Greater Dublin Drainage Project

Irish Water

Environmental Impact Assessment Report: Volume 3 Part A of 6

Chapter 14 Air Quality, Odour and Climate

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14. Air Quality, Odour and Climate

This Chapter assesses the potential air quality, odour and climate impacts which may be generated during the Construction Phase and Operational Phase of the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project). The principal Construction Phase air quality impacts will be associated with dust emissions due to construction activities. Transport associated with the Proposed Project will also contribute to air quality impacts through the generation of dust and vehicle emissions. The potential air quality impacts associated with the Operational Phase of the Proposed Project will arise primarily as a result of the treatment of the air and gases collected at each stage of the operations and discharge to atmosphere following treatment. Air Quality impacts may also arise as a result of emissions of combustion gases from the energy sources associated with the Proposed Project.

An air dispersion modelling assessment was carried out to determine the potential for impacts on air quality as a result of the Proposed Project, particularly from the Odour Control Units, the Combined Heat and Power system and the backup generators. The air dispersion modelling assessment concluded that there would be no exceedances of the Air Quality Standards caused by the operation of the Proposed Project. During the Operational Phase of the Proposed Project, odour will be contained and treated in Odour Control Units which will be dispersed in the atmosphere and will not be detectable beyond the boundaries of the sites. The results of the modelling undertaken for this impact assessment have shown that no odours will be detectable as a result of emissions to atmosphere during the Operational Phase.

14.1 Introduction

This Chapter of the Environmental Impact Assessment Report (EIAR) considers the potential air quality, odour and climate impacts associated with the Greater Dublin Drainage Project (hereafter referred to as the Proposed Project). Impacts are considered by taking account of the existing baseline, the nature and magnitude of projected impacts and compliance with relevant standards.

The assessment focuses on the key pollutants which may be emitted from the activities associated with the Construction Phase and Operational Phase of the Proposed Project. The pollutants potentially emitted during construction activity are dust and particulate matter (PM) and gases such as nitrogen oxides (NO_x), carbon dioxide (CO_2) and benzene from traffic associated with the Construction Phase. The principal pollutants of concern in relation to the Proposed Project during the Operational Phase are odour, which could be emitted from the proposed Abbotstown pumping station, the rising main connection to the gravity sewer along the proposed orbital sewer route and the proposed Wastewater Treatment Plant (WwTP); fine PM (PM_{10} and $PM_{2.5}$); and carbon monoxide (CO); NO_x; methane (CH_4); and sulfur dioxide (SO_2) potentially released from transport and the various energy systems associated with the activity.

The Proposed Project will form a significant component of a wider strategy to meet future wastewater treatment requirements within the Greater Dublin Area as identified in a number of national, regional and local planning policy documents. The plant, equipment, buildings and systems associated with the Proposed Project will be designed, equipped, operated and maintained in such a manner to ensure a high level of energy performance and energy efficiency.

The table below includes a summary of the Proposed Project elements. A full description of the Proposed Project is detailed within Volume 2 Part A, Chapter 4 Description of the Proposed Project of this EIAR.

Proposed Project Element	Outline Description of Proposed Project Element
Proposed Wastewater Treatment Plant (WwTP)	• WwTP to be located on a 29.8 hectare (ha) site in the townland of Clonshagh (Clonshaugh) in Fingal. • 500,000 population equivalent wastewater treatment capacity. • Maximum building height of 18m. • Sludge Hub Centre (SHC) to be co-located on the same site as the WwTP with a sludge handling and treatment capacity of 18,500 tonnes of dry solids per annum. • SHC will provide sustainable treatment of municipal wastewater sludge and domestic septic tank sludges generated in Fingal to produce a biosolid end-product. • Biogas produced during the sludge treatment process will be utilised as an energy source. • Access road from the R139 Road, approximately 400m to the southern boundary of the site. • Egress road, approximately 230m from the western boundary of the site, to Clonshaugh Road. • A proposed temporary construction compound to be located within the site boundary.
Proposed Abbotstown pumping station	• Abbotstown pumping station to be located on a 0.4ha site in the grounds of the National Sports Campus at Abbotstown. • Abbotstown pumping station will consist of a single 2-storey building with a ground level floor area of 305m^2 and maximum height of 10m and a below ground basement 17m in depth with floor area of 524m^2 incorporating the wet/dry wells. • The plan area of the above ground structure will be 305m^2 and this will have a maximum height of 10m. • A proposed temporary construction compound to be located adjacent to the Abbotstown pumping station site.
Proposed orbital sewer route	• The orbital sewer route will intercept an existing sewer at Blanchardstown and will divert it from this point to the WwTP at Clonshagh. • Constructed within the boundary of a temporary construction corridor. • 13.7km in length; 5.2km of a 1.4m diameter rising main and 8.5km of a 1.8m diameter gravity sewer. • Manholes/service shafts/vents along the route. • Odour Control Unit at the rising main/gravity sewer interface. • Proposed temporary construction compounds at Abbotstown, Cappoge, east of Silloge, Dardistown and west of Collinstown Cross to be located within the proposed construction corridor.
Proposed North Fringe Sewer (NFS) diversion sewer	• The NFS will be intercepted in the vicinity of the junction of the access road to the WwTP with the R139 Road in lands within the administrative area of Dublin City Council. • NFS diversion sewer will divert flows in the NFS upstream of the point of interception to the WwTP. • 600m in length and 1.5m in diameter. • Operate as a gravity sewer between the point of interception and the WwTP site.
Proposed outfall pipeline route (land based section)	• Outfall pipeline route (land based section) will commence from the northern boundary of the WwTP and will run to the R106 Coast Road. • 5.4km in length and 1.8m in diameter. • Pressurised gravity sewer. • Manholes/service shafts/vents along the route. • Proposed temporary construction compounds (east of R107 Malahide Road and east of Saintdoolaghs) located within the proposed construction corridor.
Proposed outfall pipeline route (marine section)	• Outfall pipeline route (marine section) will commence at the R106 Coast Road and will terminate at a discharge location approximately 1km north-east of Ireland's Eye. • 5.9km in length and 2m in diameter. • Pressurised gravity tunnel/subsea (dredged) pipeline. • Multiport marine diffuser to be located on the final section. • Proposed temporary construction compounds (west and east of Baldoyle Bay) to be located within the proposed construction corridor.
Proposed Regional Biosolids Storage Facility	• Located on an 11ha site at Newtown, Dublin 11. • Maximum building height of 15m. • Further details and full impact assessment are provided in Volume 4 Part A of this EIAR.

The total Construction Phase will be approximately 48 months, including a 12 month commissioning period to the final Operational Phase. The Proposed Project will serve the projected wastewater treatment requirements of existing and future drainage catchments in the north and north-west of the Dublin agglomeration, up to the Proposed Project's 2050 design horizon.

Please note that the air quality and climate impact assessment of the proposed RBSF aspect of the Proposed Project is addressed in Chapter 8 Air Quality and Climate in Volume 4 Part A of this EIAR. The odour impact assessment of the proposed RBSF aspect of the Proposed Project is addressed in Chapter 10 Odour in Volume 4 Part A of this EIAR.

14.2 Methodology

14.2.1 Study Areas

The Proposed Project, the subject of this planning application, is illustrated in Figure 4.1 Proposed Project Overview.

Air quality impacts of the Proposed Project on receptors which could potentially be affected by the Proposed Project are considered in this Chapter of the EIAR. The study area includes all areas that could potentially be affected by the emissions from the Proposed Project. The study area for the Construction Phase air quality impact assessment was defined according to the Institute of Air Quality Management's (IAQM's) *Guidance on the Assessment of Dust from Demolition and Construction* (IAQM 2014a), and includes sensitive receptors (e.g. houses, schools and hospitals) that are located within 350m of construction activities. This study area is shown in Figure 14.1 Study Area for the Construction Phase Air Quality Impact Assessment, and is described in more detail in Appendix A14.1 in Volume 3 Part B of this EIAR.

The study area for the Operational Phase air quality assessment includes receptors and ecological designated sites that could be affected by the Proposed Project. The study area for the Operational Phase air quality assessment was determined using professional judgement and from a consideration of the potential impacts on receptors located near the Proposed Project. The area extends to the Rye Water Valley in the west, north of Malahide Estuary and south Dublin Bay and covers an area of approximately 1,500km^2. Although potential impacts are not significant across the entire study area, the assessment considers all of these areas in order to demonstrate that sensitive ecological areas in particular will not be adversely affected by the emissions to atmosphere from the Proposed Project. The potential impact on human receptors does not extend beyond a distance of a few kilometres from the emission sources. The Operational Phase study area is shown in Diagram 14.1 and in Figure 14.2 Study Area for the Operational Phase Air Quality Impact Assessment.

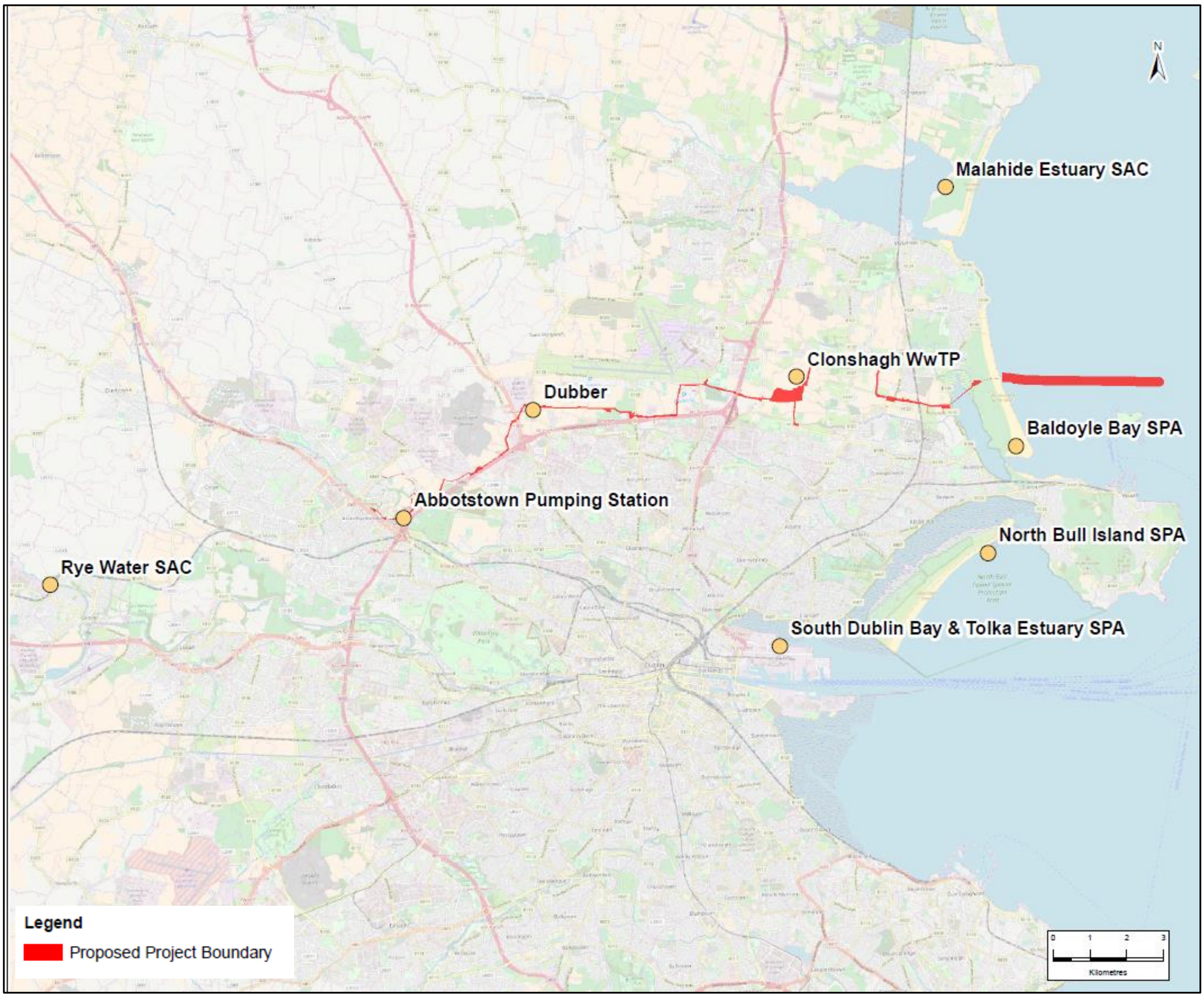

Diagram 14.1: Study Area for the Operational Phase Air Quality Impact Assessment

14.2.2 Impact Assessment Methodology

General Approach

The impact assessment methodology involves identification and characterisation of the air quality impacts that may be associated with the Proposed Project, characterisation of the baseline environment to benchmark the existing situation, quantitative prediction of air quality impacts and assessment of the impacts against recognised Air Quality Standards (AQS) and guidelines. From this assessment comes a definition of mitigation measures that are required to ensure that all aspects of the impacts of the Proposed Project, through the Construction Phase and the Operational Phase, are managed and controlled to protect human health, the environment and amenity.

The effects of the Proposed Project are described by considering the possible impacts that could occur as a result of the Proposed Project, the probability of their occurrence and the nature and significance of such impacts. The Environmental Protection Agency's (EPA's) draft *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* (EPA 2017a) (draft Guidelines) take account of Directive 2014/52/EU of 16 April 2014 on the assessment of the effects of certain public and private projects on the environment (EIA Directive) and have been considered in this assessment. Impacts are described in the draft Guidelines under various headings which are summarised as follows:

- Probability – likely, possible, unlikely;
- Quality – positive, neutral, negative;
- Significance – e.g. Imperceptible, Moderate, Profound; and
- Magnitude – duration, frequency, extent, context.

A description of the significance of effects is presented in Table 14.1, which shows the approach taken to quantifying the significance and magnitude of potential air quality impacts in this assessment.

In addition to considering the above guidance, the general approach adopted for the air quality impact assessment is summarised as follows:

- Describe the existing baseline air quality at the Proposed Project site and in the vicinity of receptors;
- Describe the potential impacts of the Proposed Project on air quality;
- Identify appropriate criteria against which to assess the significance of the impacts associated with the Proposed Project;
- Propose avoidance and mitigation measures where required; and
- Identify and assess all cumulative impacts with potential to impact upon the baseline environment.

Table 14.1: Describing the Significance and Magnitude of Environmental Effects (EPA 2017a)

Aspect	Description
Significance of effects	
Imperceptible	An effect capable of measurement but without noticeable consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without noticeable consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends.
Significant	An effect which, by its character, magnitude, duration or intensity, alters most of a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics
Magnitude of effects	
Extent	This is described by the size of the area, the number of sites and the proportion of the population affected by the effect.
Duration	**Momentary effects** last seconds to minutes.
	Brief effects last less than a day.
	Temporary effects last less than one year.
	Short-term effects last from one to seven years.
	Medium-term effects last from seven to 15 years.
	Long-term effects last from 15 to 60 years.
	Permanent effects last over 60 years.
Frequency	How often the effect will occur
Context	The contextual relationship between the effect and the existing baseline

Construction Phase

The IAQM's (2014a) *Guidance on the Assessment of Dust from Demolition and* describes a five-step approach to the assessment which is summarised as follows:

- Screen the Proposed Project to determine if there is a requirement for a more detailed assessment;
- Assess the risk of dust impacts for each of the four activities (demolition, earthworks, construction and construction traffic) and take account of the scale and nature of the works, and the sensitivity of the area;
- Determine the site-specific mitigation for each potential activity;
- Examine the residual effects and determine whether these are significant; and
- Prepare the dust assessment report.

This approach has been applied to the Proposed Project. A detailed assessment is required when there are human receptors within 350m of the boundary of a Proposed Project site, and since the closest human receptors to the Proposed Project site boundaries are within this distance, a detailed assessment was required.

There are no European or Designated Sites within 50m of the site boundary on land, which is the threshold distance for ecological sensitivity. Therefore, there are no significant Construction Phase air quality impacts predicted for ecological sites from the land based works, and this element is not assessed further. The construction of the proposed outfall pipeline route (marine section) will lead to interactions with Designated Sites, and potential impacts are assessed separately in Chapter 9 Biodiversity (Marine) and Chapter 10 Biodiversity (Marine Ornithology). The Guidance advises that most large projects of this type will require a detailed assessment as the approach adopted is conservative, and therefore a detailed assessment has been carried out in this study.

The impacts on air quality from the Construction Phase will arise through the generation and subsequent deposition of dust and elevated local PM_{10} concentrations. The detailed assessment criteria applied to this assessment are presented in Appendix A14.1 Construction Dust Assessment together with a definition of the study area. The estimated magnitudes of each construction activity (small, medium, large or negligible) are combined with the area sensitivity, which is determined by the number and proximity of receptors to the construction boundary and the background PM_{10} concentration. High sensitivity receptors include properties such as residences, care homes, hospitals and schools, and medium sensitivity receptors include hotels, offices and supermarkets. There are high sensitivity receptors close to every major element of the Proposed Project, and therefore as a worst-case approach, the assessment is based on a high sensitivity rating for all receptors. Since the potential emissions are predominantly in the 30µm to 75µm size range, PM_{10} impacts are screened out as insignificant for this assessment; the assessment therefore focuses on the larger particle sizes. This qualitative analysis provides the overall level of risk of impacts for dust soiling, human health and ecology. The level of risk of each impact is used to identify appropriate mitigation measures.

Operational Phase

The potential Operational Phase impacts are assessed principally by means of a dispersion modelling study using computerised dispersion modelling to evaluate the impact of emissions to atmosphere during the Operational Phase on ambient air quality. The results of the assessment are compared with benchmarks, discussed in Section 14.2.3. The assessment of impact significance is based on a comparison of predicted impacts with AQS and guidelines, and consideration of the magnitude and duration of the potential impact.

Odour impacts are also possible during some elements of work in the Operational Phase. The IAQM's (2014b) *Guidance on the Assessment of Odour for Planning* has been used for the assessment of the odour impacts of the Proposed Project. This Guidance is especially suitable for the assessment of the temporary impacts which could arise during the Operational Phase. The Guidance recommends a number of key stages in the odour impact assessment process as follows, and this methodology was adopted for the odour impact assessment study reported here:

- The magnitude of the potential odour emissions from all sources is identified;
- Sensitive receptors are identified and classified according to their relative sensitivity;
- The magnitude of the odour impact on receptors is identified; and
- The significance of the effect is assessed as either 'Significant' or 'Not Significant'.

Climate Impact Assessment Methodology

The potential climate impact of the Proposed Project is assessed by comparing the total emissions of greenhouse gases (GHG) that may arise with those that would occur if the site were left as it is. The Climate

Action and Low Carbon Development Act 2015, which provides for new arrangements aimed at achieving transition to a low-carbon, climate-resilient and environmentally sustainable economy by 2050, requires that Irish Water consider and reduce their carbon footprint in all aspects of the activities they undertake. This objective is also recognised in the *Fingal Development Plan 2017-2023* (Fingal County Council 2017), as outlined in Chapter 4 Description of the Proposed Project in Volume 3 Part A of this EIAR. This assessment provides information on how the Proposed Project considers this objective in the selection of the preferred approaches for the Proposed Project, and a more detailed discussion is presented in Volume 3 Part A, Chapter 4 Description of the Proposed Project.

The principal GHG emissions associated with the Proposed Project are CH_4 and CO_2. For the purposes of this assessment, the Proposed Project is compared with a 'do nothing' scenario, and some of the scenarios below are also evaluated. Therefore, three scenarios have been assessed, as follows:

Scenario 1 – Do Nothing

In this scenario, there will be no proposed WwTP at the Clonshagh site.

Scenario 2 – Do Something (Proposed Project)

In this scenario, the Proposed Project is assessed. This has assessed the scenario where the Proposed Project as described in this EIAR will be completed.

Scenario 3 – Do Something (Alternatives Considered)

In this scenario, some of the alternative design approaches were evaluated for comparison with the Proposed Project.

The principal element of the project with potential for GHG emissions is the proposed WwTP at Clonshagh; GHG emissions associated with the proposed Abbotstown pumping station and orbital sewer route are negligible. A simplified model of the proposed WwTP site and the emissions was created for each of the scenarios assessed. Although there are some minor differences between the boundaries for each of the scenarios, the indicative Model used is shown on Diagram 14.2 below. The assessment boundary includes reasonably anticipated on-site and off-site activities associated with the Proposed Project.

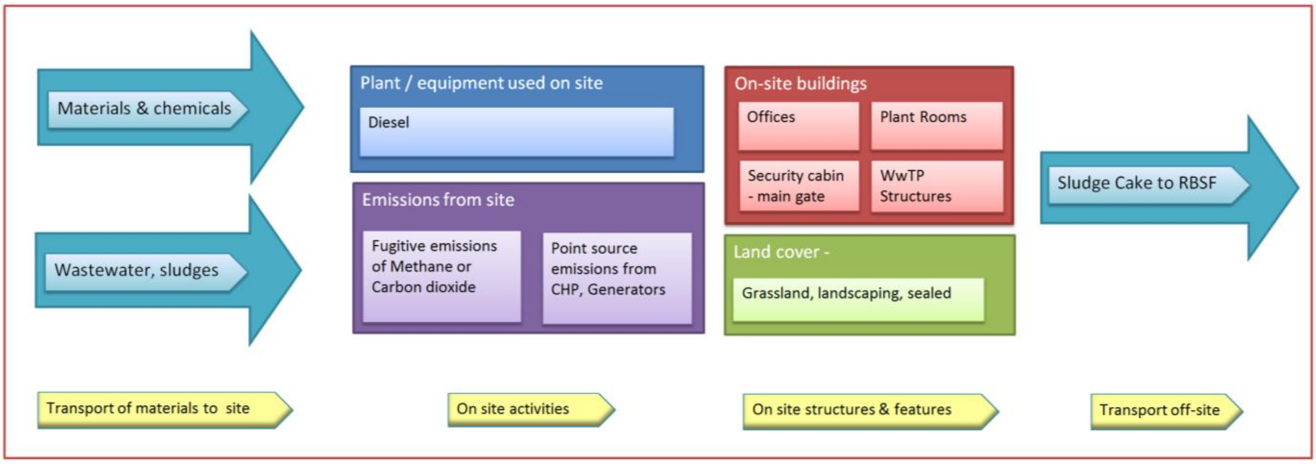

Diagram 14.2: Indicative Model for Climate Impact Assessment

The assessment estimates the total GHG emissions from direct and indirect activities associated with the Proposed Project. Annual emissions as well as overall emissions over the lifetime of the Proposed Project are considered. The assessment is presented in terms of relative GHG emissions from all the various sources.

While there are some uncertainties, the assessment allows a reliable comparison of the climate impact of the Proposed Project relative to the ‘do nothing’ scenario and some of the alternatives that were considered.

14.2.3 Impact Assessment Criteria

AQS in Ireland have been defined to ensure compliance with European Commission Directives; they are developed at different levels for different purposes. European legislation on air quality has been framed in terms of two categories: limit values and guide values. Limit values are concentrations that cannot be exceeded and are based on World Health Organisation (WHO) guidelines for the protection of human health. Guide values are set as a long-term precautionary measure for the protection of human health and the environment. The WHO Guidelines differ from the European Union Air Quality Standards (EU AQS) in that they are primarily set to protect public health from the effects of air pollution, whereas AQS are recommended by governments, and other factors, such as socio-economic factors, may be considered in setting the standards.

The AQS and guidelines referenced in this report are summarised in Table 14.2 and Table 14.3. These criteria have been chosen to ensure that the potential impacts of the Proposed Project during both the Construction Phase and the Operational Phase will be benchmarked against appropriate standards. There are no national or European AQS with which dust deposition can be compared. However, a figure of 350mg/m^2/day, based on the German Standard, Technical Instructions on Air Quality Control (TA Luft) Regulations, is commonly applied by Local Authorities and the EPA to ensure that no nuisance effects will result from specified industrial activities.

The only specific Irish legislation dealing with odour from WwTPs is the European Communities (Waste Water Treatment) (Prevention of Odours and Noise) Regulations 2005 (S.I. No. 787 of 2005), which requires that WwTPs are designed, constructed, operated and maintained in order to avoid causing nuisance arising from odours or noise. The regulations do not define ‘nuisance’ in terms of a numerical standard, and there is no statutory odour limit or AQS for odour in Ireland.

The EPA’s (2010) *Air Dispersion Modelling from Industrial Installations Guidance Note (AG4)*, which includes guidance on appropriate odour standards against which odour emissions may be evaluated, is the most widely used Guidance in Ireland for assessments of this type. This Guidance recognises that the exposure of the population to odour is assessed based on the odour concentration as well as the length of time that the population may perceive the odour. By definition, one odour unit per cubic metre (OU_E/m^3) is the detection threshold of 50% of a qualified panel of observers working in an odour-free laboratory using odour-free air as the zero reference, and standards are defined relative to this benchmark.

The EPA has issued guidance specific to intensive agriculture which sets target values for odour for pig-production units of 1.5 to 6.0OU_E/m^3 as a 98th percentile of one hour averaging periods. Guidance from the United Kingdom (UK) recommends that odour standards should vary from 1.5 to 6.0OU_E/m^3 as a 98th percentile of one hour averaging periods at the site boundary based on the offensiveness of the odour and with adjustments for local factors such as population density. The benchmarks vary depending on the relative offensiveness of odours with a target benchmark of 1.5OU_E/m^3 for the most offensive odours, 3OU_E/m^3 for moderately offensive odours and 6OU_E/m^3 for less offensive odours. The most offensive odour category includes raw sewage and septic sludge, while the moderately offensive odours include such sources as the aeration tanks and clarifiers at the proposed WwTP. Guidance from New Zealand is based on consideration of the sensitivity of the receiving environment rather than the offensiveness of the odour and specifies odour criteria of 1 to 10OU_E/m^3 for the 99.9 to 99.5 percentile if one-hour average ground level odour concentration, with target specifications of 1.0 to 2.0OU_E/m^3 for high sensitivity receiving environments. Similar guidance from Europe, especially the Netherlands, sets similar performance criteria.

The target specification is no odour nuisance beyond the Proposed Project site boundary. Targets for odour nuisance vary as outlined above, but there is a general consensus from relevant guidance that the target performance specification for the 98th percentile of one-hour average concentration should be 1.0 to 1.5OU_E/m^3. Because the proposed Abbotstown pumping station will be located in a densely populated area and the proposed WwTP will be located close to residential areas, it is considered appropriate to specify a performance target of 1.5OU_E/m^3 for the 98th percentile of one-hour average concentration in order to prevent odour nuisance at site boundaries. The target is set at the boundary, thereby ensuring that there is no odour nuisance to receptors beyond this point.

Table 14.2: Air Quality Impact Assessment Criteria

Pollutant	EU Regulation	Limit Type	Value
Dust deposition	None	Limit over 28 to 30 days	350mg/m^2/day
Odour	None	Hourly limit for prevention of nuisance – not to be exceeded more than 176 hours per year (98th percentile)	1.5OU_E/m^3

AQS for other air pollutants are derived from European legislation. 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 (Clean Air for Europe Directive) is an amalgamation of Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management (Air Quality Framework Directive) and its subsequent daughter Directives and sets out limit and target values for named air quality parameters. The Clean Air for Europe Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (Fourth Daughter Directive) was transposed into Irish legislation by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009). These Directive and the Irish Regulations set out the main standards against which the potential impacts of the Proposed Project on air quality are assessed, as summarised in Table 14.3.

In addition to the Air Quality Standards Regulations 2011 and the Clean Air for Europe Directive standards, it is also appropriate to consider the WHO Guidelines. These Guidelines were developed by the WHO to provide appropriate air quality targets worldwide, based on the latest health information available. The air quality guidelines for PM_{10}, NO_2 and SO_2, and $PM_{2.5}$ are considered in this Chapter. While the WHO Guidelines are not mandatory, they represent the current informed opinion on the levels to which we should be aspiring in order to minimise the adverse health impacts of air pollution. The WHO guidelines referenced in this report are summarised in Table 14.4.

Table 14.3: Air Quality Standards Regulations 2011 (S.I. 180 of 2011; Based on Clean Air for Europe Directive 2008/50/EC)

Pollutant	EU Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen dioxide (NO_2)	2008/50/EC	Hourly limit for protection of human health – not to be exceeded more than 18 times/year	None	200µg/m^3
		Annual limit for protection of human health	None	40µg/m^3
		Annual limit for protection of vegetation, nitrogen oxides (NO_x)	None	30µg/m^3
Sulfur dioxide (SO_2)	2008/50/EC	Hourly limit for protection of human health – not to be exceeded more than 24 times/year	150µg/m^3	350µg/m^3
		Daily limit for protection of human health – not to be exceeded more than three times/year	None	125µg/m^3
		Annual and winter limit for the protection of human health and ecosystems	None	20µg/m^3
Particulate matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health – not to be exceeded more than 35 times/year	50%	50µg/m^3
		Annual limit for protection of human health	20%	40µg/m^3
Particulate matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health (Stage 1)	20% from June 2008. Decreasing linearly to 0% by 2015	25µg/m^3
		Annual limit for protection of human health (Stage 2)	None To be achieved by 2020	20µg/m^3
Carbon monoxide (CO)	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health	60%	10mg/m^3 (8.6 parts per million)
Benzene	2008/50/EC	Annual limit for protection of human health	0% by 2010	5µg/m^3

Table 14.4: World Health Organisation Air Quality Guidelines

Pollutant	Limit Type	Value
Nitrogen dioxide (NO_2)	Hourly limit for protection of human health	200µg/m^3
	Annual limit for protection of human health	40µg/m^3
Sulfur dioxide (SO_2)	Daily limit for protection of human health	20µg/m^3
	10-minute limit for protection of human health	500µg/m^3
Particulate matter (as PM_{10})	24-hour limit for protection of human health	50µg/m^3
	Annual limit for protection of human health	20µg/m^3
Particulate matter (as $PM_{2.5}$)	24-hour mean for protection of human health	25µg/m^3
	Annual mean for protection of human health	10µg/m^3

14.3 Baseline Environment

14.3.1 Meteorological Conditions

The magnitude of potential impacts of the Proposed Project on air and climate will largely be influenced by the local meteorological conditions, in particular by wind speed and direction and by precipitation rates. An evaluation of the climatic conditions in the vicinity of the Proposed Project has therefore been undertaken.

The Irish climate is subject to strong maritime influences, the effects decreasing with increasing distance from the Atlantic Coast. Data from the Irish Meteorological Service, Met Éireann, indicate that Ireland's average annual temperature is between 9°C and 10°C. Temperatures in the middle and east of the country tend to be somewhat more extreme than in other parts of the country. Mean annual wind-speed varies between about 4m/sec in the east midlands and 7m/sec in the north-west. Strong winds tend to be more frequent in winter than in summer. Sunshine duration is highest in the south-east of the country. Most areas of the western half of the country experience rainfall in the region of between 1,000mm and 1,400mm per annum, much higher than the eastern half of the country which experiences 750mm to 1,100mm per annum.

Met Éireann operates a Synoptic Network of weather stations at Belmullet, Malin Head, Rosslare (closed since 2008), Johnstown Castle, Birr, Clones, Kilkenny and Mullingar while the Aviation Division of Met Éireann maintains observing stations at Shannon Airport, Knock Airport, Casement Aerodrome, Dublin Airport and Cork Airport. There is no continuous meteorological monitoring on the Proposed Project site, but the general guidance on selection of meteorological data for air quality impact assessments is to choose representative data, recently acquired, which best represents conditions at the Proposed Project site. At least three years of recently acquired data is preferred. Comprehensive monitoring data are available for Dublin Airport (approximately 2.4km north-west of the proposed WwTP site and 10km north-east of the proposed Abbotstown pumping station site) which would be indicative of the meteorological conditions that are experienced at the Proposed Project site. Therefore, for the purpose of obtaining reliable information about the climatological conditions at the Proposed Project site, a full set of three years' meteorological data for the period 2012 to 2016 recorded at Dublin Airport were analysed.

Wind speed and direction in particular is important in determining how emissions associated with the activity are dispersed. The prevailing wind direction determines which areas are most significantly affected by the emissions from the activity, and wind speed determines in part the effectiveness of the dispersion of the emissions. The windroses for Dublin Airport are presented in Diagram 14.3 for each of the years from 2012 to 2016. The dominant wind direction for Dublin Airport is from the west. The wind speed is below 5.14m/s for 64% of the time. The average long-term wind speed over the period 1985 to 2010 is 5.3m/s.

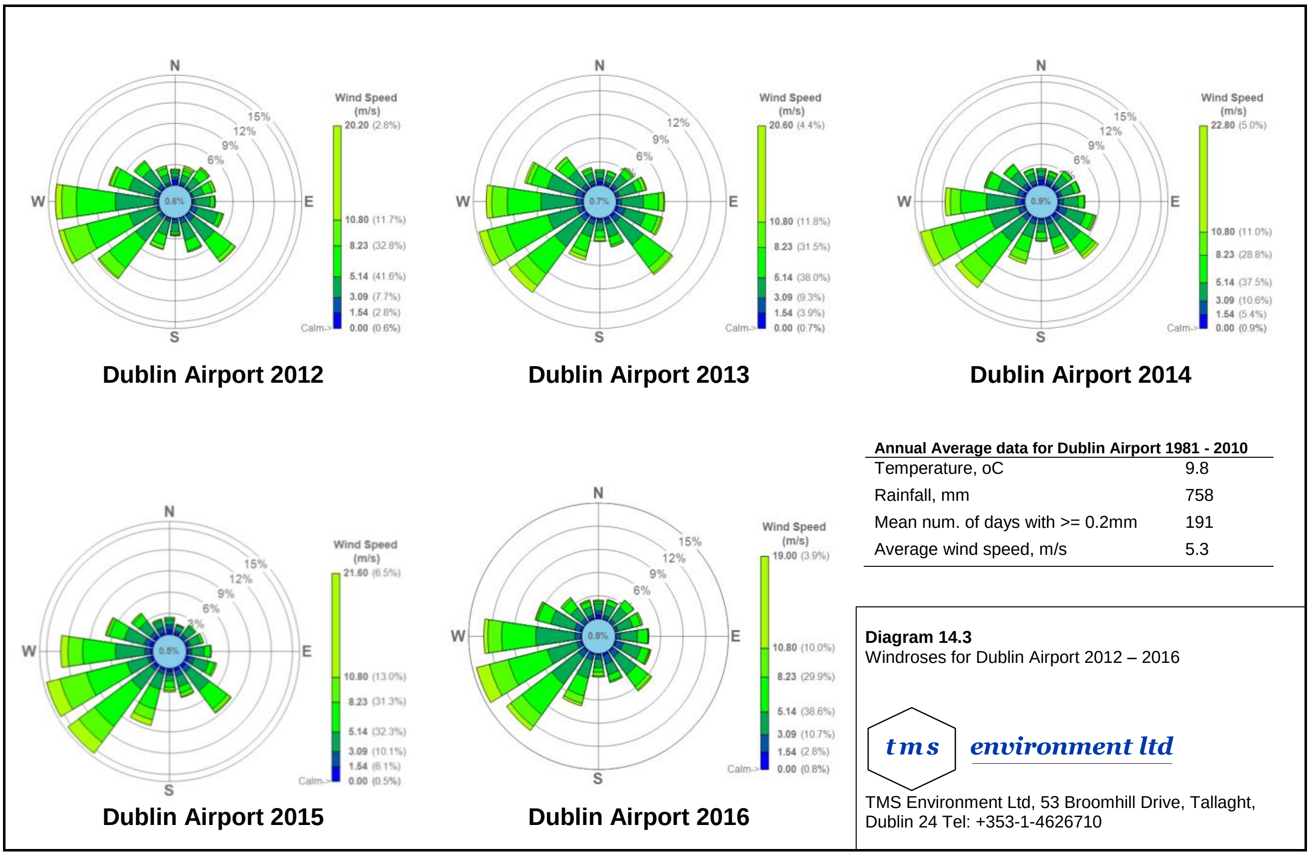

Diagram 14.3: Windroses for Dublin Airport (2012 to 2016)

14.3.2 Influences on Ambient Air Quality

The existing activities at and near the Proposed Project site have the potential to exert an influence on ambient air quality by release of emissions to atmosphere as follows:

- emissions of fine PM (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO from domestic, commercial and industrial heating;
- emissions of fine PM (PM_{10} and $PM_{2.5}$), SO_2, NO_x, CO and benzene from traffic on adjoining roads;
- emissions of fine PM (PM_{10} and $PM_{2.}$), SO_2, NO_x, CO and benzene from air traffic approaching/departing Dublin Airport; and
- emissions of dust and PM from agricultural activities, especially near the proposed WwTP site in Clonshagh and along sections of the proposed orbital sewer route.

Overall, the contribution of traffic to air quality is considered to be the most significant influence on air quality in the immediate vicinity of the various Proposed Project sites, but all other sources also exert significant influences on air quality.

The main substances which are of interest in terms of existing air quality are SO_2, NO_x, PM (including PM_{10} and $PM_{2.5}$) which could originate from combustion sources and traffic. A description of existing levels of the various substances in ambient air is required to allow completion of the evaluation of air quality impacts associated with the Proposed Project and is presented in the following Section.

14.3.3 Existing Ambient Air Quality

The main substances which are of interest in terms of existing air quality in all areas potentially affected by the Proposed Project are SO_2, NO_x (nitric oxide (NO) and NO_2, collectively referred to as NOx), fine PM including PM_{10} and $PM_{2.5}$ which could originate from combustion sources, traffic and the existing commercial and industrial activities in the study areas. CO is also potentially of interest, and benzene may also be of interest from traffic sources.

Particulate Matter

PM is made up of tiny particles in the atmosphere that can be solid (except for ice) or liquid (except for water) and is produced by a wide variety of natural and manmade sources. PM includes dust, dirt, soot, smoke and tiny particles of pollutants. PM of 10 micrometres (µm) in aerodynamic diameter or less is also referred to as PM_{10} or, more strictly, particles which pass through a size selective inlet with a 50% efficiency cut-off at 10µm aerodynamic diameter. Similarly, $PM_{2.5}$ refers to PM of 2.5µm or less in aerodynamic diameter. In the past, domestic coal burning was a major source of PM in Irish cities during winter months. Levels of particles have decreased significantly following the introduction of abatement strategies including Special Control Areas and other Regulations regarding the use, marketing, sale and distribution of certain fuels. The significance of PM in relation to air quality is predominantly related to human health and respiratory effects.

Nitrogen Oxides

NO_x, which is the sum of NO and NO_2, are generated primarily by combustion processes. The main anthropogenic (man-made) sources are mobile combustion sources (road and air traffic) and stationary combustion sources (including industrial combustion and domestic heating). The main source of NO_x near the Proposed Project study area is traffic. The significance is health-related for NO_2 and ecological-related for NO_x.

Sulfur Dioxide

SO_2 also originates from combustion but predominantly from heating sources and not traffic. The trend in ambient SO_2 concentrations is clearly downward and this pollutant is not a matter for concern in Ireland. The reduction in ambient SO_2 concentrations in recent years can be attributed to fuel switching from high-sulfur content fuels, such as coal and oil, to natural gas and to decreases in the sulfur content of oil.

Carbon Monoxide

CO is a colourless and odourless gas, formed when carbon in fuel is not burned completely. It is a component of motor-vehicle exhaust, which accounts for most of the CO emissions nationwide. Consequently, CO concentrations are generally higher in areas with heavy traffic congestion. CO is also a significant emission from air traffic.

Carbon Dioxide

CO_2 may be emitted from any combustion sources which include road and air traffic and commercial and domestic heating.

Odour

The principal odorous gases potentially present in emissions from the proposed WwTP will include various organic substances, ammonia, hydrogen sulfide (H_2S), traces of CH_4 and organic nitrogen compounds. Where available, data for existing levels of these substances in ambient air are discussed.

A description of existing levels of the various substances in ambient air is required to allow completion of the evaluation of air quality impacts associated with the Proposed Project. The available data from the National Ambient Air Quality Network is a reliable dataset for consideration in this study. The EPA and Local Authorities maintain and operate a number of ambient air quality monitoring stations throughout Ireland in order to implement European Directives and to assess the country's compliance with national AQS. Ireland's small population and generally good air quality means that a relatively small number of monitoring stations are sufficient across the country for the purposes of implementing the European Directives. For ambient air quality management and monitoring in Ireland, four zones (A, B, C and D) are defined in the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011) and are defined as follows:

Zone A: Dublin Conurbation.
Zone B: Cork Conurbation.
Zone C: 24 cities and large towns. Includes Galway, Limerick, Waterford, Clonmel, Kilkenny, Sligo, Drogheda, Wexford, Athlone, Ennis, Bray, Naas, Carlow, Tralee, Dundalk, Navan, Newbridge, Mullingar, Letterkenny, Celbridge and Balbriggan, Portlaoise, Greystones and Leixlip.
Zone D: Rural Ireland, i.e. the remainder of the State excluding Zones A, B &C.

The proposed Abbotstown pumping station site is located in Zone A, and while the proposed WwTP site is located on the boundary of Zone A and Zone D, the air quality in the area is best described under the Zone A heading. The proposed orbital sewer lies almost entirely within Zone A and air quality is best described by data for Zone A as a result. The EPA publishes Ambient Air Quality Reports every year, which detail the air quality in each of the four zones. The most recent report, published by the EPA in 2017, is the *Air Quality in Ireland 2016* report (EPA 2017b) which contains monitoring data collected during 2016. Best practice requires that an average of at least three years of recent monitoring data are used for assessments of this type, so data for 2014 to 2016 has been reviewed.

The EPA maintains monitoring stations in a number of areas to monitor urban and suburban background air quality as well as some traffic-oriented monitoring stations. The network of 33 air quality monitoring stations operated by the EPA from 2014 to 2016 includes 15 monitoring stations in Zone A as shown in Table 14.5.

Table 14.5: Environmental Protection Agency Ambient Air Monitoring Stations in Dublin

Monitoring Station	Area Classification	Station Classification	Pollutants Monitored (2015)
Ballyfermot Library	Suburban	Background	NO_2, NO_x, PM_{10}
Blanchardstown River Road	Suburban	Traffic	NO_2, NO_x, PM_{10}
Clonskeagh Road Richview	Suburban	Not applicable	O_3
Coleraine Street	Urban	Traffic	SO_2, CO, NO_2, NO_x, PM_{10}, $PM_{2.5}$
Davitt Road	Suburban	Not applicable	PM_{10}
Dun Laoghaire The Glen	Suburban	Traffic	NO_2, NO_x, PM_{10}
Finglas	Suburban	Not applicable	$PM_{2.5}$
Marino Brian Road	Suburban	Not applicable	$PM_{2.5}$
Phoenix Park Ordnance Survey Road	Suburban	Not applicable	PM_{10}
Rathmines Wynnefield Rd	Urban	Background	SO_2, O_3, NO_2, NO_x, PM_{10}, $PM_{2.5,}$ Benzene, Toluene, Ethylbenzene and Xylene
Tallaght Old Bawn Road	Suburban	Not applicable	SO_2, PM_{10}
Winetavern Street	Urban	Traffic	SO_2, CO, NO_2, NO_x,
Swords Watery Lane	Suburban	Background	NO_2, NO_x, O_3
St Anne's Park	Suburban	Background	NO_2, NO_x, PM_{10}
Clonskeagh Rosemount	Suburban	Not applicable	Metals

The suburban monitoring stations at St Anne's Park and Swords provide data relevant to the description of background air quality at Abbotstown and Clonshagh. For those parameters not measured at either of those two sites, data from Tallaght, Marino and Phoenix Park stations is appropriate. These data give a reliable indicator of air quality in the areas of the proposed sites. Other monitoring stations have operated at various times and some new stations have been added to the network in recent years, but long-term data are available for the above stations. Ozone precursors (benzene, toluene, ethylbenzene and xylenes) are only measured at Rathmines, so data from that station are included for discussion.

Data from the EPA's air quality monitoring annual reports for 2014 to 2016 were reviewed, and a summary of the data for representative stations for the three most recent years is presented for each parameter of interest in Table 14.6. In particular, it is noted that wherever available, data from the designated suburban background monitoring stations are chosen as these would best describe the existing ambient air quality near the sites. The approach taken is to take the average of the three most recent years for each of the designated suburban stations as appropriate and the averages of the values for the stations are reported in Table 14.6. For comparison, the suburban traffic data are also shown in Table 14.6.

It is noted from the data that the existing ambient air quality is good for all health-related pollutants, as shown by the low levels relative to the AQS. Although NOx levels are approaching the EU Standard, these levels apply to the protection of vegetation and are not directly applicable in the suburban context.

A limited site-specific survey of air quality was also undertaken in 2016 and 2017 at 12 locations near the Proposed Project sites. The complete monitoring report is presented in Appendix A14.2 in Volume 3 Part B of this EIAR for the 2017 survey and Appendix A14.3 in Volume 3 Part B of this EIAR for the 2016 survey. A summary of the results is presented in Table 14.7 and Table 14.8; maps showing the monitoring locations are presented in Figure 14.3 Air Quality Monitoring Locations and Appendix A14.2 and Appendix A14.3. The limited data acquired on the site for NO_2 and benzene, toluene, ethylbenzene and xylenes is consistent with the data recorded by the EPA over much longer term monitoring periods for similar locations. The average values recorded during the survey were compared with the chosen data from the long-term EPA monitoring, and the agreement is good. An important finding of the site-specific survey is that most NO_x are present as NO_2 which demonstrates that traffic is not the dominant influence on air quality in each of the locations where measurements were undertaken. This finding supports the selection of the suburban background rather than suburban traffic data as a reliable descriptor of air quality in the designated locations for this assessment.

A summary of the available data is presented in Table 14.9. There is excellent agreement between the data from the long-term EPA air quality monitoring, which was selected for the assessment, and the site-specific survey.

Table 14.6: Background Air Quality Data for Suburban Background Stations in Zone A

Pollutant	Station	2014	2015	2016	Average (2014 – 2016)
		Annual Mean (µg/m^3)			
Nitrogen dioxide, NO_2	St Anne's Park; Swords	12	14	16	14
Nitrogen dioxide, NO_2	Blanchardstown	29	31	30	30
Nitrogen oxides, NO_x	St Anne's Park; Swords	22	22	25	23
Nitrogen oxides, NO_x	Blanchardstown	62	67	76	69
Sulfur dioxide, SO_2	Tallaght	4	6	2	4
Sulfur dioxide, SO_2	Rathmines	2	3	2	2
Particulate Matter PM_{10}	Phoenix Park	19	17	11	16
Particulate Matter PM_{10}	Blanchardstown (Tallaght 2012)	20	18	18	19
Particulate Matter $PM_{2.5}$	Marino	9	8	7	8
Particulate Matter $PM_{2.5}$	Rathmines	11	9	10	10
Carbon monoxide	Balbriggan	0.6	05	0.5	0.5
Benzene	Rathmines	0.94	0.94	1.0	1.0
Toluene	Rathmines	1.9	2.07	2.1	2.0
Ethylbenzene	Rathmines	0.31	0.28	0.20	0.23
Xylenes	Rathmines	1.33	2.02	1.2	1.5

Note: There are no data for benzene, toluene, ethylbenzene or xylenes for suburban monitoring station

Table 14.7: Baseline Air Quality Data for Nitrogen Oxides and Sulfur Dioxide

Monitoring Location	Monitoring Dates	NO_2 (µg/m^3)	NO_x (µg/m^3)	SO_2 (µg/m^3)
AQ1 St. Francis Hospice, Connolly Hospital, north of proposed Abbotstown pumping station	Jan – Feb 2016	18.3	21.6	NM
	June 2017	14.8	NM	<1.5
	June – July 2017	14.1	NM	<2.66
AQ2 Elm Green Nursing Home, south-east of proposed Abbotstown pumping station	Jan – Feb 2016	26.3	38.6	NM
	June 2017	14.1	NM	<1.5
	June – July 2017	12.7	NM	<2.65
AQ3 St. Michael's House, south of proposed WwTP	Jan – Feb 2016	22.5	23.9	NM
	June 2017	15.2	NM	<1.5
	June – July 2017	19.4	NM	<2.65
AQ4 In the vicinity of the proposed WwTP site	Jan – Feb 2016	25.5	28.1	NM
	June 2017	13.2	NM	3.7
	June – July 2017	15.3	NM	<2.64
AG5 In the vicinity of the proposed WwTP site	Jan – Feb 2016	14.6	17.4	NM
	June 2017	10.6	NM	<1.5
	June – July 2017	11.0	NM	<2.64
AQ6 In the vicinity of the proposed WwTP site	Jan – Feb 2016	18.3	26.0	NM
	June 2017	9.1	NM	<1.5
	June – July 2017	9.3	NM	<2.64
AQ7 In the vicinity of the proposed WwTP site	Jan – Feb 2016	21.0	20.3	NM
	June 2017	11.6	NM	<1.5
	June – July 2017	10.3	NM	<2.64
AQ8 In the vicinity of the proposed WwTP site	Jan – Feb 2016	25.9	25.6	NM
	June 2017	14.5	NM	<1.5
	June – July 2017	10.4	NM	<2.64
AQ9 In the vicinity of the proposed WwTP site	Jan – Feb 2016	24.5	51.3	NM
	June 2017	12.4	NM	<1.5
	June – July 2017	11.9	NM	<2.64
AQ10 In the vicinity of the proposed WwTP site	Jan – Feb 2016	21.5	23.8	NM
	June 2017	13.8	NM	<1.5
	June – July 2017	13.7	NM	<2.64
AQ11 Grange	Jan – Feb 2016	12.9	16.5	NM
	June 2017	9.0	NM	<1.5
	June – July 2017	11.6	NM	<2.65
AQ12 Grange	Jan – Feb 2016	20.1	21.1	NM
	June 2017	14.0	NM	<1.5
	June – July 2017	16.9	NM	<2.65

Note: NM = not measured

Table 14.8: Baseline Air Quality Data for Benzene, Toluene, Ethhylbenzene and Xylene

Monitoring Location	Date	Benzene (µg/m³)	Toluene (µg/m³)	Ethylbenzene (µg/m³)	m-, p-xylene (µg/m³)	o-Xylene (µg/m³)
AQ1	Jan – Feb 2016	<0.19	13.6	<0.24	<0.24	<0.24
	June 2017	<0.38	2.03	<0.51	0.56	<0.51
	June – July 2017	0.60	2.34	1.36	1.92	0.75
AQ2	Jan – Feb 2016	0.68	1.66	0.28	0.94	0.32
	June 2017	<0.38	1.23	2.75	2.53	1.02
	June – July 2017	<0.39	0.64	0.69	0.67	<0.51
AQ3	Jan – Feb 2016	0.59	0.96	<0.25	0.48	<0.25
	June 2017	<0.38	1.56	1.56	1.55	0.58
	June – July 2017	<0.39	<0.43	<0.51	<0.51	<0.51
AQ4	Feb 2016	<0.21	0.32	<0.27	0.30	<0.27
	June 2017	<0.38	0.72	<0.51	<0.51	<0.51
	June – July 2017	0.53	<0.43	<0.51	<0.51	<0.51
AG5	Jan – Feb 2016	0.59	1.38	<0.25	0.38	<0.25
	June 2017	<0.38	0.56	0.80	0.94	<0.51
	June – July 2017	<0.38	0.93	1.23	1.11	<0.51
AQ6	Jan – Feb 2016	0.43	0.77	<0.25	0.44	<0.25
	June 2017	0.77	3.98	<0.51	0.67	<0.51
	June – July 2017	0.59	1.70	<0.51	2.05	0.52
AQ7	Feb 2016	0.59	2.81	0.36	1.08	0.34
	June 2017	<0.38	2.85	2.14	2.02	0.83
	June – July 2017	<0.38	0.66	<0.51	<0.51	<0.51
AQ8	Feb – Mar 2016	0.59	2.12	0.28	0.98	0.30
	June 2017	0.45	4.30	3.78	3.02	1.32
	June – July 2017	0.67	1.54	<0.51	<0.51	<0.51
AQ9	Feb 2016	0.71	2.99	0.34	1.01	0.31
	June 2017	<0.38	10.01	1.35	2.69	0.92
	June – July 2017	<0.38	<0.43	<0.51	<0.51	<0.51
AQ10	Feb 2016	0.48	0.83	<0.27	0.73	<0.27
	June 2017	<0.38	<0.43	<0.51	<0.51	<0.51
	June – July 2017	<0.38	2.10	3.61	3.27	1.26
AQ11	Jan – Feb 2016	0.45	0.78	<0.25	0.36	<0.25
	June 2017	<0.38	0.81	<0.51	<0.51	<0.51
	June – July 2017	0.42	0.59	<0.51	<0.51	<0.51
AQ12	Jan – Feb 2016	0.80	1.11	<0.25	0.79	0.25
	June 2017	<0.38	4.10	<0.51	0.70	<0.51
	June – July 2017	<0.39	0.68	<0.51	<0.51	<0.51

Note: NM = not measured

Table 14.9: Summary of Available Baseline Air Quality Data

Parameter	Concentration (µg/m³)	
	Site-Specific Survey	Environmental Protection Agency Long-Term Data
NO_2	16	14
NO_x	26	23
SO_2	4	4
PM_{10}	NM	16
$PM_{2.5}$	NM	8
CO	NM	530
Benzene	0.58	1.0
Toluene	2.27	2.0
Ethylbenzene	1.47	0.30
Xylenes	1.92	1.5

14.4 Air Quality Impact Identification

14.4.1 Existing Activities

The existing activities in all areas potentially affected by the Proposed Project have the potential to release SO_2, NO_x (NO and NO_2, collectively referred to as NO_x), fine PM including PM_{10} and $PM_{2.5}$, CO and benzene. These substances could originate from combustion sources, traffic and the existing agricultural, commercial and industrial activities in the study areas. Section 14.3.3 describes the levels of these substances in the baseline environment.

14.4.2 Potential Construction Phase Impacts

The potential air quality impacts during the Construction Phase are summarised in the following sections.

Dust Emissions Associated with Excavations and Demolition Works

The most significant of the potential air quality impacts associated with the Construction Phase is dust. Dust can be generated as a result of disturbance of materials, as a result of wind blowing across exposed surfaces and as a result of construction vehicle movements across exposed surfaces.

There are three potential impacts on air quality from dust/PM emissions:

- Dust deposition on surfaces is the main potential impact associated with the larger particles, and this could lead to soiling of properties and vegetation;
- Nuisance effects such as reduced visibility could be associated with excessively high levels of suspended PM, and
- Respiratory effects could occur as a result of excessive levels of fine particles such as PM_{10} and $PM_{2.5}$.

Dust emissions associated with the Construction Phase of the Proposed Project are expected to be predominantly in the 30µm to 75µm particle size range due to the nature of the activities undertaken. Because of their size, these particles will generally be deposited within 100m of the emission source. Only under exceptional meteorological conditions would the dusts be carried further downwind.

Suspended particulate matter may also be released and this matter may remain suspended in the air. The main effect would be on visibility, but this type of material could also be a respiratory nuisance if present at excessive levels. Emissions of dust in the form of fine PM, PM_{10} and $PM_{2.5}$ may also occur, primarily as a result of materials handling and storage since the dominant particle size of the main construction materials is in the lower size ranges. There may also be some emissions of particles in these size ranges from the general site activities.

Aspergillus Emissions from Excavation and Earthmoving Activity

The fungal disease 'invasive Aspergillosis' may be contracted as a result of disturbance of materials that release fungal spores into the atmosphere. Fungal spores (the Aspergillus moulds) are found everywhere but are of particular concern when large scale demolition, excavation and earth-moving activity takes place and would be particularly important at the proposed Abbotstown pumping station site which is close to Connolly Hospital and St. Francis' Hospice.

Construction Phase Transport Emissions

Emissions of dust raised by vehicle movement on the roads near the sites and on-site are considered under the general Construction Phase emissions in the 'Dust Emissions Associated with Excavations and Demolition Work' section above. Emissions from the construction vehicles as a result of fuel combustion are considered in this Chapter. The emissions include PM_{10} and $PM_{2.5}$, NO_2 and NO_x, CO and benzene.

14.4.3 Potential Operational Phase Impacts

Potential Sources of Emissions

The site of the proposed WwTP is located primarily in the townland of Clonshagh in Fingal. It lies approximately 2.4km south-east of Dublin Airport, and the residential areas of Belcamp and Darndale are approximately 0.8km to the south. The proposed WwTP site has a total area of approximately 29.8ha. The required treatment capacity of the new proposed WwTP is estimated at 500,000 PE.

Embankments planted with dense bands (approximately 15m to 20m wide) of hedgerow tree species will provide visual screening of the Proposed Project to the east, north and west (refer to Section 12.7 of Chapter 12 Landscape and Visual in Volume 3 Part A). The embankments will rise to a maximum height of about 4m with gentle outward facing slopes. This will be achieved using a generous buffer zone width of approximately 60m.

The proposed WwTP will achieve a treated wastewater standard that will be in accordance with all current legislation, and a wastewater discharge licence which will be issued by the EPA. Secondary treatment processes may include:

- Conventional Activated Sludge Plant;
- Activated Sludge Plant in Sequencing Batch Reactors;
- Submerged Attached Growth Processes (e.g. Biological Aerated Flooded Filters);
- Integrated fixed film activated sludge processes; and
- Aerated Granular Sludge.

An SHC will be co-located with the proposed WwTP, with a capacity to treat all wastewater sludges arising in Fingal. The sludge will be treated using advanced anaerobic digestion to produce a by-product with a high solids content. Sludge storage will be managed at the proposed RBSF to be located on an 11.4ha site at Newtown, Dublin 11.

Since different treatment processes are possible, the maximum potential environmental impact is assessed with respect to the potential impact of the design. A preliminary indicative layout has been developed for the proposed WwTP site. This layout is based on a conventional Activated Sludge Plant, which would be expected to require the largest footprint. The indicative layout can be broken into three zones. The western zone (Zone 1) contains the inlet works, which includes the preliminary unit treatment processes, and the primary sedimentation tanks. The middle zone (Zone 2) contains the biological treatment tanks and final settlement tanks (clarifiers). The sludge treatment facilities are contained in the eastern zone (Zone 3). The Proposed Project is considered to represent the scenario with the maximum potential impact, and the assessment undertaken has therefore considered the maximum potential impact associated with the proposed WwTP.

The other major elements of the Proposed Project are the proposed Abbotstown pumping station, orbital sewer route and outfall pipeline route (marine section).

There are a number of possible sources of emissions to atmosphere during the Operational Phase from the various elements of the Proposed Project as summarised in Table 14.10. A discussion on the nature and significance of these emissions is presented in the following sections;

Table 14.10: Potential Sources of Emissions to Atmosphere

Element and Emissions Source	Potential Emissions
Proposed Abbotstown pumping station	
Wet and dry well	Odour associated with hydrogen sulfide (H_2S), ammonia, organic substances
Diesel generator	Sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM_{10}), carbon monoxide (CO)
Rising main from Abbotstown connection to gravity pipeline	
Connection chamber	Odour associated with Hydrogen sulfide (H_2S), ammonia, organic substances
Proposed wastewater treatment plant	
Inlet works Preliminary treatment Primary treatment Secondary treatment, Activated Sludge Plant Sludge handling	Odour Hydrogen sulfide (H_2S), ammonia, organic substances
Various	Methane
Combined Heat and Power (CHP) system	Sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM_{10}), carbon monoxide (CO), hydrogen sulfide (H_2S), ammonia, organic substances, mercaptans, odour

Proposed Abbotstown Pumping Station

The proposed Abbotstown pumping station generators are required to provide power in the event of an emergency power outage. The generators are not expected to be in use continuously, but they will be switched on at regular intervals to ensure ongoing effective operation. Emissions from the generator will include SO_2 from the fuel used, NO_x, CO and PM_{10} arising from combustion.

The proposed Abbotstown pumping station will be constructed by wet/dry well methods, i.e. the pumps will be mounted in a dry well with the suction pipework being constructed in the proposed Abbotstown pumping station wet well. The main odour source will be the wet well, with lower emissions from the dry well. Both chambers will be vented and the extracted air will be treated in an OCU before discharge to atmosphere through a stack above the height of the proposed Abbotstown pumping station building. The odorous gases present will include various organic substances, ammonia, H_2S, and CH_4.

Rising Main Connection from Abbotstown to Gravity Pipeline

There is a possibility that odours could be released at the point of transition from the rising main to the gravity sewer on the sewer connection from Abbotstown. This potential discharge is near Dubber Cottages. As a precautionary measure, air will be extracted from this connection and treated in an OCU before discharge to atmosphere through a stack above the OCU. The odorous gases present will include various organic substances, ammonia, H_2S and CH_4. The pumps are expected to operate six to eight times an hour, and the OCU will operate continuously.

Proposed Wastewater Treatment Plant Combined Heat and Power System

The CHP system, which will be located at the proposed WwTP, will burn gas generated in the sludge digester plant. SO_2 emissions will be present in the emissions but the emission rate is expected to be relatively low. NO_x are also present in the emission stream as a result of the combustion process, primarily in the form of NO which is substantially oxidised to NO_2 in the atmosphere. CO is also emitted as a result of combustion and fine PM is also expected to be emitted in the form of PM_{10}. Other substances that may be present include H_2S, ammonia and mercaptans. The CHP system can also burn natural gas and there would be no change in the nature of the emissions for this fuel.

Proposed Wastewater Treatment Plant

The main odour sources will be the inlet works, preliminary treatment stages and the sludge handling activities, with odour emissions also released from the other main elements of the proposed WwTP. These include the following:

- The inlet works;
- The preliminary treatment stages;
- The primary settlement tanks;
- Primary treatment stages;
- Activated sludge plant lanes;
- Sludge reception, handling, storage and processing facilities, and
- Final treatment stages.

Studies of odorous emissions from WwTPs have identified a broad range of chemical substances which include organic acids, organic nitrogen compounds and organic sulfides. The primary source of odour from WwTPs is the degradation of organic matter by microorganisms under anaerobic conditions leading to the production of CH_4, H_2S, ammonia, organic sulfur including thiols, mercaptans and sulfides, amines, indole and skatole. Volatile fatty acids, alcohols and, aldehydes and ketones may also be produced under anaerobic conditions. Odorous substances associated with aerobic conditions are generally described as musty, and ammonia is also often present. H_2S is often used as an indicator of odour from WwTPs, but this is an over-simplification. The odour from works of this type is due to a complex mix of substances depending on the precise composition of the influent and the operating details for the plant. The principal odorous gases potentially present in emissions from this proposed facility will include various organic substances, ammonia, H_2S, traces of methane and organic nitrogen compounds.

Proposed Sludge Hub Centre

The proposed SHC will occupy the eastern zone (Zone 3) of the proposed WwTP site and will provide sludge handling and treatment facilities for wastewater sludges. In addition, the SHC will have the capacity to provide sustainable treatment for municipal wastewater sludge and domestic septic tank sludges generated in Fingal, which is currently served by septic tank or individual domestic wastewater treatment systems. The wastewater sludge will be transported to the SHC via the road network in tankers and/or covered skips and will be treated by advanced anaerobic digestion treatment to produce a ‘biosolid’ end product suitable for reuse in agriculture, with the biogas produced during the treatment process used on-site for energy recovery. The 'biosolid' end product will be transported to the RBSF via the road network in covered trucks.

Emissions to atmosphere associated with the SHC would include a broad range of chemical substances, which includes organic acids, organic nitrogen compounds and organic sulides; CH_4; H_2S; ammonia; organic sulfur including thiols, mercaptans and sulfides, amines, indole and skatole. H_2S is often used as the only indicator of odour from sludge processes, but this is an over-simplification since there are many other substances that contribute to odours in the emissions.

Predicted Odour Emissions from the Proposed Abbotstown Pumping Station

Odours may arise in both the wet well and dry well chambers, with the higher rate of odour generation associated with the wet well. Both chambers will be ventilated with the extracted air being treated in a dedicated OCU and discharged to atmosphere through a stack which discharges above the roof of the proposed Abbotstown pumping station control building. Two scenarios are possible: a normal extraction rate and a higher extraction rate during a peak event which may be triggered as a result of varying influent composition and/or a storm event. Both scenarios are investigated in this Chapter. The peak predicted untreated odour loading at the proposed Abbotstown pumping station is 10,450OU_E/m^3, which has been determined from the volume of the wet and dry wells and the required air extraction rates as well as the projected odour emission rate for a facility of this type and size.

Predicted Odour Emissions from the Connection at Dubber Between the Rising Main from the Proposed Abbotstown Pumping Station and the Gravity Pipeline

Odorous air will be ventilated with the extracted air being treated in a dedicated OCU at the transition point. The treated air will be discharged to atmosphere through a stack. The peak predicted untreated odour loading is expected to be the same as at the proposed Abbotstown pumping station (i.e. 10,450OU/m^3). The size of the OCU will also be similar to that for the proposed Abbotstown pumping station. It should be noted that, although the proposed WwTP may be built in stages to deal with the full PE design capacity, the emission rate projections and the dispersion modelling consider the maximum potential emission rate and therefore the maximum potential impact of the facility.

Predicted Emissions from the Diesel Generators at the proposed Abbotstown Pumping Station and the Combined Heat and Power System at the Proposed Wastewater Treatment Plant

The power requirements for the proposed Abbotstown pumping station are well established, and from this information, the emission rates of various substances from the diesel generator are calculated. The SO_2 emission rate is derived from the fuel usage rate and the maximum permissible sulfur content of the fuel (0.1%).

Emissions to atmosphere for the CHP system at the proposed WwTP are derived from similar considerations. In this instance, the fuel output from the proposed WwTP designed for 500,000PE is well established, and from this information, the potential maximum emission rate of various substances is determined. Information from prospective suppliers of equipment suitable for this application was considered in developing the projections.

Predicted Emissions from the Proposed Wastewater Treatment Plant

Odour emissions may arise at all stages of the treatment process. Estimates of odour emission rates were made using information derived from the following sources:

- Literature references, including the UK Water Industry Research's (2000) Technical Reference Document *Odour Control in Wastewater Treatment* and the WRc publication CP149 *Reducing odour from Sludge*;
- Measurement data for existing similar WwTPs; and
- Information provided by the operators of similar WwTPs throughout Europe.

A summary of the data used to derive the odour emission rate is presented in Appendix A14.4 in Volume 3 Part B of this EIAR. These data are based on indicative design data for the proposed WwTP and are a reliable estimate of projected maximum odour emission rates requiring treatment. Using the data presented in Appendix A14.4, a potential untreated odour emission rate for each phase of operation has been derived. A typical odour emission rate from a conventional treatment works, with sources covered/enclosed and abated, is of the order of 0.5 to 1.0OU_E/s per person. For a works serving 500,000PE, an estimate of 500,000OU_E/s is derived; add to this an allowance for additional load due to imported sludge for the SHC, and the estimated emission rate is broadly in line with expectation. A summary of the projected untreated odour emission rates is presented in Table 14.11 for the 500,000PE capacity design, with additional information on the derivation of this data presented in Appendix A14.4.

Table 14.11: Predicted Odour Emission Rates from the Proposed Wastewater Treatment Plant

Source	Gross Surface Area (m^2)	Odour Emission Rate ($OU_E/m^2/s$)	Process Emission (Untreated) (OU_E/s)
Inlet works	190	11	2,090
Preliminary treatment	1,078	20	21,560
Primary treatment	4,364	2	8,728
Activated Sludge Plant	4,708	2	9,416
Final settlement tanks	22,572	2	45,144
Sludge Treatment 1	1,290	90	387,000
Sludge Treatment 2	762	90	228,600
Sludge Treatment 3	469	90	140,700
Digesters	1,062	90	318,600
Dewatering and drying	1,091	12	13,092
Peak condition			83,588
		Total	**1,258,518**

The proposed SHC will be co-located with the proposed WwTP on the site at Clonshagh and, as noted above, will provide sludge handling and treatment facilities for wastewater sludges. Sludges will be transported to the SHC via the road network in tankers and/or covered skips. The final product will be removed in covered tankers to the RBSF. As a result of the enclosure, emissions to atmosphere from the transport to and from the SHC of sludges will be insignificant. Emissions to atmosphere associated with processing are derived as shown in Appendix A14.4.

The appointed contractor(s) will be appointed to design, build and operate the proposed WwTP (including the proposed SHC) to achieve the required design standards. Indicative unit processes in the proposed SHC include:

- Buffer tanks;
- Dewatering (centrifuges);
- Thermal hydrolysis (pasteurisation) tanks;
- Mesophilic anaerobic digestion tanks;
- Sludge storage building; and

- Bio-gas storage.

Odorous gases generated at the various stages in the wastewater treatment process will be captured and vented for odour abatement in six dedicated OCUs. Untreated odour emission rate projections are summarised in Table 14.11. The Odour Control Units will be deployed as shown in Table 14.12.

Table 14.12: Odour Abatement Systems Configuration for the Proposed Wastewater Treatment Plant

Source	Odour Control Unit
Inlet works	OCU 6
Preliminary treatment	
Primary treatment	OCU 1
Activated Sludge Plant	OCU 2
Final settlement tanks	OCU 5
Sludge Treatment 1	OCU 3
Sludge Treatment 2	
Sludge Treatment 3	
Dewatering and drying	
Digesters	OCU 4

Traffic Impacts

There will be a slight increase in traffic movements. The principal substances that are associated with transport activity are PM, NO_x and CO. Dust emissions associated with the Operational Phase traffic are also possible.

14.4.4 'Do Nothing' Impact

There will be no significant change in air quality impacts if the Proposed Project does not proceed. There are plans to develop a Link Road and various industrial developments in the area, as well as the broader plans for Dublin Airport which are being addressed in Chapter 23 Cumulative Impacts and Environmental Interactions. These developments may affect air quality in the area but are not expected to exert a significant impact on the ambient air quality in the region.

14.5 Impact of the Proposed Project – Construction Phase

14.5.1 Proposed Abbotstown Pumping Station Construction Phase Impact

The construction of the proposed Abbotstown pumping station will involve general construction activities. Site clearance will require the use of heavy earth-moving machinery and equipment that will be used for soil stripping, excavation, importation of materials to site and foundation laying equipment. Below ground construction will be required, and this may involve some piling activities and rock-breaking at the proposed Abbotstown pumping station site. Conventional construction work will then be required to build up the individual units that will be required on-site.

The risk of dust being emitted in sufficient quantities to cause a nuisance or health impacts is evaluated by considering the scale of the works programme. The IAQM's (2014a) *Guidance on the Assessment of Dust from Demolition and Construction* gives advice on classifying the magnitude of the potential dust impacts, The magnitude of the dust emissions is estimated as shown in Table 14.13 for the proposed Abbotstown pumping station, using the advice and information derived from the Construction Plan for the proposed Abbotstown pumping station site.

Table 14.13: Assessment of Magnitude of Dust Emissions for Construction of the Proposed Abbotstown Pumping Station

Activity	Magnitude of Dust Emission
Demolition	Not applicable
Excavations	Medium
Construction	Medium
Construction traffic	Medium

There are no structures to be demolished. Some excavation work is required with by far the majority of excavated materials being topsoil, made ground, sandy clay and limestone in the deeper excavations.

The potential air quality impact arises from emissions of PM and may result in deposition of dust around the proposed Abbotstown pumping station site and track-out onto the roads nearby. The magnitude of the potential emissions associated with construction is assessed as medium using the above criteria.

The significance of the dust emissions and impacts is evaluated in terms of the sensitivity of the receptors in the area that could be affected by the emissions. The receptor sensitivity in the immediate vicinity of the proposed Abbotstown pumping station site is high because of the proximity of residential receptors, Connolly Hospital and St. Francis' Hospice. A summary of the assessment of sensitivity for each activity is presented in Table 14.14.

Table 14.14: Assessment of Receptor Sensitivity for Construction Programme for the Proposed Abbotstown Pumping Station

Activity	Sensitivity of Receptors and Surrounding Areas		
	Dust Soiling	Human Health	Ecological
Demolition	Not applicable	Not applicable	Not applicable
Excavations	High	High	Low
Construction	High	High	Low
Construction traffic	Medium	Medium	Low

Using the alternative assessment approach outlined in the draft Guidelines (EPA 2017a) as outlined in Section 14.2.2, the assessment shows that the most significant potential impacts are those associated with the site excavations and construction activities. There is predicted to be a short-term Slight adverse impact on the closest receptors during the Construction Phase with potential short-term impacts from traffic on the surrounding roads within about 50m of the proposed Abbotstown pumping station site. There will be no lasting impact and the short-term impact will be managed by means of an effective Construction Environmental Management Plan (CEMP) incorporating the mitigation measures outlined in Section 14.8. The CEMP will include a specific Dust Minimisation Plan which will ensure that dust impacts are prevented or minimised during the Construction Phase of the Proposed Project.

As noted in Section 14.4.2, there is concern about a fungal disease, 'invasive Aspergillosis', which may be contracted as a result of disturbance of materials that release fungal spores into the atmosphere. This is a disease which is detrimental to persons with suppressed immune systems, such as hospital patients, and is therefore of concern in relation to the proposed Abbotstown pumping station site due to the close proximity to Connolly Hospital and St. Francis' Hospice. The *National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis During Construction/Renovation Activities* (Health Protection Surveillance Centre 2018) deals specifically with construction works occurring within or adjacent to hospitals. The report states that the fungal spores responsible for invasive Aspergillosis can originate from a number of sources such as construction, demolition, renovation, disturbance of soil, removal of fibrous insulation material, removal of suspended ceiling tiles and from poorly maintained air ventilation systems.

Fungal spores (the Aspergillus moulds) are found everywhere but are of particular concern when large scale demolition, excavation and earth-moving activity takes place and especially in close proximity to areas where vulnerable individuals are located. The dispersion of spores (or indeed dust or any other substance) which are released at a particular location depends on a significant number of factors, including the rate and temperature of the release, the release height, the wind speed, rainfall, wind direction, topography, local meteorological conditions, the nature of the substances released, the potential for physical or chemical interactions and the concentrations of the substances released and other factors. The dispersion of fungal spores will depend on all of the above factors and this dispersion is evaluated by considering the factors noted above and the distances from the source at which the predicted impacts are to be assessed. In the first instance, the key factors are the concentration of the spores released and the distance to sensitive receptors. Dispersion of fungal spores released as a result of any activity is a function of time and distance and would be completely dispersed, i.e. no measurable concentration, at approximately 250m from the source of the release.

The National Guidelines report referred to above notes that the fundamental requirements in respect of eliminating Aspergillus infection from construction works is, first, to minimise the dust generated during construction and, second, to prevent dust infiltration into patient care areas. All construction works on the grounds of and in the immediate vicinity of Connolly Hospital and St. Francis' Hospice will be carried out in accordance with the requirements of the National Guidelines.

Proposed temporary construction compound no. 1 will be located at the proposed Abbotstown pumping station site to facilitate the work programme. Raw materials required for construction will be delivered to the sites using conventional Heavy Goods Vehicles (HGVs), and any wastes requiring removal from the site will be removed using HGVs. Vehicular movement associated with the Construction Phase is presented in detail in Chapter 13 Traffic and Transport in Volume 3 Part A of this EIAR and relevant details are discussed below.

14.5.2 Proposed Orbital Sewer Route Construction Phase Impact

The proposed orbital sewer route will be constructed along a route from Blanchardstown to the proposed WwTP site in Clonshagh, with the works completed within the proposed construction corridor (40m width) which will frame the entire route.

It is expected that the construction methodology that will be employed for the majority of the proposed orbital sewer route construction will be conventional open cut, whereby the proposed construction corridor for the pipe is stripped of topsoil, a trench of suitable dimension is excavated and the pipe is installed, on suitable bedding material, to the lines and levels determined by the design. The pipe is then surrounded with specified material and the trench is backfilled.

This methodology will not be suitable for the full route of the proposed orbital sewer route as the crossing of obstructions, such as significant watercourses, major roads, railways and major infrastructure, will necessitate the use of trenchless techniques. A combination of microtunnelling and pipe jacking will be required. The proposed orbital sewer route construction will also require heavy earth-moving machinery and equipment that will be used for soils stripping, excavation, trenching and the associated laying of the sewer pipework. Some rock-breaking activities may be required at locations where normal excavation is not possible, but this will only occur for an insignificant length of trench over the total length of the proposed orbital sewer route.

The risk of dust being emitted in sufficient quantities to cause a nuisance or health impacts is evaluated by considering the scale of the works programme. The IAQM's (2014a) *Guidance on the Assessment of Dust from*

Demolition and Construction gives advice on classifying the magnitude of the potential dust impacts, and using the advice and information derived from the Construction Plan for the proposed orbital sewer route site, the magnitude of the dust emissions is estimated as shown in Table 14.15 for the proposed orbital sewer route construction. The assessment is based on the closest receptors to any section of the proposed orbital sewer route construction and therefore represents a worst-case assessment scenario whereby the maximum potential impact is assessed.

Table 14.15: Assessment of Magnitude of Dust Emissions and Receptor Sensitivity for the Construction Programme for the Proposed Orbital Sewer Route for Closest Receptors

Activity	Magnitude of Dust Emission	Sensitivity of Receptors and Surrounding Areas		
		Dust Soiling	Human Health	Ecological
Demolition	Not applicable	Not applicable	Not applicable	Not applicable
Soil stripping	Low	High	High	Low
Trench excavation	Low	High	High	Low
Pipe-laying	Low	High	High	Low
Back-filling	Low	High	High	Low
Reinstatement	Low	High	High	Low
Construction traffic	Low	Low	Low	Low

There are no structures to be demolished. Most of the work is excavation work with the majority of excavated materials being topsoil, made ground, sandy clay and limestone in the deeper excavations, as determined from the site investigations carried out along the proposed orbital sewer route. Excavated materials will be replaced in the area they originated which means that no significant volumes of waste will be generated.

The significance of the dust emissions and impacts is evaluated in terms of the sensitivity of the receptors in the area that could be affected by the emissions. The receptor sensitivity in the immediate vicinity of the proposed orbital sewer route varies from low to high depending on the proximity of residences and/or other sensitive receptors.

The duration of impact at any given receptor will depend on the rate of progress of the works. The faster the rate of progress, the shorter the duration of the impact that may be experienced at any receptor along the route. The proposed orbital sewer route works are scheduled to take approximately 18 months to complete which would very conservatively estimate the rate of progress of the Construction Phase works at 30m per day. This means that the closest receptors will only be exposed to potential impacts for a relatively short period of time. Dust emissions associated with the Construction Phase of the proposed orbital sewer route are expected to be predominantly in the 30μm to 75μm particle size range. Because of their size, these particles will generally be deposited within 100m of the emission source. Only under exceptional meteorological conditions would the dusts be carried further downwind. At 30m of progress per day, works will be this close to a specific receptor for no more than three to four days, so any potential impact will only be experienced at each receptor for this limited period of time.

The potential air quality impact arises from emissions of PM and may result in deposition of dust around the proposed orbital sewer route and track-out onto the roads in the vicinity. The magnitude of the potential emissions associated with construction is assessed as low using the above criteria. The CEMP will include a specific Dust Minimisation Plan which will ensure that dust impacts are prevented or minimised during the Construction Phase of the Proposed Project.

Using the alternative assessment approach outlined in the draft Guidelines (EPA 2017a), as outlined in Section 14.2.2, the significance of potential dust emissions during construction is summarised in Table 14.16.

Table 14.16: Assessment of Significance of Dust Emissions for Construction Programme for the Proposed Orbital Sewer Route

Activity	Magnitude of Dust Emission	Significance of Dust Emission	Duration of Dust Emission
Demolition	Not applicable	Not applicable	Not applicable
Soil stripping	Small	Not significant	Temporary
Trench excavation	Small	Not significant	Temporary
Pipe-laying	Small	Not significant	Temporary
Back-filling	Small	Not significant	Temporary
Reinstatement	Small	Imperceptible	Brief
Construction traffic	Small	Imperceptible	Brief

This assessment shows that the most significant potential impacts are those associated with soil stripping and excavation. There is predicted to be a temporary Slight impact on the closest receptors during the Construction Phase. There will be no lasting impact and the temporary impact will be managed by means of an effective CEMP incorporating the mitigation measures outlined in Section 14.8.

All Construction Phase works on and in the immediate vicinity of Connolly Hospital and St. Francis' Hospice will be carried out in accordance with the requirements of the *National Guidelines for the Prevention of Nosocomial Invasive Aspergillosis During Construction/Renovation Activities* (Health Protection Surveillance Centre 2018).

Proposed temporary construction compounds will be located at 10 main locations along the proposed pipeline routes to facilitate the work programme. In addition, some proposed temporary construction compounds will be located adjacent to some of the trenchless crossing sites for short time periods. Raw materials required for the construction will be delivered to the sites using conventional HGVs. Vehicular movement associated with the Construction Phase is presented in detail in Chapter 13 Traffic and Transport in Volume 3 Part A of this EIAR and relevant details are discussed below.

14.5.3 Proposed Outfall Pipeline Route (Land Based Section and Marine Section) Construction Phase Impact

The proposed outfall pipeline route (land based section) commences at the outfall of the proposed WwTP, at Clonshagh, and runs eastward to the western side of the Baldoyle Estuary where the proposed outfall pipeline route (marine section) commences. The proposed outfall pipeline route (marine section) commences at the western side of the Baldoyle Estuary and runs in an eastern direction for approximately 5.9km to terminate approximately 1km north-east of Ireland's Eye.

The proposed outfall pipeline route (land based section and marine section) will be constructed by a combination of open cut construction and trenchless construction methods, similar to the construction of the proposed orbital sewer route.

The risk of dust being emitted in sufficient quantities to cause a nuisance or health impacts is evaluated by considering the scale of the works programme. The IAQM's (2014a) *Guidance on the Assessment of Dust from Demolition and Construction* gives advice on classifying the magnitude of the potential dust impacts, and using the advice and information derived from the Construction Plan for the proposed outfall pipeline route (land based section) site, the magnitude of the dust emissions is estimated as shown in Table 14.17 for proposed outfall pipeline route (land based section) construction. The assessment is based on the closest receptors to any section of the construction route and therefore represents a worst-case assessment scenario whereby the maximum potential impact is assessed.

Table 14.17: Assessment of Magnitude and Significance of Dust Emissions for Construction Programme for the Proposed Outfall Pipeline Route (Land Based Section)

Activity	Magnitude of Dust Emission	Significance of Dust Emission	Duration of Dust Emission
Demolition	Not applicable	Not applicable	Not applicable
Soil stripping	Small	Not significant	Temporary
Trench excavation	Small	Not significant	Temporary
Pipe-laying	Small	Not significant	Temporary
Back-filling	Small	Not significant	Temporary
Reinstatement	Small	Imperceptible	Brief
Construction traffic	Small	Imperceptible	Brief

There are no structures to be demolished. The majority of excavated materials will be topsoil, made ground, sandy clay and limestone in the deeper excavations as determined from the site investigations carried out along the proposed outfall pipeline route (land based section and marine section). Excavated materials will be replaced in the area they originated which means that no significant volumes of waste will be generated (refer to Section 20.4.2 of Chapter 20 Waste in Volume 3 Part A of this EIAR).

The significance of the dust emissions and impacts is evaluated in terms of the sensitivity of the receptors in the area that could be affected by the emissions. In general, receptors located close to the construction site boundary are considered high sensitivity with sensitivity decreasing with increasing distance from the source reflecting the exponential decrease in dust levels as distance increases. The receptor sensitivity in the immediate vicinity of the proposed outfall pipeline route (land based section and marine section) varies from low to high depending on the proximity of residences and/or other sensitive receptors, including ecological sites.

Table 14.18: Assessment of Magnitude of Dust Emission and Sensitivity for Construction Programme for the Proposed Outfall Pipeline Route (Land Based Section) for Closest Receptors

Activity	Magnitude of Dust Emission	Sensitivity of Receptors and Surrounding Areas		
		Dust Soiling	Human Health	Ecological
Demolition	Not applicable	Not applicable	Not applicable	Not applicable
Soil stripping	Low	High	High	Low
Trench excavation	Low	High	High	Low
Pipe-laying	Low	High	High	Low
Back-filling	Low	High	High	Low
Reinstatement	Low	High	High	Low
Construction traffic	Low	Low	Low	Low

The duration of impact at any given receptor will depend on the rate of progress of the works. The faster the rate of progress, the shorter the duration of impact that may be experienced at any receptor along the route. An estimate of the rate of progress of the construction works is 30m per day which means that the closest receptors will only be exposed to potential impacts for a relatively short period of time. Dust emissions associated with the Construction Phase of the proposed outfall pipeline route (land based section) are expected to be predominantly in the 30µm to 75µm particle size range so these particles, because of their size, will generally be deposited within 100m of the emission source. Only under exceptional meteorological conditions would the dusts be carried further downwind. At 30m progress per day, works will be this close to a specific receptor for no more than three to four days, so any potential impact will only be experienced at each receptor for this limited period of time.

The potential air quality impact arises from emissions of PM and may result in deposition of dust around the proposed outfall pipeline route (land based section) and track-out onto the roads in the vicinity. The magnitude of the potential emissions associated with construction is assessed as low using the above criteria. The CEMP will include a specific Dust Minimisation Plan which will ensure that dust impacts are prevented or minimised during the Construction Phase of the Proposed Project.

Using the alternative assessment approach outlined in the draft Guidelines (EPA 2017a) as outlined in Section 14.2.2, and based on professional judgement, the significance of potential dust emissions during construction is summarised in Table 14.19.

Table 14.19: Assessment of Significance of Dust Emissions for Construction Programme for the Proposed Outfall Pipeline Route (Land Based Section)

Activity	Magnitude and Significance of Dust Emission	Duration of Dust Emission
Demolition	Not applicable	Not applicable
Soil stripping	Not significant	Temporary
Trench excavation	Not significant	Temporary
Pipe-laying	Not significant	Temporary
Back-filling	Not significant	Temporary
Reinstatement	Imperceptible	Brief
Construction traffic	Imperceptible	Brief

This assessment shows that the most significant potential impacts are those associated with soil stripping and excavation. There is predicted to be a temporary insignificant adverse impact on the closest receptors during the Construction Phase. There will be no lasting impact and the temporary impact will be managed by means of an effective CEMP incorporating the mitigation measures outlined in Section 14.8.

The proposed construction methodology for the proposed outfall pipeline route (marine section) is a combination of microtunnelling and subsea pipe laying techniques. The microtunnelled section will commence at the west side of the Baldoyle Estuary and it is planned to tunnel beneath Baldoyle Estuary and terminate seaward of the Baldoyle Bay Special Area of Conservation (SAC)/Special Area of Protection (SPA), a distance of approximately 2km in total.

The tunnel section would require two proposed temporary construction compounds onshore. At each of the proposed temporary construction compounds, the access shaft would be constructed, tunnelling equipment would be located and the tunnel materials would be stored temporarily. It is estimated that the microtunnelling would progress at a rate of approximately 60m per week and that the tunnelling would take in the region of 12 months including site mobilisation. Once commenced, the tunnelling work would proceed for 24 hours per day, seven days per week.

The section of the proposed outfall pipeline route (marine section) will be constructed by subsea pipe-laying methods and will be constructed in a 5m deep trench of trapezoidal section of 5m at the base and between 20m and 40m at the surface. The trench would be constructed with a combination of a backhoe dredger, in shallower areas, and a trailer suction hopper dredger where the water depths are beyond the limits of the backhoe dredger.

Excavated material would be temporarily stored on the seabed along the length of the trench. The pipe would then be floated into place and sunk into the trench, with the previously excavated material replaced around and over the pipe. The Construction Phase for this element is estimated at between four and five months.

Since this section of the works will be under water, there is very limited potential for release of dust and particulate emissions, and the magnitude of the potential emissions associated with construction is assessed as low using the IAQM criteria (IAQM 2014a). The CEMP will include a specific Dust Minimisation Plan which will ensure that dust impacts are prevented or minimised during the Construction Phase of the Proposed Project.

Using the alternative assessment approach outlined in the draft Guidelines (EPA 2017a) as outlined in Section 14.2.2, there is predicted to be a Slight but Not Significant impact in the vicinity of the works during the Construction Phase. There will be no lasting impact and the short-term impact will be managed by means of an effective CEMP incorporating the mitigation measures outlined in Section 14.8.

Proposed temporary construction compounds will be located at eight main locations along the proposed pipeline routes to facilitate the work programme, plus proposed temporary construction compound no. 1 at the proposed Abbotstown pumping station and proposed temporary construction compound no. 6 at the proposed WwTP site. In addition, some smaller temporary construction compounds will be located adjacent to some of the trenchless crossing sites for short time periods. Raw materials required for the construction will be delivered to the sites using conventional HGVs. Vehicular movement associated with the Construction Phase is presented in detail in Chapter 13 Traffic and Transport in Volume 3 Part A of this EIAR and relevant details are discussed below.

14.5.4 Proposed Wastewater Treatment Plant Construction Phase Impact

The Outline CEMP provides information on construction methodologies that will be employed at the proposed WwTP site. Construction of the proposed WwTP will involve:

- Excavation for building foundations and tanks;
- Reinforced concrete works, erection of structural steel/concrete building frames;
- Erection of building walls (concrete/blockwork);
- Erection of prefabricated cladding panels to walls and roofs of buildings;
- Erection of prefabricated steel tanks;
- Mechanical and electrical fit out of buildings and tanks;
- Installation of below and above ground pipework;
- Construction of screening berms;
- Construction of access roads to site and internal circulation roads;
- Car parks and footpaths;
- Landscaping; and
- Final planting.

Over the estimated three-year Construction Phase, these activities will be sequentially scheduled by the appointed contractor(s) to optimise resource usage.

There will be between 100 to 150 people working on-site during peak Construction Phase. While the precise Construction Plan will be formulated by the appointed contractor(s), a typical sequence of work is outlined below to facilitate this impact assessment:

- Establish proposed temporary construction compound, secure site and proposed access roads;
- Strip topsoil from site and set aside for reuse in screening berms and landscaping;
- Excavate foundations;
- Pour concrete foundations/base for tanks and structures;
- Erect structural steel/concrete building frame, or reinforced concrete walls of structures;
- Erect inner/outer walls and roof of buildings;

- Finish and fitout of buildings;
- Erect prefabricated steel tanks;
- Install below ground and above ground pipework;
- Commissioning work on wastewater and sludge treatment systems;
- Final construction of proposed access roads and internal circulation roads, car parks and footpaths;
- Erect permanent site security fencing;
- Landscape site; and
- Remove proposed temporary construction compound fencing/compound.

Excavated material will be reused on-site in construction of the screening berms and landscaping such that quantities of excavated material will balance the fill material required in the screening berms and site landscaping.

The IAQM Guidance Note (IAQM 2014a) gives advice on classifying the magnitude of the potential dust impacts associated with the Construction Phase works, and using the advice and information derived from the Construction Plan for the site, the magnitude of the dust emissions is estimated as shown in Table 14.20 for the proposed WwTP site.

Table 14.20: Assessment of Magnitude and Sensitivity for the Construction Phase for the Proposed Wastewater Treatment Plant

Activity	Magnitude of Dust Emission	Sensitivity of Receptors and Surrounding Areas		
		Dust Soiling	Human Health	Ecological
Demolition	Not applicable	Not applicable	Not applicable	Not applicable
Site set-up	Low	Low	Low	Low
Soil stripping	High	Medium	High	Low
Excavations	High	Medium	High	Low
Concrete pours	Medium	Medium	High	Low
Erection of structures	Medium	Medium	High	Low
Fit-outs	Low	Low	Low	Low
Commissioning	Low	Low	Low	Low
Landscaping and finishing	Low	Low	Low	Low
Construction traffic	Medium	Low	Low	Low

The significance of the dust emissions and impacts is evaluated in terms of the sensitivity of the receptors in the area that could be affected by the emissions. In general, receptors located close to the construction site boundary are considered high sensitivity with sensitivity decreasing with increasing distance from the source reflecting the exponential decrease in dust levels as distance increases.

There are no structures to be demolished. A detailed site investigation by IGSL and Arup engineers revealed that ground conditions consist mainly of topsoil overlying glacial till with limestone bedrock at depth; made ground was not identified in any of the preliminary site investigation locations (Section 18.3.3 of Chapter 18 Soils and Geology in Volume 3 Part A of this EIAR).

The potential air quality impact arises from emissions of PM and may result in deposition of dust around the proposed WwTP site and track-out onto the roads in the vicinity. The magnitude of the potential emissions associated with construction is assessed as medium using the above criteria. The CEMP will include a specific

Dust Minimisation Plan which will ensure that dust impacts are prevented or minimised during the Construction Phase of the Proposed Project.

Using the alternative assessment approach outlined in the draft Guidelines (EPA 2017a) as outlined in Section 14.2.2, the significance of potential dust emissions during construction is summarised in Table 14.21.

Table 14.21: Assessment of Significance of Dust Emissions for the Construction Phase for the Proposed Wastewater Treatment Plant

Activity	Magnitude of Dust Emission	Significance of Dust Emission	Duration of Dust Emission
Demolition	Not applicable	Not applicable	Not applicable
Site set-up	Small	Imperceptible	Brief
Soil stripping	Large	Moderate	Temporary
Excavations	Large	Slight	Temporary
Concrete pours	Medium	Slight	Temporary
Erection of structures	Small	Not significant	Temporary
Fit-outs	Small	Imperceptible	Brief
Commissioning	Small	Imperceptible	Brief
Landscaping and finishing	Small	Slight	Temporary
Construction traffic	Medium	Moderate	Temporary

This assessment shows that the most significant potential impacts are those associated with soil stripping and excavations, landscaping and construction traffic. There is predicted to be a temporary Slight adverse impact on the closest receptors during the Construction Phase with potential short-term impacts from traffic on the surrounding roads within about 50m of the proposed WwTP site. There will be no lasting impact and the short-term impact can be managed by means of an effective CEMP incorporating the mitigation measures outlined in Section 14.8.

Proposed temporary construction compound no. 6 will be located at the proposed WwTP site to facilitate the work programme. Raw materials required for construction will be delivered to the site using conventional HGVs. There will be very little waste generated as excavated materials will be reused in site landscaping and screening berms. Vehicular movement associated with the Construction Phase is presented in detail in Chapter 13 Traffic and Transport in Volume 3 Part A of this EIAR and relevant details are discussed below.

14.5.5 Construction Phase Climate Impact

The principal GHG emissions associated with construction are CO_2 from transport and machinery utilised in construction. For the ‘do nothing’ scenario, if the Proposed Project does not proceed then the emissions of GHGs in the area are projected to remain the same with some relatively minor increases as activity in the area develops. However, GHG emissions will still occur somewhere because the wastewater treatment infrastructure must be provided to cater for existing and future needs.

The relative impact of the Construction Phase for the alternative scenarios considered for the proposed WwTP, which is the principal source of GHG emissions, is considered to be the same since the principal activities would be the same and there would be no quantifiable difference in the GHG emissions for the different configurations. Although the overall impact of each of the potential scenarios assessed would be the same, opportunities for minimisation of GHG emissions during construction will arise and will be required to ensure that the overall objectives of enhanced energy efficiency and minimisation of GHG emissions are achieved.

14.6 Impact of the Proposed Project – Operational Phase

14.6.1 Dispersion Modelling Impact Assessment

Dispersion Modelling Protocol

The EPA's AG4 guidance note (EPA 2010) gives guidance on the use of dispersion models which was followed in the execution of this study. A detailed modelling assessment was undertaken using the current version of the United States EPA's model AERMOD Prime model. The model computes average ground-level concentrations of pollutants emitted from either elevated or ground-level emission sources. Separate utilities associated with the dispersion modelling software allow for computation of ground-level concentrations of pollutants over defined statistical averaging periods, and additional features permit suitable consideration to be given to building downwash effects and the effects of elevated terrain near the proposed WwTP.

Model Input Data

Evaluation of the impact of the Proposed Project on air quality using dispersion modelling requires information on the following:

- Site layout and topography;
- Climatological data;
- Averaging intervals;
- Receptor locations; and
- Emissions characteristics.

This data are summarised in the following sections of this Chapter.

Site Layout and Topography

The layout and area of the Proposed Project site and the dimensions of the various plant buildings were obtained from scaled drawings. Topographical information was obtained from a site survey and from maps, orthographic photographs and digital Ordnance Survey data. Building downwash effects are possible as a result of the buildings o-site, so possible downwash effects were modelled using the modelling suite facilities.

The presence of terrain can lead to significantly higher ambient concentrations than would occur in the absence of terrain features, especially if there is a significant relative difference in elevation between the source and off-site receptors. International guidance and the Guidance Note AG4 (EPA 2010) suggest that, when modelling in a region of flat terrain, no digital mapping of terrain will be necessary. In relation to AERMOD, the guidance in AG4 is that digital mapping of terrain should be conducted where terrain features are greater than 10% of the effective stack height within 5km of the stack (for effective stack heights of 100m or less). From a review, it is concluded that digital terrain data are not required because there are no terrain features greater than 10% of the effective stack height within 5km of the site. However, terrain data were included as part of the sensitivity analysis for the proposed project which tested the sensitivity of the projections to varying input approaches and datasets.

Climatological Data

The magnitude of potential impacts of the Proposed Project on air quality and climate will largely be influenced by the local meteorological conditions, in particular by wind speed and direction and by precipitation rates. The meteorological data used as input to a dispersion model should be selected on the basis of spatial and climatological (temporal) representativeness as well as the ability of the selected parameters to characterise the transport and dispersion conditions in the area under investigation. The reliability of the data used as input data will depend on the proximity of the meteorological monitoring site to the area of interest, the complexity of the terrain and the amount of data available. In accordance with the EPA's AG4 guidance note (EPA 2010), data were selected for the most appropriate station (Dublin Airport) and five years of recent data (2012 to 2016) were used for the assessment. In addition, to test the sensitivity of the predictions to varying input data, five years of recent data (2012 to 2016) from Casement Aerodrome were also used for aspects of the assessment.

Averaging Intervals

The dispersion model was used to predict the incremental additions to ground level concentrations (GLCs) of all substances emitted from the facility over defined averaging periods. These averaging intervals were chosen to allow direct comparison of predicted GLCs with the relevant assessment criteria as outlined in Section 14.2.3. In particular, one-hour, eight-hour, 24-hour and annual average GLCs of various substances were calculated at various distances from the site; percentiles of these average GLCs were also computed for comparison with the relevant AQS.

Receptor Locations

Two modelling approaches were adopted for the assessment. Up to 250 discrete receptors were modelled to predict the air quality impacts that could arise as a result of the emissions from the Proposed Project. Human sensitive receptors as well as ecologically sensitive receptors were included in the assessment. Receptor Grids centred on the study area and set at 20m to 100m intervals at a distance of up to 25km from the site were also modelled for the purpose of this assessment with up to 5,000 receptors modelled.

Key sensitive human receptors were identified within the study area that are considered representative of the worst case locations where members of the public will potentially be affected by the emissions from the Proposed Project. These locations include residential properties, schools, hospitals and care homes. The locations of selected worst case sensitive receptors are shown in Figure 14.4 Air Quality Receptor Locations and Table A14.5.1 in Appendix A14.5 in Volume 3 Part B of this EIAR gives the grid co-ordinates for the selected receptors. Operational Phase impacts on these receptors were specifically assessed by including the receptors in the scope of the modelling protocol.

Operational Phase impacts of the Proposed Project on sensitive ecological receptors were also considered. There are a number of Natura 2000 sites which, due to their proximity to the Proposed Project, have the potential to be adversely affected by the Proposed Project. These are listed in Appendix A14.5.

The closest designated site to the proposed Abbotstown pumping station site is the Rye Water Valley SAC to the east of the site at Leixlip. The closest designated sites to the Proposed Project to the east are Malahide Estuary SAC, Baldoyle Bay SPA, North Bull Island SPA, and South Dublin Bay and River Tolka Estuary SPA. These sites were selected as the sites which could potentially experience the most significant potential impacts and were included in a detailed assessment of potential impacts from the emissions to atmosphere associated with the Operational Phase of the Proposed Project. The locations of these sites relative to the Proposed Project are shown in Figure 14.2 Study Area for the Operational Phase Air Quality Impact Assessment and in Diagram 14.4.

The assessment of potential Operational Phase impacts on the ecological designated sites was completed using a number of approaches. A receptor grid centred on each of the proposed Abbotstown pumping station site and the proposed WwTP site at Clonshagh and extending to each of the selected designated sites with grid intervals of 100m (Abbotstown) and 500m (Clonshagh) was constructed and model predictions were generated and evaluated for each receptor. In addition, transects of representative receptors at each of the selected designated sites have been defined that extend up to 25km from the Proposed Project. These receptors have been included in the model to calculate NO_X concentrations, which is the ecologically relevant impact parameter. The locations of each transect are shown in Appendix A14.5 which also shows the co-ordinates of the selected discrete receptors.

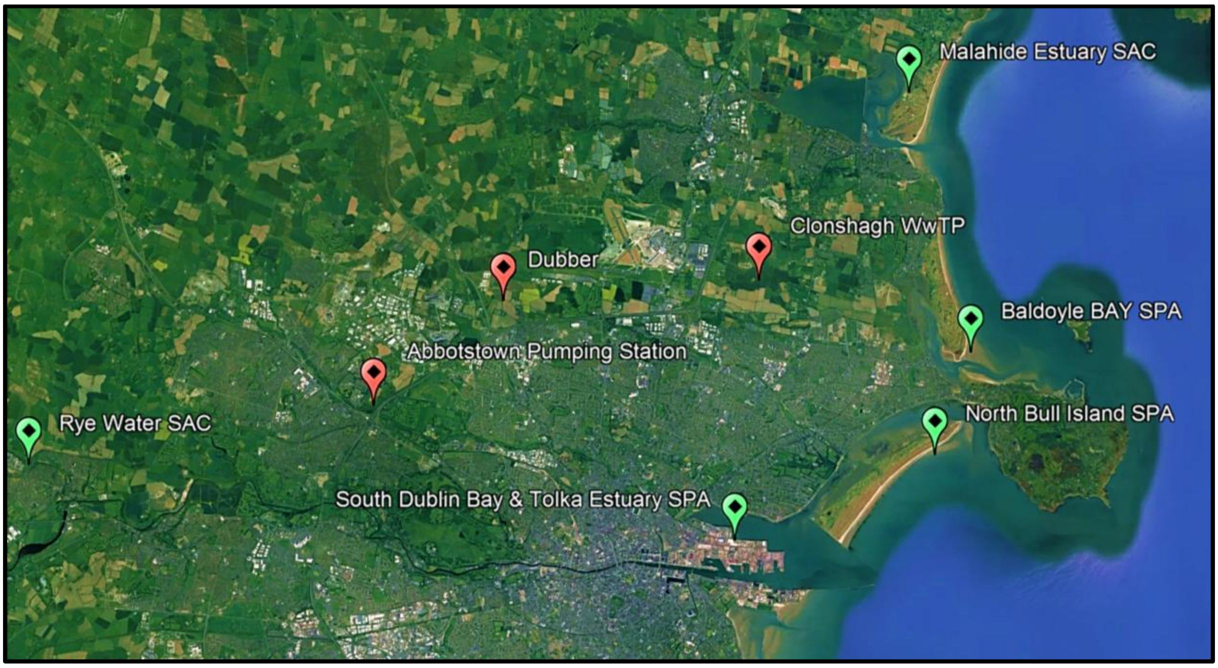

Diagram 14.4: Locations of Ecological Designated Sites Relative to the Proposed Project

Background Ambient Air Quality

The predictions from the dispersion model are evaluated by comparison with AQS. The existing background concentrations of the various substances must also be added to the predicted impact of the emissions. The exception is odour, for which background measurements are meaningless and cannot be added to predictions.

Impact Assessment Criteria

Impact assessment criteria are discussed in Section 14.2.3 and are summarised there and in Table 14.2, Table 14.3 and Table 14.4.

Emissions Characteristics

Information on dimensions and physical characteristics of the main emission sources was obtained by TMS Environment Ltd. from the Design Team for the Proposed Project, and from similar installations. A summary of the factors considered in deriving emission rates for modelling as well the modelling scenarios considered is presented below. All of the emissions are treated as point emission sources. An ambient temperature of 288 Kelvin (K) has been assumed. The actual exit velocity from each of the sources was used as input data for the modelling study.

Nitrogen Oxides

A significant issue in respect of model input data for emissions from combustion sources is the selection of NO_x input data. In most combustion processes, NO_x is emitted almost totally in the form of NO. NO_x are very reactive and also contribute, due to the formation of NO_2 from NO, to the phenomenon of photochemical ozone formation. These transformations are generally of greatest concern in the areas where the highest ozone concentrations occur, for example in rural areas in late afternoon in summer time. Unless photochemical dispersion models are used for the assessment of impacts associated with the release of nitrogen oxides from point emissions sources, then assumptions must be made regarding the rate and extent of conversion of NO to NO_2.

Since site-specific conversion factors for NO to NO_2 are not available for the site, photochemical dispersion models cannot be used for this application and an alternative approach is required. The United States EPA (40 Code of Federal Regulations Chapter 1, Part 51, Appendix W) suggest that in circumstances such as this, the NO_2/NO_x ratio is assumed to be 0.75 (United States national annual default value), i.e. the assumption is that 75% of the NO_X is present in the form of NO_2. In the EPA's AG4 guidance note (EPA 2010), the recommendation is that a default annual NO_2/NO_x ratio of 1.00 is used and a default hourly ratio of 0.5 is used, and that detailed modelling is to use the Plume Volume Molar Ratio Method in AERMOD. This is also the guidance given in the UK for dispersion modelling assessments.

AG4 further notes that the AERMOD modelling suite treats NO_x emissions in one of two ways:

- All of the NO_x emissions are treated as NO_2 and an assumption is made that a pre-determined ratio of NO_2/NO_x applies to the predictions; this is where the default conversion rates noted above would apply; and
- The Plume Volume Molar Ratio Method is used whereby an assumption is made that the in-stack NO_2/NO_x ratio is 0.1 and the equilibrium ratio is 0.90.

The EPA's AG4 guidance note was published in 2010 and new guidance has been issued by the United States EPA since then in 2010, 2011 and in September 2014. The most recent guidance from 2014 is a memorandum issued on 30 September 2014: *Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard*. This guidance was introduced because, in 2010, the United States published a new 1-hour NO_2 National Ambient Air Quality Standard and the Memoranda were required to explain how modelling would be executed to demonstrate compliance with the Standard. In summary, the clarification memos noted that the 1-hour NO_2 standard requires different modelling considerations from the annual standard, and that both the In Stack Ratio of NO_2/NO_x and the ambient ozone concentration may be much more important for the 1-hour standard than the annual Standard. Accordingly, the following Guidance has been abstracted from the Clarification Memos:

- The most conservative approach is to assume that all of the NO_x is converted to NO_2 and this approach is generally used for screening analyses;
- When modelling to demonstrate compliance with the annual AQS, use of an In Stack Ratio should be justified case-by-case, and where source-specific data are not available, an In Stack Ratio of 0.1 is recommended; for estimating impacts at distances beyond 2.5km, a conversion ratio of 0.2 is appropriate; and
- When modelling to demonstrate compliance with the 1-hour AQS, use of an In Stack Ratio of 0.5 is recommended.

In this assessment, the assumption made is that the In Stack Ratio is 0.1 for evaluation of the predicted annual average or 0.5 for the 1-hour average in line with current guidance on the use of dispersion modelling for air quality impact assessment. The equilibrium NO_2/NO_x ratio is 0.9, i.e. that 90% of the NO_X is present in the form of NO_2.

Particulate Matter, PM_{10} and $PM_{2.5}$

For simplicity it can be assumed that all of the PM is present as $PM_{10}/PM_{2.5}$. This simple assumption that all the particulates will be present as PM_{10} or $PM_{2.5}$ and comparison with the stringent AQS for $PM_{10}/PM_{2.5}$ is also likely to overestimate the potential impact of such emissions. Data for $PM_{2.5}$ are also presented using the very conservative assumption that all of the particulates are present as $PM_{2.5}$, i.e. equivalent to the PM_{10} emission rate. This conservative approach is considered prudent but is likely to overestimate the emissions.

Carbon Monoxide

The potential maximum emission rate of CO is unlikely to be attained but is modelled as a conservative approach.

Odour

Odour emission rates were derived using the approaches described in Section 14.4.2.

Other Substances

Modelling of other individual substances, such as H_2S, ammonia and mercaptans, has not been included in the model because there are no Irish AQS against which compliance may be assessed for these substances. Modelling of odour emission rates rather than individual substances is considered a more reliable indicator of potential odour impact and atmospheric significance of the emissions – this is in accordance with standard procedures. Modelling of some individual substances at the proposed WwTP has been included to test the robustness of the odour modelling approach and the sensitivity of projections to varying input data.

Emissions Modelling Scenarios

A number of modelling scenarios were considered to evaluate the impact of potential variations in the emission rates and to consider different potential operating scenarios for the Proposed Project. These are summarised in Table 14.22 for the proposed Abbotstown pumping station and in Table 14.23 for the proposed WwTP.

Table 14.22: Dispersion Modelling Scenarios for the Proposed Abbotstown Pumping Station

Location	Scenario	Dispersion Model Details
Proposed Abbotstown pumping station	Scenario 1: Normal Operating Condition	Outlet odour concentration from OCU
	Scenario 2: Peak Operating Condition	Outlet odour concentration from OCU
	Scenario 3: Normal Operation	Diesel generators running for one week at a time, 12 times per year
Proposed Dubber OCU	Normal operation	Outlet odour concentration from OCU

Table 14.23: Dispersion Modelling Scenarios for the Proposed Wastewater Treatment Plant

Emissions Sources	Scenario	Dispersion Model Details
All odour sources	WwTP Scenario 1: Normal Operation	Outlet odour concentration from each individual OCU modelled
All odour sources	WwTP Scenario 2: Peak Operating Conditions	Outlet odour concentration from each individual OCU modelled
CHP system	WwTP Scenario 3: Normal Operation	Various stack heights

The sewage will be fed by gravity into and stored in an underground pit called a wet well from where the sewage will be fed forward until the sewage eventually reaches its point of destination – in this case, the proposed WwTP at Clonshagh. The pumps and access areas for maintenance crews will be in the dry well which will be isolated from the raw sewage contained in the wet well. This will be necessary for both convenience and safety. The main source of odour at the proposed Abbotstown pumping station will be the wet well with some contribution coming from the dry well. The proposed Abbotstown pumping station will be fully enclosed and the wet and dry wells will be separated with air extracted from both to maintain safe and comfortable working conditions as needed.

The proposed Abbotstown pumping station is designed for a peak flow of $2.5m^3$ per second. The wet wells and dry wells will be ventilated and extracted air will be treated in Odour Control Units which will be housed indoors. The ventilation rates will be chosen to ensure safe working conditions in the dry well during maintenance events and to ensure that odours are captured and effectively and efficiently treated in the Odour Control Unit. During normal operations, the air will be extracted from the wet and dry wells at an appropriate rate. Under peak operating conditions, which could be triggered by a storm event or a change in influent loading, an increased extraction rate applies. These operating scenarios are modelled as Normal and Storm operation, respectively. OCUs will operate at an outlet odour concentration of 500OU_E/m^3, so this is the input data that is used in the model. The design and sizing of the OCU will be selected to ensure that this will be the maximum odour level in the emissions after passing through the odour abatement system(s).

For the OCU at Dubber, a single operating scenario has been modelled using the same design data as that for the proposed Abbotstown pumping station OCU, although this is considered likely to over-estimate the odour emission rate.

The diesel generators are not expected to operate continuously. They will provide emergency backup in the event of power failure and will also be powered on occasionally to ensure continued operation. As a conservative estimate, a scenario in which the generators run for a week at a time, every month, has been modelled.

The proposed WwTP is designed for 500,000PE; future growth will be addressed in future planning applications. The CHP system will provide the power needs for the proposed WwTP and will be fuelled with biogas from the plant; the CHP system can also run on natural gas. There is no requirement for diesel generators. Continuous operation of the CHP system is assumed in the model. Input data for all modelling scenarios is presented in Table 14.24, Table 14.25, Table 14.26 and Table 14.27.

Table 14.24: Input Data for AERMOD Dispersion Model for the Proposed Abbotstown Pumping Station

Parameter	Diesel Generator	Odour Control Unit	
		Normal Operating Conditions	Peak Operating Conditions
Emission point co-ordinates	675503, 5918572	675509, 5918548	
Stack height (m)	10	10	
Flow rate (m^3/s)	3.43	5.20	6.27
Temperature (K)	789	293	
Emission rate (g/s)			
SO_2	2.68×10^{-4}	Not applicable	
CO	0.024	Not applicable	
Particulates as PM_{10}	0.030	Not applicable	
Particulates as $PM_{2.5}$	0.030	Not applicable	
Nitrogen dioxide, NO_2	0.048	Not applicable	
Emission rate (OU_E/s)			
Odour	n/a	1,559	2,820

Note 1 Emission rates are derived as stated in Section 14.4.2 and Appendix A14.4
Note 2 Stack height refers to height above ground level

Table 14.25: Input Data for AERMOD Dispersion Model at Dubber Odour Control Unit

Parameter	Odour Control Unit
Emission point co-ordinates	678991, 5921626
Stack height (m)	5
Flow rate (m^3/s)	5.2
Temperature (K)	293
Emission rate (OU_E/s), Normal Operating Conditions	1,559

Note 1 Emission rates are derived as stated in Section 14.4.2 and Appendix A14.4
Note 2 Stack height refers to height above ground level

Table 14.26: Input Data for AERMOD Dispersion Model for the Proposed Wastewater Treatment Plant and Combined Heat and Power System

Parameter	Combined Heat and Power System	
	Normal Operating Conditions	Peak Operating Conditions
Emission point co-ordinates	686225, 5922060	
Stack height (m)	21	
Flow rate (Nm^3/hr)	16,200	
Velocity (m^3/s)	11.7	
Temperature (K)	311	
Emission concentration		
SO_2 (mg/Nm^3)	250	250
CO (mg/Nm^3)	250	1,050
Particulates as PM_{10} (mg/Nm^3)	10	10
Particulates as $PM_{2.5}$ (mg/Nm^3)	10	10
Nitrogen dioxide, NO_2 (mg/Nm^3)	250	250
Odour (OU_E/m^3)	500	500
Hydrogen sulfide, H_2S (mg/Nm^3)	1.5	4.5
Mercaptans (mg/Nm^3)	2.5	7.5
Ammonia (mg/Nm^3)	10.5	31.5
Emission rate (g/s)		
SO_2	0.995575	0.995575
CO	1.577778	4.181416
Particulates as PM_{10}	0.014481	0.014481
Particulates as $PM_{2.5}$	0.014481	0.014481
Nitrogen oxides, NO_x	0.361111	0.995575
Hydrogen sulfide, H_2S	0.005973	0.01792
Emission rate (OU_E/s)		
Odour	1,800	2,250

Note 1 Emission rates are derived as stated in Section 14.2.2 and Appendix A14.4
Note 2 Stack height refers to height above ground level

Table 14.27: Input Data for AERMOD Dispersion Model for the Proposed Wastewater Treatment Plant Odour Control Units

Parameter	Odour Control Unit 1	Odour Control Unit 2	Odour Control Unit 3	Odour Control Unit 4	Odour Control Unit 5	Odour Control Unit 6
Emission point co-ordinates	685709, 5922023	685834, 5922029	686137, 5921930	686071, 5921931	685928, 5921953	685692, 5921905
Stack height (m)	9	9	22	21	21	24
Flow rate (Nm^3/hr)	8,900	14,000	11,000	99,000	37,000	4,150
Velocity (m/s)	12.6	13.9	14.5	15.6	13.0	9.2
Temperature (K)	293	293	293	293	293	293
Emission rate (OU_E/s)						
WwTP Scenario 1: Normal Operating Conditions	744	1,176	3,415	8,260	3,069	346
WwTP Scenario 2: Peak Operating Conditions	1,488	2,351	3,415	8,260	6,137	346

Note 1 Emission rates are derived as stated in Section 14.4.2 and Appendix A14.4
Note 2 Stack height refers to height above ground level

14.6.2 Dispersion Modelling Predictions: Proposed Abbotstown Pumping Station

Proposed Abbotstown Pumping Station Odour Control Unit

Model executions were completed to assess the incremental additions to GLCs of odour as a result of emissions from the proposed Abbotstown pumping station to allow comparison of the predictions with the relevant AQS and guidelines which are discussed in Section 14.2.3 and Table 14.2. The models were executed with the emission characteristics as presented above in Section 14.6.1. The modelling predictions are presented in Table 14.28 and Table 14.29, together with the AQS. In each case, the maximum predicted incremental contribution to GLCs is shown in the tables. Projections are presented for each of three stack heights assessed for the worst case meteorological dataset. The projections for all meteorological datasets are presented in Appendix A14.5. Isopleths showing the distribution of predicted GLCs are presented in Figure 14.6 Isopleth showing odour predictions for 98-percentile of 1-hour ground level odour concentration for Proposed Abbotstown PS for Normal Operating Conditions and Figure 14.7 Isopleth showing odour predictions for 98-percentile of 1-hour ground level odour concentration for Proposed Abbotstown PS for Peak Operating Conditions.

Table 14.28: Proposed Abbotstown Pumping Station: Maximum Predicted Ground Level Concentration of Odour

Air Quality Standard		Predicted Ground Level Concentration (OU_E/m^3)	
Scenario 1: Normal Operating Conditions			
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	$1.5OU_E/m^3$	**Stack Height (m)** 9 10 11 12	0.57 0.49 0.46 0.39
Scenario 2: Peak Operating Conditions			
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	$1.5OU_E/m^3$	**Stack Height (m)** 9 10 11 12	0.69 0.59 0.55 0.47

Note: Dublin Airport meteorological data

It is clear from the data presented in Table 14.28 that the predicted ground level odour concentration as a result of the emissions will not exceed the assessment standard of $1.5OU_E/m^3$ for the 98-percentile predictions for stack heights of 9m and 10m. As noted earlier, this is a very conservative assessment criterion and there is therefore confidence that the facility can easily operate within the required performance criteria without causing adverse impacts. Even under peak conditions, the performance standard is achieved.

In accordance with best practice guidance on modelling, the process contribution under peak operation should be no more than two-thirds (66.7%) of the ambient AQS. A stack height of 10m is therefore recommended so that when uncertainties associated with the modelling predictions are considered, the target specification is achieved for all operating scenarios.

The sensitivity of the predictions to the selection of meteorological dataset was also investigated by using meteorological data from Casement Aerodrome. These data show that there is very little difference between the predictions for the two sets of meteorological data, which demonstrates the reliability of the predictions and the lack of sensitivity of the predictions to the meteorological data selection. The complete set of modelling predictions is presented in Appendix A14.5.

Table 14.29: Proposed Abbotstown Pumping Station: Maximum Predicted Ground Level Concentration of Odour

Air Quality Standard	Stack Height (m)	Predicted Ground Level Concentration (OU_E/m^3)	
		Casement Aerodrome 2013	Dublin Airport 2013
APS Scenario 1: Normal Operating Conditions			
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	9 10 11 12	0.61 0.53 0.43 0.47	0.57 0.49 0.46 0.39
APS Scenario 2: Peak Operating Conditions			
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	9 10 11 12	0.83 0.61 0.60 0.60	0.69 0.59 0.55 0.47

Note: Dublin Airport and Casement Aerodrome 2013 meteorological data

Proposed Abbotstown Pumping Station Generator

In the event of a power failure, the generator may be used to maintain operations at the proposed Abbotstown pumping station, and regular use is required to ensure ongoing effective operation. Model executions were completed to assess the incremental additions to GLCs of PM_{10}, $PM_{2.5}$, NO_2, NO_x, SO_2 and CO over specified averaging intervals to allow comparison of the predictions with the relevant AQS and guidelines; a summary of the AQS is presented in Table 14.2, Table 14.3 and Table 14.4. The models were executed with the emission characteristics as presented above in Section 14.6.1. The modelling predictions are presented in Table 14.30 to Table 14.35, together with the AQS. In each case, the maximum predicted incremental contribution to GLCs is shown. The modelling predictions are presented for the maximum potential impact associated with the Proposed Project. Projections are presented for the worst case meteorological dataset. The projections for all meteorological datasets are presented in Appendix A14.5. Isopleths showing the distribution of predicted GLCs are presented in Figure 14.8 Proposed Abbotstown Pumping Station: Isopleth showing predictions for 90.4-percentile of 24-hour GLC of PM_{10} to Figure 14.17 Proposed Abbotstown Pumping Station: Isopleth showing predictions for annual mean of GLC of NO_x for the expected maximum emission rates.

The modelling predictions are discussed in the following sections of this Chapter. The background ambient air quality is considered in Section 14.3.3 of this Chapter. In accordance with the guidance presented in the EPA's AG4 guidance note (EPA 2010), the background concentrations are treated as follows:

- For the assessment of 24-hour and annual mean concentrations, the predicted contribution from the site is added to the average annual background concentration; and
- For the assessment of 1-hour mean concentrations, the predicted contribution from the site is added to twice the average annual background concentration.

Particulate Matter, PM_{10} and $PM_{2.5}$

Emissions from the facility will contribute primarily to airborne particulate concentrations due to the expected particle size and, since this consists primarily of PM_{10}, the impact assessment is based primarily on the assessment criteria for this parameter. The modelling results for airborne particulate concentrations are presented in Table 14.30 for maximum potential emission rates from the facility. The background ambient air quality is considered in Section 14.3.3 of this Chapter. The predicted GLCs as a result of the emissions from the facility combined with the background concentrations are as shown in Table 14.30 alongside the relevant AQS. The data demonstrate that the emissions from the facility will not cause the AQS to be exceeded.

Table 14.30: Proposed Abbotstown Pumping Station Generator: Maximum Predicted Ground Level Concentration of PM_{10}

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
24-hour limit not to be exceeded more than 35 times/year (90.4th percentile)	50µg/m³	16	0.67	16.7
Annual limit	40µg/m³	16	0.16	16.2

Data for $PM_{2.5}$ is also presented using the very conservative assumption that all of the particulates are present as $PM_{2.5}$. This conservative approach will overestimate the significance of the $PM_{2.5}$ emissions. Even so, the data presented in Table 14.31 demonstrate that the emissions from the facility will not cause the AQS to be exceeded.

Table 14.31: Proposed Abbotstown Pumping Station Generators: Maximum Predicted Ground Level Concentration of $PM_{2.5}$

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
Annual limit	25µg/m³	8	0.16	8.2

Note A limit of 20µg/m³ will apply from 2020 and this limit is also complied with.

Isopleths showing the distribution of ground level PM_{10} and $PM_{2.5}$ concentrations as a result of the generator emissions are presented in Figure 14.8 Proposed Abbotstown Pumping Station: Isopleth showing predictions for 90.4-percentile of 24-hour GLC of PM_{10}, Figure 14.9 Proposed Abbotstown Pumping Station: Isopleth showing predictions for annual mean of GLC of PM_{10} and Figure 14.10 Proposed Abbotstown Pumping Station: Isopleth showing predictions for annual mean of GLC of $PM_{2.5}$.

Carbon Monoxide

The modelling results for CO are presented in Table 14.32. The data demonstrate that the emissions from the facility will not cause the AQS to be exceeded. An isopleth showing the distribution of the GLC of CO arising from the emissions is presented in Figure 14.11 Abbotstown Pumping Station: Isopleth showing predictions for 8-hour rolling mean of GLC of CO.

Table 14.32: Proposed Abbotstown Pumping Station Generators: Maximum Predicted Ground Level Concentration of CO

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
8-hour limit	10,000µg/m³	1,060	1.9	1,062

Sulfur Dioxide

The modelling results for SO_2 are presented in Table 14.33 for maximum potential emission rates from the facility. The data presented demonstrate that the emissions from the facility will not cause the AQS to be exceeded. The model has assumed that the facility will operate using diesel which contains very little Sulfur, so the predictions are as expected. Isopleths showing the distribution of ground level SO_2 concentrations as a result of the generator emissions are presented in Figure 14.12 Proposed Abbotstown Pumping Station: Isopleth showing predictions for 99.7-percentile of 1-hour GLC of SO_2, Figure 14.13 Proposed Abbotstown Pumping Station: Isopleth showing predictions for 99.2-percentile of 24-hour GLC of SO_2 and Figure 14.14 Proposed Abbotstown Pumping Station: Isopleth showing predictions for annual mean of GLC of SO_2.

Table 14.33: Proposed Abbotstown Pumping Station Generators: Maximum Predicted Ground Level Concentration of SO_2

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
Hourly limit – not to be exceeded more than 24 times per year (99.7th percentile)	350µg/m³	8	0.23	8.2
Daily limit – not to be exceeded more than 3 times per year (99.2nd percentile)	125µg/m³	4	0.016	4.0
Annual limit	20µg/m³	4	0.001	4.0

Nitrogen Dioxide and Nitrogen Oxides

The modelling results for NO_2 are presented in Table 14.34 and Table 14.35. The data presented demonstrate that the emissions from the facility will not cause the AQS to be exceeded. It is also noted that a conservative modelling approach was adopted with assumptions that most of the NO_x are present as NO_2, so the assessment is based on a worst-case impact assessment scenario. Isopleths showing the distribution of ground level NO_2 and NO_x concentrations as a result of the generator emissions are presented in Figure 14.15 Proposed Abbotstown Pumping Station: Isopleth showing predictions for 99.8-percentile of 1-hour GLC of NO_2, Figure 14.16 Proposed Abbotstown Pumping Station: Isopleth showing predictions for annual mean of GLC of NO_2 and Figure 14.17 Proposed Abbotstown Pumping Station: Isopleth showing predictions for annual mean of GLC of NO_x.

Table 14.34: Proposed Abbotstown Pumping Station Generators: Maximum Predicted Ground Level Concentration of NO_2

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
Hourly limit – not to be exceeded more than 18 times per year (99.8th percentile)	200µg/m³	28	3.9	31.9
Annual limit for protection of human health	40µg/m³	14	0.23	14.2

Table 14.35: Proposed Abbotstown Pumping Station Generators: Maximum Predicted Ground Level Concentration of NO_x

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
Annual limit for protection of vegetation	30µg/m³	23	0.25	23.3

Dubber Odour Control Unit

The modelling predictions are presented in Table 14.36 and Table 14.37, together with the AQS. In each case, the maximum predicted incremental contribution to GLCs is shown. Projections are presented for each of three stack heights assessed for the worst case meteorological dataset. The projections for all meteorological datasets are presented in Appendix A14.5. Isopleths showing the distribution of predicted GLCs are presented in Figure 14.18 Isopleth showing odour predictions for 98-percentile of 1-hour ground level odour concentration Dubber OCU for Normal Operating Conditions to Figure 14.19 Isopleth showing odour predictions for 98-percentile of 1-hour ground level odour concentration Dubber OCU for Peak Operating Conditions.

Table 14.36: Dubber Odour Control Unit: Maximum Predicted Ground Level Concentration of Odour (Dublin Airport Meteorological Data)

Air Quality Standard		Predicted Ground Level Concentration (OU_E/m^3)	
Typical Normal Operating Conditions			
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	$1.5OU_E/m^3$	**Stack Height (m)** 3 4 5 6 7	 1.1 0.74 0.51 0.37 0.37
Peak Operating Conditions			
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	$1.5OU_E/m^3$	**Stack Height (m)** 3 4 5 6 7	 1.5 1.0 0.72 0.52 0.52

Table 14.37: Dubber Odour Control Unit: Maximum Predicted Ground Level Concentration of Odour (Casement Data)

Air Quality Standard		Predicted Ground Level Concentration (OU_E/m^3)	
		Normal Operating Conditions	Peak Operating Conditions
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	$1.5OU_E/m^3$	0.65 (Dublin 0.51)	0.92 (Dublin 0.72)

Note: Casement Aerodrome 2015 meteorological data (Dublin Airport data in brackets)

It is clear from the data presented that the predicted ground level odour concentration as a result of the emissions will not exceed the assessment target of $1.5OU_E/m^3$ for the 98th-percentile predictions for stack heights of 5m and 7m. As noted earlier, this is a very conservative assessment criterion, and there is therefore confidence that the facility can easily operate within the required performance criteria and without causing adverse impact. Even under peak conditions, the performance target is achieved.

In accordance with best practice guidance on modelling, the process contribution under peak operation should be no more than two-thirds (66.7%) of the ambient AQS. A stack height of 5m is therefore recommended so that, when uncertainties associated with the modelling predictions are considered, the target specification is achieved for all operating scenarios.

The sensitivity of the predictions to the selection of meteorological dataset was also investigated by using meteorological data from Casement Aerodrome. These data show that there is very little difference between the predictions for the two sets of meteorological data, which demonstrates the reliability of the predictions and the lack of sensitivity of the predictions to the meteorological data selection.

Predictions for discrete sensitive human receptors are presented in Appendix A14.5 and a summary is presented in Table 14.40. These data demonstrate that emissions associated with the OCU at Dubber will not cause a breach in any AQS or guideline, and will not cause a nuisance as a result of the emissions.

Discrete Sensitive Receptor Impact Predictions

Sensitive human receptors were identified within the study area that are considered representative of the worst case locations where members of the public are likely to be exposed to a potentially significant change in concentrations associated with the Proposed Project. Fifty-two sensitive receptors located near to the elements of the Proposed Project were included in the assessment as detailed in Appendix A14.5. Predictions are presented in Appendix A14.5 for every modelling scenario and meteorological year assessed for the proposed Abbotstown pumping station, Odour Control Unit at Dubber and proposed WwTP. For the proposed Abbotstown pumping station assessment, a summary of the principal findings is presented in Table 14.38. These data clearly demonstrate that emissions associated with the proposed Abbotstown pumping station will not cause a breach in any AQS or guideline.

Operational Phase impacts on sensitive ecological receptors were also considered. As described in Appendix A14.5, 40 discrete receptors in ecologically sensitive areas within the study area were included in the model to evaluate the potential impact. A summary of the predicted concentrations of the relevant pollutant, NO_x, is presented in Table 14.39.

The impact of the emissions is assessed by comparison against the AQS for NO_x for protection of ecosystems and the relevant critical loads for the habitat. Critical levels and critical loads are a quantitative estimate of an exposure of one or more pollutants below which significant harmful effects on specified sensitive environmental receptors do not occur. The critical level for NO_x is 30µg/m^3. There is a screening criterion of 1% increase on a critical load, as being a threshold below which no significant adverse effect is expected to occur (IAQM 2016; UK Environment Agency 2015). The data presented in Table 14.39 show that the predicted impact is several orders of magnitude lower than the critical level, and therefore no adverse ecological impact is predicted. Deposition of nitrogen over the marine habitats was also shown to be significantly lower than the significance threshold, and therefore no adverse impact is predicted.

Table 14.38: Proposed Abbotstown Pumping Station: Summary of Predicted Impact on Discrete Human Receptors

Descriptor	Maximum Predicted Concentration at Receptor for Worst-Case Meteorological Year (µg/m³)									Max (OU_E/m^3)	
	NO_2		SO_2			PM_{10}	PM_{10}	$PM_{2.5}$	CO	Odour (Typical)	Odour (Peak)
	Annual	Max 1-hour	Max 1-hour	Max 24-hour	Annual	Annual	Max 24-hour	Annual	8-hour Rolling Average	Max 1-hour	Max 1-hour
Maximum predicted	0.040	1.869	0.012	0.002	0.000	0.353	0.028	0.35326	0.377	0.418	0.664
Air Quality Standard	40	200	350	125	20	40	41	25	10,000	1.5	1.5
Maximum predicted as a percentage of AQS	0.100%	0.934%	0.003%	0.002%	0.001%	0.883%	0.068%	1.413%	0.004%	41.8%	66.4%

Table 14.39: Summary of Proposed Abbotstown Pumping Station Predicted NO_x Impact on Selected Ecological Sensitive Receptors

Sensitive Location	Max Annual Mean NOx (µg/m^3)				
	2012	2013	2014	2015	2016
Rye Water Valley SAC	0.00009	0.00012	0.0001	0.00009	0.00013
North Bull Island SPA	0.00026	0.00026	0.00024	0.00022	0.00027
South Dublin Bay & Tolka Estuary SPA	0.00029	0.00033	0.00023	0.00022	0.00026
Baldoyle Bay SPA	0.00022	0.00017	0.00021	0.00016	0.00017
Malahide Estuary SPA	0.00016	0.00018	0.00018	0.00018	0.00018
Sensitive Location	**Max Annual Mean NOx, Percentage of Air Quality Standard**				
	2012	**2013**	**2014**	**2015**	**2016**
Rye Water Valley SAC	0.0003%	0.0004%	0.0003%	0.0003%	0.0004%
North Bull Island SPA	0.0009%	0.0009%	0.0008%	0.0007%	0.0009%
South Dublin Bay & Tolka Estuary SPA	0.0010%	0.0011%	0.0008%	0.0007%	0.0009%
Baldoyle Bay SPA	0.0007%	0.0006%	0.0007%	0.0005%	0.0006%
Malahide Estuary SPA	0.0005%	0.0006%	0.0006%	0.0006%	0.0006%

Table 14.40: Dubber Odour Control Unit Summary of Predicted Impacts on Discrete Sensitive Receptors

Descriptor	Max (OU_E/m^3)	
	Odour (Typical)	Odour (Peak)
	Max 1-hour	Max 1-hour
Maximum predicted	0.12	0.17
Air Quality Target	1.5	1.5
Maximum predicted as a percentage of AQS	11.9%	16.8%

Proposed Wastewater Treatment Plant – Combined Heat and Power System

The CHP system will provide power for the facility by utilising the biogas generated in the process; the system can also run on natural gas. There will be no requirement for generators at the facility as all power needs will be satisfied from this source. Model executions were completed to assess the incremental additions to GLCs of odour, PM_{10}, $PM_{2.5}$, NO_2, NO_x, SO_2 and CO over specified averaging intervals to allow comparison of the predictions with the relevant AQS and guidelines; a summary of the AQS is presented in Table 14.2, Table 14.3 and Table 14.4. The models were executed with the emission characteristics as presented above in Section 14.6.1. The modelling predictions are presented in Table 14.41 to Table 14.46 together with the AQS. In each case, the maximum predicted incremental contribution to GLCs is shown, and isopleths showing the distribution of predicted GLCs are presented in Figure 14.20 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for 90.4-percentile of 24-hour GLC of PM_{10} to Figure 14.29 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for annual mean of GLC of NO_x.

The modelling predictions are presented for a 500,000PE design capacity. Further modelling predictions and isopleths for other scenarios are presented in Appendix A14.5. Odour impacts from this source are considered together with the emissions from the remainder of the proposed WwTP.

Particulate Matter, PM_{10} and $PM_{2.5}$

Emissions from the facility will contribute primarily to airborne particulate concentrations due to the expected particle size and, since this consists primarily of PM_{10}, the impact assessment is based primarily on the assessment criteria for this parameter. The modelling results for airborne particulate concentration are presented in Table 14.41 and Table 14.42 for maximum potential emission rates from the facility. The background ambient air quality is considered in Section 14.3.3 of this Chapter. The predicted GLCs as a result of the emissions from the facility combined with the background concentrations are as shown in Table 14.41 and Table 14.42, alongside the relevant AQS. These data demonstrate that the emissions from the facility will not cause AQS to be exceeded.

Data for $PM_{2.5}$ are also presented using the very conservative assumption that all of the particulates are present as $PM_{2.5}$. This conservative approach will overestimate the significance of the $PM_{2.5}$ emissions. Even so, the data presented in Table 14.41 demonstrate that the emissions from the facility will not cause the AQS to be exceeded.

Isopleths showing the distribution of ground level PM_{10} and $PM_{2.5}$ concentrations as a result of the CHP emissions are presented in Figure 14.20 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for 90.4-percentile of 24-hour GLC of PM_{10}, Figure 14.21 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for annual mean of GLC of PM and Figure 14.22 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for annual mean of GLC of $PM_{2.5}$.

Table 14.41: Proposed Wastewater Treatment Plant Combined Heat and Power System: Maximum Predicted Ground Level Concentration of PM_{10}

Air Quality Standard		Background Concentration (µg/m^3)	Predicted Incremental Contribution (µg/m^3)	Predicted Ground Level Concentration Including Background (µg/m^3)
Typical normal operating conditions				
24-hour limit not to be exceeded more than 35 times per year (90.4th percentile)	50µg/m^3	16	0.17	16.2
Annual limit	40µg/m^3	16	0.06	16.1
Peak operating conditions				
24-hour limit not to be exceeded more than 35 times per year (90.4th percentile)	50µg/m^3	16	0.17	16.2
Annual limit	40µg/m^3	16	0.06	16.1

Table 14.42: Proposed Wastewater Treatment Plant Combined Heat and Power System: Maximum Predicted Ground Level Concentration of $PM_{2.5}$

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
Typical Normal Operating Conditions				
Annual limit	25µg/m³	8	0.06	8.1
Peak Operating Conditions				
Annual limit	25µg/m³	8	0.06	8.1

Note: A Limit of 20µg/m3 will apply from 2020 and this limit is also complied with

Carbon Monoxide

The modelling results for CO are presented in Table 14.43. The data demonstrate that the emissions from the facility will not cause the AQS to be exceeded. Isopleths showing the distribution of ground level CO concentrations as a result of the CHP emissions are presented in Figure 14.23 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for 8-hour rolling mean of GLC of CO.

Table 14.43: Proposed Wastewater Treatment Plant Combined Heat and Power System: Maximum Predicted Ground Level Concentration of CO

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
Typical Normal Operating Conditions				
8-hour limit	10,000µg/m³	1,060	73.7	1,134
Peak Operating Conditions				
8-hour limit	10,000µg/m³	1,060	209.7	1,270

Sulfur Dioxide

The modelling results for SO_2 are presented in Table 14.44 for maximum potential emission rates from the facility. The data presented demonstrate that the emissions from the facility will not cause the AQS to be exceeded. Isopleths showing the distribution of ground level SO_2 concentrations as a result of the CHP emissions are presented in Figure 14.24 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for 99.7-percentile of 1-hour GLC of SO_2, Figure 14.25 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for 99.2-percentile of 24-hour GLC of SO_2 and Figure 14.26 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for annual mean of GLC of SO_2.

Table 14.44: Proposed Wastewater Treatment Plant Combined Heat and Power System: Maximum Predicted Ground Level Concentration of SO_2

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
Normal and Peak Operating Conditions				
Hourly limit – not to be exceeded more than 24 times per year (99.7th percentile)	350µg/m³	8	71.0	79.0
Daily limit – not to be exceeded more than 3 times per year (99.2nd percentile)	125µg/m³	4	23.3	27.3
Annual limit	20µg/m³	4	3.3	7.3

Nitrogen Dioxide and Nitrogen Oxides

The modelling results for NO_2 are presented in Table 14.45 and for NO_x in Table 14.46. The data presented demonstrate that the emissions from the facility will not cause the AQS to be exceeded. It is also noted that a conservative modelling approach was adopted with assumptions that most of the nitrogen oxides are present as NO_2, so the assessment is based on a worst-case impact assessment scenario. Isopleths showing the distribution of ground level NO_2 and NO_x concentrations as a result of the CHP emissions are presented in Figure 14.27 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for 99.8-percentile of 1-hour GLC of NO_2, Figure 14.28 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for annual mean of GLC of NO_2 and Figure 14.29 Proposed Wastewater Treatment Plant Combined Heat and Power: Isopleth showing predictions for annual mean of GLC of NO_x.

Table 14.45: Proposed Wastewater Treatment Plant Combined Heat and Power System: Maximum Predicted Ground Level Concentration of NO_2

Air Quality Standard		Background Concentration (µg/m³)	Predicted Incremental Contribution (µg/m³)	Predicted Ground Level Concentration Including Background (µg/m³)
Typical normal operating conditions				
Hourly limit – not to be exceeded more than 18 times per year (99.8th percentile)	200µg/m³	28	24.3	52.3
Annual limit for protection of human health	40µg/m³	14	1.2	15.2
Peak operating conditions				
Hourly limit -– not to be exceeded more than 18 times/year (99.8th percentile)	200µg/m³	28	64.7	92.7
Annual limit for protection of human health	40µg/m³	14	2.6	16.6

Table 14.46: Proposed Wastewater Treatment Plant Combined Heat and Power System: Maximum Predicted Ground Level Concentration of NO_x

Air Quality Standard		Background Concentration (μg/m³)	Predicted Incremental Contribution (μg/m³)	Predicted Ground Level Concentration Including Background (μg/m³)
Typical normal operating conditions				
Annual limit for protection of vegetation	30μg/m³	23	2.6	25.6
Peak operating conditions				
Annual limit for protection of vegetation	30μg/m³	23	4.1	27.1

Proposed Wastewater Treatment Plant Odour Assessment

All of the potential emission sources at the facility are fully enclosed in buildings and/or covered, which limits the potential for release of odours. The emissions are contained and captured at each source and vented to odour abatement systems as discussed in Section 14.4.

Emissions to atmosphere from the OCUs at the proposed WwTP and from the CHP system were modelled for typical normal and peak operating conditions. The odour modelling results are presented in Table 14.47 and isopleths showing modelling predictions are presented in Figure 14.30 Isopleth showing odour predictions for 98-percentile of 1-hour ground level odour concentration: Proposed Wastewater Treatment Plant, Normal Operating Conditions and Figure 14.31 Isopleth showing odour predictions for 98-percentile of 1-hour ground level odour concentration: Proposed Wastewater Treatment Plant, Normal Peak Conditions. Further modelling predictions and isopleths for other scenarios are presented in Appendix A14.5.

Table 14.47: Proposed Wastewater Treatment Plant Combined Heat and Power System: Maximum Predicted Ground Level Concentration of Odour

Air Quality Target		Predicted Ground Level Concentration (OU_E/m^3)	
		Dublin Airport	Casement
Typical Normal Operating Conditions			
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	1.5OU_E/m^3	0.40	0.35
Peak Operating Conditions			
1-hour limit not to be exceeded more than 176 hours per year 98th percentile	1.5OU_E/m^3	0.63	0.48

The data presented in Table 14.47 show that the predicted ground level odour concentration as a result of the emissions will not exceed the assessment target of 1.5OU_E/m^3 for the 98th percentile predictions. This is a very conservative assessment criterion, and there is therefore confidence that the facility can easily operate within the required performance criteria without causing adverse impact. Even under peak conditions associated with storm events, the performance standard is achieved. Stack heights were optimised in this assessment so that when uncertainties associated with the modelling predictions are considered, the target specification is achieved for all operating scenarios. Isopleths for the 98th percentile one-hour GLCs are presented in Figure 14.30 Isopleth showing odour predictions for 98-percentile of 1-hour ground level odour concentration: Proposed Wastewater Treatment Plant, Normal Operating Conditions and Figure 14.31 Isopleth showing odour predictions for 98-percentile of 1-hour ground level odour concentration: Proposed Wastewater Treatment Plant, Normal Peak Conditions. The isopleths show that the highest predicted concentrations are experienced close to the site boundary as expected and that the odour will be undetectable at the closest receptors to the facility.

The modelling predictions presented in this Chapter have focused on the comparison of impact predictions with AQS which are designed for the protection of human health and ecosystems. A further issue to be considered is the potential for odour nuisance as a result of the emissions from the facility. This potential is considered by examining the 1-hour GLC of H_2S as a result of the emissions from the facility. All of the odour sources are fully enclosed, so only the emissions from the OCUs and the CHP system are considered in this element of the assessment.

The 98th percentile of 1-hour GLC of H_2S was modelled and is shown in Table 14.48. The 98th percentile is the maximum concentration level for 98% of the time, or 8,584 hours in a year; so this level is reached or exceeded for just 2% of the time or for 176 hours per year. The modelling predictions are evaluated by comparing the 98th percentile of the one-hour GLC to the odour threshold for H_2S (0.7µg/m^3, *Odour Threshold Determinations of 53 Odorant Chemicals* (Leonardos et al. 1969)). The assessment has shown that odour attributable to the H_2S emissions is not detectable beyond the site boundary for the scenarios modelled.

Table 14.48: Predicted Ground Level Concentration of H_2S Resulting from Combined Heat and Power System Emissions

Air Quality Indicator	Odour Threshold((µg/m^3)	Predicted 98 percentile of 1-hour Ground Level Concentration (µg/m^3)
Normal Operating Conditions	0.7	0.33
Peak Operating Conditions	0.7	0.63

Discrete Sensitive Receptor Impact Predictions

Fifty-two sensitive receptors located near the elements of the Proposed Project were included in the assessment as detailed in Appendix A14.5. Predictions are presented in Appendix A14.5 and a summary of the principal findings is presented in Table 14.49. These data clearly demonstrate that emissions associated with the operation of the proposed WwTP will not cause a breach in any AQS or guideline.

Operational impacts on sensitive ecological receptors were also considered. As described in Appendix A14.5, 40 discrete receptors in ecologically sensitive areas within the study area were included in the model to evaluate the potential impact. A summary of the predicted concentrations of the relevant pollutant, NO_x, is presented in Table 14.50. The data show that the predicted impact is several orders of magnitude lower than the critical level, and therefore no adverse ecological impact is predicted. Deposition of nitrogen over the marine habitats was also shown to be significantly lower than the significance threshold, and therefore no adverse impact is predicted.

Table 14.49: Proposed Wastewater Treatment Plant Summary of Predicted Air Quality Impacts on Discrete Human Sensitive Receptors

Descriptor	Maximum Predicted Concentration at Receptor for Worst-Case Meteorological Year, Peak Operating Conditions (µg/m³)									Max (OU_E/m^3)	
	NO_2		SO_2			PM_{10}	PM_{10}	$PM_{2.5}$	CO	Odour (Typical)	Odour (Peak)
	Annual	Max 1-hour	Max 1-hour	Max 24-hour	Annual	Annual	Max 24-hour	Annual	8-hour Rolling Average	Max 1-hour	Max 1-hour
Maximum predicted	1.281	55.140	71.973	9.005	1.547	0.023	0.131	0.02251	89.526	0.51	0.76
Air Quality Standard	40	200	350	125	20	40	41	25	10,000	1.5	1.5
Maximum predicted as a percentage of AQS	3.204%	27.570%	20.564%	7.204%	7.737%	0.056%	0.319%	0.090%	0.895%	51.3%	76.3%

Table 14.50: Proposed Wastewater Treatment Plant Summary of Predicted NO_x Impact on Selected Ecological Sensitive Receptors

Sensitive Location	Max Annual Mean NOx (µg/m³)				
	2012	2013	2014	2015	2016
Rye Water Valley SAC	0.003	0.005	0.003	0.003	0.004
North Bull Island SPA	0.026	0.026	0.024	0.025	0.025
South Dublin Bay & Tolka Estuary SPA	0.010	0.012	0.012	0.018	0.014
Baldoyle Bay SPA	0.063	0.072	0.048	0.048	0.054
Malahide Estuary SPA	0.027	0.031	0.035	0.030	0.038
Sensitive Location	**Max Annual Mean NOx, Percentage of Air Quality Standard**				
	2012	**2013**	**2014**	**2015**	**2016**
Rye Water Valley SAC	0.009%	0.016%	0.010%	0.011%	0.014%
North Bull Island SPA	0.088%	0.086%	0.081%	0.084%	0.082%
South Dublin Bay & Tolka Estuary SPA	0.035%	0.039%	0.041%	0.059%	0.045%
Baldoyle Bay SPA	0.210%	0.241%	0.162%	0.159%	0.180%
Malahide Estuary SPA	0.090%	0.103%	0.118%	0.100%	0.126%

14.6.3 Operational Phase Traffic Impacts

Traffic generated during the operation of the Proposed Project will be related to the sludge removal from the proposed WwTP and the staff travelling to and from the proposed WwTP and Abbotstown pumping station. Due to the very low staff numbers for the proposed Abbotstown pumping station, the traffic impacts will be negligible compared with the existing background traffic. Therefore, Operational Phase air quality impacts associated with traffic for the proposed Abbotstown pumping station will be Imperceptible. Staff numbers for the proposed WwTP are more significant than the proposed Abbotstown pumping station, but the change in traffic relative to the existing background, adjusted for future growth, is relatively small. Since the number of vehicle movements associated with the Operational Phase is low, the magnitude of the emissions is also low as determined using vehicle emission factors for NO_x and PM_{10} derived from the Defra Emission Factor Toolkit (Version 7.0).

The air quality impacts of Operational Phase traffic on pollutant concentrations are assessed in accordance with the IAQM's *Land-Use Planning and Development Control* (IAQM 2017). The significance of the impact of the proposed Project is assessed at each receptor, and is based on the percentage contribution of the absolute pollutant concentration and magnitude of change (between the existing and proposed scenarios) to the Air Quality Assessment Level (AQAL). The AQAL is the AQS for each pollutant. Specific criteria are used to determine significance relating to the percentage contribution of the absolute pollutant concentration to the AQAL. Table 14.51 provides the criteria required to define a significant impact.

Table 14.51: Magnitude of Change Criteria

Annual Average Concentration at Receptor in Assessment Year	Percentage Change in Concentration Relative to Air Quality Assessment Level (AQAL)			
	1%	2% to 5%	6% to 10%	>10%
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76% to 94% of AQAL	Negligible	Slight	Moderate	Moderate
95% to 102% of AQAL	Slight	Moderate	Moderate	Substantial
103% to 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

The existing annual average concentration of NO_2 and PM_{10} is <75% of the AQS, and the predicted change in concentrations of both substances is in the range 2% to 5%. Using this methodology, the potential impact of the proposed WwTP Operational Phase traffic emissions on air quality is assessed as Negligible for both NO_2 and PM_{10}, the principal emissions associated with traffic.

14.6.4 Sensitivity Analyses

The sensitivity of the modelling predictions to varying input data was tested to evaluate the robustness of the modelling assumptions. A discussion of the principal findings of this sensitivity analyses is presented here, and further information is presented in Appendix A14.5.

Meteorological Data

Data from Dublin Airport was used as the primary dataset in this assessment. Given the close proximity of Dublin Airport to all of the Proposed Project sites of interest, it is considered that the data are a reliable indicator of meteorological conditions at the Proposed Project sites. The robustness of the assessment was strengthened by using five years of recent data (2012 to 2016) for the sensitivity assessment. Details are presented in this Chapter of the worst-case year, and the additional data acquired for all of the other years are presented in Appendix A14.5. There was very little variation noted between the datasets used in the study, but a conservative approach was adopted by using the worst-case dataset, as evidenced by the high predictions reported in this Chapter.

A further sensitivity check was performed by running data from Casement Aerodrome in Baldonnell through the model. Results for the proposed Abbotstown pumping station, Dubber OCU and the proposed WwTP sources are presented in the relevant sections of this Chapter, and all data checks are summarised in Appendix A14.5. There was no significant difference between the predictions for the two alternative datasets.

Stack Height

Stack height is a particularly important variable in this assessment. Details of the effect of stack height on the dispersion of emissions from the proposed Abbotstown pumping station OCU is presented in this Chapter, and the optimum stack height was selected for the proposed Abbotstown pumping station from the assessments. Further details are included in Appendix A14.5.

Stack height for the CHP system and the Odour Control Units at the proposed WwTP is also a very important variable. Some of the buildings and tanks at the proposed WwTP are large and tall and therefore may exert significant influences on the dispersion of emissions from sources within specified distances. The results presented in this Chapter are those for the final selection of the optimum stack height for each source. Appendix A14.5 contains details of assessments of varying stack heights for all of the main emission sources which led to the selection of the optimum dispersion arrangements.

Terrain

Although terrain in the immediate vicinity of all three of the Proposed Project sites assessed is simple, and guidance does not recommend that terrain be considered, the sensitivity of the modelling predictions to terrain was tested by using digitised terrain data in the assessment. The detailed results are presented in Appendix A14.5 and demonstrate that there is very little difference between the predictions with and without terrain data applied.

Exit Velocity

The sensitivity of the predictions for release of odour from the various Odour Control Units at each of the sites was investigated. In general terms, more effective dispersion and lower predictions are associated with higher exit velocities, but a stage is reached where there is very little difference in the predictions. The general approach has been to choose a stack configuration which leads to a minimum of 8m/s exit velocity as this is an effective dispersion velocity for odour in general. The results of the study are presented in Appendix A14.5.

Modelling Uncertainty

The inherent uncertainty in dispersion modelling is approximately 50%. As a general rule, it is recommended that the predicted contribution to GLCs from the activity should not exceed approximately 67% of the AQS. This approach was considered in all of the assessments undertaken here, and where appropriate, higher stack heights were recommended to allow this criterion to be satisfied.

Variable Operating Conditions

The potential impact of variable emission rates associated with the emission sources was also considered. For the proposed Abbotstown pumping station, the Normal Operating Conditions for the diesel generator will be to run the generator for a maximum of one week every month. A sensitivity run was executed to test the significance of continuous operation of the generator. Table A14.5.7 in Appendix A14.5 shows that, even if the generator runs 100% of the time at peak emissions, the predictions demonstrate that all AQS will be complied with. Continuous operation at peak emission rates for all of the OCUs at the proposed Abbotstown pumping station, Dubber and the proposed WwTP were also evaluated as shown in Appendix A14.5. Even for this very unlikely scenario, compliance with the relevant AQS and guidelines has been demonstrated.

The potential impact of the covers on the aeration tanks and final settlement tanks was also investigated. The model was executed without covers on these tanks for various operating scenarios that included partial and full covers as well as the application of odour abatement and the omission of odour abatement. The results of the assessment demonstrated that the predicted odour level at the site boundary would not exceed $1.0OU_E/m^3$ even if these scenarios were considered. This demonstrates the robustness of the general approach that has been adopted for the assessment and lends confidence to the conclusions that the proposals can be executed without causing an odour nuisance at the site boundary.

The general findings of the sensitivity analyses are that, where necessary, the dispersion arrangements were optimised so that the effect of further variations on input data were insignificant. For all other elements investigated, there was very little difference between the predictions using the different datasets.

14.6.5 Climate Impact Assessment

The operation of biological WwTPs results in direct emissions of GHGs such as CO_2, CH_4 and N_2O, as well as indirect emissions of CO_2 resulting from energy generation to run the plant. The N_2O emitted is generated by nitrification and denitrification processes used to remove nitrogenous compounds from wastewater, and most of the CO_2 and CH_4, is generated as a result of the sludge processes with some dissolved CH_4 potentially present in the wastewater throughout the treatment stages. The most significant contributions to GHG emissions are CH_4 and CO_2.

The amount of GHG emissions from wastewater treatment is determined from the PE in the area. One estimate of the annual wastewater emissions derived using the Intergovernmental Panel on Climate Change (IPCC) Guidelines (IPPC 2006) and *Developing CO_2 Baselines* (Codema 2017) is 23kg CO_{2eq} / PE / annum. This figure essentially remains the same for all potential proposed WwTP configurations until the detailed design features and opportunities for minimisation are considered.

There are three possible ways to reduce GHG emissions from the proposed WwTP: minimisation through design, treatment of the gas streams, and prevention and minimisation of the emissions by optimising the operating conditions. The treatment of the gas streams containing the GHGs is not considered a sustainable option due to limitations in current technologies, so the opportunities for minimising GHG emissions from wastewater treatment are focused on optimisation of design and operations processes. This has been considered in the overall design and discussion of the alternatives considered is presented in Chapter 4 Description of the Proposed Project in Volume 2 Part A of this EIAR.

The CO_2 released due to energy usage is directly reduced by enhancing the energy efficiency of the proposed WwTP. In this respect, the selection of a system to utilise gas produced in the process is the optimum strategy. In order to maximise the amount of CH_4 captured and utilised in the CHP, fugitive emissions will be minimised by ensuring effective containment through design. N_2O and CO_2 emissions can be minimised by good control of the operational conditions of the activated sludge system, and N_2O emissions will depend mainly on the operational conditions (and O_2 concentrations) of the reactor systems. The proposed design considers these factors and contributes to the overall objective of minimising GHG emissions.

14.7 'Do Nothing' Impact

For all of the sites studied, if the Proposed Project does not proceed there will be no significant change in air quality at the various locations. Traffic is a dominant influence on air quality in many of the areas as discussed in Section 14.3, and if the Proposed Project does not proceed, this will continue to be the case.

14.8 Mitigation Measures and Monitoring

The preliminary design of the proposed Abbotstown pumping station and the proposed WwTP has incorporated several mitigation measures to minimise the impact of the Proposed Project. These include the following measures:

- All buildings at the proposed Abbotstown pumping station will be fully enclosed to contain all process activities;
- All gases at the proposed Abbotstown pumping station will be contained and treated in Odour Control Units;
- Stack height will be optimised for all emission sources to ensure that AQS are met;
- All tanks and structures will be covered at the proposed WwTP;

- Layout of the site of the proposed WwTP in Clonshagh has been optimised to promote effective dispersion of emissions;
- All activities in buildings at the proposed WwTP, including sludge intake in the SHC, will be fully enclosed;
- Odours at the proposed WwTP will be contained at source and will be treated in Odour Control Units; and
- Two-stage and three-stage Odour Control Units will be used, where necessary.

The Construction Phase of the Proposed Project will be carefully managed and a Dust Management Plan will be formulated to ensure that construction activities are managed to minimise dust emissions associated with construction activities. In order to mitigate against air quality effects at receptors during the Construction Phase, Best Practice Measures will be adopted. These measures will include techniques such as those outlined in the IAQM's (2014a) *Guidance on the Assessment of Dust from Demolition and Construction*.

The appointed contractor(s) will be required to produce an Air Quality and Dust Management Plan as part of their CEMP, including Best Practice Measures to control dust and, in particular, measures to prevent dust nuisance. The principal objective of the Air Quality and Dust Management Plan will be to ensure that dust emissions do not cause significant nuisance at receptors near the Proposed Project. The Air Quality and Dust Management Plan will include measures such as enclosure of material stockpiles, hard surfacing of heavily used areas, and covering of vehicles carrying spoil. Measures specific to maintaining AQS are presented in the following sections.

Site Planning

The design of the construction programme, the location and layout of the proposed temporary construction compounds and the storage of materials will be carefully planned to ensure that air quality impacts are minimised. The following is a summary of the main mitigation measures which will be employed in order to minimise emissions from the activity and the associated impacts of such emissions:

- Activities with potential for significant emissions will be located as far as possible from the nearest residential receptors;
- The areas of the proposed WwTP and Abbotstown pumping station sites which vehicles will be travelling on will be hard-surfaced, thus significantly reducing the potential for dust emissions from the vehicles;
- Proposed temporary construction compound areas will have hard standing areas to minimise dust generation from windblow;
- In order to minimise the potential for wind-generated emissions from material storage bays, these bays will be oriented away from the dominant wind direction;
- A training programme will be implemented for all contract staff to ensure that the objectives of the CEMP and the Air Quality and Dust Management Plan are fully understood;
- Fixed and mobile water sprays will be used to control dust emissions from material stockpiles and road and yard surfaces as necessary in dry and/or windy weather;
- A daily inspection programme will be formulated and implemented in order to ensure that dust control measures are being operated and managed effectively; and
- A dust deposition monitoring programme will be implemented during the Construction Phase in order to verify the continued compliance with relevant standards and limits.

Construction Traffic

Construction Phase traffic should be managed to ensure that air quality impacts associated with such traffic are minimised. In particular, the following will be observed:

- All vehicles will switch off engines when not active;
- Effective vehicle cleaning and specific wheel-washing will be undertaken on leaving site, and damping down of haul routes, where there is potential for carrying dust or mud off the Proposed Project site, will be in place;
- All loads entering and leaving Proposed Project sites will be covered;
- On-road vehicles must comply with set emission standards;
- Movement of construction traffic around Proposed Project sites will be minimised;
- Maximum speed limits of 5mph on unsurfaced haul routes and work areas, and 10mph on surfaced haul routes and work areas, will be enforced; and
- Haul routes will be inspected for integrity and the surfaces maintained to minimise the potential for dust emissions.

Site Activities

Site activities will be managed to ensure that dust impacts are minimised. Control measures include the following:

- All dust control equipment will be maintained in good condition and maintenance activities will be recorded;
- Water will be used as dust suppressant where applicable;
- Double handling of material will be avoided wherever reasonably practicable;
- Loaded bins and skips will be covered or enclosed;
- Drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment will be minimised, and fine water sprays will be used on such equipment, wherever appropriate;
- Mixing of cement, grout and other similar materials will take place in enclosed areas remote from Proposed Project site boundaries and potential receptors;
- Slopes on stockpiles will be no steeper than the natural angle of repose of the material and a smooth profile will be maintained;
- Stockpiles will be located away from sensitive receptors as far as practicable;
- Bulk cement and other fine powder materials will be delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- Any runoff water from dust suppression activities will be disposed of in accordance with the legal requirements.

Odour abatement systems will be designed to ensure that the odour emissions do not reach a level that could cause odour nuisance at or outside the Proposed Project site boundary. A list of abatement system options with proven effectiveness in the treatment of odours for the proposed WwTP and proposed Abbotstown pumping station is presented in Appendix A14.6 in Volume 3 Part B of this EIAR together with discussion of likely options for this facility.

While the facility will not be formally regulated by the EPA, the same rigorous controls that would be applied by the EPA if an EPA Licence were in place, and which would be considered best practice, will be implemented at the facility. In particular, the performance of the Odour Control Units will be monitored during a comprehensive Process

Proving Phase at commissioning and at regular intervals throughout the lifetime of the facility. Continuous monitors will be installed which monitor key elements of performance for the abatement systems, such as H_2S levels in the exit gases. Independent performance checks will be carried out by an ISO17025 accredited testing laboratory at quarterly intervals during the first two years of operation to verify the effectiveness of control measures and ongoing compliance with the required performance standards.

The most important factor that allows for verification of performance, and acts as a check on the effectiveness of the procedures and controls in place, is the odour emission rate from the abatement systems at the facility, which has been determined from the dispersion model to not cause odour nuisance at the site boundary. This level has been determined in the assessment reported here. During operation, measurements on the odour level in the outlets from the abatement systems will be carried out to ensure that the performance of the odour abatement systems meets the design specifications and ensures that odour is not detectable at nuisance levels beyond the site boundary.

14.9 Residual Impacts

The proposed mitigation measures have been shown to be effective in the management of air quality and odour impacts associated with the Proposed Project. Construction will be managed so that there are no residual air quality impacts after completion. The comprehensive mitigation and management proposals for the proposed Abbotstown pumping station and the proposed WwTP will ensure that there are no significant residual impacts. A summary of predicted residual impacts is presented in Table 14.52.

Table 14.52: Summary of Predicted Residual Impacts

Construction Phase	Impact Significance	Residual Significance
Abbotstown Pumping Station: Excavation Dust emissions	Slight	Not Significant
Abbotstown Pumping Station: Construction dust emissions	Slight	Not Significant
Abbotstown Pumping Station: Construction traffic emissions	Slight	Not Significant
WwTP: Soil Stripping Dust Emissions	Moderate	Not Significant
WwTP: Excavations Dust Emissions	Slight	Not Significant
WwTP: Concrete pours Dust Emissions	Slight	Not Significant
WwTP: Landscaping & finishing Dust Emissions	Slight	Not Significant
WwTP: Construction Traffic Dust Emissions	Moderate	Not Significant
Operational Phase		
No significant Operational Phase impacts predicted		

14.10 Difficulties Encountered in Compiling Required Information

There were no specific difficulties encountered when carrying out this assessment.

14.11 References

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