Eco-Power Environmental Ltd

Biomass Boilers at Waste Drying Plant, Gibson Lane, Melton, Hull, HU14 3HH

Air Quality Assessment and Odour Assessment

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Executive Park, Avalon Way, Anstey, Leicester, LE7 7GR
Tel: +44 (0)116 234 8090
Email: zhiyuan.yang@wyg.com

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Prepared by:	Zhiyuan Yang *Principal Environmental*	Initialled:	ZY
Contributor:	Donald Towler-Tinlin *Environmental*	Initialled:	DTT
Checked	Daniel Clampin *Principal Environmental*	Initialled:	DC
Verified by:	Nigel Mann *Director*	Initialled	NM

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Executive Summary

Eco-Power Environmental Limited commissioned WYG Environment Planning Transport (WYG) to undertake an air quality assessment to assess the impact from 41 proposed Orlan Super 130 kW Biomass boilers at Waste Drying Plant, at Gibson Lane, Melton, Hull, HU14 3HH.

Eco-Power's Biomass Boiler Emission Impact Assessment

The predicted long-term and short-term NO_2, PM_{10}, $PM_{2.5}$ and CO, concentrations from the emissions of the operation of the proposed Orlan Super 130 kW Biomass boilers are all below the relevant AQOs for the protection of human health.

The significance of effects on the emissions on the ground level receptors from the boiler operations with respect to long-term NO_2, PM_{10} and $PM_{2.5}$ is determined to be 'negligible'.

Habitat Assessment

The annual mean and daily (24 hour mean) NO_x PEC at the ecological receptors from Eco-Power's boiler operations are below the relevant critical level for the protection of vegetation and Ecosystems. the NO_x impacts from the proposed development on the ecological receptors are insignificant.

The process contribution (PC, as predicted by the detailed dispersion model) from Eco-Power biomass boiler operations is <1% of the relevant critical level or load (CL) and it can be considered inconsequential. It does not need to be included in an in-combination (cumulative) habitat assessment.

Cumulative Impact Assessment for the Protection of Human Health

Cumulative impact assessment for the protection human health has been undertaken including the emission sources adjacent to Eco-Power biomass boilers and the emission sources in the cumulative assessment include:

(1) 41 Orlan Super 130 kW_{th} biomass boilers proposed by Eco-Powers;
(2) Three Kalvis 0.95 MW_{th} biomass boilers operated by Transwaste Ltd; and
(3) Two emission flues at Energy Recovery Facility (ERF) operated by HRS Energy.

The predicted cumulative long-term and short-term NO_2, PM_{10}, $PM_{2.5}$ and CO, concentrations from the cumulative emission source considered are all below the relevant AQOs for the protection of human health.

The significance of cumulative effects on the emissions on the ground level receptors from the emission source considered with respect to long-term NO_2, PM_{10} and $PM_{2.5}$ is determined to be 'negligible'.

In essence, the proposed development is not considered to be contrary to any of the national and local planning policies.

1. Introduction

Eco-Power Environmental Limited commissioned WYG Environment Planning Transport (WYG) to undertake an air quality assessment to support a planning application of the installation of 41 proposed Orlan Super 130 kW Biomass boilers Biomass Boilers at Waste Drying Plant, at Gibson Lane, Melton, Hull, HU14 3HH.

1.1 Site Location and Context

The United Kingdom National Grid Reference (NGR) of the site is approximately 496730, 425530. The site is bounded by farmland to the west and industrial /commercial uses to the north, east and south. Reference should be made to Figure 1 for a map of the proposed development site and surrounding area.

The indicative site boundary is shown in Figure 2; and the site layout and boiler location plan is presented in Figure 3.

The following assessment stages have been undertaken as part of this assessment:

- Baseline evaluation;
- Identification of receptors, including ecological receptors;
- Baseline traffic air quality modelling to determine NO_2 pollutant levels to consider emissions from traffic;
- Assessment of potential air quality impacts from the operation of biomass boilers at Eco-Power plant;
- Cumulative impact assessment from adjacent industrial points sources, including Transwaste's biomass boilers and Energy Recovery Facility;
- Assessment of impact on the ecological receptors using "IAQM's guide to the assessment of air quality impacts on designated nature conservation sites"; and
- Odour assessment from the drying floor operations.

The objective of the air quality assessment is to determine whether the impacts from biomass boiler emissions meet the required air quality standards (AQSs), AQOs, or air quality environmental assessment limits (EALs) for the protection of human health and for the protection of vegetation and ecosystems.

1.2 Revision History

This second issue of the air quality assessment report includes an odour assessment from the drying floor operations and WYG's responses to the comments from Mr Philip Hill, Senior Environmental Control Officer of Yorkshire Council. Mr Hill contacted WYG with regards to the potential increased short-term impact from the waiting traffic at the level crossing at Gibson Lane on residential receptors.

2. Policy and Legislative Context

The following assessment has been undertaken in accordance with the legislation and best practice guidance as stated below.

2.1 Documents Consulted

The following documents were consulted during the undertaking of this assessment:

Legislation and Best Practice Guidance

- National Planning Policy Framework, Ministry for Housing, Communities and Local Governments, Revised February 2019;
- Planning Practice Guidance: Air Quality, Ministry for Housing, Communities and Local Governments, March 2014;
- The Air Quality Standards Regulations (Amendments), 2016;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007;
- The Environment Act, 1995;
- Local Air Quality Management Technical Guidance LAQM.TG16, Defra, 2018;
- Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07 - Air Quality, Highways Agency, 2007;
- Land-Use Planning & Development Control: Planning for Air Quality, EPUK & IAQM, 2017;
- Guidance on the Assessment of Dust from Demolition and Construction, IAQM, 2014.
- Local Air Quality Management Note on Projecting NO_2 concentrations, DEFRA, April 2012;

Websites Consulted

- Google maps (maps.google.co.uk);
- The UK National Air Quality Archive (www.airquality.co.uk);
- Department for Transport Matrix (www.dft.go.uk/matrix);
- emapsite.com;
- Multi-Agency Geographic Information for the Countryside (http://magic.defra.gov.uk/);
- Planning Practice Guidance (http://planningguidance.planningportal.gov.uk/); and
- East Riding Council website http://www.eastriding.gov.uk.

Site Specific Reference Documents

- East Riding Local Plan (2012-2029) (Adopted April 2016).
- 2018 Air Quality annual status Report (ASRR), East Riding of Yorkshire Council, June 2018.

2.2 Air Quality Legislative Framework

European Legislation

European air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides new air quality objectives for fine particulates. The consolidated Directives include:

- **Directive 1999/30/EC** – the First Air Quality "Daughter" Directive – sets ambient air limit values for NO_2 and oxides of nitrogen, sulphur dioxide, lead and PM_{10};
- **Directive 2000/69/EC** – the Second Air Quality "Daughter" Directive – sets ambient air limit values for benzene and carbon monoxide; and,
- **Directive 2002/3/EC** – the Third Air Quality "Daughter" Directive – seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The fourth daughter Directive was not included within the consolidation and is described as:

- **Directive 2004/107/EC** – sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

UK Legislation

The Air Quality Standards Regulations (Amendments 2016) seek to simplify air quality regulation and provide a new transposition of the Air Quality Framework Directive, First, Second and Third Daughter Directives and also transpose the Fourth Daughter Directive within the UK. The Air Quality Limit Values are transposed into the updated Regulations as Air Quality Standards, with attainment dates in line with the European Directives. SI 2010 No. 1001, Part 7 Regulation 31 extends powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to Local Authorities (LAs) for the implementation of these Directives.

The UK Air Quality Strategy is the method for implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland and provides a framework for improving air quality and protecting human health from the effects of pollution.

For each nominated pollutant, the Air Quality Strategy sets clear, measurable, outdoor air quality standards and target dates by which these must be achieved; the combined standard and target date is referred to as the Air Quality Objective (AQO) for that pollutant. Adopted national standards are based on the recommendations of the Expert Panel on Air Quality Standards (EPAQS) and have been translated into a set of Statutory Objectives within the Air Quality (England) Regulations (2000) SI 928, and subsequent amendments.

The AQOs for pollutants included within the Air Quality Strategy and assessed as part of the scope of this report are presented in Table 2.1 along with European Commission (EC) Directive Limits and World Health Organisation (WHO) Guidelines.

Table 2.1 Air Quality Standards, Objectives, Limit and Target Values

Pollutant	Applies	Objective	Concentration Measured as[10]	Date to be achieved and maintained thereafter	European Obligations	Date to be achieved and maintained thereafter	New or existing
NO_2	UK	200µg/m^3 not to be exceeded more than 18 times a year	1-Hour Mean	31st December 2005	200µg/m^3 not to be exceeded more than 18 times a year	1st January 2010	Retain Existing
	UK	40µg/m^3	Annual Mean	31st December 2005	40µg/m^3	1st January 2010	
PM_{10}	UK	40µg/m^3	Annual Mean	31st December 2004	40µg/m^3	1st January 2005	Retain Existing
	UK	50µg/m^3 not to be exceeded more than 35 times a year	24-Hour Mean	31st December 2004	50µg/m^3 not to be exceeded more than 35 times a year	1st January 2005	
$PM_{2.5}$	UK	25µg/m^3	Annual Mean	31st December 2010	25µg/m^3	1st January 2010	Retain Existing
CO	UK	10mg/m^3	Maximum daily 8 Hour Mean	31st December 2004	10mg/m^3 Maximum daily 8 hour mean	1st January 2005	Retain Existing

Within the context of this assessment, the annual mean objectives are those against which facades of residential receptors will be assessed and the short-term objectives apply to all other receptor locations, where people may be exposed over a short duration, both residential and non-residential such as using gardens, balconies, walking along streets, using playgrounds, footpaths or external areas of employment uses.

Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality

Management (LAQM). This review and assessment of air quality involves assessing present and likely future air quality against the AQOs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA, the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.3 Planning and Policy Guidance

National Policy

The National Planning Policy Framework (NPPF), revised February 2019, principally brings together and summarises the suite of Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) which previously guided planning policy making. The NPPF states that:

> *'Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas or Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic or travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan'*

The Planning Practice Guidance (PPG) web-based resource was launched by the Ministry for Housing, Communities and Local Government (MHCLG) on 6 March 2014 to support the National Planning Policy Framework and make it more accessible. A review of PPG: Air Quality identified the following guidance:

> *'When deciding whether air quality is relevant to a planning application, local planning authorities should consider whether the development would:*
>
> *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.*
>
> *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require*

approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area.

Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.

Give rise to potentially significant impact (such as dust) during construction for nearby sensitive locations.

Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites.'

Local Policy

The East Riding Local Plan 2012 – 2029, Adopted April 2016, comprises a number of different documents with policies to address key planning issues, as well policies that allocate land for specific uses.

The East Riding Local Plan has been reviewed and the following policy was deemed relevant:

Policy EC5: Supporting the energy sector

A. Proposals for the development of the energy sector, excluding wind energy, will be supported where any significant adverse impacts are addressed satisfactorily and the residual harm is outweighed by the wider benefits of the proposal. Developments and their associated infrastructure should be acceptable in terms of:

1. The cumulative impact of the proposal with other existing and proposed energy sector developments;

2. The character and sensitivity of landscapes to accommodate energy development, with particular consideration to the identified Important Landscape Areas,

3. The effects of development on:

i. local amenity, including noise, air and water quality, traffic, vibration, dust and visual impact.

3. Assessment Methodology

The potential environmental effects of the operational phase of the proposed development are identified as far as current knowledge of the site and development allows. The significance of potential environmental effects is assessed according to the latest guidance produced by EPUK and IAQM in January 2017.

The methodology used to determine the potential air quality effects of the construction phase of the proposed development has been derived from the IAQM 'Guidance on the Assessment of the Impacts of Dust from Demolition and Construction' document and is summarised in Section 5.

3.1 Determining the Impact Magnitude of the Air Quality Effects

The impact magnitude of the effects during the operational phase of the development is based on the latest guidance produced by EPUK and IAQM in January 2017. The guidance provides a basis for a consistent approach that could be used by all parties associated with the planning process to professionally judge the overall significance of the air quality effects based on severity of air quality impacts.

The following rationale is used in determining the severity of the air quality effects at individual receptors:

1. The change in concentration of air pollutants, air quality effects, are quantified and evaluated in the context of AQOs. The impacts are provided as a percentage of the Air Quality Assessment Level (AQAL), which may be an AQO, EU limit or target value, or a Natural Resources Wales Assessment Level (NRWAL)';
2. The absolute concentrations are also considered in terms of the AQAL and are divided into categories for long term concentration. The categories are based on the sensitivity of the individual receptor in terms of harm potential. The degree of harm potential to change increases as absolute concentrations are close to or above the AQAL;
3. Severity of the effect is described as qualitative descriptors; negligible, slight, moderate or substantial, by taking into account in combination the harm potential and air quality effect. This means that a small increase at a receptor which is already close to or above the AQAL will have higher severity compared to a relatively large change at a receptor which is significantly below the AQAL;
4. The impacts can be adverse when pollutant concentrations increase or beneficial when concentration decrease as a result of development;
5. The judgement of overall significance of the effects is then based on severity of effects on all the individual receptors considered; and,

6. Where a development is not resulting in any change in emissions itself, the significance of effect is based on the effect of surrounding sources on new residents or users of the development, i.e., will they be exposed to levels above the AQAL.

Table 3.1 Impact Descriptors for Individual Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to AQAL			
	1	2-5	6-10	>10
≤75% of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109 of AQAL	Moderate	Moderate	Substantial	Substantial
≥110 of AQAL	Moderate	Substantial	Substantial	Substantial

In accordance with explanation note 2 of Table 6.3 of the EPUK & IAQM guidance, the Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5%, will be described as Negligible.

4. Baseline Conditions

4.1 Air Quality Review

This section provides a review of the existing air quality in the vicinity of the proposed development site in order to provide a benchmark against which to assess potential air quality impacts of the proposed development. Baseline air quality in the vicinity of the proposed development site has been defined from a number of sources, as described in the following sections.

Local Air Quality Management (LAQM)

As required under section 82 of the Environment Act 1995, East Riding of Yorkshire Council (ERYC) has conducted an ongoing exercise to review and assess air quality within its area of jurisdiction. The assessments have indicated that concentrations of NO_2 and PM_{10} are above the relevant AQOs at a number of locations of relevant public exposure within the Council.

Air Quality Monitoring

Monitoring of air quality within the EYRC is conducted through non-continuous monitoring methods. These have been reviewed in order to provide an indication of existing air quality in the area surrounding the proposed development site.

Continuous Monitoring

East Riding of Yorkshire did not carry out any automatic (continuous) monitoring for any pollutions in 2017.

Non - Continuous Monitoring

EYRC operates a network of 77 passive diffusion tubes. The most recent monitoring data have recorded NO_2 concentrations within EYRC in 2017. The closest diffusion tube is located next to A63 approximately 900m north from the proposed site boundary.

The representative diffusion tube data within the site area are from 2017 which is presented in Table 4.1.

Table 4.1 Monitored Annual Mean NO_2 Concentrations

Site ID	Location	X	Y	Site Type	Distance to Kerb of Nearest Road (m)	NO_2 Annual Mean Concentration 2018 (µg/m³)
1	Gibson Lane North (footbridge), Melton	497094	426482	Roadside	29	29
28	A63/Gibson Lane North, Welton	497107	426463	Roadside	4.3	52
35	A63 East (The Old Foundry), Welton	495736	427033	Roadside	10	50

Site ID	Location	X	Y	Site Type	Distance to Kerb of Nearest Road (m)	NO_2 Annual Mean Concentration 2018 (µg/m³)
45	A63 West (Pool Bank Farm), Welton	495833	426926	Roadside	9	35
72	A63 West (Melton Grange), Melton	497332	426384	Roadside	4	36

As indicated in Table 4.2, the roadside diffusion tubes (28 and 35) next to A63 were above the relevant AQO (40 µg/m³ annual mean) in 2017.

Council's LAQM Annual Status Report 2018 states that:

"Tubes No.28 & No.35 were highlighted in the ASR 2017 and are located adjacent to the A63, the main connecting route from the M62 towards Hull (see Fig's 4 and 5). This eastern extremity of the M62/A63 corridor can experience significant levels of congestion, particularly during peak hours as it carries a high volume of not only cars but also HGV's serving businesses and the nearby ports of Hull and Goole.

As previously reported in the ASR 2017, tube No.28 recorded a decrease in annual mean NO_2 concentration of 13% (61µg/m³ to 53µg/m³) between 2013 and 2014, followed by a further 4% decrease between 2014 and 2015, from 53µg/m³ to 49µg/m³. In 2016, this tube again shows a significant decrease of 6% from 49µg/m³ to 46µgm³ However between 2016 and 2017 there has been a 13% increase from 46µgm³ to 52µgm³. The reasons for such an increase aren't immediately apparent, but it is likely down to a combination of meteorological conditions and traffic volumes.

Tube No.35 returned an annual mean of 48µg/m³ in 2015 and 2016. In 2017 this has increased by 4% to 50µg/m³.

When subjected to the Defra "NO_2 fall-off with distance calculator", the predicted annual mean NO_2 concentrations at the nearest relevant receptor locations for tubes No.28 and No.35 are both within the 40µg/m³ objective, at 33.5 µg/m³ and 38.7 µg/m³ respectively."

The monitoring data from the diffusion tubes Table 4.1 have been used in the traffic emission modelling to determine baseline pollutant levels for the assessment.

4.2 Baseline/Background Concentrations Inclusive of Contributions from Traffic Emissions

ADMS Roads has been used to undertake a verified baseline modelling to determine baseline pollutant levels at the selected receptor locations by considering emissions from traffic. Details of the background concentrations used in this assessment are provided in Appendix A.

5. Detailed Dispersion Modelling Methodology

In order to consider the air quality impacts of the biomass boilers on the local air quality, a quantitative assessment using the third generation Breeze AERMOD dispersion model has been undertaken. AERMOD is a development from the ISC3 dispersion model and incorporates improved dispersion algorithms and pre-processors to integrate the impact of meteorology and topography within the modelling output.

The model uses hourly meteorological data to define conditions for plume rise, transport, diffusion and deposition. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected short-term averages.

5.1 Modelling Parameter and Averaging Period

The dispersion modelling has assessed cumulative impact of emissions from the boilers taking into consideration of the operation of the proposed installation.

The same averaging period should be used for comparison of emissions against environmental standards. For example, most long-term standards are expressed as an annual mean and many short-term standards as an hourly mean. Note that there are certain exceptions to this which are important when considering compliance with statutory EQS. The averaging period associated with the relevant modelled pollution are detailed in Table 5.1.

Table 5.1 Modelling Parameter and Averaging Period

Parameter	Modelled As	
	Short Term	Long Term
NO_2	99.79th percentile (%ile) 1-hour mean	Annual Mean
PM_{10}	90.41th percentile (%ile) 24-hour mean	Annual Mean
$PM_{2.5}$	-	Annual Mean
CO	8-hour running mean	-

NO_2 background concentrations are taken from ADMS Road modelling results, which includes the contribution from the traffic emissions.

For short term averaging periods, the following UK Defra methodology, for example, has been followed:

For 1-hour NO_2 concentrations:

- 99.79th percentile(%ile) 1-hour Process Contribution NO_2 + 2 x (annual mean background contribution NO_2).

5.2 Emissions Sources

5.2.1 Emission Sources from Eco-Power's Waste Drying Plant

This air quality assessment for the plant has been based on the installation of 41 Orlan Super 130 kW_h biomass boilers.

The emissions from the boilers have been calculated using the information on its specifications and a boiler emission testing report. The pollutant mass emission rates used within AERMOD and stack gas parameters are presented in Table 5.2.

Table 5.2 Orlan Super 130 kW_{th} Biomass Boiler Stack Emissions and Stack Parameters

Parameter	Angus Orlan Super 130 kW Boiler (Each Boiler)	Unit
Fuel Consumptions	24.5 [a]	kg/hr
Fuel Humidity	15 [a]	%
CV (Net, Dry basis)	19.1 [b]	MJ/kg
Dry Flue gas Volume at 10% of O_2	479 [b]	m^3/MJ
NO_x Emission rate	145 mg/m^3 at 10% O_2 [c]	mg/m^3
PM_{10} Emission rate	40 mg/m^3 at 10% O_2 [c]	mg/m^3
CO Emission rate	1928 mg/m^3 at 10% O_2 [c]	mg/m^3
Mass NO_x Emission rate	27.6	g/hr
Mass PM_{10} Emission rate	7.6	g/hr
Mass CO Emission rate	367.2	g/hr
Stack Gas Temperature	160 [a]	°C
Stack Volumetric Flow Rate at 10% O_2 and 0 C°	190.5	m^3/hr
Stack Oxygen content	6.1[c]	%
Stack moisture content	15 [d]	%
Modelled stack diameter	0.2 [e]	m
Stack velocity	6.4 [e]	m/s
Stack Height	12.5	m

Note:

(a) *Orlan Super 130 kW_{th} Biomass Boiler Instruction Manual and technical data;*

(b) *Derived from the AEA report of "Conversion of biomass boiler emission concentration data for comparison with renewable heat incentive emission criteria", Ref: AEA/ED46626/AEA/R/3296, May 2012;*

(c) *Data from the Test Report of 32 – 0119, 31/10/2011;*

(d) *GLA air quality report of Biomass and CHP Emission standards, March 2013; and*

(e) *Stack diameter and efflux velocity (after applications of exodraft fan to increase the velocity).*

The impact from the boiler emissions has been assessed assuming simultaneous operation of biomass boilers for 8,760 hours per annum and it produces a worst-case assessment.

Figure 4 illustrates the location of the modelled emission points for the Orlan Super 130 kW_{th} biomass boilers boiler stacks.

5.2.2 Emission Sources for Cumulative Impact Assessment

Cumulative impact assessment has been undertaken by assessing the adjacent industrial points sources, including Transwaste's biomass boilers and Energy Recovery Facility.

Transwaste Ltd operates on the Gibson Lane site and recently received planning permission for three 0.95 MW_{th} biomass boilers burning waste wood and providing process heating for on-site Refuse Derived Fuel (RDF) and Solid Recovered Fuel (SRF) waste treatment processes.

An energy recovery facility (ERF), operated by HRS Energy, was recently granted planning permission at the Gibson Lane site, and will utilise some of the RDF and SRF produced on site to generate electricity for export to the National Grid. The energy recovery facility consists of two emission flues/stacks and it is proposed one stack encases of two flows. Within the modelling assessment, both flues have been modelled as a single stack source of emissions. The energy recovery facility has currently got planning approval, to operate an increase stack height of 55m above ground level.

Therefore, following emission sources have been included in the cumulative assessment:

(1) 41 Orlan Super 130 kW_{th} biomass boilers proposed by Eco-Powers;
(2) Three Kalvis 0.95 MW_{th} biomass boilers operated by Transwaste Ltd; and
(3) Two emission flues operated by HRS Energy.

Emission Calculations for Kalvis 0.95 MW_{th} Biomass Boilers

The emissions from the Kalvis biomass boilers have been calculated using the information on its specifications and a boiler emission testing report. The pollutant mass emission rates used within AERMOD and stack gas parameters are presented in Table 5.3.

Table 5.3 Kalvis 0.95 MW_{th} Biomass Boilers Stack Emissions and Stack Parameters

Parameter	Kalvis 950 kW Biomass Boiler (Each Boiler)	Unit
Fuel Consumptions	419 [a]	kg/hr
Fuel Humidity	31 [a, d]	%
Calorific Value (Dry base)	2407 [d]	Kcal/kg
Calculated CV (Net, Dry basis)	10.07	MJ/kg
Dry Flue gas Volume at 10% of O_2 for Wood	479 [b]	m^3/MJ
NO_x Emission rate	183 to 269 mg/m^3 at 10% O_2 [d]	mg/m^3
PM_{10} Emission rate	51 mg/m^3 at 10% O_2 [d]	mg/m^3
CO Emission rate	675 to 995 mg/m^3 at 10% O_2 [d]	mg/m^3
Mass NO_x Emission rate	513 [e]	g/hr
Mass PM_{10} Emission rate	103.1	g/hr
Mass CO Emission rate	2011.1 [f]	g/hr
Stack Gas Temperature	185 [a]	°C
Stack Volumetric Flow Rate at 10% O_2 and 0 C°	2021.2	m^3/hr
Stack Oxygen content	6.1[g]	%
Stack moisture content	15 [h]	%
Modelled stack diameter	0.48 [a]	m
Stack velocity	4.41	m/s
Stack Height	11.0	m

Note:

(a) Biomass Boiler technical data;

(b) The emission limit from Defra Guidance (an AEA Report for Defra) "Conversion of biomass boiler emission concentration data for comparison with renewable heat incentive emission criteria", Ref: AEA/ED46626/AEA/R/3296, May 2012;

(c) Gas volumetric flow rates have been derived from the AEA report of "Conversion of biomass boiler emission concentration data for comparison with renewable heat incentive emission criteria", Ref: AEA/ED46626/AEA/R/3296, May 2012;

(d) Data from the Test Report No. 11/10-LG, 28/04/2010;

(e) Calculated to meet the emission limit of 150g/GJ in the Guidance of "Conversion of biomass boiler emission concentration data for comparison with renewable heat incentive emission criteria", Ref: AEA/ED46626/AEA/R/3296, May 20122;

(f) Using the maximum of measured concentration for a worst-case assessment;

(g) Using Orlan Super 130 kW_{th} Biomass Boiler; and

(h) GLA air quality report of Biomass and CHP Emission standards, March 2013.

The impact from the boiler emissions has been assessed assuming simultaneous operation of biomass boilers for 8,760 hours per annum and it produces a worst-case assessment.

Figure 5 illustrates the location of the modelled emission points for the Kalvis boiler stacks.

Emission Calculations for Energy Recovery Facility

The emission data for energy recovery facility are taken from the report of "Air quality assessment for planning variation, Melton Energy from Waste Plant, HRS Energy", produced by WSP, project No. 70042100, January 2018.

The stack emissions and stack parameters are presented in Table 5.4.

Table 5.4 Summary of Stack Discharge Conditions (Flue 1&2 Combined) (after WSP Report, January 2018)

Parameter	Energy Recovery Facility Flue 1 & 2 Assessed as a Single Point	Unit
Stack Gas Temperature	150	°C
Volumetric Flow Rate dry, 11% O_2 and 0 C°	52	Nm^3/s
Stack volumetric Flow Rate 18.11% H_2O, 4.97% O_2 and 150 C°	61.14	Am^3/s
Stack Efflux velocity	19.86	m/s
Modelled stack diameter	1.98	m
Stack Height	55	m
Stack OS Grid Reference	X: 496710, Y:425461	

The impact from the facility emissions has been assessed assuming simultaneous operations for 8,760 hours per annum and it produces a worst-case assessment.

Figure 5 illustrates the location of the modelled emission point for the ERF stacks.

5.3 Model Scenarios

Two operations scenarios have been assessed for Eco-Power's biomass boilers.

- Scenario 1 – normal operation scenario. The design heat demand of the associated Eco-Power drying plant only requires 35 Orlan Super 130 kW_{th} biomass boilers to be operate at any one time.

- Scenario 2 – theoretical worst-case scenario. It is theoretically possible for all 41 Orlan Super 130 kW_{th} biomass boilers to operate and this scenario is to provide a worst-case assessment.

5.4 Sensitive Receptors

5.4.1 Discrete (Individual) Receptors

The discrete sensitive receptors identified for the purposes of this air quality assessment are contained in Table 5.5 and shown further in Figure 6. The assessment has also been undertaken to determine the potential impacts at those selected receptors.

It should be noted that these do not represent an exhaustive list of all receptors within the vicinity of the Site, rather worst-case representative locations within and adjacent to the site.

Table 5.5 Modelled Sensitive Receptor Locations

Discrete Sensitive Receptors		UK NGR (m)	
AERMOD ID/ADMS ID	Name	X	Y
D1	100 Gibson Lane South	496955	425795
D2	88 Gibson Lane South	496966	425882
D3	54 Gibson Lane	497015	426249
D4	The Coach House, Melton Grange, Main Road	497209	426365
D5	21 Brickyard Lane	497442	426144
D6	25 the triangle, North Ferriby	498166	425622
D7	Lowcroft Farm, Lowfield Lane	496343	426287
D8	South Hunsley School, 41 East Dale Road	496689	426616
D9	62 Common Lane	495613	426302
D10	79 Plantation Drive	497983	426212
D11	75 Southfield Drive	498268	425278
E1	Humber Estuary SPA, SAC, Ramsar, SSSI 1	495737	424661
E2	Humber Estuary SPA, SAC, Ramsar, SSSI 2	496260	424641
E3	Humber Estuary SPA, SAC, Ramsar, SSSI 3	496719	424633
E4	Humber Estuary SPA, SAC, Ramsar, SSSI 4	497218	424746
E5	Humber Estuary SPA, SAC, Ramsar, SSSI 5	498147	425020

5.4.2 Cartesian Grid Receptor

A Cartesian receptor grid was used in the model in order to produce the concentration contour lines. The Cartesian receptor grid consists of receptors identified by their x (east-west) and y (north-south) coordinates. The grid was constructed with grid spacing (x, y) of 50m by 50m over an area covering 4000m by 4000m with south-west corner UK NGR (m) of 495100, 423600.

5.4.3 Ecological Receptors

Guidance of air emissions risk assessment for your environmental permit (Defra and Environment Agency, August 2016) states that assessments should consider whether conservation sites fall within set distances of the installation:

- Special Protection Area (SPAs), Special Areas of conservation (SACs) or Ramsar sites within 10 km of the installation (or within 15km for coal or oil-fired power stations); and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs), local wildlife sites and ancient woodland within 2 km of the location of the installation.

Following a review, three ecological site located close to the site was identified as below.

- Humber Estuary SPA, SAC, Ramsar, SSSI – Located approximately 900 m south of the boiler house at its closest point;

The identified ecological site has been included as receptor in the assessment.

There is a Melton Bottom Chalk Pit SSSI located to the north of the boiler house. This site, however, is not included in the assessment as it is identified as of importance only for geology.

5.5 Meteorological Data

The 3 year meteorological data (2016, 2017 and 2018) used in the assessment is derived from Leconfield weather station, which is considered representative of conditions within the vicinity of the site, with all the complete parameters necessary for the AERMOD model. Reference should be made to Figure 7 for an illustration of the prevalent wind conditions at the Leconfield weather station.

5.6 Surface Characteristics

The land uses surrounding the Site are mostly described as farmland and commercial uses. A surface roughness value of 0.5m for open suburbia area/commercial uses and a surface roughness value of 0.3m for farmland area have been used in the modelling for a worst-case assessment.

5.7 Buildings in the Modelling Assessment

Buildings nearby or immediately adjacent to the boiler stack/emission source could potentially cause building downwash effects on emission sources and have therefore been modelled for the proposed development.

The locations and dimensions of the buildings used in the model are given in Table 5.6 and illustrated in Figure 8.

Table 5.6 Locations and Heights of Building Used in the Model

Name		UK NGR (m)		Height (m)
		X	Y	
1	Eco-Power Boiler House	496691	425508	8.0
2	Eco-Power Shed 3 - Main Processing Plant	496702	425509	12.15
3	Shed 1	496819	425546	12.5
4	Shed 4	496798	425479	12.5
5	Shed 5	496772	425480	12.5
6	ERF Power Module	496673	425449	24.0
7	ERF Boiler Module 1	496716	425483	24.0
8	ERF Boiler Module 2	496700	425453	24.0
9	Transwaste Boiler Building	496651	425333	6.7

5.8 Treatment of Terrain

The presence of steep terrain can influence the dispersion of emissions and the resulting pollutant concentrations. USEPA guidance indicates that terrain effects should be considered if the gradient exceeds 1:10. A digital terrain file in the UK Ordnance Survey (OS) Landranger format (.NTF) has been used in the assessment.

5.9 NO_X to NO_2 Conversion

Emissions of NO_x from combustion processes are predominantly in the form of NO. Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. Given the short travel time to the areas of maximum concentration and the rate of reaction to convert NO to NO_2, it is unlikely that more than 30% of the NO_x is present at ground level as NO_2. This conversion factor is based on comparison of ambient NO and NO_2 continuous measurements evaluated over recent years.

Ground level NO_x concentrations have been predicted through dispersion modelling. NO_2 concentrations reported in the results section assume 70% conversion from NO_x to NO_2 for annual means and a 35% conversion for short term (hourly) concentrations, based upon EA methodology[1].

[1] Conversion Ratios for NO_x and NO_2, Environment Agency, updated.

5.10 Modelling Uncertainty

Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - including emissions estimates, background estimates and meteorology; and,
- Variability - randomness of measurements used.

However, potential uncertainties in model results have been minimised as far as practicable and worst-case inputs considered in order to provide a robust assessment. This included the following:

- Choice of model - AERMOD is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible.
- Facility operating parameters - Operational parameters were provided for the facility.
- Background concentrations - Background pollutant concentrations were obtained from a number of recognised sources in order to consider baseline levels in the vicinity of the site, as detailed within the main report text.
- Variability - All model inputs are as accurate as possible and worst-case conditions have been considered where necessary in order to ensure a robust assessment of potential pollutant concentrations.

6. Detailed Modelling Assessment Results : Protection of Human Health

The detailed modelling assessment of process emissions for the proposed Eco-Power boiler operations was undertaken using the input parameters detailed in Section 7.

All predicted concentrations have been compared to the relevant environmental assessment criteria, as detailed in Sections 2 and 3.

6.1 Nitrogen Dioxide (NO_2) – Scenario 1 (Normal Operations)

Long-Term (Annual Mean) NO_2 – Scenario 1

The long-term emissions of NO_2 from the source considered were assessed for all 3 years of meteorological data. The maximum process contributions (PCs) within the modelled receptor locations and their associated predicted environmental concentrations (PECs) are compared against the relevant AQO, in Table 6.1.

From the meteorological dataset, the year resulting in maximum long-term NO_2 PC concentration was identified as 2017. The predicted maximum PC occurs at the receptor location of 100 Gibson Lane South (D1).

The maximum NO_2 PC in Table 6.1 is 1.22 µg/m^3 and the associated NO_2 PEC is 12.49µg/m^3, which is below the relevant long-term AQS of 40 µg/m^3 for the protection of human health.

Table 6.1 The Maximum Long-Term (Annual Mean) Concentrations of NO_2 – Scenario 1

Pollutant	Year	Process Contrib'tn (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	Easting (m)	Northing (m)	Receptor Name
NO_2	2016	1.13	2.83	11.27	12.41	496955	425795	100 Gibson Lane South
NO_2	2017	1.22	3.05	11.27	12.49	496955	425795	100 Gibson Lane South
NO_2	2018	1.19	2.97	11.27	12.46	496955	425795	100 Gibson Lane South
AQOs	40							

Note:

a. *Inclusive of Background concentration from the traffic assessment.*

Table 6.2 presents a summary of the predicted nitrogen dioxide concentrations, both PCs and PECs, at the modelled receptors locations.

The impact description of changes associated with the operations of the boiler with respect to annual mean NO_2 exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in Table 6.2.

Table 6.2 The Long-Term (Annual Mean) Concentrations of NO_2 and Impact Description of Effects at Receptors – Scenario 1

Receptor		Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and NO_2 Impact Description at Receptors						
ID	Name	Process Contribution (PC)	PC as percentage of AQO (%)	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as percentage of AQO	PEC as percentage of AQO	Impact Descriptor
D1	100 Gibson Lane South	1.22	3.05	11.27	12.49	31.2%	≤ 75 of AQO	Negligible
D2	88 Gibson Lane South	0.91	2.29	11.27	12.19	30.5%	≤ 75 of AQO	Negligible
D3	54 Gibson Lane	0.46	1.14	14.84	15.29	38.2%	≤ 75 of AQO	Negligible
D4	The Coach House, Melton Grange, Main Road	0.33	0.82	14.84	15.16	37.9%	≤ 75 of AQO	Negligible
D5	21 Brickyard Lane	0.35	0.89	14.84	15.19	38.0%	≤ 75 of AQO	Negligible
D6	25 the triangle, North Ferriby	0.32	0.81	12.09	12.41	31.0%	≤ 75 of AQO	Negligible
D7	Lowcroft Farm, Lowfield Lane	0.25	0.62	14.55	14.80	37.0%	≤ 75 of AQO	Negligible
D8	South Hunsley School, 41 East Dale Road	0.23	0.59	14.55	14.79	37.0%	≤ 75 of AQO	Negligible
D9	62 Common Lane	0.09	0.23	13.26	13.35	33.4%	≤ 75 of AQO	Negligible
D10	79 Plantation Drive	0.23	0.58	14.84	15.07	37.7%	≤ 75 of AQO	Negligible
D11	75 Southfield Drive	0.19	0.48	12.09	12.28	30.7%	≤ 75 of AQO	Negligible
AQO		**40 µg/m³**						

The percentage changes in process contribution of NO_2 relative to the AQAL as a result of the boiler operations at all receptor locations, with respect to NO_2 exposure, are determined to be 3.05% or less. The impact is determined to be 'negligible', based on the methodology outlined in Section 3. The effect of the proposed boiler operations on the local area is considered to be insignificant.

The predicted long-term NO_2 concentrations from the proposed development are considered acceptable for the protection of human health.

Short-Term (1-Hour Mean) NO_2 – Scenario 1

The short-term emissions of NO_2 from the source considered were assessed for all 3 years of meteorological data. The maximum PCs within the modelled receptor locations and their associated PECs are compared against the relevant AQS, in Table 6.3.

From the meteorological dataset, the year resulting in maximum short-term NO_2 PC concentration was identified during 2018. The predicted maximum short-term PC occurs at the receptor location of 100 Gibson Lane South (D1).

The highest short-term NO_2 PC in Table 6.3 is 23.42 µg/m^3 and the associated short-term NO_2 PEC is 45.96 µg/m^3, which is below the relevant short-term AQO of 200 µg/m^3 for the protection of human health.

Table 6.3 The Maximum Short-Term (1-Hour Mean, 99.79th Percentile) Concentrations of NO_2 – Scenario 1

Pollutant	Year	Process Contrib'tn (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	Easting (m)	Northing (m)	Receptor Name
NO_2	2016	21.96	10.98	22.55	44.51	496955	425795	100 Gibson Lane South
NO_2	2017	19.70	9.85	22.55	42.25	496955	425795	100 Gibson Lane South
NO_2	2018	23.42	11.71	22.55	45.96	496955	425795	100 Gibson Lane South
AQOs	200							

Note:

a. *Inclusive of Background concentration from the traffic assessment.*

The short-term NO_2 PEC concentrations have been calculated at each of the discrete receptors listed for the worst meteorological year of 2017 and these results are detailed in Table 6.4 (overleaf).

Table 6.4 Summary of the Predicted Short-Term NO_2 Concentrations at Discrete Receptors – Scenario 1

Receptor		Predicted 1-hour Mean (99.79th Percentile) Concentration (µg/m³) – 2018 Met Data				
ID	Name	Process Contribution (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as percentage of AQO
D1	100 Gibson Lane South	23.42	11.71	22.55	45.96	22.98
D2	88 Gibson Lane South	18.06	9.03	22.55	40.61	20.31
D3	54 Gibson Lane	11.75	5.87	29.67	41.42	20.71
D4	The Coach House, Melton Grange, Main Road	8.98	4.49	29.67	38.65	19.33
D5	21 Brickyard Lane	11.09	5.55	29.67	40.77	20.38
D6	25 the triangle, North Ferriby	7.47	3.74	24.18	31.65	15.83
D7	Lowcroft Farm, Lowfield Lane	14.81	7.40	29.10	43.91	21.95
D8	South Hunsley School, 41 East Dale Road	9.71	4.86	29.10	38.81	19.41
D9	62 Common Lane	6.46	3.23	26.52	32.98	16.49
D10	79 Plantation Drive	5.10	2.55	29.67	34.77	17.39
D11	75 Southfield Drive	6.05	3.03	24.18	30.23	15.12
AQOs	200 µg/m³					

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 6.4, there are no exceedances of the short-term NO_2 AQO at any of the identified sensitive receptors. The predicted impacts are significantly below the AQO of 200 µg/m³.

Therefore, the predicted short-term NO_2 concentrations from the boiler operations are considered acceptable for the protection of human health.

The contour plots of the predicted long-term and short-term ground level PCs of NO_2 for all receptors, including discrete and grid receptors are presented in Figures 9 and 10. The contour plots show that the predicted maximum concentrations occur adjacent to the emission source, with a predicted decrease in concentration with the increased distance from the stack.

6.2 Particulate Matter (PM_{10}) – Scenario 1

Long-Term (Annual Mean) PM_{10} – Scenario 1

The predicted long-term PCs and PECs from 2017 meteorological data, the year resulting in maximum long-term NO_2 PC concentration, at receptor locations are compared against the relevant AQS, in Table 6.5.

Table 6.5 The Long-Term (Annual Mean) Concentrations of PM_{10} and Significance of Effects at Key Receptors – Scenario 1

Receptor	Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and PM_{10} Significance Impacts at Receptors						
	Process Contrib'tn (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as %age of AQO	PEC as %age of AQO	Significance
D1	0.48	1.19	13.78	14.25	35.6%	<75% of AQAL	Negligible
D2	0.36	0.89	13.78	14.13	35.3%	<75% of AQAL	Negligible
D3	0.18	0.45	15.08	15.26	38.2%	<75% of AQAL	Negligible
D4	0.13	0.32	15.08	15.21	38.0%	<75% of AQAL	Negligible
D5	0.14	0.35	15.08	15.22	38.1%	<75% of AQAL	Negligible
D6	0.13	0.32	13.52	13.64	34.1%	<75% of AQAL	Negligible
D7	0.10	0.24	15.73	15.83	39.6%	<75% of AQAL	Negligible
D8	0.09	0.23	15.73	15.82	39.6%	<75% of AQAL	Negligible
D9	0.04	0.09	14.72	14.75	36.9%	<75% of AQAL	Negligible
D10	0.09	0.23	15.08	15.17	37.9%	<75% of AQAL	Negligible
D11	0.08	0.19	13.52	13.59	34.0%	<75% of AQAL	Negligible
AQOs	40						

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 6.5, there are no exceedances of the long-term NO_2 AQO at any of the identified sensitive receptors. The predicted impacts are significantly below the AQO of 40 µg/m³.

The percentage change in process concentrations relative to the AQAL as a result of the boiler operations at all receptor locations, with respect to PM_{10} exposure, are determined to be 1.19% or less. The significance is determined to be 'negligible', based on the methodology outlined in Section 3.

Therefore, the predicted long-term PM_{10} concentrations from the Site are considered acceptable for the protection of human health.

Short-Term (24-Hour Mean) PM_{10} – Scenario 1

The predicted short-term PCs and PECs from 2018 meteorological data, the year resulting in maximum short-term NO_2 PC concentration, at receptor locations are compared against the relevant AQS, in Table 6.6.

Table 6.6 The Short-Term (24-Hour Mean) Concentrations of PM_{10} at Key Receptors – Scenario 1

Receptor	Predicted 24-Hour Mean (90.41th Percentile) Concentration (µg/m³) – 2018 Met Data at Receptors				
	Process Contrib'tn (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as %age of AQO
D1	1.27	2.55	13.78	15.05	30.10
D2	0.97	1.95	13.78	14.75	29.50
D3	0.56	1.12	15.08	15.64	31.28
D4	0.36	0.72	15.08	15.45	30.89
D5	0.42	0.84	15.08	15.50	31.01
D6	0.35	0.71	13.52	13.87	27.74
D7	0.33	0.66	15.73	16.06	32.12
D8	0.34	0.68	15.73	16.07	32.14
D9	0.12	0.23	14.72	14.83	29.67
D10	0.30	0.59	15.08	15.38	30.76
D11	0.22	0.44	13.52	13.74	27.48
AQOs	50				

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 6.6, there are no exceedances of the short-term NO_2 AQO at any of the identified sensitive receptors. The predicted impacts are significantly below the AQO of 50 µg/m³.

Therefore, the predicted short-term PM_{10} concentrations from the boiler operations are considered acceptable for the protection of human health.

The contour plots of the predicted long-term ground level PCs of PM_{10} for all receptors, including discrete and grid receptors are presented in Figure 11. The contour plots show that the predicted maximum concentrations occur adjacent to the emission source, with a predicted decrease in concentration with the increased distance from the stack.

The contour plots of the predicted short-term ground level PCs of PM_{10} for all receptors, including discrete and grid receptors are not presented as the PCs are well below 10% of relevant AQO.

6.3 Particulate Matter ($PM_{2.5}$) – Scenario 1

A worst-case scenario assumption of 100% of PM_{10} to be $PM_{2.5}$ has been made in the assessment. The predicted long-term PCs of $PM_{2.5}$ and the significance of changes associated with the operations of the boilers with respect to annual mean $PM_{2.5}$ exposure has been presented and assessed in Table 6.7.

Table 6.7 The Long-Term (Annual Mean) Concentrations of $PM_{2.5}$ and Significance of Effects at Key Receptors – Scenario 1

Receptor	Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and $PM_{2.5}$ Significance Impacts at Receptors						
	Process Contrib'tn (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as %age of AQO	PEC as %age of AQO	Significance
D1	0.48	1.91	8.85	9.32	37.3%	<75% of AQAL	Negligible
D2	0.36	1.43	8.85	9.20	36.8%	<75% of AQAL	Negligible
D3	0.18	0.71	9.63	9.80	39.2%	<75% of AQAL	Negligible
D4	0.13	0.51	9.63	9.75	39.0%	<75% of AQAL	Negligible
D5	0.14	0.55	9.63	9.76	39.1%	<75% of AQAL	Negligible
D6	0.13	0.51	8.91	9.04	36.2%	<75% of AQAL	Negligible
D7	0.10	0.39	9.91	10.01	40.0%	<75% of AQAL	Negligible
D8	0.09	0.37	9.91	10.01	40.0%	<75% of AQAL	Negligible
D9	0.04	0.14	9.49	9.52	38.1%	<75% of AQAL	Negligible
D10	0.09	0.36	9.63	9.72	38.9%	<75% of AQAL	Negligible
D11	0.08	0.30	8.91	8.99	35.9%	<75% of AQAL	Negligible
AQOs	25						

Note:

(a) *Inclusive of Background concentrations from the traffic assessment.*

As shown in Table 6.7, there are no exceedances of the short-term NO_2 AQO at any of the identified sensitive receptors. The predicted impacts are significantly below the AQO of 25 µg/m³.

The percentage change in process concentrations relative to the AQAL as a result of the boiler operations at all receptor locations, with respect to $PM_{2.5}$ exposure, are determined to be 1.91% or less. The significance is determined to be 'negligible', based on the methodology outlined in Section 3.

Therefore, the predicted long-term $PM_{2.5}$ concentrations from the Site are considered acceptable for the protection of human health.

6.4 Carbon Monoxide (CO) – Scenario 1

Predicted ground level short-term (8-hour running mean) CO concentrations were assessed against the relevant AQO using 2018 met data (the year resulting in maximum short-term PC concentration). The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 6.8.

Table 6.8 Summary of Predicted CO Concentrations

Receptor	Predicted Maximum 8-hour Running Mean Concentration (µg/m³)		
	Process Contrib'tn (PC)	PC as %age of AQO	PEC[(a)] (PC +Background)
D1	406.42	4.06	540.42
D2	299.16	2.99	433.16
D3	191.74	1.92	325.74

Receptor	Predicted Maximum 8-hour Running Mean Concentration (µg/m³)		
	Process Contrib'tn (PC)	PC as %age of AQO	PEC[(a)] (PC +Background)
D4	143.75	1.44	277.75
D5	104.79	1.05	238.79
D6	129.86	1.30	263.86
D7	157.39	1.57	291.39
D8	127.81	1.28	261.81
D9	79.26	0.79	213.26
D10	62.66	0.63	196.66
D11	65.43	0.65	199.43
AQOs	10000		

Note:
[(a)] *Inclusive of Background concentration of 134µg/m³*

As indicated in Table 6.8, the maximum predicted 8-hour running mean CO process contributions (PC) at receptors is 406.42 µg/m³ when using 2018 met data. The predicted 8-hour running mean PCs of CO at the modelled discrete receptors are well below 4.06% of the short-term AQO, which are considered insignificant.

The maximum PEC of 8-hour running mean CO emissions is 540.42/m³, which does not exceed the relevant short-term AQS of 10000 µg/m³. Therefore, the short-term PECs of CO at all receptors are below the relevant short-term AQS of 10000 µg/m³ for the protection of human health.

6.5 Nitrogen Dioxide (NO_2) – Scenario 2 (Worst Case Operations)

For scenario 2, only the impact of the nitrogen dioxide on the receptors has been assessment. Other pollutants, such as, PM_{10}, $PM_{2.5}$ and CO have not included in the assessment due to the impacts of those pollutants from the normal operation scenario are well below the relevant AQO.

Long-Term (Annual Mean) NO_2 – Scenario 2

Predicted long-term (annual mean) PCs and PECs of NO_2 concentrations were assessed against the relevant AQO using 2017 met data (the year resulting in maximum long-term PC concentration). The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 6.9.

Table 6.9 The Long-Term (Annual Mean) Concentrations of NO_2 and Impact Description of Effects at Receptors – Scenario 2

Receptor		Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and NO_2 Impact Description at Receptors						
ID	Name	Process Contribution (PC)	PC as percentage of AQO (%)	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as percentage of AQO	PEC as percentage of AQO	Impact Descriptor
D1	100 Gibson Lane South	1.44	3.60	11.27	12.72	31.8%	≤ 75 of AQO	Negligible
D2	88 Gibson Lane South	1.09	2.73	11.27	12.37	30.9%	≤ 75 of AQO	Negligible
D3	54 Gibson Lane	0.54	1.36	14.84	15.38	38.5%	≤ 75 of AQO	Negligible
D4	The Coach House, Melton Grange, Main Road	0.39	0.98	14.84	15.23	38.1%	≤ 75 of AQO	Negligible
D5	21 Brickyard Lane	0.42	1.04	14.84	15.25	38.1%	≤ 75 of AQO	Negligible
D6	25 the triangle, North Ferriby	0.38	0.95	12.09	12.47	31.2%	≤ 75 of AQO	Negligible
D7	Lowcroft Farm, Lowfield Lane	0.29	0.72	14.55	14.84	37.1%	≤ 75 of AQO	Negligible
D8	South Hunsley School, 41 East Dale Road	0.27	0.68	14.55	14.82	37.1%	≤ 75 of AQO	Negligible
D9	62 Common Lane	0.11	0.26	13.26	13.36	33.4%	≤ 75 of AQO	Negligible
D10	79 Plantation Drive	0.27	0.68	14.84	15.11	37.8%	≤ 75 of AQO	Negligible
D11	75 Southfield Drive	0.22	0.56	12.09	12.31	30.8%	≤ 75 of AQO	Negligible
AQO		**40 µg/m³**						

There are no exceedances of the long-term NO_2 AQO at any of the identified sensitive receptors for scenario 2. The predicted impacts are significantly below the AQO of 40µg/m^3.

The percentage changes in process contribution of NO_2 relative to the AQAL as a result of the boiler operations at all receptor locations, with respect to NO_2 exposure, are determined to be 3.60% or less. The impact is determined to be 'negligible', based on the methodology outlined in Section 3. The effect of the proposed boiler operations on the local area is considered to be insignificant for scenario 2.

The predicted long-term NO_2 concentrations from the proposed development are considered acceptable for the protection of human health for scenario 2.

Short-Term (1-Hour Mean) NO_2 – Scenario 2

Predicted short-term (1hour mean) PCs and PECs of NO_2 concentrations were assessed against the relevant AQO using 2018 met data (the year resulting in maximum long-term PC concentration). The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 6.10.

Table 6.10 Summary of the Predicted Short-Term NO_2 Concentrations at Discrete Receptors – Scenario 2

Receptor		Predicted 1-hour Mean (99.79th Percentile) Concentration (µg/m^3) – 2018 Met Data				
ID	Name	Process Contribution (PC)	PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as percentage of AQO
D1	100 Gibson Lane South	26.77	13.38	22.55	49.32	24.66
D2	88 Gibson Lane South	21.39	10.69	22.55	43.94	21.97
D3	54 Gibson Lane	14.50	7.25	29.67	44.17	22.09
D4	The Coach House, Melton Grange, Main Road	10.93	5.47	29.67	40.61	20.30
D5	21 Brickyard Lane	12.97	6.49	29.67	42.65	21.32
D6	25 the triangle, North Ferriby	8.87	4.44	24.18	33.05	16.53
D7	Lowcroft Farm, Lowfield Lane	16.79	8.39	29.10	45.89	22.94
D8	South Hunsley School, 41 East Dale Road	11.34	5.67	29.10	40.44	20.22
D9	62 Common Lane	7.77	3.89	26.52	34.29	17.14
D10	79 Plantation Drive	5.90	2.95	29.67	35.58	17.79
D11	75 Southfield Drive	7.06	3.53	24.18	31.24	15.62
AQOs	200 µg/m^3					

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

There are no exceedances of the short-term NO_2 AQO at any of the identified sensitive receptors. The predicted impacts are significantly below the AQO of 200 µg/m^3.

Therefore, the predicted short-term NO_2 concentrations from the boiler operations are considered acceptable for the protection of human health for scenario 2.

7. Habitat Assessment

The habitat assessment has been undertaken for the following identified nature conservation site.

- Humber Estuary SPA, SAC, Ramsar, SSSI;

The long-term and short-term concentrations among those ecological sites have been calculated for habitat assessment against relevant critical loads, using 2017 met data (the year resulting in maximum long-term and short-term PC concentrations).

Scenario 1 – Operation of 35 Biomass Boilers

Predicted Nitrogen Oxide Concentrations Compared to Critical Levels of Long-Term and Short-Term NO_x (as NO_2) for Scenario 1

Table 7.1 presents a summary of the predicted nitrogen oxide concentrations using 2017 and 2018 met data (the year resulting in maximum long-term and short-term PC concentrations respectively) at the Humber Estuary ecological receptor locations.

able 7.1 Summary of Predicted NO_x (as NO_2) Concentrations for Protection of Vegetation and Ecosystems – Scenario 1

Ecological Receptor		Predicted Maximum Annual Mean Concentration (µg/m³)				Predicted 24-hour Mean Concentration (µg/m³)			
		Process Contrib'tn (PC)	PC as %age of AQO	BC	PEC[a] (PC +Background)	Process Contrib'tn (PC)	PC as %age of AQO	BC	PEC[b] (PC +Background)
E1	Humber Estuary SPA, SAC, Ramsar, SSSI 1	0.05	0.17	14.25	14.30	1.69	2.25	16.82	18.50
E2	Humber Estuary SPA, SAC, Ramsar, SSSI 2	0.08	0.26	14.82	14.90	4.34	5.78	17.49	21.82
E3	Humber Estuary SPA, SAC, Ramsar, SSSI 3	0.15	0.50	14.82	14.97	4.71	6.27	17.49	22.19
E4	Humber Estuary SPA, SAC, Ramsar, SSSI 4	0.21	0.69	14.78	14.99	4.37	5.82	17.44	21.81
E5	Humber Estuary SPA, SAC, Ramsar, SSSI 5	0.19	0.65	16.60	16.79	2.48	3.31	19.59	22.07
	AQO/Critical Level (CL)	30[c]				75[d]			

Note:

[a] Inclusive of Background concentrations. The Background concentration was taken from http://www.apis.ac.uk/.
[b] The Inclusive of Background concentration[s]. The Background concentration was taken from http://www.apis.ac.uk/.
[c] The AQO of 30 µg/m³ is the annual standard for the protection of vegetation and ecosystems; and
[d] The AQO of 75 µg/m³ is the daily standard for the protection of vegetation and ecosystems.

The annual mean NO_x (as NO_2) PEC at the ecological receptor locations are below the annual mean critical level of 30 µg/m³ for the protection of vegetation and Ecosystems.

The NO_x daily (24 hour) predicted environmental concentration at all ecological receptor locations are well below the daily mean critical levels of 75 µg/m^3 for the protection of vegetation and Ecosystems.

The significance of changes associated with the operations of the facility with respect to annual mean NO_x (as NO_2) exposure at the ecological receptors has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in Table 7.2.

Table 7.2 The Long-Term (Annual Mean) Concentrations of NO_x (as NO_2) and Significance of Effects at Ecological Receptors – Scenario 1

Receptor		Predicted Annual Mean Concentration (µg/m^3) – 2017 Met Data, and NO_2 Significance Impacts at Ecological Receptors						
		Process Contrib'tn (PC)	PC as %age of AQO	BC	PEC[(a)] (PC +Background)	PEC as %age of AQO	PEC as %age of AQO	Significance
E1	Humber Estuary SPA, SAC, Ramsar, SSSI 1	0.05	0.17	14.25	14.30	47.67	≤75% % of AQAL	Negligible
E2	Humber Estuary SPA, SAC, Ramsar, SSSI 2	0.08	0.26	14.82	14.90	49.66	≤75% % of AQAL	Negligible
E3	Humber Estuary SPA, SAC, Ramsar, SSSI 3	0.15	0.50	14.82	14.97	49.90	≤75% % of AQAL	Negligible
E4	Humber Estuary SPA, SAC, Ramsar, SSSI 4	0.21	0.69	14.78	14.99	49.96	≤75% % of AQAL	Negligible
E5	Humber Estuary SPA, SAC, Ramsar, SSSI 5	0.19	0.65	16.60	16.79	55.98	≤75% % of AQAL	Negligible

The percentage change in long-term process concentrations relative to the AQAL as a result of the proposed development at all ecological receptor locations, with respect to NO_x (as NO_2) exposure, are determined to be 0.69% or less. The significance is to be 'negligible' for all ecological receptor locations, based on the methodology outlined in Section 3.

As the percentage change in long-term process concentrations relative to the AQAL is below 1% of the relevant critical level for the protection of vegetation and Ecosystems, the long-term process contributions have been screened out against the relevant standard/critical level. The nitrogen deposition assessment has not been undertaken.

Furthermore, Guidance of "A guide to the assessment of air quality impacts on designated nature conservation sites, June 2019 states that:

"5.5.2.3 In March 2015. AQTAG (Air quality Technical Advisory Group) clarified to the planning inspectorate that 'for installations other than intensive pig and poultry farms, AQTAG is confident that a process contribution (PC, as predicted by H1 or a detailed dispersion model) <1% of the relevant critical level or load (CL) can be considered inconsequential and does not need to be included in an in-combination assessment".

Therefore, in-combination habitat assessment (cumulative habitat assessment) does not need to be undertaken.

In summary, the NO_x impacts from the proposed development on the ecological receptors are insignificant for scenario 1.

Scenario 2 – Operation of 41 Biomass Boilers

Predicted Nitrogen Oxide Concentrations Compared to Critical Levels of Long-Term and Short-Term NO_x (as NO_2) for Scenario 2

Table 7.3 presents a summary of the predicted nitrogen oxide concentrations using 2017 and 2018 met data (the year resulting in maximum long-term and short-term PC concentrations respectively) at the Humber Estuary ecological receptor locations for scenario 2.

able 7.3 Summary of Predicted NO_x (as NO_2) Concentrations for Protection of Vegetation and Ecosystems – Scenario 2

Ecological Receptor		Predicted Maximum Annual Mean Concentration (µg/m³)				Predicted 24-hour Mean Concentration (µg/m³)			
		Process Contrib'tn (PC)	PC as %age of AQO	BC	PEC[a] (PC +Background)	Process Contrib'tn (PC)	PC as %age of AQO	BC	PEC[b] (PC +Background)
E1	Humber Estuary SPA, SAC, Ramsar, SSSI 1	0.06	0.20	14.25	14.31	1.98	2.64	0.00	1.98
E2	Humber Estuary SPA, SAC, Ramsar, SSSI 2	0.09	0.30	14.82	14.91	5.10	6.81	0.00	5.10
E3	Humber Estuary SPA, SAC, Ramsar, SSSI 3	0.17	0.58	14.82	14.99	5.43	7.24	0.00	5.43
E4	Humber Estuary SPA, SAC, Ramsar, SSSI 4	0.24	0.80	14.78	15.02	5.08	6.77	0.00	5.08
E5	Humber Estuary SPA, SAC, Ramsar, SSSI 5	0.23	0.76	16.60	16.83	2.92	3.90	0.00	2.92
	AQO/Critical Level (CL)	30[c]				75[d]			

Note:

[a] Inclusive of Background concentrations. The Background concentration was taken from http://www.apis.ac.uk/.
[b] The Inclusive of Background concentration[s]. The Background concentration was taken from http://www.apis.ac.uk/.
[c] The AQO of 30 µg/m³ is the annual standard for the protection of vegetation and ecosystems; and
[d] The AQO of 75 µg/m³ is the daily standard for the protection of vegetation and ecosystems.

The annual mean NO_x (as NO_2) PEC at the ecological receptor locations are below the annual mean critical level of 30 µg/m³ for the protection of vegetation and Ecosystems.

The NO_x daily (24 hour) predicted environmental concentration at all ecological receptor locations are well below the daily mean critical levels of 75 µg/m³ for the protection of vegetation and Ecosystems.

The significance of changes associated with the operations of the facility with respect to annual mean NO_x (as NO_2) exposure at the ecological receptors has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in Table 7.4.

Table 7.4 The Long-Term (Annual Mean) Concentrations of NO_x (as NO_2) and Significance of Effects at Ecological Receptors – Scenario 2

Receptor		Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and NO_2 Significance Impacts at Ecological Receptors						
		Process Contrib'tn (PC)	PC as %age of AQO	BC	PEC[(a)] (PC +Background)	PEC as %age of AQO	PEC as %age of AQO	Significance
E1	Humber Estuary SPA, SAC, Ramsar, SSSI 1	0.06	0.20	14.25	14.31	47.70	≤75% % of AQAL	Negligible
E2	Humber Estuary SPA, SAC, Ramsar, SSSI 2	0.09	0.30	14.82	14.91	49.70	≤75% % of AQAL	Negligible
E3	Humber Estuary SPA, SAC, Ramsar, SSSI 3	0.17	0.58	14.82	14.99	49.98	≤75% % of AQAL	Negligible
E4	Humber Estuary SPA, SAC, Ramsar, SSSI 4	0.24	0.80	14.78	15.02	50.07	≤75% % of AQAL	Negligible
E5	Humber Estuary SPA, SAC, Ramsar, SSSI 5	0.23	0.76	16.60	16.83	56.09	≤75% % of AQAL	Negligible

The percentage change in long-term process concentrations relative to the AQAL as a result of the proposed development at all ecological receptor locations, with respect to NO_x (as NO_2) exposure, are determined to be 0.80% or less. The significance is to be 'negligible' for all ecological receptor locations, based on the methodology outlined in Section 3.

As the percentage change in long-term process concentrations relative to the AQAL is below 1% of the relevant critical level for the protection of vegetation and Ecosystems, the long-term process contributions have been screened out against the relevant standard/critical level. The nitrogen deposition assessment has not been undertaken.

Furthermore, Guidance of "A guide to the assessment of air quality impacts on designated nature conservation sites, June 2019, states that:

"5.5.2.3 In March 2015. AQTAG (Air quality Technical Advisory Group) clarified to the planning inspectorate that 'for installations other than intensive pig and poultry farms, AQTAG is confident that a process contribution (PC, as predicted by H1 or a detailed dispersion model) <1% of the relevant critical level or load (CL) can be considered inconsequential and does not need to be included in an in-combination assessment".

Therefore, in-combination habitat assessment (cumulative habitat assessment) for scenario 2 does not need to be undertaken.

In summary, the NO_x impacts from the proposed development on the ecological receptors are insignificant for scenario 2.

8. Cumulative Impact Assessment Results For the Protection Human Health

Cumulative impact assessment for the protection human health has been undertaken by assessing the adjacent industrial points sources, including Transwaste's biomass boilers and Energy Recovery Facility.

Following emission sources have been included in the cumulative assessment:

(1) 41 Orlan Super 130 kW_{th} biomass boilers proposed by Eco-Powers;
(2) Three Kalvis 0.95 MW_{th} biomass boilers operated by Transwaste Ltd; and
(3) Two emission flues at Energy Recovery Facility (ERF) operated by HRS Energy.

All predicted concentrations using 2017 and 2018 met data (the year resulting in maximum long-term and short-term PC concentrations from Eco-Power biomass boiler operations respectively) have been compared to the relevant environmental assessment criteria, as detailed in Sections 2 and 3.

8.1 Nitrogen Dioxide (NO_2) – Cumulative Assessment

Long-Term (Annual Mean) NO_2 – Cumulative Assessment

Predicted long-term (annual mean) PCs and PECs of NO_2 concentrations were assessed against the relevant AQO using 2017 met data (the year resulting in maximum long-term PC concentration from Eco-Power biomass boiler operations). The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 8.1.

The impact description of changes associated with the operations of the all emission sources with respect to annual mean NO_2 exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in Table 8.1.

Table 8.1 The Long-Term (Annual Mean) Concentrations of NO_2 and Impact Description of Effects at Receptors – Cumulative Assessment

Receptor		Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and NO_2 Impact Description at Receptors									
ID	Name	Process Contribution (PC)				Total PC as percentage of AQO (%)	Background from the Traffic assessment	Total PEC[(a)] (PC +Background)	Total PEC as percentage of AQO	PEC as percentage of AQO	Impact Descriptor
		Eco-Power Boilers	Three Kalvis Boilers	ERF	Total						
D1	100 Gibson Lane South	1.22	0.86	0.27	2.35	5.86	11.27	13.62	34.0%	≤ 75 of AQO	Negligible
D2	88 Gibson Lane South	0.91	0.66	0.35	1.92	4.81	11.27	13.20	33.0%	≤ 75 of AQO	Negligible
D3	54 Gibson Lane	0.46	0.29	0.39	1.13	2.82	14.84	15.97	39.9%	≤ 75 of AQO	Negligible
D4	The Coach House, Melton Grange, Main Road	0.33	0.24	0.38	0.95	2.37	14.84	15.79	39.5%	≤ 75 of AQO	Negligible
D5	21 Brickyard Lane	0.35	0.27	0.38	1.00	2.50	14.84	15.84	39.6%	≤ 75 of AQO	Negligible
D6	25 the triangle, North Ferriby	0.32	0.27	0.40	0.99	2.48	12.09	13.08	32.7%	≤ 75 of AQO	Negligible
D7	Lowcroft Farm, Lowfield Lane	0.25	0.11	0.15	0.51	1.28	14.55	15.06	37.7%	≤ 75 of AQO	Negligible
D8	South Hunsley School, 41 East Dale Road	0.23	0.14	0.15	0.53	1.32	14.55	15.08	37.7%	≤ 75 of AQO	Negligible
D9	62 Common Lane	0.09	0.06	0.10	0.25	0.63	13.26	13.51	33.8%	≤ 75 of AQO	Negligible
D10	79 Plantation Drive	0.23	0.20	0.28	0.71	1.79	14.84	15.55	38.9%	≤ 75 of AQO	Negligible
D11	75 Southfield Drive	0.19	0.26	0.33	0.78	1.95	12.09	12.87	32.2%	≤ 75 of AQO	Negligible
AQO		**40 µg/m³**									

The predicted cumulative long-term NO_2 PECs at selected receptor locations are below the relevant long-term AQS of 40 µg/m^3 for the protection of human health.

The percentage changes in process contribution of NO_2 relative to the AQAL as a result of the emission emissions at all receptor locations, with respect to NO_2 exposure, are determined to be 5.86% or less. The impact is determined to be 'negligible', based on the methodology outlined in Section 3. The effect of the proposed boiler operations on the local area is considered to be insignificant.

The predicted cumulative long-term NO_2 concentrations from the proposed development are considered acceptable for the protection of human health.

Short-Term (1-Hour Mean) NO_2 – Cumulative Assessment

The short-term cumulative NO_2 PEC concentrations have been calculated at each of the discrete receptors listed for the worst meteorological year of 2018 and these results are detailed in Table 8.2.

Table 8.2 Summary of the Predicted Short-Term NO_2 Concentrations at Discrete Receptors

Receptor		Predicted 1-hour Mean (99.79th Percentile) Concentration (µg/m³) – 2018 Met Data							
ID	Name	Process Contribution (PC)				PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as percentage of AQO
		Eco-Power Boilers	Three Kalvis Boilers	ERF	Total				
D1	100 Gibson Lane South	19.70	13.60	4.04	37.34	18.67	22.55	59.89	29.94
D2	88 Gibson Lane South	16.65	10.90	4.54	32.09	16.04	22.55	54.64	27.32
D3	54 Gibson Lane	12.29	4.06	4.13	20.48	10.24	29.67	50.15	25.08
D4	The Coach House, Melton Grange, Main Road	9.06	4.31	3.82	17.18	8.59	29.67	46.86	23.43
D5	21 Brickyard Lane	10.05	4.00	3.86	17.91	8.96	29.67	47.59	23.79
D6	25 the triangle, North Ferriby	7.83	3.42	2.82	14.07	7.04	24.18	38.25	19.13
D7	Lowcroft Farm, Lowfield Lane	15.19	2.87	4.16	22.23	11.11	29.10	51.33	25.66
D8	South Hunsley School, 41 East Dale Road	11.43	4.17	3.47	19.07	9.54	29.10	48.17	24.09
D9	62 Common Lane	5.62	3.96	2.50	12.08	6.04	26.52	38.59	19.30
D10	79 Plantation Drive	6.99	3.85	2.74	13.58	6.79	29.67	43.25	21.63
D11	75 Southfield Drive	5.54	3.43	2.63	11.60	5.80	24.18	35.78	17.89
AQOs	200 µg/m³								

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 8.2 there are no exceedances of the short-term NO_2 AQO at any of the identified sensitive receptors. The predicted cumulative impacts are significantly below the AQO of 200 µg/m^3.

Therefore, the predicted cumulative short-term NO_2 concentrations from the cumulative emission sources are considered acceptable for the protection of human health.

The contour plots of the predicted cumulative long-term and short-term ground level PCs of NO_2 for all receptors, including discrete and grid receptors are presented in Figures 12 and 13. The contour plots show that the predicted maximum concentrations occur adjacent to the emission source, with a predicted decrease in concentration with the increased distance from the stack.

8.2 Particulate Matter (PM_{10}) – Cumulative Assessment

Long-Term (Annual Mean) PM_{10} – Cumulative Assessment

The predicted long-term cumulative PCs and PECs from 2017 meteorological data, the year resulting in maximum long-term NO_2 PC concentration from Eco-Power biomass boiler operations, at receptor locations are compared against the relevant AQS, in Table 8.3.

Table 8.3 The Long-Term (Annual Mean) Concentrations of PM_{10} and Impact Description of Effects at Receptors – Cumulative Assessment

Receptor		Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and PM_{10} Impact Description at Receptors									
ID	Name	Process Contribution (PC)				Total PC as percentage of AQO (%)	Background from the Traffic assessment	Total PEC[(a)] (PC +Background)	Total PEC as percentage of AQO	PEC as percentage of AQO	Impact Descriptor
		Eco-Power Boilers	Three Kalvis Boilers	ERF	Total						
D1	100 Gibson Lane South	0.48	0.25	0.03	0.75	1.88	13.78	14.53	36.3%	≤ 75 of AQO	Negligible
D2	88 Gibson Lane South	0.36	0.19	0.04	0.58	1.46	13.78	14.36	35.9%	≤ 75 of AQO	Negligible
D3	54 Gibson Lane	0.18	0.08	0.04	0.30	0.76	15.08	15.39	38.5%	≤ 75 of AQO	Negligible
D4	The Coach House, Melton Grange, Main Road	0.13	0.07	0.04	0.24	0.59	15.08	15.32	38.3%	≤ 75 of AQO	Negligible
D5	21 Brickyard Lane	0.14	0.08	0.04	0.26	0.64	15.08	15.34	38.3%	≤ 75 of AQO	Negligible
D6	25 the triangle, North Ferriby	0.13	0.08	0.04	0.25	0.62	13.52	13.76	34.4%	≤ 75 of AQO	Negligible
D7	Lowcroft Farm, Lowfield Lane	0.10	0.03	0.02	0.15	0.36	15.73	15.88	39.7%	≤ 75 of AQO	Negligible
D8	South Hunsley School, 41 East Dale Road	0.09	0.04	0.02	0.15	0.37	15.73	15.88	39.7%	≤ 75 of AQO	Negligible
D9	62 Common Lane	0.04	0.02	0.01	0.06	0.16	14.72	14.78	37.0%	≤ 75 of AQO	Negligible
D10	79 Plantation Drive	0.09	0.06	0.03	0.18	0.45	15.08	15.26	38.2%	≤ 75 of AQO	Negligible
D11	75 Southfield Drive	0.08	0.07	0.04	0.18	0.46	13.52	13.70	34.3%	≤ 75 of AQO	Negligible
AQO	**40 µg/m³**										

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 8.3, there are no exceedances of the long-term NO_2 AQO at any of the identified sensitive receptors. The predicted cumulative impacts are significantly below the AQO of 40 µg/m^3.

The percentage change in process concentrations relative to the AQAL as a result of the cumulative emission sources at all receptor locations, with respect to PM_{10} exposure, are determined to be 1.88% or less. The significance is determined to be 'negligible', based on the methodology outlined in Section 3.

Therefore, the predicted cumulative long-term PM_{10} concentrations from the Site are considered acceptable for the protection of human health.

Short-Term (24-Hour Mean) PM_{10} – Cumulative Assessment

The predicted short-term PCs and PECs from 2018 meteorological data, the year resulting in maximum short-term NO_2 PC concentration from Eco-Power biomass boiler operations, at receptor locations are compared against the relevant AQS, in Table 8.4.

Table 8.4 The Short-Term (24-Hour Mean) Concentrations of PM_{10} at Key Receptors – Cumulative Assessment

Receptor	Predicted 24-Hour Mean (90.41th Percentile) Concentration (µg/m^3) – 2018 Met Data at Receptors							
	Process Contrib'tn (PC)				PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as %age of AQO
	Eco-Power Boilers	Three Kalvis Boilers	ERF	Total				
D1	1.27	0.74	0.09	2.10	4.21	13.78	15.88	31.76
D2	0.97	0.57	0.13	1.68	3.35	13.78	15.45	30.90
D3	0.56	0.25	0.13	0.94	1.89	15.08	16.03	32.05
D4	0.36	0.21	0.15	0.73	1.45	15.08	15.81	31.62
D5	0.42	0.23	0.12	0.77	1.54	15.08	15.85	31.70
D6	0.35	0.21	0.14	0.70	1.41	13.52	14.22	28.44
D7	0.33	0.11	0.05	0.49	0.97	15.73	16.22	32.43
D8	0.34	0.15	0.06	0.55	1.10	15.73	16.28	32.56
D9	0.12	0.06	0.03	0.21	0.43	14.72	14.93	29.87
D10	0.30	0.17	0.09	0.56	1.12	15.08	15.64	31.28
D11	0.22	0.23	0.12	0.56	1.13	13.52	14.08	28.16
AQOs	50							

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 8.4, there are no exceedances of the short-term NO_2 AQO at any of the identified sensitive receptors. The predicted cumulative impacts are significantly below the AQO of 50 µg/m^3.

Therefore, the predicted cumulative short-term PM_{10} concentrations from the all source emissions are considered acceptable for the protection of human health.

The contour plots of the predicted cumulative long-term ground level PCs of PM_{10} for all receptors, including discrete and grid receptors are presented in Figure 14. The contour plots show that the predicted maximum concentrations occur adjacent to the emission source, with a predicted decrease in concentration with the increased distance from the stack.

The contour plots of the predicted cumulative short-term ground level PCs of PM_{10} for all receptors, including discrete and grid receptors are not presented as the cumulative PCs are well below 10% of relevant AQO.

8.3 Particulate Matter ($PM_{2.5}$) – Cumulative Assessment

A worst-case scenario assumption of 100% of PM_{10} to be $PM_{2.5}$ has been made in the cumulative assessment. The predicted long-term PCs of $PM_{2.5}$ and the significance of changes associated with the operations of the all sources considered with respect to annual mean $PM_{2.5}$ exposure has been presented and assessed in Table 8.5.

Table 8.5 The Long-Term (Annual Mean) Concentrations of $PM_{2.5}$ and Impact Description of Effects at Receptors – Cumulative Assessment

Receptor		Predicted Annual Mean Concentration (µg/m³) – 2017 Met Data, and $PM_{2.5}$ Impact Description at Receptors									
ID	Name	Process Contribution (PC)				Total PC as percentage of AQO (%)	Background from the Traffic assessment	Total PEC[(a)] (PC +Background)	Total PEC as percentage of AQO	PEC as percentage of AQO	Impact Descriptor
		Eco-Power Boilers	Three Kalvis Boilers	ERF	Total						
D1	100 Gibson Lane South	0.48	0.25	0.03	0.75	3.01	8.85	9.60	38.39	≤ 75 of AQO	Negligible
D2	88 Gibson Lane South	0.36	0.19	0.04	0.58	2.34	8.85	9.43	37.72	≤ 75 of AQO	Negligible
D3	54 Gibson Lane	0.18	0.08	0.04	0.30	1.21	9.63	9.93	39.71	≤ 75 of AQO	Negligible
D4	The Coach House, Melton Grange, Main Road	0.13	0.07	0.04	0.24	0.95	9.63	9.86	39.45	≤ 75 of AQO	Negligible
D5	21 Brickyard Lane	0.14	0.08	0.04	0.26	1.02	9.63	9.88	39.53	≤ 75 of AQO	Negligible
D6	25 the triangle, North Ferriby	0.13	0.08	0.04	0.25	0.99	8.91	9.16	36.63	≤ 75 of AQO	Negligible
D7	Lowcroft Farm, Lowfield Lane	0.10	0.03	0.02	0.15	0.58	9.91	10.06	40.24	≤ 75 of AQO	Negligible
D8	South Hunsley School, 41 East Dale Road	0.09	0.04	0.02	0.15	0.60	9.91	10.06	40.25	≤ 75 of AQO	Negligible
D9	62 Common Lane	0.04	0.02	0.01	0.06	0.26	9.49	9.55	38.20	≤ 75 of AQO	Negligible
D10	79 Plantation Drive	0.09	0.06	0.03	0.18	0.72	9.63	9.81	39.22	≤ 75 of AQO	Negligible
D11	75 Southfield Drive	0.08	0.07	0.04	0.18	0.74	8.91	9.10	36.38	≤ 75 of AQO	Negligible
AQO	**25 µg/m³**										

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 8.5, there are no exceedances of the short-term NO_2 AQO at any of the identified sensitive receptors. The predicted impacts are significantly below the AQO of 25 µg/m^3.

The percentage change in process concentrations relative to the AQAL as a result of the boiler operations at all receptor locations, with respect to $PM_{2.5}$ exposure, are determined to be 3.01% or less. The significance is determined to be 'negligible', based on the methodology outlined in Section 3.

Therefore, the predicted cumulative long-term $PM_{2.5}$ concentrations from the all emission sources considered are considered acceptable for the protection of human health.

8.4 Carbon Monoxide (CO) – Cumulative Assessment

Predicted ground level cumulative short-term (8-hour running mean) CO concentrations were assessed against the relevant AQO using 2018 met data (the year resulting in maximum short-term PC concentration). The results of the model predictions at each discrete receptor, inclusive of background, are summarised in Table 8.6.

Table 8.6 Summary of Predicted CO Concentrations – Cumulative Assessment

Receptor	Predicted Maximum 8-hour Running Mean Concentration (µg/m^3)					
	Process Contrib'tn (PC)				Total PC as %age of AQO	PEC[(a)] (PC +Background)
	Eco-Power Boilers	Three Kalvis Boilers	ERF	Total		
D1	406.42	78.61	3.95	488.98	4.89	622.98
D2	299.16	50.58	4.67	354.41	3.54	488.41
D3	191.74	23.79	5.07	220.61	2.21	354.61
D4	143.75	23.75	3.97	171.47	1.71	305.47
D5	104.79	18.62	4.78	128.20	1.28	262.20
D6	129.86	23.98	2.90	156.74	1.57	290.74
D7	157.39	14.02	6.10	177.51	1.78	311.51
D8	127.81	25.00	3.58	156.39	1.56	290.39
D9	79.26	21.78	4.74	105.78	1.06	239.78
D10	62.66	20.85	2.87	86.38	0.86	220.38
D11	65.43	18.97	2.96	87.35	0.87	221.35
AQOs	10000					

Note:
[(a)] *Inclusive of Background concentration of 134µg/m^3*

As indicated in Table 8.6, the maximum predicted cumulative 8-hour running mean CO process contributions (PC) at receptors is 488.98 µg/m^3 when using 2018 met data. The predicted cumulative 8-hour running mean PCs of CO at the modelled discrete receptors are well below 4.89% of the short-term AQO, which are considered insignificant.

The maximum cumulative PEC of 8-hour running mean CO emissions is 622.98/m^3, which does not exceed the relevant short-term AQS of 10000 µg/m^3. Therefore, the cumulative short-term PECs of CO at all receptors are below the relevant short-term AQS of 10000 µg/m^3 for the protection of human health.

In addition, the process contribution (PC, as predicted by the detailed dispersion model) from Eco-power biomass boiler operations being <1% of the relevant critical level or load (CL) can be considered inconsequential and does not need to be included in an in-combination (cumulative) habitat assessment.

8.5 Short-Term NO_2 – Cumulative Assessment including Level Crossing Traffic

Investigations of the potential increase of the short-term impact on receptors from level crossing related waiting traffic has been undertaken.

Mr Philip Hill, Senior Environmental Control Officer of Yorkshire Council has reviewed the first issue of this air quality assessment report. Mr Hill has contacted to WYG with comments of additional studies of the potential increased short-term impact from the waiting traffic at the level crossing at Gibson Lane on the residential receptors.

Additional air quality modelling has been used to determine the pollutant levels from the waiting traffic at the level crossing.

The waiting traffic emissions have been modelled by assuming a worst-case total of 22 HGVs being idle on both side of the railway line on Gibson Lane.

The idle traffic NO_x emissions have been based on following data:

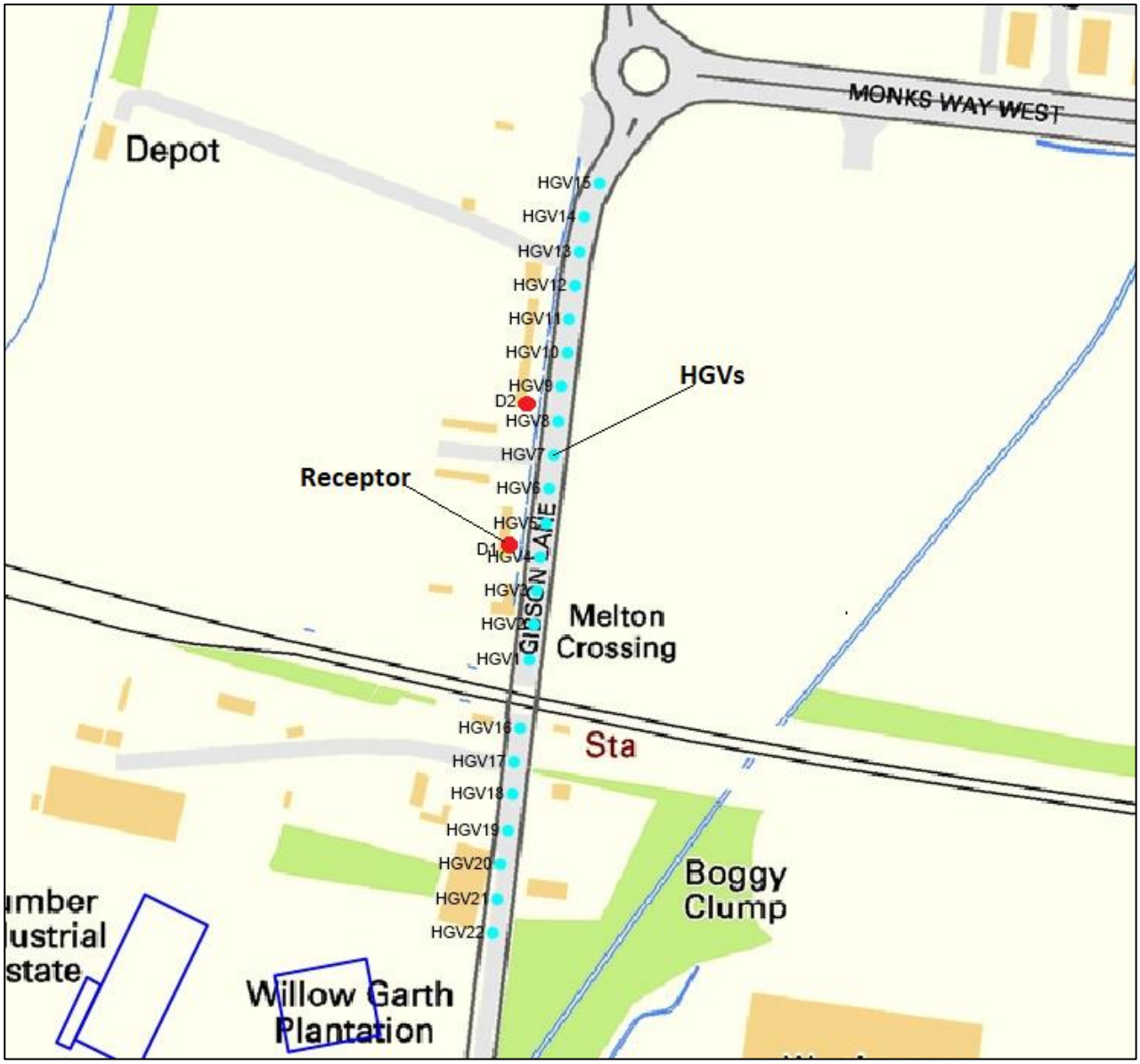
(1) Number of HGV's: 22;
(2) Length for HGV's: 17m;
(3) Idle diesel car NO_x emission rate: 4.5 g/hr [a] ;
(4) A diesel car fuel consumption: 0.65 litter/hr;
(5) Idle diesel HGV NO_x emission rate: 13.86 g/hr;

Note:

(a) Source: "Road tunnels: vehicle emissions and air demand for ventilation", Technical committee D.5 Road Tunnels, 2019R02EN.

The HGV emission source locations and the receptor locations are presented in Figure 8.1 below:

Figure 8.1 HGV Emission Source Locations



Short-Term (1-Hour Mean) NO_2 – Cumulative Assessment including the Waiting Traffic

The predicted short-term NO_2 PC from the waiting traffic are 17.09 µg/m^3 and 22.34 µg/m^3 at 100 Gibson Lone South (R1) and at 88 Gibson Lane South (R2) respectively.

The total of the predicted cumulative short-term NO_2 PEC, including (1) the waiting traffic (2) Eco-Power boiler, (3) three Kalvis boilers, (4) Two emission flues at the ERF, and (5) the background (including normal traffic emissions), at 100 Gibson Lone South (R1) and at 88 Gibson Lane South (R2) is presented in Table 8.7.

Table 8.7 Summary of the Predicted Short-Term NO_2 Concentrations at Discrete Receptors including the waiting Traffic

Receptor		Predicted 1-hour Mean (99.79th Percentile) Concentration (µg/m³) – 2018 Met Data								
ID	Name	Process Contribution (PC)					PC as %age of AQO	Background from the Traffic assessment	PEC[(a)] (PC +Background)	PEC as percentage of AQO
		Waiting Traffic	Eco-Power Boilers	Three Kalvis Boilers	ERF	Total				
D1	100 Gibson Lane South	17.09	19.70	13.60	4.04	54.43	27.22	22.55	76.98	38.49
D2	88 Gibson Lane South	22.34	16.65	10.90	4.54	54.43	27.22	22.55	76.98	38.49
AQOs	200 µg/m³									

Note:

(a) Inclusive of Background concentrations from the traffic assessment.

As shown in Table 8.7 there are no exceedances of the short-term NO_2 AQO at 100 Gibson Lone South (R1) and at 88 Gibson Lane South (R2). The predicted cumulative impacts including the waiting traffic contributions are significantly below the AQO of 200 µg/m^3.

9. Odour Assessment for Drying Floor Operations

9.1 Process Descriptions

The Perry Belt Drier (drying floor) is ideally suited to drying almost any non-flowing product or more granular products that require a lower throughput capacity. Popular applications have included waste materials, such as woodchip.

Air is drawn down through the product bed/waste materials which keeps the product tight to the belt, improving drying efficiency & reducing product loss through fans via product lift.

The proposed dryer has a throughput capacity of 14.8 tonnes per hour on SRF 100kg/m^3 (dry output 13,300 kg per hour). The overall drying section length is 33 m.

There are 6 heat exchanger units and each unit has a heated air volume of approximately 50,000 m^3/hr. It is proposed to install 13 emission stacks to disperse the exhausted air volumes. Definition of Odour Impact and Effect

Following major regulations/guidance/guidelines have been used in the assessment:

- Guidance on the assessment of odour for planning, IAQM, July 2018; and
- H4 Odour Management, How to comply with your environmental permit, March 2011.

IEMA Guidelines for Environmental Impact Assessment (2004) recommend a clear progression from the characterisation of "impact" to the assessment of the significance of the "effect" taking into account the evaluation of the sensitivity and value of the receptors. The guidelines emphasise the need to clearly define at the outset how the two terms will be used and then to apply them in a consistent fashion. In this IAQM guidance, the following definitions are used:

- **Impacts** – these are changes to the environment attributable to the development proposal.
- **Effects** – these are the results of the changes on specific receptors.
- **Receptors** - are the users of the adjacent land, which may vary in their sensitivity to odour.

An increase in odour levels (the impact) would therefore cause a particular effect (e.g. loss of amenity) if the adjacent land use was residential, and perhaps a lesser effect if the adjacent land use was an industrial facility.

9.2 Odour Benchmarks

Environment Agency Guidance H4 Odour Management (March 2011) and the latest Institute of Air Quality Management (IAQM) Guidance on the Assessment of Odour for Planning (July 2018) provides a methodology for assessing the impacts of odour based on the combinations of field odour survey observations and odour dispersion modelling.

The modelling method (if used) calculates the 98th percentile of hourly average odour concentrations ($C_{98,\ 1\text{-}hour}$) over a year, (i.e. the levels exceeded for 2% of the time) with the results being expressed as European Odour Unit contours on a map. The exposure contours can then be used to check unacceptable levels of odour pollution against exposure benchmarks at sensitive receptor locations.

The H4 benchmarks are based on the 98th percentile of hourly averages and they are presented in Table 9.1.

Table 9.1 H4 Benchmark Odour Criteria

Criterion C_{98} ou_E/m^3	Offensiveness	Odour Emission Sources
1.5	Most offensive odours	Processes involving decaying animal or fish remains Processes involving septic effluent or sludge Biological landfill odours
3.0	Moderately offensive odours	Intensive livestock rearing Fat frying (food processing) Sugar beet processing Well aerated green waste composting
6.0	Less offensive odours	Brewery Confectionery Coffee

The latest IAQM guidance states that the predictive, quantitative approach involves obtaining estimates of the odour source emission rate, use of the emissions in a dispersion model to predict 98th percentile concentration at sensitive receptors and comparison of these with criteria that have evolved from research and survey work. At the present time, this remains an accepted technique and the IAQM supports this.

IAQM confirm that in the absence of comprehensive dose-response information the assessor should allow the derivation of exact C98 concentration metrics for different types of odour, IAQM is *'of the opinion that the practitioner should observe, from the various scientific studies, case law and practical examples of the investigation of odour annoyance cases, that in any specific case, an appropriate criterion could lie somewhere in the range of 1 to 10 ouE/m^3 as a 98th percentile of hourly mean odour concentrations.*

Taking into account the available scientific evidence and the collective experience of IAQM members involved in drafting this guidance, the odour concentration change descriptors together with impact descriptors in

Table 9.2 are proposed by IAQM for an odour at the offensive end of the spectrum. These adopt the C98 as the appropriate frequency metric, encompasses the 1 to 10 ouE/m³ concentration range referred to above and also considers also the potential sensitivity of different receptors. It is also consistent in format and concept with other guidance in the air quality field.

For odours that are less unpleasant, the level of odour exposure required to elicit the same effect may be somewhat higher, requiring professional judgement to be applied. For example, 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 (Table 9.1) and can be considered on par with 'moderately offensive' odours such as intensive livestock rearing. Table 9.3 below shows the impact descriptors proposed for a 'moderately offensive' odour.'

Table 9.2 Proposed odour effect descriptors for impacts predicted by modelling – "Most Offensive" odours

Odour Exposure Level C_{98}, ou_E/m^3	Receptor Sensitivity		
	Low	Medium	High
≥10	Moderate	Substantial	Substantial
5-<10	Moderate	Moderate	Substantial
3-<5	Slight	Moderate	Moderate
1.5-<3	Negligible	Slight	Moderate
0.5-<1.5	Negligible	Negligible	Slight
<0.5	Negligible	Negligible	Negligible

It should be noted that the Table applies equally to cases where there are increases and decreases in odour exposure as a result of this development, in which case the appropriate terms "adverse" or "beneficial "should be added to the descriptors.

Table 9.3 Proposed odour effect descriptors for impacts predicted by modelling – "Moderately Offensive" odours

Odour Exposure Level C_{98}, ou_E/m^3	Receptor Sensitivity		
	Low	Medium	High
≥10	Moderate	Substantial	Substantial
5-<10	Slight	Moderate	Moderate
3-<5	Negligible	Slight	Moderate
1.5-<3	Negligible	Negligible	Slight
0.5-<1.5	Negligible	Negligible	Negligible
<0.5	Negligible	Negligible	Negligible

It should be noted that the Table applies equally to cases where there are increases and decreases in odour exposure as a result of this development, in which case the appropriate terms "adverse" or "beneficial "should be added to the descriptors.

A benchmark odour criterion of 3.0 OU_e/m^3 has been used in this assessment.

9.3 Odour Emission Sources

The odour emissions from drying floor activities have been assessed by using 13 odour point sources within the model.

For odour emission rate estimations, it is assumed that odour will be continuously emitted from the waste on the drying belt and odour concentrations at the exhaust air after heat exchanger is 212 OU_E/m^3, which is equivalent to the odour outlet concentrations for biofilters treating biowaste odour (sniffer report: Understanding biofilter performance and determining emission concentration under operation conditions, Final Report – project Number ER36, June 2014).

The odour emissions used within AERMOD and stack gas parameters are presented in Table 9.4.

Table 9.4 Odour Emissions for the Assessment and Stack Parameters

Parameter	Drying Belt and Odour Emissions	Unit
Belt Width	3	m
Overall Drying Section length	33	m
No. of Heat Exchanger Units	6	-
Heated Air Volume per Unit	50,000	m^3/hr
Total Heated Air Volume for 6 Units	300,000	m^3/hr
No. of Stacks	13	-
Exhaust Air Volume per Stack	6.41	m^3/s
Exhaust Air Temperature	60	C°
Odour concentration in Exhaust Air [a]	202	OU_E/m^3
Odour Emission Rate per Stack	1,359	OU_E/s
Stack Diameter	1.0	m
Stack velocity	8.16	m/s
Stack Height	13.15	m

Note:

(a) Sniffer report: Understanding biofilter performance and determining emission concentration under operation conditions, Final Report – project Number ER36, June 2014.

9.4 Odour Modelling Assessment Results

The detailed computational modelling assessment of odour impact was undertaken using the input parameters detailed in Section 9.3.

All predicted odour concentrations have been compared to the relevant environmental assessment criteria, as detailed in Section 9.2.

The results of the model predictions at each discrete receptor using three met data are summarised in Table 9.5. The results are presented at the 98th%ile of hourly averages (Environment Agency, March 2011).

Table 9.5 The 98th%ile Maximum Short-Term (Hourly) Concentrations of Odour

Receptors		Predicted Hourly PEC OU_E/m^3		
		2016 Met Data	2017 Met Data	2018 Met Data
D1	100 Gibson Lane South	0.66	0.86	0.83
D2	88 Gibson Lane South	0.57	0.70	0.74
D3	54 Gibson Lane	0.26	0.43	0.39
D4	The Coach House, Melton Grange, Main Road	0.16	0.27	0.25
D5	21 Brickyard Lane	0.18	0.24	0.22
D6	25 the triangle, North Ferriby	0.13	0.20	0.19
D7	Lowcroft Farm, Lowfield Lane	0.07	0.12	0.12
D8	South Hunsley School, 41 East Dale Road	0.11	0.10	0.08
D9	62 Common Lane	0.03	0.04	0.05
D10	79 Plantation Drive	0.11	0.16	0.14
D11	75 Southfield Drive	0.09	0.13	0.11

Notes:
1. There is no background for odour and hence the PC = PEC.

The odour emissions from the sources considered were assessed for all 3 years of meteorological data. The results indicate that the maximum predicted odour concentration at sensitive/residential receptors using three years of meteorological data is 0.86 OU_E/m^3, which occurs along on 100 Gibson Lane South and does not exceed the 3.0 OU_E/m^3 assessment level at the 98th%ile.

Odour Effects on the Receptors

The magnitudes of odour effects on receptors for 2017, the year resulting in maximum total short-term odour concentrations, are presented in Table 9.6.

The residential dwellings are assessed as high sensitivity receptors.

Table 9.6 The 98th%ile Maximum Short-Term (Hourly) Concentrations of Odour

Receptors		Predicted Hourly PEC OU_E/m^3	Odour Effect
		2017 Met Data	2017 Met Data
D1	100 Gibson Lane South	0.86	Slight
D2	88 Gibson Lane South	0.70	Slight
D3	54 Gibson Lane	0.43	Negligible
D4	The Coach House, Melton Grange, Main Road	0.27	Negligible
D5	21 Brickyard Lane	0.24	Negligible
D6	25 the triangle, North Ferriby	0.20	Negligible
D7	Lowcroft Farm, Lowfield Lane	0.12	Negligible

Receptors		Predicted Hourly PEC OU_E/m^3	Odour Effect
		2017 Met Data	2017 Met Data
D8	South Hunsley School, 41 East Dale Road	0.10	Negligible
D9	62 Common Lane	0.04	Negligible
D10	79 Plantation Drive	0.16	Negligible
D11	75 Southfield Drive	0.13	Negligible

Notes:

1. *There is no background for odour and hence the PC = PEC.*

The results indicate that the predicted odour concentrations at the existing residential receptors using 2017 meteorological data range from 0.04 OU_E/m^3 to 0.86 OU_E/m^3.

The odour effects at the receptors are predicted to be 'Slight' to 'Negligible'.

Therefore, the predicted short-term odour emissions from the Site are considered acceptable.

From the meteorological dataset, the year resulting in maximum odour concentration was identified as 2017. The contour plot of the predicted odour concentrations using 2017 meteorological data both inside and outside the site boundary is presented in Figure 15.

Figure 15 shows that the predicted maximum concentrations occur adjacent to the northern boundary of the composting pad area, with a predicted decrease in concentration with the increased distance from the odour sources.

9.5 Sensitivity Analysis – Inter-Annual Variability

The short-term odour emissions from the modelled sources have been assessed for the 3 complete years of meteorological data. The model sensitivity to inter-annual variation of meteorological conditions was calculated by using the following equation:

$$\% \text{ Variation} = \frac{[(\text{Maximum mean} - \text{Minimum mean}) \div 2]}{[(\text{Maximum mean} + \text{Minimum mean}) \div 2]} \times 100$$

In the above equation "mean" refers to the true mean for all of the concentrations calculated by the model at all discrete receptors and grid receptors. Results are shown for short-term odour PC in Table 9.7.

Table 9.7 Sensitivity Analysis

Substance	3 Year of Meteorological Date			% Variation
	2016	2017	2018	
Short-term Odour PC (OU_E/m^3)	0.209	0.216	0.226	7.29

The sensitivity analysis indicates that for the emissions of odour and all 3 years of meteorological data the percentage variations were 7.29%.

10. Conclusions

WYG has undertaken an air quality assessment to support a planning application of installations of 41 proposed Orlan Super 130 kW Biomass boilers at Waste Drying Plant, at Gibson Lane, Melton, Hull, HU14 3HH.

The objective of the air quality assessment is to determine whether the impacts from biomass boiler emissions meet the required air quality standards (AQSs), AQOs, or air quality environmental assessment limits (EALs) for the protection of human health and for the protection of vegetation and ecosystems.

The detailed air dispersion modelling for the plant process emissions have been undertaken and the modelling results have been presented in this report in terms of the emitted pollutant Process Contribution (PC) and Predicted Environmental concentration (PEC = PC + Background concentration). AERMOD modelling was undertaken for the most representative meteorological dataset and the worst-case, highest predicted long-term and short-term PECs were compared to the appropriate AQOs/ EALs or relevant impact assessment criteria.

Baseline air quality conditions have been defined. Baseline modelling has been undertaken to determine pollutant, such as, NO_2, PM_{10} and $PM_{2.5}$, levels to consider emissions from traffic.

Two operation scenarios have been assessed for Eco-Power biomass boilers.

- Scenario 1 – normal operation scenario. The design heat demand of the associated drying plant only requires 35 Orlan Super 130 kW_{th} biomass boilers to be operate at any one time.
- Scenario 2 – theoretical worst-case scenario. It is theoretically possible for all 41 Orlan Super 130 kW_{th} biomass boilers to operate and this scenario is to provide a worst-case assessment.

Eco-Power Biomass Boiler Emission Impact Assessment

The predicted long-term and short-term NO_2, PM_{10}, $PM_{2.5}$ and CO, concentrations from the emissions of the operation of the proposed Orlan Super 130 kW Biomass boilers at Waste Drying Plant, for two scenarios, are all below the relevant AQOs for the protection of human health.

The significance of effects on the emissions on the ground level receptors from the plant operations with respect to long-term NO_2, PM_{10} and $PM_{2.5}$ is determined to be 'negligible' for two scenarios.

Habitat Assessment of Eco-Power Biomass Boilers

The annual mean and daily (24 hour mean) NO_x PEC at the ecological receptors from the operations of Eco-Power biomass boilers are below the relevant critical level for the protection of vegetation and Ecosystems. the NO_x impacts from the proposed development on the ecological receptors are insignificant.

As the percentage change in long-term process concentrations relative to the AQAL is below 1% of the relevant critical level for the protection of vegetation and Ecosystems, the long-term process contributions have been screened out against the relevant standard/critical level. The nitrogen deposition assessment has not been undertaken.

The process contribution (PC, as predicted by the detailed dispersion model) from Eco-power biomass boiler operations being <1% of the relevant critical level or load (CL) can be considered inconsequential and does not need to be included in an in-combination (cumulative) habitat assessment.

Cumulative Impact Assessment for the Protection of Human Health

Cumulative impact assessment for the protection human health has been undertaken including the emission sources adjacent to Eco-Power biomass boilers and the emission sources in the cumulative assessment include:

(1) 41 Orlan Super 130 kW_{th} biomass boilers proposed by Eco-Powers;
(2) Three Kalvis 0.95 MW_{th} biomass boilers operated by Transwaste Ltd; and
(3) Two emission flues at Energy Recovery Facility (ERF) operated by HRS Energy.

The predicted cumulative long-term and short-term NO_2, PM_{10}, $PM_{2.5}$ and CO, concentrations from the emission source considered are all below the relevant AQOs for the protection of human health.

The significance of cumulative effects on the emissions on the ground level receptors from the emission source considered with respect to long-term NO_2, PM_{10} and $PM_{2.5}$ is determined to be 'negligible'.

As the process contribution (PC, as predicted by the detailed dispersion model) from Eco-power biomass boiler operations is <1% of the relevant critical level or load (CL) and can be considered inconsequential. It is not required to be included in an in-combination (cumulative) habitat assessment.

Cumulative Short-Term Impact Assessment of Queuing Traffic

The predicted short-term NO_2 PC from level crossing related waiting traffic are 17.09 µg/m^3 and 22.34 µg/m^3 at 100 Gibson Lone South (R1) and at 88 Gibson Lane South (R2) respectively.

The cumulative short-term PEC including the waiting traffic at 100 Gibson Lone South and at 88 Gibson Lane South are significantly below the AQO of 200 µg/m^3.

Odour Impact Assessment from Drying Floor Operations

The odour emissions from a Perry Belt Drier (drying floor) operations were assessed for all 3 years of meteorological data. The results indicate that the maximum predicted odour concentration at

sensitive/residential receptors using three year meteorological data is 0.86 OU_E/m^3, which occurs at a location of dwelling receptor on 100 Gibson Lane South does not exceed the 3.0 OU_E/m^3 assessment level at the 98th%ile.

Therefore, the predicted short-term odour emissions from the Site are considered acceptable.

In conclusion, the proposed development is not considered to be contrary to any of the national and local planning policies.

Figures

Figure 1 Site Location

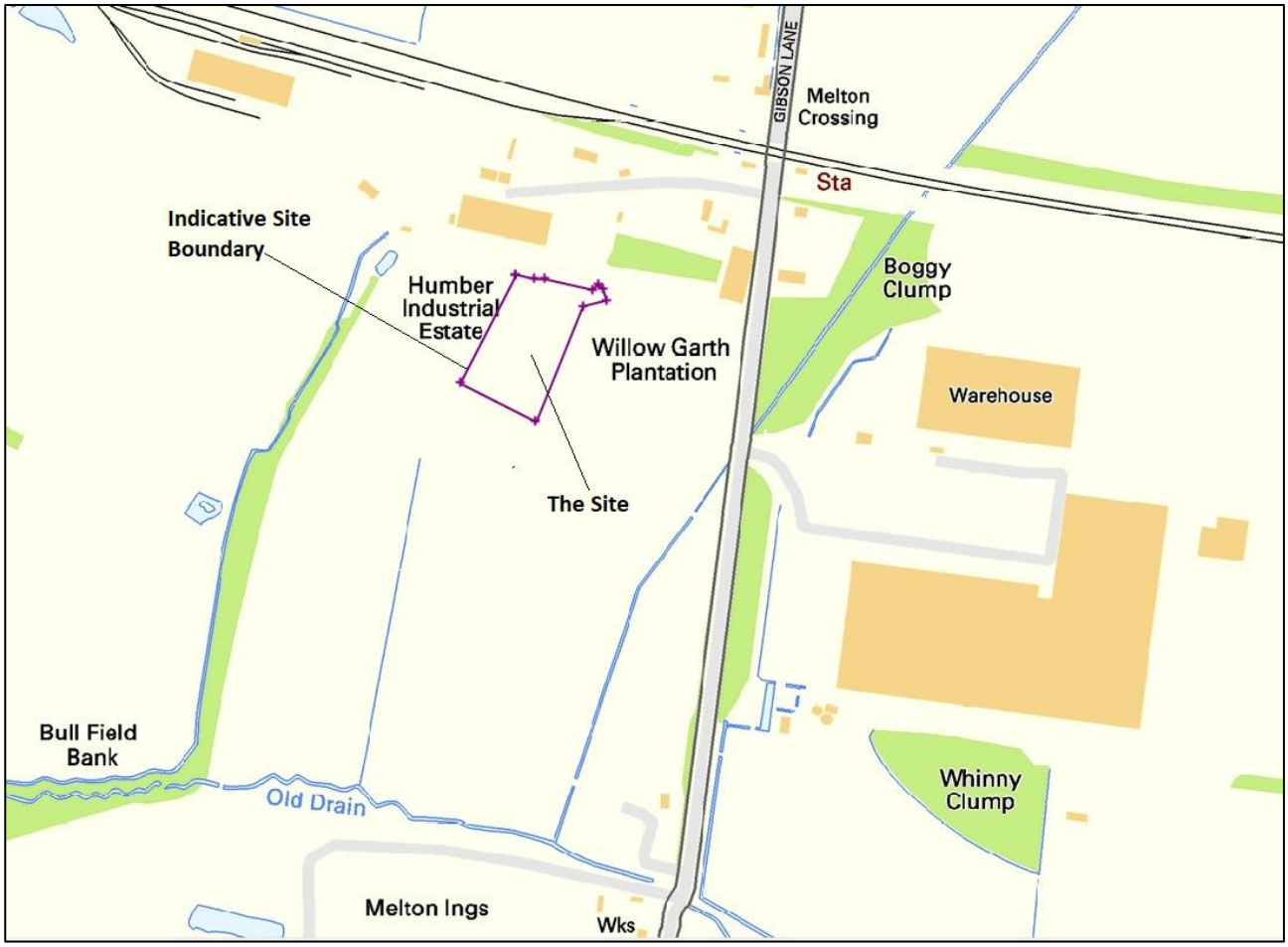


Figure 2 Indicative Site Boundary

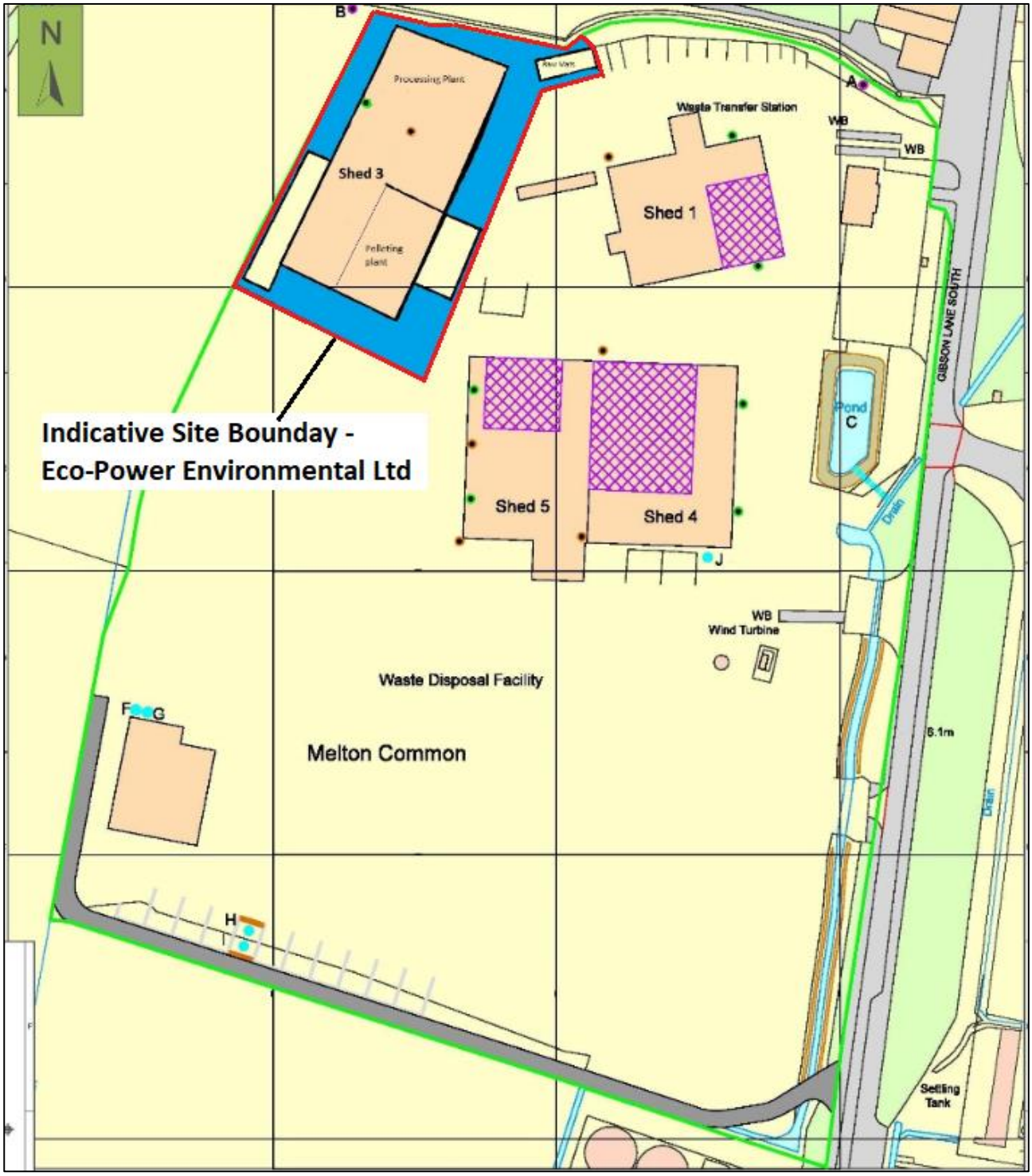
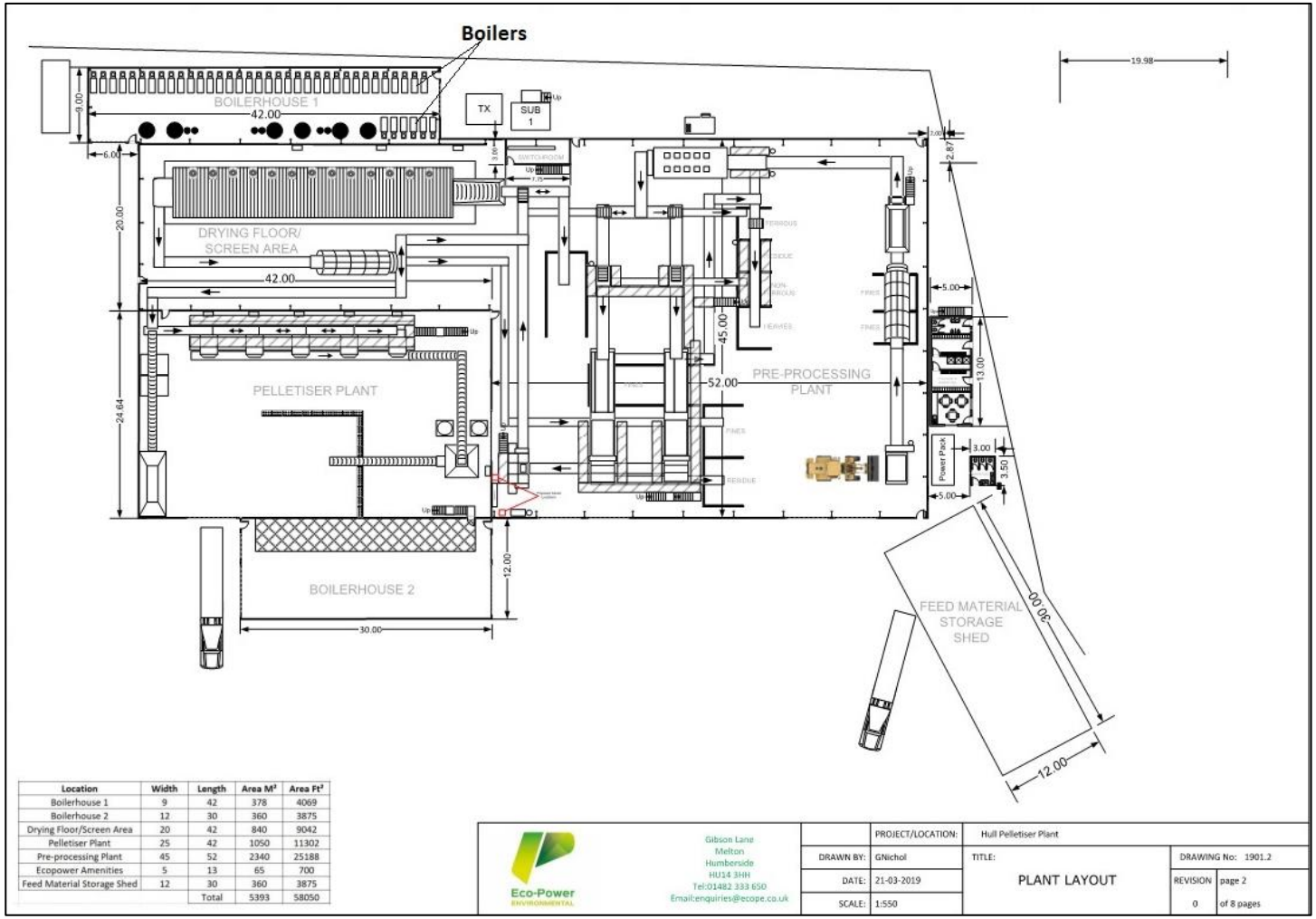


Figure 3 Site Layout Plan



Location	Width	Length	Area M²	Area Ft²
Boilerhouse 1	9	42	378	4069
Boilerhouse 2	12	30	360	3875
Drying Floor/Screen Area	20	42	840	9042
Pelletiser Plant	25	42	1050	11302
Pre-processing Plant	45	52	2340	25188
Ecopower Amenities	5	13	65	700
Feed Material Storage Shed	12	30	360	3875
		Total	5393	58050

Figure 4 Eco-Power Biomass Boiler Stack Locations

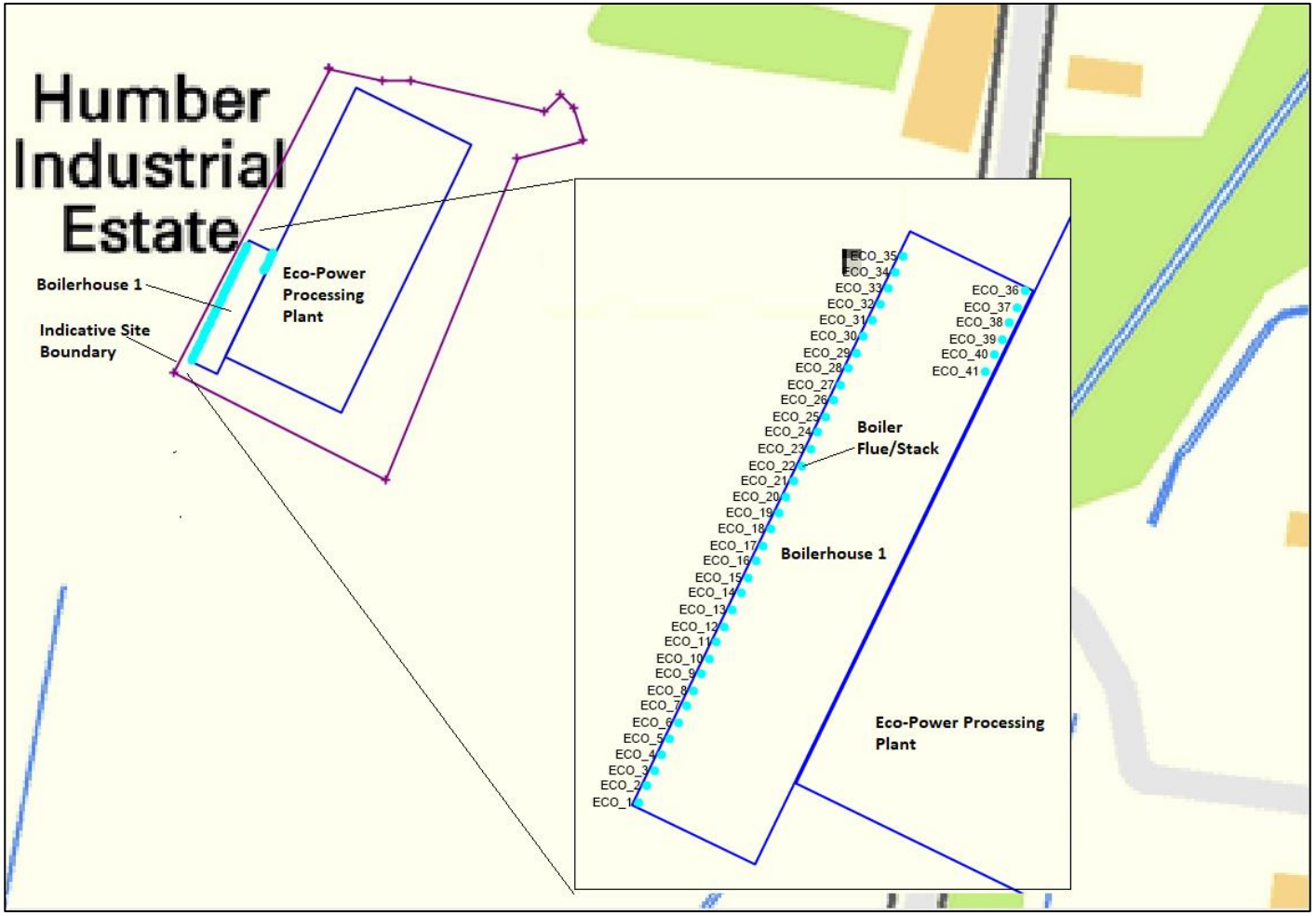


Figure 5 Kalvis Boiler Stack Locations and ERF Emission Point

Figure 6 Receptor Locations

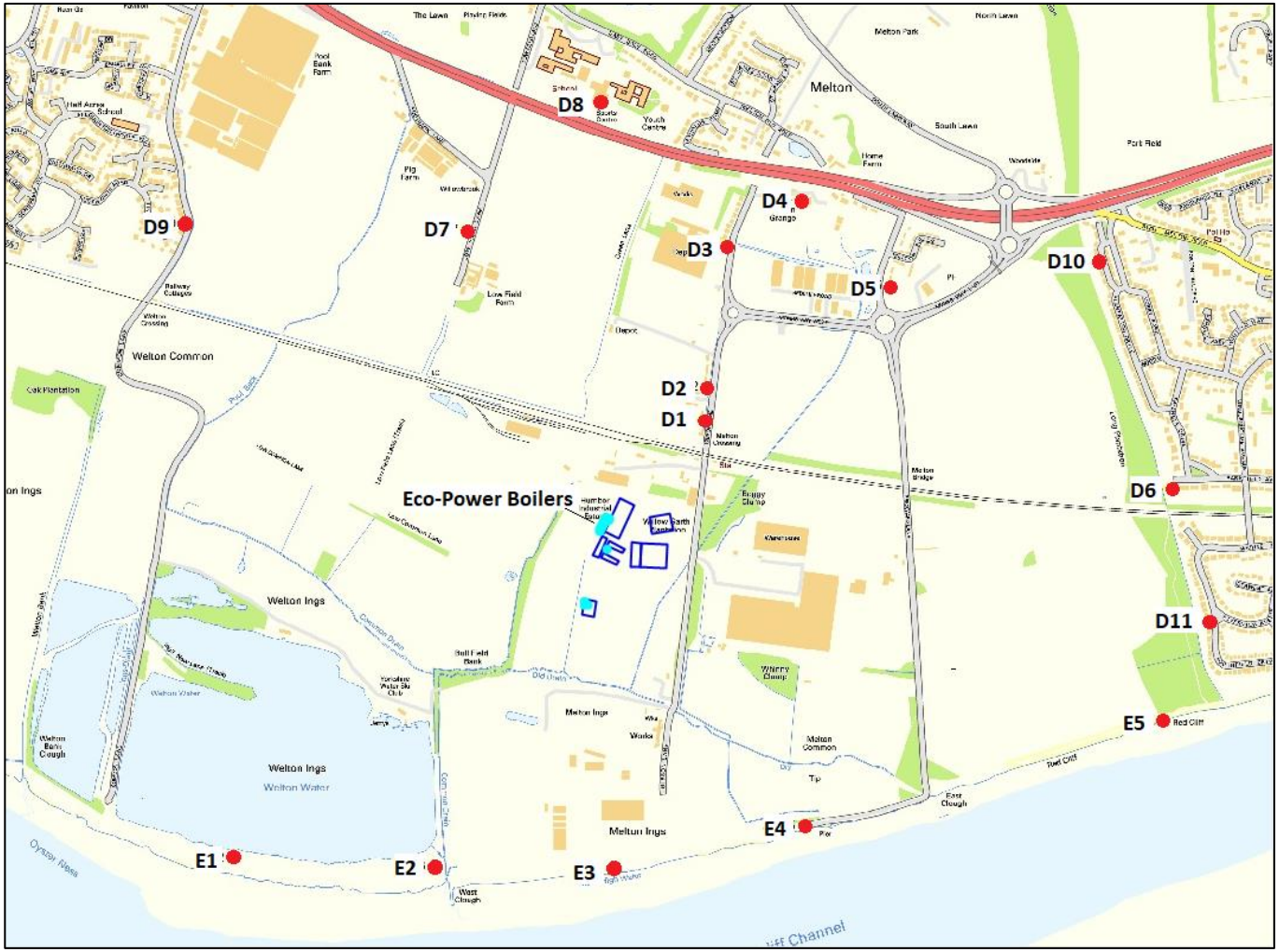
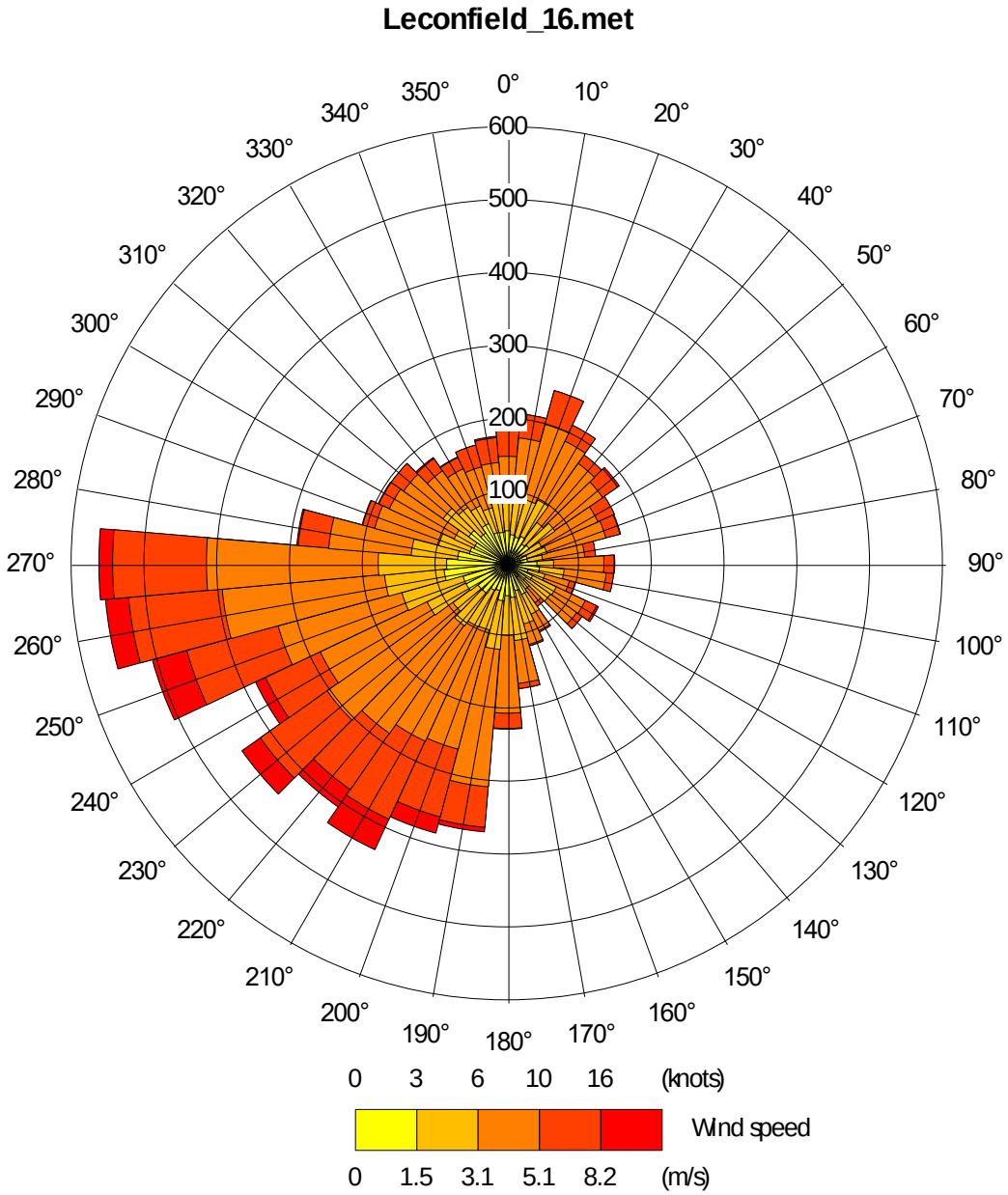
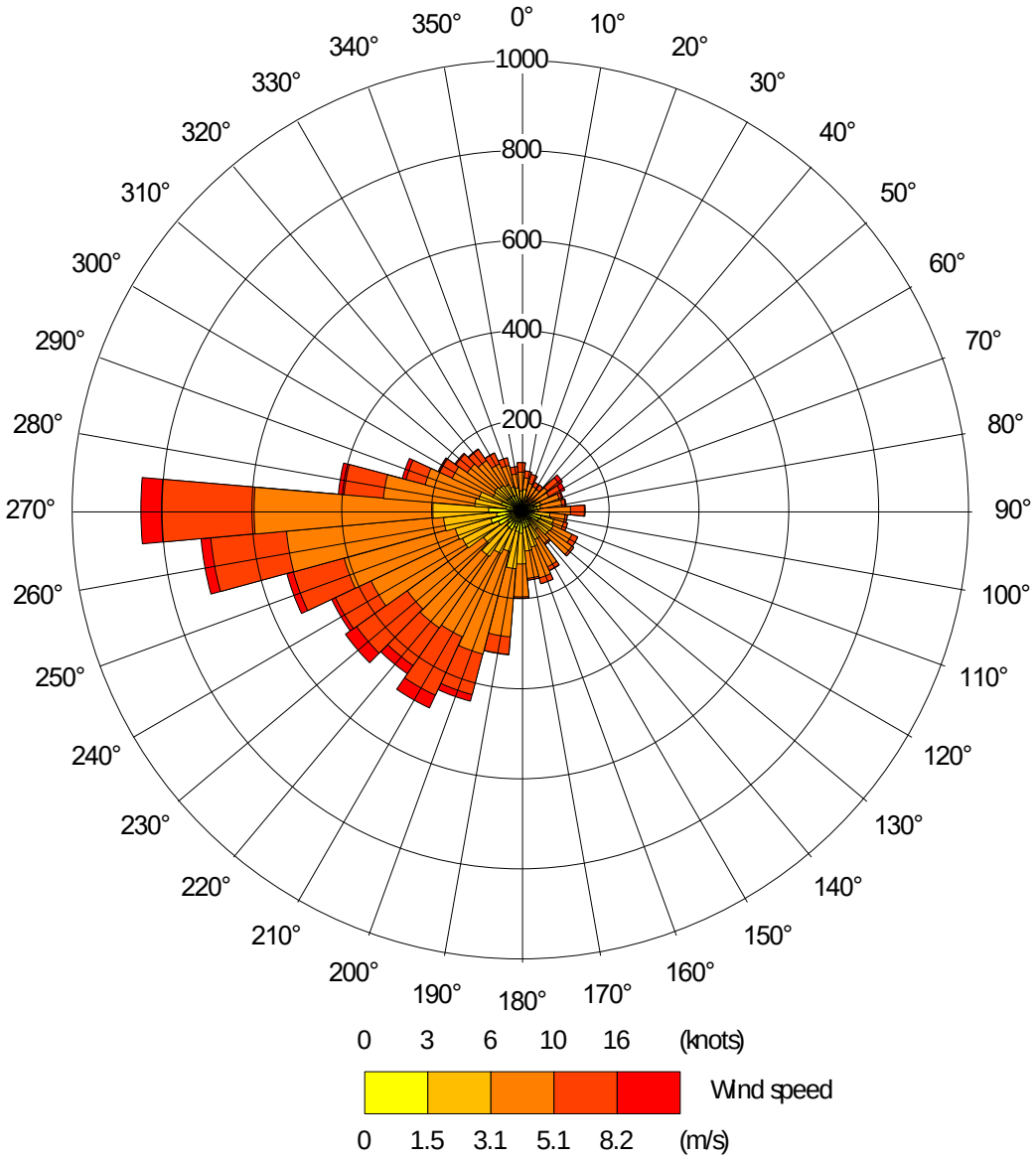


Figure 7 Leconfield Meteorological Station Wind Rose



Leconfield_17.met



Leconfield_18.met

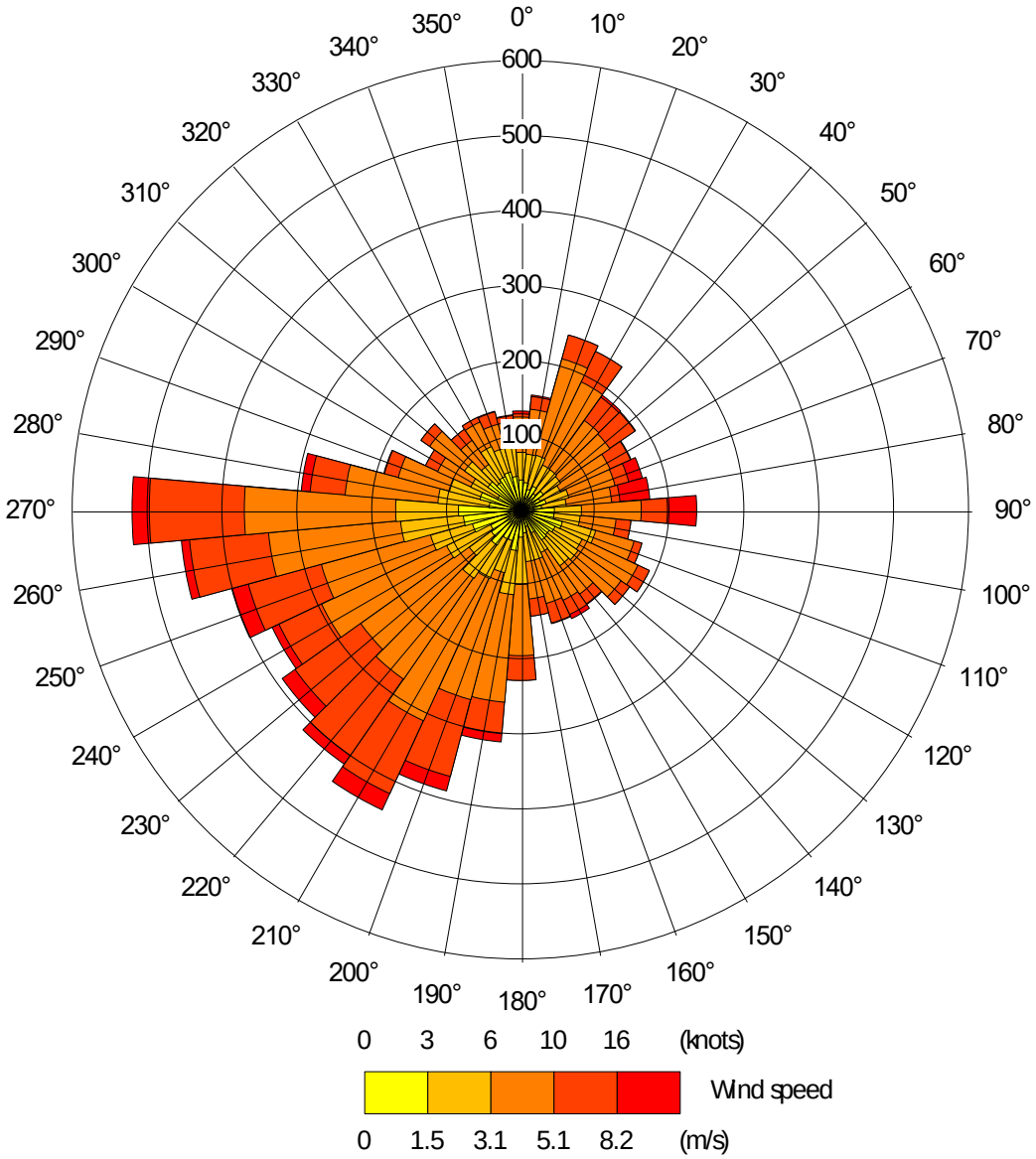


Figure 8 Buildings for the Modelling

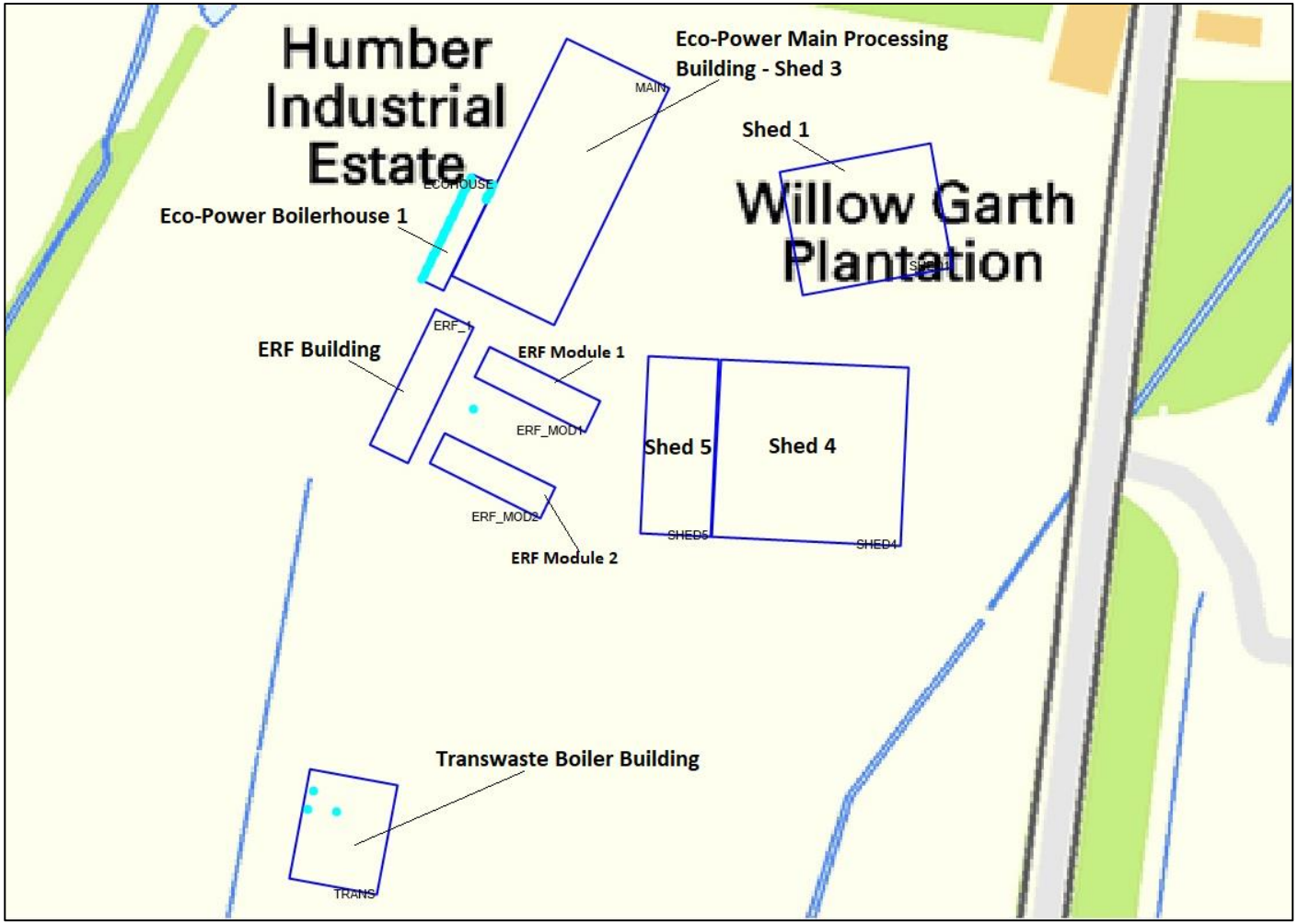


Figure 9 Predicted Long-Term NO_2 Concentrations (PC) from the Operation of Eco-Power Boilers (2017 Met Data)

Figure 10 Predicted Short-Term NO_2 Concentrations (PC, 1-Hour Mean, 99.79th Percentile) from the Operation of Eco-Power Boilers (2018 Met Data)

Figure 11 Predicted Long-Term PM_2 Concentrations (PC) from the Operation of Eco-Power Boilers (2017 Met Data)

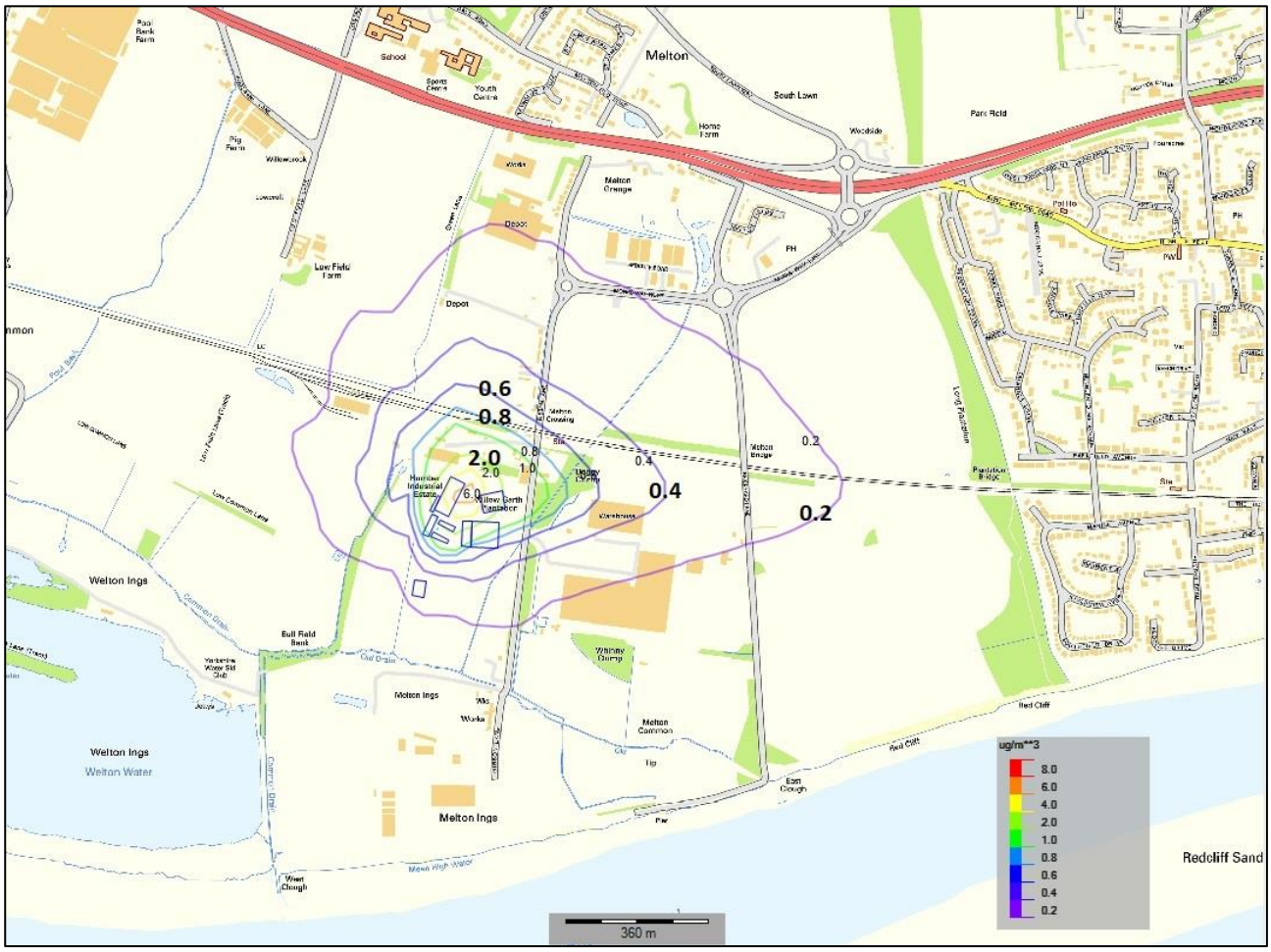


Figure 12 Predicted Long-Term NO_2 Concentrations (PC) from the Cumulative Assessment – Including Emissions from Eco-Power Boilers, Transwaste Kalvis Boilers and ERF (2017 Met Data)

Figure 13 Predicted Short-Term NO_2 Concentrations (PC, 1-Hour Mean, 99.79th Percentile) from the Cumulative Assessment – Including Emissions from Eco-Power Boilers, Transwaste Kalvis Boilers and ERF (2018 Met Data)

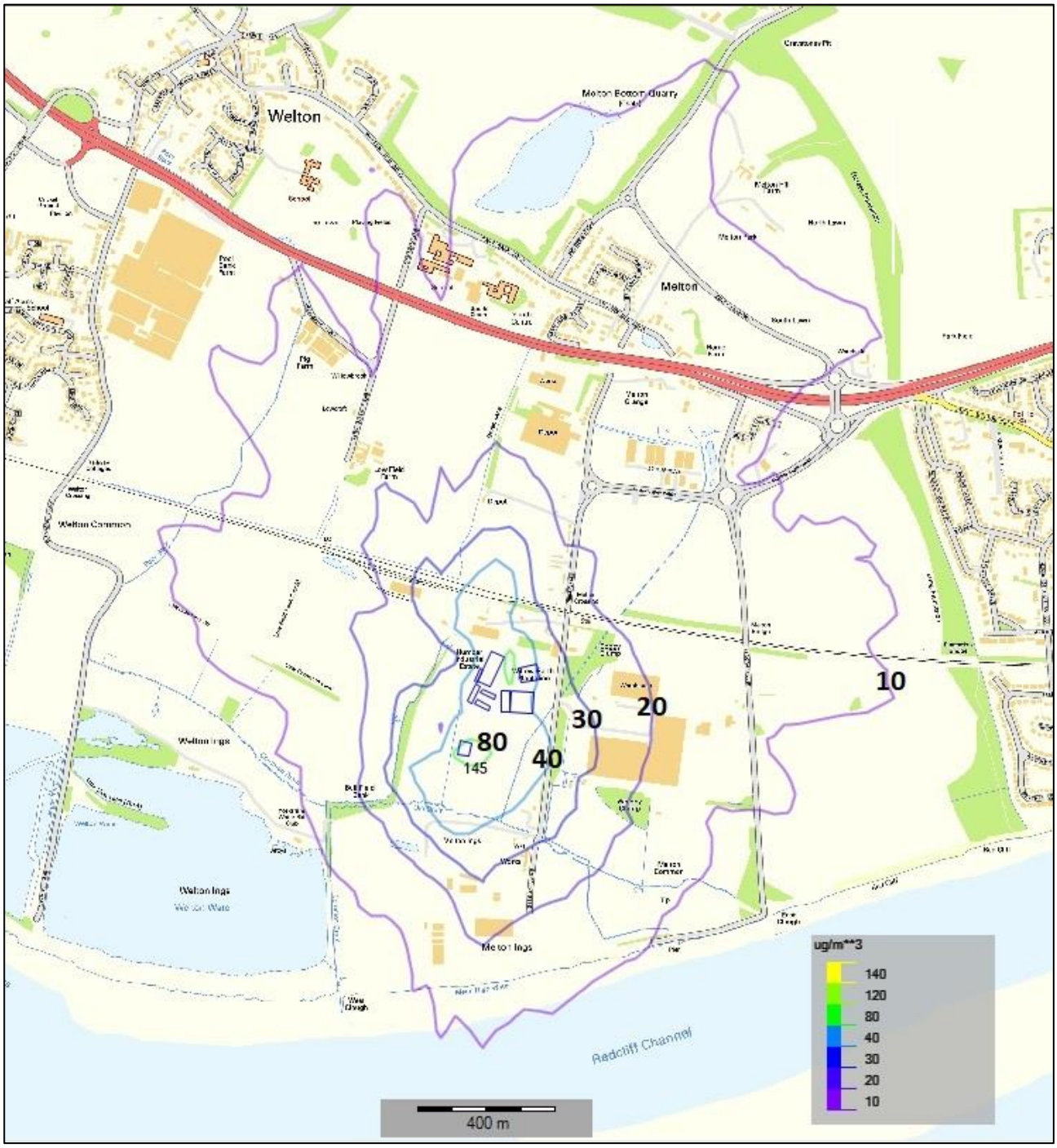


Figure 14 Predicted Long-Term PM_{10} Concentrations (PC) from the Cumulative Assessment – Including Emissions from Eco-Power Boilers, Transwaste Kalvis Boilers and ERF (2017 Met Data)

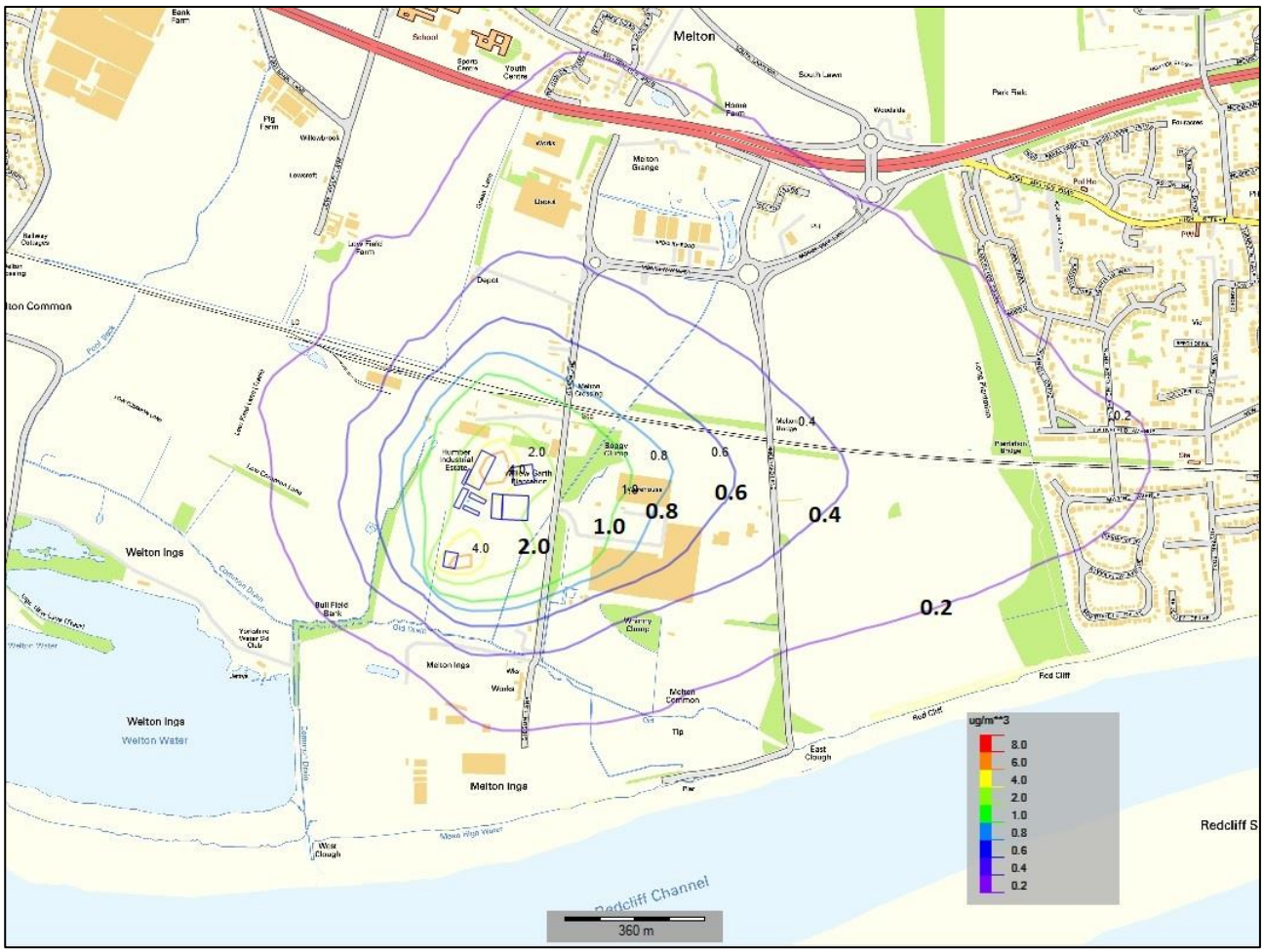


Figure 15 Predicted the 98th%ile Short-Term (Hourly) Concentrations of Odour

Appendix A Baseline Traffic Air Quality Modelling

Traffic Air Quality ADMS Model Inputs

The traffic air quality modelling assessment has utilised:

- ADMS Roads 4.1;
- Backgrounds determined from the non-Modelled Roadside Contribution;
- 2017 Leconfield Meteorological Data;
- Emissions Factor Toolkit (v9.0, May 2019);
- NO_x to NO_2 calculator (v7.1,); and,
- 2017 AADT Traffic Data downloaded from the Department for Transport.

The inputs for the traffic model are as follows in Tables A1 and A2.

Air quality assessment areas, including ADMS road sources and receptor locations are presented in Figure A1.

Table A1 Traffic Data used in the ADMS Roads Traffic Modelling

Link	Speed (km/h)	2017	
		AADT	HGV %
Gibson Lane	48	936	0.32%
Gibson Lane	48	936	0.32%
Gibson Lane South	48	936	0.32%
Monks Way West	48	936	0.32%
Monks Way East	48	1873	0.32%
A63	112	43226	12.70%
Bridge	48	5403	25.41%
Melton Road	48	5403	12.70%
Melton Road (South of Corby Park)	48	5403	12.70%

Table A2 ADMS Roads Model Inputs

Parameter	Description	Input Value
Chemistry	A facility within ADMS-Roads to calculate the chemical reactions in the atmosphere between Nitric Oxide (NO), NO_2, Ozone (O_3) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included
Meteorology	Representative meteorological data from a local source	**Leconfield**, hourly sequential data
Surface Roughness	A setting to define the surface roughness of the model area based upon its location.	**0.5m** representing a typical surface roughness for **Parkland, open suburbia**
Latitude	Allows the location of the model area to be set	United Kingdom = **53.7**
Monin-Obukhov Length	This allows a measure of the stability of the atmosphere within the model area to be specified depending upon its character.	Mixed Urban / Industrial= **30m.**

Parameter	Description	Input Value
Elevation of Road	Allows the height of the road link above ground level to be specified.	All road links were set at ground level = **0m**.
Road Width	Allows the width of the road link to be specified.	Road width used depended on data obtained from OS map data for the specific road link
Topography	This enables complex terrain data to be included within the model in order to account for turbulence and plume spread effects of topography	No topographical information used
Time Varied Emissions	This enables daily, weekly or monthly variations in emissions to be applied to road sources	No time varied emissions used
Road Type	Allows the effect of different types of roads to be assessed.	**Urban (Not London)** settings were used for the relevant links
Road Speeds	Enables individual road speeds to be added for each road link	Based on national speed limits
Canyon Height	Allows the model to take account turbulent flow patterns occurring inside a street with relatively tall buildings on both sides, known as a "street canyon".	No canyons used within the model
Road Source Emissions	Road source emission rates are calculated from traffic flow data using the in-built EFT database of traffic emission factors.	The **EFT** Version **9.0.1 (2019)** dataset was used.
Year	Predicted EFT emissions rates depend on the year of emission.	**2017** data for verification and baseline operational phase assessment

This traffic data has been utilised to assess the corresponding receptors within the assessment. These are outlined in Table A3.

Table A3 Modelled Existing Sensitive Receptor Locations

Discrete Sensitive Receptors		Receptor Height (m)
AERMOD ID /ADMS ID	Name	
R1	100 Gibson Lane South	1.5
R2	88 Gibson Lane South	1.5
R3	54 Gibson Lane	1.5
R4	The Coach House, Melton Grange, Main Road	1.5
R5	21 Brickyard Lane	1.5
R6	25 the triangle, North Ferriby	1.5
R7	Lowcroft Farm, Lowfield Lane	1.5
R8	South Hunsley School, 41 East Dale Road	1.5
R9	62 Common Lane	1.5
R10	79 Plantation Drive	1.5
R11	75 Southfield Drive	1.5
R12 [1]	Yew Lodge, Hellyer Close	1.5

Note:

(1) *Receptor of Yew Lodge, Hellyer Close (R12), which is located adjacent to a diffusion tube, are included in the traffic modelling for model verifications.*

This data has been input into the ADMS Roads 4.1 model and the model has been verified to local monitoring data.

Table A4 Comparison of Roadside Modelling & Monitoring Results for NO_2

Tube location	NO_2 µg/m^3		
	Monitored NO_2	Modelled NO_2	Difference (%)
1	29.00	29.77	2.67
28	52.00	55.74	7.19

Tube location	NO_2 µg/m³		
	Monitored NO_2	Modelled NO_2	Difference (%)
35	50.00	47.81	-4.39
45	35.00	31.93	-8.78
72	36.00	34.39	-4.48
*Located in AQMA			

The final verified model has produced output at the monitoring locations being within 10% of the monitoring results, which meets the requirement by TG16 guidance.

The final verification model correlation coefficient (representing the model uncertainty) is 1.00[2]. This figure demonstrates that the model predictions were in line with the road traffic emissions at the monitoring locations.

The modelled baseline concentrations of NO_2 are outlined in Table A5.

Table A5 Predicted 2017 Annual Average Concentrations of NO_2

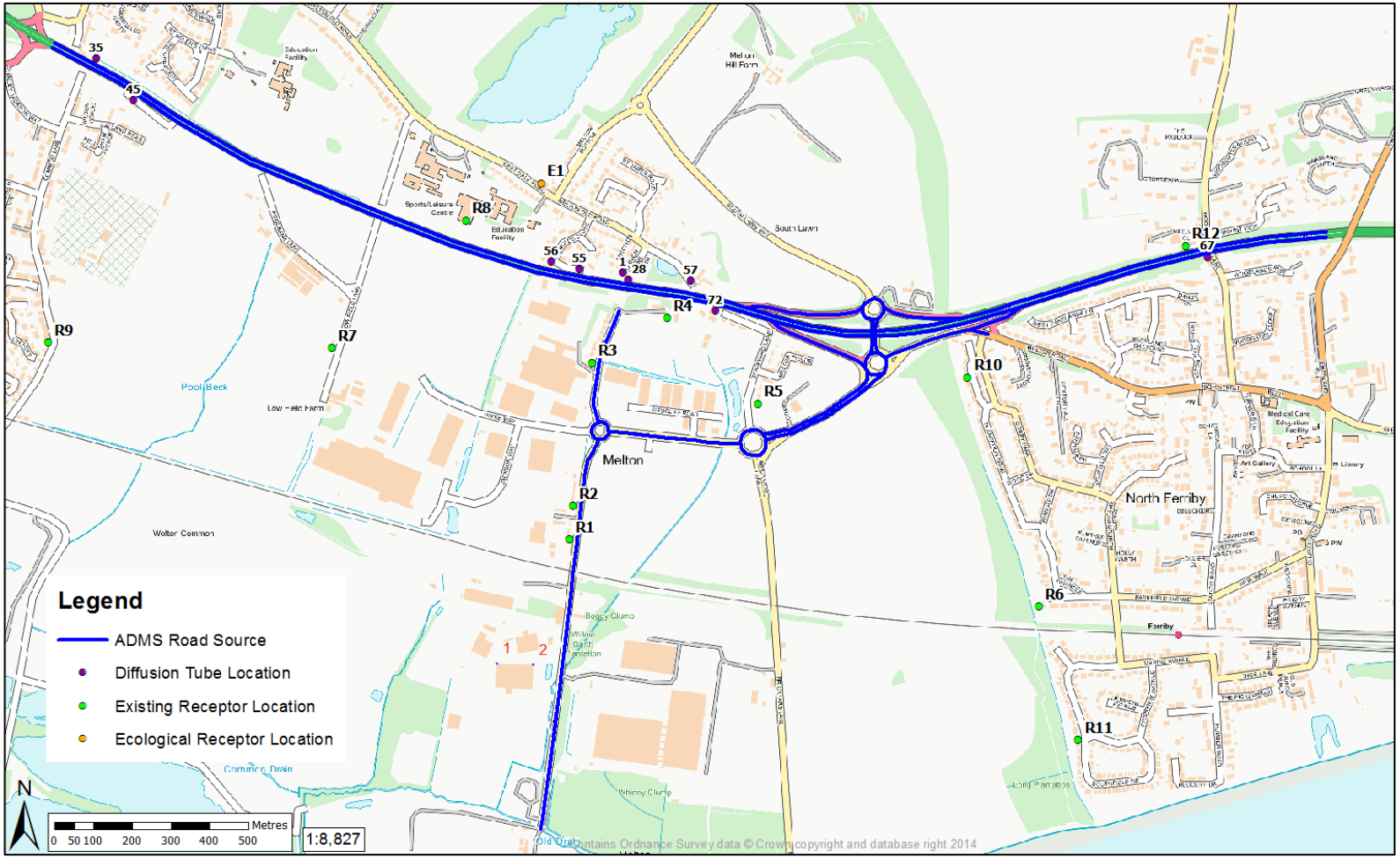
Discrete Sensitive Receptors		Modelled Baseline (2017) Pollutant Concentrations (µg/m³)		
AERMOD ID /ADMS ID	Name	NO_2	PM_{10}	$Pm_{2.5}$
R1	100 Gibson Lane South	10.81	13.81	7.84
R2	88 Gibson Lane South	10.91	13.83	7.85
R3	54 Gibson Lane	16.06	15.01	8.67
R4	The Coach House, Melton Grange, Main Road	21.27	15.72	9.11
R5	21 Brickyard Lane	16.14	15.02	8.67
R6	25 the triangle, North Ferriby	11.40	13.00	7.76
R7	Lowcroft Farm, Lowfield Lane	14.51	15.48	8.69
R8	South Hunsley School, 41 East Dale Road	28.05	17.38	9.87
R9	62 Common Lane	12.39	14.25	8.20
R10	79 Plantation Drive	18.41	15.34	8.87
R11	75 Southfield Drive	11.17	12.97	7.74
R12[1]	Yew Lodge, Hellyer Close	43.32	18.85	11.22

Note:

(1) *Receptor of Yew Lodge, Hellyer Close (R12), which is located adjacent to a diffusion tube, are included in the traffic modelling for model verifications.*

[2] This was achieved by applying a model correction factor of 1.56 to roadside predicted NO_X concentrations before converting to NO_2.

Figure A1 AQ Assessment Area Including Receptors Locations



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