# 8. AIR & CLIMATE

## 8.1 Introduction

MKO prepared the Air & Climate section of this Environmental Impact Assessment Report (EIAR) for the proposed housing development at Knocknacarra, Co. Galway.

This Chapter examines the effect of the proposed development on air and climate. Where required, appropriate mitigation measures to limit any identified significant impacts to air and climate are recommended.

### 8.1.1 Statement of Authority

This section of the EIAR has been prepared by Eoin Gilson and reviewed by Michael Watson, both of MKO. Eoin is an Environmental scientist with over a years' experience in Environmental Consultancy. Eoin holds an MSc in Applied Environmental Science. Michael has over seventeen years' experience in the environmental sector and had worked for the Geological Survey of Ireland and then a prominent private environmental & hydrogeological consultancy prior to joining MKO in 2014. Michael completed an MA in Environmental Management at NUI, Maynooth in 1999. Michael is a professional geologist (PGeo) and full member of IEMA (MIEMA) as well as a Chartered Environmentalist (CEnv).

## 8.2 Air

### 8.2.1 Background

The proposed development site, which is approximately 2.8 hectares, is located within the townland of Rahoon, to the west of Galway City. It is estimated that the site programme will be 24 months depending on construction phasing.

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).

### 8.2.2 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 ($\mu g/m^3$) 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. $PM_{2.5}$ 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 European sites within likely zone of impact of the Proposed Development*

| Pollutant | Limit Value Objective | Averaging Period | Limit Value (µg/m3) | 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 | 1st 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 | 1st Jan 2005 |
| Sulphur dioxide ($SO_2$) | Protection of vegetation | Calendar year | 20 | 7.5 | Annual mean | 19th Jul 2001 |
| Sulphur dioxide ($SO_2$) | Protection of vegetation | 1st Oct to 31st Mar | 20 | 7.5 | Winter mean | 19th Jul 2001 |

| Pollutant | Limit Value Objective | Averaging Period | Limit Value (µg/m3) | Limit Value (ppb) | Basis of Application of Limit Value | Attainment Date |
|---|---|---|---|---|---|---|
| Nitrogen dioxide ($NO_2$) | Protection of human health | 1 hour | 200 | 105 | Not to be exceeded more than 18 times in a calendar year | 1st Jan 2010 |
| Nitrogen dioxide ($NO_2$) | Protection of human health | Calendar year | 40 | 21 | Annual mean | 1st Jan 2010 |
| Nitrogen monoxide (NO) and nitrogen dioxide ($NO_2$) | Protection of ecosystems | Calendar year | 30 | 16 | Annual mean | 19th 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 | 1st Jan 2005 |
| Particulate matter 2.5 ($PM_{2.5}$) | Protection of human health | Calendar year | 40 | - | Annual mean | 1st Jan 2005 |
| Particulate matter 2.5 ($PM_{2.5}$)<br><br>Stage 1 | Protection of human health | Calendar year | 25 | - | Annual mean | 1st Jan 2015 |
| Particulate matter 2.5 ($PM_{2.5}$) Stage 2 | Protection of human health | Calendar year | 20 | - | Annual mean | 1st Jan 2020 |
| Lead (Pb) | Protection of human health | Calendar year | 0.5 | - | Annual mean | 1st Jan 2005 |
| Carbon Monoxide (CO) | Protection of human health | 8 hours | 10,000 | 8,620 | - | 1st Jan 2005 |

| Pollutant | Limit Value Objective | Averaging Period | Limit Value (µg/m3) | Limit Value (ppb) | Basis of Application of Limit Value | Attainment Date |
|---|---|---|---|---|---|---|
| Benzene ($C_6H_6$) | Protection of human health | Calendar Year | 5 | 1.5 | - | 1st 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 | AOT40 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 $mg/m^3$ | - |

$AOT_{40}$ is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 $g/m^3$ and is expressed as $g/m^3$ hours.

#### 8.2.2.1 Air Quality and Health

The World Health Organisation (WHO) estimates show that more than 400,000 premature deaths are attributable to poor air quality in Europe annually. In Ireland, the number of premature deaths attributable to air pollution is estimated at 1,510 people, with fine particulate matter ($PM_{2.5}$) being predominantly responsible for the majority of the estimated premature deaths (1,480 Irish deaths) . These emissions, along with others including nitrogen oxides (NOx) and sulphur oxides (SOx) 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 the 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 8.3.2.1 below.

### 8.2.3 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.

### 8.2.4 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.

#### 8.2.4.1 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 Sulphur Dioxide Data for Galway City in 2001*

| Parameter | Measurement |
|---|---|
| No. of measured values | 3,672 |
| Percentage Coverage | 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.

#### 8.2.4.2 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 Particulate Matter ($PM_{10}$) Data for Galway City in 2001*

| Parameter | Measurement |
|---|---|
| No. of measured values | 187 |

| Parameter | Measurement |
|---|---|
| Percentage Coverage | 83.8% |
| Maximum daily value | 49.9 µg/m3 |
| 98 percentile for daily values | 45.8 µg/m3 |
| Mean daily value | 22.1 µg/m3 |

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.

#### 8.2.4.3 Nitrogen Dioxide ($NO_2$)

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 and Oxides of Nitrogen Data Galway City 2001*

| Parameter | Measurement |
|---|---|
| No. of measured values | 4,531 |
| Percentage Coverage | 84.6% |
| Maximum hourly value ($NO_2$) | 120.7 µg/m3 |
| 98 percentile for hourly values ($NO_2$) | 50.5 µg/m3 |
| Mean hourly value ($NO_2$) | 19.9 µg/m3 |
| Mean hourly value ($NO_x$) | 34.8 µg/m3 |

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 NOX (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.

#### 8.2.4.4 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 for Galway City 2001*

| Parameter | Measurement |
|---|---|
| No. of hours | 5,356 |
| No. of measured values | 4,533 |
| Percentage Coverage | 84.6% |
| Maximum hourly value | 2.8 mg/m3 |
| 98 percentile for hourly values | 1.3 mg/m3 |
| Mean hourly value | 0.5 mg/m3 |
| Maximum 8-hour mean | 1.6 mg/m3 |
| 98 percentile for 8-hour mean | 1.1 mg/m3 |

#### 8.2.4.5 Ozone ($O_3$)

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 | Measurement |
|---|---|
| Annual Mean | 77 µg/m3 |
| Median | 77 µg/m3 |
| % Data Capture | 100% |
| No. of days > 120 | 3 days |
| Maximum 8-hour value | 132 µg/m3 |

# 8.3 Air Quality

## 8.3.1 Potential Air Quality Impacts and Associated Mitigation Measures

## 8.3.2 "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 as a result of the construction and operational phases of the proposed development.

### 8.3.2.1 Construction Phase

#### 8.3.2.1.1 *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

- 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 Effect

Short-term Imperceptible Negative Impact

##### Significance of Effects

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

### 8.3.2.2 Air Quality

The construction of the proposed development will require the use of machinery and plant, thereby giving rise 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.
- Mobile plant should be switched off when not in use and not left idling.

#### Residual Effect

Short term Imperceptible Negative Impact

#### Significance of Effects

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

## 8.3.3 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 Effect

Short term Imperceptible Negative Impact

#### Significance of Effects

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

## 8.3.4 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.

### 8.3.5 Cumulative Effect

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. Any cumulative impacts between the proposed development and all others listed in Section 2.6.2 of this EIAR would likely be not significant, given the small-scale operations and proposed mitigation measures for the proposed development.

#### 8.3.5.1 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.

#### 8.3.5.2 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.

## 8.4 Climate

### 8.4.1 Climate Change and Greenhouse Gases

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.

#### 8.4.1.1 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.

##### 8.4.1.1.1 *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).

#### 8.4.1.1.2 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.

#### 8.4.1.1.3 Emissions Projections

In 2016, the EPA published an update on Ireland's Greenhouse Gas Emission Projections to 2020. 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.

Greenhouse gas emissions are projected to 2020 using two scenarios; 'With Measures' and 'With Additional Measures'. The 'With 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 assumes implementation of the 'With Measures' scenario in addition to full achievement of Government renewable and energy efficiency targets for 2020, as set out in the National Renewable Energy Action Plan and the National Energy Efficiency Action Plan.

The EPA Emission Projections Update notes the following key trends:

- Ireland's non-Emissions Trading Scheme (ETS) emissions are projected to be 6% and 11% below 2005 levels in 2020 under the 'With Measures' and 'With Additional Measures' scenarios, respectively. The target for Ireland is a 20% reduction.

- Ireland is projected to exceed its annual binding limits in 2016 and 2017 under both scenarios, 'With Measures' and 'With Additional Measures'.
- Over the period 2013 – 2020, Ireland is projected to cumulatively exceed its compliance obligations by 12 Mt $CO_2$ (metric tonnes of Carbon Dioxide) equivalent under the 'With Measures' scenario and 3 Mt $CO_2$ equivalent under the 'With Additional Measures' scenario.

The EPA report states that "Failure to meet 2020 renewable and energy efficiency targets will result in Ireland's emission levels moving even further from its emission reduction targets". The report also concludes:

- The latest projections estimate that by 2020 non-ETS emissions will be at best 11% below 2005 levels compared to the 20% reduction target. Emission trends from agriculture and transport are key determinants in meeting targets, however emissions from both sectors are projected to increase in the period to 2020.
- It is clear that Ireland faces significant challenges in meeting emission reduction targets for 2020 and beyond. ('Greenhouse Gas Emission Projections to 2020 – An Update', EPA, 2016).

#### 8.4.1.1.4 *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' report provides a summary of recent statistics on climate change and energy in the EU.

In 2014, EU greenhouse gas emissions, including emissions from international aviation and indirect carbon dioxide ($CO_2$) emissions, were down by 23% 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:

- 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**, the Czech Republic and the Netherlands.
- In 2014, France, the Netherlands, the United Kingdom and **Ireland** were farthest from reaching their national targets.

While the EU as a whole is projected to exceed it's 2020 target of reducing GHG emissions by 20%, Ireland is currently one of the countries project to miss its national targets.

## 8.4.2 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 west 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.

#### 8.4.2.1 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 Shannon Airport, is 4.6 metres per second.

#### 8.4.2.2 Rainfall

Long term rainfall data was also obtained from the monitoring station at Shannon Airport. The 30-year annual average rainfall for Shannon is 978mm/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 Clare's oceanic position on the Atlantic seaboard, given that Galway has a similar oceanic position these data have been used as an approximation of Galway's climactic conditions.

*Table 8-8 Data from Met Éireann Weather Station, Shannon, Co. Clare 1981 to 2010*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TEMPERATURE (degrees Celsius) | | | | | | | | | | | | | |
| 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 |
| Absolute min. | -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 |
| Mean num. of days with air frost | 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 |
| Mean num. of days with ground frost | -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 |
| RELATIVE HUMIDITY (%) | | | | | | | | | | | | | |
| Mean at 0900UTC | 13.7 | 12.6 | 11.0 | 8.3 | 3.3 | 0.3 | 0.0 | 0.1 | 1.2 | 3.8 | 9.5 | 12.5 | 76.3 |
| Mean at 1500UTC | | | | | | | | | | | | | |
| SUNSHINE (Hours) | | | | | | | | | | | | | |
| Mean daily duration | 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 |
| Greatest daily duration | | | | | | | | | | | | | |
| Mean no. of days with no sun | 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 |
| RAINFALL (mm) | | | | | | | | | | | | | |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean monthly total | 102.3 | 76.2 | 78.7 | 59.2 | 64.8 | 69.8 | 65.9 | 82.0 | 75.6 | 104.9 | 94.1 | 104.0 | 977.6 |
| Greatest daily total | 38.2 | 29.4 | 28.1 | 40.2 | 25.0 | 40.6 | 39.5 | 51.0 | 52.3 | 36.9 | 26.9 | 41.2 | 52.3 |
| Mean num. of days with >= 0.2mm | 20 | 16 | 19 | 16 | 16 | 15 | 16 | 18 | 16 | 20 | 20 | 19 | 211 |
| Mean num. of days with >= 1.0mm | 16 | 12 | 14 | 11 | 12 | 11 | 12 | 13 | 12 | 16 | 15 | 15 | 159 |
| Mean num. of days with >= 5.0mm | 8 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 7 | 6 | 7 | 63 |
| WIND (knots) | | | | | | | | | | | | | |
| Mean monthly speed | 10.3 | 10.2 | 10.0 | 9.0 | 8.9 | 8.5 | 8.5 | 8.2 | 8.4 | 9.2 | 9.1 | 9.4 | 9.1 |
| Max. gust | 75 | 80 | 65 | 62 | 59 | 51 | 52 | 55 | 62 | 71 | 66 | 83 | 83 |
| Max. mean 10-minute speed | 52 | 46 | 44 | 40 | 37 | 37 | 38 | 35 | 40 | 47 | 41 | 57 | 57 |
| Mean num. of days with gales | 1.7 | 0.9 | 0.8 | 0.3 | 0.2 | 0.1 | 0.0 | 0.1 | 0.1 | 0.6 | 0.7 | 1.2 | 6.7 |
| WEATHER (Mean No. of Days With:) | | | | | | | | | | | | | |
| Snow or sleet | 2.3 | 2.3 | 1.4 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.3 | 8.0 |
| Snow lying at 0900UTC | 0.6 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 |
| Hail | 3.6 | 3.3 | 3.4 | 2.2 | 1.2 | 0.1 | 0.1 | 0.1 | 0.3 | 0.9 | 1.1 | 2.4 | 18.6 |
| Thunder | 0.9 | 0.5 | 0.4 | 0.3 | 0.5 | 0.5 | 0.8 | 0.4 | 0.2 | 0.4 | 0.4 | 0.5 | 5.7 |
| Fog | 3.3 | 2.0 | 2.1 | 1.9 | 1.5 | 1.4 | 1.4 | 2.0 | 2.9 | 2.9 | 3.9 | 4.2 | 29.6 |

## 8.4.3 Potential Climate Impacts and Associated Mitigation Measures

### 8.4.3.1 'Do-Nothing' Effect

If the proposed development were not to proceed, there would be no change to existing climate conditions in the area.

### 8.4.3.2 Construction Phase Impacts

The use of machinery during the construction phase will result in the emission of greenhouse gases. Operations such as the transport of soil and materials as well as excavation works are typical examples of machinery use. This effect is considered to be imperceptible only, given the insignificant quantity of greenhouse gases that will be emitted over the 'Do Nothing' scenario.

### 8.4.3.3 Operational Phase Impacts

The proposed development will be landscaped with green areas and trees. 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. Full details of the thermal performance and energy saving measures proposed for the development are given in the Mechanical and Electrical Services Basis of Design Report, which forms Appendix 3-5 of this EIAR.

### 8.4.3.4 Cumulative Impacts

The construction of the proposed development, in conjunction with other developments in the area (listed in Section 2.6.2 of this EIAR), 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.

### 8.4.3.5 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

### 8.4.3.6 Mitigation Measures

As the proposed development will have no significant negative effects on climate, mitigation measures are not proposed other than all machinery and plant will be maintained in good operational order while on-site, minimising any emissions that are likely to arise. These measures will minimise any effect that the development might have on climate in the long-term.

### 8.4.3.7 Residual Effect

There will be a Long-term, Imperceptible, neutral Effect on climate associated with the proposed project.

### 8.4.3.8 Significance of Effects

Based on the assessment above there will be no significant effects