**Quinn Estates**

# Beeston Waste Water Treatment Works

# Odour Assessment

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| Revision | Date | Notes | Author | Checked | Approved |
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**Entran Limited**
**2nd & 3rd Floors**
**Northgate house**
**Upper Borough Walls**
**Bath**
**BA1 1RG**

**T: 0117 937 4077**
**www.entranltd.co.uk**

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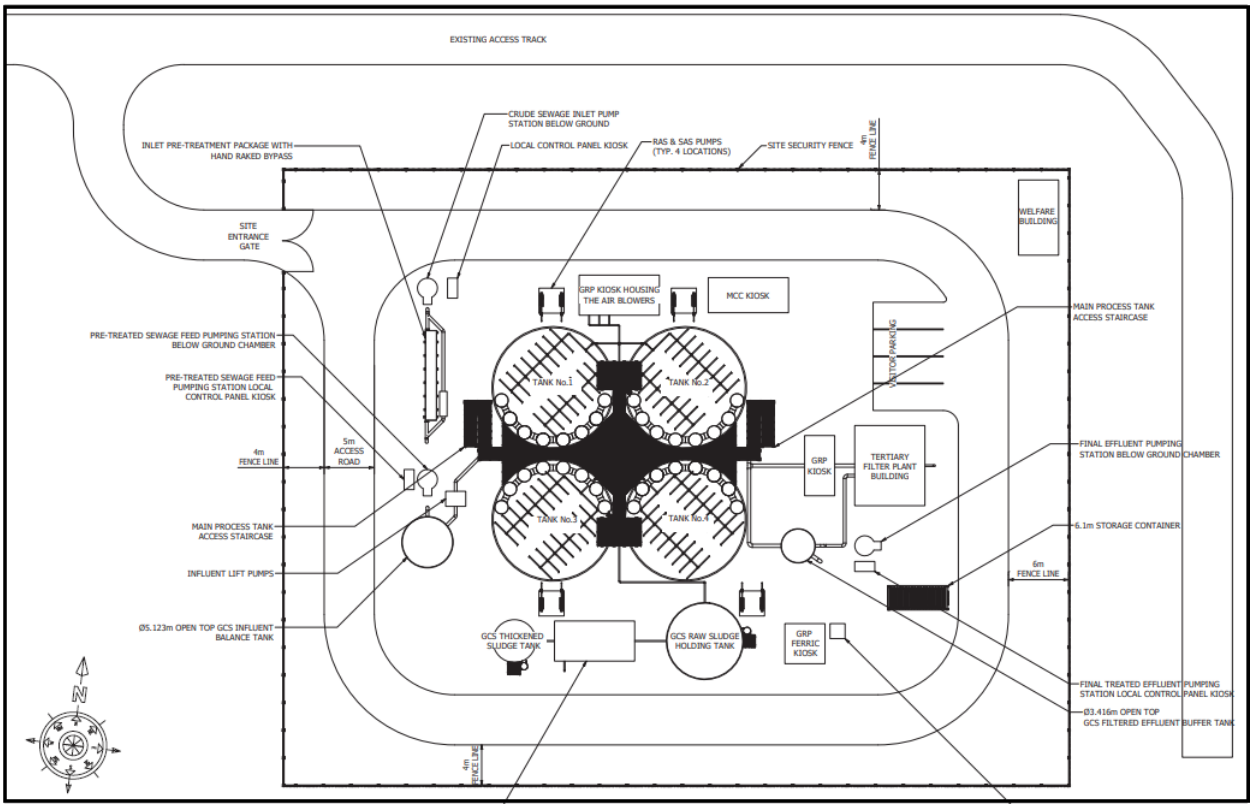
# 1 INTRODUCTION

1.1 Entran Limited have been commissioned to undertake an assessment of the likely odour impacts arising from a proposed Waste Water Treatment Works (WWTW). The Site location and layout are identified in Figures 1.1 and 1.2 respectively.

1.2 This report presents the findings of an assessment to determine the impact of the proposed facility on odour at sensitive receptors in the surrounding area.

**Figure 1.1: Site Location**

## Figure 1.2: Site Layout



## 2 LEGISLATION AND POLICY

### Environmental Protection Act 1990

2.1 Section 79 of the Environmental Protection Act 1990 provides the following definitions of a statutory nuisance relevant to odour:

- Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases from premises so as to be prejudicial to health or a nuisance.

2.2 Following this, Section 80 states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

2.3 In the context of the proposed facility, the main potential sources of odour will be from the raw effluent and the sludge tanks during processing.

### Broadland District Council, Norwich and South Norfolk Council Joint Core Strategy[1]

2.4 The Joint Core Strategy for Broadland, Norwich and South Norfolk was adopted in March 2011 and amended in Jan 2014. It does not include any policies specific to odour.

### H4 Odour Management[2]

2.5 The Environment Agency have published technical guidance for the assessment of odour issues. This guidance, which is referred to in this report as H4 provides benchmarks against which predicted odour concentrations can be assessed. Details of the odour benchmarks are provided in **Appendix A**.

[1] Greater Norwich Development Partnership. Joint Core Strategy for Broadland, Norwich and South Norfolk. (Adopted March 2011, amendments adopted January 2014)

[2] Environment Agency. H4 Odour Management. How to comply with your environmental permit.

**IAQM Guidance on the Assessment of Odour for Planning[3]**

2.6 The IAQM published guidance in 2018 to provide guidance on the assessment of odour impacts for planning purposes. It provides background information relating to the requirements for odour impact assessments and suitable assessment criteria and draws from other sources of information such as that described in EPR H4 horizontal odour guidance.

2.7 It includes guidance on the determination of significance of odour effects taking into account the sensitivity of the receptors in the surrounding area and the nature (unpleasantness) of the odour and provides methodologies appropriate for assessing both fugitive and non-fugitive emissions. Advice provided in this guidance has been used within this assessment.

[3] Institute of Air Quality Management (IAQM). Guidance on the assessment of odour for planning. V1.1 (July 2018)

## 3 METHODOLOGY

### Scope of Assessment

3.1 The scope of the assessment has been determined in the following way:

- desk study to confirm the location of nearby areas that may be sensitive to odour; and
- review of emission data of odour from the process, which has been used as an input into the detailed odour modelling assessment.

3.2 The operation of the facility may lead to odour being emitted from the processes and the tanks on-site. The assessment includes a quantitative assessment of emissions using detailed modelling.

3.3 Details of the methodology and specific issues considered are provided below.

### Assessment Methodology

3.4 The impact of emissions arising from the proposed plant has been assessed using the ADMS Extra dispersion model (Version 5.0.0.3, Jan 2022). The dispersion modelling has been carried out using five years of hourly sequential meteorological data from Norwich meteorological station for the years 2019 to 2022 to take account of inter-annual variability and reduce the effect of atypical conditions.

3.5 The assessment of odour may be undertaken with two differing approaches, by the use of indicator determinants, or total odour.

3.6 In the case where an emission is dominated by one particular odorous gas, the use of an indicator determinant allows simple validation of an assessment through monitoring at source and receptor. However, more commonly (and is the case in this assessment) an odour is the result of a complex mixture of chemicals. On this basis, a more appropriate approach is to assess the impact using the concept of total odour. In this case, odour assessments are undertaken using the concept of the European Odour Unit ($OU_E$), as defined in BS EN 13725[4]. This approach allows assessment of any odorous gas as it is independent of chemical constituents and centres instead on multiples of the detection threshold (i.e. the physiological

[4] BS EN 13725:2003 Air Quality – Determination of Odour Concentration by Dynamic Olfactory.

response of a human) of the gas in question. The assessment presented in this chapter uses this concept.

3.7 As the odour unit is a Standard Unit in the same way as gram or milligram, the notation used in odour assessment follows the conventions of any mass emission unit as follows:

- concentration: $OU_E/m^3$
- emission: $OU_E/s$

3.8 Details of the odour sources and emission parameters used as an input to the model (as rates by the project team) are provided in **Appendix B**.

Topography

3.9 The presence of elevated terrain can significantly affect dispersion by increasing turbulence and reducing the distance between the plume centre line and the ground level. Terrain has been included as an input into the odour model.

Building Downwash / Entrainment

3.10 The presence of buildings close to emission sources can significantly affect the dispersion of pollutants by leading to a phenomenon called 'downwash'. This occurs when a building distorts the wind flow, creating zones of increased turbulence. Increased turbulence causes the plume to come to ground earlier than otherwise would be the case and result in higher ground level concentrations closer to the stack.

3.11 Downwash effects are only significant where building heights are greater than 30 to 40% of the emission release height. The downwash structure also need to be sufficiently close for their influence to be significant. There are no significant structures on site that require inclusion in the model.

Receptor Sensitivity

3.12 The sensitivity of a receptor to odour effects has been determined using the information provided within the IAQM guidance 'Guidance on the Assessment of Odour for Planning' (Ref. 3), as reproduced in Table 3.1 below.

**Table 3.1: Receptor Sensitivity to Odours**

| Receptor Sensitivity | Description |
|---|---|
| **High Sensitivity Receptor** | Surrounding land where:<br>• Users can reasonably expect enjoyment of a high level of amenity; and<br>• People would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.<br>Examples may include residential dwellings, hospitals, schools/education and tourist/cultural. |
| **Medium Sensitivity Receptor** | Surrounding land where:<br>• Users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or<br>• People wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.<br>Examples may include places of work, commercial/retails premises and playing/recreation fields |
| **Low Sensitivity Receptor** | Surrounding land where:<br>• The enjoyment of amenity would not reasonably be expected; or<br>• There is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.<br>Examples may include industrial use, farms, footpaths and roads |

3.13 The detailed modelling predicts the likely odour concentration measured in $OU_E/m^3$ which is known as the Odour Exposure Level (OEL) or impact. OELs were predicted at nearby sensitive receptors and within a modelled grid across the study area. The predicted OELs are compared with the odour benchmark / assessment criteria of 3 $OU_E/m^3$, further detail on the determination of an appropriate benchmark for use in this assessment is provided in **Appendix A**.

3.14 The IAQM guidance provides advice on determining the effects of odour on amenity by considering the OEL (or impact) in conjunction with the sensitivity of the receptors. This is reproduced in Table 3.2 below and has been used to determine the likely odour effects at each

of the selected sensitive receptors due to the predicted OELs (or impacts) associated with the exhaust emissions arising from the plant and tanks on-site.

**Table 3.2: IAQM suggested descriptors for Odour Effects for 'moderately offensive odours'.**

| Odour Exposure Level ($C_{98}$, $OU_E/m^3$) | Receptor Sensitivity | | |
|---|---|---|---|
| | Low | Medium | High |
| ≥10 | Moderate Adverse | Substantial Adverse | Substantial Adverse |
| 5 – 10 | Slight Adverse | Moderate Adverse | Moderate Adverse |
| 3 – 5 | Negligible | Slight Adverse | Moderate Adverse |
| 1.5 – 3 | Negligible | Negligible | Slight Adverse |
| 0.5 – 1.5 | Negligible | Negligible | Negligible |
| <0.5 | Negligible | Negligible | Negligible |

*Sensitive Receptors*

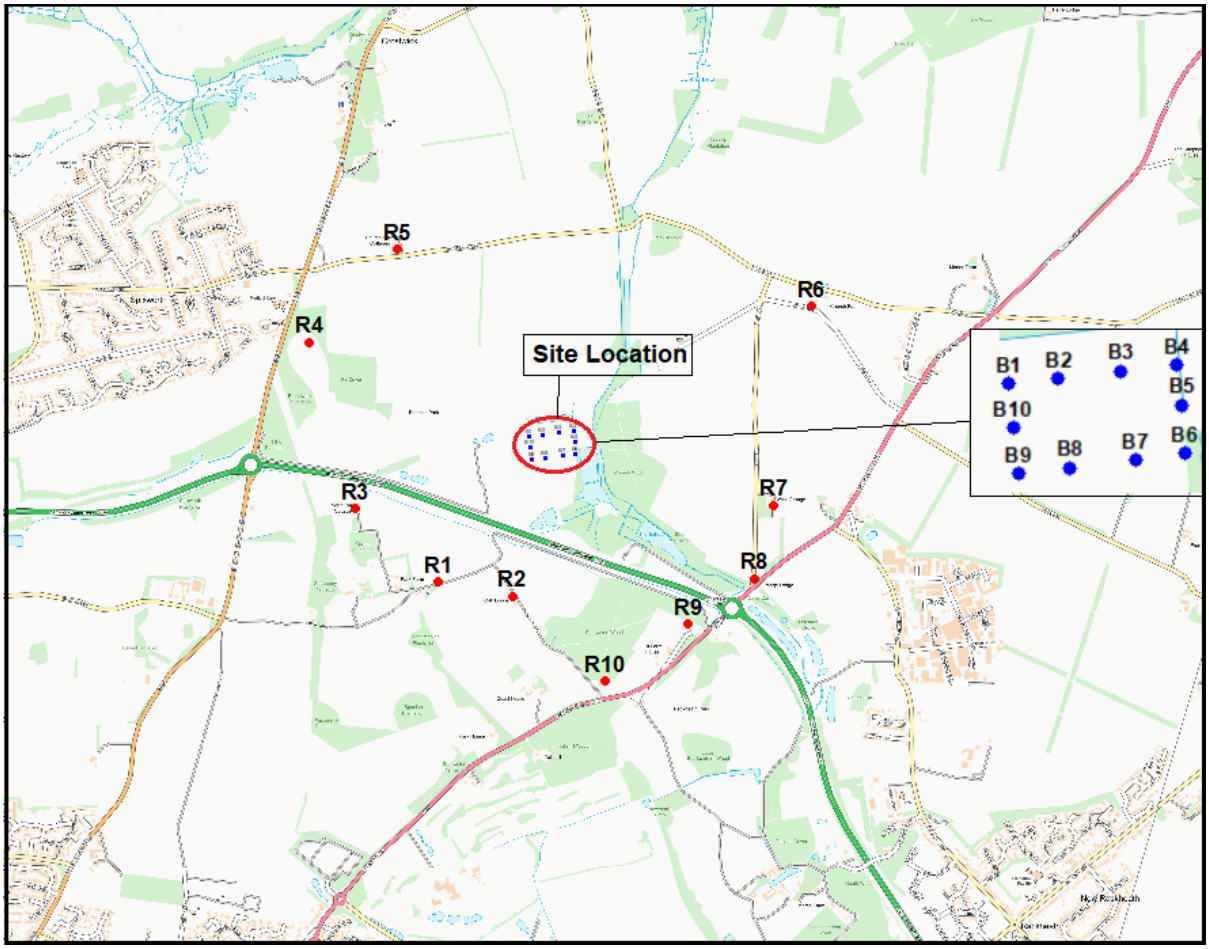
3.15 To assess the effects of odour emitted from the proposed plant, odour concentrations were predicted at 10 sensitive receptors in the vicinity of the Site, at 10 receptors around the boundary of the Site and within a grid across the study area of size 5km by 5km with a spacing of 50m.

**Table 3.3: Location of Sensitive Receptors included in the Odour Model**

| ID | Receptor | Type | Easting | Northing |
|---|---|---|---|---|
| R1 | Manor Farm Cottages | Residential | 626000 | 313932 |
| R2 | Oak Lodge | Residential | 626313 | 313871 |
| R3 | North Park Cottages | Residential | 625647 | 314242 |
| R4 | Property off N Walsham Road | Residential | 625452 | 314950 |
| R5 | Church Farm Cottages | Residential | 625825 | 315346 |
| R6 | All Saints House, Swash Lane | Residential | 627584 | 315103 |
| R7 | Rackheath Grange | Residential | 627425 | 314257 |
| R8 | Grange Lodge | Residential | 627343 | 313946 |
| R9 | Hill Farm Lodge | Residential | 627062 | 313753 |
| R10 | Deepwell Lodge | Residential | 626708 | 313509 |

3.16 The location of the selected sensitive receptors are illustrated on Figure 3.1 below.

**Figure 3.1: Location of Receptors Considered within Odour Model**




**Significance Criteria**

3.17 The IAQM guidance indicates that for the purposes of EIA, an overall odour effect of greater than 'slight adverse' is considered to be significant.

## 4 ASSESSMENT OF IMPACT

4.1 The predicted odour exposure level (OEL), or odour concentration (expressed as the 98$^{th}$ percentile of hourly averages) at the 10 discrete sensitive receptors are presented in Table 4.1. Results presented are the maximum predicted over the five year period.

**Table 4.1: Predicted OEL (OUE/m$^3$) presented as 98$^{th}$ percentile of Hourly Averages**

| Receptor | Max 5 Year OEL | Sensitivity of Receptor | Likely Odour Effect |
|---|---|---|---|
| R1 | 0.11 | High | Negligible |
| R2 | 0.16 | High | Negligible |
| R3 | 0.05 | High | Negligible |
| R4 | 0.03 | High | Negligible |
| R5 | 0.05 | High | Negligible |
| R6 | 0.06 | High | Negligible |
| R7 | 0.08 | High | Negligible |
| R8 | 0.05 | High | Negligible |
| R9 | 0.05 | High | Negligible |
| R10 | 0.06 | High | Negligible |

4.2 The predicted OELs at all of the receptors are below the relevant Odour Benchmark of 3 $OU_E/m^3$.

4.3 The highest predicted OEL at a sensitive receptor is 0.16 $OU_E/m^3$ predicated at R2 which is a residential property located off Beeston Lane 725m to the south-southwest of the Site. The sensitivity of all the receptors to odour effects is considered to be high in accordance with the criteria outlined in the IAQM guidance and reproduced in Table 3.1. The likely odour effect at all of the sensitive receptors is determined to be negligible in accordance with the advice provided in the IAQM guidance and reproduced in Table 3.2.

4.4 The IAQM guidance states that for the purposes of determining the significance of odour effects, any odour effect greater than 'slight adverse' is considered to be significant. Therefore, the significance of the odour effects arising from the proposed plant is considered to be insignificant.

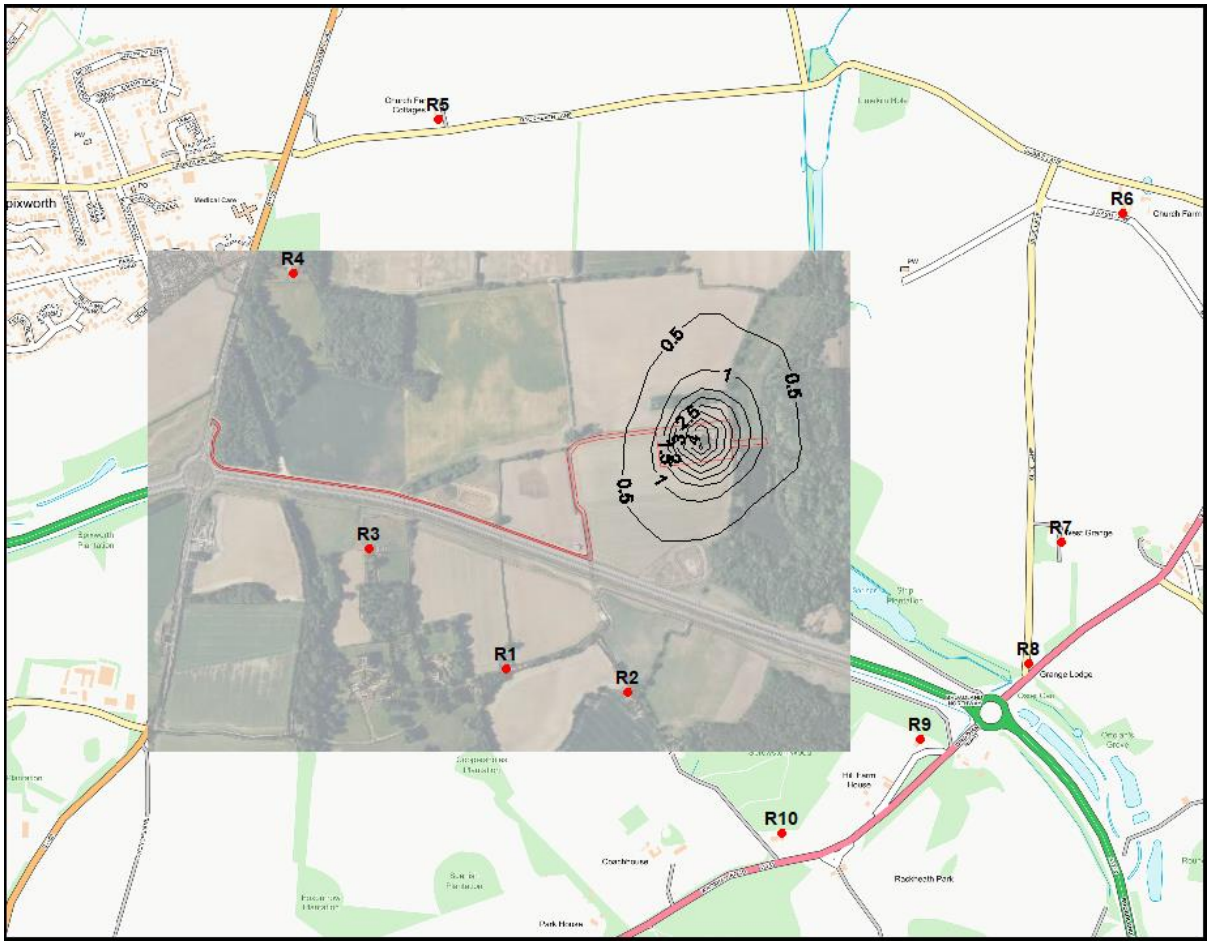
4.5 The predicted odour exposure level (OEL) at the 10 boundary receptors are presented in Table 4.2. Results presented are the maximum predicted over the five year period.

**Table 4.2: Predicted OEL (OUE/m$^3$) presented as 98$^{th}$ percentile of Hourly Averages**

| Receptor | Max 5 Year OEL | Sensitivity of Receptor | Likely Odour Effect |
|---|---|---|---|
| B1 | 0.93 | Low | Negligible |
| B2 | 1.85 | Low | Negligible |
| B3 | 4.56 | Low | Negligible |
| B4 | 2.61 | Low | Negligible |
| B5 | 2.63 | Low | Negligible |
| B6 | 1.94 | Low | Negligible |
| B7 | 3.60 | Low | Negligible |
| B8 | 2.32 | Low | Negligible |
| B9 | 1.21 | Low | Negligible |
| B10 | 1.10 | Low | Negligible |

4.6 A contour plot illustrating the maximum OELs across the study area over the 5 year period is illustrated in Figure 4.1 below.

**Figure 4.1: Odour Exposure Levels ($OU_E/m^3$) presented as 98th percentile of hourly mean**



## 5 CONCLUSIONS

5.1 An assessment has been carried out to determine the impacts with regards to odour associated with the operation of the proposed Waste Water Treatment Works.

5.2 Detailed air quality modelling has been undertaken to predict the impacts associated with emissions arising from the proposed plant.

5.3 The concentration of odour at the nearby sensitive receptors is predicted to be below the relevant benchmark, an assessment following the IAQM guidance has shown the impact is determined to be insignificant.

5.4 Based on the above information, it is considered that odour does not pose a constraint to development of the Site as proposed.

## APPENDIX A – BENCHMARKS FOR THE ODOUR ASSESSMENT

Odour assessment benchmarks are set according to the perceived offensiveness of an odour. This is often referred to as its hedonic tone. A scoring system has been developed for measuring the hedonic tone of an odour which typically ranges from +4 for very pleasant odours (for example, bakeries) to -4 for foul ones (for example, rotting fish). Neutral odours score 0.

The H4 Guidance contains odour assessment benchmarks for odours categorised by their offensiveness, as illustrated in Table A1 below.

**Table A1: Odour Assessment Benchmarks**

| Offensiveness | Odour Emission Sources | Criterion $C_{98}$ ($OU_E/m^3$) |
|---|---|---|
| Most Offensive | • Processes involving decaying animal or fish remains<br>• Processes involving septic effluent or sludge<br>• Biological landfill option | 1.5 |
| Moderately Offensive | • Intensive livestock rearing<br>• Fat frying (food processing)<br>• Sugar beet processing<br>• Well aerated green waste composting | 3.0 |
| Less Offensive | • Brewery<br>• Confectionery<br>• Coffee | 6.0 |

The IAQM guidance states that *'odours from sewage treatment works plant operating normally i.e. non-septic conditions, would not be expected to be at the 'most offensive' end of the spectrum and can be considered on par with 'moderately offensive' odours such as intensive livestock rearing'*.

The odour arising from the Proposed Development is therefore considered to fall within the 'Moderately Offensive' category, therefore a benchmark of 3.0 $OU_E/m^3$ presented as the 98$^{th}$ percentile of hourly mean concentrations ($C_{98}$) has been used in this assessment.

## APPENDIX B – DETAILS OF ODOUR EMISSION RATES

| Odour Source | Emission Rate (OUE/m2/s) |
|---|---|
| Inlet pre-treatment area | 50 |
| Tanks 1, 2, 3 & 4 | 10 |
| GCS Thickening Sludge Tank | 40 |
| GCS Raw Sludge Holding Tank | 40 |
| GCS Influent Balancing Tank | 0.1 |