Limerick WWTP Upgrade and Regional Bioresource Centre

Appendix 7.1 - Dispersion Model Report

June 2026

Formerly JB Barry Partners who became part of Egis in 2023

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ASSESSMENT OF AIR QUALITY IMPACTS OF A PROPOSED DEVELOPMENT AT LIMERICK WASTE WATER TREATMENT PLANT

FOR

EGIS ON BEHALF OF UISCE EIREANN

TMS Environment Ltd.

28 May 2026

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Contents

1.0 INTRODUCTION AND SCOPE

This report deals with an assessment of the impacts on air quality of a proposed upgrade to the Limerick Wastewater Treatment Plant (WWTP). Particular attention is focused on ensuring that ground level odour problems do not arise as a result of the operation of the facility.

The report was commissioned by Egis for Uisce Eireann in relation to proposed upgrade works at the WWTP. The following background information was considered in the assessment.

- Details of the proposed works;
- Site layout details;
- Emissions characterisation data;

The Proposed Development will cater for future population growth and industrial development in the area, in line with population projections for Limerick as set out in the National Planning Framework (NPF) Implementation Roadmap and the Southern Region Regional Economic Spatial Strategy (RSES). It will provide 20% Headroom allowance, in line with Uisce Éireann guidelines for large urban settlements. It will also ensure the WWTP continues to comply with requirements of the EPA Wastewater Discharge License (WWDL), Urban Wastewater Treatment Regulations (UWWTR) and other relevant Uisce Éireann Guidelines.

The initial upgrade works will cater for the +10-year growth projections, increasing to 285,000 PE including a future industrial committed load of 27,500 PE. There will be provision made in the civil infrastructural development of the plant (tank sizing and pipework) for the +25-year growth projections of 325,000 PE.

2.0 METHODOLOGY

2.1 Study area

The location of the proposed project, the subject of this assessment report, is illustrated in Figure 2.1 Site Location. Air quality impacts on receptors which could potentially be affected by the proposed project are considered in this report. The study area for the Operational Phase air quality assessment includes receptors that could be affected by the proposed project. The study area was determined using professional judgement and from a consideration of the potential impacts on receptors located near the site. The area covers an area of approximately 4km^2. Although potential impacts are not significant across the entire study area, the assessment considers all of these areas in order to demonstrate that receptors will not be

adversely affected by the emissions to atmosphere from the Proposed Project. Sensitive Receptors specifically included in the study are shown in Figure 2.2 and in Table 2.1.

Figure 2.1 Site Location and study area for assessment

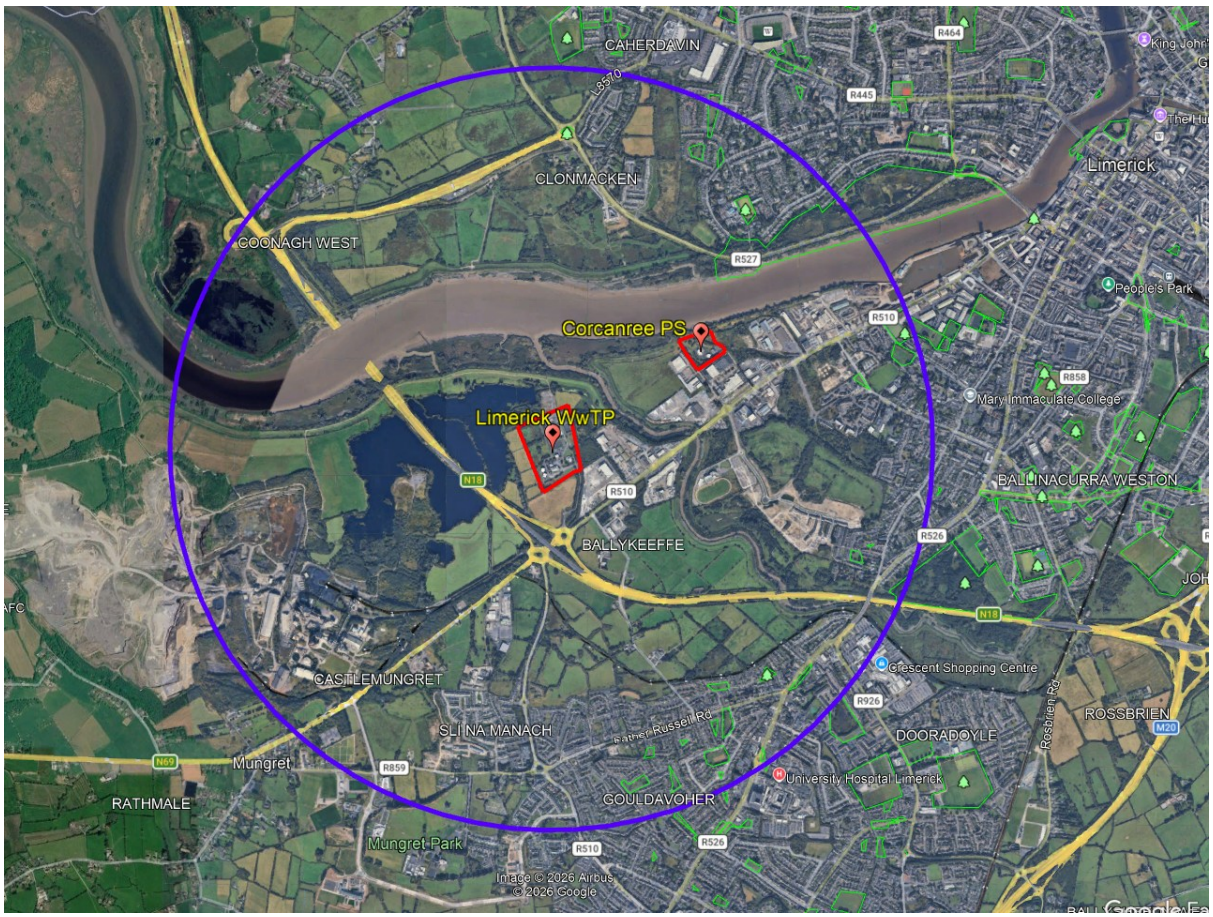


Figure 2.2 Sensitive Receptors included in the assessment

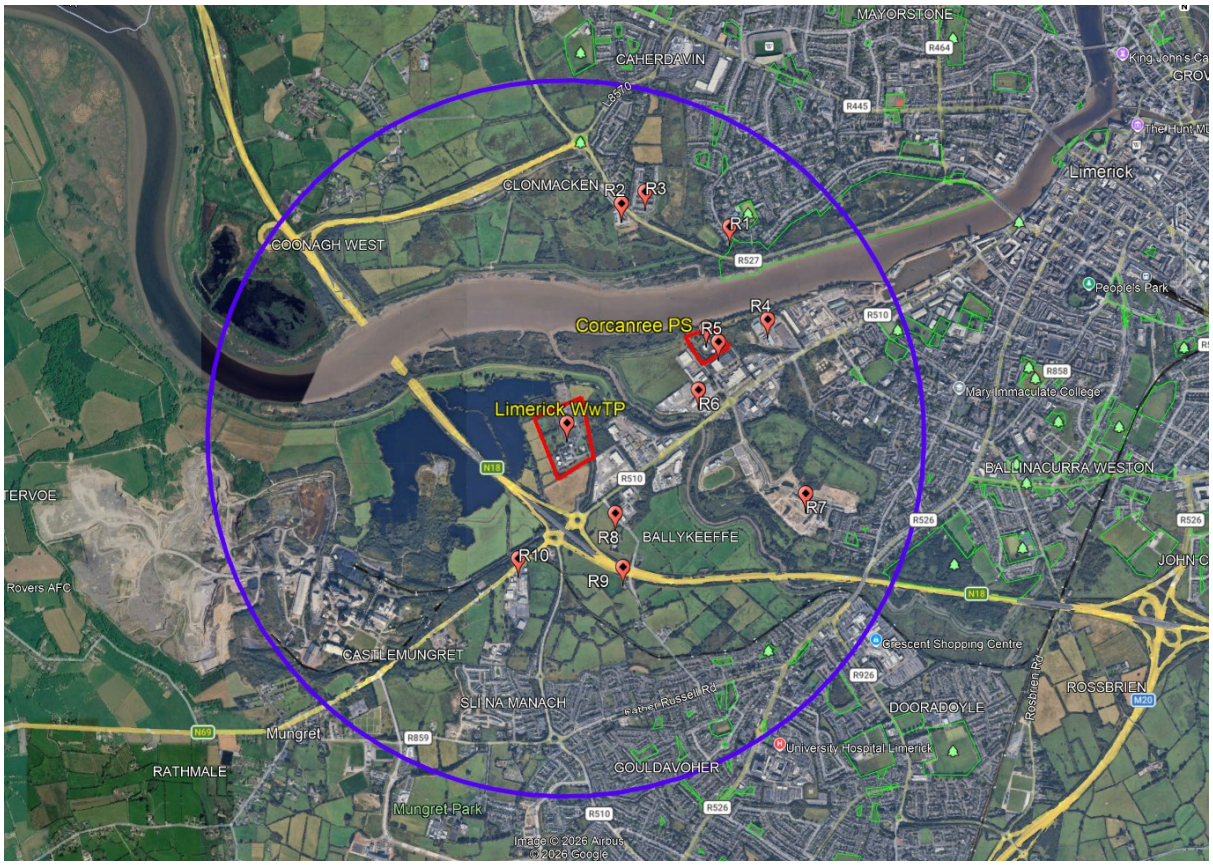


Table 2.1 Sensitive Receptors

Sensitive Receptors	**Location**
R1	52.660138º -8.657474°
R2	52.661303° -8.666420°
R3	52.661896° -8.664465°
R4	52.655489° -8.654329°
R5	52.654370° -8.658403°
R6	52.651954° -8.660050°
R7	52.646755° -8.651193°
R8	52.645766° -8.666934°
R9	52.643074° -8.666306°
R10	52.643489° -8.674952°

2.2 Impact assessment methodology

The potential air quality 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 2.3. The assessment of impact significance is based on a comparison of predicted impacts with Air Quality Standards (AQS) and guidelines, and consideration of the magnitude and duration of the potential impact.

Odour impacts are possible during some elements of work in the Operational Phase. The Institute of Air Quality Management (IAQM 2014, updated 2018) *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'.

When impacts are assessed as being significant, a quantitative dispersion modelling assessment is undertaken to evaluate the significance of the impacts.

2.3 Impact assessment criteria

As noted in section 2.2, the assessment of impact is based on a comparison of the dispersion modelling predictions with Air Quality Standards (AQS) or guidelines. 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 (2020) 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. The EPA Guidance recommends that these limits should be applied at the most sensitive receptors located near the facility.

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 applicable in Ireland that the target performance specification for the 98th percentile of one-hour average concentration should be 1.5OU_E/m^3 for the most offensive sources and 3OU_E/m^3 for the remaining sources at the WWTP. The target is set at the boundary, thereby ensuring that there is no odour nuisance to receptors beyond this point as well as at sensitive receptors. The target for the combined impact of all odour sources is 3OU_E/m^3 for the 98th percentile of one-hour average concentration at sensitive receptors close to the facility. It is noted that the Irish EPA Guidance applies at the worst-case affected receptors and application of the assessment criterion at the site boundaries is more conservative and affords even more protection to the local receptors.

It is clear from the foregoing discussion that various different approaches have been adopted in different guidance for the assessment of odour impact. In accordance with Irish EPA Guidance, it is recommended in consultation with the client that the appropriate assessment standards are as follows:

- The target performance specification for the combined effect of all odour sources is $3OU_E/m^3$ for the 98th percentile of one-hour average concentration at sensitive receptors close to the facility.
- The target performance specification to prevent nuisance at the site boundary is $3OU_E/m^3$ for the 98th percentile of one-hour average concentration applied at and beyond the site boundary.

3.0 DISPERSION MODELLING METHODOLOGY

3.1 Scope of Modelling Study

The scope of the modelling study included prediction of the impact on ambient air quality of odour emissions from the facility. This involved computation of predicted incremental contributions to ground level concentrations of odour over one-hour averaging intervals as a result of emissions from the facility.

3.2 Model Selection

Computerised mathematical dispersion models are used to predict the incremental additions to ground level concentrations of relevant criteria pollutants as a result of emissions from a given development. AG4 (The Environmental Protection Agency Guidance Note on Dispersion Modelling, 2020) gives guidance on the use of Dispersion Models which was followed in the execution of this study. A detailed modeling assessment was undertaken using the US EPA Model AERMOD Prime using the current regulatory version of this 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 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 in the vicinity of the plant.

3.3 Dispersion Modelling Protocol

3.3.1 Model Input Data

Evaluation of the impact of the proposed development on air quality using dispersion modelling requires information on the following:

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

Information on each of these was obtained from a combination of sources as set out in the following sections of this report.

3.3.2 Emissions Characteristics

The existing WWTP operates as a conventional activated sludge plant and the PS is a conventional pumping station with foul pumps to pump forward to the WWTP. The Proposed Development is primarily intended to increase capacity and the main elements of the Proposed Development are summarised below.

Wastewater Treatment Capacity Upgrade

- Construct a new inlet works and aerobic granular sludge (AGS) process stream to operate in parallel with the existing conventional activated sludge (CAS).
- Split flows from Corcanree PS between the existing and new process streams.
- Retain Mungret pumping arrangement through existing CAS streams.
- Retrofit the existing process stream to increase capacity.

Stormwater Storage (Corcanree PS)

- Construct new 12,500 m3 stormwater storage tank with gravity overflow to existing Corcanree outfall chamber.
- Upgrade existing foul pumps to increase pumping capacity to the WWTP (< 1,100 l/s per rising main).

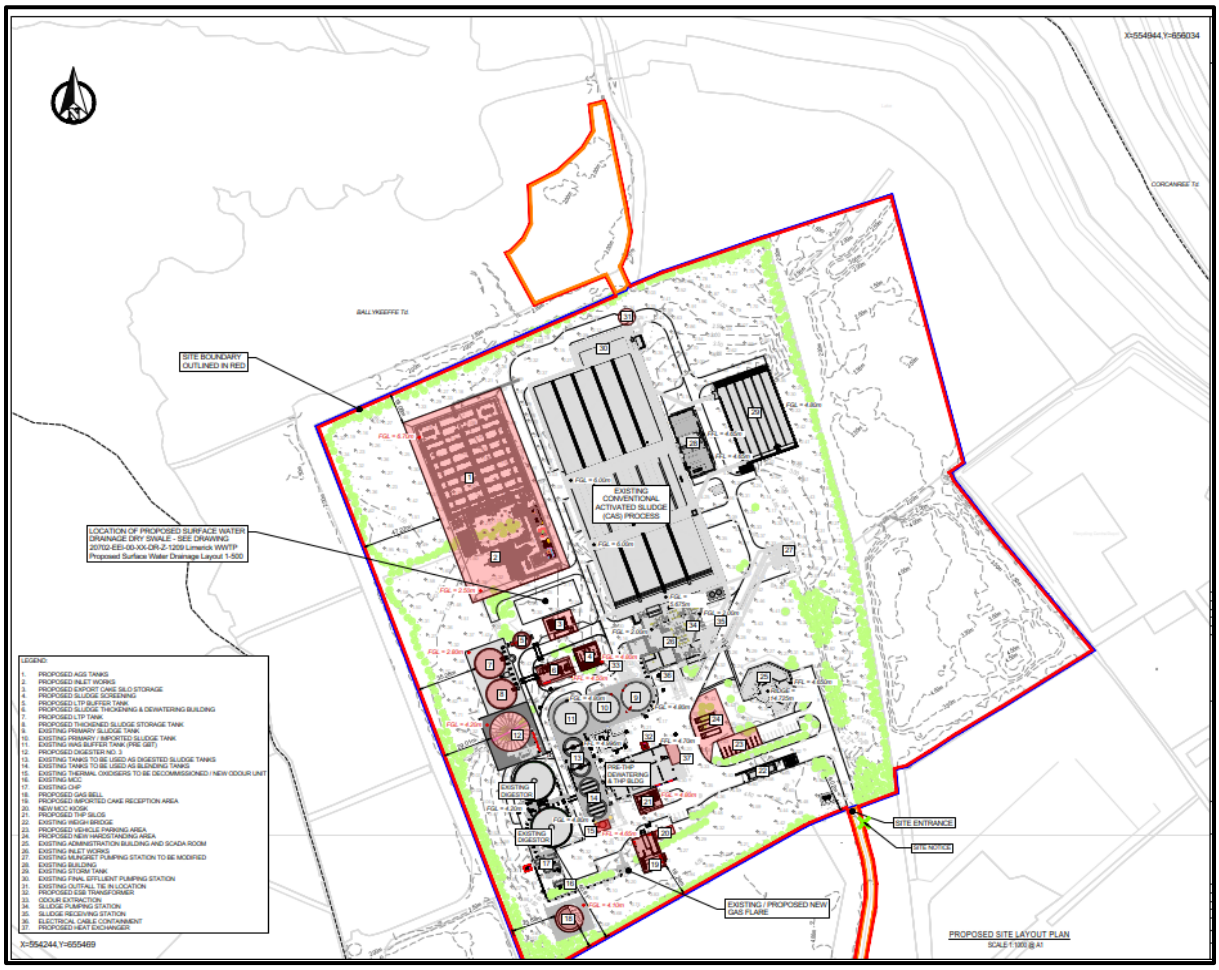
Regional Bioresource Centre

- Upgrade existing imported sludge reception facility.

- Installation of new dewatered sludge cake reception facility.
- New mechanical thickening system and associated polymer dosing
- Retain & refurbish existing 2. No digester feed tanks as pre-THP dewatering feed tanks.
- Upgrade mixing system & transfer pumps for pre-THP dewatering blend tank.
- New odour control system to cater for overall Bioresource Centre installation.
- New dewatering and storage installation for pre-THP dewatering and cake imports.
- New Thermal Hydrolysis Process (THP) with capacity of 50 TDS/day.
- Options for introduction of new AD tank to allow operational flexibility.
- Construct new Biogas production process and storage bell.
- Combined Heat and Power Engine (CHP) Biomethane production options.
- New digested sludge tank adjacent to existing digesters.
- New digested sludge dewatering.
- Export storage silo installation adjacent to dewatering facility.
- New centrate return PS located adjacent to digested sludge dewatering installation.
- Upgraded wash water system with added UV treatment/consider expanded new system designed for full regional BC associated demands only.

An extract from the frozen design drawing showing the proposed layout is presented in Figure 3.1 with the new / upgraded elements shown in red alongside the existing activities. This extract is reproduced to illustrate the location and scale of the new elements of the WWTP alongside the existing structures and process.

Figure 3.1 Proposed site layout showing new elements in red



Reproduced from Egis Drawing Ref 20702-JBB-00-XX-DR-Z-1202

Information on dimensions and physical characteristics of the main emission source was obtained from the Client and the Design Team. Information on emission characteristics was obtained from a consideration of the nature and scale of the processes that will be carried out at the plant, from experience with other facilities and from information provided by the client. Emission characteristics predicted for the emission sources are summarised in Table 3.1 to Table 3.4.

The plant is expected to operate continuously and therefore this has been modelled in the assessment. The worst possible emissions scenario is one where the maximum permissible emission rates from the plant occur, but it is not expected that the maximum emissions would occur continuously. For the purposes of modelling, however, the maximum possible emission values were used. It is likely, therefore, that the ground level concentrations of pollutants

predicted by the model are significantly overestimated. This is considered a prudent approach given the number and proximity of sensitive receptors in the area.

Table 3.1 Potential Sources of Odour Emissions to Atmosphere

Emissions source	Potential emissions
Existing Inlet works	Odour; H_2S, ammonia, organic substances
Existing CAS Tank	Odour; H_2S, ammonia, organic substances
Existing Final Effluent Pumping Station	Odour; H_2S, ammonia, organic substances
Existing SBR Tank	Odour; H_2S, ammonia, organic substances
Existing Storm Tank	Odour; H_2S, ammonia, organic substances
Existing Thickened sludge storage tank	Odour; H_2S, ammonia, organic substances
Existing primary sludge tank	Odour; H_2S, ammonia, organic substances
Existing imported sludge tank	Odour; H_2S, ammonia, organic substances
Existing WAS Buffer tank	Odour; H_2S, ammonia, organic substances
Existing Digestor Tank x 2	Odour; H_2S, ammonia, organic substances
Existing Pre-THP dewatering and THP building	Odour; H_2S, ammonia, organic substances
Existing Primary Sludge Tank	Odour; H_2S, ammonia, organic substances
Existing Imported Sludge Tank	Odour; H_2S, ammonia, organic substances
Existing WAS Buffer Tank (pre-GBT)	Odour; H_2S, ammonia, organic substances
2 (No) Existing tanks to be used as Digested Sludge Tanks	Odour; H_2S, ammonia, organic substances
2 (No) Existing tanks to be used as Digester Feed Blending Tanks	Odour; H_2S, ammonia, organic substances
Proposed new AGS Tanks	Odour; H_2S, ammonia, organic substances
Proposed new Inlet Works	Odour; H_2S, ammonia, organic substances
Proposed new Liquids Import Reception	Odour; H_2S, ammonia, organic substances
Proposed Cake Silo storage	Odour; H_2S, ammonia, organic substances
Proposed WAS, Poly dosing, digested sludge dewatering	Odour; H_2S, ammonia, organic substances
Proposed LPT Tank	Odour; H_2S, ammonia, organic substances
Proposed LPT Buffer Tank	Odour; H_2S, ammonia, organic substances
Proposed thickened sludge storage tank (post GBT pre-THP thickening)	Odour; H_2S, ammonia, organic substances
Potential future Gas Storage Bell	Odour; H_2S, ammonia, organic substances
Proposed new Odour Control Unit	Odour; H_2S, ammonia, organic substances
Proposed New CHP	Odour; H_2S, ammonia, organic substances
Proposed imported cake reception area	Odour; H_2S, ammonia, organic substances
Proposed pre-THP silos	Odour; H_2S, ammonia, organic substances

Table 3.2 Characteristics of emissions from the existing WWTP activities

Process Unit	Odour Emission ($OU/m^2/s$)	Hydrogen Sulphide Emission ($\mu g/m^2/s$)
Screen	200 (1)	60
Screenings	150 (2)	
Grease trap	1000 (2)	
Grease from grease trap	4200 (2)	
Grit channel	560 (2)	
Sand from grit chamber	180 (2)	
Channel to PST	250 (1)	75
PST including weirs	76 (1)	23
Distributor to aeration tank	1000 (1)	300
Activated sludge FBDA	40 (1)	0.6
Activated sludge surface aeration	100 (1)	1.5
Final tank	3 (1)	0.1
Tertiary biological treatment	27 (1)	0.4
Quiescent raw sludge tank/lagoon	160 (1)	120
Primary sludge thickener	970 (2)	
Stabilised sludge thickener	140 (2)	
Stabilised sludge, dewatered	450 (2)	
Raw sludge tank, some disturbance	1400 (1)	1100
SAS tank	3 (1)	0
Digested sludge tank	280 (1)	210
Sludge cake	80 (1)	24

1) UKWIR: Odour Control in Wastewater Treatment: A Technical Reference Document. Report Refer No.: 01/ww/13/3. 2001.

2) Prediction of odorous emissions' in Odours in Wastewater Treatment, measurement modelling control ed R. Stuetz and F-B Frechen, IWA Publishing, 2001 ISBN 1 900222 46 9 page 210.

Reproduced from Egis Report *Odour Abatement System Requirements Limerick (Bunlicky) WWTP Interim Sludge Upgrade, April 2025*

Table 3.3 Characteristics of emissions from the existing WWTP

Minimum

Parameter	Diameter	Surface Area	Height	Roof Height	Tank Empty Volume	Total Tank Empty Volume	ACH^{-1}	Air Extraction Rate	Odour Release Rate	Total Odour Release Rate	Odour Concentration	H_2S inlet concentration	Desired Concentration	Required Reduction
Unit	m	m^2	m	m	m^3	m^3		m^3/hr	$OU/s/m^2$	OU/hr	OU/m^3	ppm	OU/m^3	%
Transfer Sludge PS	4.00	12.57	3.00	0.00	37.70	37.70	12.00	452.39	1400	63334508	140000	70.00		
Imported Sludge Storage Tank 1	17.06	228.64	6.22	3.20	1422.13	1665.94	2.00	3331.88	160	131695896	39526	19.76		
Imported Sludge Storage Tank 2	17.06	228.64	6.22	3.20	1422.13	1665.94	2.00	3331.88	160	131695896	39526	19.76		
WAS Tank	19.62	302.46	6.22	3.62	1881.29	2246.25	1.00	2246.25	5	5444242	2424	1.21		
Total								9362.39		332170542	35479	17.74	500.00	98.6%

Peak

Parameter	Diameter	Surface Area	Height	Roof Height	Tank Empty Volume	Total Tank Empty Volume	ACH^{-1}	Air Extraction Rate	Odour Release Rate	Total Odour Release Rate	Odour Concentration	H_2S inlet concentration	Desired Concentration	Required Reduction
Unit	m	m^2	m	m	m^3	m^3		m^3/hr	$OU/s/m^2$	OU/hr	OU/m^3	ppm	OU/m^3	%
Transfer Sludge PS	4.00	12.57	3.00	0.00	37.70	37.70	12.00	452.39	1400	63334508	140000	70.00		
Imported Sludge Storage Tank 1	17.06	228.64	6.22	3.20	1422.13	1665.94	2.00	3331.88	1400	1152339086	345853	172.93		
Imported Sludge Storage Tank 2	17.06	228.64	6.22	3.20	1422.13	1665.94	2.00	3331.88	1400	1152339086	345853	172.93		
WAS Tank	19.62	302.46	6.22	3.62	1881.29	2246.25	1.00	2246.25	50	54442424	24237	12.12		
Total								9362.39		2422455105	258743	129.37	500.00	99.8%

Reproduced from Egis Report *Odour Abatement System Requirements Limerick (Bunlicky) WWTP Interim Sludge Upgrade, April 2025*

Table 3.4 Predicted odour emission rates from the proposed WWTP

Emissions source	Odour emission rate OU_E/m^2-sec
Inlet works	11
Preliminary treatment	20
Primary treatment	2
Activated Sludge Plant	2
Final settlement tanks	2
Sludge Treatment	90
Digesters	90
Dewatering and drying	12
THP	500 OU_E/m^3
Sludge plant and OCU	500 OU_E/m^3

3.3.3 Site Layout and Topography

The layout and area of the site and the dimensions of the various plant items on site were taken from the drawings of the site. Topographical information was obtained from a site survey and from Ordnance Survey of Ireland maps. Building downwash effects might be expected as a result of the proximity of the plant items on site to the Odour Control System stack, so these effects were modelled using the modelling facility, BPIP, which is part of the AERMOD modelling suite.

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 Agency Guidance Note AG4, suggests 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 is not required because there are no terrain features greater than 10% of the effective stack height within 5km of the site. However, terrain data was included as part of the sensitivity analysis for the proposed project which tested the sensitivity of the projections to varying input approaches and datasets.

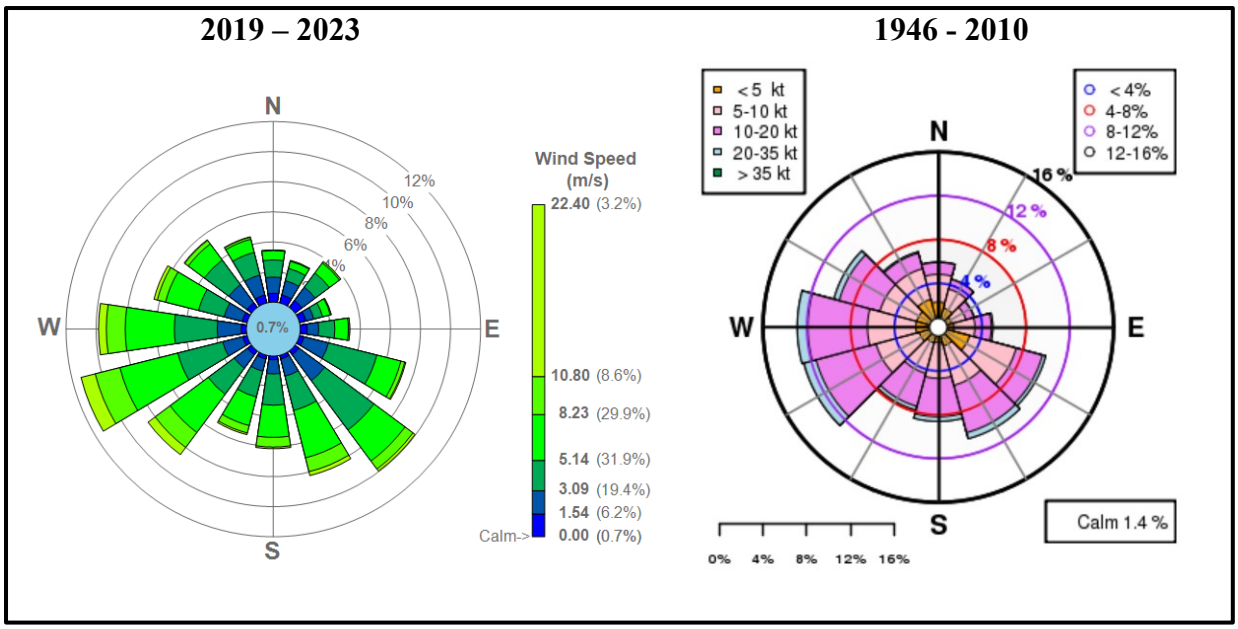
3.3.4 Climatological Data

The magnitude of potential impacts of emissions from the proposed development will be substantially influenced by the local meteorological conditions, in particular by wind speed and direction and also by precipitation rates.

Comprehensive monitoring data is available for Shannon Airport which is located approximately ca 19km NW of where the WWTP is located. For the purpose of obtaining reliable information about the climatological conditions at the site of the proposed development, meteorological data for the period 2019 - 2023 recorded at Shannon Airport was analysed. This data was selected for use in the dispersion modelling study for the facility. This is considered an appropriate data set for the study because of the close proximity of the station to the site and the similarity in topography in the immediate area and at the site of the proposed development. Comprehensive data for Cork Airport (located 70km south) are also available and were considered for the purpose of testing the sensitivity of the modelling predictions to the input meteorological data.

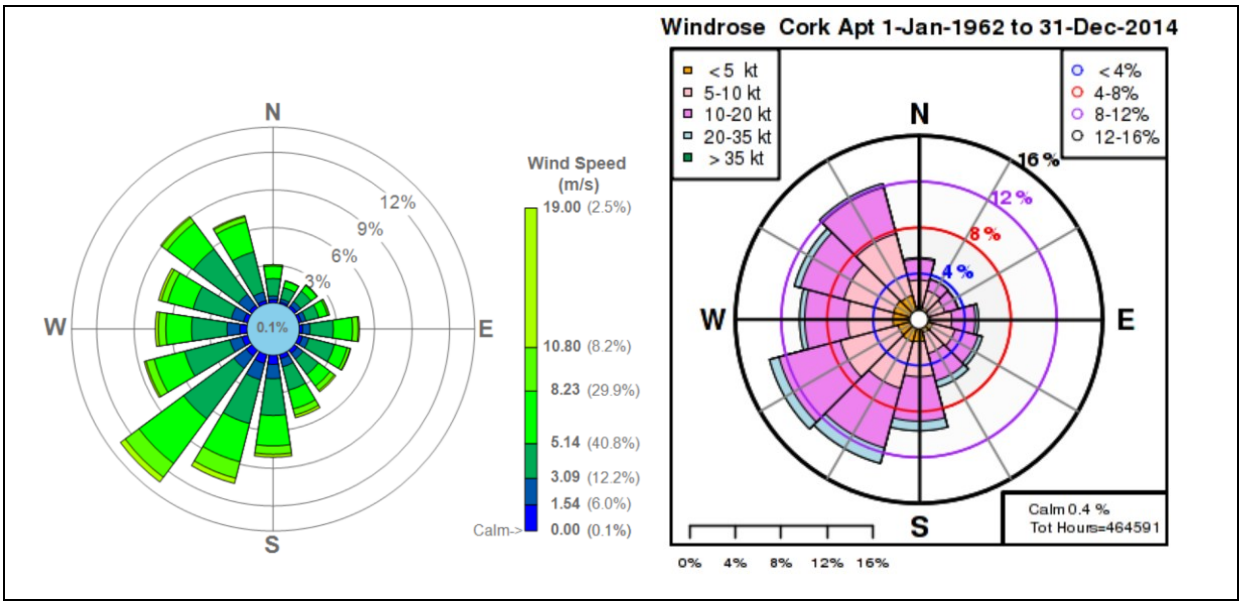
The windrose for Shannon is presented in Figure 3.2 for the years 2019 – 2023 together with the long term average windrose for 1946 – 2010. The dominant wind direction for Shannon is from the southwest quadrant with wind blowing from this quadrant for more than 40% of the time. The average long-term wind speed over the period 1991 to 2020 is 4.7m/s.

Figure 3.2 Windrose for Shannon Airport



Analysis of the monitoring data from the meteorological station at Cork Airport for the periods 2019 – 2023 shows that the dominant wind direction is from the S-SW-W quadrant, with in excess of 45% of wind directions in this quadrant, and wind from the W-NW-N quadrant for approximately 23%. The long term wind direction pattern is shown in the Windrose in Figure 3.2 and the windrose for 2019 – 2023 is also presented in Figure 3.3.

Figure 3.3 Windroses for Cork Airport, 2019 -2023 and 1961 to 2014



3.3.5 Averaging Intervals

The dispersion model was used to predict the incremental additions to ground level concentrations of odour and hydrogen sulfide emitted from the plant over defined averaging periods. These averaging periods were chosen to allow direct comparison of predicted ground level concentrations with the relevant assessment criteria as outlined in Section 3.2. In particular, 1-hour average ground level concentrations (GLCs) of odour were calculated at various distances from the site; percentiles of these average GLCs were also computed for comparison with the relevant Air Quality Standards.

3.3.6 Receptor Locations

Since the impact of the emissions can be observed at distances from the emission sources, an inner 2km x 2km grid with 20m spacing, and a 2km x 2km grid was constructed with receptors placed at 100m intervals to assess the extent of dispersion of emissions from the facility. In

line with expectations, the highest predicted ground level concentrations occur at the receptors closer to the source.

Ten (No.) discrete sensitive receptors were modelled to predict the air quality impacts that could arise as a result of the odour emissions from the Proposed Development. Human sensitive receptors were included in the assessment. Receptor Grids centred on the study area set at 20m to 100m intervals at a distance of up to 2km from the site were also modelled for the purpose of this assessment.

Key sensitive human receptors were identified within the study area that are considered representative of the worst case locations where members of the public could potentially be affected by the emissions from the Proposed Development. These locations include residential, commercial and industrial properties. The locations of selected worst case sensitive receptors are shown in Figure 2.2. 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 Development on sensitive ecological receptors were screened out of the assessment as odour is not a specific impact on ecological receptors.

3.4 Background ambient air quality

The site is located in a busy commercial and industrial area in Limerick. To the south and west is agricultural land. The dominant influences on air quality in the area are emissions from industrial facilities, agriculture, and traffic. Background odour monitoring is not possible for odour so no consideration is afforded to background levels in the modelling assessment.

4.0 DISPERSION MODELLING PREDICTIONS

Model executions were completed to assess the incremental additions to ground level concentrations of odour over one-hour averaging intervals to allow comparison of the predictions with the relevant Air Quality Standards. The model was executed for various emission scenarios to evaluate the potential impact of the development.

The modelling predictions (using meteorological data for 2019 – 2023 from Shannon Airport) are presented in Table 4.1 and in Table 4.2. The maximum predicted incremental contribution to ground level concentrations is shown in the Tables for each year modelled and for the worst

case meteorological year. Modelling results are presented for the predicted combined impact of all emission sources operating simultaneously.

Representative isopleths showing the distribution of emissions of substances from the odour sources at the plant are shown in Figure 4.1 to show the output from the model in a map format for odour. Results are also presented for the worst case affected receptors in the vicinity of the proposed site since the AG4 Guidance requires that this is included. The receptor locations are shown in Figure 2.2 and the Receptor predictions are presented in Table 4.2.

Table 4.1 Dispersion modelling predictions for odour beyond site boundary

Odour source	**98-%ile 1-hour GLC, OU_E/m^3**					**Standard 98-%ile 1-hour GLC, OU_E/m^3**
	2019	**2020**	**2021**	**2022**	**2023**	
All odour sources	0.86	0.51	0.62	0.63	0.62	3

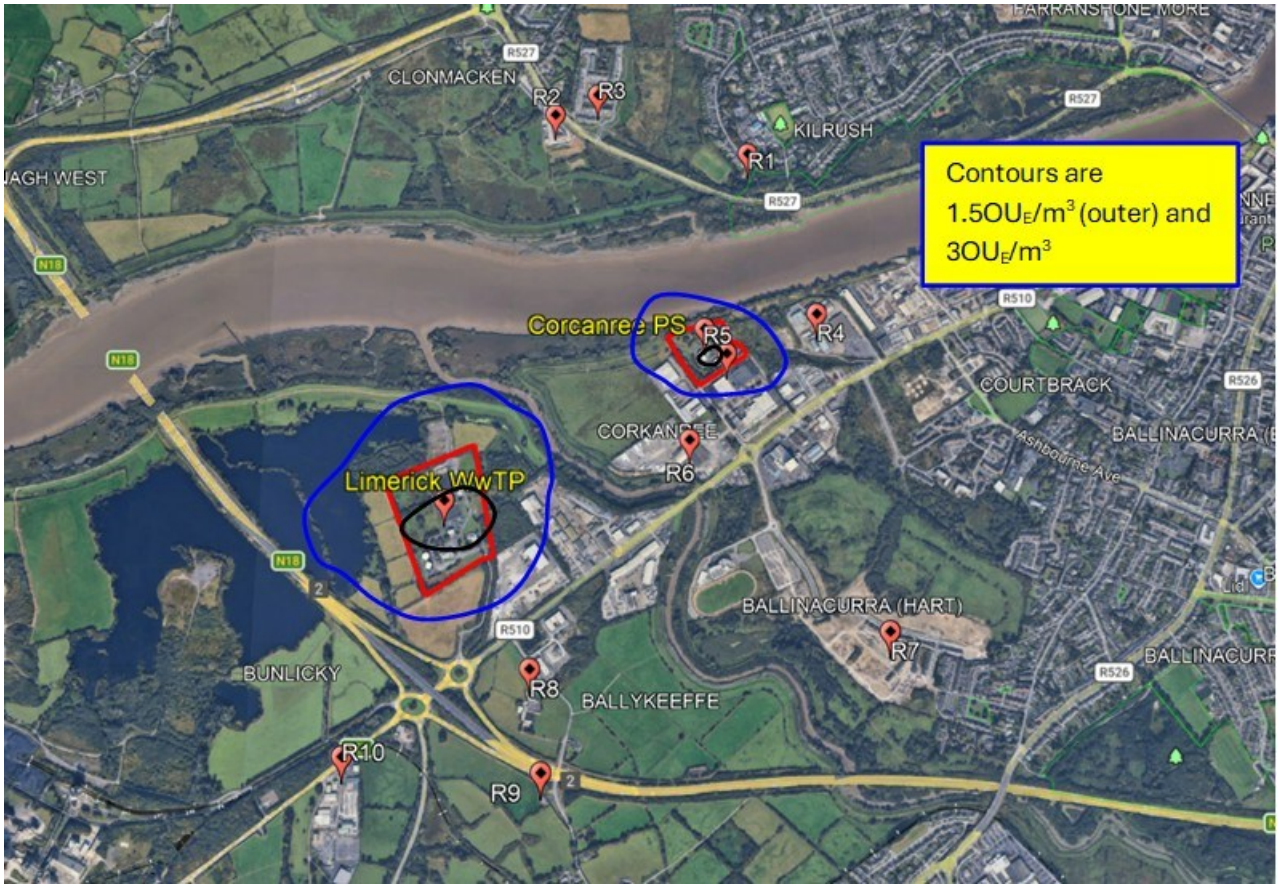
Note

1. The target odour standard is applied at sensitive receptors near the facility in accordance with EPA Guidance.
2. The target to prevent nuisance at the site boundary is $3OU_E/m^3$ for the 98th percentile of one-hour average concentration to be applied at the site boundary.

Table 4.2 Dispersion modelling predictions for odour at worst-case sensitive receptors

Odour source	All Odour Sources				
Sensitive Receptors	**98-%ile 1-hour GLC, OU_E/m^3**				
	2019	**2020**	**2021**	**2022**	**2023**
R1	0.15	0.05	0.05	0.04	0.05
R2	0.15	0.05	0.05	0.04	0.05
R3	0.14	0.05	0.05	0.04	0.05
R4	0.28	0.20	0.20	0.20	0.18
R5	0.34	0.25	0.25	0.27	0.24
R6	0.38	0.28	0.25	0.28	0.3
R7	0.34	0.25	0.25	0.27	0.24
R8	0.15	0.06	0.07	0.06	0.05
R9	0.13	0.04	0.04	0.04	0.04
R10	0.11	0.02	0.03	0.02	0.03

Figure 4.1a Isopleth showing the maximum predicted ground level concentration of odour arising from plant emissions, expressed as the 98th percentile of the 1-hour GLC



5.0 EVALUATION OF THE IMPACT OF THE DEVELOPMENT

The maximum potential emission rates of odour from the facility were modelled as a worst-case emissions scenario assuming that all sources operate continuously and emissions are at the maximum continuously. Since this is an improbable scenario it represents a worst-case assessment scenario.

The data presented in Table 4.1 and Table 4.2 represent the maximum potential ground level concentrations of odour expressed as the 98-percentile of 1-hour ground level concentrations for each of the modelled scenarios. The graphical representations of the data are presented in Figure 4.1. When the predictions are compared with the appropriate performance standard of 3.0 OU_E/m^3 for the combined impact of all emission sources, the model has demonstrated that the predicted concentrations are below the assessment criterion levels. This indicates that in accordance with the relevant Guidance that odour nuisance will not occur as a result of the emissions.

The highest values are found at the northeast site boundary of the WWTP which is consistent with expectations since the dominant wind direction is towards these locations.

Since the maximum potential emission rates will not be routinely or continuously attained, it is possible that this assessment over-estimates the ground level concentrations of pollutants.

6.0 SENSITIVITY ANALYSIS

6.1 Sensitivity to meteorological data set

The dispersion modeling predictions presented in Section 4 and 5 were obtained using meteorological data for Shannon Airport for 2019 to 2023. In order to test the sensitivity of the predictions to the meteorological data selection, meteorological data for Cork Airport for 2019 to 2023 was also used in the Model. The predictions are shown in Table 6.1. The predictions demonstrate that there is a little difference in the predictions using the different meteorological data sets. Once again, the predicted concentrations do not approach or exceed the Air Quality Standards for odour.

Table 6.1 Dispersion modelling predictions for odour beyond site boundary (worst case Sensitive Receptor)

Odour source	98-%ile 1-hour GLC, OU_E/m^3		Standard 98-%ile 1-hour GLC, OU_E/m^3
	Shannon Airport 2019 - 2023	Cork Airport 2019 - 2023	
Anywhere outside site boundary	0.86	0.86	3
Worst-affected sensitive receptor	0.38 (R6)	0.35 (R6)	3

6.2 Sensitivity to odour control system flow rate

In addition to modelling the emissions at full flow the EPA Guidance Note AG4 advises that studies of this type should also investigate the effect of changing the volume flow from maximum operation to average (or 75% of maximum) operation for point emission sources. This approach is recommended in order to ensure that the assessment is robust and considers the maximum potential impact of the emissions on ground level air quality. Therefore a model run was executed to determine the influence on ambient air quality of operating at 75% of maximum flow for the OCU. The results of those assessments are presented in Table 6.2. The predicted ground level concentrations do not approach or exceed the Air Quality Standards and the predictions are similar to those for the 100% flow scenario.

Table 6.2 Dispersion modelling predictions for odour beyond site boundary

Odour source	98-%ile 1-hour GLC, OU_E/m^3		Standard 98-%ile 1-hour GLC, OU_E/m^3
	Full Flow Rate	75% Flow Rate	
Anywhere outside site boundary	0.86	0.92	3
Worst-affected sensitive receptor	0.38 (R6)	0.35 (R6)	3

7.0 CONCLUSIONS

A comprehensive evaluation of the potential impact of emissions from the WWTP on ambient air quality has been completed. The main assessment criteria used were selected from the Environmental Protection Agency Guidance Note AG4 on Dispersion Modelling as applied in Ireland.

The assessment was completed using the worst possible estimated emission rates of pollutants in order to assess the maximum potential impact on ambient air quality. Since the model scenario is based on the maximum emissions from the plant, it is likely that the predicted ground level concentrations of pollutants are overestimated. The results for each scenario show that the required performance standard will be achieved with no odour nuisance at sensitive receptors in the vicinity of the plant or anywhere beyond the site boundary.

Sensitivity checks were carried out with the use of meteorological data from Cork Airport and for 75% of the maximum emission flow rate. In each sensitivity check, the predicted ground level concentrations of odour do not exceed the air quality standard and no adverse impact on air quality will occur.

Ireland

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