel national strategies – respectively through a series of National Mitigation Plans and a series of National Climate Change Adaptation Frameworks.

The National Policy Position envisages that development of National Mitigation Plans will be guided by a long-term vision of low carbon transition based on the following:

- An aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and
- In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

Further to the National Policy Position, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) was enacted on the 10th of December 2015. The Climate Act sets out the proposed

national objective to transition to a low carbon, climate resilient and environmentally sustainable economy by the end of 2050.

On 14th May 2018, the European Council adopted a regulation on greenhouse gas emission reductions – EU effort Sharing Regulation sets out 2030 targets for member states. The starting point is an average of 2016 – 2018 emissions with binding emission reduction targets of 30% compared to 2005 levels.

The Climate Action and Low Carbon Development (Amendment) Act 2021 embeds the process of setting binding and ambitious emissions-reductions targets in law. In addition, the act provides for a national climate objective, which commits the State to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally-sustainable and climate-neutral economy. The act provides that the first two five-year carbon budgets proposed by the Climate Change Advisory Council should equate to a total reduction of 51% over the period to 2030, relative to a baseline of 2018.

After the publication of the 2021 Climate Act in July 2021 and the 2021 Climate Action Plan (CAP) is aligned with the government's carbon budget programme and is to provide a roadmap of actions needed to comply with said budgets and sectoral emission ceilings.

At a national level, according to the latest Ireland's Final Greenhouse Gas Emissions 1990-2020 report (EPA, 2022), emissions of GHGs in Ireland are estimated to be 57.72 million tonnes (Mt) carbon dioxide equivalents (CO_2eq). This is 3.6% lower than emissions in 2019. The EPA also reported that Ireland is estimated to have cumulatively exceeded its compliance obligations by 12.04 Mt CO_2eq over the 2013-2020 period and will need to use credits and/or purchase surplus annual emission allocations from other Member States to achieve compliance.

In 2020, emissions from Ireland's Emissions Trading Sector ((ETS), which covers power stations, large industrial plants and airlines) decreased by 6.1% or 0.87 Mt CO_2eq while non-ETS emissions decreased by 2.8% or 1.27 Mt CO_2eq. Since 2005, ETS sector emissions have decreased by 40.7% or 9.14 Mt CO_2eq whereas emissions under the non-ETS sectors only decreased by 7.0% or 3.34 Mt CO_2eq, considerably short of Ireland's 20% reduction commitment.

The evidence points to emissions increasing as a result of economic activity and employment. *Agriculture* remains the single largest contributor to the overall emissions at 37.1% of the total. *Transport* and *Energy Industries* (which includes waste-to-energy incineration) are the second and third largest contributors at 17.8% and 15.1% respectively. Emissions from the *Residential* and *Manufacturing Combustion* sectors account for 12.3% and 7.8% respectively. The remainder is made up of *Industrial Processes* (3.7%)*, F-Gases* (1.4%)*, Commercial Services* (1.6%)*, Public Services* (1.6%) and *Waste* (1.6%)*.*

Looking forward, the EPA state in their 2022 report, Ireland's Greenhouse Gas Emissions Projections 2021-2040 (EPA, 2022), that implementation of the '*With Additional Measures*' (WAM) scenario (including those in the Climate Action Plan 2021) is projected to save 58 Mt CO_2eq over the period 2021-2030 compared to the '*With Existing Measure*s' (WEM) scenario. This represents a reduction of 1.8% per annum in emissions over the period. These projections indicate that Ireland can meet its non-ETS EU targets over the period 2021 to 2030, assuming full implementation of the Climate Action Plan 2021 and the use of the flexibilities available. Future, more ambitious targets as presented in the European Climate Law[13] and Ireland's pending Carbon Budget 2022 will require many (as yet unidentified) additional measures.

The waste sector currently contributes 1.5% (which consists of landfill, incineration and open burning of waste, mechanical & biological treatment and wastewater treatment) of Ireland's national GHG emissions. Emissions in the waste sector are primarily attributed to methane emissions from landfills, however, the EPA projects the reduction in waste going to landfill, subsequently reducing GHG emissions during this projection. The EPA estimate emissions to 2035 using two scenarios as follows:

- 'With Existing Measures' – scenario assumes that no additional policies and measures, beyond those already in place by the end of 2017 (latest EPA GHG Emissions Projections Report), are implemented; and

[13] European Climate Law: https://ec.europa.eu/clima/eu-action/european-green-deal/european-climate-law_en

- 'With Additional Measures' – scenario assumes implementation of the 'With Existing Measures' scenario in addition to progressing of renewable and energy efficient targets for 2020.

GHG projections by sector under 'With Additional Measures' projects that waste will contribute to 0.9% of Irelands total GHG emissions in 2020, this is projected to decrease to 0.7% in 2030. Emissions in the waste sector are projected to decrease 40% to 0.5 Mt CO_{2eq} between 2017 and 2020 and by 53% between 2017 and 2030 (0.4 Mt CO_{2eq}).

11.2.4 Existing Climate

The weather in Ireland is influenced by the Atlantic Ocean, resulting in mild, moist weather dominated by maritime air masses. The prevailing wind direction is from a quadrant centred on west-southwest. These are relatively warm winds from the Atlantic and frequently bring rain. Easterly winds are weaker and less frequent and tend to bring cooler weather from the northeast in spring and warmer weather from the southeast in summer. The site of the proposed development is approximately 11km west of the east coast would experience a higher frequency of easterly winds than more inland locations or those on the west coast.

The nearest meteorological station to the area is the Met Éireann Station in Dublin Airport which lies approximately 14km south of the subject site. The 30-year averages from the station at Dublin Airport are presented in **Table 11-18**. The proposed development must consider the extreme weather events relating to cold weather, wind, rain and events (storms, snow etc.).

Table 11-18 30-Year Average Meteorological Data from Dublin Airport (Annual Values from 1981-2010, source: www.met.ie)

Parameter	30-Year Average
Mean Temperature (°C)	9.8
Mean Relative Humidity at 0900UTC (%)	83.0
Mean Daily Sunshine Duration (Hours)	3.9
Mean Annual Total Rainfall	758.0
Mean Wind Speed (knots)	10.3

11.2.4.1 Temperature

At Dublin Airport the 30-year record for temperature (**Table 11-19**) shows that the average daily temperature across a calendar year is 9.8°C with an average maximum of 13.3°C and an average minimum of 6.4°C. Across the calendar year the average number of days with air frost is 29.4.

Table 11-19 30-Year average data for rainfall at Dublin Airport (Annual Values from 1981-2010, source: www.met.ie)

Temperature (°C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Daily Max	8.1	8.3	10.2	12.1	14.8	17.6	19.5	19.2	17	13.6	10.3	8.3	13.3
Mean Daily Min	2.4	2.3	3.4	4.6	6.9	9.6	11.7	11.5	9.8	7.3	4.5	2.8	6.4
Mean Temperature	5.3	5.3	6.8	7.3	10.9	13.6	15.6	15.3	13.4	10.5	7.4	5.6	9.8
Mean num. of Days with Air Frost	6.4	6.5	3.8	2.4	0.3	0	0	0	0	0.5	3.0	6.4	29.4

11.2.4.2 Wind

The prevailing wind direction for the area is between west and southwest (10-20%) as presented in the wind-rose for Dublin Airport Met Station for 1981-2010 in **Figure 11-2**. Northerly and north-easterly winds tend to be very infrequent (less than 5%) with easterly and south-easterly winds marginally more frequently (5-10%).

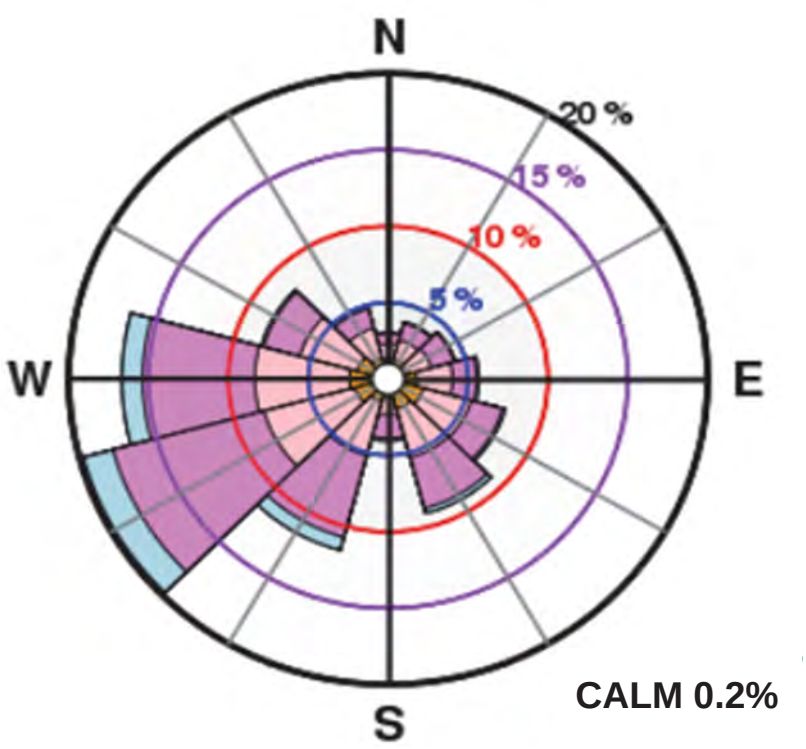

Figure 11-2 Wind-rose for the Dublin Airport Met Station 1981 – 2010 (Source: www.met.ie)

Wind characteristics are typically moderate with relatively infrequent gales with an average of 8.2 days with gales per annum with an average maximum wind gust of 80 knots during the year (January) (**Table 11-20**).

Table 11-20 30-Year average data for wind at Dublin Airport (Annual Values from 1981-2010, source: www.met.ie)

Wind (knots)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Monthly Speed	12.5	12.0	11.6	9.9	9.2	8.6	8.7	8.7	9.2	10.4	11.0	11.3	10.3
Max. Gust	80	73	66	59	58	53	54	56	59	69	66	76	80
Mean num. of Days with Gales	2.3	1.5	1.1	0.1	0.1	0.1	0.1	0.1	0.2	0.5	0.8	1.3	8.2

11.2.4.3 Rainfall

The average yearly rainfall in the 30-year average is 758.0mm, this is broken down into monthly averages in Table 11-21. The greatest daily total of rain is recorded in May (73.9mm) with moderately frequent days with ≥5.0mm per annum (42 days).

Table 11-21 30-Year average data for rainfall at Dublin Airport (Annual Values from 1981-2010, source: www.met.ie)

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Monthly Total	62.6	48.8	52.7	54.1	59.5	66.7	56.2	73.3	59.5	79.0	72.9	72.7	758.0
Greatest Daily Total	27.1	28.1	35.8	30.4	42.1	73.9	39.2	72.2	40.6	53.2	62.8	42.4	73.9
Mean num. Days with ≥5.0mm	4	3	3	3	3	3	3	4	4	4	4	4	42

11.2.4.4 Weather Events

The proposed development must consider weather events that may disrupt operations. **Table 11-22** displays the mean number of days per annum on average across the 30-year average a weather event occurs. Snow lying at 0900UTC is infrequent occurring on average 3.4 days per annum, posing a low risk to operations. Fog is the most frequent weather event observed at Dublin Airport during the 30-year average records, occurring on average 41.5 days per annum.

Table 11-22 30-Year average data for weather events at Dublin Airport (Annual Values from 1981-2010, source www.met.ie)

Weather (mean num. of days with…)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Snow or Sleet	4.6	4.2	2.8	1.2	0.2	0	0	0	0	0	0.8	2.9	16.6
Snow lying at 0900UTC	1.6	0.6	0.1	0	0	0	0	0	0	0	0.1	0.9	3.4
Hail	1.2	1.5	2.0	1.9	1.3	0.1	0.2	0.1	0.1	0.3	0.3	0.7	9.7
Thunder	0.3	0.2	0.3	0.2	0.9	0.8	0.8	0.9	0.3	0.3	0.2	0.2	5.5
Fog	3.3	3.1	3.6	3.6	3.4	2.8	3.3	3.8	4.2	3.2	3.1	4.1	41.5

11.2.4.5 Carbon Footprint (CO_{2eq})

IMS publish an Annual Environmental Report (AER) to report and track progress on the site's resource uses and energy efficiency, the information is submitted to the EPA. Using established SEAI emission factors, the calculated footprint for the period 2015 – 2020 is presented in **Table 11-23** and show the annual emissions relative to the annual throughput of waste.

The results indicate that electricity consumption at the facility has been declining at a steady rate in recent years but with an increase in 2020. Conversely, the volume of heavy fuel oil employed on site has increased year on year in the period 2015 to 2020. The net effect is an increase in direct carbon emissions from the site in the period 2015 to 2020 as a direct result of the increased electricity and fuel use. The continued use of the site will result in a continued annual emission of the order of 300-400 tonnes of CO_2 per annum for the 25 year timeframe of the proposed development.

It is noteworthy that the emissions show no correlation with the waste throughput indicating that emissions from the site are decoupled from the waste throughput.

Table 11-23 IMS carbon footprint 2015-2020

Category	2015	2016	2017	2018	2019	2020
Electricity						
Electricity (kWh)	25,880	23,400	18,700	18,600	18,921	38,842
EF (SEAI – electricity)	436.6gCO_2/kWh					
Electricity CO_2 (tCO_2)	11.30	10.23	8.16	8.12	10.60	16.96
Fossil Fuel Consumption						
Heavy Fuel Oil (m^3)	12.6	17.61	24.3	42.5	-	-
EF (SEAI – diesel oil)	73.3t CO_2/TJ					
Heavy Fuel Oil CO_2	33.81	47.25	65.21	114.05	334	337
Summary						
Total CO_2 Emissions (tCO_2)	**45.11**	**57.47**	**73.37**	**122.17**	**344.60**	**353.96**
Throughput (tpa)	**66,433**	**160,041**	**54,747**	**226,946**	**270,842**	**326,363**

This analysis presented in **Table 11-23** does not include off-site impact such as material transport. Based on the projected 120 HGV deliveries per day with the site operating at full capacity (500,000 tonnes per annum) and assuming all material is transported from the GDA (assumed 50km from the site to the wider GDA), the material transport emissions may be estimated. The UK Government GHG Conversion Factors for Company Reporting (as published by defra) present a series of emission factors for a typical rigid HGV (>17 tonne) as follows:

- 0% Laden 0.76810 kgCO_2e/km
- 50% Laden 0.93372 kgCO_2e/km
- 100% Laden 1.09934 kgCO_2e/km

Assuming the HGVs arrive laden and leave unladen the total daily emissions equate to 11,205 kgCO_{2e} per day or 2,801 tonnes CO_{2e} annually (based on a 250 day operation per annum).

11.2.5 Impact Assessment

11.2.5.1 'Do-Nothing' Impact

Under such a scenario, the existing operation would remain unchanged and the baseline GHG generation rates would continue in the short to medium term. This includes a circa 300-400 tonnes CO_{2e} per annum from site and circa 2,801 tonnes CO_{2e} annually from transport.

11.2.5.2 Generation of Greenhouses Gases

During the construction phase there is potential for greenhouse gas to be generated through embodied carbon in materials, construction activities and material and personnel transport. However, much of the construction materials required on site will be site won aggregates thereby eliminating transport emissions. In addition, the reuse of these materials eliminates the embodied carbon for virgin aggregates.

Specialist equipment such as pipes and other drainage equipment for the pond will generate embodied and transport emissions but these are considered imperceptible in scale.

During the operation phase, the proposed operation would be similar in scale to the existing operation. Emissions would remain unchanged as per the baseline GHG generation rates which would continue for the 25 year timeframe. This includes a circa 300-400 tonnes CO_{2e} per annum from site and circa 2,801 tonnes CO_{2e} annually from transport. This equates to a permanent slight adverse impact on a scale similar to the existing operation which is not considered significant.

11.2.5.3 Climate Change Adaption

In terms of the risk of major disasters which are relevant to the proposed development, given the location and physical characteristics of the proposed development, the main potential risks of flooding, wind, rain and weather events are reduced.

Regarding the flood risk of the proposed development, the Waste Licence boundary is will not be affected by a 100-year event. There is an area north east of the site boundary that would be susceptible to a fluvial – indicative 1% AEP (100-year) event (CFRAM). A flood risk assessment of the proposed development is presented in **Chapter 10** and confirms the low vulnerability of the proposed development.

11.2.6 Mitigation Measures

Consideration is given in this section to specific measures associated with the proposed development and also wider measures applicable to the landfill operations. It is noted that the mitigation measures proposed for air quality will also benefit in terms of reducing CO_2 emissions.

Monitoring meteorological conditions is required of IMS as per the EPA licence requirements (Schedule C.4: Meteorological Monitoring) (**Table 11-24**). Climatic data for the site was compiled, relating to temperature, rainfall, wind and evapotranspiration. Monitoring is undertaken mainly for context of dust nuisance control and other environmental management factors.

Table 11-24 Meteorological monitoring requirements set in the current EPA Waste Licence

Parameter	Monitoring Frequency	Analysis Method/Technique
Precipitation Volume	Daily	Standard
Temperature (min/max)	Daily	Standard
Wind Force and Direction	Daily	Standard
Evaporation	Daily	Standard
Evapotranspiration	Daily	Standard
Humidity	Daily	Standard
Atmospheric Pressure	Daily	Standard

11.2.6.1 GHG Emissions

Mitigation measures to minimise CO_2 emissions from the proposed development operations include the following:

- Alternating electricity suppliers to ensure a higher renewable fraction on the electricity supply;
- Turning off vehicular engines (and mobile plant) when not in use for more than five minutes. This restriction will be enforced strictly unless the idle function is necessary for security or functionality reasons;
- Regular maintenance of plant and equipment. Technical inspection of vehicles to ensure they will perform the most efficiently;
- The use of thermostatic controls on all space heating systems in site buildings to maintain optimum comfort at minimum energy use;
- The use of sensors on light fittings in all site buildings and low energy lighting systems;
- The use of low energy equipment and 'power saving' functions on all PCs and monitors in the site offices;
- The use of low flow showers and tap fittings; and
- The use of solar/thermal power to heat water for the on-site welfare facilities and contamination unit (sinks and showers).

11.2.7 Residual Impacts

The proposed development is continue infilling a more diverse mix of wastes at the site similar to the current operation, therefore, the proposed development will not have additional significant impacts on the microclimate or local climate of the area. Rainfall, wind speeds and wind direction will not significantly influence environmental impacts as no odours, gases or harmful leachates will be generated at the proposed development.

In terms of emissions, the ongoing on-site energy/electricity use coupled with the associated road transport will result in a permanent slight adverse impact on a scale similar to the existing operation which is not considered significant.

If natural extreme weather conditions do occur during operation times, IMS will take the appropriate methods to ensure safety of all people associated with the site. If a major weather event was to occur the site will be shut down and be re-opened when it is safe to recommence operations.

11.3 References

1. Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (Rev. 1), NRA, (2011).
2. Design Manual for Road and Bridges (DMRB), Volume 11, Section 3, Part 1, UK Highways Agency, (2007).

3. Technical Instructions on Air Quality Control - TA Luft in accordance with art. 48 of the Federal Immission Control Law (BImSchG) dated 15 March 1974 (BGBI. I p.721), German Federal Ministry for Environment, (1986).
4. 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.
5. Air Quality Standards Regulations 2011 (S.I. 180 of 2011).
6. Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58/2009)
7. Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide, Global update 2005 Summary of Risk Assessment, WHO, (2005).
8. Council Decision 2003/33/EC establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.
9. Air Quality in Ireland 2014, 2015, 2016, 2017, 2018 EPA (2019).
10. SI 155 of 2011 - European Communities Act, 1972 (Environmental Specifications for Petrol, Diesel Fuels and Gas Oils for use by non-road mobile machinery, including inland waterway vessels, agricultural and forestry tractors, and recreational craft) Regulations 2011;
11. SI No. 119 of 2008 - Sulphur Content of Heavy Fuel Oil, Gas Oil and Marine Fuels; and
12. SI 156 of 2011 - European Communities Act 1972 (Sulphur Content of Heavy Fuel Oil, Gas Oil, and Marine Fuels) (Amendment) Regulations 2011.
13. Annual Environmental Report (AER), IMS (2015-2018).
14. National Policy Position on Climate Action and Low Carbon Development, Department of Communications, Climate Action and Environment, (2017).
15. National Adaption Framework - Planning for a Climate Resilient Ireland, Department of Communications, Climate Action and Environment, (2018).
16. Greenhouse gas reporting: conversion factors, UK Government, (2021).