

8 AIR AND CLIMATE

8.1 Air Quality

8.1.1 Background

The Proposed Crown Square mixed-use development site, which is approximately 5.1 hectares, is located in Mervue (approximately 2.1km from Eyre Square in Galway City Centre). The proposed works will be completed as a single phase, which will run for an overall length of approximately two-three years. The wider Crown Square project also involves an initial phase which is a mixed use development (comprising primarily commercial and hotel space). The currently proposed development will likely be constructed after the first phase, and although it will be subject to a separate planning permission, it is being cumulatively assessed in this EIAR. The same groundworks element of the proposed development are included in both applications.

Due to the nature of the development, the general character of the surrounding environment and publicly available information on air quality, air quality sampling, was deemed to be unnecessary for this Environmental Impact Assessment Report (EIAR).

8.1.2 Air Quality Standards

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) deals with sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- A third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive, published in 2007, deals with polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air.

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for PM_{2.5} (fine particles) including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years (for particulate matter PM₁₀) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 8.1 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre ($\mu\text{g}/\text{m}^3$) and parts per billion (ppb). The notation PM_{10} is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. $\text{PM}_{2.5}$ represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

The CAFE Directive was transposed in to Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). These Regulations supersede 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 the Ambient Air Quality Assessment and Management Regulations 1999 (S.I. No. 33 of 1999).

Table 8.1 Limit values of Directive 2008/50/EC, 1999/30/EC and 2000/69/EC (Source: EPA)

Pollutant	Limit Value Objective	Averaging Period	Limit Value ($\mu\text{g}/\text{m}^3$)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1 st Jan 2005
Sulphur dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1 st Jan 2005
Sulphur dioxide (SO_2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19 th Jul 2001
Sulphur dioxide (SO_2)	Protection of vegetation	1 st Oct to 31 st Mar	20	7.5	Winter mean	19 th Jul 2001
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1 st Jan 2010
Nitrogen dioxide (NO_2)	Protection of human health	Calendar year	40	21	Annual mean	1 st Jan 2010
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar year	30	16	Annual mean	19 th Jul 2001
Particulate matter 10 (PM_{10})	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1 st Jan 2005
Particulate matter 2.5 ($\text{PM}_{2.5}$)	Protection of human health	Calendar year	40	-	Annual mean	1 st Jan 2005
Particulate matter 2.5 ($\text{PM}_{2.5}$) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1 st Jan 2015

Particulate matter 2.5 (PM _{2.5}) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1 st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1 st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1 st Jan 2005
Benzene (C ₆ H ₆)	Protection of human health	Calendar Year	5	1.5	-	1 st Jan 2010

The Ozone Daughter Directive 2002/3/EC is different from the other Daughter Directives in that it sets target values and long-term objectives for ozone rather than limit values. Table 8.2 presents the limit and target values for ozone.

Table 8.2 Target values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of human health	Maximum daily 8 hour mean	120 mg/m ³ not to be exceeded more than 25 days per calendar year averaged over 3 years	120 mg/m ³
Protection of vegetation	AOT ₄₀ calculated from 1 hour values from May to July	18,000 mg/m ³ .h averaged over 5 years	6,000 mg/m ³ .h
Information Threshold	1 hour average	180 mg/m ³	-
Alert Threshold	1 hour average	240 mg/m ³	-

AOT₄₀ is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 µg/m³ and is expressed as µg/m³ hours.

8.1.2.1 Air Quality and Health

Recent Environmental Protection Agency (EPA), EU and World Health Organisation reports estimate that poor air quality accounted for premature deaths of approximately 600,000 people in Europe in 2012, with 1,200 Irish deaths attributable to fine particulate matter (PM_{2.5}) and 30 Irish deaths attributable to Ozone (O₃) (*Source: www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2014/03/almost-600-000-deaths-due-to-air-pollution-in-europe-new-who-global-report and 'Ireland's Environment 2016 – An Assessment', EPA, 2016*). These emissions, along with others including nitrogen oxides (NO_x) and sulphur oxides (SO_x) are produced during fossil fuel based electricity generation in various amounts, depending on the fuel and technology used. Whilst there is the potential of such emissions to be generated from construction operations, a number of mitigation measures will be implemented at this site to reduce the impact from dust and vehicle emissions, which are discussed in Sections 8.4.3 below.

8.1.3 Air Quality Zones

The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs

- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The site of the proposed development lies within Zone C, which represents urban areas with a population of greater than 15,000.

8.1.4 Existing Air Quality

The EPA publishes Air Monitoring Station Reports for monitoring locations in all four Air Quality Zones. The ambient air quality monitoring carried out closest to the subject site is at Bohermore in Galway City. This monitoring location also lies within Zone C which comprises urban areas with populations greater than 15,000. The air quality in the vicinity of the proposed development site is likely to be quite similar in nature and composition.

For the purposes of this assessment, air quality monitoring data from the station at Bohermore in Galway City is used. Data for Bohermore in Galway City is available in the EPA report '*Ambient Air Monitoring in Galway City; March 13th 2001 – 23rd October 2001*'. Similar measurement values for all air quality parameters would be expected for the proposed development site.

8.1.4.1 Sulphur Dioxide (SO₂)

Data for sulphur dioxide (SO₂) monitoring carried out in Galway City for 2001 is shown in Table 8.3.

Table 8.3 SO₂ Data for Galway City in 2001

Parameter	Measurement
No. of measured values	3,672
Percentage covered	68.6%
Maximum hourly value	87.8 µg/m ³
98 percentile for hourly values	42.3 µg/m ³
Mean hourly value	10.0 µg/m ³

The hourly limit value was not exceeded during the measurement period. The lower assessment threshold was not exceeded during the measurement period. The mean hourly value of 10 µg.m-3 exceeds the lower assessment threshold for the protection of ecosystems but not the upper assessment threshold. However, this threshold may not be relevant to monitoring in an urban environment. Air quality of the proposed development site would be expected to be similar.

8.1.4.2 Particulate Matter (PM₁₀)

Sources of particulate matter include vehicle exhaust emissions, soil and road surfaces, construction works and industrial emissions. No limit values were exceeded during this measurement period in Galway City. PM₁₀ monitoring results from 2001 are presented in Table 8.4 below.

Table 8.4 PM₁₀ Data for Galway City in 2001

Parameter	Measurement
No. of measured values	187
Percentage covered	83.8%
Maximum daily value	49.9 µg/m ³
98 percentile for daily values	45.8 µg/m ³
Mean daily value	22.1 µg/m ³

The twenty four hour limit value for the protection of human health (50µg.m-3) was not exceeded during the measurement period. The upper assessment threshold was exceeded on 32 days (17.1% of measured values), the lower assessment threshold was exceeded on 96 days (51.3% of measured values). The directive stipulates that each of the assessment thresholds should not be exceeded more than 7 times in a calendar year. The mean of the daily values during the measurement period (22.2 µg.m-3) is below the annual limit value for the protection of human health (40 µg.m-3). Air quality of the proposed development site would be expected to be similar in terms of PM₁₀ levels.

8.1.4.3 Nitrogen Dioxide (NO₂)

The values for the concentrations of nitrogen dioxide recorded in Galway City from 2001 are displayed in Table 8.5 below. Daily and annual limit values for the protection of human health were not exceeded during the assessment.

Table 8.5 Nitrogen Dioxide Data Galway City in 2001

Parameter	Measurement
No. of measured values	4,531
Percentage covered	84.6%
Maximum hourly value	120.7 µg/m ³
98 percentile for hourly values	50.5 µg/m ³
Mean hourly value (NO ₂)	19.9 µg/m ³
Mean hourly value (NO _x)	34.8 µg/m ³

The hourly limit value was not exceeded during the measurement period. One hourly mean NO₂ value was above the lower assessment threshold, the directive stipulates that the lower assessment threshold should not be exceeded more than 18 times in a calendar year. With the exception of this value, all other hourly mean NO₂ values were below the lower assessment threshold. The mean hourly NO₂ value (19.9µg.m-3) during the measurement period was below the annual lower assessment threshold for the protection of human health (26 µg.m-3). The mean hourly value of NO_x (34.8 µg.m-3 NO₂) during the measurement period exceeded the annual limit value for the protection of vegetation (30 µg.m-3 NO₂). However, the applicability of this limit to urban air pollution monitoring is questionable.

8.1.4.4 Carbon Monoxide (CO)

Carbon monoxide data has been sourced from air quality monitoring carried out in Galway City (March to October 2001) and is presented in Table 8.6. The mean hourly concentration of carbon monoxide recorded was 0.5 mg/m³. The carbon monoxide limit value for the protection of human health is 10 mg/m³. On no occasions were values in excess of the 10 mg limit value set out in Directives 2000/69/EC or 2008/69/EC recorded.

Table 8.6 Carbon Monoxide Data Galway City March to October 2001

Hourly Values	Result
No. of hours	5,356
No. of measured values	4,533
Percentage Coverage	84.6%
Maximum hourly value	2.8 mg/m ³
98 percentile for hourly values	1.3 mg/m ³
Mean hourly value	0.5 mg/m ³
Maximum 8-hour mean	1.6 mg/m ³
98 percentile for 8-hour mean	1.1 mg/m ³

8.1.4.5 Ozone (O₃)

Ozone data for the Mace Head Atmospheric Research Station for 2008 is presented in Table 8.7. The maximum daily eight-hour mean limit of 120 µg/m³ was exceeded on three days. The legislation stipulates that this limit should not be exceeded on more than 25 days.

Table 8.7 Summary statistics for rolling 8-hr O₃ concentrations in 2008: Mace Head

Parameter	Value
Annual Mean	77 µg/m ³
Median	77 µg/m ³
% Data Capture	100%
No. of days > 120	3 days
Maximum 8-hour value	132 µg/m ³

8.2 Climate

8.2.1 Climate Change and Greenhouse Gases

Although variation in climate is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

8.2.1.1 Greenhouse Gas Emission Targets

Ireland is a Party to the Kyoto Protocol, which is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It is a protocol to the United Nations Framework for the Convention on Climate Change. The Kyoto Protocol came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are now binding.

Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions in the period 2008 to 2012. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

8.2.1.1.1 Doha Amendment to the Kyoto Protocol

In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of five percent against 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020; however, the composition of Parties in the second commitment period is different from the first.

Under the protocol, countries must meet their targets primarily through national measures, although market based mechanisms (such as international emissions trading can also be utilised).

8.2.1.1.2 COP21 Paris Agreement

COP21 was the 21st session of the Conference of the Parties (COP) to the United Nations Convention. Every year since 1995, the COP has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments. COP21 was organised by the United Nations in Paris and held from 30th November to 12th December 2015.

COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The twelve-page text, made up of a preamble and 29 articles, provides for a limitation of the temperature rise to below 2°C above pre-industrial levels and even to tend towards 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions.

8.2.1.1.3 Emissions Projections

Ireland's target is to achieve a 20% reduction of non-Emissions Trading Scheme (non-ETS) sector emissions, i.e. agriculture, transport, residential, commercial, non-energy intensive industry and waste, on 2005 levels, with annual binding limits set for each year over the period 2013 – 2020. In May 2018, the EPA published an update on Ireland's Greenhouse Gas Emission Projections to 2035, *'Ireland's Greenhouse Gas Emissions Projections 2017 – 2035'* (Environmental Protection Agency, 2018).

The 2018 report states that the *"latest EPA greenhouse gas emissions projections indicate an overall increase in greenhouse gas emissions from most sectors. The projected growth in emissions is largely underpinned by projected strong economic growth and relatively low fuel prices leading to increasing energy demand over the period"*.

Greenhouse gas emissions are projected to 2035 using two scenarios; 'With Existing Measures' and 'With Additional Measures'. The 'With Existing Measures' scenario assumes that no additional policies and measures, beyond those already in place by the end of 2014 are implemented. The 'With Additional Measures' scenario takes into account an expected shortfall in achieving full energy efficiency targets and renewable targets for electricity, transport and heat as set out in the National Energy Efficiency Action Plan and National Renewable Energy Action Plan.

The EPA Greenhouse Gas Emission Projections notes the following key trends:

- Ireland's non-Emissions Trading Scheme (ETS) emissions are projected to be 0% and 1% below 2005 levels in 2020 under the 'With Measures' and 'With Additional Measures' scenarios, respectively. The target for Ireland is a 20% reduction.
- Over the period 2013 – 2020, Ireland is projected to cumulatively exceed its compliance obligations by 17 Mt CO₂ (metric tonnes of Carbon Dioxide) equivalent under the 'With Measures' scenario and 16.3 Mt CO₂ equivalent under the 'With Additional Measures' scenario.

The EPA report states that *"Ireland is not projected to meet 2020 emissions reduction targets and is not on the right trajectory to meet longer term EU and national emission reduction commitments"*. The report also states:

Fossil fuels such as coal and peat continue to be key contributors to emissions from the power generation sector and the extent of their use will be a key determinant in influencing future emissions trends from this sector. Total emissions are projected to increase from current levels by 1% and 4% by 2020 and 2030 respectively under the With Existing Measures scenario. Under the With Additional Measures scenario emissions are estimated to increase by 2% by 2020 and decrease by 1% by 2030. Ireland is not on the right long term trajectory in meeting national 2050 targets in the electricity generation, built environment and transport sectors (Greenhouse Gas Emission Projections 2017 - 2035, EPA, 2018)

8.2.1.1.4 Progress to Date

The 'Europe 2020 Strategy' is the EU's agenda for growth and jobs for the current decade. The Europe 2020 Strategy targets on climate change and energy include:

- Reducing greenhouse gas (GHG) emissions by at least 20% compared with 1990 levels;
- Increasing the share of renewable energy in final energy consumption to 20%; and
- Moving towards a 20% increase in energy efficiency.

Regarding progress on targets, the *'Europe 2020 indicators – climate change and energy'* report¹ provides a summary of recent statistics on climate change and energy in the EU. In 2015, EU greenhouse gas emissions, including emissions from international aviation and indirect carbon dioxide (CO₂) emissions, were down by 22.1% when compared with 1990 levels. However, regarding the progress of individual Member States, and Ireland in particular, the Europe 2020 indicators include the following statements:

¹ http://ec.europa.eu/eurostat/statistics-explained/index.php/Europe_2020_indicators_-_climate_change_and_energy

- 24 countries are on track to meet their GHG targets, except Austria, Belgium, **Ireland** and Luxembourg.
- Luxembourg emitted the most GHG per capita in the EU in 2014 ... followed by Estonia, **Ireland** and the Netherlands.
- In 2015, Malta was the farthest from reaching their national target, followed by **Ireland**, Belgium and Luxembourg.

The June 2018 'Off Target Report' published by the Climate Action Network (CAN) Europe which ranks EU countries ambition and progress in fighting climate change listed Ireland as the second worst performing EU member state in tackling climate change. It also stated that Ireland is set to miss its 2020 climate and renewable energy targets and is also off course for its unambitious 2030 emissions target.

8.2.2 Climate and Weather in the Existing Environment

County Galway has a temperate oceanic climate, resulting in mild winters and cool summers. The prevailing wind direction is between south and west² which bring moist air and frequent rain. According to Met Éireann, the average number of wet days per year in the west of Ireland is 225. The wettest months are December and January and April is usually the driest. July is the warmest month with an average temperature of 15.7° Celsius. The Met Éireann weather station at Shannon, County Clare is the nearest weather and climate monitoring station to the subject site, located approximately 65km south of the site. Meteorological data recorded at Shannon over the 30-year period from 1981-2010 is shown in Table 8.8 overleaf. The wettest months are October and December, and April is the driest. July is the warmest month with a mean daily temperature of 16.4° Celsius.

Rainfall and wind speed data was also available for the Athenry monitoring station which is located approximately 19km northwest of the site.

8.2.2.1 Wind

The wind field characteristics of the area are important climatological elements in examining the potential for the generation of fugitive dust emissions from the site. Fugitive dust emissions from a surface occur if the winds are sufficiently strong and turbulent and the surface is dry and loose, together causing re-suspension of particulate matter from the ground. A wind speed at ground level in excess of about five metres per second is considered to be the threshold above which re-suspension of fine sized material from an exposed surface may occur. The surface needs to have a relatively low moisture content for this type of dust emission to take place and any wetting either by rainfall or sprayers, will greatly reduce the potential of fugitive dust emissions. The mean annual wind speed at the station, in Athenry, is 3.6 metres per second.

8.2.2.2 Rainfall

Long term rainfall data was also obtained from the monitoring station at Athenry. The 18-year annual average rainfall for Athenry is 1,152mm/yr. This is considered to be high when compared to the annual average rainfall for Dublin (Merrion Square) which recorded annual average rainfall of 730 mm/yr over the same period. This will be due to Galway's oceanic position on the Atlantic seaboard.

² <https://www.met.ie/climate/wind.asp> (accessed 23/10/17).

Table 8.8 Data from Met Éireann Weather Station, Shannon, Co. Clare 1981 to 2010

	Monthly and Annual Mean and Extreme Values												
TEMP (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
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

8.3 Air Quality

8.3.1 Potential Air Quality Impacts and Associated Mitigation Measures

8.3.1.1 “Do-Nothing” Scenario

If the proposed development were not to proceed, there would be no change to existing air quality conditions in the area and therefore there would be no negative effects. There would be no potential for minor emissions to occur at this site as a result of the construction and operational phases of the proposed development.

8.3.1.2 Construction Phase

8.3.1.2.1 Dust

The potential for dust to be emitted will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction.

Dust generation rates depend on the site activity, particle size (in particular the silt content, defined as particles smaller than 75 microns in size), the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under “wet day” conditions where rainfall greater than 0.2 mm has fallen. Information collected from Shannon Airport Meteorological Station (1981-2010) identified that typically 211 days per annum are “wet”. Thus for greater than 55% of the time no significant dust generation will be likely due to meteorological conditions.

Mitigation

Dust control should be achieved by:

- Dampening down the dust at the source
- By the use of barriers such as debris netting on scaffolding around the building to block dust escaping where the building is within 10m of the site boundary where residential properties exist.
- If required, site road ways will be maintained in a stoned hardcore condition not allowing soil to accumulate which when dry can create dust.
- Wheel wash equipment will be set up at the site exit gate for all construction vehicles to pass through prior to leaving the site thus ensuring that no dirt etc. is transported outside the site onto the roadways.
- Plant and equipment that have the potential to create volumes of dust will have appropriate attachments to allow water source to dampen dust to not allow it to get airborne.
- Deploy Road Sweeper as required on External Roads.

Residual Impact

Short term Imperceptible Negative Impact

Significance of Effects

Based on the assessment above there will be no significant effects.

8.3.1.2.2 Air Quality

The construction of the proposed development will require the use of machinery and plant, thereby giving risk to exhaust emissions. This is likely to have a short to

medium-term slight negative effect, which will be reduced through the use of the best practices mitigation measures as presented below.

Mitigation

All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.

Residual Impact

Short term Imperceptible Negative Impact

Significance of Effects

Based on the assessment above there will be no significant effects.

8.3.1.3 Operational Phase

There will be no impact on human health from dust emissions in the vicinity of the proposed development site once the development has been built and all construction vehicles and personal are offsite.

Any further works which may need to occur on site as part of maintenance and repairs during the operation of the site, may cause localised slight temporary dust emissions, and is unlikely to have any negative significant impact on human health. In the case of such occasional maintenance works, Section 8.3.2.1 above can be referred to for air quality and dust related impacts.

Mitigation

No mitigation will be required on site during the majority of the operational phase for the proposed development, as the impact is assessed as being imperceptible, and will not be noticed within the area which already contains many residential developments.

Residual Impact

No negative impact.

Significance of Effects

Based on the assessment above there will be no significant effects

8.3.1.4 Human Health Effects

Whilst the construction phase of the proposed development is likely to lead to imperceptible increases in dust and vehicle emissions, the implementation of the mitigation measures discussed above and good management practices can prevent or minimise potential effects off-site. Good management practice consists of good site design and layout, adopting appropriate working methods, choosing the right equipment and ensuring that the workforce understands the company's responsibilities and is familiar with good working practice and dust suppression techniques. The potential for health effects are considered imperceptible as the potential for both exhaust and dust emissions will be limited and controlled through site layout design and mitigation measures.

8.3.1.5 Cumulative Impact

Potential cumulative effects on air quality between the proposed development and other developments in the vicinity, including all those listed in Section 2.6.2 of this EIAR, were also considered as part of this assessment. It is noted that the other land use activities in the area are mostly residential or commercial land uses. In particular, if permitted, construction of Phase 1 of the Crown Site will occur approximately 11 months before Phase 2 construction commencement, meaning there will be some

overlap in construction with that of the proposed development. As such, this has been assessed within the cumulative assessment. Any cumulative impacts between the proposed development and all others listed in Section 2.6.2 of this EIAR (including Phase 1 of the Crown Square site) would likely be not significant, given the small-scale operations and proposed mitigation measures for the proposed development.

8.3.1.5.1 General Air Quality

Light commercial activity, residential heating, transport vehicles, other local construction activities and the construction of the proposed development will require the consumption of fossil fuels and therefore will lead to a minor level of air emissions cumulatively. However, given the relatively small-scale fossil fuel use in the area with the implementation of the mitigation measures discussed above, there is unlikely to be cumulative impacts arising from the construction phase of the proposed development and other local existing developments, projects and plans. In conjunction with the Phase 1 development, construction activities and use of transport vehicles will allow for a slight increase in the overall fossil fuel use within the site, but the increase will be minor and will be mitigated as noted above in Section 8.3.2.1.2.

8.3.1.5.2 Dust Emissions

Dust emissions from the other land use activities in the area are likely to be imperceptible. The potential for dust emissions from the construction phase of the proposed development exist but the residual effects will be imperceptible given the proposed mitigation measures in Sections 8.3.2.1 above. In conjunction with the Phase 1 development, construction activities will allow for an imperceptible impact from dust which will be short term and not allow for any significant effects.

8.3.1.6 Residual Impact

No negative impact.

8.3.1.7 Significance of Effects

Based on the assessment above there will be no significant effects

8.4 Climate

8.4.1 Potential Climate Impacts and Associated Mitigation Measures

8.4.1.1 “Do-Nothing” Scenario

If the proposed Phase 2 development were not to proceed, there would be no potential for minor emissions to occur as a result of the construction and operational phases of the proposed Phase 2 development. Phase 1 of the development (which includes Commercial Offices (Blocks A-E), Hotel and Site Infrastructure, including all basement structures for the entire site) has received permission, and will be constructed regardless of whether this currently proposed phase 2 is permitted or not. The potential impacts are considered to be not significant on Air & Climate.

8.4.1.2 Construction Phase

The use of machinery during the construction of the proposed development may result in the emission of greenhouse gases. Operations such as the transport of equipment and materials as well as earth moving are typical examples of machinery use. This impact is considered to be imperceptible given the insignificant quantity of greenhouse gases that are emitted.

8.4.1.3 Operational Phase

The proposed development will be landscaped with green areas and trees. A preliminary energy strategy has been proposed for the development which includes energy centres for both the office and hotel developments. The proposed scheme is designed to comply with Building Regulations Part L 2017 nZEB (near zero energy building). Therefore, the climate impacts from the proposed development are expected to be imperceptible. Further information on the thermal performance, proposed energy saving measures, Environmental Services and Sustainable Design can be found in Appendix 3-5 of this EIAR, the Architectural Design Statement.

8.4.1.4 Cumulative Impact

The construction of the proposed development, in conjunction with other developments in the area (listed in Section 2.6.2 of this EIAR), in particular the proposed Phase 1 development at the Crown Site, will require plant items which consume fossil fuels and therefore will lead to a minor emission of greenhouse gases cumulatively. However, given the small-scale operations and proposed mitigation measures for the proposed development, the cumulative impacts are likely to be imperceptible.

8.4.2 Human Health Effects

Whilst the construction phase of the proposed development is likely to lead to imperceptible increases in greenhouse gas emissions, the implementation of the mitigation measures discussed above, alongside good management practices can prevent or minimise potential effects of this. Good management practice consists of good site design and layout, adopting appropriate working methods, choosing appropriate materials and equipment and ensuring that the workforce understands the company's responsibilities and is familiar with good working practice and emission minimisation techniques. The potential for health effects are considered imperceptible as the potential for greenhouse gas emissions will be limited and controlled through site and project design and mitigation measures.

8.4.2.1 Mitigation Measures

As the proposed development, will have no significant negative impacts or effects on climate, mitigation measures are not proposed other than all construction machinery and plant will be maintained in good operational order while on-site and damping down of the operational areas will be carried out to reduce dust emissions, minimising any emissions that are likely to arise. Further details of the thermal performance and energy saving measures proposed for the development are given in Appendix 3-5 of this EIAR. These measures will minimise any impact that the development might have on climate in the long-term.

8.4.2.2 Residual Impact

There will be a permanent neutral impact on climate associated with the proposed project.

8.4.2.3 Significance of Effects

Based on the assessment above there will be no significant effects