Earthcare TECHNICAL

Air Quality and Odour Impact Assessment to Support a Substantial Variation to Bespoke Installation at Herriard Bio Power Limited

On behalf of: Herriard Bio Power Limited, Bushywarren Lane, Herriard, Basingstoke, RG25 2NS

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Abbreviations

AAD	Ambient Air Quality Directive (2008/50/EC)
AADT	Annual average daily traffic
AcidDep	Acid deposition
acph	Air changes per hour
AD	Anaerobic Digester
AOD	Above Ordnance Datum
AQMA	Air Quality Management Area
AQOIA	Air Quality and Odour Impact Assessment
AQS	Air Quality Standards
AQSR	Air Quality Standards Regulations 2010
AW	Ancient woodland
BAT	Best Available Techniques
BDBC	Basingstoke and Deane Borough Council
BLD	Boundary layer depth
BUP	Biogas upgrading plant
CH_4	Methane
CHP	Combined heat and power engine
CLe	Critical level (concentration)
CLo	Critical load (deposition)
CO_2	Carbon dioxide
Defra	Department for the Environment, Food and Rural Affairs
EA	Environment Agency
EAL	Environmental Assessment Level
EC	European Commission
ELV	Emission limit value
EPR	Environmental Permitting Regulations
EPUK	Environmental Protection UK
EU	European Union
GFS	Global Forecast System
GPU	Gas processing unit
h/day	hours per day
H1	Environment Agency Horizontal Guidance Note H1
H_2S	Hydrogen sulphide
HGV	Heavy goods vehicle
IAQM	Institute of Air Quality Management
IED	Industrial Emissions Directive
kWe	Kilowatts electrical output

kWthi	Kilowatts thermal input
LAQM	Local Air Quality Management
LWS	Local wildlife site
MCP	Medium Combustion Plant
n/a	Not applicable
N	Nitrogen
NDep	Nutrient nitrogen deposition
NGR	National Grid Reference
NH_3	Ammonia
O_2	Oxygen
PC	Process Contribution
PEC	Predicted environmental concentration
PVRV	Pressure and vacuum relief valve
PST	Pre-storage tank
RVEI	Road Verges of Ecological Importance
RWBT	Raw waste buffer yank
S	Sulphur
SAC	Special Area of Conservation
SINC	Sites of Importance for Nature Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TG	Technical Guidance
TPA	Tonnes per annum
TVOC	Total gaseous and vaporous organic substances, expressed as total organic carbon
VOC	Volatile organic compounds

1 Introduction

1.1 Background

Earthcare Technical Ltd (ETL) has been commissioned on behalf of Herriard Bio Power Limited, to prepare an Air Quality and Odour Impact Assessment (AQOIA) to support an application for a substantial variation to a bespoke waste operation permit for an anaerobic digestion (AD) plant, including the use of resultant biogas, at Herriard Bio Power Limited, Bushywarren Lane, Herriard, Basingstoke, RG25 2NS herein termed 'the Site'. The plant is operated by Herriard Bio Power Limited, herein termed 'the Operator'.

The bespoke waste operation permit for the site was issued by the Environment Agency (EA) on 20 January 2014 (EPR/AB3807KW) under the Environmental Permitting Regulations 2010.[1] It permits no more than 36,500 tonnes a year (TPA) of waste to be accepted at the site, a biological treatment capacity of no more than 100 tonnes per day, and includes as emission points to air:

- 1,200kWe biogas-fuelled combined heat and power plant (CHP) (MWM TCG2020V12)
- biogas-fuelled flare
- pressure and vacuum relief valves (PVRVs) on the crop-fed primary digester and post digester.

The permit now requires updating to reflect the current and proposed infrastructure and to increase the maximum permitted quantity of waste to 40,000 TPA and a biological treatment capacity of over 100 tonnes per day. The current and planned infrastructure that is the subject of the substantial variation is herein termed the 'Proposed AD plant.'

The changes between the permit and this substantial variation with respect of emissions to air are:

- Replacement of UV odour control system in the Waste Reception Building with a woodchip biofilter which will exhaust from the top of the media bed, located outside the building, on the northeast side.
- Addition of a CHP (CHP2), the latest version of the 1,200kWe MWM TCG2020V12. CHP2 will become the 'duty' CHP and the existing CHP, (CHP1), will become the 'standby'. Each CHP will have a thermal input of 2,850kWthi.
- Replacement of the existing flare with a BAT Compliant Uniflare UF10-500-BGF Biogas Controlled Combustion Flare which can burn up to 500m^3/h of biogas and addition of a second flare, a Uniflare UF10-1000-BGF Biogas Controlled Combustion Flare which can burn up to 1,000m^3/h.
- Addition of an 414kWe emergency backup generator (Doosan P158LE). It is unlikely to run for more than 50h/yr, it will only run to provide power in the event of an emergency.
- Remodelling of the single uncovered lagoon with two digestate lagoons (each 16,500m^3 capacity) with impermeable, floating covers. Any emissions from the vents on the lagoons will

[1] The Environmental Permitting (England and Wales) (Amendment) Regulations 2018, Statutory Instrument 2010 No, 675, 10 March 2010

be channelled via pipework through two carbon filters in series before being discharged from a single lagoon vent.

- Installation of a new pasteuriser (180m^3) which will have a PVRV.
- Installation of a Pentair biogas upgrade plant (BUP) for production of biomethane for transport off site via virtual gas pipeline. The BUP is installed but currently vents carbon dioxide (CO_2) to atmosphere; it will be upgraded to include carbon capture and storage of CO_2 prior to dispatch for offsite use.
- Covering of the separator by a tent-like structure above and on three sides. The front will be open to allow access for tractors and trailers.
- PVRVs on:
    - Two new primary digesters (2,440m^3 capacity) treating food waste.
    - A new raw waste buffer tank (RWBT) of 452m^3 capacity with mixing and gas storage.

There are two new process water tanks (100m^3 each) which will hold process water only and do not require a PVRV.

The working face of the clamps, external feed hopper for crop feedstock, separator, leachate tank vent and lagoons vent have been considered as sources of odour.

An updated processes description of the Proposed AD plant and the sources of emissions to air are given in Section 2. Appendix A contains Site drawings: the Site location, Site layout and Process flow diagrams.

1.2 Site description

The Site is located to the south of Basingstoke, 3.9km at the nearest point from the M3 motorway which borders Basingstoke to the south; the centre of the Site is at approximate National Grid Reference (NGR) SU 65490 46638, as shown in Appendix A. The surrounding land use is agricultural and horticultural, grassland and woodland: ancient woodland that is partly semi-natural and partly replanted i.e. part deciduous and part coniferous.

The immediate surrounding area is sparsely populated however, Veolia Environmental Services' green waste composting site, Little Bushy Warren Composting Facility lies adjacent to the Site to the northeast. It is an open windrow composting facility accepting up to 100,000 TPA of green waste. It has an office block to the south of the site and employees may work across the site managing the windrows. A solar farm lies to the west of the Site. The nearest residential receptors lie in the village of Herriard, the centre of which lies approximately 1km to the southeast of the Site. The Site does not lie in or near to an Air Quality Management Area (AQMA). The nearest AQMA lies over 18km to the east, it is Waverley AQMA No.1 – Farnham in Waverley Borough Council area.

There are no Sites of Special Scientific Interest (SSSIs) within 2km of the Site; no Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites within 10km of the Site. There are 16 sites of Ancient Woodland (AW) within 2km of the Site including: Great Bushywarren Copse which lies to the south of the Site and partly within the Site boundary; Kingsmore, Allwood & Fryingdown Copses which lie approximately 60m away at the close point; Cowdray's Copse to the north; and Hen Wood to the northeast. There are also four road verges of ecological importance

(RVEI), and seven Sites of Importance for Nature Conservation (SINCs); RVEIs and SINCS are both categories of Local Wildlife Sites (LWSs).

Terrain in the vicinity of the Site is gently rolling, varying from a minimum of 75m to a maximum of 208m within 5km. The Site lies at an elevation of 175m Above Ordnance Datum (AOD), on a ridge that runs southeast to west, above a valley that lies to the north.

1.3 Scope of report

This AQOIA assesses the impact on human and ecological receptors of emissions to air from combustion, feedstock storage and processing, and digestate treatment and storage on the Site. Combustion sources have been modelled in normal operation at the specified Emissions Limit Values (ELVs) if ELVs exist for the sources; if there are no ELVs nor permit limit values, the emission concentrations have been taken from indicative monitoring data from similar plant at other sites.

The ADMS 6 dispersion model has been used to calculate concentrations of the pollutants, from which dry deposition to sensitive conservation sites has been calculated.

While ELVs and the air quality standards for ecological receptors are specified for NOx, standards for human health are for nitrogen dioxide (NO_2) which is emitted as a by-product of combustion and is formed (and consumed) in chemical reactions including NOx and other species.

Predicted concentrations have been compared with relevant air quality standards (AQS) (limits, targets, objectives, and assessment levels) in order to assess their significance, considering background concentration data where relevant. There are no AQS for TVOC but there is an AQS for benzene which is one of the volatile organic compounds (VOC) emitted. TVOC from combustion sources has been modelled as 10% benzene.[2]

The pollutants considered in this AQOIA are, therefore:

- Oxides of nitrogen (NOx)
- Nitrogen dioxide (NO_2)
- Sulphur dioxide (SO_2)
- Carbon monoxide (CO)
- Total Volatile Organic Compounds (TVOCs)
- Benzene
- Hydrogen sulphide (H_2S)
- Ammonia (NH_3), and
- Odour.

Predicted deposition fluxes have been compared with critical loads for nutrient nitrogen deposition and acid deposition at sensitive conservation sites.

This report describes: Proposed AD plant processes on Site (Section 2); relevant legislation and guidance for industrial emissions, ambient air quality and modelling of emissions to air (Section 3); the

[2] N R Passant (2002) Speciation of UK emissions of non-methane volatile organic compounds. Reference: AEAT/ENV/R/0545 Issue 1

assessment methodology used to model concentrations of pollutants and odour (Section 4); assessment criteria including air quality limit values, objectives and Environmental Assessment Levels and significance criteria (Section 5); background concentrations (Section 6); and results of the dispersion modelling (Sections 7, 8 and 9); before Section 10 concludes.

2 Process description

This section describes the proposed operation of the Site with the new infrastructure operational. A process flow diagram is provided as Appendix A, section A.3.

2.1 AD Process Description

2.1.1 Feedstocks

The Proposed AD plant will process up to 40,000 TPA of liquid and solid waste and 12,500 TPA of crop material. It will export from Site 7,000 TPA of fibre digestate and 40,000 TPA of digestate liquor.

Solid food waste will be delivered by (covered) heavy goods vehicle (HGV) to the **Waste Reception Building** where the loads will deposited, stored and treated. Waste shall only be delivered to the Site between the hours of 07:00 and 18:00 Monday to Friday, between 07:00 and 12:00 on Saturday mornings and between 7:00 and 15:00 on Bank Holidays except Christmas Day and Easter Sunday. There shall be no more than 36 HGV vehicle movements (18 in and 18 out) per day to and from the site. They will enter the Waste Reception Building via fast-acting roller shutter doors that have a maximum opening speed of 0.5m/s and a closing speed of 0.3m/s.

Loads are deposited within the building. The maximum solid waste stored at any time will be 315 tonnes and the maximum length of time that waste may be stored is 72 hours. The Mavitec depackaging plant inside the Waste Reception Building will separate packaging from organic food wastes; the resulting feedstock will then be pumped to the **raw waste buffer tank** (RWBT) where it will be blended with liquid wastes pumped directly to the RWBT before the blended mixture is pumped to the **primary digesters** (primary digester 2 and 3 are for food waste only). Packaging removed by the depackaging plant will be washed, passed to a screw press compactor and then a container for disposal.

Liquid food waste, delivered in tankers, is currently dispatched directly into the RWBT within the secondary containment area. The dispatch point is to be moved to inside the Waste Reception Building such that any off gas from tankers will be contained and abated by the building's odour abatement system. The RWBT has a **pressure vacuum release valve (PVRV)**. These valves only operate as a final safety measure in the event of an overpressure or under pressure within the tank; the pressure threshold for release is set higher than the pressure threshold for flaring therefore, the flare would be operational and deal with any over-pressure without the need for the PVRVs to operate.

Energy crops including maize and rye silage will be delivered to the Site by tractor and trailer or HGV during the harvest period. They will be compacted and stored in the two **clamps**, each with a capacity of 7,500m^3, covered with plastic under-sheeting and then silage membrane sheet to form an airtight and water-tight layer. It is important that the silage is maintained anaerobically to ensure ensilement to preserve its effectiveness as a feedstock. Leachate from the clamps will drain to an underground **leachate tank** with a capacity of 126m^3 which vents to air via a grate approximately 0.3m x 0.6m, at ground level.

Run-off from dirty areas of the site including the secondary containment area will drain to the two **process water storage tanks (100m^3 each)** which do not vent to atmosphere.

The clamps will only be exposed, at the 'working face,' for removal of feedstocks. The MT Alligator Plus, 40 tonne external **feed hopper**, will be filled twice a day to maintain it at 40 tonnes full fill. The feed hopper feeds silage to the primary digester (Digester 1) via a walking floor. Loading of silage from the working face of the clamps and loading into the feed hopper will take approximately 2h/day.

There will be four digesters in total (three digesters and one **post-digester**). Each digester will have a PVRV to emit biogas or take in air if there is an over-pressure or under-pressure event respectively. PVRVs will not operate during normal operation and over-pressure is managed by operation of the flare before the PVRVs.

2.1.2 Digestate

The crop feedstock will be digested in primary Digester 1, with some food waste; primary Digesters 2 and 3 treat food waste only; and there is one post digester which is fed by all three primary digesters. Digestate from the digesters will be macerated, screened and pasteurised at over 70°C for one hour before being cooled and pumped to the separator. The **pasteuriser** will have a PVRV.

The **separator** comprises two FAN screw press separators fed by a **separator buffer tank** with a working capacity of 100m^3 which has one vent in a tented roof. Fibre digestate will fall into a bunker (4.5m x 5.3m x 1.85m high). The total fibre stored at any time will be approximately 23t, 1 day's production of fibre digestate. The separator will be enclosed in a tented structure, open on one side to allow easy access for vehicles to remove fibre digester which will be removed from the Site to farm destination field heaps.

Liquid digestate is piped to the lagoons; there will be two lagoons, each with a capacity of 16,500m^3. Each **lagoon** will have an impermeable floating cover with six vents. Emissions from the lagoons will be channelled via two carbon filters in sequence to one **lagoon vent**, located between the lagoons on the western side. The carbon filters will be filled with activated carbon/charcoal resin to reduce emissions of NH_3 and odour to an acceptable level. This assessment has assumed a volume flow rate of 0.003m^3/s from the lagoon vent and a concentration of NH_3 at exhaust of less than 865ppm.

Once installed, monitoring will be conducted to determine the actual off gas volume flow rate from the lagoons and the concentration of NH_3 before treatment. The monitoring will be conducted in each of the four seasons to record the effect of ambient temperature on the emissions. It will inform any further investment if required.

Liquid digestate is removed from site by pipework to the local estate land; there is no routine tankering offtake point.

2.1.3 Biogas and biomethane

Biogas will be stored above the digesters in the double membrane gas storage domes all of which have desulphurisation nets and injection of low-level oxygen to reduce H_2S levels. Ferric hydroxide powder will be dosed into the feeders as a further measure to manage and reduce H_2S levels if required. Biogas from the gas holders will pass through two active carbon filters to reduce NH_3 and H_2S levels before passing into the Pentair **biogas upgrading plant (BUP)**. The medium in the BUP cannot work properly unless the trace gases (NH_3, H_2S) are removed.

Biogas (60% CH_4, 40% CO_2 by volume) will be treated in the BUP to create biomethane (100% CH_4 by volume) which leaves the BUP to be compressed and stored prior to dispatch from the site via gas tankers to a National grid injection point, this is referred to as a virtual pipeline. The BUP separates the biogas to methane (CH_4) and carbon dioxide (CO_2). T a. There is also a vehicle refuelling station on site, which is not in use at the time of writing. CO_2 is currently vented from the BUP, however, the BUP will be fitted with carbon capture equipment so the remaining output stream, 100% CO_2, will be captured, cleaned, liquefied, and exported from the site via tankers for industrial use or permanent sequestration. The site will capture and remove around 5,500-6,000 TPA of CO_2.

Biogas will be used to fuel CHPs on site to generate heat and electricity for site operations. The existing CHP will become the 'standby' CHP and a new CHP will become the 'duty' CHP. The new CHP provides surety of electricity supply given that the existing CHP is over 10 years old and becoming less reliable and allows capacity to burn biogas should the BUP and export of biomethane be compromised. If this happens feeding will be markedly reduced or stopped to reduce gas production levels, but in the interim any biogas can be effectively used to generate electricity from both CHPs. Though only enough biogas will be produced to fuel both CHPs at 80% capacity due to the treatment/production capacity of the AD plant. The site has a capacity to export 2 MW of electricity to the grid. Each CHP can produce 1.2 MW of electricity. There is capacity to use 2.4 MW of electricity from both CHPs to supply the grid and the Pentair gas upgrade unit, but it is preferable to run one CHP as the 'duty' CHP at 100% and use the second CHP as standby. All heat produced from the CHPs can be used on site at certain times of the year dependent on ambient temperature at the time of production. The new CHP2, an MWM TCG2020V12, 1,200kWe engine, is in a dedicated sound proofed container. The current CHP, CHP1, which is the same model of CHP, is also in a dedicated soundproofed container. The duty CHP is a new engine under the Medium Combustion Plant Directive[3] (MCPD) and will meet an emission limit value (ELV) of 40mg/Nm^3 of SO_2 (dry gas, 273K, 15% O_2); the standby CHP is existing under MCPD and will meet the limit set in the current permit of 130mg/Nm^3 of SO_2 (dry gas, 273K, 15% O_2) which is equivalent to 350mg/Nm^3 (dry gas, 273K, 5% O_2).

The CHPs will emit pollutants (SO_2, TVOC, NOx and CO) from 7m stacks and provide heat and power to the Proposed AD plant with excess electricity exported to the national electricity grid.

Biogas may be burnt within either of two flares under abnormal operating conditions such as during extended maintenance or malfunction of the BUP or malfunction of the CHPs by the **emergency flares**: Flare 1 and Flare 2. Flare 1 is a Uniflare UF10-500-BGF Biogas Controlled Combustion Flare which can burn up to 500m^3/h; Flare 2 is a Uniflare UF10-1000-BGF Biogas Controlled Combustion Flare which can burn up to 1,000m^3/h. The flare should operate for a limited number of hours per year as production of gas can be controlled by controlling the rate of feeding to the digesters and there is

[3] DIRECTIVE (EU) 2015/2193 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants

adequate provision for the use of all biogas generated on site. It has been considered as a source of pollutants (TVOC, NOx and CO) and for the impact on long-term concentrations it has been assumed, pessimistically, that it would operate for 10% of the year. The contribution of the flare to short-term impacts has been modelled in this report.

A diesel-fired generator will provide back-up power. It will only be used infrequently during abnormal operations (mains power outages) and will be subject to planned preventative maintenance. The generator has not been modelled as a source of emissions to air as it is anticipated that it may operate for a few hours per year under emergency conditions.

2.1.4 Operational scenarios

Under normal operation the only combustion source operating will be the duty CHP; operation of the emergency flares for 10% of the time has been modelled to account, conservatively, for the impact of the flares on long-term impacts, such as annual average concentration and deposition.

Two abnormal operating conditions have been considered:

- Abnormal 1. If the BUP and export of biomethane are compromised, both CHPs would operate, each at 80% load
- Abnormal 2. If the CHPs are not operational, one or more flares will operate. They have both been modelled operating at 100% load.

2.2 Odour control of emissions in the Waste Reception Building

Odour emissions from the building are controlled using an air handling and odour abatement system and fast-acting roller shutters on the vehicle access doors of the building. The air handling system will deliver at least three air changes per hour (acph) which will maintain a negative pressure in the building, thereby reducing the potential for fugitive emissions from the door. The maximum opening speed of the roller shutters is 0.5m/s and the closing speed is 0.3m/s.

The odour abatement system proposed at the AD plant is a sealed unit biofilter, located to the northeast of the building. The biofilter, from Mike Thompson Partnership Ltd, will have a 3m deep media bed. There will be no dust nor aerosols in the exhaust from the buildings due to the nature of the material being processed in the Waste Reception Building. Exhaust air going to the biofilter is relatively humid, coming from directly above the waste storage bays. Should the humidity drop, the biofilter can be watered if required.

The biofilter exhausts from the top of the media, from an area 5.4m x 10.5m at a height of 3.6m. It has been modelled as a source of NH_3, H_2S and odour.

The combination of fast-acting roller shutter doors, constant negative pressure and an odour abatement system will minimise fugitive odour emissions from the roller shutter doors in the short time they are open; fugitive emissions have, therefore, been assumed to be negligible.

2.3 PVRVs

PVRVs are a necessary safety feature for an AD plant but will only be used as a contingency to maintain the integrity of the tank and therefore the dome structures which sit above. The PVRVs are only activated in the event of an over or under pressure within the AD tanks. Biogas will be burnt via an emergency flare in preference to release to atmosphere via the PVRVs. The supervisory control and data acquisition system (SCADA) for the AD plant ensures that biogas is controlled in this manner.

Activation of the PVRVs represents an abnormal operating scenario and therefore the frequency of PVRV activation is not possible to predict for any plant in any given year albeit is monitored when it occurs. The operator seeks to minimise PVRV activation always through diligent optimised operation of the AD plant. Therefore, the nature of these releases, typically very short-term sporadic events, would be difficult to represent accurately.

PVRVs have therefore been neglected as a source of pollutants and odour.

2.4 Summary of emissions to air

Table 1 lists the sources of emissions to air that have been considered in this impact assessment.

Table 1 Sources of emissions to air to be assessed

Source	Emissions	Operation profile
CHP2 (duty CHP)	NOx, SO_2, TVOC, CO	Normal: Continuous Abnormal 1: 80% load
CHP1 (standby CHP)	NOx, SO_2, TVOC, CO	Abnormal 1: 80% load
Flare 1, Flare 2	NOx, TVOC, CO	Emergency back-up[1]
Biofilter	NH_3, H_2S, Odour	Continuous
Lagoon vent	NH_3, Odour	Continuous
Clamps, working face	Odour	Assumed to be exposed continuously
External feed hopper	Odour	Continuous
Separator	NH_3, Odour	Continuous
Notes: [1]assumed to operate for 10% of the year for comparison with long-term AQS.		

3 Legislation and guidance

3.1 Overview

This section describes the relevant legislation, policy, and guidance relevant to this assessment which is summarised in Table 2 and described further in Sections 3.2 to 3.3.

Table 2 Summary of legislation, policy and guidance

Short name	Name	Body	Scope
Legislation			
1995 Act	Environment Act 1995[4]	UK Parliament	Establishes the framework for managing air quality to achieve compliance with air quality objectives.
4th Daughter Directive	Directive 2004/107/EC[5]	European Commission, now EU	Sets limit values for arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
AAD	Ambient Air Quality Directive 2008/50/EC[6]	EU	Ambient air quality, sets limit and target values
IED	Industrial Emissions Directive, 2010/75/EU[7]	EU	Industrial emissions
MCPD	Medium Combustion Plant Directive, EU/2015/2193[3]	EU	Emission limit values for pollutants from combustion plant greater than 1MWth and less than 50MWth
AQSR	Air Quality (Standards) Regulations 2010[8] as amended in 2016[9]	UK Parliament	Ambient air quality, standards for pollutant concentrations. Transposed EU limit values defined in AAD into law in England and Wales

[4] Environment Act 1995, 1995 Chapter 25, Part IV Air Quality
[5] DIRECTIVE 2004/107/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, of 15 December 2004, relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
[6] DIRECTIVE 2008/50/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 May 2008 on ambient air quality and cleaner air for Europe comment on amendment
[7] DIRECTIVE 2010/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
[8] Statutory Instrument: 2010 No. 1001, ENVIRONMENTAL PROTECTION, The Air Quality (Standards) Regulations 2010 comment on amendment
[9] The Air Quality Standards (Amendment) Regulations 2016, Statutory Instrument 2016 No, 1184, Made 6th December 2016

Short name	Name	Body	Scope
EPR	Environmental Permitting Regulations 2018[1]	UK Parliament	Industrial emissions. Transposed IED into law in England and Wales
Guidance			
Defra permit guidance	Air emissions risk assessment for your environmental permit[10]	Department for Environment, Food & Rural Affairs and Environment Agency	How to undertake an air quality assessment for a permit
Waste Treatment BREF	BAT Reference Document Waste Treatment[11]	European IPPC Bureau,	Indicative BAT for waste treatment including Associated Emission Levels
Appropriate Measures	Biological waste treatment: appropriate measures for permitted facilities[12]	Environment Agency	Sets out appropriate measures for the treatment of organic materials
EA H4	Technical Guidance Note H4 – Odour Management[13]	Environment Agency	Guidance on assessing odour impact, includes benchmark values
Defra SWIP	Specified generators: dispersion modelling assessment[14]	Environment Agency and Natural Resources Wales	Includes reference for conversion of NOx to NO_2
AQTAG06	AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air[15]	Air Quality Advisory Group	Guidance on calculating deposition
LAQM.TG16	Local Air Quality Management, Technical Guidance (TG16)[16]	Department for Environment, Food & Rural Affairs and the Devolved Authorities	Includes general guidance on dispersion modelling

[10] Department for Environment, Food & Rural Affairs and Environment Agency, Air emissions risk assessment for your environmental permit, Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [Accessed 20/11/2023]
[11] Best Available Techniques (BAT) Reference Document for Waste Treatment, European IPPC Bureau, 2018
[12] Environment Agency (21 September 2022) Biological waste treatment: appropriate measures for permitted facilities. Available at: https://www.gov.uk/guidance/biological-waste-treatment-appropriate-measures-for-permitted-facilities/1-when-appropriate-measures-apply
[13] Environment Agency (March 2011) Technical Guidance Note H4 - Odour Management. How to comply with your environmental permit
[14] Environment Agency and Natural Resources Wales, Specified generators: dispersion modelling assessment, Available at: https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment#nosubxsub-to-nosub2sub-conversion-ratios-to-use [Accessed 29/10/2023]
[15] Air Quality Advisory Group, 2014, AQTAG06 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air
[16] Department for Environment, Food & Rural Affairs and the Devolved Authorities, Local Air Quality Management Technical Guidance (TG16), February 2018

3.2 Legislation and policy

3.2.1 Environment Act

The Environment Act, which established the Environment Agency for England and Wales with functions including the control of pollution. Part IV of the Environment Act 1995 establishes the framework for managing air quality to achieve compliance with air quality objectives and for local air quality management (LAQM). Under LAQM local authorities (district councils) are required to monitor, review, assess and improve air quality in their areas; if exceedances are monitored or predicted, they must consider establishing an AQMA. Part IV requires the Secretary of State to prepare a National Air Quality Strategy.

3.2.2 Ambient Air Quality Directive and 4th Daughter Directive

The Ambient Air Quality Directive and 4th Daughter Directive contain **Limit Values** and **Target Values** with which the UK must comply. The Ambient Air Quality Directive also addresses common methods and criteria; information on ambient air quality to help combat air pollution and nuisance, to monitor long-term trends; and making information and pollution alerts available to the public.

3.2.3 Air Quality Standards Regulations

The Air Quality (Standards) Regulations 2010 is the instrument by which the Ambient Air Quality Direction and the 4th Daughter Directive were transposed into English law.

3.2.4 Industrial Emissions Directive

The IED is the main EU instrument by which pollutant emissions from industrial installations are regulated. It consolidated seven earlier directives including, in particular, the Integrated Pollution Prevention and Control Directive and the Waste Incineration Directive. It defines emissions limit values (ELVs) for some process-fuel combinations but there are no ELVs relevant to the Biogas upgrading stack.

3.2.5 Medium Combustion Plant Directive

The MCPD regulates emissions of SO_2, NOx and dust to air and requires monitoring of carbon monoxide (CO) emissions in order to reduce emissions and risks to human and ecological receptors. MCPD ELVs apply from 2025 or 2030 for existing plants, depending on their size.

The relevant ELVs for proposed engines using biogas, which have been used in this assessment, are those defined in Part 2 of Annex II of the MCPD.

3.2.6 Environmental Permitting Regulations

The Environmental Permitting (England and Wales) (Amendment) Regulations 2018 is the latest consolidated version of instrument by which the IED was transposed into national legislation.

3.3 Guidance

3.3.1 Air emissions risk assessment for your environmental permit

The webpage provides Department for Environment, Food & Rural Affairs and Environment Agency guidance on how to carry an air emissions risk assessment. It replaced the Environment Agency, H1 Annex F – Air Emissions.[17] It includes guidance on the ecological receptors to be assessed, tests on significance on results, relevant air quality Limit Values (from the Ambient Air Directory), objectives from the National Air Quality Strategy and it lists short-term (hourly) and long-term (annual mean) **Environmental Assessment Levels (EALs)** for human health.

3.3.2 Biological waste treatment: appropriate measures for permitted facilities.

This guidance applies to aerobic and anaerobic processes including AD including the combustion or upgrading of the resulting biogas and treating the digestate (AD can include wet, dry, and dry-batch digestion). There is overlap between BAT and necessary measures for waste operations. The EA uses the term 'appropriate measures' to cover both sets of requirements.

3.3.3 Technical Guidance Note H4 – Odour Management

The guidance from EA is intended for permit holders and applicants, to advise them on how to comply with odour conditions set by the permit. It covers, assessing odour pollution, measures to reduce pollution, control measures and monitoring. It contains advice on odour thresholds or benchmarks for assessment.

3.3.4 Specified generators: dispersion modelling assessment

The webpage provides Defra and Environment Agency guidance on how to do detailed air quality modelling for specified generators. This includes the use environmental standards for air, the use of NOx to NO_2 conversion ratios, and guidance on impact assessment.

3.3.5 Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air

This document (AQTAG06) provides guidance on how to carry out a quantitative assessment (Stage 3 appropriate assessment) including guidance on calculating deposition for emissions to air in order to fulfil the requirements of the Habitats Regulations.

3.3.6 Local Air Quality Management, Technical Guidance

This technical guidance (LAQM.TG16) is published to support local authorities in carrying out their duties under the Environment Act 1995, which established the LAQM process. It provides guidance on monitoring and assessing air quality, action planning and reporting. While aimed at local authorities the advice in used more widely by those working in the field, and not just for LAQM.

[17] Environment Agency, H1 Annex F – Air Emissions – now withdrawn. Version 2.2, December 2011

4 Assessment Methodology

4.1 Introduction

The methodology comprised three parts which are described in more detail in Sections 4 to 6:

1. Baseline conditions assessment at the Site and the surrounding area:
    - AQMAs and designated conservation areas; background concentration and deposition (section 6).
2. Modelling of impacts:
    - Assessment of the likely changes in concentration and deposition due to emissions from the sources listed in Table 1. Operation of the plant under normal and abnormal operating conditions. The assessment was undertaken using the ADMS 6 dispersion model (section 4.2).
    - Assessment of air quality impacts due to the exhausts of traffic arising from the Proposed AD plant in the construction and operational phases.
    - The modelling assessment included an assessment of the sensitivity of model results and hence, the impacts, to changes in model input.
    - Modelling of odour impacts due to odour emissions from the sources listed in Table 1.
3. Assessment of significance. Sections 5.2, 5.3 and 5.4 describe the significance criteria.

If the impacts are significant then further investigation would be required.

4.2 Modelling of air quality impacts

4.2.1 Model

The dispersion model used to predict ambient concentrations due to the stack emissions was ADMS 6 (version 6.0.0.1). The model is termed a 'new generation' model and is commonly used in the UK for industrial permit applications to the Environment Agency.

It requires as input: data on the source of emissions and the mass emission rates of each pollutant (Table 3 to Table 6

Table 6), meteorological data and associated parameters, buildings data, terrain data, and receptor locations. Full details of the meteorological, buildings and receptor data are described in Appendix B.

The outputs calculated by the model are the air concentrations of pollutants from the sources modelled for the relevant averaging times and statistics. The contribution from the modelled sources on the Site to air concentration and to deposition rates are referred to the Process Contribution (PC), which is then compared with the relevant AQS. When background concentrations or deposition rates are added to the PC, the totals are referred to as Predicted Environmental Concentration (PEC) and Predicted Environmental Deposition Rate (PEDR) respectively, which are also compared with the relevant AQS.

From air concentrations of NO_2 and NH_3 the deposition rate of nitrogen can be calculated and the acid deposition due to nitrogen; from the air concentration of SO_2 the contribution of sulphur to acid deposition.

4.2.2 Model options and scenarios

Three operational scenarios have been modelled. In all three scenarios the clamps, external feed hopper, separator, leachate tank vent and lagoon vent have been modelled as operational all year plus:

- Normal operation:
  - CHP2 the duty CHP at 100% load and the Pentair BUP operational. Flare 1 and Flare 2 modelled as operational 10% of the time to include their impact on long-term average concentrations and depositions.
  - CHP1, the standby CHP, not operational.
- Abnormal 1:
  - CHP2 and CHP1 operational, each at 80% load
  - Pentair BUP, Flare 1, Flare 2 not operational.
- Abnormal 2:
  - Flare 1 and Flare 2 operational
  - CHP1, CHP2, Pentair BUP not operational.

The emergency generator has not been included in any of the scenarios as it will only be operated for testing purposes, unless required to provide emergency power, and its impacts will be much smaller than the impacts modelled in the Abnormal operation scenarios.

All three scenarios have been modelled as occurring all year in order to capture the impacts if the scenario coincides with the worst-case meteorological data that gives rise to the greatest impacts. It is a very conservative assumption in terms of the Abnormal scenarios to assume that their occurrence, which will persist for a short period, will coincide with all the worst-case meteorological conditions.

Normal operation has been used to calculate impacts for comparison with long-term AQS. Short-term impacts have been assessed from the maximum impact of each of the three scenarios; Abnormal 1 was the scenario giving rise to the maximum short-term impacts.

Emissions from the CHPs have been modelled, for the main scenario, at the ELVs. Monitoring data for CHP1 shows that it will achieve lower emissions of SO_2, TVOC and CO than the ELVs (Appendix C) and the same performance would be expected for TVOC and CO from CHP2. These values have been used in investigating the short-term impacts.

- SO_2, 182mg/Nm^3 compared with 350mg/Nm^3, 52% of the ELV
- TVOC, 611mg/Nm^3 compared with 1,000mg/Nm^3, 61% of the ELV
- CO, 673mg/Nm^3 compared with 1,400mg/Nm^3, 48% of the ELV

In the absence of ELVs or permit levels, typical permit levels and monitoring data from comparable plant at other sites or manufacturer specified values have been used. Assuming the continuous operation of these sources provides a pessimistic prediction of impacts as no account has been taken of planned outages for maintenance.

The model was run for each of the five years of meteorological data (2018-2022) for three combinations of model option scenarios:

- Flat terrain: no buildings and no terrain (hills)
- Flat terrain: with buildings and no terrain (hills)
- Terrain (hills): with buildings

Results at the receptors were calculated as the maximum value at each receptor from these 15 model runs and are therefore worst-case values across all five years and the three model options scenarios. Use of five years' meteorological data in the modelling is to account for intra-annual variation.

4.2.3 Model options and sensitivity

The impact of buildings, terrain and meteorological data year were assessed, and the results are given in Appendix D.

The sensitivity tests showed that, for human receptors, modelling buildings led to higher model prediction than for flat terrain. Modelling terrain as well buildings did not affect results significantly while the variation due to meteorological data year is generally less significant than the impact of modelling buildings. For ecological receptors the effect on results of modelling buildings was not so marked and the impact of inter-annual variation was greater than that of modelling or not modelling buildings or buildings and terrain.

The results presented in this report are the worst case across 15 model runs: flat terrain, with buildings, with buildings and terrain, each modelled with five years of meteorological data. The assessment is therefore conservative (pessimistic) is this respect.

4.2.4 Sources and emissions

The source geometry, parameters, ELVs, design emission limits and calculated emissions are given in Table 3 for the CHPs (1 No CHP at 100% and 2 No. CHP at 80% load), Table 4 the emergency flares, Table 5 the biofilter exhaust, lagoon vent and leachate tank vent, and Table 6 for the clamps, feed hopper and separator. The emission point plan in Appendix A and Figure 1 show the source locations. No ELVs are set for the current flare in the permit; typical permit values have been used for Flare 1 and Flare 2.

While the exact plant has not been finalised at this stage, representative data have been used in this assessment. Manufacturer technical specifications used are given in Appendix G to Appendix J.

The modelling is conservative (pessimistic) in assuming a CHP will operate at 100% load all year, that flares will operate at an equivalent of full load for 10% of the year and in the Abnormal 1 scenario that the CHPs each operate at 80% load to consume the maximum quantity of biogas that may be produced on site.

It has been assumed, conservatively, that the emergency flare may operate at the ELV for NOx (150mg/Nm^3) although the technical specifications for the flares have an emission limit of 100mg/Nm^3 (Appendices H and I).

The biofilter exhaust is expected to achieve the Best Available Techniques (BAT) associated emission levels (AELs) for the waste treatment sector, BAT-AEL[12] of 1,000ou$_E$/m^3 for odour. Exhaust concentrations of NH_3 and H_2S are a conservative estimate based on monitored emissions inside the Waste Reception Building before abatement (Appendix E) and biofilter outlet monitoring data from a comparable site processing a similar tonnage of food waste within a similarly sized building[18]: NH_3 <0.5ppm; H_2S <0.2 ppm. The NH_3 concentration of 0.5ppm (0.6mg/m^3) meets the BAT-AEL of 0.3-20mg/m^3 for channelled emissions. Concentrations are low for food waste whether delivered in bulk or packaged, compared to for instance if manure were being stored.

The lagoon vent has been assumed to have a height of 3m, diameter of 0.1m and exit velocity of 0.4m/s; it has been modelled as a point source. An odour concentration of 10,000ou$_E$/m^3 before abatement has been assumed.[19] Emissions of NH_3 before abatement have been calculated using the total nitrogen of the digestate, 5.5kg total N/t (Appendix F) and an emission rate of 0.0266 kg NH_3/kg N from EMEP/EEA.[20] Emissions will pass through carbon filters between the lagoons and the lagoon vent. The carbon filters, filled with activated carbon/charcoal resin, has been assumed to reduce odour and NH_3 emissions by 95%.

The leachate tank has a maximum cross-sectional area of 76.4m^2 (2.1m x 36.4m) and passively vents at ground level via a grate approximately 0.3m x 0.6m, which has been modelled as an equivalent point source (0.48m diameter) with a low emission velocity (0.1m/s). The odour and NH_3 emission rates have been calculated on the same basis as those from the lagoon, with an 80% reduction has been assumed as the tanks will hold leachate rather than slurry.

The clamps, feed hopper and separator have all been modelled as volume sources.

The working face of the clamp will be uncovered to enable the loader to remove silage which is then transferred to the solids feeder. The clamps hold 12,500 tonnes (15,000m^3) of silage, which equates to 34.2 tonnes per day. It has conservatively been assumed that 20% of the width of the clamps would be exposed at any one time, with a depth of 3m. It is assumed that 2m of the top of the clamps is exposed at any time. This corresponds to 40.5 tonnes, over 1 day's supply (34.2t). The odour emission rate used, 20ou$_E$/m^2 for maize silage, is that used by Redmore Environmental in their odour assessment for this Site for Planning, 2021.[21]

Loading of the external crop feed hopper takes 1-2 hours per day but the feed hopper will operate continuously, transferring feedstock to the digesters using a walking floor, i.e. without agitation. The same odour emission rate of 20ou$_E$/m^2 as for the clamps has been used. Emissions have been assumed

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[18] Confidential correspondence with ETL.
[19] Smith S. (2017) A Dispersion Modelling Study of the Impact of Odour from the Proposed Biofertilizer Storage Lagoon at land west of Hangman Stone Lane, near High Melton in South Yorkshire, AS Modelling & Data Ltd, 19 September 2017
[20] EEA/EMEP (2019) Emissions Guidebook, NFR 5.B.2, Biological treatment of waste – anaerobic digestion at biogas facilities
[21] Redmore Environmental, Odour Assessment, Herriard Anaerobic Digestion Plant, Herriard, Reference: 2256-4r1, 16th December 2021r

to occur continuously and have been modelled as an elevated volume source, 0.5m in depth, at the top of the feed hopper to represent the fugitive nature of the emissions.

Emissions from the separator have been modelled as a volume source for the size of the bunker ($44.1m^3$). NH_3 emissions have been calculated as for NH_3 emissions from the lagoons (liquid digestate) odour emission rates have been taken from the Redmore Environmental assessment[21] ($2.8ou_E/m^2$). A reduction factor has been applied to account for the covering of the separator by a tent-link structure above and on all sides except the front. The reduction factor of 0.26 has been calculated as the ratio of the front face exposed area of fibre digestate, with the covering in place, to the top and front face area exposed without the cover.

Table 3 Point sources: CHPs at full load and 80% load

Parameter	Units	CHP 1[1] (100%)	CHP 2[2] (100%)	CHP 1[1] (80%)	CHP 2[2] (80%)
Electrical output	kWe	1,200	1,200	960	960
Thermal input	kWthi	2,850	2,850	2,330	2,330
Location	NGR (X,Y)	465434, 146688	465444, 146693	465434, 146688	465444, 146693
Stack height	m	7	7	7	7
Internal diameter at stack exit	m	0.35	0.35	0.35	0.35
Volume flow rate (dry)	Nm^3/s	1.04	1.04	0.84	0.84
Volume flow rate (wet)	Am^3/s	2.41	2.41	1.98	1.98
Velocity	m/s	25.1	25.1	20.1	20.1
Temperature	°C	180	180	180	180
Exit concentration SO_2	mg/Nm^3	350 (ELV, 5% O_2)	107 (ELV, 5% O_2)	350 (ELV, 5% O_2)	107 (ELV, 5% O_2)
Exit concentration TVOC	mg/Nm^3	1,000 (ELV, 5% O_2)	1,000 (ELV, 5% O_2)	1,000 (ELV, 5% O_2)	1,000 (ELV, 5% O_2)
Exit concentration NOx	mg/Nm^3	500 (ELV, 5% O_2)	500 (ELV, 5% O_2)	500 (ELV, 5% O_2)	500 (ELV, 5% O_2)
Exit concentration CO	mg/Nm^3	1,400 (ELV, 5% O_2)	1,400 (ELV, 5% O_2)	1,400 (ELV, 5% O_2)	1,400 (ELV, 5% O_2)
Emission rate SO_2	g/s	0.365	0.112	0.293	0.090
Emission rate TVOC	g/s	1.042	1.042	0.837	0.837
Emission rate NOx	g/s	0.521	0.521	0.418	0.418
Emission rate CO	g/s	1.459	1.459	1.172	1.172

Notes:

[1]CHP1, MWM TCG2020V12, 1,200kWe engine (Appendix G) in a dedicated sound proofed container. Emissions will meet the limit set in the current permit of $130mg/Nm^3$ of SO_2 (dry gas, 273K, 15% O_2) which is equivalent to $350mg/Nm^3$ (dry gas, 273K, 5% O_2).

[2]CHP2, MWM TCG2020V12, 1,200kWe engine (Appendix G) in a dedicated sound proofed container. Emissions will meet the MCPD limit of $40mg/Nm^3$ of SO_2 (dry gas, 273K, 15% O_2) which is equivalent to $107mg/Nm^3$ (dry gas, 273K, 5% O_2).

Table 4 Point sources: Emergency flares

Parameter	Units	Emergency Flare 1[1]	Emergency Flare 2[2]
Location	NGR (X,Y)	465437, 1467114	65428, 146709
Stack height	m	7.67	7.67
Internal diameter at stack exit	m	1.183[3]	1.673[3]
Volume flow rate (dry)	Nm^3/s	1.10	2.21
Volume flow rate (wet)	Am^3/s	12.64	25.28
Velocity	m/s	11.5	11.5
Temperature	°C	1,000	1,000
Exit concentration TVOC	mg/Nm^3	10 (3% O_2)	10 (3% O_2)
Exit concentration NOx	mg/Nm^3	150 (3% O_2)	150 (3% O_2)
Exit concentration CO	mg/Nm^3	50 (3% O_2)	50 (3% O_2)
Emission rate TVOC	g/s	0.011	0.022
Emission rate NOx	g/s	0.166	0.331
Emission rate CO	g/s	0.055	0.110

Notes:
[1]Uniflare UF10-500-BGF Biogas Controlled Combustion Flare, Job no. 1836, 29/9/2022 (Appendix H) with maximum biogas flow rate of 500Nm^3/h. Emission rates shown are for continuous operation; for long-term impact it has been assumed the flare will operate for a maximum of 10% of the time.
[2]Uniflare UF10-1000-BGF Biogas Controlled Combustion Flare, Job no. 1837, 29/9/2022 (Appendix I) with maximum biogas flow rate of 1,000Nm^3/h. Emission rates shown are for continuous operation; for long-term impact it has been assumed the flare will operate for a maximum of 10% of the time.
[3]Hot face diameter

Table 5 Area and point sources: Biofilter (area), lagoon vent and leachate tank vent

Parameter	Units	Biofilter exhaust[1]	Lagoon vent[3]	Leachate tank vent[4]
Location	NGR (X,Y)	Centred at 465394, 146686	465469, 146539	465452, 146620
Emission height	m	3.6	3	0
Diameter	m	-	0.1	0.48 (equivalent)
Emission area	m^2	56.7 (10.5 x 5.4)	0.0079	0.18
Volume flow rate (wet)	m^3/s	5.647	0.003	0.018
Velocity	m/s	0.1	0.4	0.1
Temperature	°C	15, modelled as 'Ambient'	Ambient	Ambient
Exit concentration H_2S	mg/Nm^3	0.288 (0.2 ppm)	-	-
Exit concentration NH_3	mg/Nm^3	0.360 (0.5 ppm)	987[5]	$1.41x10^{-3}$ [6]
Exit concentration Odour	ou_E/Nm^3	1,000[2]	500[5]	2,000[6]
Emission rate H_2S	g/s	$2.45x10^{-5}$ $g/m^2/s$	-	-
Emission rate NH_3	g/s	$3.06x10^{-5}$ $g/m^2/s$	$3.1x10^{-3}$	$2.54x10^{-5}$
Emission rate Odour	ou_E/s	84.9 $ou_E/m^2/s$	6.28	36

Notes:
n/a: not applicable
[1]Mike Thompson Ltd, Biofilter Manual – V3 MTP, Job No: RKEBW21-01, Report Issue: December 2021 (Appendix J)
Exit concentrations for NH_3 and H_2S are a conservative estimate based on monitored emissions in the Waste Reception Building (Appendix E) and biofilter outlet data from a comparable site.[18]
[2]BAT AEL for channelled emissions.
[3]Aquaspira Undertank, drawing (Appendix K). A diameter of 0.1m has been assumed and an exhaust velocity of 0.4m/s.
[4]Exit concentrations not given as the emission is assumed to be passive i.e. modelled with zero velocity/volume flow rate.
[5]Assuming 95% reduction in emissions due to the abatement
[6]Assuming 80% reduction in emissions due to the rigid tank

Table 6 Volume sources: Clamps, feed hopper and separator

Parameter	Units	Working face of clamp exposed	Feed hopper	Separator
Depth, width, length	Each in m	3, 11.25, 2	0.5[2], 8.46, 3[3]	1, 2, 1
Emitting surface area	m^2	33.75	20	8
Emission mid-height	m	1.5	2.75	0.93
Total emission of NH_3	kg/yr	n/a	n/a	3.39[4, 5]
Exit concentration Odour	$ou_E/m^2/s$	20[1]	20[1]	2.8[5]
Emission rate NH_3	$g/m^3/s$	n/a	n/a	6.3×10^{-7}
Emission rate Odour	$ou_E/m^3/s$	10	40	0.528

Notes:
n/a = not applicable
[1]Redmore Environmental, Odour Assessment, Herriad Anaerobic Digestion Plant, Herriad, Reference: 2256-4r1, 16th December 2021
[2]Depth of the modelled, elevated volume source
[3]Solids feeder MT-Alligator plus 57m3 with MT-MixBoxBox
[4]Calculated assuming 5.5kg total N/t of fibre digestate (Appendix F) and an emission rate of 0.0266 kg NH_3/kg N from EMEP/EEA.[20]
[5]Reduction factor of 0.26 used to account for the impact of the separator covering (Section 4.2.4).

5 Assessment criteria

5.1 Air Quality Standards

European and national legislation, policy, and guidance, as described in Section 3.2 to Section 3.3, set various limit values, target values, objectives and environmental assessment levels (EALs) that may apply to human or ecological receptors. These will be collectively referred to throughout this report as air quality standards (AQS).

The AQS are defined with respect to an averaging time and a statistic. Annual mean AQS are an example of a long-term AQS, which is defined over a long period of time as the effects of the pollutant on human health or the environment are chronic, that is, due to long-term exposure. Pollutants may also have acute impacts, that is, the effects become apparent after short period of exposure to high values. For these pollutants short-term AQS are defined, for instance the 24-hour limit for benzene and 1-hour limit for H_2S are a maximum hourly average that must not be exceeded.

5.2 AQS for human health

Table 7 sets out the AQS for human health for the pollutants relevant to this assessment. The standards which apply at human receptor locations apply where people will be exposed to a pollutant for a period relevant to the standard such as at residential locations, hospitals, and schools for annual mean values.

Emissions are specified for TVOC for which there are no AQS. There is an AQS for benzene, one component of TVOC. An AEA Technology report on the Speciation of UK emissions of non-methane volatile organic compounds (2002)[2] reported on a series of VOC species profiles available for stationary combustion sources, covering a range of both fuel types and scale of combustion. The benzene fraction in industrial and commercial combustion of natural gas was reported to be less than 10%, therefore the TVOC concentrations at receptors has been modelled as 10% benzene. The short-term EAL for benzene is a newly published, stricter value; the previous value was 195μg/m^3 as a 1-hour average.

Table 7 Air Quality Standards for human health

Substance	Emission period	Limit (average)	Standard	Exceedances[1]
Ammonia	1 hour	2,500μg/m^3	EAL	None
Ammonia	Annual	180μg/m^3	EAL	None
Benzene	24 hour	30μg/m^3	EAL	None
Benzene	Annual	5μg/m^3	AAD Limit Value and AQS Objective	None
Carbon monoxide	8 hour running average across a 24-hour period	10,000μg/m^3	AAD Limit Value	None

Substance	Emission period	Limit (average)	Standard	Exceedances[1]
Hydrogen sulphide	1 hour	150µg/m^3	EAL	None
Hydrogen sulphide	Annual	140µg/m^3	EAL	None
Nitrogen dioxide	1 hour	200µg/m^3	AAD Limit Value	Up to 18 1-hour periods
Nitrogen dioxide	Annual	40µg/m^3	AAD Limit Value	None
Sulphur dioxide	15 minutes	266µg/m^3	UK AQS Objective	Up to 35 15-minute periods
Sulphur dioxide	1 hour	350µg/m^3	AAD Limit Value	Up to 24 1-hour periods
Sulphur dioxide	24 hour	125µg/m^3	AAD Limit Value	Up to 3 24-hour periods
Notes: AQS taken from https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [1]number of times a year that you can exceed the limit				

5.2.1 Significance of results

The Defra permit guidance[10] addresses when impacts can be considered insignificant. The guidance considers initial screening and then detailed modelling.

At the initial screening stage, a PC can be screened out from further assessment if:

- the short-term PC is less than 10% of the short-term environmental standard, and
- the long-term PC is less than 1% of the long-term environmental standard.

The second stage of screening considers the background concentration as well as the PC. The Predicted Environmental Concentration (PEC) is the sum of the PC and background concentration. A further assessment is not needed if:

- the short-term PC is less than 20% of the 'headroom,' where headroom is defined as the short-term environmental standards minus twice the long-term background concentration, and
- the long-term PEC is less than 70% of the long-term environmental standards.

If the PC cannot be screened out on that basis, following detailed modelling, two tests are applied:

- the proposed emissions must comply with BAT associated emission levels (AELs) or the equivalent requirements where there is no BAT AEL
- the resulting PECs will not exceed environmental standards.

If those tests are not satisfied it is necessary to consider whether: the PCs could cause the PEC to exceed an AQS; the PEC already exceeds an AQS; or the activity on site is not covered by a BAT reference document. Ultimately a cost-benefit analysis may be required.

5.3 AQS for sensitive conservation sites

The Defra/Environment Agency guidance[10] specifies that SACs, SPAs and Ramsar site within 10km should be considered and SSSIs, AWs, LWSs, Local Nature Reserves and National Nature Reserves within 2km should also be considered. Data supplied by Hampshire Biodiversity Information Centre (Appendix L) shows that the only sensitive conservation sites within the specified distances are 16 sites of AW, some of which are semi-natural and some replanted, four RVEIs, and seven SINCs. The RVEIs and SINCs are classes of LWSs. The main habitat in each AW area is: Broadleaved, mixed and yew woodland. All the road verges have also been treated as Broadleaved, mixed and yew woodland as a conservative approach. Ecological receptors were placed in each designated area at the nearest locations to the Site and additional locations.

Table 8 presents the sensitive conservation sites, receptors and habitats in each area. All the sites have been modelled as Broadleaved, mixed and yew woodland, which is a conservative assumption with respect to the four RVEIs and one SINC, Ham Copse (E6.1). The supplied information on the habitats for the SINCs is given in Appendix L and SINC criteria can be found in the Hampshire Biodiversity Information Centre SINC Criteria document.[22]

In Table 9 the AQS for the pollutants relevant to this assessment for designated ecological site receptors are summarised. AQS for concentrations of pollutants are referred to as critical levels (CLes) and those for deposition flux of nutrient nitrogen (NDep) and acid deposition due to nitrogen (N) and sulphur (S) (AcidDep) are referred to as critical loads (CLos). For AW the CLes and CLos are:

- CLe for NH_3: 1-3$\mu g/m^3$, a value of 1$\mu g/m^3$ has been used.
- CLos for NDep: 10 - 15 kgN/ha/yr for the most sensitive class, Broadleaved deciduous woodland.
- CLos for Acid Dep: CLmaxS: 2.851 CLminN: 0.142 CLmaxN: 2.993 (keq/ha/yr), for the most sensitive class, Broadleafed/Coniferous unmanaged woodland.

[22] Wilson P., (2021) Criteria for the Selection of Sites of Importance for Nature Conservation (SINCs) in Hampshire Updated October 2021, Edited by the Hampshire Biodiversity Information Centre. Available at: https://documents.hants.gov.uk/biodiversity/SINCCriteria.pdf [Accessed 01 December 2023]

Table 8 Sensitive conservation sites

Name	Receptors	Habitat
Great Bushywarren Copse	E12.1 – E12.3	Broadleaved, mixed and yew woodland
Little Bushywarren Copse	E15.1 – E15.2	
Cowdray's Copse 1	E14.1 - E14.3	
Kingsmore, Allwood & Fryingdown Copses	E4.1 – E4.9	
Buckshorn Copse	E7.1 – E7.2	
Swallick Wood	EX.1 – EX.2	
Hen Wood	E19.1 – E19.5	
Guy's Copse	E20.1	
Tom's Copse	E23.1	
Honeyleaze Copse	E25.1	
Hook's Copse, Weston Corbett	E26.1	
Coombe Wood, Tunworth	E24.1 – E24.2	
Great Matts Copse	E18.1 – E18.2	
Bushy Leane Copse	E9.1	
Merritt's Copse	E8.1 – E8.2	
Parkfield Copse Complex & Lower Common Pit	E1.1	
A339 Alton Road, Herriard	RV089	Broadleaved, mixed and yew woodland
Ellisfield Road Verge	RV255	
U259 College Lane, Ellisfield	RV236	
C12 Bagmore Lane	RV148	
Kit Lane & Longfield Dells	E5.1	Ancient Semi-natural Woodlands
Ham Copse, Ellisfield	E6.1	Other woodland where there is a significant element of ancient semi-natural woodland surviving
Herriard Common	E10.1	Pasture woodland and wooded commons not included in any of the above which are of considerable biological and historical interest
Platts Copse	E17.1	Ancient Semi-natural Woodlands
Hummocks Clump	E21.1	Other woodland where there is a significant element of ancient semi-natural woodland surviving
Smallhill Clump	E22.1	Other woodland where there is a significant element of ancient semi-natural woodland surviving or supporting some characteristics of ancient woodland/Agriculturally unimproved grasslands which are not of recent origin
Picked Craft Copse	EY.1	Ancient Semi-natural Woodlands

Table 9 Environmental standards for protected conservation areas

Substance	Target	Emission period
Ammonia	1µg/m³ where lichens or bryophytes (including mosses, landworts and hornwarts) are present. 3µg/m³ where they are not present	Annual
Sulphur dioxide[1]	10µg/m³ where lichens or bryophytes are present. 20µg/m³ where they are not present	Annual
Nitrogen oxide (expressed as nitrogen dioxide)[2]	30µg/m³	Annual
Nitrogen oxide (expressed as nitrogen dioxide)	75µg/m³ 200µg/m³ for detailed assessments where the ozone is below the AOT404 critical level and sulphur dioxide is below the lower critical level of 10µg/m³	Daily
Nutrient nitrogen deposition	Depends on location, use www.apis.ac.uk[23]	Annual
Acidity deposition	Depends on location, use www.apis.ac.uk	Annual
Notes: Environmental standards taken from https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [1]20µg/m³ is an AAD Limit Value if you have nature or conservation sites in the area; [2]30µg/m³ is an AAD Limit Value		

5.3.1 Significance of results

For locally designated sites such as AW and LWS, impacts can be screened out as insignificant if the short-term and long-term PCs are less than 100% of the relevant AQS.

5.4 Odour benchmarks

Most odours arise from mixtures of pollutants and the odour threshold is judged subjectively.

Environment Agency H4 Odour Management guidance[13] sets out benchmark odour criteria based on the 98th percentile of hourly mean concentrations of odour modelled over a year at a site boundary, that is the benchmarks are odour concentrations that may be exceeded during 2% of hours.

The benchmarks, to which predicted odour impacts have been compared are:

- 1.5ou_E/m^3 for "most offensive" odours e.g. processes involving septic effluent or sludge, processes involving decaying animal or fish remains, biological landfill odours.
- 3.0 ou_E/m^3 for "moderately offensive" odours e.g. intensive livestock rearing, well-aerated green composting, sugar beet processing. Odours from poultry rearing and Wastewater Treatment Works operating normally i.e. non-septic conditions, are usually placed in the "moderately offensive" category.
- 6.0 ou_E/m^3 for "less offensive" odours e.g. brewery, bakery, coffee roasting.

Odours from the normal operation of the plant are considered to fall within the "moderately offensive" category.

[23] UK Air Pollution Information System (APIS) http://www.apis.ac.uk/

6 Background concentrations and deposition fluxes

6.1 Basingstoke and Deane Borough Council air quality monitoring

In 2022, the latest year for which results are available, Basingstoke and Deane Borough Council (BDBC), the Council area within which the Site lies, did not carry out any monitoring using automatic (continuous) monitors but monitored NO_2 at 28 sites across the district using passive monitors, diffusion tubes. There are no AQMAs in the BDBC;[24] the nearest AQMA to the Site lies over 18km to the east, it is Waverley AQMA No.1 – Farnham, in Waverley Borough Council area.

There are no rural background monitoring sites in BDBC; there are three urban background sites and in 2022 they measured between 12.3$\mu g/m^3$ and 18.5$\mu g/m^3$. The nearest monitoring locations to the Site is the Venture Roundabout, roadside monitoring site; in 2022 it measured 25.6$\mu g/m^3$.

6.2 Defra modelled background

Defra provides maps of 2023 background concentrations of NOx and NO_2 that have been projected from a base year of 2018, benzene projected to 2010 from a base year of 2001 and SO_2 and CO for 2001. Factors are provided to project the concentrations of benzene, CO and SO_2 to future years.[25] The maps and factors have been used to determine 2023 background concentrations at each of the receptors which are shown in Table 10. Background concentrations of NH_3 are not part of the Defra mapped data and have been obtained from APIS.[26]

Background NO_2 concentrations (9.24-9.90$\mu g/m^3$) are, as expected, lower than the lowest urban background concentration monitored in BDBC. The Defra spatially varying background concentrations have been used in this assessment.

Table 10 2023 annual mean background concentrations ($\mu g/m^3$)

ID	Annual mean concentration ($\mu g/m^3$)					
	NOx	NO_2	SO_2	Benzene	CO	NH_3
H1	9.50	7.40	2.38	0.18	111	1.4
H2	9.53	7.42	2.45	0.18	110	1.4
H3	9.55	7.43	2.40	0.17	108	1.4
H4	9.55	7.43	2.40	0.17	108	1.4
H5	9.53	7.42	2.45	0.18	110	1.4
H6	9.53	7.42	2.45	0.18	110	1.4
H7	9.90	7.69	2.34	0.18	113	1.4
H8	9.24	7.21	2.40	0.18	110	1.4

[24] Basingstoke and Deane, 2023 Air Quality Annual Status Report (ASR), June 2023
[25] Defra, Background Maps, Available at: https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html [Accessed 20 November 2023]
[26] Air Pollution Information System, Available at www.apis.ac.uk, [Accessed 20 November 2023]

6.3 NH_3 concentration at sensitive conservation sites

Background concentrations of NOx, SO_2, NH_3 and deposition of NDep at all the ecological receptors have been obtained from APIS maps which provide the data on a 1km grid cell basis. The NDep values depend on whether the habitat is forest (woodland) or grass (moorland) as deposition rates varying according to the nature of the vegetation. All receptors have been modelled as forest. The background values are the latest available and are an average for the years 2019-2021 and are shown in Table 11.

APIS does not provide maps of background AcidDep (S and N) deposition rates for conservation sites that are not SSSIs, SACs or SPAs and therefore it has not been possible to obtain background values to use in a full calculation at the AWs. Instead, the PC to nitrogen AcidDep has been compared to the CLo for nitrogen AcidDep (CLmaxN).

Table 11 Background concentrations and deposition at ecological receptors

Receptor ID	NOx (µg/m³)	SO_2 (µg/m³)	NH_3 (µg/m³)	NDep (kgN/ha/yr)
E12.1	9.5	0.8	1.4	27.3
E12.2	9.5	0.8	1.4	27.3
E12.3	9.5	0.8	1.4	27.3
E15.1	9.5	0.8	1.4	27.3
E15.2	9.5	0.8	1.4	27.3
E14.1	9.9	0.8	1.4	27.5
E14.2	9.9	0.8	1.4	27.5
E14.3	9.9	0.8	1.4	27.5
E4.1	9.5	0.8	1.4	27.3
E4.2	9.9	0.8	1.4	27.5
E4.3	9.9	0.8	1.4	27.5
E4.4	9.7	0.8	1.4	27.9
E4.5	9.8	0.8	1.4	28.2
E4.6	9.8	0.8	1.4	28.2
E4.7	9.3	0.8	1.4	27.6
E4.8	9.3	0.8	1.4	27.6
E4.9	9.8	0.8	1.4	28.2
E7.1	9.7	0.8	1.4	27.9
E7.2	10.8	0.9	1.4	27.9
EX.1	10.8	0.9	1.4	27.9
EX.2	10.8	0.9	1.4	27.9
E19.1	9.9	0.8	1.4	27.5
E19.2	9.5	0.8	1.4	27.3
E19.3	9.6	0.8	1.4	27.0
E19.4	9.5	0.8	1.4	27.3
E19.5	9.5	0.8	1.4	27.3
E20.1	9.6	0.8	1.4	27.0
E23.1	9.3	0.8	1.4	26.8
E25.1	9.3	0.8	1.4	26.8
E26.1	9.4	0.8	1.4	26.7
E24.1	9.4	0.8	1.4	26.7
E24.2	9.4	0.8	1.4	26.7
E18.1	9.5	0.8	1.4	27.0
E18.2	9.0	0.8	1.4	27.0
E9.1	9.0	0.7	1.4	27.1

Receptor ID	NOx (µg/m^3)	SO_2 (µg/m^3)	NH_3 (µg/m^3)	NDep (kgN/ha/yr)
E8.1	9.2	0.7	1.4	27.3
E8.2	9.2	0.7	1.4	27.3
E1.1	9.2	0.8	1.3	27.5
Notes: *Forest/woodland				

6.4 Odour

The Site is adjacent to the Veolia Environmental Services, green waste composting facility, Little Bushy Warren Composting Facility. Composting of green waste is a potential source of odour. Information on odour complaints in the vicinity of the Site and the adjacent green waste compositing site was obtained through two freedom of information (FOI) requests with respect to the Site and the Veolia green waste composting site,[27, 28] the responses are given in Appendix M. The responses show:

- There have been no odour or other nuisance reports / complaints about the site of Herriard Bio Power AD Site, Bushywarren Lane, Basingstoke, RG25 2NS between 01/01/2015 and current day.
- There have been no complaints about the operation of Veolia Environmental Services, green waste composting facility, Basingstoke RG25 2NS between 2015 and current day.

Therefore, although the two sites currently undertake potentially odorous activities, over the last nine years there have been no reported complaints, therefore, it is unlikely that the sites are perceived as an odour nuisance.

[27] BDBC, FOI request – FOI 749/23, submitted 07/11/2023
[28] BDBC, FOI request – FOI 748/23, submitted 07/11/2023

7 Impact assessment of air quality on human health

7.1 Long-term AQS

Predicted impacts of each pollutant at each human receptor are given in Appendix N. In this section the highest results are presented, that is, the impacts at the worst-case receptor. Impacts have been compared to the screening thresholds given in section 5.2.

Table 12 shows the maximum annual mean (long-term) concentration and Table 13 shows the comparison of predicted short-term impacts, from 15 minutes to 24 hours. The predicted concentrations, with and without background concentrations, have been compared with the AQS. Long-term AQS are not applicable at the workplaces and recreational locations where the public are unlikely to spend long periods of time.

The maximum long-term concentrations for each AQS, across all receptors and all meteorological years, and the worst with and without buildings and terrain, are given in Table 12. Maximum long-term impacts for all pollutants are predicted at the residential receptor, H4, Manor Farmhouse in Herriard, which is located 745m to the southeast of the Site boundary.

None of the PCs exceed 1% of the AQS. The long-term impacts at all receptors can therefore be screened out as **not significant** and there is no need for further assessment.

Table 12 Results, long-term AQS

Pollutant	AQS (µg/m^3)	PC (µg/m^3)	PC/AQS (%)	PEC (µg/m^3)	PEC/AQS (%)	Receptor
NO_2	40	0.1	<1	7.5	19	H4
Benzene	5	0.03	<1	0.2	4	H4
NH_3	180	0.01	<1	1.4	1	H4
H_2S	140	<0.01	<1	<0.01	<1	H4
Notes: bold font indicates an exceedance of the screening threshold Data on each row is for one receptor, the receptor at which the percentage of PC/AQS is greatest						

7.2 Short-term AQS

The maximum short-term concentrations for each AQS, across all receptors and all meteorological years, and the worst of with and without buildings, are given in Table 13. Maximum short-term impacts are predicted at H1, Little Bushy Warren Composting Facility, the closest receptor.

Calculated PCs have been compared with the AQS and to the 'Headroom' as defined in section 5.2. It is a measure used by the Environment Agency in assessing air quality impacts for an environmental permit. The maximum PCs for NO_2, 1h SO_2, CO, NH_3 and H_2S do not exceed the screening threshold of 10%; the PCs for 15min SO_2 and 24h Benzene exceed 10% but the PCs are less than 20% of the Headroom.

Moreover, the results in Table 14, and contour plots in Figure 2 (99.9th percentile 15min SO_2) and Figure 3 (100th percentile 24h Benzene) the maximum short-term impact for all the scenarios excluding the nearest receptor H1, show that at all other receptors the 10% threshold for PC/AQS was not exceeded. The contour plots show the areas exceeding 10% of the relevant short-term AQS is localised to the area around the Site.

The short-term impacts at all receptors can therefore be screened out as **not significant** and there is no need for further assessment.

Table 13 Results, short-term AQS

Pollutant	Statistic	AQS (μg/m^3)	PC (μg/m^3)	PC/AQS (%)	Headroom (μg/m^3)	PC/ Headroom (%)	PEC/ AQS (%)	Receptor
NO_2	99.79th 1h	200	19.4	10	185.2	10	17	H1
SO_2	99.9th 15min	266	40.3	**15**	261.2	15	17	H1
SO_2	99.73rd 1h	350	24.5	7	345.2	7	8	H1
SO_2	99.18th 24h	125	8.7	7	120.2	7	11	H1
CO	Max daily 8h*	10,000	162	2	9,777	2	4	H1
Benzene	Max 24h	195	4.7	**16**	30	16	17	H1
NH_3	Max 1h	2,500	4.9	<1	2,497	<1	<1	H1
H_2S	Max 1h	150	1.6	1	150	1	1	H1

Notes: *Maximum daily 8h running
Bold font indicates an exceedance of the screening threshold
Data on each row is for one receptor, the receptor at which the percentage of PC/AQS is greatest

Table 14 Results, short-term AQS, excluding H1

Pollutant	Statistic	AQS (μg/m^3)	PC (μg/m^3)	PC/AQS (%)	Headroom (μg/m^3)	PC/ Headroom (%)	PEC/ AQS (%)	Receptor
SO_2	99.9th 15min	266	17.7	7	261.1	7	9%	H2
Benzene	Max 24h	195	1.0	3	30	3	5%	H2

Notes: Bold font indicates an exceedance of the screening threshold
Data on each row is for one receptor, the receptor at which the percentage of PC/AQS is greatest

8 Impact assessment of air quality on ecological receptors

Predicted impacts of each pollutant at each ecological receptor are given in Appendix O. In this section the highest results are presented, that is, the impacts at the worst-case receptor across all meteorological years, and the worst with and without buildings and terrain. Impacts have been compared to the screening thresholds given in section 5.3.

8.1 Locally designated sites

Considering the locally designated sites, AWs and LWSs, Table 15 shows that predicted PCs do not exceed any of the screening thresholds (section 5.3.1). Maximum concentration impacts were predicted at E15.2, Little Bushywarren Copse, except for NH_3 for which the maximum predicted impact, 12% of the lower critical level ($1\mu g/m^3$), was predicted at E12.2, Great Bushywarren Copse.

The maximum predicted PC for NDep is given in Table 16 and is 12% of CLomin, 8% of CLomax, predicted at E15.2, Little Bushywarren Copse.

The maximum predicted acid deposition given in Table 17 is also predicted at receptor E15.2, Little Bushywarren Copse, where the PC of nitrogen Acid Dep is predicted to be 3% of CLmaxN.

All predicted impacts are less than 100% of the relevant CLes and CLos and can therefore be screened out as **not significant** and there is no need for further assessment.

Table 15 Results at AW and LWS, long-term and short-term AQS, worst case impact

Pollutant	AQS (μg/m³)	Averaging time	Statistic	LT or ST AQS*	PC (μg/m³)	PC/AQS (%)	PEC (μg/m³)	PEC/AQS (%)	Receptor
NOx	30	Annual	mean	LT	2.8	9	12.3	41	E15.2
SO_2	20	Annual	mean	LT	0.6	3	1.4	7	E15.2
SO_2	10	Annual	mean	LT	0.6	6	1.4	14	E15.2
NH_3	1	Annual	mean	LT	0.12	12	1.5	152	E12.2
Pollutant	**AQS (μg/m³)**	**Averaging time**	**Statistic**	**LT or ST AQS***	**PC (μg/m³)**	**PC/AQS (%)**	**Headroom (μg/m³)**	**PC/ Headroom (%)**	**Receptor**
NOx	200	24-hour	100th percentile	ST	35	17	182	19	E15.2

Notes: *LT= long-term, ST = short-term; Bold font indicates an exceedance of the screening threshold (PC/AQS = 100%)
Data on each row is for one receptor, the receptor at which the percentage of PC/AQS is greatest
'-' : CLe of 3μg/m³ not applicable at any of the receptors

Table 16 Worst-case nutrient nitrogen deposition

Habitat	PC (kg/ha/y)	CLomin (ka/ha/y)	CLomax (ka/ha/y)	PC/CLomin (%)	PC/CLomax (%)	PEDR/CLomin (%)	PEDR/CLomax (%)	Receptor
Ancient Woodland	1.2	10	15	12	8	285	190	E15.2

Notes: Bold font indicates an exceedance of the screening threshold; data on each row is for one receptor, the receptor at which the percentage of PC/CLmin is greatest

Table 17 Worst-case acid deposition

Habitat	PC_N (keqN/ha/yr)	CLmaxN	PC_N/CLmaxN (%)	Receptor
Ancient Woodland	0.087	2.993	3	E15.2

Notes: Bold font indicates an exceedance of the screening threshold; data on each row is for one receptor, the receptor at which the percentage of PC/CLo is greatest

9 Impact assessment of odour

Table 18 shows the predicted 98th percentile of 1-hour mean odour concentrations at the modelled discrete receptor locations. The values given are the worst case for each year (with or without buildings and terrain) and the final column gives the worst case across all five years. The maximum odour predicted, 0.87ou_E/m^3, is at the nearest receptors, H1, Little Bushy Warren Composting Facility, 79m to the east of the Site boundary. H4, Manor Farmhouse, 745m to the southeast of the Site, is the *residential* receptor at which the maximum odour impact is predicted (0.09ou_E/m^3).

The maximum odour impact of 0.87ou_E/m^3 is well below the relevant benchmark of 3.0ou_E/m^3 for "moderately offensive," (section 5.4) and is also under the strictest threshold of 1.5ou_E/m^3 for the "most offensive" odours and therefore the Site operation is not likely to be an odour nuisance at human receptors.

Table 18 98th percentile hour mean odour concentration (ou_E/m^3)

ID	2018	2019	2020	2021	2022	Worst case
H1	0.87	0.70	0.66	0.70	0.66	0.87
H2	0.15	0.15	0.12	0.15	0.11	0.15
H3	0.15	0.15	0.14	0.15	0.14	0.15
H4	0.16	0.15	0.14	0.15	0.12	0.16
H5	0.14	0.13	0.11	0.14	0.10	0.14
H6	0.10	0.10	0.09	0.10	0.07	0.10
H7	0.09	0.12	0.09	0.10	0.14	0.14
H8	0.09	0.11	0.07	0.09	0.09	0.11

10 Conclusion

This AQOIA has been prepared to support an application for a substantial variation of a bespoke waste operation permit for an AD plant, including the use of resultant biogas, at the Site. The permit requires updating to reflect the current and proposed infrastructure and increase the maximum permitted quantity of waste from 36,500 to 40,000 TPA and a biological treatment capacity of over 100 tonnes per day.

The Site lies 3.9km to the south of Basingstoke; the surrounding land use is agricultural and horticultural, grassland and woodland: ancient woodland that is partly semi-natural and partly replanted i.e. part deciduous and part coniferous. The immediate surrounding area is sparsely populated however, Veolia Environmental Services's green waste composting facility, Little Bushy Warren Composting Facility lies adjacent to the Site to the northeast. The nearest residential receptors lie in the village of Herriard, the centre of which lies approximately 1km to the southeast of the Site.

The proposed Site is not in an AQMA, the nearest of which is in Farnham, approximately 18km away.

There are no SSSIs within 2km of the Site; no SACs, SPAs nor Ramsar sites within 10km of the Site. There are 16 sites of Ancient Woodland (AW) and 11 LWS within 2km of the Site including: Great Bushywarren Copse which lies to the south of the Site and partly within the Site boundary; Kingsmore, Allwood & Fryingdown Copses which lie approximately 60m away at the close point; Cowdray's Copse to the north; and Hen Wood to the northeast.

Baseline conditions of sensitive receptors, current background concentrations and deposition rates have been established. Detailed modelling has been carried out using the ADMS 6 dispersion model and numerical modelled meteorological data for the Site location. Conservative assumptions have been made throughout the assessment.

Normal operation (CHP2 at 100% load) and two 'Abnormal' scenarios were modelled. In 'Abnormal Scenario 1'' the duty and standby CHPs each operating at 80% load, in the event that the Pentair BUP is not operational. In 'Abnormal Scenario 2' Flare 1 and Flare 2 both operate at maximum capacity, the CHPs and Pentair BUP are not operational. Both Abnormal scenarios have been modelled as occurring all year to capture the impacts if the scenario coincides with the worst-case meteorological data that gives rise to the greatest impacts. This is a very conservative assumption. In practice, the abnormal scenarios will not persist for many hours as the rate of biogas generation, and hence combustion, can be reduced by controlling the rate of feeding of the digesters.

10.1 Human receptors

The long-term and short-term impacts at all receptors can be screened out as **not significant** and there is no need for further assessment.

10.2 Ecological receptors

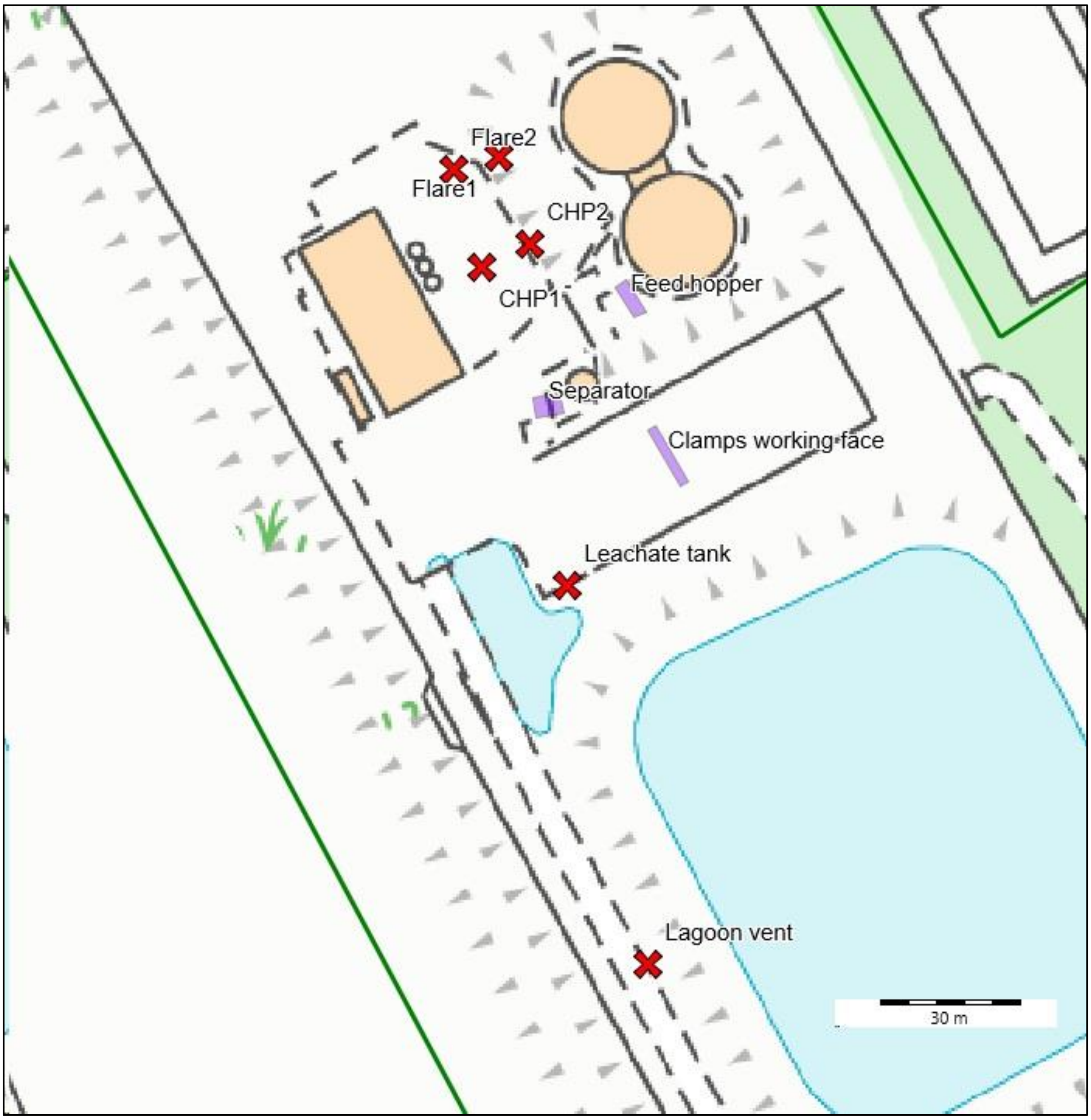
Considering the locally designated sites, AWs, all predicted impacts are less than 100% of the relevant CLes and CLos and can therefore be screened out as **not significant** and there is no need for further assessment.

10.3 Odour

The maximum odour impact 0.84ou_E/m^3, predicted at H1, Little Bushy Warren Composting Facility, is well below the relevant benchmark of 3.0ou_E/m^3 for “moderately offensive,” and is also under the lowest threshold of 1.5ou_E/m^3 for the “most offensive” odours and therefore the Site operation is **not likely to be an odour nuisance** at human receptors.

Figures

Figure 1 Modelled point, area and volume sources



Legend

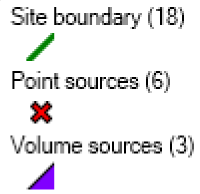
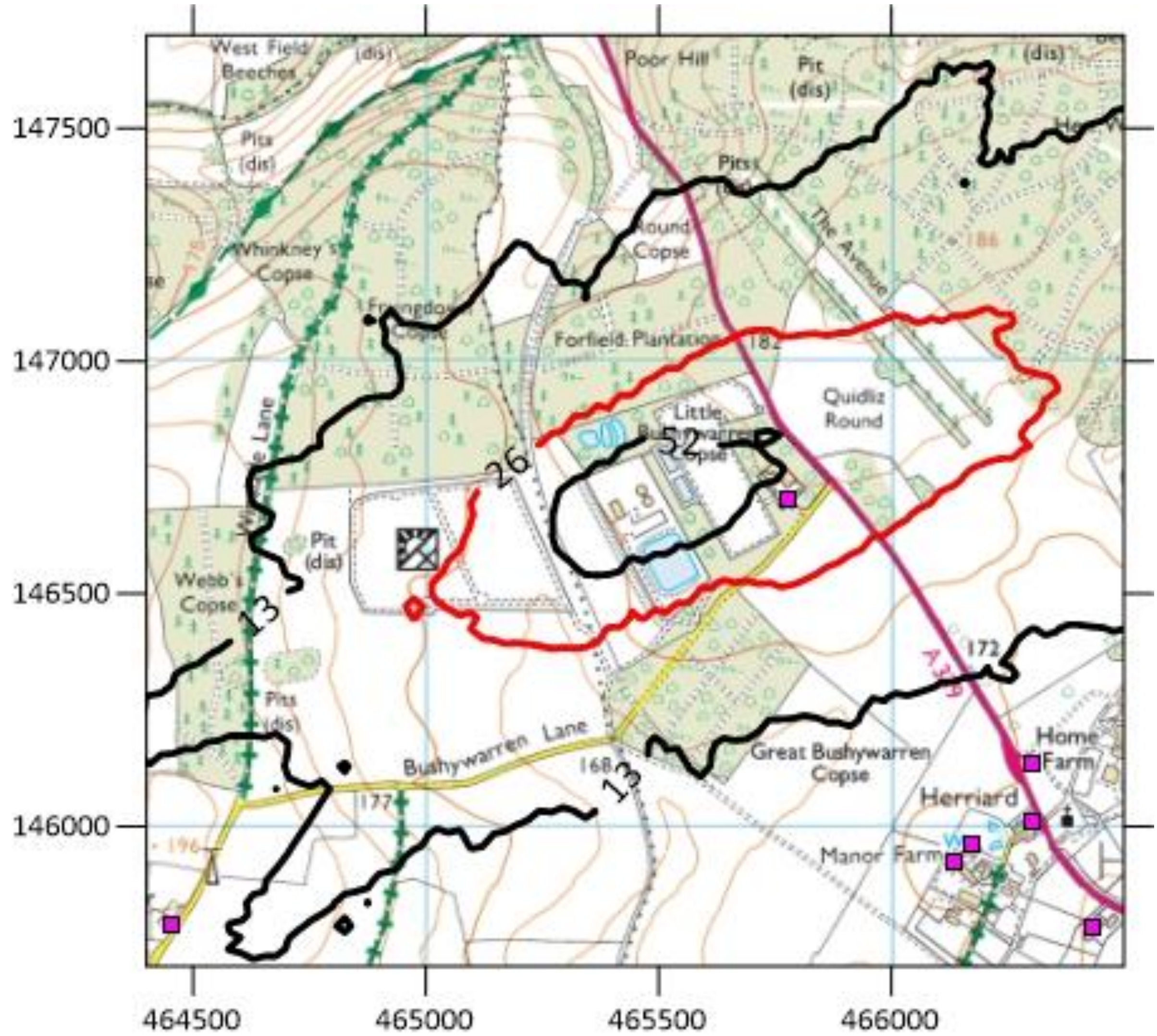


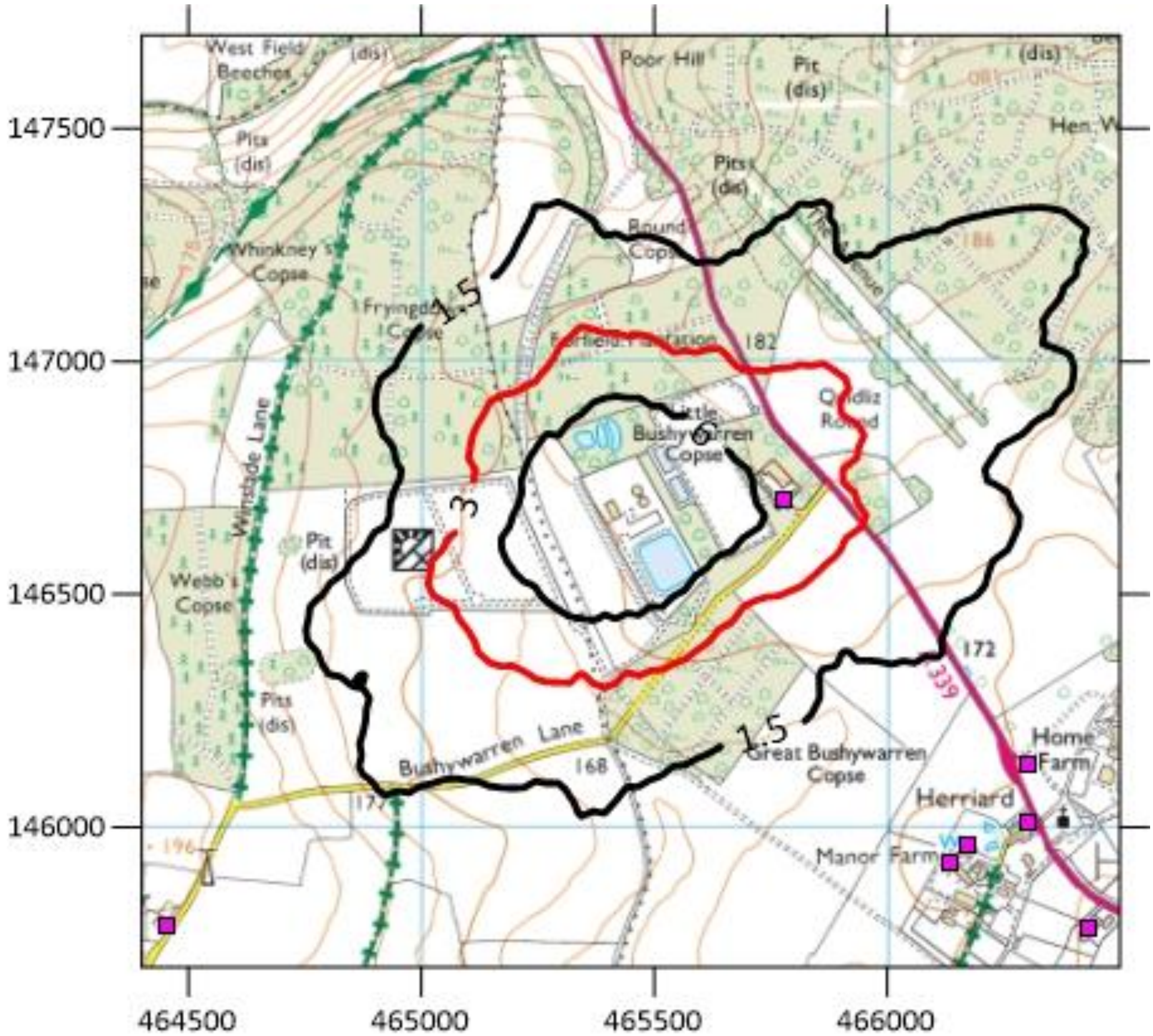
Figure 2 Contours, SO_2 99.9th percentile 15min average



Background image © Crown copyright and database rights (2023), Ordnance Survey 0100031673

Notes: Contours are 5% of the AQS (13µg/m^3); 10% of the AQS (26µg/m^3) shown in red and 20% of the AQS (52µg/m^3).

Figure 3 Contours, Benzene 100th percentile 24-hour average



Notes: Contours are 5% of the AQS (1.5μg/m^3); 10% of the AQS (3μg/m^3) shown in red and 20% of the AQS (6μg/m^3).

Figure 4 GFS meteorological data, windroses 2018-2022

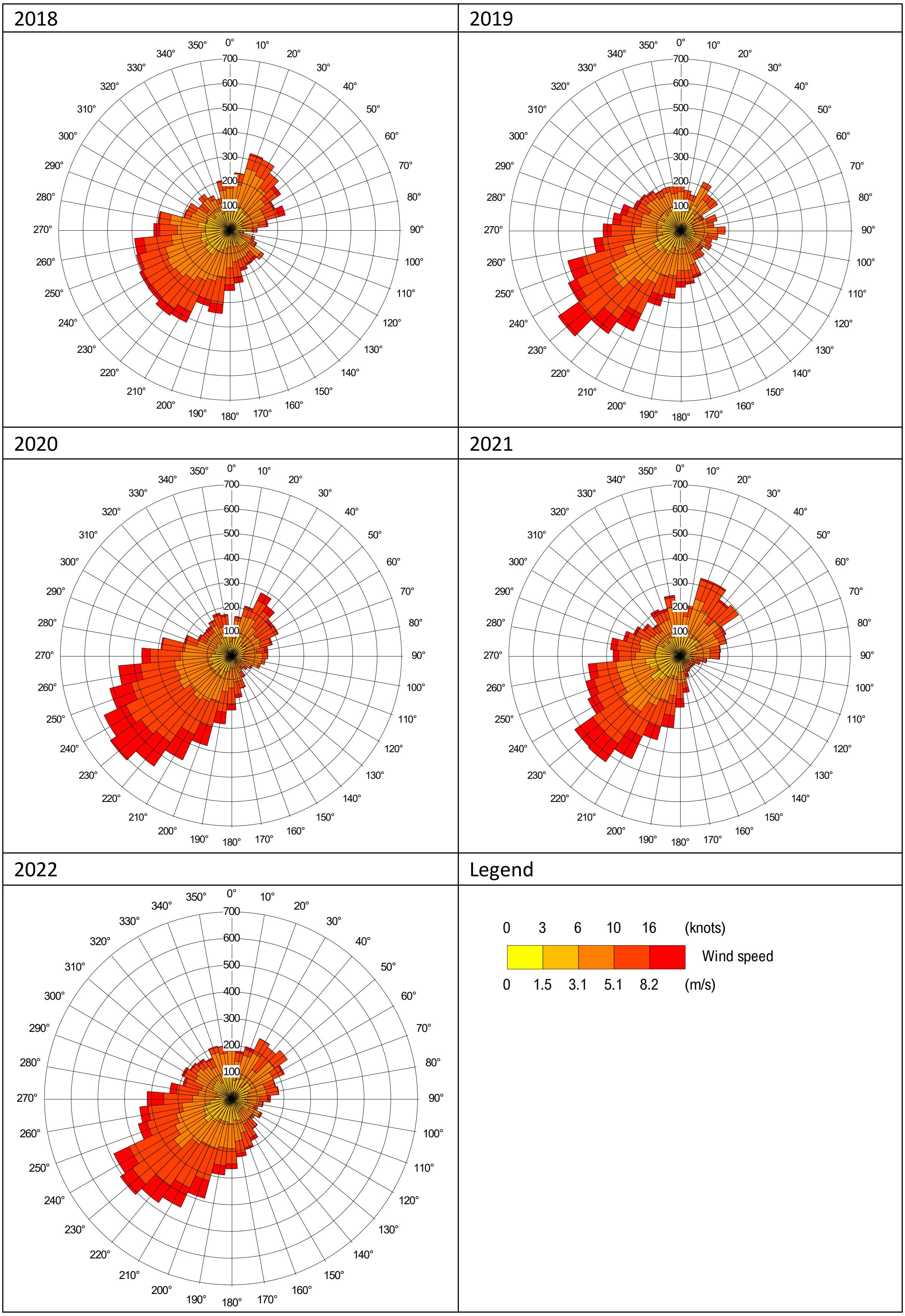
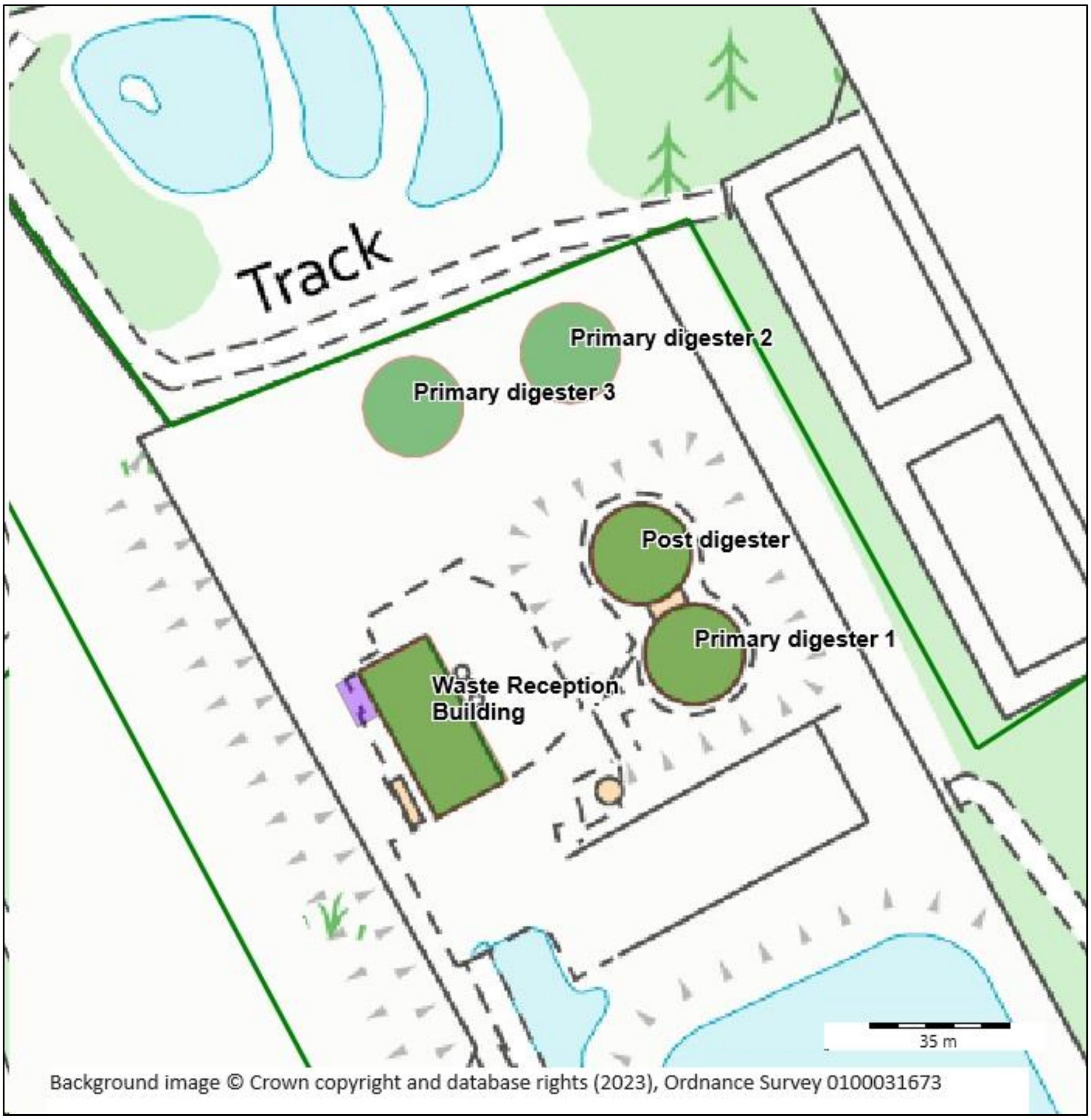


Figure 5 Modelled buildings



Legend

Figure 6 Terrain data

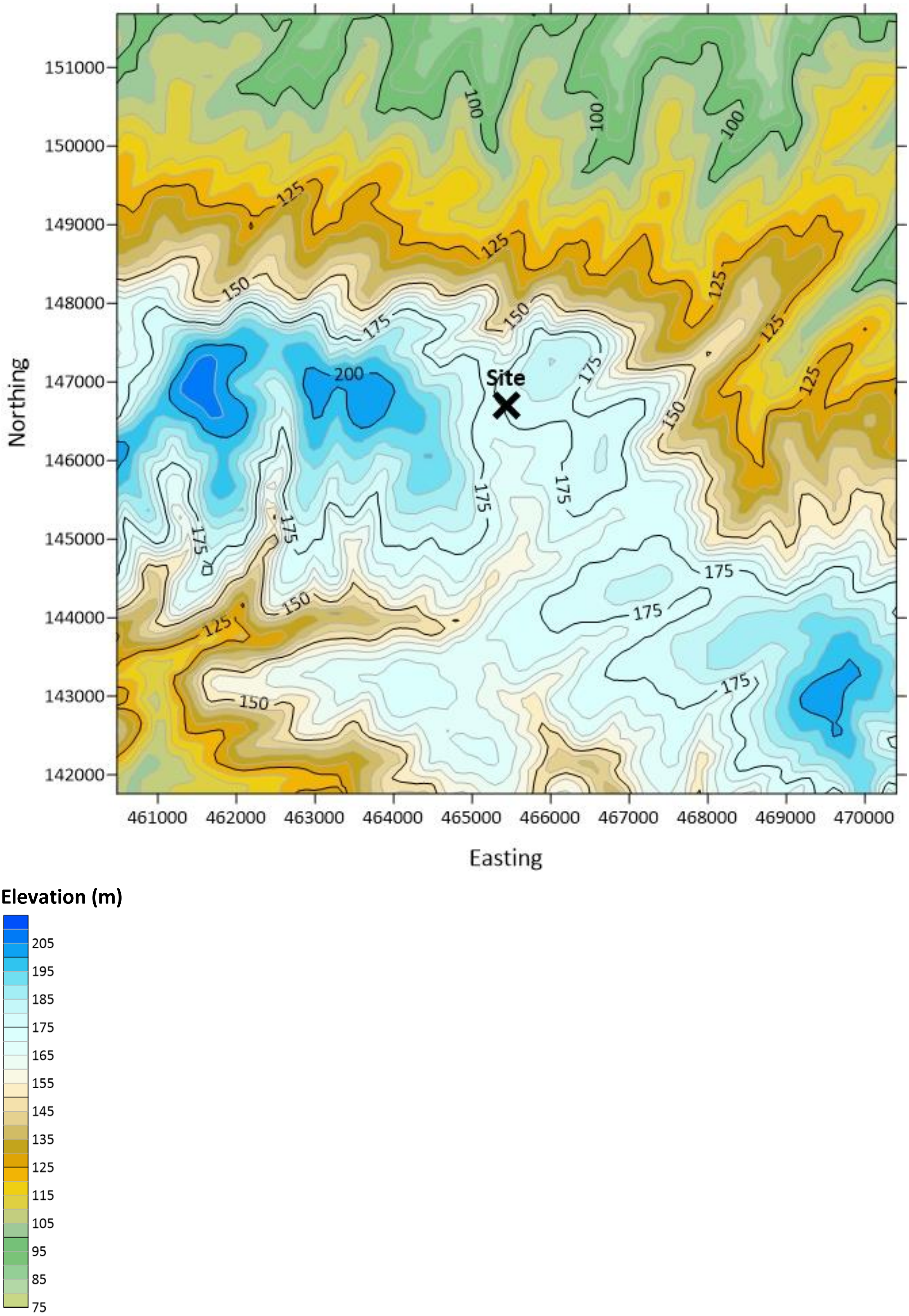
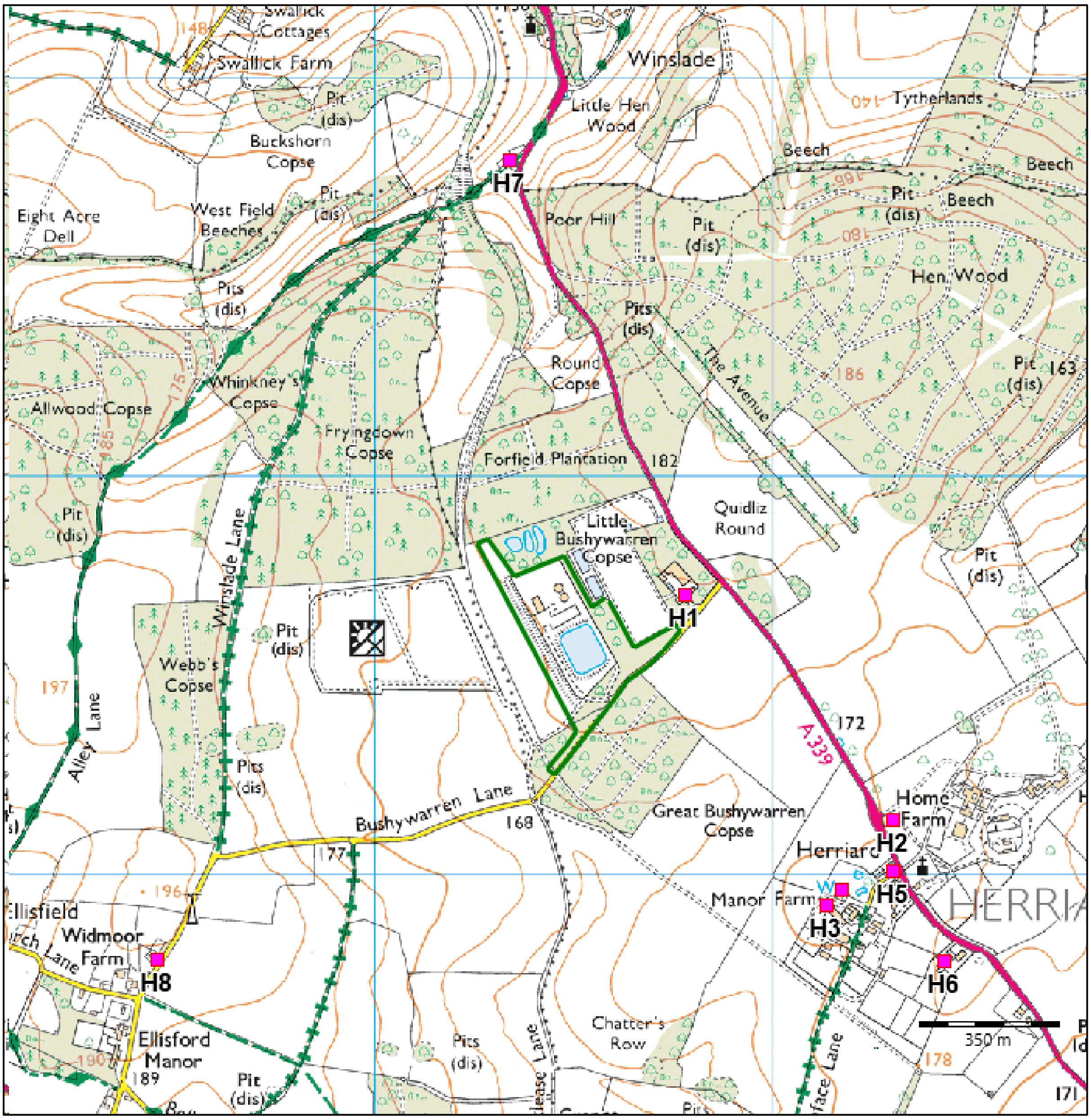


Figure 7 Human receptors

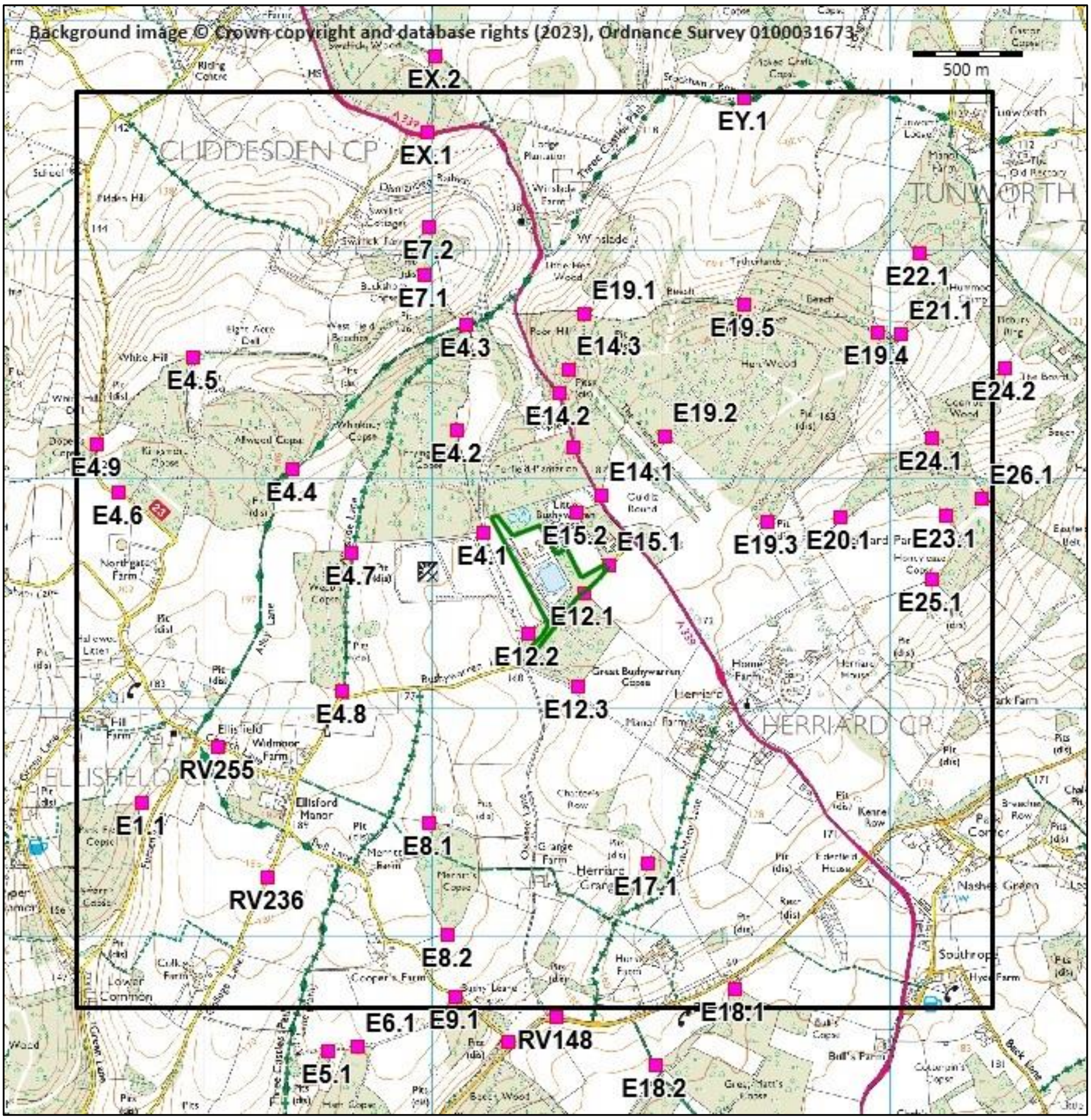


Legend

Site boundary (18)

Human receptors (8)

Figure 8 Ecological receptors



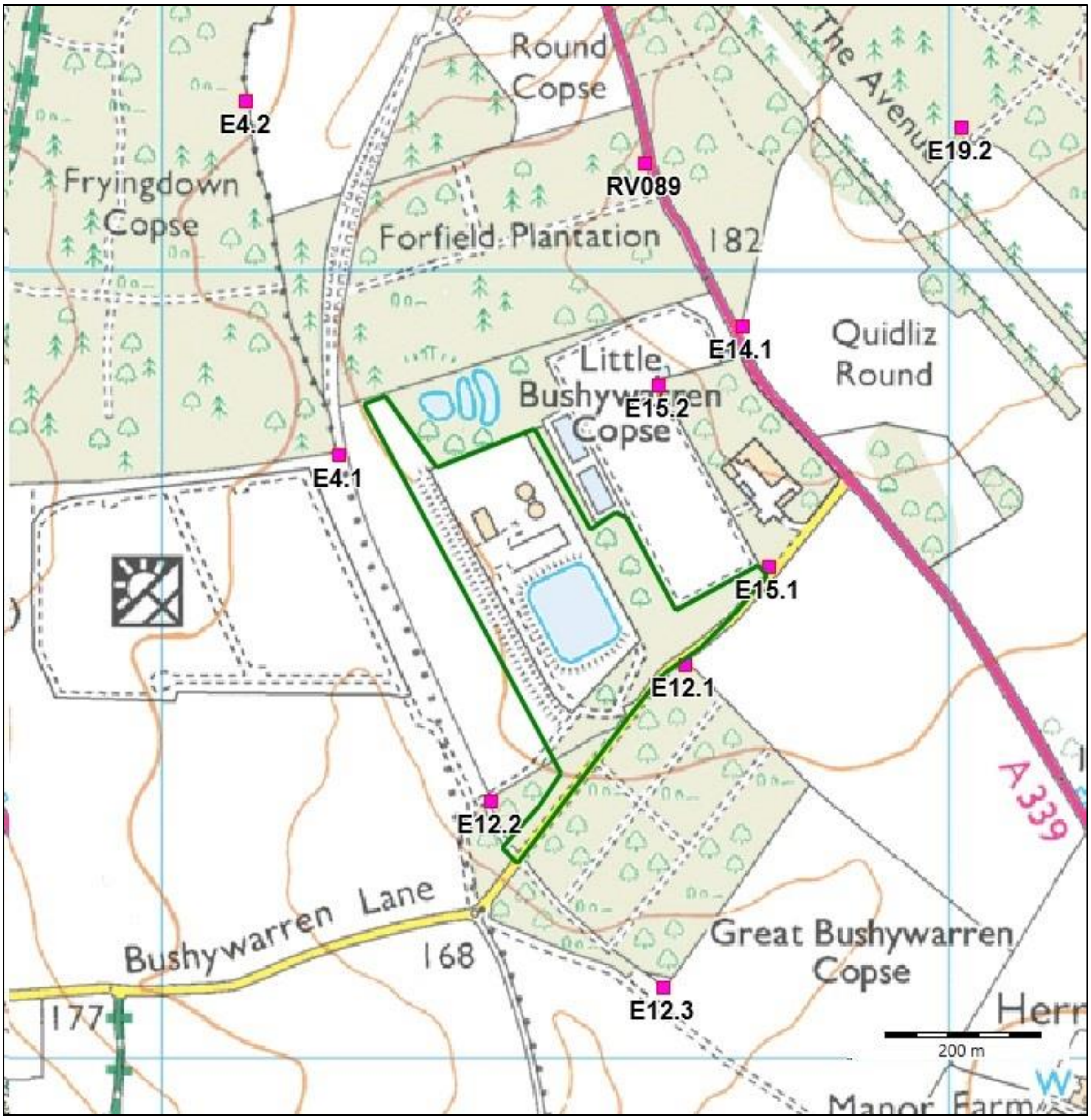
Legend

Site boundary (18)

+/-2km

Ecological receptors (49)

Figure 9 Ecological receptors, zoomed-in view



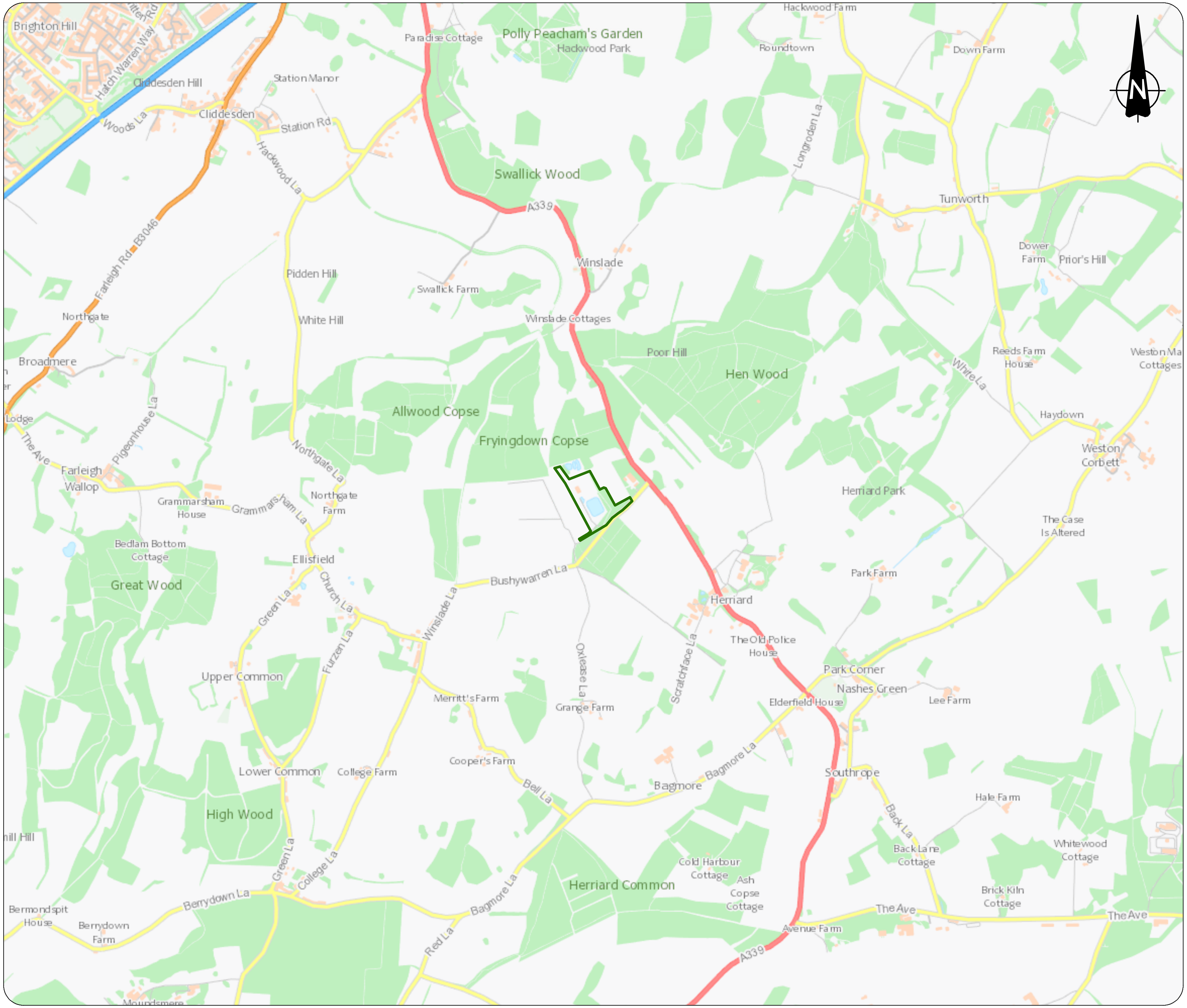
Legend

Site boundary (18)

Ecological receptors (49)

Appendix A Site location, emission point plan and process diagram

- Proposed Site Location
- Proposed Emission Point Plan
- Process Diagram



REVISIONS					
REV	DATE	DESCRIPTION	DWN	CHK	APP
-	01/12 2023	First Issue	JJ	MF	MF

LEGEND

Permit Boundary

0 250 500 750 1,000 m

Scale at A3: 1:25,000

Client
Herriard Bio Power Limited

Project
Substantial Permit Variation

Title
Site Location Plan

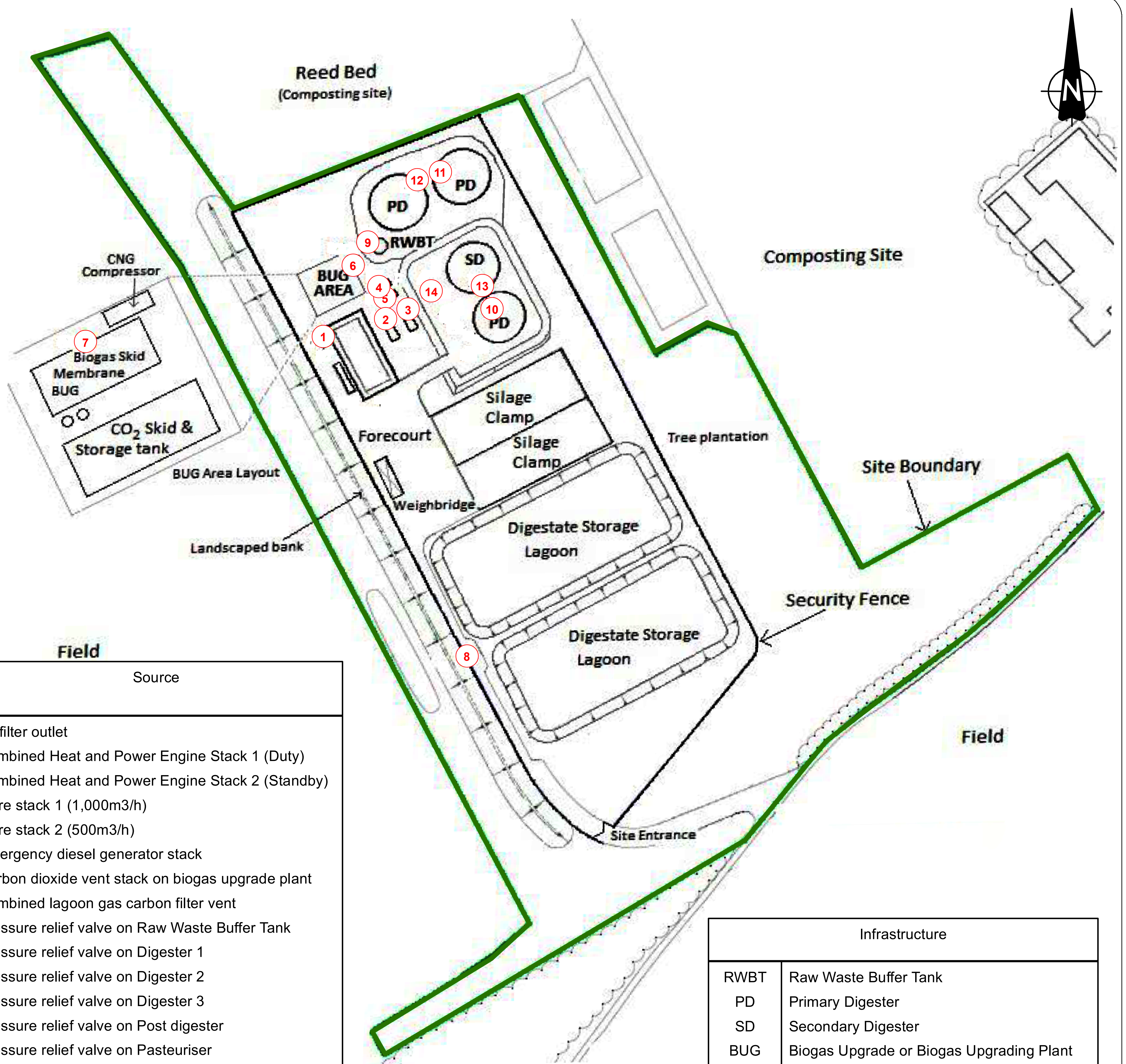
Earthcare TECHNICAL

Manor Farm
Chalton
Waterlooville
Hants PO8 0BG

Tel: 02392 290488

enquiries@earthcaretechnical.co.uk
www.earthcaretechnical.co.uk

Drawn	Checked	Approved	Revision
JJ	MF	MF	
Date: December 2023		Scale: 1:25,000	Sheet Size: A3
Drawing Number: ETL813/HBP/EPR01			File Reference: ETL813.mxd



Emission Point Reference	Source
EP1	Biofilter outlet
EP2	Combined Heat and Power Engine Stack 1 (Duty)
EP3	Combined Heat and Power Engine Stack 2 (Standby)
EP4	Flare stack 1 (1,000m3/h)
EP5	Flare stack 2 (500m3/h)
EP6	Emergency diesel generator stack
EP7	Carbon dioxide vent stack on biogas upgrade plant
EP8	Combined lagoon gas carbon filter vent
EP9	Pressure relief valve on Raw Waste Buffer Tank
EP10	Pressure relief valve on Digester 1
EP11	Pressure relief valve on Digester 2
EP12	Pressure relief valve on Digester 3
EP13	Pressure relief valve on Post digester
EP14	Pressure relief valve on Pasteuriser

Infrastructure	
RWBT	Raw Waste Buffer Tank
PD	Primary Digester
SD	Secondary Digester
BUG	Biogas Upgrade or Biogas Upgrading Plant

REVISIONS

REV	DATE	DESCRIPTION	DWN	CHK	APP
-	06/12 2023	First Issue	JJ	MF	MF

LEGEND

Permit Boundary

EP1

0 25 50 75 m

Scale at A3: 1:2,000

Client
Herriard Bio Power Limited

Project
Substantial Permit Variation

Title
Permit Boundary & Emission Point Plan

Earthcare TECHNICAL
Manor Farm
Chalton
Waterlooville
Hants PO8 0BG
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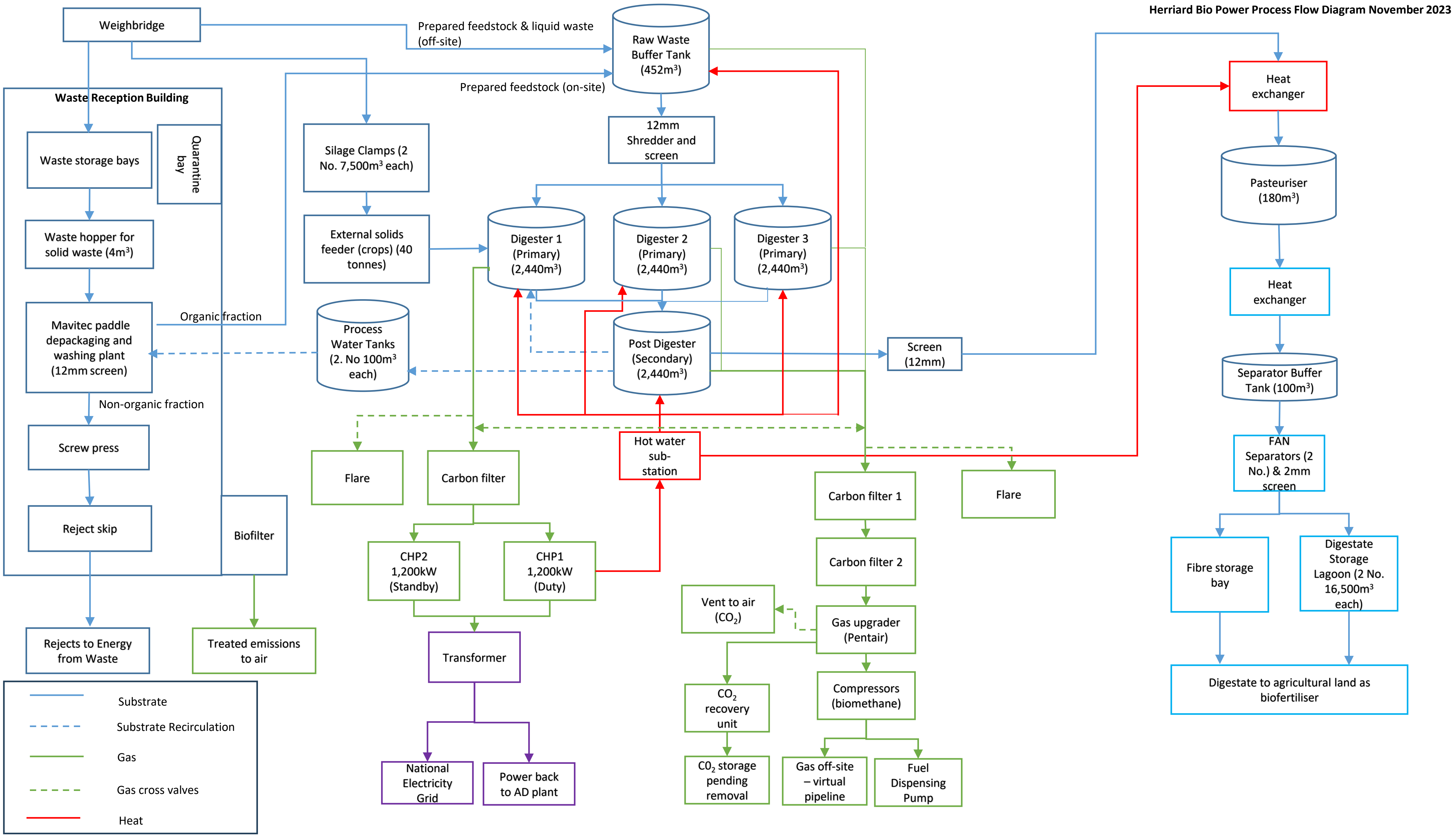
Drawn	Checked	Approved	Revision
JJ	MF	MF	

Date	Scale	Sheet Size
December 2023	1:2,000	A3

Drawing Number	File Reference
ETL813/HBP/EPR02	ETL813.mxd


Herriard Bio Power Process Flow Diagram November 2023
Weighbridge
Prepared feedstock & liquid waste (off-site)
Raw Waste Buffer Tank (452m³)
Prepared feedstock (on-site)
Waste Reception Building
Waste storage bays
Quarantine bay
Waste hopper for solid waste (4m³)
Mavitec paddle depackaging and washing plant (12mm screen)
Organic fraction
Non-organic fraction
Screw press
Reject skip
Biofilter
Rejects to Energy from Waste
Treated emissions to air
Silage Clamps (2 No. 7,500m³ each)
External solids feeder (crops) (40 tonnes)
12mm Shredder and screen
Digester 1 (Primary) (2,440m³)
Digester 2 (Primary) (2,440m³)
Digester 3 (Primary) (2,440m³)
Process Water Tanks (2. No 100m³ each)
Post Digester (Secondary) (2,440m³)
Screen (12mm)
Flare
Carbon filter
Hot water sub-station
CHP2 1,200kW (Standby)
CHP1 1,200kW (Duty)
Transformer
National Electricity Grid
Power back to AD plant
Carbon filter 1
Carbon filter 2
Flare
Vent to air (CO₂)
Gas upgrader (Pentair)
CO₂ recovery unit
Compressors (biomethane)
CO₂ storage pending removal
Gas off-site – virtual pipeline
Fuel Dispensing Pump
Heat exchanger
Pasteuriser (180m³)
Heat exchanger
Separator Buffer Tank (100m³)
FAN Separators (2 No.) & 2mm screen
Fibre storage bay
Digestate Storage Lagoon (2 No. 16,500m³ each)
Digestate to agricultural land as biofertiliser
Substrate
Substrate Recirculation
Gas
Gas cross valves
Heat

Appendix B Model and Model Set-up

B.1 Meteorology and associated parameters

B.1.1 Hourly meteorological data

The model uses hourly data of surface meteorology parameters that are typically measured at a synoptic station or are generated by a numerical model. In this assessment, five years' meteorological data were obtained for the period 2018-2022 for the area surrounding the Site location (Latitude 51.215°, Longitude -1.063°), from a Numerical Weather Prediction system known as the Global Forecast System (GFS).

The GFS is a spectral model and data are archived at a horizontal resolution of 0.5 degrees longitude, or approximately 50km over the UK (latterly 0.25 degrees, or approximately 25km). The GFS resolution captures major topographical features and the broad-scale characteristics of the weather over the UK. The use of NWP data has advantages over traditional meteorological records as:

- Calm periods in traditional records may be over-represented.
- Traditional records may include local deviations from the broad-scale wind flow that would not necessarily be representative of the site being modelled
- Information on the state of the atmosphere above ground level which would otherwise be estimated by the meteorological pre-processor may be included explicitly.

Figure 4 shows windroses for each year of data. The prevailing wind direction is southwesterly. The data were used with the ADMS 6 calms option with default values. Table 19 shows the number of lines of usable data each year with and without calms option. Without the clams options the lowest percentage of usable lines was 99.8% and with the calms option 100%.

Defra's LAQM TG16[16] contains cautionary guidance on use of data with less than 85% usable data in calculating for comparison with short-term AQS. The minimum values of usable data were far above this threshold.

Table 19 Meteorological station data for calm conditions

Year of data	Number of hours modelled with calm conditions	Number of hours with inadequate data (excluding calms)	Hours used
2018	0	14 (0.16%)	8760
2019	0	11 (0.13%)	8760
2020	0	13 (0.15%)	8784
2021	0	11 (0.13%)	8760
2022	0	20 (0.23%)	8760
Notes: Meteorological parameters supplied are: wind speed, wind direction, near-ground air temperature, cloud cover			

Meteorological parameters

The ADMS model uses various meteorological parameters to represent the area at the meteorological station and the site of the Site. The key parameters that have been defined are the surface roughness and minimum Monin-Obuhkov length which are defined at the site of the meteorological data measurement and the Site.

- Surface roughness: this is related to land-use and the height of obstacles on the ground which give rise to mechanically generated turbulence; and
- Minimum Monin-Obuhkov length: this is used to model the extent to which the urban heat island effect limits the most stable atmospheric conditions. Heat released from the urban area prevents the atmospheric boundary layer becoming very stable.

Table 20 shows the values of the parameters that can be selected in the model from a drop-down menu. Other, intermediate, values can be entered directly. The values selected for the meteorological data site and the Site are given Table 21. A value of 2m for minimum Monin-Obuhkov length reflects the rural nature of the surrounding area; values of 0.3m for surface roughness across the wide area reflect the mixed arable, grassland and woodland, while a value of 0.5m close to the Site reflects the proximity of woodland.

ADMS sets a higher value of minimum turbulence when modelling terrain, therefore, a value of 0.01m/s was set in the ADMS additional input file (.aai) so that the value used when modelling terrain would be the same as that calculated by the model for flat terrain as a function of Monin-Obuhkov length (ADMS 6 User Guide, section 4.15.3).

Table 20 ADMS 6 meteorological parameter values

Surface roughness	
Descriptor	**Value (m)**
Large urban areas	1.5
Cities, woodland	1.0
Parkland, open suburbia	0.5
Agricultural areas (max)	0.3
Agricultural areas (min)	0.2
Root crops	0.1
Open grassland	0.02
Short grass	0.005
Sea	0.0001

Minimum Monin-Obuhkov length	
Descriptor	**Value (m)**
Large conurbations >1million	100m
Cities and large towns	30m
Mixed urban/industrial	30m
Rural areas (max) [1]	20m
Small towns < 50,000	10m
Rural areas (min)[1]	2m

Notes: [1] Not available from the ADMS drop-down menu

Table 21 Meteorological site and wide Site met parameters

Parameter	**Meteorological data site**	**Site**
Surface roughness	0.3m	0.5m
Minimum Monin-Obhukov length	2m	2m

B.2 Buildings

The presence of buildings close to an emission point can affect the dispersion from a source, bringing the plume centreline down towards the ground in the lee of a building and entraining pollutant into the cavity (or, recirculation) region in the lee of a building. In the cavity, concentrations are assumed to be uniform, and it may be a region of high concentrations depending on the amount of pollutant entrained. The presence of buildings may increase or decrease concentrations at a location compared with the no buildings scenario.

ADMS allows up to 25 buildings to be included as input and the model combines the relevant input buildings into one effective building; the effective building is calculated for each line of meteorological data. Buildings can only be circular or rectangular in cross-section, so the buildings entered are simplified geometries. Buildings less than one third of the height of the stack will be ignored by the ADMS 6 model. Smaller Site structures such as the CHP containers and tanks with smaller diameters than the digesters have been neglected as their effect outside the Site will be limited compared with the larger structures: digesters, Waste Reception Building.

The building height entered into the model is the height to the eaves plus half the roof height for domed structures and one third of the roof height for structures with sloping roofs, the latter corresponding to the centre of mass of the roof; the roof height is the height to the apex minus the height to the eaves.

The impact of buildings on area and volume sources is not modelled in ADMS. For the biofilter, which is at a height of 3.6m on the upwind side of the Waste Reception Building, modelled at a height of 11.2m, neglect of the buildings is likely to be unimportant as the model will treat it as near-ground source and it has low buoyancy and momentum. If it were modelled as a point source, or multiple point sources, the plume would be predicted to be wholly entrained downwind of the Waste Reception Building and it would be treated as a near-ground source.

Table 22 shows the (simplified) parameters of the five largest buildings on site used as input to the model; they are shown in Figure 5.

In ADMS, for each stack a 'main' building must be specified; for all point sources the Waste Reception Building was specified as the main building.

Table 22 Modelled buildings

Building name	Building centre X	Building centre Y	Height to eaves (m)	Height to apex (m)	Length/ Diameter (m)	Width (m)	Orientation (°)
Waste Reception Building	465413	146678	10	12.4	39.9	19.6	151.6
Digester 1	465476	146696	6	13	24	-	-
Digester 2	465446	146769	6	13	24.3	-	-
Digester 3	465408	146756	6	13	24.3	-	-
Post digester	465463	146720	6	13	24	-	-
Notes: Buildings with circular cross-section, such as the digesters, do not have a width and orientation specified							

B.3 Terrain

The effect of terrain is not usually modelled when terrain gradients in the modelled domain are below the 1:10 threshold usually applied. However, when using numerical weather data, it is recommended to consider the dispersion model predictions with and without terrain.

Terrain in the vicinity of the Site is gently rolling, varying from a minimum of 75m to a maximum of 208m within 5km. The Site lies at an elevation of 175m Above Ordnance Datum (AOD), on a ridge that runs southeast to west, above a valley that lies to the north.

Figure 6 shows the terrain data used. The terrain data file covered a domain 9.92km by 9.92km, with a total of 15,625 data points, with a grid spacing of 80m in the Easting and Northing directions. In ADMS 6 a calculation grid of resolution 64x64 was used.

B.4 Receptors

The impact of stack emissions at relevant human and ecological receptors has been modelled. A relevant receptor is defined in Defra's LAQM TG16[16] as:

> '*A location representative of human (or ecological) exposure to a pollutant, over a time period relevant to the objective that is being assessed against, where the Air Quality Strategy objectives are considered to apply*.'

B.4.1 Human receptors

For long-term AQS the relevant receptors are residences (including care homes), schools and hospitals. For short-term AQS additional receptors may also need to be considered: outdoor spaces such as balconies, gardens, leisure sites and public space where human populations may spend the relevant time period. As most short-term AQS allow for a number of exceedances per annum, the human exposure may need to be repeated in order to be relevant. Workplaces are usually excluded from consideration as air quality in workplaces is covered by Health and Safety legislation.[29]

Table 23 shows the locations and type of the receptors selected to be representative of the relevant human receptors. All the receptors have been modelled at a height of 1.5m, representative of inhalation height (nose level) at ground level. Their locations are shown in Figure 7.

Table 23 Human receptors

ID	Location	Type	NGR X	NGR Y	Distance from Site boundary (m)	Direction from Site
H1	Little Bushy Warren Composting Facility	Workplace	465779	146705	79	East
H2	Herriard Estates office	Workplace	466303	146137	714	Southeast
H3	Manor Court, Herriard	Workplace	466135	145922	744	Southeast
H4	Manor Farmhouse	Residential	466173	145962	745	Southeast
H5	Houses on Scratchface Lane	Residential	466303	146008	806	Southeast
H6	3 Parsonages Cottages	Residential	466430	145784	1,061	Southeast
H7	Winslade Cottages	Residential	465340	147794	952	North
H8	Widmoor bungalows	Residential	464454	145787	1,095	Southwest

Notes: All modelled at a height of 1.5m.

[29] Health and Safety Executive EH40/2005 Workplace Exposure Limits (Fourth Edition 2020)

B.4.2 Ecological receptors

The Defra/Environment Agency guidance[16] specifies that SACs, SPAs and Ramsar site within 10km should be considered and SSSIs, AWs, LWSs, Local Nature Reserves and National Nature Reserves within 2km should also be considered.

Ecological receptors were placed in the designated areas at the nearest locations to the Site and additional locations. Table 8 in section 5.3 lists the sensitive conservation sites identified within the specified distance, their designation and main habitat. Table 24 lists the ecological receptors modelled which are illustrated in Figure 8 and Figure 9. All the ecological receptors have been modelled at a height of 1.5m.

Table 24 Ecological receptors

ID	Site name	NGR X	NGR Y	Distance from boundary (km)	Direction from boundary
E12.1	Great Bushywarren Copse	465664	146501	7	Southeast
E12.2	Great Bushywarren Copse	465418	146328	97	West
E12.3	Great Bushywarren Copse	465637	146091	243	South
E15.1	Little Bushywarren Copse	465771	146626	10	East
E15.2	Little Bushywarren Copse	465631	146856	221	East
E14.1	Cowdray's Copse 1	465737	146930	774	East
E14.2	Cowdray's Copse 1	465557	147376	583	North
E14.3	Cowdray's Copse 1	465597	147478	690	North
E4.1	Kingsmore, Allwood & Fryingdown Copses	465225	146767	59	West
E4.2	Kingsmore, Allwood & Fryingdown Copses	465106	147216	412	Northwest
E4.3	Kingsmore, Allwood & Fryingdown Copses	465147	147671	844	North
E4.4	Kingsmore, Allwood & Fryingdown Copses	464387	147044	894	Northwest
E4.5	Kingsmore, Allwood & Fryingdown Copses	463955	147535	1,482	Northwest
E4.6	Kingsmore, Allwood & Fryingdown Copses	463629	146941	1,632	West
E4.7	Kingsmore, Allwood & Fryingdown Copses	464649	146680	684	West
E4.8	Kingsmore, Allwood & Fryingdown Copses	464603	146077	852	Southwest
E4.9	Kingsmore, Allwood & Fryingdown Copses	463534	147154	1,756	West
E7.1	Buckshorn Copse	464968	147891	1,101	North
E7.2	Buckshorn Copse	464987	148104	1,302	North
EX.1	Swallick Wood	464977	148517	1,706	North
EX.2	Swallick Wood	465015	148844	2,023	North
E19.1	Hen Wood	465667	147722	939	North
E19.2	Hen Wood	466016	147183	667	Northeast
E19.3	Hen Wood	466465	146811	728	East
E19.4	Hen Wood	466945	147638	1,559	Northeast
E19.5	Hen Wood	466362	147759	1,317	Northeast
E20.1	Guy's Copse	466780	146830	1,038	East
E23.1	Tom's Copse	467242	146840	1,490	East
E25.1	Honeyleaze Copse	467183	146563	1,413	East
E26.1	Hook's Copse, Weston Corbett	467400	146916	1,661	East
E24.1	Coombe Wood, Tunworth	467183	147177	1,527	East
E24.2	Coombe Wood, Tunworth	467502	147486	1,941	East
E18.1	Great Matts Copse	466322	144773	1,717	South
E18.2	Great Matts Copse	465979	144443	1,884	South
E9.1	Bushy Leane Copse	465103	144738	1,561	South
E8.1	Merritt's Copse	464986	145501	885	Southwest
E8.2	Merritt's Copse	465064	145011	1,303	Southwest
E1.1	Parkfield Copse Complex & Lower Common Pit	463729	145584	1,840	Southwest
RV089	A339 Alton Road, Herriard	465613	147138	366	Northeast
RV255	Ellisfield Road Verge	464062	145830	1,440	Southwest

ID	Site name	NGR X	NGR Y	Distance from boundary (km)	Direction from boundary
RV236	U259 College Lane, Ellisfield	464283	145263	1,531	Southwest
RV148	C12 Bagmore Lane	465543	144647	1,607	South
E5.1	Kit Lane & Longfield Dells	464547	144501	1,969	Southwest
E6.1	Ham Copse, Ellisfield	464671	144518	1,896	Southwest
E10.1	Herriard Common	465330	144543	1,712	South
E17.1	Platts Copse	465942	145324	1,051	South
E21.1	Hummocks Clump	467048	147636	1,637	Northeast
E22.1	Smallhill Clump	467127	147987	2,006	Northeast
EY.1	Picked Craft Copse	466360	148665	2,068	Northeast

B.5 Post-processing

B.5.1 Use of background data

Considering long-term AQS, it is a straightforward matter to add the annual mean contribution from the source, (annual mean PC) to the annual mean background concentration to predict the total concentration (annual mean PEC).

For comparison with short-term AQS the addition of background is not so straightforward. The ADMS model allows for the calculation of percentiles from hourly background and process concentrations, but hourly background concentrations are not commonly available, and not for all pollutants. The approach used was that described in the Defra permit guidance:[10]

> '*When you calculate background concentration, you can assume that the short-term background concentration of a substance is twice its long-term concentration.*'

This has been used for all for short-term AQS for averaging times for 15 minutes to 24 hours.

B.5.2 Conversion of NOx to NO_2

The ADMS model includes a NOx chemistry model, but the conversion of primary NOx emissions to NO_2 is usually undertaken as a post-processing step for industrial permitting applications. For primary NO_2 to NO_x ratios of 10% or less, which is likely to be the case for the stack emissions, the Environment Agency and Natural Resources Wales[30] recommend use of the following conversion ratios:

- 35% for short term assessment
- 70% for long term assessment.

These ratios have been used in main part of this assessment. In fact, combustion sources emit NOx with approximately 5% NO_2 by volume,[31] and conversion from nitric oxide (NO) to NO_2 proceeds relatively slowly, depending on temperature. Assuming a temperature of 15°C and a wind speed of 3m/s, in the 50 seconds taken for emissions to travel 150m, 19% of a mole of NO would have been

[30] https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment#nosubxsub-to-nosub2sub-conversion-ratios-to-use

[31] CERC Ltd (2023) ADMS 6 Atmospheric Dispersion Modelling System, user Guide, Version 6.0, March 2023

converted to NO_2.[32] The prediction of short-term NO_2 impacts at the nearest human receptor (H1) is therefore conservative.

B.5.3 Conversion of TVOC to benzene

Emissions are specified as TVOC for which there are no AQS. There is an AQS for benzene, one component of TVOC. An AEA Technology report on the Speciation of UK emissions of non-methane volatile organic compounds (2002)[2] reported on a series of VOC species profiles available for stationary combustion sources, covering a range of both fuel types and scale of combustion. The benzene fraction in industrial and commercial combustion of natural gas was reported to be less than 10%, therefore the TVOC concentrations at receptors has been modelled as 10% benzene.

B.5.4 Deposition to ecological receptors

The ADMS model includes the ability to calculate the deposition flux rate (deposition) of pollutants, but the Environment Agency recommends deposition be calculated as a post-processing step in order to give conservative estimates of both ground level concentration and deposition, by assuming no loss of pollutant from air concentration to ground deposition.

Deposition may be ‘dry’ or ‘wet’. Dry deposition of gases occurs due to diffusive motions and removal at surfaces, primarily the ground. It is characterised by a deposition velocity that depends on the pollutant and the nature of the surface.

Table 25 gives the deposition velocities for grassland and forest for the pollutants included in this assessment which are the values recommended by AQTAG 06.[15] The values for grassland, which are lower than those for forest, have been used to represent deposition at all receptors.

Wet deposition occurs when precipitation washes pollutants out of the air. Some pollutants have a low solubility, and in addition, wet deposition is considered to be of limited importance close to the source. Wet deposition has been neglected.

Table 25 Dry deposition velocities

Pollutant	Deposition velocity (m/s)	
	Grassland	Forest
NO_2	0.0015	0.003
SO_2	0.012	0.024
NH_3	0.020	0.030

Deposition ($\mu g/m^2/s$) is calculated by multiplying the near ground air concentration ($\mu g/m^3$) by deposition velocity. Ecological receptors are sensitive to deposition of nitrogen (nutrient nitrogen) and to deposition of acid species including nitrogen (N), sulphur (S) and HCl. To convert from deposition of a pollutant to deposition of a species, the conversion factors given in Table 26 were used.

[32] CERC Ltd (2023) NOx Chemistry Model in ADMS 6, P18/02K/23, March 2023

Nutrient nitrogen deposition is calculated as the total deposition of N in kg/ha/year, due to NO_2 and NH_3. To convert from deposition of N or S deposited to equivalent acidification units, a measure of how acidifying the chemical species can be, (keq/ha/year), the conversion factors given in Table 27 were used. Acid deposition is calculated taking into account the acidifying nitrogen and sulphur deposition, both expressed as keq/ha/year.

Table 26 Conversion factors for deposition of species N, S

Pollutant	Species deposited	Conversion factor from deposition of pollutant ($\mu g/m^2/s$) to deposition of species (kg/ha/year)
NO_2	N	96
SO_2	S	157.7
NH_3	N	259.7

Table 27 Conversion factors for deposition of species deposition to acid equivalent

Species	Conversion factor from deposition of species (kg/ha/year) to deposition of equivalent acidification units (keq/ha/year)
N	0.071428
S	0.0625

Appendix C CHP1 emissions monitoring

Element, Unit C6, Emery Court, The Embankment Business Park, Heaton Mersey, Stockport, SK4 3GL
Your Element Contact: David Littlewood (07772 250 040)
E: david.littlewood@element.com

Stack Emissions Testing Report Commissioned by
Herriard Bio Power Ltd

Installation Name & Address
Herriard Bio Power Ltd
Bushywarren Lane
Herriard
Basingstoke
Hampshire
RG25 2NS

EPR Permit: AB3807KW

Stack Reference
CHP Engine 1 - MWM Engine

Dates of the Monitoring Campaign
9th February 2022

Job Reference Number
ERE-22098

Report Written by
Yu Shen Senior Team Leader MCERTS Level 2 MM06 727 TE1 TE2 TE3 TE4

Report Approved by
David Littlewood Operations Manager MCERTS Level 2 MM06 772 TE1 TE2 TE3 TE4

Report Date
15th February 2022

Version
Version 1

Signature of Report Approver

CONTENTS

Opinions and interpretations expressed herein are outside the scope of Element's ISO 17025 accreditation.

MONITORING OBJECTIVES

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine
9th February 2022

Overall Aim of the Monitoring Campaign

Element were commissioned by Herriard Bio Power Ltd to carry out stack emissions testing on the CHP Engine 1 - MWM Engine at Basingstoke.

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values (ELVs) as specified in the Site's Permit.

Special Requirements

There were no special requirements.

Target Parameters

Sulphur Dioxide, Total VOCs (as Carbon), Oxides of Nitrogen (as NO_2), Carbon Monoxide

MONITORING RESULTS

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine
9th February 2022

where MU = Measurement Uncertainty associated with the Result

Parameter		Units	Concentration Result		MU +/-	Limit
Sulphur Dioxide	1	mg/m^3		182	15	350
Total VOCs (as Carbon)	1	mg/m^3		611	26	1000
Oxides of Nitrogen (as NO_2)	1	mg/m^3		499	23	500
Carbon Monoxide	1	mg/m^3		673	31	1400
Oxygen		% v/v	Dry	8.03	0.29	
Water Vapour		% v/v		11.6	0.6	

[1] Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 5% oxygen.

Executive Summary

MONITORING DATE(S) & TIMES

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine
9th February 2022

Parameter		Units	Concentration		Sampling Date(s)	Sampling Times	Duration mins
Sulphur Dioxide	R1	mg/m³	182		09/02/2022	11:40 - 12:40	60
Total VOCs (as Carbon)	R1	mg/m³	611		09/02/2022	11:40 - 12:40	60
Oxides of Nitrogen (as NO_2)	R1	mg/m³	499		09/02/2022	11:40 - 12:40	60
Carbon Monoxide	R1	mg/m³	673		09/02/2022	11:40 - 12:40	60
Oxygen	R1	% v/v	8.03		09/02/2022	11:40 - 12:40	60

All results are expressed at the respective reference conditions.

PROCESS DETAILS

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine
9th February 2022

Standard Operating Conditions

Parameter	Value
Process Status	Normal Operation
Capacity (of 100%) and Tonnes / Hour	1200kWe Output @ 1200kWe
Continuous or Batch Process	Continuous
Feedstock (if applicable)	N/A
Abatement System	None
Abatement System Running Status	N/A
Fuel	Biogas
Plume Appearance	None Visible

MONITORING & ANALYTICAL METHODS

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine
9th February 2022

	Monitoring				Analysis					
Parameter	**Standard**	**Technical Procedure**	**Sampling Status**	**Testing Lab**	**Analytical Procedure**	**Analytical Technique**	**Analysis Status**	**Analysis Lab**	**Overall Status**	**LOD (Average)**
Sulphur Dioxide	EN 14791	CAT-TP-09	MCERTS	EET	CAT-AP-01	IC	MCERTS	EET	MCERTS	0.072 mg/m³
Water Vapour	EN 14790	CAT-TP-05	MCERTS	EET	CAT-TP-05	Gravimetric	MCERTS	EET	MCERTS	0.10 % v/v
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20	MCERTS	EET	Flame Ionisation Detection by Signal 3000HM				MCERTS	0.32 mg/m³
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-21	MCERTS	EET	Chemiluminescence by Horiba PG-250				MCERTS	0.41 mg/m³
Carbon Monoxide	EN 15058	CAT-TP-21	MCERTS	EET	NDIR by Horiba PG-250				MCERTS	0.25 mg/m³
Oxygen	EN 14789	CAT-TP-21	MCERTS	EET	Dry Zirconia Cell by Horiba PG-250				MCERTS	0.1 %

ANALYSIS LABORATORIES

(with short name reference as appears in the table above)

Element (Stockport Lab - EET)	ISO 17025 Accreditation Number: 4279

SUMMARY OF SAMPLING DEVIATIONS

Parameter	Run	Deviation
All	All	There are no deviations associated with the sampling employed.

SUITABILITY OF SAMPLING LOCATION

Duct Characteristics

Parameter	Units	Value
Type	-	Circular
Depth	m	0.30
Width	m	-
Area	m²	0.07
Port Depth	cm	-
Orientation of Duct	-	Vertical
Number of Ports	-	1
Sample Port Size	-	3/4" BSP

Location of Sampling Platform

General Platform Information	Value
Permanent / Temporary Platform	On Ground
Inside / Outside	Inside

Platform Details

EA Technical Guidance Note M1 / EN 15259 Platform Requirements	Value
Sufficient working area to manipulate probe and operate the measuring instruments	Yes
Platform has 2 levels of handrails (approx. 0.5m & 1.0m high)	N/A
Platform has vertical base boards (approx. 0.25m high)	N/A
Platform has chains / self closing gates at top of ladders	N/A
There are no obstructions present which hamper insertion of sampling equipment	Yes
Safe Access Available	Yes
Easy Access Available	Yes

Sampling Location / Platform Improvement Recommendations

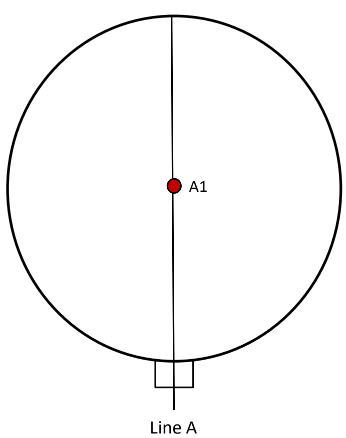
Due to the nature of the access into the duct, it is not possible to conduct a full velocity profile, however no particulate phase sampling was required and all gaseous species were considered to be mixed sufficiently for the purposes of these tests. There is also no requirement to undertake a homogeneity test as per EN 15259 and as such the location cannot be compared against that or the criteria within TGN M1. The sampling location used in this instance has been approved for use by the Environment Agency.

EN 15259 Homogeneity Test Requirements

There is no requirement to perform a EN 15259 Homogeneity Test on this Stack.

PLANT PHOTOS

SAMPLE POINTS



where ○ = isokinetic point sampled at
● = isokinetic point <u>not</u> sampled at
● = combustion gases sample point
● = non-isokinetic sample point

APPENDIX CONTENTS

STACK EMISSIONS MONITORING PERSONNEL

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Team Leader	Yu Shen	MCERTS Level 2	MM06 727	TE1 TE2 TE3 TE4
Technician	David Godfrey	MCERTS Level 1	MM16 1393	None

LIST OF EQUIPMENT

Extractive Sampling

Equipment Type	Equipment I.D.
DGM (Apex)	CAT DGM#02
Manometer ('Apex' Orange)	CAT MAN#12
Manometer ('Apex' Red)	CAT MAN#13
Thermocouple (Apex)	CAT TC#46
Timepiece (Apex)	CAT TP#20
Thermocouple Reader (Apex)	CAT TCR#24
Thermocouple Reader (Apex)	CAT TCR#25
Thermocouple Reader (Apex)	CAT TCR#26
Heated Probe (1)	-
Heated Probe (2)	-
Heated Probe (3)	-
S-Pitot (1)	-
S-Pitot (2)	-
L-Pitot	-
Site Balance	CAT BAL#06
500g / 1Kg Check Weights	CAT CW#02
Last Impinger Arm	CAT TC#08
Callipers	-
Tubes Kit Thermocouple	-

Instrumental Analysers

Equipment Type	Equipment I.D.
Horiba PG-250	CAT 9.25
SELECT Horiba Model (2)	-
Servomex 4900	-
Eco Physics CLD 822Mh	-
ABB AO2020-URAS26	-
Testo 350 XL	-
Signal 200SM	CAT COND#03
Ankersmid AOX210	CAT CONV#07
Gasmet Sampling System	-
Signal 3010HM	CAT FID#06
M&C PSS	CAT 12.966
Mass Flow Controller (1)	-
Mass Flow Controller (2)	-
Mass View (1)	-
Mass View (2)	-
Squirrel 2020	CAT DL#02
Easylogger EN-EL-12 Bit	-
Bioaerosols Temperature Logger	-
Electronic Refrigerator	-

Miscellaneous Items

Equipment Type	Equipment I.D.
Digital Manometer (1)	-
Digital Manometer (2)	-
Digital Temperature Meter	CAT 3.274
Stopwatch	CAT 15.56
Barometer	CAT 13.64
Stack Thermocouple (1)	CAT TC#60
Stack Thermocouple (2)	-
Stack Thermocouple (3)	-
1m Heated Line (1)	-
1m Heated Line (2)	-
1m Heated Line (3)	-
5m Heated Line (1)	-
15m Heated Line (1)	CAT HL#04
20m Heated Line (1)	-
20m Heated Line (2)	-
Dual Channel Heater Controller	CAT HLC#01
Single Channel Heater Controller	-
Laboratory Balance	
Tape Measure	CAT 16.106

METHODS & TECHNICAL PROCEDURES USED

Parameter	Standard	Technical Procedure
Sulphur Dioxide	EN 14791	CAT-TP-09
Water Vapour	EN 14790	CAT-TP-05
Total VOCs (as Carbon)	EN 12619:2013	CAT-TP-20
Oxides of Nitrogen (as NO_2)	EN 14792	CAT-TP-21
Carbon Monoxide	EN 15058	CAT-TP-21
Oxygen	EN 14789	CAT-TP-21

SULPHUR DIOXIDE: RESULTS SUMMARY

Herriard Bio Power Ltd, Basingstoke

CHP Engine 1 - MWM Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m³	182.30	182.30
Uncertainty	±mg/m³	15.37	15.37
Mass Emission	g/hr		
Uncertainty	±g/hr		

Parameter	Units	Run 1	Mean
Water Vapour	% v/v	11.61	11.61
Uncertainty	±% v/v	0.58	0.58

Blank Runs

Parameter	Units	Blank 1	Maximum
Concentration	mg/m³	0.04	0.04

General Sampling Information

Parameter	Value	
Standard	EN 14791	
Technical Procedure	CAT-TP-09	
Name of Analytical Laboratory	EET	
Analytical Laboratory's Procedure	CAT-AP-01	
ISO 17025 Accredited Analysis?	MCERTS	
Date of Sample Analysis	11/02/2022	
Probe Material	Titanium	
Filter Housing Material	Titanium	
Impinger Material	Borosilicate Glass	
Absorption Solution	0.3% Hydrogen Peroxide	
Positioning of Filter	Out Stack Heated Head	
Filter Size and Material	0.1µm Glass Fibre	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

SULPHUR DIOXIDE: SAMPLING DETAILS

Sample Runs

Parameter	Units	Run 1
Sampling Times	-	11:40 - 12:40
Sampling Dates	-	09/02/2022
Sampling Device	-	DGM
Duration	mins	60
DGM Start Volume	m³	546.0750
DGM End Volume	m³	546.7144
DGM Start Temperature	°C	15.0
DGM End Temperature	°C	17.0
Start ΔH	mmH_2O	10.00
End ΔH	mmH_2O	10.00
DGM Y_d	-	1.0166
Barometric Pressure	kPa	102.6
Volume Sampled (STP, Dry)	m³	0.6223
Volume Sampled (STP, Wet)	m³	0.7040
Volume Sampled (REF)	m³	0.5045
Sample Flow Rate	l/min	10.83
Laboratory Result for Front Impingers	µg/ml	185.64
Laboratory Result for Back Impinger	µg/ml	0.37
Volume in Front Impingers	ml	495.0
Volume in Back Impinger	ml	235.0
Mass in Front Impingers	µg	91891.8
Mass in Back Impinger	µg	87.0
Total Mass Collected	µg	91978.8
Calculated Concentration	mg/m³	182.30
Liquid Trap Start Mass	g	2435.3
Liquid Trap End Mass	g	2491.6
Silica Trap Start Mass	g	765.7
Silica Trap End Mass	g	775.0
Total Mass Of Water Vapour	g	65.6
Calculated Water Vapour	% v/v	11.61

Where: DGM stands for Dry Gas Meter

Blank Runs

Parameter	Units	Blank 1
Blank Dates	-	09/02/2022
Average Volume Sampled (REF)	m³	0.5045
Laboratory Result for Impingers	µg/ml	0.07
Volume in Impingers	ml	280.0
Total Mass Collected	µg	19.6
Calculated Concentration	mg/m³	0.04

SULPHUR DIOXIDE: QUALITY ASSURANCE

Sample Runs

Leak Test Results	Units	Run 1
Mean Sampling Rate	l/min	10.8
Pre-Sampling Leak Rate	l/min	0.10
Post-Sampling Leak Rate	l/min	0.10
Allowable Leak Rate	l/min	0.22
Leak Test Acceptable	-	Yes

Absorption Efficiency	Units	Run 1
Absorption Efficiency	%	99.9
Allowable Absorption Efficiency	%	95
Absorption Efficiency Acceptable	-	Yes

Water Droplets	Units	Run 1
Are Water Droplets Present	-	No

MU (Concurrent Water Vapour)	Units	Run 1
Measurement Uncertainty (MU)	%	5.0
Allowable MU	%	20.0
MU Acceptable	%	Yes

Silica Gel (Concurrent Water Vapour)	Units	Run 1
Less than 50% Faded	%	Yes

Test Conditions	Units	Run 1
Ambient Temperature Recorded?	-	Yes

Blank Runs

Leak Test Results	Units	Blank 1
Expected Sampling Rate	l/min	10.0
Pre-Sampling Leak Rate	l/min	0.10
Post-Sampling Leak Rate	l/min	0.10
Allowable Leak Rate	l/min	0.20
Leak Test Acceptable	-	Yes

Validity of Blank vs ELV	Units	Blank 1
Allowable Blank	mg/m³	35.0
Blank Acceptable	-	Yes

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run, wx = deviation also applies to the concurrent water vapour run)	1	
There are no deviations associated with the sampling employed.	wx	

SULPHUR DIOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Measured Quantities	Value Symbol	Value Run 1	Standard uncertainty Symbol	Units	Run 1
Sampled Volume (Actual)	V_m	0.6394	uV_m	m³	0.0128
Sampled Gas Temperature	T_m	289.0	uT_m	K	2.00
Sampled Gas Pressure	ρ_m	102.6	$u\rho_m$	kPa	0.50
Sampled Gas Humidity	H_m	0.00	uH_m	% v/v	1.00
Leak	L	0.92	uL	%	-
Laboratory Result	L_r	2.90	uL_r	%	-

Measured Quantities	Uncertainty as a Percentage Units	Run 1	Requirement of Standard
Sampled Volume (Actual)	%	2.00	≤2%
Sampled Gas Temperature	%	0.69	≤1%
Sampled Gas Pressure	%	0.49	≤1%
Sampled Gas Humidity	%	1.00	≤1%
Leak	%	0.92	≤2%
Laboratory Result	%	2.90	No Requirement

Measured Quantities	Uncertainty in Measurement Units Symbol	Units	Run 1	Sensitivity Coefficient Run 1
Sampled Volume (STP)	V_m	m³	0.6223	292.96
Leak	L	mg/m³	0.972	1.00
Laboratory Result	L_r	mg/m³	5.287	1.00

Measured Quantities	Uncertainty in Result Units	Run 1
Sampled Volume (STP)	mg/m³	4.443
Leak	mg/m³	0.9716
Laboratory Result	mg/m³	5.2868

Measured Quantities	Oxygen Correction Part of MU Budget Units	Run 1
O_2 Correction Factor	-	1.23
Stack Gas O_2 Content	% v/v	8.03
MU for O_2 Correction	-	0.05
Overall MU For O_2 Measurement	%	3.85

Parameter	Units	Run 1
Combined uncertainty	mg/m³	6.97
Expanded uncertainty (95% confidence), without Oxygen Correction	mg/m³	13.67
Expanded uncertainty (95% confidence), with Oxygen Correction	mg/m³	15.37
Expanded uncertainty (95% confidence), estimated with Method Deviations	mg/m³	15.37
Reported Uncertainty	mg/m³	15.37
Expanded uncertainty (95% confidence), without Oxygen Correction	%	7.5
Expanded uncertainty (95% confidence), with Oxygen Correction	%	8.4
Expanded uncertainty (95% confidence), estimated with Method Deviations	%	8.4
Reported Uncertainty	%	8.4

TOTAL VOCs (as CARBON): RESULTS SUMMARY

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m³	610.92	610.92
Uncertainty	±mg/m³	26.36	26.36
Mass Emission	g/hr		
Uncertainty	±g/hr		

General Sampling Information

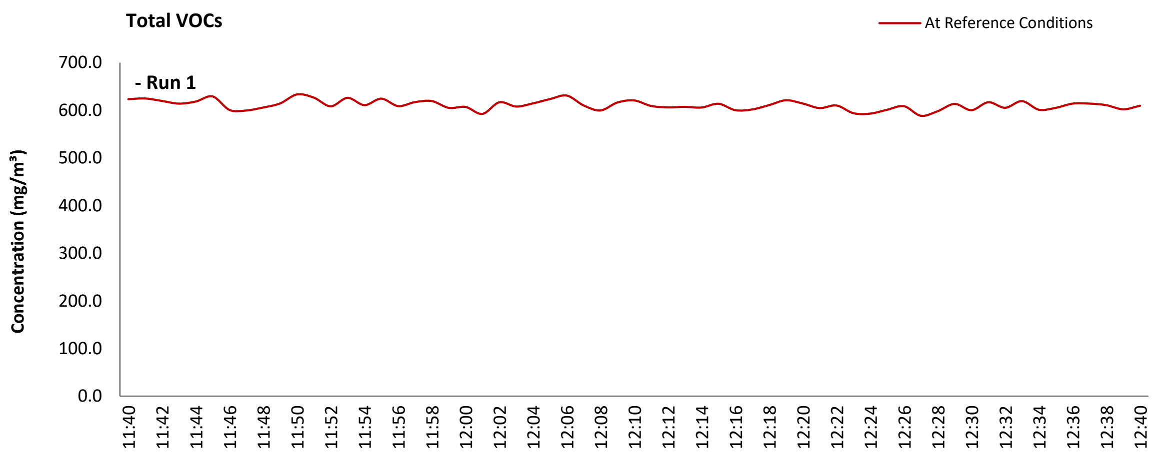
Parameter	Value	
Standard	EN 12619:2013	
Technical Procedure	CAT-TP-20	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Propane In Synthetic Air (5 Grade)	
Span Gas Reference Number	VC8050321	
Span Gas Expiry Date	26/04/2022	
Span Gas Start Pressure (bar)	20	
Gas Cylinder Concentration (ppm)	601	
Span Gas Set Point (ppm)	601.00	
Span Gas Uncertainty (%)	N/A	
Zero Gas Type	Synthetic Air (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

TOTAL VOCs (as CARBON): DATA TREND

Graphical Trend of Data



TOTAL VOCs (as CARBON): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:40 - 12:40
Sampling Dates	-	09/02/2022
Instrument Range	ppm	1000
Span Gas Value	ppm	601.0

Quality Assurance

	Zero Drift	Units	Run 1
CAL 1	Zero Down Sampling Line (Pre)	ppm	2.00
CAL 1	Zero Down Sampling Line (Post)	ppm	2.00
CAL 1	Zero Drift	ppm	0.00
CAL 2	Zero Down Sampling Line (Pre)	ppm	
CAL 2	Zero Down Sampling Line (Post)	ppm	
CAL 2	Zero Drift	ppm	
CAL 3	Zero Down Sampling Line (Pre)	ppm	
CAL 3	Zero Down Sampling Line (Post)	ppm	
CAL 3	Zero Drift	ppm	
	Allowable Zero Drift	± ppm	30.05
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span Down Sampling Line (Pre)	ppm	600.00
CAL 1	Span Down Sampling Line (Post)	ppm	598.00
CAL 1	Span Drift	ppm	-2.00
CAL 2	Span Down Sampling Line (Pre)	ppm	
CAL 2	Span Down Sampling Line (Post)	ppm	
CAL 2	Span Drift	ppm	
CAL 3	Span Down Sampling Line (Pre)	ppm	
CAL 3	Span Down Sampling Line (Post)	ppm	
CAL 3	Span Drift	ppm	
	Allowable Span Drift	± ppm	30.05
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 12

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1
There are no deviations associated with the sampling employed.	x

TOTAL VOCs (as CARBON): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	1000.0		mg/m³ (REF)
Allowable MU	15.0		%
Measured concentration	495.33		mg/m³ (STP, dry)
Range Used	1000.0		ppm
Range Used [A]	1606.1		mg/m³
Cal gas conc.	601.0		ppm
Conversion	1.61		ppm to mg/m³
MCERTS Range [B]	15.0		mg/m³
Lower of [A] or [B]	15.0		mg/m³
Cal gas conc.	965.3		mg/m³

Performance characteristics	RUN 1		Units
Response time	15		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.15		% full scale
Repeatability at span level	0.80		% full scale
Deviation from linearity	0.20		% of value
Zero drift	0.00		% full scale
Span drift	-0.33		% full scale
Volume or pressure flow dependence	2.00		% of full scale
Atmospheric pressure dependence	0.80		% of value/kPa
Ambient temperature dependence	1.00		% full scale/10K
Combined interference	1.20		% range
Dependence on voltage	0.10		% full scale/10V
Losses in the line (leak)	0.17		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.10		mg/m³
Lack of fit	0.02		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.03		mg/m³
Ambient temperature dependence	0.14		mg/m³
Combined interference (from MCERTS Certificate)	0.10		mg/m³
Dependence on voltage	0.01		mg/m³
Losses in the line (leak)	0.48		mg/m³
Uncertainty of calibration gas	5.72		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	495.33		mg/m³
Combined uncertainty			5.74		mg/m³
Expanded uncertainty	k =	1.96	11.26		mg/m³
Uncertainty corrected to std conds. (O_2)			13.89		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.27		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.13		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	15.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.31		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.92		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	15.4		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <15% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 15% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXIDES OF NITROGEN (as NO_2): RESULTS SUMMARY

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m³	498.94	498.94
Uncertainty	±mg/m³	23.07	23.07
Mass Emission	g/hr		
Uncertainty	±g/hr		

General Sampling Information

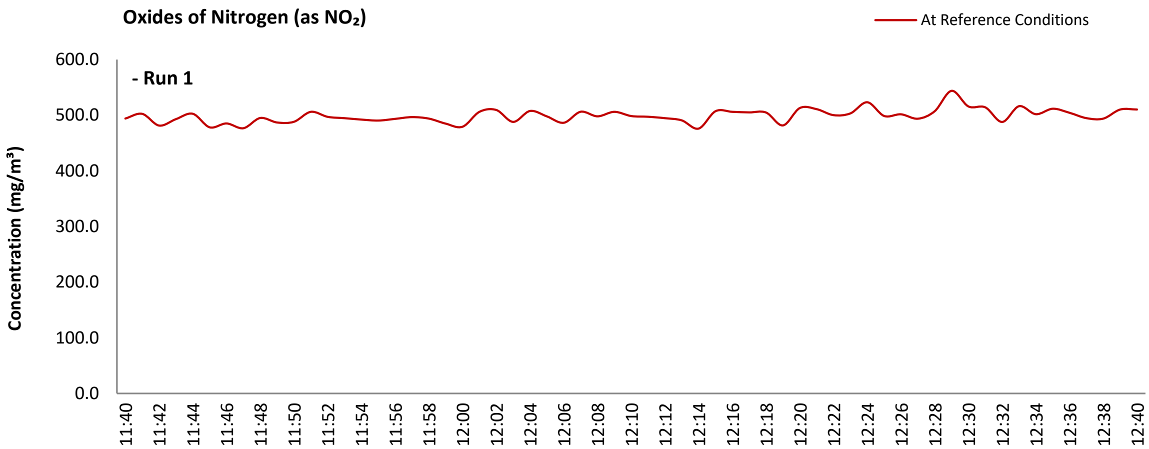
Parameter	Value	
Standard	EN 14792	
Technical Procedure	CAT-TP-21	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Date & Result of Last Converter Check	16/07/2021 - 95.8%	
Span Gas Type	Nitrogen Monoxide	
Span Gas Reference Number	VCD500555	
Span Gas Expiry Date	26/04/2022	
Span Gas Start Pressure (bar)	20	
Gas Cylinder Concentration (ppm)	262.8	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

OXIDES OF NITROGEN (as NO_2): DATA TREND

Graphical Trend of Data



OXIDES OF NITROGEN (as NO_2): SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:40 - 12:40
Sampling Dates	-	09/02/2022
Instrument Range	ppm	500
Span Gas Value	ppm	262.8

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.4
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	0.50
CAL 1	Zero Drift	ppm	0.50
CAL 1	Zero Drift	%	0.19
CAL 1	Drift Correction Applied	2-5%	No
CAL 2	Zero at Analyser (Pre)	ppm	
CAL 2	Zero at Analyser (Post)	ppm	
CAL 2	Zero Drift	ppm	
CAL 2	Zero Drift	%	
CAL 2	Drift Correction Applied	2-5%	
CAL 3	Zero at Analyser (Pre)	ppm	
CAL 3	Zero at Analyser (Post)	ppm	
CAL 3	Zero Drift	ppm	
CAL 3	Zero Drift	%	
CAL 3	Drift Correction Applied	2-5%	
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	262.80
CAL 1	Span at Analyser (Post)	ppm	261.00
CAL 1	Span Drift	ppm	-1.80
CAL 1	Zero Adj. Span Drift	%	0.88
CAL 1	Drift Correction Applied	2-5%	No
CAL 2	Span at Analyser (Pre)	ppm	
CAL 2	Span at Analyser (Post)	ppm	
CAL 2	Span Drift	ppm	
CAL 2	Zero Adj. Span Drift	%	
CAL 2	Drift Correction Applied	2-5%	
CAL 3	Span at Analyser (Pre)	ppm	
CAL 3	Span at Analyser (Post)	ppm	
CAL 3	Span Drift	ppm	
CAL 3	Zero Adj. Span Drift	%	
CAL 3	Drift Correction Applied	2-5%	
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 12

Method Deviations

Nature of Deviation (x = deviation applies to the associated run)	Run Number 1	
There are no deviations associated with the sampling employed.	x	

OXIDES OF NITROGEN (as NO_2): MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	500.0		mg/m³ (REF)
Allowable MU	10.0		%
Measured concentration	404.53		mg/m³ (STP, dry)
Ratio NO / NO_2	5		%
Range Used	500.0		ppm
Range Used [A]	1026.1		mg/m³
Cal gas conc.	262.8		ppm
Conversion	2.05		ppm to mg/m³
MCERTS Range [B]	125.0		mg/m³
Lower of [A] or [B]	125.0		mg/m³
Cal gas conc.	539.3		mg/m³

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	0.43		% of value
Zero drift	0.19		% full scale
Span drift	-0.88		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.18		% full scale/10K
Combined interference	0.60		% range
Dependence on voltage	0.40		% full scale/10V
Converter efficiency	95.8		%
Losses in the line (leak)	0.30		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m³
Standard deviation of repeatability at span level	0.05		mg/m³
Lack of fit	0.31		mg/m³
Drift	0.00		mg/m³
Volume or pressure flow dependence	0.00		mg/m³
Atmospheric pressure dependence	0.11		mg/m³
Ambient temperature dependence	0.03		mg/m³
Combined interference (from MCERTS Certificate)	0.43		mg/m³
Dependence on voltage	0.05		mg/m³
Converter efficiency	0.49		mg/m³
Losses in the line (leak)	0.71		mg/m³
Uncertainty of calibration gas blending	3.27		mg/m³
Uncertainty of calibration gas	4.67		mg/m³

			RUN 1		Units
Measurement uncertainty		**Result**	404.53		mg/m³
Combined uncertainty			5.81		mg/m³
Expanded uncertainty	k =	1.96	11.39		mg/m³
Uncertainty corrected to std conds. (O_2)			14.04		mg/m³ (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.81		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	2.28		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	10.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.62		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	4.62		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	10.7		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <10% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 10% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

CARBON MONOXIDE: RESULTS SUMMARY

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine

Sample Runs

Parameter	Units	Run 1	Mean
Concentration	mg/m³	673.40	673.40
Uncertainty	±mg/m³	31.01	31.01
Mass Emission	g/hr		
Uncertainty	±g/hr		

General Sampling Information

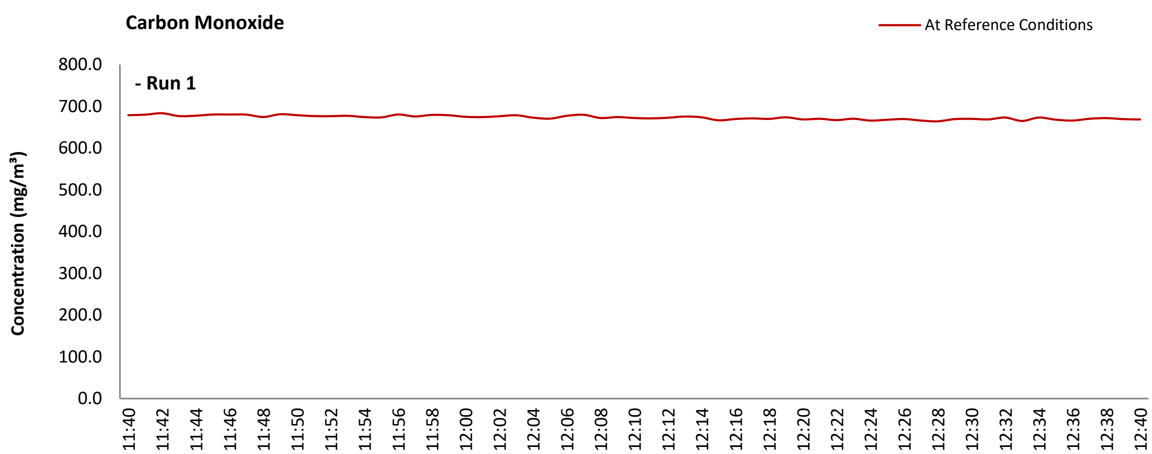
Parameter	Value	
Standard	EN 15058	
Technical Procedure	CAT-TP-21	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Carbon Monoxide	
Span Gas Reference Number	VCD500555	
Span Gas Expiry Date	26/04/2022	
Span Gas Start Pressure (bar)	20	
Gas Cylinder Concentration (ppm)	1202	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

Reference Conditions

Reference Conditions are: 273K, 101.3kPa, dry gas, 5% oxygen.

CARBON MONOXIDE: DATA TREND

Graphical Trend of Data



CARBON MONOXIDE: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:40 - 12:40
Sampling Dates	-	09/02/2022
Instrument Range	ppm	2000
Span Gas Value	ppm	1202.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.4
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	ppm	0.00
CAL 1	Zero at Analyser (Post)	ppm	2.00
CAL 1	Zero Drift	ppm	2.00
CAL 1	Zero Drift	%	0.17
CAL 1	Drift Correction Applied	2-5%	No
CAL 2	Zero at Analyser (Pre)	ppm	
CAL 2	Zero at Analyser (Post)	ppm	
CAL 2	Zero Drift	ppm	
CAL 2	Zero Drift	%	
CAL 2	Drift Correction Applied	2-5%	
CAL 3	Zero at Analyser (Pre)	ppm	
CAL 3	Zero at Analyser (Post)	ppm	
CAL 3	Zero Drift	ppm	
CAL 3	Zero Drift	%	
CAL 3	Drift Correction Applied	2-5%	
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	ppm	1202.00
CAL 1	Span at Analyser (Post)	ppm	1201.00
CAL 1	Span Drift	ppm	-1.00
CAL 1	Zero Adj. Span Drift	%	0.25
CAL 1	Drift Correction Applied	2-5%	No
CAL 2	Span at Analyser (Pre)	ppm	
CAL 2	Span at Analyser (Post)	ppm	
CAL 2	Span Drift	ppm	
CAL 2	Zero Adj. Span Drift	%	
CAL 2	Drift Correction Applied	2-5%	
CAL 3	Span at Analyser (Pre)	ppm	
CAL 3	Span at Analyser (Post)	ppm	
CAL 3	Span Drift	ppm	
CAL 3	Zero Adj. Span Drift	%	
CAL 3	Drift Correction Applied	2-5%	
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 12

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	
There are no deviations associated with the sampling employed.	x	

CARBON MONOXIDE: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	1400.0		mg/m^3 (REF)
Allowable MU	6.0		%
Measured concentration	545.98		mg/m^3 (STP, dry)
Range Used	2000.0		ppm
Range Used [A]	2498.4		mg/m^3
Cal gas conc.	1202.0		ppm
Conversion	1.25		ppm to mg/m^3
MCERTS Range [B]	95.0		mg/m^3
Lower of [A] or [B]	95.0		mg/m^3
Cal gas conc.	1501.6		mg/m^3

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.40		% full scale
Repeatability at span level	0.40		% full scale
Deviation from linearity	1.08		% of value
Zero drift	0.17		% full scale
Span drift	-0.25		% full scale
Volume or pressure flow dependence	0.40		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	0.05		% full scale/10K
Combined interference	0.73		% range
Dependence on voltage	0.40		% full scale/10V
Losses in the line (leak)	0.17		% of value
Uncertainty of calibration gas blending	1.40		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		mg/m^3
Standard deviation of repeatability at span level	0.05		mg/m^3
Lack of fit	0.59		mg/m^3
Drift	0.00		mg/m^3
Volume or pressure flow dependence	0.00		mg/m^3
Atmospheric pressure dependence	0.08		mg/m^3
Ambient temperature dependence	0.01		mg/m^3
Combined interference (from MCERTS Certificate)	0.40		mg/m^3
Dependence on voltage	0.05		mg/m^3
Losses in the line (leak)	0.52		mg/m^3
Uncertainty of calibration gas blending	4.41		mg/m^3
Uncertainty of calibration gas	6.30		mg/m^3

			RUN 1		Units
Measurement uncertainty		**Result**	545.98		mg/m^3
Combined uncertainty			7.76		mg/m^3
Expanded uncertainty	k =	1.96	15.20		mg/m^3
Uncertainty corrected to std conds. (O_2)			18.75		mg/m^3 (REF)

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	2.78		% of Value
Expanded uncertainty (no O_2) - at 95% Confidence	1.09		% at ELV
Overall Allowable uncertainty (no O_2) - at 95% Confidence	6.0		% at ELV
Result of Compliance with Uncertainty Requirement	**N/A**		-

	RUN 1		Units
Expanded uncertainty (with O_2) - at 95% Confidence	4.61		% of Value
Expanded uncertainty (with O_2) - at 95% Confidence	3.90		% at ELV
Overall Allowable uncertainty (with O_2) - at 95% Confidence	7.0		% at ELV
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be <6% of the value at the ELV, on a dry gas basis, or if O_2 correction is applied less than 6% + the uncertainty associated with the O_2 correction (using sqrt of sum squares to add uncertainty components).

OXYGEN: RESULTS SUMMARY

Herriard Bio Power Ltd, Basingstoke
CHP Engine 1 - MWM Engine

Sample Runs

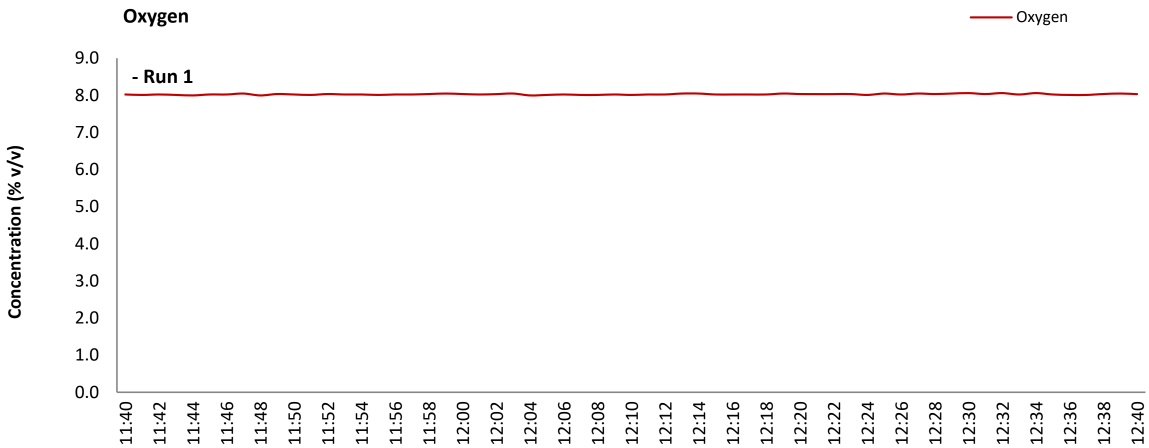
Parameter	Units	Run 1		Mean
Concentration	% v/v	8.03		8.03
Uncertainty	±% v/v	0.29		0.29

General Sampling Information

Parameter	Value	
Standard	EN 14789	
Technical Procedure	CAT-TP-21	
Probe Material	Titanium	
Filtration Type / Size	0.1µm Glass Fibre	
Heated Head Filter Used	Yes	
Heated Line Temperature	180°C	
Span Gas Type	Synthetic Air (5 Grade)	
Span Gas Reference Number	VC8050321	
Span Gas Expiry Date	26/04/2022	
Span Gas Start Pressure (bar)	20	
Gas Cylinder Concentration (% v/v)	8.02	
Span Gas Uncertainty (%)	2	
Zero Gas Type	Nitrogen (5 Grade)	
Number of Sampling Lines Used	1/1	FORMAT: Number Used / Number Required
Number of Sampling Points Used	1/1	FORMAT: Number Used / Number Required
Sample Point I.D.'s	A1	

OXYGEN: DATA TREND

Graphical Trend of Data



OXYGEN: SAMPLING DETAILS & QUALITY ASSURANCE

Sampling Details

Parameter	Units	Run 1
Sampling Times	-	11:40 - 12:40
Sampling Dates	-	09/02/2022
Instrument Range	% v/v	25.0
Span Gas Value	% v/v	8.0

Quality Assurance

Conditioning Unit Temperature	Units	Run 1
Average Temperature	°C	2.4
Allowable Temperature	< °C	4.0
Temperature Acceptable	-	Yes

	Zero Drift	Units	Run 1
CAL 1	Zero at Analyser (Pre)	% v/v	0.00
CAL 1	Zero at Analyser (Post)	% v/v	0.05
CAL 1	Zero Drift	% v/v	0.05
CAL 1	Zero Drift	%	0.62
CAL 1	Drift Correction Applied	2-5%	No
CAL 2	Zero at Analyser (Pre)	% v/v	
CAL 2	Zero at Analyser (Post)	% v/v	
CAL 2	Zero Drift	% v/v	
CAL 2	Zero Drift	%	
CAL 2	Drift Correction Applied	2-5%	
CAL 3	Zero at Analyser (Pre)	% v/v	
CAL 3	Zero at Analyser (Post)	% v/v	
CAL 3	Zero Drift	% v/v	
CAL 3	Zero Drift	%	
CAL 3	Drift Correction Applied	2-5%	
	Allowable Zero Drift	± %	5.00
	Zero Drift Acceptable	-	Yes

	Span Drift	Units	Run 1
CAL 1	Span at Analyser (Pre)	% v/v	8.02
CAL 1	Span at Analyser (Post)	% v/v	8.00
CAL 1	Span Drift	% v/v	-0.02
CAL 1	Zero Adj. Span Drift	%	0.87
CAL 1	Drift Correction Applied	2-5%	No
CAL 2	Span at Analyser (Pre)	% v/v	
CAL 2	Span at Analyser (Post)	% v/v	
CAL 2	Span Drift	% v/v	
CAL 2	Zero Adj. Span Drift	%	
CAL 2	Drift Correction Applied	2-5%	
CAL 3	Span at Analyser (Pre)	% v/v	
CAL 3	Span at Analyser (Post)	% v/v	
CAL 3	Span Drift	% v/v	
CAL 3	Zero Adj. Span Drift	%	
CAL 3	Drift Correction Applied	2-5%	
	Allowable Span Drift	± %	5.00
	Span Drift Acceptable	-	Yes

Test Conditions	Units	Run 1
Run Ambient Temperature Range	°C	10 - 12

Method Deviations

Nature of Deviation	Run Number	
(x = deviation applies to the associated run)	1	
There are no deviations associated with the sampling employed.	x	

OXYGEN: MEASUREMENT UNCERTAINTY CALCULATIONS

Performance characteristics	RUN 1		Units
Limit value	N/A		%vol
Allowable MU	6.0		%
Measured concentration	8.03		%vol
Range Used	25.0		%vol
Cal gas conc.	8.0		%vol

Performance characteristics	RUN 1		Units
Response time	60		seconds
Number of readings in measurement	60		-
Repeatability at zero	0.04		% full scale
Repeatability at span level	0.04		% full scale
Deviation from linearity	0.09		% of value
Zero drift	0.62		% full scale
Span drift	-0.87		% full scale
Volume or pressure flow dependence	0.20		% of full scale
Atmospheric pressure dependence	0.30		% of value/kPa
Ambient temperature dependence	-0.07		% full scale/10K
Combined interference	0.56		% range
Dependence on voltage	0.02		% full scale/10V
Losses in the line (leak)	0.25		% of value
Uncertainty of calibration gas	2.00		% of value

Performance characteristic	RUN 1		Units
Standard deviation of repeatability at zero	use rep at span		%vol
Standard deviation of repeatability at span level	0.01		%vol
Lack of fit	0.01		%vol
Drift	0.00		%vol
Volume or pressure flow dependence	0.00		%vol
Atmospheric pressure dependence	0.02		%vol
Ambient temperature dependence	-0.01		%vol
Combined interference (from MCERTS Certificate)	0.08		%vol
Dependence on voltage	0.00		%vol
Losses in the line (leak)	0.01		%vol
Uncertainty of calibration gas	0.09		%vol

			RUN 1		Units
Measurement uncertainty		**Result**	8.03		%vol
Combined uncertainty			0.15		%vol
Expanded uncertainty	k =	1.96	0.29		%vol

	RUN 1		Units
Expanded uncertainty (no O_2) - at 95% Confidence	3.67		% of Value
Result of Compliance with Uncertainty Requirement	**COMPLIANT**		-

Requirement for SRM is that Uncertainty should be 0.3% vol absolute or 6% relative whichever is the lower, on a dry gas basis. Source, EN 14789.

Version Number	Record of changes made within this version of the document
V1	The original document issued to the client

Appendix D Results of sensitivity tests

The impact of buildings, terrain and meteorological data year have been assessed. The eight cases modelled, A-G, are shown in Table 28. They are for the 'Normal' operation of the plant.

Results of the sensitivity tests were the maximum concentration predicted at any human receptor and any ecological receptor. For each AQS, the predicted maximum was divided by (normalised) the AQS value, or if the AQS is expressed as a number of exceedances of threshold value, by the threshold value. These normalised values have been expressed as a percentage and are shown in Table 29. The comparison is expressed this way to show the relative importance of the change in terms of exceedance of the AQS. If all the results are a very small percentage of the AQS, the variation in results is unlikely to affect the conclusions of the study.

For human receptors, comparing the results for tests A, B and C, it can be seen that modelling buildings led to higher model prediction than for flat terrain. Modelling terrain as well buildings did not affect results significantly. Comparing the results for tests A, D, E, F and G shows that the variation due to meteorological data year is generally less significant than the impact of modelling buildings.

For ecological receptors the effect on results of modelling buildings was not so marked and the impact of inter-annual variation was greater than that of modelling or not modelling buildings or buildings and terrain.

Table 28 Sensitivity tests

Sensitivity test	Flat/Buildings/Terrain model options	Meteorological data year
A	Flat	2018
B	Buildings	2018
C	Terrain & buildings	2018
A	Flat	2018
D	Flat	2019
E	Flat	2020
F	Flat	2021
G	Flat	2022

Table 29 Results as a percentage of the EAL or threshold

Pollutant	Long-term (LT) or Short-term (ST)	Value, EAL or threshold, (µg/m³)	A	B	C	A	D	E	F	G
Human receptors										
VOC	LT	5	4%	5%	4%	4%	4%	5%	4%	4%
VOC	ST	30	6%	11%	10%	6%	5%	6%	6%	5%
CO	ST	10,000	0%	1%	1%	0%	0%	0%	0%	0%
NOx	LT	40	2%	2%	2%	2%	2%	2%	2%	2%
NOx	ST	200	2%	8%	7%	2%	2%	2%	2%	2%
SO_2	ST	266	1%	6%	6%	1%	1%	1%	1%	1%
SO_2	ST	350	1%	3%	2%	1%	1%	1%	1%	1%
SO_2	ST	125	1%	2%	2%	1%	1%	1%	1%	1%
NH_3	LT	180	0%	0%	0%	0%	0%	0%	0%	0%
NH_3	ST	2,500	0%	0%	0%	0%	0%	0%	0%	0%
Odour	ST	3	28%	28%	28%	28%	23%	21%	23%	21%
Ecological receptors										
NOx	LT	30	7%	7%	7%	7%	9%	9%	8%	8%
NOx	ST	75	19%	18%	18%	19%	19%	17%	20%	20%
SO_2	LT	20	2%	2%	2%	2%	3%	3%	2%	2%
SO_2	LT	10	4%	4%	4%	4%	5%	6%	5%	5%
NH_3	LT	1	12%	12%	11%	12%	11%	11%	12%	10%

Appendix E Waste Reception Building concentration monitoring

From Odour Data to Odour Knowledge

Ammonia (NH_3) report - results of NH_3 concentration analysis

This report summarises the results of the NH_3 concentration analysis performed at Olfasense's odour laboratory, performed by Olfasense staff.

The following table presents the results of NH_3 concentration analysis.

Table 1: NH_3 concentration results

Analyser used :	Gastec GM36 3L	Project Code:	REDM21C
Client Reference	OSUK Analysis File	NH_3 concentration (ppm)	Date of measurement
1	210803AGP	<0.5	04/08/21
2	210803BGP	<0.5	04/08/21
3	210803CGP	<0.5	04/08/21

Hydrogen Sulphide (H_2S) report - results of H_2S analysis

This report summarises the results of the H_2S concentration analysis performed at Olfasense's odour laboratory, performed by Olfasense staff.

The following table presents the results of H_2S analysis.

Table 1: Hydrogen sulphide concentration results

Analyser used :	Jerome GM01	Project Code:	REDM21C
Client Reference	OSUK Analysis File	H_2S concentration (ppm)	Date of measurement
1	210803AGP	0.069	04/08/21
2	210803BGP	0.074	04/08/21
3	210803CGP	0.047	04/08/21

Appendix F Digestate analysis

REAL BCS Approved Testing Laboratory

PAS110 2014 Certificate of Analysis

Client: MICHAL ANTOS
(P427) HERRIARD BIOPOWER LTD
BUSHYWARREN LANE
HERRIARD
BASINGSTOKE
RG25 2NS

Originator: HERRIARD BIOPOWER
SEPARATED LIQUOR

Lab ID:	72388 - 137656	**Certification Code:**	HER-HER-SL	**Date Received:**	17/05/2023
Sample ID:	HBSL160523	**BCS Number:**	BCS1214C59	**Date Reported:**	19/06/2023
Sample Type:	Separated Liquor	**Plant / Site Name:**	Herriard	**Date Sampled:**	16/05/2023

Potentially Toxic Elements in WD / SL / SF, on a fresh weight basis

Parameter	Units	Result	Upper Limit	Pass	Method of Test
Cadmium (Cd)	mg/kg	0.02	0.72 mg / kg	Y	BS EN 15587 (soluble in aqua regia)
Chromium (Cr)	mg/kg	0.32	48 mg / kg	Y	BS EN 15587 (soluble in aqua regia)
Copper (Cu)	mg/kg	1.66	96 mg / kg	Y	BS EN 15587 (soluble in aqua regia)
Lead (Pb)	mg/kg	<0.5	96 mg / kg	Y	BS EN 15587 (soluble in aqua regia)
Mercury (Hg)	mg/kg	<0.05	0.48 mg / kg	Y	BS EN 15587 (soluble in aqua regia)
Nickel (Ni)	mg/kg	0.49	24 mg / kg	Y	BS EN 15587 (soluble in aqua regia)
Zinc	mg/kg	8.36	192 mg / kg	Y	BS EN 15587 (soluble in aqua regia)

Stability of WD / SL / SF on a fresh weight basis

Parameter	Units	Result	Upper Limit	Pass	Method of Test
Volatile Fatty Acids	g COD / g VS	0.10	0.774 g VS	Y	Chromatography
Residual Biogas Potential	l / g VS	0.21	0.45 l / g VS	Y	OFW004-005 (WRAP)

Parameter	Units	Digestate Result *	QC Result **	Inoculum Result ***
RBP 1st Replicate	l / g VS	0.22	0.62	0.06
RBP 2nd Replicate	l / g VS	0.21	0.65	0.06
RBP 3rd Replicate	l / g VS	0.20	0.66	0.06

28 day plot of biogas results for sample, inoculum and QC can be emailed as a PDF file on request.
VFAs expressed as COD equivalent. Used as a pre-screening method: high VFA concentration indicates high potential biodegradability.
Samples with VFA concentrations above 0.774 g COD / g VS are expected to fail on RBP.
Test is valid as no spikes or inconsistencies were observed, the plots were smooth for all replicates.
All quality control criteria have been met.

* The digestate RBP is allowed to be negative only during the first 5 days of the test.
** The reference material RBP is allowed to be negative only during the first 5 days of the test. The 28-day RBP of the reference material should exceed 0.5 l/g VS
*** The inoculum control should produce a measurable volume of biogas over the 28 day period.

REAL BCS Approved Testing Laboratory

PAS110 2014 Certificate of Analysis (Continued)

Client: MICHAL ANTOS
(P427) HERRIARD BIOPOWER LTD
BUSHYWARREN LANE
HERRIARD
BASINGSTOKE
RG25 2NS

Originator: HERRIARD BIOPOWER SEPARATED LIQUOR

Lab ID: 72388 - 137656
Sample ID: HBSL160523
Sample Type: Separated Liquor

Certification Code: HER-HER-SL
BCS Number: BCS1214C59
Plant / Site Name: Herriard

Date Received: 17/05/2023
Date Reported: 19/06/2023
Date Sampled: 16/05/2023

Physical contaminants in WD / SL / SF on a fresh weight basis

Parameter	Units	Result	Upper Limit	Pass	Method of Test
Plastics > 2mm	kg / t	0.062			NRM-SOP-JAS-497
Glass > 2mm	kg / t	Zero			NRM-SOP-JAS-497
Metals > 2mm	kg / t	Zero			NRM-SOP-JAS-497
Other > 2mm	kg / t	Zero			NRM-SOP-JAS-497
Total > 2mm	kg / t	0.062	0.22 kg / t	Y*	NRM-SOP-JAS-497
of which Sharps:	kg / t	Zero	Zero in sample tested	Y	NRM-SOP-JAS-497
Stones > 5mm	kg / t	Zero	19.2 kg / t		NRM-SOP-JAS-497

Zero - No visible contaminants were found in the sample as submitted

The sample was dispatched within one day of sampling
The sample was received within 24 hours of dispatch (48 for extreme geographical locations)
The sample was received within 72 hours of dispatch.
The sample was received in a cool box with ice packs

Released by: *Daniel Petty* **Date: 19/06/2023**

REAL BCS Approved Testing Laboratory

PAS110 2014 Certificate of Analysis (Continued)

Client: MICHAL ANTOS
(P427) HERRIARD BIOPOWER LTD
BUSHYWARREN LANE
HERRIARD
BASINGSTOKE
RG25 2NS

Originator: HERRIARD BIOPOWER
SEPARATED LIQUOR

Lab ID:	72388 - 137656	**Certification Code:**	HER-HER-SL	**Date Received:**	17/05/2023
Sample ID:	HBSL160523	**BCS Number:**	BCS1214C59	**Date Reported:**	19/06/2023
Sample Type:	Separated Liquor	**Plant / Site Name:**	Herriard	**Date Sampled:**	16/05/2023

Characteristics of WD / SL / SF for declaration, without limit values, that influence application rates
(Results on an 'as received' basis)

Parameter	Units	Result	M *	Amount per fresh tonne or m^3	Amount applied at an equivalent total Nitrogen application of 250 kg N/ha	Units
pH		8.8	1			
Oven Dry Matter	% m/m	4.34	2	43.40	2127	Kg DM
Loss On Ignition	% m/m	3.04	3	30.40	1490	Kg OM
Total Kjeldahl Nitrogen (N)	% m/m	0.51	4	5.10	250	Kg N
Ammoniacal Nitrogen (NH4-N)	mg/kg	3341	5	3.34	163.78	Kg NH4-N
Total Phosphorus (P)	mg/kg	710	6	1.63	79.70	Kg P2O5
Total Potassium (K)	mg/kg	2512	6	3.01	147.77	Kg K2O
Total Magnesium (Mg)	mg/kg	162	6	0.27	13.18	Kg MgO
Total Sulphur (S)	mg/kg	365	6	0.91	44.73	Kg SO3
Equivalent field application rate		——		1.00	49.02	tonnes or m^3 / ha

*** Method of Test**

1 BS EN 13037
2 BS EN 14346
3 BS EN 15169
4 BS EN 13654-1 (Kjeldahl)
5 Sciantec SOP S1162 (Kjeldahl)
6 BS EN 15587 (soluble in aqua regia)

REAL BCS Approved Testing Laboratory

PAS110 2014 Certificate of Analysis (Continued)

Client: MICHAL ANTOS
(P427) HERRIARD BIOPOWER LTD
BUSHYWARREN LANE
HERRIARD
BASINGSTOKE
RG25 2NS

Originator: HERRIARD BIOPOWER
SEPARATED LIQUOR

Lab ID:	72388 - 137656	**Certification Code:**	HER-HER-SL	**Date Received:**	17/05/2023
Sample ID:	HBSL160523	**BCS Number:**	BCS1214C59	**Date Reported:**	19/06/2023
Sample Type:	Separated Liquor	**Plant / Site Name:**	Herriard	**Date Sampled:**	16/05/2023

Pathogens (human and animal indicator species) **in WD / SL / SF**

Parameter	Units	Result Rep 1	Result Rep 2	Result Rep 3	Result Rep 4	Result Rep 5	Pass	Method of Test
Salmonella		Absent	Absent	Absent	Absent	Absent	Y	Part II schedule of ABP regulations 2005
E. coli	CFU/g	<10	<10	<10	<10	<10	Y	Part III schedule of ABP regulations 2005

For Salmonella spp 5 out of 5 sub-sample results must be ABSENT in the quantity tested.

For Escherichia coli 4 out of 5 sub-sample results must be less than or equal to 1000 CFU/g but none may be greater than 5000 CFU/g.

How does your sample analysis compare with the 'standard' figures for organic manures?

Farmyard Manure	Dry Matter (% DM)	Total Nitrogen (Kg N/t)	Total Phosphate (Kg P2O5/t)	Total Potash (Kg K2O/t)	Total Sulphur (Kg SO3/t)	Total Magnesium (Kg MgO/t)
Cattle FYM	25	6.0	3.2	9.4	2.4	1.8
Pig FYM	25	7.0	6.0	8.0	3.4	1.8
Sheep FYM	25	7.0	3.2	8.0	4.0	2.8
Duck FYM	25	6.5	5.5	7.5	2.6	2.4
Horse FYM	25	5.0	5.0	6.0	1.6	1.5
Goat FYM	40	9.5	4.5	12.0	2.8	1.8

Notes: The 'standard' phosphate & potash availability figures to the next crop grown from Defra's Fertiliser Manual are 60% & 90% respectively.

Poultry Manure	Dry Matter (% DM)	Total Nitrogen (Kg N/t)	Total Phosphate (Kg P2O5/t)	Total Potash (Kg K2O/t)	Total Sulphur (Kg SO3/t)	Total Magnesium (Kg MgO/t)
	20	9.4	8.0	8.5	3.0	2.7
	40	19.0	12.0	15.0	5.6	4.3
	60	28.0	17.0	21.0	8.2	5.9
	80	37.0	21.0	27.0	11.0	7.5

Notes: The 'standard' phosphate & potash availability figures to the next crop grown from Defra's Fertiliser Manual are 60% & 90% respectively.

Cattle & Pig Slurries	Dry Matter (% DM)	Total Nitrogen (Kg N/m3)	Total Phosphate (Kg P2O5/m3)	Total Potash (Kg K2O/m3)	Total Sulphur (Kg SO3/m3)	Total Magnesium (Kg MgO/m3)
Cattle slurry	6.0	2.6	1.2	2.5	0.7	0.6
Dirty water (from cattle)	0.5	0.5	0.1	1.0	0.1	0.1
Separated cattle slurries						
- strainer box liquid	1.5	1.5	0.3	1.5	ND	ND
- weeping wall liquid	3.0	2.0	0.5	2.3	ND	ND
- mechanically separated liquid	4.0	3.0	1.2	2.8	ND	ND
- solid portion after separation	20.0	4.0	2.0	3.3	ND	ND
Pig slurry	4.0	3.6	1.5	2.2	0.7	0.7
Separated pig slurry - liquid	3.0	3.6	1.1	2.0	ND	ND
Separated pig slurry - solid	20.0	5.0	3.7	2.0	ND	ND

Notes: ND = no data.
The 'standard' phosphate & potash availability figures to the next crop grown from Defra's Fertiliser Manual are 50% & 90% respectively (50% & 100% for dirty water).

Biosolids	Dry Matter (% DM)	Total Nitrogen (Kg N/t)	Total Phosphate (Kg P2O5/t)	Total Potash (Kg K2O/t)	Total Sulphur (Kg SO3/t)	Total Magnesium (Kg MgO/t)
Digested cake	25	11.0	11.0	0.6	8.2	1.6
Thermally dried	95	40.0	55.0	2.0	23.0	6.0
Lime stablised	25	8.5	7.0	0.8	7.4	2.4
Composted	40	11.0	10.0	3.0	6.1	2.0

Notes: The 'standard' phosphate & potash availability figures to the next crop grown from Defra's Fertiliser Manual are 50% & 90% respectively.

Other Organic Manures	Dry Matter	Total Nitrogen	Total Phosphate	Total Potash	Total Sulphur	Total Magnesium
Composts	(% DM)	(Kg N/t)	(Kg P2O5/t)	(Kg K2O/t)	(Kg SO3/t)	(Kg MgO/t)
Green compost	60	7.5	3.0	6.8	3.4	3.4
Green/food compost	60	11.0	4.9	8.0	5.1	3.4
Mushroom compost	35	6.0	5.0	9.0	ND	ND
Digestates						
Food-based whole	4.1	4.8	1.1	2.4	0.7	0.2
Food-based separated liquor	3.8	4.5	1.0	2.8	1.0	0.2
Food-based separated fibre	27.0	8.9	10.2	3.0	4.0	2.2
Farm-sourced whole	5.5	3.6	1.7	4.0	0.8	0.6
Farm-sourced separated liquor	3.0	1.9	0.6	2.5	<0.1	0.4
Farm-sourced separated fibre	24.0	5.6	4.7	6.0	1.2	1.8
Paper Crumble						
Chemically / physically treated	40	2.0	0.4	0.2	0.6	1.4
Biologically treated	30	7.5	3.8	0.4	2.4	1.0
Water Treatment Cake						
Water treatment cake	25	2.4	3.4	0.4	5.5	0.8
Food industry 'wastes'	(% DM)	(Kg N/m3)	(Kg P2O5/m3)	(Kg K2O/m3)	(Kg SO3/m3)	(Kg MgO/m3)
Dairy waste	4	1.0	0.8	0.2	ND	ND
Soft drinks waste	4	0.3	0.2	Trace	ND	ND
Brewing waste	7	2.0	0.8	0.2	ND	ND
General food waste	5	1.6	0.7	0.2	ND	ND

Notes: ND = no data.

The 'standard' figures for the above organic manures have been taken from Defra's Fertiliser Manual 2017 (RB209) 9th edition and the corresponding PLANET version 3 software. Further information on fertiliser recommendations for organic manures can be obtained from the Fertiliser Manual or from a FACTS qualified adviser.

REAL BCS Approved Testing Laboratory

PAS110 2014 Certificate of Analysis

Client:	MICHAL ANTOS	**Originator:**	BUSHYWARREN LANE
(P427)	HERRIARD BIOPOWER LTD		SEPARATED FIBRE
	BUSHYWARREN LANE		
	HERRIARD		
	BASINGSTOKE		
	RG25 2NS		

Lab ID:	94959 - 152281	**Certification Code:**	BCS-OUTPUT-0008	**Date Received:**	12/10/2023
Sample ID:	HBSF111023	**BCS Number:**		**Date Reported:**	15/11/2023
Sample Type:	Separated Fibre	**Plant / Site Name:**	Bushywarren Lane	**Date Sampled:**	11-10-2023

Potentially Toxic Elements in WD / SL / SF, on a fresh weight basis

Parameter	Units	Result	Upper Limit	Pass	Method of Test
Cadmium (Cd)	mg/kg	<0.1	0.72 mg / kg	Y	BS EN 13650 (soluble in aqua regia)
Chromium (Cr)	mg/kg	<2	48 mg / kg	Y	BS EN 13650 (soluble in aqua regia)
Copper (Cu)	mg/kg	4.06	96 mg / kg	Y	BS EN 13650 (soluble in aqua regia)
Lead (Pb)	mg/kg	<1	96 mg / kg	Y	BS EN 13650 (soluble in aqua regia)
Mercury (Hg)	mg/kg	<0.1	0.48 mg / kg	Y	BS ISO 16772
Nickel (Ni)	mg/kg	1.20	24 mg / kg	Y	BS EN 13650 (soluble in aqua regia)
Zinc	mg/kg	19.2	192 mg / kg	Y	BS EN 13650 (soluble in aqua regia)

Stability of WD / SL / SF on a fresh weight basis

Parameter	Units	Result	Upper Limit	Pass	Method of Test
Volatile Fatty Acids	g COD / g VS	N/A	0.774 g VS		Chromatography
Residual Biogas Potential	l / g VS	0.13	0.45 l / g VS	Y	OFW004-005 (WRAP)

Parameter	Units	Digestate Result *	QC Result **	Inoculum Result ***
RBP 1st Replicate	l / g VS	0.12	0.55	0.03
RBP 2nd Replicate	l / g VS	0.13	NR (2)	0.03
RBP 3rd Replicate	l / g VS	0.14	0.52	0.03

28 day plot of biogas results for sample, inoculum and QC can be emailed as a PDF file on request.
NR (2) = No result due to equipment failure
VFAs expressed as COD equivalent. Used as a pre-screening method: high VFA concentration indicates high potential biodegradability.
Samples with VFA concentrations above 0.774 g COD / g VS are expected to fail on RBP.
Test is valid as no spikes or inconsistencies were observed, the plots were smooth for all replicates.
All quality control criteria have been met.

* The digestate RBP is allowed to be negative only during the first 5 days of the test.

** The reference material RBP is allowed to be negative only during the first 5 days of the test. The 28-day RBP of the reference material should exceed 0.5 l/g VS

*** The inoculum control should produce a measurable volume of biogas over the 28 day period.

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Testing Laboratory

PAS110 2014 Certificate of Analysis (Continued)

Client: **(P427)** MICHAL ANTOS
HERRIARD BIOPOWER LTD
BUSHYWARREN LANE
HERRIARD
BASINGSTOKE
RG25 2NS

Originator: BUSHYWARREN LANE
SEPARATED FIBRE

Lab ID:	94959 - 152281	**Certification Code:**	BCS-OUTPUT-0008	**Date Received:**	12/10/2023
Sample ID:	HBSF111023	**BCS Number:**		**Date Reported:**	15/11/2023
Sample Type:	Separated Fibre	**Plant / Site Name:**	Bushywarren Lane	**Date Sampled:**	11-10-2023

Physical contaminants in WD / SL / SF on a fresh weight basis

Parameter	Units	Result	Upper Limit	Pass	Method of Test
Plastics > 2mm	kg / t	0.040			NRM-SOP-JAS-497
Glass > 2mm	kg / t	Zero			NRM-SOP-JAS-497
Metals > 2mm	kg / t	Zero			NRM-SOP-JAS-497
Other > 2mm	kg / t	Zero			NRM-SOP-JAS-497
Total > 2mm	kg / t	0.040	0.22 kg / t	Y*	NRM-SOP-JAS-497
of which Sharps:	kg / t	Zero	Zero in sample tested	Y	NRM-SOP-JAS-497
Stones > 5mm	kg / t	Zero	19.2 kg / t		NRM-SOP-JAS-497

Zero - No visible contaminants were found in the sample as submitted

The sample was dispatched within one day of sampling
The sample was received within 24 hours of dispatch (48 for extreme geographical locations)
The sample was received within 72 hours of dispatch.
The sample was received in a cool box with ice packs

Released by: *Myles Nicholson* **Date: 15/11/2023**

REAL BCS Approved Testing Laboratory

PAS110 2014 Certificate of Analysis (Continued)

Client: MICHAL ANTOS
(P427) HERRIARD BIOPOWER LTD
BUSHYWARREN LANE
HERRIARD
BASINGSTOKE
RG25 2NS

Originator: BUSHYWARREN LANE
SEPARATED FIBRE

Lab ID:	94959 - 152281	**Certification Code:**	BCS-OUTPUT-0008	**Date Received:**	12/10/2023
Sample ID:	HBSF111023	**BCS Number:**		**Date Reported:**	15/11/2023
Sample Type:	Separated Fibre	**Plant / Site Name:**	Bushywarren Lane	**Date Sampled:**	11-10-2023

Characteristics of WD / SL / SF for declaration, without limit values, that influence application rates
(Results on a dry matter basis)

Parameter	Units	Result	M *	Amount per fresh tonne or m³	Amount applied at an equivalent total Nitrogen application of 250 kg N/ha	Units
pH		9.1	1			
Oven Dry Matter	% m/m	28.5	2	285.00	13022	Kg DM
Loss On Ignition	% m/m	89.1	3	253.93	11602	Kg OM
Total Nitrogen (N)	% m/m	1.92	4	5.47	250	Kg N
Ammoniacal Nitrogen (NH4-N)	mg/kg	1109	5	0.32	14.44	Kg NH4-N
Total Phosphorus (P)	% m/m	0.659	6	4.30	196.51	Kg P2O5
Total Potassium (K)	% m/m	1.39	6	4.75	217.20	Kg K2O
Total Magnesium (Mg)	% m/m	0.268	6	1.27	57.93	Kg MgO
Total Sulphur (S)	% m/m	0.345	6	2.46	112.31	Kg SO3
Equivalent field application rate		——		1.00	45.69	tonnes or m³ / ha

*** Method of Test**

1 BS EN 13037
2 BS EN 14346
3 BS EN 15169
4 BS EN 13654-2 (Dumas)
5 NRM-SOP-JAS-083 (soluble in potassium chloride)
6 BS EN 13650 (soluble in aqua regia)

REAL BCS Approved Testing Laboratory

PAS110 2014 Certificate of Analysis (Continued)

Client: MICHAL ANTOS
(P427) HERRIARD BIOPOWER LTD
BUSHYWARREN LANE
HERRIARD
BASINGSTOKE
RG25 2NS

Originator: BUSHYWARREN LANE
SEPARATED FIBRE

Lab ID: 94959 - 152281
Sample ID: HBSF111023
Sample Type: Separated Fibre

Certification Code: BCS-OUTPUT-0008
BCS Number:
Plant / Site Name: Bushywarren Lane

Date Received: 12/10/2023
Date Reported: 15/11/2023
Date Sampled: 11-10-2023

Pathogens (human and animal indicator species) **in WD / SL / SF**

Parameter	Units	Result Rep 1	Result Rep 2	Result Rep 3	Result Rep 4	Result Rep 5	Pass	Method of Test
Salmonella		Absent	Absent	Absent	Absent	Absent	Y	Part II schedule of ABP regulations 2005
E. coli	CFU/g	<100	<100	<100	<100	<100	Y	Part III schedule of ABP regulations 2005

For Salmonella spp 5 out of 5 sub-sample results must be ABSENT in the quantity tested.
For Escherichia coli 4 out of 5 sub-sample results must be less than or equal to 1000 CFU/g but none may be greater than 5000 CFU/g.
Salmonella & E Coli testing is sub-contracted to a UKAS accredited testing laboratory which also meets the requirements for DEFRA ABPR testing.

How does your sample analysis compare with the 'standard' figures for organic manures?

Farmyard Manure	Dry Matter (% DM)	Total Nitrogen (Kg N/t)	Total Phosphate (Kg P2O5/t)	Total Potash (Kg K2O/t)	Total Sulphur (Kg SO3/t)	Total Magnesium (Kg MgO/t)
Cattle FYM	25	6.0	3.2	9.4	2.4	1.8
Pig FYM	25	7.0	6.0	8.0	3.4	1.8
Sheep FYM	25	7.0	3.2	8.0	4.0	2.8
Duck FYM	25	6.5	5.5	7.5	2.6	2.4
Horse FYM	25	5.0	5.0	6.0	1.6	1.5
Goat FYM	40	9.5	4.5	12.0	2.8	1.8

Notes: The 'standard' phosphate & potash availability figures to the next crop grown from Defra's Fertiliser Manual are 60% & 90% respectively.

Poultry Manure	Dry Matter (% DM)	Total Nitrogen (Kg N/t)	Total Phosphate (Kg P2O5/t)	Total Potash (Kg K2O/t)	Total Sulphur (Kg SO3/t)	Total Magnesium (Kg MgO/t)
	20	9.4	8.0	8.5	3.0	2.7
	40	19.0	12.0	15.0	5.6	4.3
	60	28.0	17.0	21.0	8.2	5.9
	80	37.0	21.0	27.0	11.0	7.5

Notes: The 'standard' phosphate & potash availability figures to the next crop grown from Defra's Fertiliser Manual are 60% & 90% respectively.

Cattle & Pig Slurries	Dry Matter (% DM)	Total Nitrogen (Kg N/m3)	Total Phosphate (Kg P2O5/m3)	Total Potash (Kg K2O/m3)	Total Sulphur (Kg SO3/m3)	Total Magnesium (Kg MgO/m3)
Cattle slurry	6.0	2.6	1.2	2.5	0.7	0.6
Dirty water (from cattle)	0.5	0.5	0.1	1.0	0.1	0.1
Separated cattle slurries						
- strainer box liquid	1.5	1.5	0.3	1.5	ND	ND
- weeping wall liquid	3.0	2.0	0.5	2.3	ND	ND
- mechanically separated liquid	4.0	3.0	1.2	2.8	ND	ND
- solid portion after separation	20.0	4.0	2.0	3.3	ND	ND
Pig slurry	4.0	3.6	1.5	2.2	0.7	0.7
Separated pig slurry - liquid	3.0	3.6	1.1	2.0	ND	ND
Separated pig slurry - solid	20.0	5.0	3.7	2.0	ND	ND

Notes: ND = no data.
The 'standard' phosphate & potash availability figures to the next crop grown from Defra's Fertiliser Manual are 50% & 90% respectively (50% & 100% for dirty water).

Biosolids	Dry Matter (% DM)	Total Nitrogen (Kg N/t)	Total Phosphate (Kg P2O5/t)	Total Potash (Kg K2O/t)	Total Sulphur (Kg SO3/t)	Total Magnesium (Kg MgO/t)
Digested cake	25	11.0	11.0	0.6	8.2	1.6
Thermally dried	95	40.0	55.0	2.0	23.0	6.0
Lime stablised	25	8.5	7.0	0.8	7.4	2.4
Composted	40	11.0	10.0	3.0	6.1	2.0

Notes: The 'standard' phosphate & potash availability figures to the next crop grown from Defra's Fertiliser Manual are 50% & 90% respectively.

Other Organic Manures	Dry Matter	Total Nitrogen	Total Phosphate	Total Potash	Total Sulphur	Total Magnesium
Composts	(% DM)	(Kg N/t)	(Kg P2O5/t)	(Kg K2O/t)	(Kg SO3/t)	(Kg MgO/t)
Green compost	60	7.5	3.0	6.8	3.4	3.4
Green/food compost	60	11.0	4.9	8.0	5.1	3.4
Mushroom compost	35	6.0	5.0	9.0	ND	ND
Digestates						
Food-based whole	4.1	4.8	1.1	2.4	0.7	0.2
Food-based separated liquor	3.8	4.5	1.0	2.8	1.0	0.2
Food-based separated fibre	27.0	8.9	10.2	3.0	4.0	2.2
Farm-sourced whole	5.5	3.6	1.7	4.0	0.8	0.6
Farm-sourced separated liquor	3.0	1.9	0.6	2.5	<0.1	0.4
Farm-sourced separated fibre	24.0	5.6	4.7	6.0	1.2	1.8
Paper Crumble						
Chemically / physically treated	40	2.0	0.4	0.2	0.6	1.4
Biologically treated	30	7.5	3.8	0.4	2.4	1.0
Water Treatment Cake						
Water treatment cake	25	2.4	3.4	0.4	5.5	0.8
Food industry 'wastes'	(% DM)	(Kg N/m3)	(Kg P2O5/m3)	(Kg K2O/m3)	(Kg SO3/m3)	(Kg MgO/m3)
Dairy waste	4	1.0	0.8	0.2	ND	ND
Soft drinks waste	4	0.3	0.2	Trace	ND	ND
Brewing waste	7	2.0	0.8	0.2	ND	ND
General food waste	5	1.6	0.7	0.2	ND	ND

Notes: ND = no data.

The 'standard' figures for the above organic manures have been taken from Defra's Fertiliser Manual 2017 (RB209) 9th edition and the corresponding PLANET version 3 software. Further information on fertiliser recommendations for organic manures can be obtained from the Fertiliser Manual or from a FACTS qualified adviser.

Appendix G CHP1 and CHP2 technical specification

Technical data   1200 kWel; 400 V, 50 Hz; Sewage gas

MWM Energy. Efficiency. Environment.

Design conditions

Comb. air temperature / rel. Humidity:	[°C / %]	25 / 60
Altitude:	[m]	100
Exhaust temp. after heat exchanger:	[°C]	180
NO_x Emission (tolerance - 8%):	[mg/m³n]	500

Genset:

Engine:	**TCG2020V12.**	
Speed:	[1/min]	1500
Configuration / number of cylinders:	[-]	V / 12
Bore / Stroke / Displacement:	[mm / mm / dm³]	170 / 195 / 53
Compression ratio:	[-]	13,5
Mean piston speed:	[m/s]	9,8
Mean lube oil consumption at full load:	[g/kWh]	0,2
Engine-management-system:	[-]	TEM EVO
Generator:	**Marelli MJB 450 LB4**	
Voltage / voltage range / frequency:	[V / % / Hz]	400 / ±5 / 50
Speed:	[1/min]	1500

Fuel gas data:

MWM Methane number:		[-]	134
Lower calorific value:		[kWh/m³]	6,48
Gas density:		[kg/m³n]	1,16
Standard gas:	Sewage gas		
Analysis:	CO_2	[Vol%]	35
	N_2	[Vol%]	0
	O_2	[Vol%]	0
	H_2	[Vol%]	0
	CO	[Vol%]	0
	CH_4	[Vol%]	65
	C_2H_6	[Vol%]	0
	C_3H_8	[Vol%]	0
	C_4H_{10}	[Vol%]	0
	C_xH_y	[Vol%]	0
	H_2S	[Vol%]	0

Energy balance

Load:	[%]	100	75	50
Electrical power COP acc. ISO 8528-1:	[kW]	**1200**	**900**	**600**
Generator efficiency with cos Phi = 1 / ind	[%]	97,4	97,3	96,8
Engine power acc. ISO 3046-1:	[kW]	1232	925	620
Engine jacket water heat:	[kW ±8%]	626	466	333
Intercooler LT heat:	[kW ±8%]	93	68	43
Lube oil heat:	[kW ±8%]			
Exhaust heat with temp. after heat exchanger:	[kW ±8%]	564	462	346
Exhaust temperature:	[°C]	459	482	506
Exhaust mass flow, wet:	[kg/h]	6526	4920	3396
Combustion mass air flow - ISO 3046/1:	[kg/h]	6017	4530	3122
Radiation heat engine / generator:	[kW ±8%]	41 / 32	39 / 25	38 / 20
Fuel consumption:	[kW +5%]	2852	2184	1534
electrical /mechanical / thermal efficiency:	[%]	42,1 / 43,2 / 41,7	41,2 / 42,4 / 42,5	39,1 / 40,4 / 44,2
Total efficiency:	[%]	83,8	83,7	83,3

System parameters [1)]

Ventilation air flow (comb. air incl.) with ΔT = 15 K	[kg/h]	30100
Combustion air temperature minimum / design:	[°C]	20 / 25
Exhaust back pressure from / to:	[mbar]	30 / 50
Maximum pressure loss in front of air cleaner:	[mbar]	5
Zero-pressure gas control unit selectable from / to: [2)]	[mbar]	20 / 300
Pre-pressure gas control unit selectable from / to: [2)]	[bar]	0,5 / 10
Starter battery 24V, capacity required:	[Ah]	430
Starter motor:	[kWel. / VDC]	15 / 24
Lube oil content engine / base frame:	[dm³]	205 / -
Dry weight engine / genset:	[kg]	5080 / 10600

Cooling system

Glycol content engine jacket water / intercooler:	[% Vol.]	35 / 35
Water volume engine jacket / intercooler:	[dm³]	111 / 20
KVS / Cv value engine jacket water / intercooler:	[m³/h]	42 / 30
Jacket water coolant temperature in / out:	[°C]	80 / 93
Intercooler coolant temperature in / out:	[°C]	50 / 53
Engine jacket water flow rate from / to:	[m³/h]	36 / 56
Water flow rate engine jacket water / intercooler:	[m³/h]	44 / 35
Water pressure loss engine jacket water / intercooler:	[bar]	1,1 / 1,4

1) See also MWM "Layout of power plants":   2) See also Techn. Circular 0199-99-3017

Engine noise level	Octave band centre frequency 63	125	250	500	1000	2000	4000	8000	Sum level (distance 1 meter)
Exhaust noise [dB(lin)]	116	123	122	119	111	110	108	107	**120 dB(A)** (±2,5 dB(A))
Air-borne noise [dB(lin)]	92	104	104	100	99	96	99	99	**106 dB(A)** (±1,0 dB(A))

Appendix H Uniflare UF10-500 technical specification

Uniflare Group

Unit 19

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UF10-500-BGF BIOGAS CONTROLLED COMBUSTION FLARE

BASINGSTOKE

HERRIAD BIOPOWER

Job No 1836

Document Control Sheet

O&M Manual Reference number	1836 UF10-500-BGF/OM/01	
	Number	**Date**
Version	01	29/09/2022
	Initials	**Date**
Manual prepared by	GW	29/09/2022
Checked by		
Approved by		

Description

High Temperature Flarestack (FL-1)

Stack Calculation

Calculation of retention time
Calculation of composition of combustion products to BS 5854
Per one volume of fuel @ 15 deg C and 1013 mbar

Constituent	**Percentage in fuel**	**Relative density**	**Relative density fuel to air**
Methane CH_4	65%	0.554	0.3601
Carbon Dioxide CO_2	35%	1.5198	0.53193
	100%	OK	0.89203
Stoichiometric air per unit volume of methane is 9.55			
Biogas flow rate		500 m^3/hour	325 m^3/hr CH_4
Min air required		3103.75 m^3/hour	
Excess air		200%	
Specific volume of air		0.819 m^3/kg	
Mass flow rate of air		11369 kg/hr	
Mass flowrate of biogas		545 kg/hr	
Total mass flow rate		11914 kg/hr	
Fuel gases above their dew point have a specific volume similar to air at the relevant temperature			
Volume of 1kg of flue gases @ 1000 deg C		4 m^3/kg	
Therefore volume flow rate		45498 m^3/hr	
		13 m^3/sec	
Hot face diameter		1.183 m	
Area		1.10 m^2	
Velocity		11.5 m/sec	
Height above flame		5.5 m	
Retention time		0.48 sec	
Retention time at sample port 1		0.39 sec	Port 1m down from top
Heat release turn down ratio		5:1	
Combustion heat release at full load		3.24 MW	
Minimum heat release		0.65 MW	
EA Guidance on Landfill Gas Flaring 4.8.7 Page 24			

Structure

The flarestack is a 500 m^3/ hour controlled combustion ground flare with cyclonic action burners. At full load, with a gas quality of 65% CH_4 and a combustion temperature of 1,000°C the retention time is greater than 0.3 seconds

Machine type	UF10-500 Biogas booster and controlled combustion ground flare.
Use environment	Landfill site in open air with restricted access and supervised by trained personnel.
Maximum design emissions Normalised at 0°C, 101.3 kPa and 3% O_2:	Carbon monoxide (CO) 50 mg Nm^{-3} Oxides of nitrogen (NO_x) 100 mg Nm^{-3} Total volatile organic carbon as carbon 10 mg Nm^{-3} Non-methane volatile organic carbon 5 mg Nm^{-3}
Operation	Unattended
Media	Biogas containing Methane 30% to 65%v/v Hydrogen sulphide 0 to 1 000 ppm
Design Flow assuming 1.292 kg m^{-3} density landfill gas	500 m3h-1 @ 0mbarg + 105 mbarg pressure lift
Turn down	5:1
Combustion temperature	1 000°C
Combustion minimum retention time	0.3 seconds
Biogas Inlet Flange (BS EN 1092-2: 1997) DN100 PN16	
<u>Control system</u> UNIFLARE standard complete with sun & weather protection roof connecting to site control	

Appendix I Uniflare UF10-1000 technical specification

Uniflare Group

Unit 19

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UF10-1000-BGF BIOGAS CONTROLLED COMBUSTION FLARE

BASINGSTOKE

HERRIAD BIOPOWER

Job No 1837

Document Control Sheet

O&M Manual Reference number	1836 UF10-500-BGF/OM/01	
	Number	**Date**
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Methane CH_4	65%	0.554	0.3601
Carbon Dioxide CO_2	35%	1.5198	0.53193
	100%	OK	0.89203
Stoichiometric air per unit volume of methane is 9.55			
Biogas flow rate		1000 m^3/hour	650 m^3/hr CH_4
Min air required		6207.5 m^3/hour	
Excess air		200%	
Specific volume of air		0.819 m^3/kg	
Mass flow rate of air		22738 kg/hr	
Mass flowrate of biogas		1089 kg/hr	
Total mass flow rate		23827 kg/hr	
Fuel gases above their dew point have a specific volume similar to air at the relevant temperature			
Volume of 1kg of flue gases @ 1000 deg C		4 m^3/kg	
Therefore volume flow rate		90996 m^3/hr	
		25 m^3/sec	
Hot face diameter		1.673 m	
Area		2.20 m^2	
Velocity		11.5 m/sec	
Height above flame		5.5 m	
Retention time		0.48 sec	
Retention time at sample port 1		0.39 sec	Port 1m down from top
Heat release turn down ratio		5:1	
Combustion heat release at full load		6.48 MW	
Minimum heat release		1.30 MW	
EA Guidance on Landfill Gas Flaring 4.8.7 Page 24			

Structure

The flarestack is a 1000 m^3/ hour controlled combustion ground flare with cyclonic action burners. At full load, with a gas quality of 65% CH_4 and a combustion temperature of 1,000°C the retention time is greater than 0.3 seconds

Machine type	UF10-1000 Biogas booster and controlled combustion ground flare.
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Maximum design emissions Normalised at 0°C, 101.3 kPa and 3% O_2:	Carbon monoxide (CO) 50 mg Nm^{-3} Oxides of nitrogen (NO_x) 100 mg Nm^{-3} Total volatile organic carbon as carbon 10 mg Nm^{-3} Non-methane volatile organic carbon 5 mg Nm^{-3}
Operation	Unattended
Media	Biogas containing Methane 30% to 65%v/v Hydrogen sulphide 0 to 1 000 ppm
Design Flow assuming 1.292 kg m^{-3} density landfill gas	1000 m3h-1 @ 0mbarg + 105 mbarg pressure lift
Turn down	5:1
Combustion temperature	1 000°C
Combustion minimum retention time	0.3 seconds
Biogas Inlet Flange (BS EN 1092-2: 1997) DN150 PN16	
<u>Control system</u> UNIFLARE standard complete with sun & weather protection roof connecting to site control	

Appendix J Biofilter manual and details

Biofilter System Details,
Construction & Operation Manual

Herriard Bio Power Site
Bushywarren Lane
Herriard
Basingstoke
Hampshire
RG25 2NS

Prepared for

RKE Bio-group,

Office Suite,
Wealden House,
First Floor,
Lewes Rd,
East Grinstead.
RH19 3TB

V.3 – December 2021

Contents

Preface

This report has been prepared by Mike Thompson Associates Ltd (MTP), and associated consultants as necessary, with all reasonable care, skill & diligence.

Information reported herein is based on the interpretation of data collected from various sources which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the client named in the report header and only for the project also detailed in the header. No warranties are expressed or should be inferred by any third parties. This report should not be relied upon by other parties without written consent from MTP.

MTP disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the works.

Evaluations and conclusions detailed herein do not preclude the presence of other issues on site, which could not be reasonably have been revealed by this report or the assessment detailed herein.

Civils works shown within this report are to be taken as a guide only and may be amended as required by site contractors in the light of experience or site conditions.

Where proprietary, branded equipment, media or items are detailed as preferred components in this project documentation, these are referred to and recommended as they are produced to a consistently high, documented specification and performance value and are able to deliver that performance as required for this project.

Alternative equipment, media or items may be used for the sake of expediency or cost, but these must be of demonstrably equivalent specification & performance to the proprietary items. If this is not so, then the overall efficiency and efficacy of the biofilter and odour control system cannot be guaranteed.

The same caveat must be recognised for equipment designed and manufactured specifically for this project, such as ductwork, venting or fan systems. Where such has been undertaken by experienced suppliers or design engineers, the supplied equipment would be specified and documented to be capable of meeting the performance requirements of the project. Where alternatives have been sourced for the sake of expediency or cost, these must be supported by competent design & performance specifications & guarantees. If this is not so, then the overall efficiency and efficacy of the biofilter and odour control system cannot be guaranteed.

1.0 Biofilter Design Rationale

The following requirements must be achieved to meet BAT for the biofilter installation.

This section details how these requirements are met.

1.1. Effective System and Biofilter Design Requirements

- Minimum 3 air changes per hour for the building
- Minimisation of dead spaces
- Air & odour flows from low odour to high odour to biofilter
- High odour areas should be away from access, etc
- Residence time should be between 30 & 60 seconds
- Provisions must be made to add water and remove bed drainage
- Media depth of >1m and <2m
- Dust and aerosols absent from airflow
- Air flow distribution via plenum before passing to media
- Humidity of inlet air

1.2. Media Selection Requirements

- Demonstrate adequate residence times
- Sufficient sorption capacity for contaminants and microbiobial attachment
- Living space and reserve nutrients for micro-organisms
- Media water/moisture content – 50 to 80% by weight
- Structural support to maintain internal structure
- Media temperature – near ambient – 15- 35 or $40^{o}C$
- Media pH – 7 to 8.5
- Biologically active, but reasonably stable
- Organic matter content >60%
- Porous and friable with 75 to 90% void volume
- Resistant to waterlogging and compaction
- Relatively low fines content to reduce gas head loss
- Relatively free of residual odour

1.3. Minimum 3 air changes per hour for the building

1.1.1. The system will give the buildings 3 air changes per hour.

1.1.2. The system is equipped with a single large fan, rated at c.20,000m^3 per hour maximum. This gives the required airflow.

1.1.3. The number of air changes may be reduced by slowing down the fan.
This may be appropriate for periods when waste processing is not taking place to reduce the power requirements of the system.

1.2. Minimisation of dead spaces

1.2.1. The main flow of air into the buildings will be through doorways or one-way inlet louvres placed as required.
Venting for the tanks will be through sleeved top vents, exhausting to the ducting system.

1.2.2. Exhausts from the buildings will be through one-way louvres into fan ducts located as shown.

1.2.3. The louvres are set to only allow air to flow through the building in one direction towards the biofilter. Their spacing is such to promote air flow through the building.

1.2.4. Odour pooling and air flow eddies may be an issue. This can be caused by dead spots in the building, flow obstruction from installed plant or air currents from the cooling fans on processing equipment.

1.2.5. Additional small one-way wall louvres (c.450mmx450mm) may be added to the buildings, should this be necessary. If used, these will act as additional inlets to disrupt any pooling within the building close to the gable ends.

1.2.6. As well as or as instead of these additional vents, small air moving fans may be used to amend the internal air currents and so promote a more effective cross flow through the building.

1.3. Air & odour flows from low odour to high odour to biofilter

1.3.1. The main flow of air through the building will be from low odour areas to high odour (processing & storage) to biofilter

1.3.2. The incoming waste storage and blending areas are located directly below the exhaust louvre to the biofilter. Odour generated here is drawn straight into the biofilter.

1.4. High odour areas should be away from access, etc

1.4.1. The internal layout of the Reception Barn means that most of the waste reception and storage will be away from the main vehicle and access doors.

1.4.2. To reduce open time, the vehicle door will use fast close mechanisms.

1.4.3. The air flow control louvres ensure that, should the wind direction be against a vehicle door when it opens, any increase in air pressure within the building assists the airflow through the biofilter as opposed to working against it.

1.5. Residence time should be between 30 & 60 seconds

1.5.1. Residence time for biofilters is measured as Empty Bed Residence Time (EBRT).

1.5.2. BAT requires that a biofilter have a minimum EBRT of between 30 & 60 seconds, the longer EBRT being required for more odorous exhausts.

1.5.3. This system gives an average EBRT of c.30seconds.
This will be sufficient on this site. The Reception Barn is not large enough to allow excessive storage of incoming waste and the whole storage area will be cleared to the floor every week, so ensuring waste within the Reception barn is relatively fresh.

1.6. Provisions must be made to add water and remove bed drainage

1.6.1. The floor of the biofilter chamber (under the plenum) is furnished with its own sealed drainage system.

1.6.2. The biofilter will also be fitted with an irrigation system to wet the media surface should this prove necessary.

1.6.3. As the air exiting the buildings will be of high humidity, irrigation will only be required through the summer months when called for by regular inspections.

1.7. **Media depth of >1m or <2m**

1.7.1. The media in the biofilter will be c.3.0m deep, above a c.400mm deep (air void) plenum.

1.7.2. This is deeper than the maximum 2m set down in BAT.

1.7.3. Woodchip media will support a 3.0m deep media bed. The deeper bed depth assists air flow and distribution.

1.7.4. This deeper bed depth also reduces the chance of tracking or bypassing within the media. Some tracking or differential flow may occur but the deeper media depth means the airflow has more time within the media, even if such instances take place.

1.8. Dust and aerosols absent from airflow

1.8.1. Dust and aerosols will not be present in the exhaust from the buildings due to the nature of the material being processed within the shed.

1.9. Air flow distribution via plenum before passing to media

1.9.1. The plenum below the media will be formed using the proprietary HAHN Biofilter Flooring System. This has a large, unobstructed void space and is resistant to damp and chemical attack.

1.9.2. The plenum will be c.400mm deep (air void), so allowing the exhaust air to dissipate evenly across the whole base of the biofilter, presenting an even flow and pressure to the base of the media.

1.9.3. All louvres are protected by grids to prevent the ingress of foreign matter that will either impede the louvre or plenum air flow.

1.10. Humidity of inlet air

1.10.1. The exhaust air going to the biofilter is relatively humid, coming from directly above the waste storage bays.

1.10.2. Should the humidity drop, the biofilter can be watered if required.

1.10.3. Wood chip media is very resistant to drying, especially as the inlet air will be at ambient temperature and relatively moist.
However, should media drying become an issue, it is possible and practical to place an atomiser into the exhaust air stream within the top of the stack if needed. These can be timer controlled to give the cover required.

2.0 Biofilter Construction Notes

To be read in conjunction with the attached figures.
Both notes and figures are to be taken as a guide for the system construction. Amendments may be made due to site conditions or engineering requirements.
Should amendments be made, the system should be re-assessed to ensure it still meets the BAT requirements.

2.1. Order of Construction

2.1.1. An order for the civils works for the biofilter is suggested below.
This is a guide and not an exhaustive list.

2.1.2. The construction contractor is to provide RAMS and work safe procedures of work to cover the civils works required for the biofilter works.

2.1.3. The area should be checked for services as per normal site practise.
The chamber adjacent to the road kerb will have to be moved into the road to allow room for the biofilter.
The lightning rod at the corner of the Reception Barn will need to be moved.
The following assumes all services are clear of the construction area or have been relocated, as required.

2.1.4. Set the end column for the panel wall

2.1.5. Excavate and pour the foundations for the panel wall.
The top of this foundation should be at the same level as the concrete pad for the old odour control unit.
This foundation should be designed by the contractor to ensure it is suitable for the site conditions.
Starter bars should be included at each end of the foundation to tie in the foundations for the lego block walls.

2.1.6. Place the base 3 panels.
Sikaflex (or similar) should be used to seal between the panels.

2.1.7. Pour a minimum 150mm deep concrete infill behind the panels, between the Reception Barn columns, to form an air seal to the base of the panels.
The top level of this pour should be higher than the floor of the Reception Barn to stop liquid creeping out from under the Reception Barn wall over time.

2.1.8. Place the rest of the concrete panels to form the back wall of the biofilter.
Again, Sikaflex (or similar) should be used to seal between the panels.

2.1.9. Place the drainage run for the biofilter, alongside the existing concrete pad.
The risers should be taken to c.200mm above the level of the existing concrete pad.

2.1.10. Pour the foundation for the lego block walls, to the same level as the concrete pad for the old odour control unit.
Place a hardcore base within the foundation ring, outside the existing concrete pad.

2.1.11. Place the lower 2 lifts of the lego block walls.
A large bead of Sikaflex should be placed along the block between the lugs and up the sides to give a seal. The inside of the block joints should be caulked with Sikaflex as well.

2.1.12. Pour the inner floor of the biofilter, to a level c.100mm above the level of the existing concrete pad and over the top of the pad, within the placed walls.

If required, expansion joints may be placed against the walls and across the floor but these must be sealed when the floor has cured.
This single pour floor will provide a good air seal to the base of the walls.
The floor should be laid flat, with no fall.
A tamped surface will suffice.

2.1.13. Once the floor has set, cut the drainage risers off level with the top of the new floor. Do not place any grates over the top of the pipes.

2.1.14. Place the Hahn air floor units, starting at the corner with the new column. Follow the Hahn instructions for laying the floor.
The Hahn floor panels can be cut to fit as required as the air floor reaches the opposite walls. Final cuts should retain the bracer ribs under the panels so the legs can be placed.
There will be a small gap around the floor once the panels have been set. This can be closed by laying a geotextile mesh when placing the biofilter media or by cable tying a suitable pipe along the edges of the panels in the gap (as shown in the drawings).

2.1.15. Lie one of the stack braces on the surface of the floor panels and mark the centre of the ring on the floor.

2.1.16. The stack should stand 2.4m away from the concrete panel wall.
Place the base plate on the floor, locating it with the marks drawn.
Mark the inner and outer limits of the base plate.
Lift the base plate and put a bead of Tiger Seal (www.eurocarparts.com) along the ribs of the floor panels. This will bond the base plate to the panels.
Put the base plate on the panels in the location marked & over the Tiger Seal, press down & leave overnight for the Tiger Seal to cure.
Once the Tiger Seal has cured, cut out the panels to the pattern shown in Figure 4. Do not cut any of the strengthening ribs under the panels.
Once the cut outs are done, drill 8 bolt holes in the base plate and down through the air floor panels. Make sure these are outside the footprint of the stack.
Put 8 M10 stainless steel bolts down through the base plate and floor panel and bolt the base plate to the air floor below. Big washers will be needed on each end of the bolt.

2.1.17. Stand the stack on the base plate.
Place the 2 bracers between the stack and the panel wall, rawl bolting the bracers to the wall, making sure the stack is in the correct position.
Tighten the ring around the stack.
A thick rubber strip can be used between the stack and bracer ring if required but is not necessary.
Once the bracers are in place, 8 150mm stainless steel angle brackets should be placed around the base of the stack. These should be drilled & coach bolted (M10 stainless steel coach bolts) to both the stack and base plate.
After placing the brackets, a 50mm fillet of Sikaflex should be placed around the base of the stack, sealing it to the base plate.

2.1.18. Once the Hahn Air Floor and stack are in place, position the rest of the lego block walls.

2.1.19. Ensure the gap around the edge of the air floor is closed (see Section 2.1.14) and place the biofilter media.
If a telehandler is to be used, take care not to bounce air floor panels out while filling the biofilter.
Close to the stack, media should be placed by hand. Do not drop media close to the stack with a telehandler as it will knock the stack out of true.
The biofilter should be filled to the top of the walls, domed up along the centre line of the biofilter by c.200mm.

2.1.20. Once the media is in place, fit the hand rails around the side of the biofilter walls.

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2.1.21. Drill & fit the monitoring point so it lies beneath the air floor, so allowing access to the plenum. This is shown in Figure 4.

2.1.22. The air ducting and fan can then be fitted by the ventilation contractor.

2.2. Biofilter Wall Concrete Panel & Block Walls

2.2.1. Walls to be formed of precast concrete panels, as used within the Reception Barn structure.

2.2.2. Wall panels to be 150mm thick and 1200mm wide. Biofilter requires 6 panels:
6 No. panels c.5705mm long
3 No panels c.2525mm long

2.2.3. Panels to be sealed (using Sikaflex or similar) top, base and sides to prevent air and moisture leakage.

2.2.4. Concrete panel retainer tags to be welded to column if possible and weld painted with galvanising paint.

2.2.5. Panels to be bolted to the lego block walls using galvanised angle brackets, rawl bolted to both panel and block.

2.2.6. Concrete panels to either be sealed to floor or cast into floor to ensure air and condensate tightness.

2.2.7. All joints to be sealed with Sikaflex between walling units and internally caulked with Sikaflex as well.

2.3. Biofilter Wall Steel Support Column

2.3.1. The single support column is a suitable Universal Column. Column is to be galvanised and is to be fixed to all 3 wall panels.

2.3.2. The column shown in the Figures has the same dimensions as the Reception Barn columns, as this was done to ease drawing the Figures. A different sized column may be used if the civil engineer feels it suitable.

2.3.3. Column and foundation to be as per local civil contractor design.

2.4. Personnel Access to Biofilter Surface

2.4.1. Access is required for regular biofilter inspections.

2.4.2. Handrails to be placed around the edge of the biofilter (Interclamp or similar system).

2.4.3. Access to top of the biofilter to be by suitable permanent access ladder up the southern wall of the biofilter.

2.5. Biofilter Plenum

2.5.1. The plenum across the base of the biofilter will be built using HAHN biofilter air floor sections. These provide a good method of providing a stable base for the biofilter and facilitating even air dispersal across the base of the biofilter media.

2.5.2. The plenum system requires a minimum load bearing capacity of 3tonnes per sq.m. to allow for machine cleaning.

2.5.3. The supplier details for this air floor are attached in Appendix 3.

2.6. Biofilter Drainage

2.6.1. The drainage system comprises a single 160mm ID drain pipes, laid alongside the existing concrete pad, with 3 drain points along the approximate centre line of the biofilter.

2.6.2. No gulleys, gratings or U bends are to be used under the media bed. Unblocking these would require emptying the biofilter.

2.6.3. Installation & fall as per standard sewage pipe.

2.6.4. The drainage line is to be provided with a cleaning/rodding access at the southern end of the biofilter, as shown in Figure 1.

2.6.5. The pipe discharges into a small, sealed chamber. Discharge from this chamber is via a small pump, discharging via a standard 15mm water pipe.
The electricity supply for this pump is to be taken from the enclosure for the inverter.

2.6.6. The pump and rodding chamber has screw-down, sealing lids to prevent surface water ingress, odour egress or air bypass from biofilter.

2.6.7. The pump chamber cis a standard small, preformed sewage or effluent pumping chamber of c.1.0cu.m.

2.7. Biofilter Stack

2.7.1. The biofilter stack is to be formed using a single 3m length of Polypipe 1200mm internal diameter twinwall culvert duct.
This is strong enough to carry the weight of the fan and ducting above and the lateral load from the placed media.

2.7.2. The stack is to be braced back to the concrete panel walls using galvanised bracers, as shown in Figure 5.

2.7.3. The stack is to have a 30mm thick HDPE base plate, cut as an annular ring, 1550mm in external diameter and 1100mm internal diameter.

2.7.4. Base plate may be sourced from Beckox (Poole) – 01202 736725

2.8. **Biofilter Monitoring Point**

2.8.1. The biofilter monitoring point is to be constructed & installed as detailed within Figure 4.

2.8.2. The monitoring point is to be placed c.300mm up from the base of the biofilter floor, to allow access to the biofilter plenum.

2.9. Biofilter Ducting

2.9.1. The inlet ducting for the biofilter is constructed to the drawings and details as attached in Appendix 5.

2.9.2. All delivery ducting, upstream of the fan will be standard pressed steel galvanised ventilation ducting to facilitate easy replacement, maintenance and sourcing of the system.

2.9.3. All items in the air ducting and fan system are standard units to ease supply and maintenance.

2.10. Building Outlet Vents

2.10.1. The air leaves the Reception Barn through a louvre protected by a grill to stop rubbish being drawn into the duct and damaging the fan.

2.10.2. The louvre will also help cut down noise caused by air entering the duct and from the fan itself.

2.10.3. Within the duct is a non-return baffle. This is to stop any exhaust returning back up the duct should a fan fail and the wind be from the west to north east quadrant, causing a vacuum by the open vehicle door.

2.10.4. The outlet vent is located above and behind the waste storage area to ensure that the most concentrated odours are dealt with right at source.

2.11. Fan & The Controls

2.11.1. The fan utilises a single, large fan. This has a duty of c.20,000m^3 per hour, sufficient to deliver 3 air changes, as required by BAT.

2.11.2. The fan is controlled by an inverter, so allowing the speed to be varied as required.

2.11.3. The details for the fan & inverter are attached in Appendix 5.

2.12. Biofilter Media

2.12.1. Melcourt Biofil Coarse to be used for the biofilter. The specification is attached as Appendix 2.
If a different media is to be used, material with similar specifications should be installed.

2.12.2. For instructions on how to place & replace media, see Appendix 2 and Section 4.4 of this manual.

2.12.3. Upon placement, media is to be back raked as it is placed to stop compaction.

2.13. Irrigation System

2.13.1. The biofilter requires an irrigation system to be installed to wet the surface of the filter, should it be required.

2.13.2. All the system needs to comprise is a pair of small horticultural irrigators, supplied by temporary water hoses that can be removed in winter to prevent frost damage.

2.13.3. The system should be provided with a timer control system to prevent people turning the system on and then forgetting to turn it off again.

2.13.4. Different atmospheric conditions will require different watering rates and regimes. These will be determined by the site operatives through observation of the biofilter media condition.

2.14. Misting System

2.14.1. A water atomiser can be mounted within the delivery ducting, immediately above the stack and downstream of the fan.

2.14.2. Mounting in this location will ensure that the mist gets to the media, as required, without causing damage to the fans.

2.14.3. The stack, plenum and contact surfaces from this point onwards will be proof against contact with the moisture-laden air.

2.14.4. This can be used to add moisture to the air feed into the biofilter media if required.

2.14.5. This system also should be fitted with a timer control system to prevent it being inadvertently left on.

2.14.6. This system should be used sparingly, for short periods with long rests in between. Excessive use will cause the lower section of the biofilter media to rot, settle, generate fines and block. This will seriously impede airflow, harm the efficiency of the filter and necessitate changing the media a lot more often.

2.15. Air Control Within Reception Barn

2.15.1. To reduce uncontrolled airflow, the Reception Barn should be sealed as far as is practical.

2.15.2. The main doors should be fast action units to reduce open time and chance of uncontrolled exhaust.

2.15.3. Personnel access doors should be fitted with auto-closure mechanism.

2.15.4. Eaves and changes in cladding should be sealed to be draught proof as well as vermin proof.

2.15.5. Once the buildings and biofilter are operational, with waste being processed and plant in place, then the internal air flow will be assessed to ensure no eddies or pooling occurs.

2.15.6. This assessment will allow the placement of small air movers on processing plant and/or small extra inlet vents in the walls of the buildings, if required.

2.15.7. The intention is that these extra measures stop any eddies or pools being generated within the building and so causing localised build-up of odour.

2.15.8. These measures are to be assessed and reviewed regularly to ensure no changes of process or layout within the building cause potential issues.

3. Media Selection Rationale

3.1. Woodchip media selection & specification

3.1.1. The media selected for this system is woodchip, specifically Melcourt Biofil Coarse. This media is produced to a specification, which is included in Appendix 2.

3.1.2. Should a different supplier for the woodchip media be appointed, the material supplied must conform to the specification in Appendix 2.

3.2. Demonstrate adequate residence times

3.2.1. The system has an EBRT of c.30 seconds.

3.2.2. With the specified wood chip media and the reduced odour loading of the exhaust air, this EBRT will be more than sufficient for this installation.

3.3. Sufficient sorption capacity for contaminants and microbiobial attachment

3.3.1. By its nature physical nature, woodchip has excellent sorption capacity and microbiobial attachment characteristics.

3.4. Living space and reserve nutrients for micro-organisms

3.4.1. Woodchip media has excellent living space for bacteria, due to the inherent rough surface and pores available within the media.

3.4.2. The media also provides an intrinsic source of nutrient for the bacterial colony through its organic nature and also as it slowly degrades.

3.5. Media water/moisture content – 50 to 80% by weight

3.5.1. The moisture content of woodchip is around 50% when unseasoned wood chip is used.

3.5.2. Seasoned woodchip has a lower water content but the water is at the surface of the woodchip, so bacteria can utilise the moisture whilst living on a stable core of material.

3.6. Structural support to maintain internal structure

3.6.1. Woodchip is light and its particle shape means that the media will lock, so preventing compaction and maintaining void space.

3.6.2. Woodchip is also strong enough to self-support at depth, maintaining the void space required for the successful operation of the biofilter.

3.7. Media temperature – near ambient – 15- 35 or 40ºC

3.7.1. Properly maintained and monitored woodchip media does not self-heat or readily compost, so the temperature of the media remains at ambient levels.

3.8. Media pH – 7 to 8.5

3.8.1. Woodchip media has a relatively neutral pH, as required.

3.9. Biologically active, but reasonably stable

3.9.1. The media is biologically active due to its nature and maintained colony.

3.9.2. It is also reasonably stable due to the colony existing on the surface of the particle, rather than through its core.

3.9.3. The mass and nature of the media also imparts physical and environmental stability to the biological colony.

3.10. Organic matter content >60%

3.10.1. Woodchip biomedia is of over 90% organic matter content, higher if virgin material is used.

3.11. Porous and friable with 75 to 90% void volume

3.11.1. Woodchip biofilter media is both porous and friable by nature.

3.11.2. The media also has a very high void volume as required by BAT and successfully demonstrated by the use of the material as biofilter media through the UK.

3.12. Resistant to waterlogging and compaction

3.12.1. Woodchip media does not self-pack or compact under its own weight as some other media is liable to do.

3.12.2. As the material is relatively light, and has a rough surface, it can self-support its own void space as it locks together.

3.12.3. Should the humidity drop, the biofilter can be watered if required.

3.12.4. Due to its high void space, the material will also self-drain relatively easily.

3.13. Relatively low fines content to reduce gas head loss

3.13.1. The media will be screened prior to use, so removing fines from the biofilter.

3.13.2. The lower 1m will be of courser grade to further assist with air dispersal through the media and reducing blocking or tracking.

3.13.3. Woodchip biofilter media is also relatively slow in generating fines from its own degradation with time.

3.14. Relatively free of residual odour

3.14.1. Woodchip media has no residual odour.

3.14.2. Should any residual process odour occur, the natural resins in the media will assist in countering any residuals.

4.0 Biofilter Operation Manual

4.1 Normal Operation

4.1.1 The biofilter system is to be run continuously, unless down for short periods for scheduled maintenance or breakdown.

4.1.2 During the site's operating and waste reception hours, the biofilter system is to be operated with the fan at the capacity required to give the air flows as detailed within the Biofilter Calculations (Appendix 3).

4.1.3 When the site is not receiving or processing waste, the fan capacity may be decreased to 60% of daytime running.
This is because less odour will be generated when the site is dormant.

4.1.4 The Reception Barn must be operated with doors closed to maintain the efficiency of the system.

4.1.5 Inspection and maintenance procedures and remedial actions as detailed below must be undertaken and recorded within the Site Diary.

4.1.6 The biofilter system is simple and robust. As long as it has been built in accordance with the construction notes, the periodic checks are carried out and the system is properly maintained, it will give reliable service.

4.2 Inspection and Maintenance Procedures

4.2.1. Daily &/or Weekly Inspection Regime

4.2.1.1. Fan
Are it operating? If it isn't – why not?
The fan should be completely free from vibration and metallic noise.
If there is noise or vibration, find out why & rectify.
The fan should have no visible damage to the casing or motor

4.2.1.2. Biofilter Ducting
The ducting should have no damage, leaks or blockages.
Any such should be recorded and rectified.
Any misting system installed below (downstream) of the fan should be checked for operation.

4.2.1.3. Biofilter Media
The media should be free from matting, surface holes, dust or weeds.
It should have no visible venting (holes) or tracking (wet or dry patches or noticeable draughts at surface).
It should not be visibly too wet (saturated) or dry to the touch. The woodchip should be damp at surface but not soaked.
Whilst over wetting at surface due to precipitation may appear to be a problem, this will rarely descend more than 300mm into the media and so will not be a major issue.
Should the media be too dry (dry to touch) at around 300mm deep, then the biofilter should be irrigated as necessary to maintain the efficiency of the bacterial colony.
The media should be temperature checked once per week, at 2 differing locations and at depth of between 300 – 1000mm.
This check may be undertaken using a hand held infrared temperature sensor, pointed at the base of a hole recently excavated within the media.
The media temperature should be close to ambient. Some rise or fall is allowable in summer and winter.
Should the media show a temperature of >50°C, then a further 3 temperature checks must take place at 1000mm depth to ascertain the extent of any heating.

Should this be discovered, refer to Section 5 below.
Any holes excavated for temperature checks should be refilled when the checks are completed.
The excavated material should also be inspected for excessive degradation, composting or mould growth.
The media irrigation system should be checked for operation and leaks and any issues noted and rectified.
Any such action should be recorded.

4.2.1.4. Biofilter Drainage System
The drainage system should show no evidence of leaking or blockages.
Any such should be recorded and rectified.

4.2.1.5. Biofilter Structure
The structure of the biofilter should be checked for damage from impact or degradation.
There should be no visible air bleed from the plenum out through joints in the wall structure.
Any such should be recorded and rectified.

4.2.1.6. Reception Barn Odour Control
Inspect all grids, one-way louvres, fans and air movers (if fitted).
If they are blocked, damaged or not working properly, they should be rectified and the action recorded.

4.2.2. Monthly Inspection Regime
As per the daily and Weekly Inspection Regime, the following should be undertaken with fan at reduced duty to reduce the air pressure in the plenum.

4.2.2.1. Fan
Check inverter operation if fitted.

4.2.2.2. Biofilter Ducting
Where accessible, open ducting inspection hatches and inspect duct interiors.

4.2.2.3. Biofilter Media
Dig four 600mm deep check pits in the biofilter media to check for sub-surface blocking, soaking, drying or excessive fines.

4.2.2.4. Biofilter Drainage System
Open the drainage system pumping chamber cover to check for airflow into the chamber (so proving the filter discharge clear), condition of the chamber and the pump.

4.2.2.5. Biofilter Structure
As per the daily and weekly checks.
Any issues should be rectified.

4.2.2.6. Reception Barn Odour Control
As per the daily and weekly checks.
Pooling, eddies and odour hot-spots within the building also need to be checked for.
With all systems in operation, an operator (or external consultant) must walk round the inside of the Reception Barn with a calibrated gas monitoring set.
The operator (or consultant) will check for any noticeable odour hot-spots whilst the monitoring set will detect raised levels of gas present.
Should this occur (and dependant on the location or operation), extra small air movers (or vents if close to the building wall) may be required to break up the pool.
Any issues should be rectified.

4.2.2.7. Reception Barn Structure

The structure of the Reception Barn should be visibly checked for damage or openings due to age, weather damage, etc.
Vehicle and personnel doors should be checked for closing and sealing efficiency.
All airflow into the Reception Barn should be controlled to assist the deodorising system as much as possible.
Any issues should be rectified.

4.2.3. Annual Inspection Regime (or as required by Permit) As per Monthly Inspection Regime as well as:

4.2.3.1. Reception Barn Structure
The overall seal of the Reception Barn and the effectiveness of the air flow system should be checked on an annual basis.

This may be done in 1 of 3 ways:

1. Method 1
   Seal all louvres, openings and doors.
   Turn off the biofilter fan & block the extraction duct.
   Pressurise the Reception Barn using a big impeller fan mounted in one of the vehicle doors and check the air pressure increase between the interior and exterior of the building.
   Should no pressure difference occur then the fabric of the building must be investigated and rectified, and the test repeated to prove air tightness.
   This must be undertaken by an external consultant, who will bring a trailer-mounted impeller fan to site.
   This test renders the odour management system redundant for the period of the test, when the Reception Barn is actively pressurised.
   As the test actively pressurises the Reception Barn with no odour control, the floor should be cleared prior to the test and no processing can take place during, to minimise odour generation during the test.
   Once the test has been completed, remove all the test equipment, unseal the louvres, doors & openings, turn the biofilter fan back on and recommence waste processing.

2. Method 2
   Seal all louvres, openings and doors.
   Turn off the biofilter fan & block the extraction duct.
   Exhaust the shed using a big extractor fan mounted in one of the vehicle doors and check the air pressure decrease between the interior and exterior of the building.
   Should no pressure difference occur then the fabric of the building must be investigated and rectified, and the test repeated to prove air tightness.
   This must be undertaken by an external consultant, who will bring a trailer-mounted extraction fan to site.
   This test renders the odour management system redundant for the period of the test, when the Reception Barn has a partial (mild) vacuum inside.
   As the test requires the biofilter be stopped, the floor should be cleared prior to the test and no processing can take place during, to minimise odour generation during the test.
   Once the test has been completed, remove all the test equipment, unseal the louvres, doors & openings, turn the biofilter fan back on and recommence waste processing.

3. Method 3
   Do not undertake this test in the rain or any smoke markers will not be visible.
   Turn off the waste processing plant.
   Turn off the biofilter fan.
   Close the Reception Barn doors but do not seal any louvres.
   Turn off the fire alarm and gas detection system, if possible. If this is not possible, inform the fire alarm monitoring company prior to the test taking place.
   Discharge 8 large proprietary smoke markers (Enola Gay or similar make) within the barn, sufficient to give a good, distributed smoke cloud within the building.

The markers should be placed regularly across the building floor and a bright colour (blue, purple or red) should be chosen.
Externally monitor the outside of the building to check for leaks from the building fabric. Occasional whisps are acceptable. Heavy clouds leaving the building aren't.
If heavy leaks are seen, photograph the location, repair the building & repeat the test once the repairs have been completed.
Assuming the building shows no heavy leakage, when the smoke inside the building is well distributed, turn on the biofilter.
The airflow through the biofilter is enough to cause mild negative pressure within the building, so any airflow will be into the building.
Walk round the outside of the building with a camera. No smoke traces, will be visible outside the building.
Photographs of the outside of the building should be taken during the test to prove the building fabric and mark any areas for repair.
Once the fan system has cleared the smoke, turn the fire alarm system back on and recommence waste processing operations.

All 3 test methods are satisfactory but method 3 allows the odour control system to remain active during testing, is less disruptive to operations and can be carried out without the use of external consultants or specialist equipment. It is also much more of a real-world test that attempting to pressurise or exhaust the Reception Barn.

The tests must be recorded and any findings or rectification works noted within the site maintenance diary.

4.2.3.2. Biofilter Efficiency
The inflow and exhaust to & from the biofilter can be sampled to check on the efficiency of the system if this is required as part of the site Permit.
It has to be undertaken by an external consultant and requires air samples to be taken immediately before and after the filter.
This testing gives a measure of objective analysis of the biofilter's performance but should not be required if the filter is monitored and maintained properly.
The pressure in the plenum can be tested by a consultant using the installed monitoring point.

4.3. Critical limits and actions in the event of non-compliance

4.3.1. The system is very simple and robust. The odour loading on the biofilter will be relatively low.

4.3.2. Highly proscriptive, technical critical limits are not required for this system, apart from monitoring the media temperature, moisture content and surface condition, the monitoring required will be kept simple to assist the site to carry out its own checks as required.

4.3.3. Any intervention required for the biofilter should be kept as simple & low impact as possible to maintain the bacteriological colony within the media at good population levels.
Heavy handed or excessive media changes or the thoughtless use of heavy machinery on the filter media pack will harm the performance of the filter to a great extent.

4.3.4. The best, most effective and simplest check on the performance of the biofilter is for a site operative to walk the whole of the surface of the filter as the first duty on shift, checking the condition of the surface of the filter media and whether any odour is apparent within the exhaust from the filter.
Walking the filter surface as first duty will ensure the operative's nose is "fresh" and so give the best check.
Traces or patches of odour above the filter will denote possible tracking within the filter, whilst a general scent across the whole surface will denote media that is too dry or is beginning to compost too much to be effective and requires changing (see Section 5).

4.3.5. Media temperature should be monitored as set down in the maintenance checks above.

Temperatures within the media should be noted against their rough locations within the media bed.
These temperatures should be referenced to ensure the temperature within the media is not moving too far away from ambient.
A temperature increase well above ambient will denote the media is beginning to compost.
A temperature drop will denote the media has become anaerobic due to blocking through excess fines or dust and is biologically dead.
Both the above changes will necessitate a change and blending of the filter media.
With woodchip (especially seasoned woodchip) it would be expected to have the change some of the media, blending the remainder, approximately once every 5 years, depending on loading, media, maintenance and weather conditions.

4.3.6. Media moisture content should be assessed by visual inspection at surface and at c.600mm depth.
Unless during a period of heavy rain, the surface tends to be the driest part of a biofilter media pack, but still should be checked as a guide to conditions below.
At around 600mm depth, the conditions have become more uniform and will be indicative of the depth of the biofilter below.
The media should be excavated and a sample taken at depth. Only a handful of pieces are required.
These pieces should be squeezed to check what moisture is present on the particle's surface.
They should feel wet to the touch but not spongy or saturated.
The pieces of woodchip should not be rotten or soft.
Some discolouration is to be expected (woodchip media rapidly goes black in operation).
Most of the moisture content within woodchip biofilter media will be at the chip's surface, especially when the media is comprised of seasoned woodchip.
If the chips are broken up and drier material lies at their centre, this is not an issue.
However, if the media sample is surface dry to the touch, the irrigation and/or misting system should be used for a set period each day and the condition monitored.
If the material is too wet, then any irrigation or misting system should be turned off.
The biofilter watering system should be checked for leaks.
The drainage system should also be inspected to ensure there are no blockages.
If the media is saturated within the middle of a very wet winter, then the pack will dry after the winter as the weather improves. Its efficiency will not be seriously impacted during the period of bad weather.
However, if the media is saturated during the drier months, this means that the lower levels of the media are choked and the airflow is not easily passing through the media, so stopping moisture evaporating from the surface of the media. Should this occur, then the media will need to be partially changed and blended, as set out on Section 5.

4.3.7. The surface condition of the media should be monitored whenever the biofilter is walked over.
Choking, tracking or weed growth can be easily detected during a walk over.
Surface matting and weeds should be removed and the local area forked over to reduce any sub-surface choking.
When the inspection pits are dug, matting should be checked for just below the surface. If this is present, then forking over the surface of the biofilter to break this up is all that is needed.
Deeper matting, heavy composting or severe degradation of the media will require a partial change and refreshing of the pack. Please see Section 5 for this.

4.4 Media Renewal

4.4.1. Wood Chip Media Source

4.4.1.1. The recommended wood chip media will be Melcourt Biofil Coarse. This material is known and is produced to a good specification.

4.4.1.2. If a different media is used, it must be to the same specification.

4.4.2. Wood Chip Media Changing Frequency

4.4.2.1. The media should only be changed when necessary. It is vital that the bacterial colony within the filter media be maintained in as good a condition as possible to maintain the biofilter's performance.

4.4.2.2. The media should only be changed when it is choked to the point that air flow is not possible and odour is apparent above the filter, as are signs of tracking and venting from the media. This will occur if the media begins to choke with fines, so blocking the void space.
This occurs as the media starts to self-compost, so softening and losing structural integrity to the point that the settlement so caused obstructs air flow through the media.

4.4.2.3. If the media becomes saturated and anaerobic, it will also settle and choke and so will need changing if this happens.

4.4.2.4. As long as the media is maintained in a good condition and the airflow is maintained, so slowing degradation, the media should require a partial change at around c.5 years after commissioning and a full change c.7 years after commissioning.

4.4.2.5. This prediction depends on the media internal environment, weather conditions, odour loading, airflow characteristics and biofilter maintenance.

4.4.3. Wood Chip Media Changing Method

4.4.3.1. Media can be changed using a small (c.1tonne) low ground pressure 360^{o} excavator, lifted onto the top of the biofilter. This can be used to remove the media from within the filter bed in a controlled manner.

4.4.3.2. Media should be moved from around the filter stack only by hand. No excavator should work close to the stack in case of damage to the duct or fan system.

4.4.3.3. Care should also be taken when working close to the biofilter walls to prevent impact damage to the seals between the blocks and panels.

4.4.3.4. The excavator should always work on top of a bed of at least 1.5m of media to prevent damage to the plenum from track and excessive compaction and matting of the media.

4.4.3.5. Any compaction will only affect the top 300-500mm of media and then only mildly. The excavator should work backwards, raking and breaking up any compaction as it goes.

4.4.3.6. When removing media, it should be cleared down to 300mm above the plenum to prevent damage, with the excavator working from a suitable pad of old media. The fresh replacement media can then be added to this remainder and be blended with it to build up the media.

4.4.3.7. Apart from when first loading the biofilter, any replacement biofilter media is to be blended 10:1 with media removed from the biofilter to provide a bacterial seeding for the new filter. The blending can be undertaken using machine bucket before loading into the biofilter. Loading and blending can be undertaken using a telehandler, feeding to the excavator within the biofilter.

4.4.4. Wood Chip Media Disposal

4.4.4.1. As long as the media is from a virgin wood source and has not been allowed to become anaerobic and odorous, it may be used as a mulch with no detrimental effects to the environmental, flora or fauna.
Some residual odour may be apparent on placement but, as long as the mulch is not over-used, this will quickly pass.
The end-of-life media will perform well as a mulch, be it originally seasoned or unseasoned wood.

4.4.4.2. If any residual odour remains from the biofilter duty, the media may be composted for a few weeks prior to use as a mulch.

4.4.4.3. To promote successful composting, it should be treated as any other green waste – blended, turned and monitored – to ensure a quality product.

Figures

Figures for Biofilter Design with 'Lego' Block Walls

Appendix 1 - Biofilter Design Calculations

Reception Building Dimensions and Volumes	L m	W m	H m	Volume m^3
Main Building Envelope	39.4	17.2	10.0	6776.8
Total Building Volume				6776.8
Effective Air Volume for Biofilter Calculations	**6776.8**	**cubic metres**		

Air Flow Requirements		
Effective Air Volume of Building	6776.8	cubic metres
Air changes per hour req'd	3	changes/hr
Air Flow Through Biofilter Per Hour	**20330.4**	**cubic metres/hr**

Biofilter Residence Time Requirement (EBRT)		
Minimum Empty Bed Residence time (EBRT)	30	Seconds

Biofilter Bed Volume Requirement to gain EBRT		
Hourly Air Flow Volume	20330.4	cubic metres/hr
Air Flow Volume per second	5.6	cubic metres/sec
Required Biofilter Volume	**169.4**	**cubic metres**

Internal Biofilter Dimensions		
Biofilter Length	10.5	metres
Biofilter Width	5.4	metres
Biofilter Height (Bed only)	3.0	metres
Biofilter Volume	**170.1**	**metres**
Overall biofilter internal height (inc. 0.5m plenum)	3.6	metres

Appendix 2 - Melcourt Biofil Media Course Specification

Attached as Melcourt-Biofil-Coarse-Technical-Information-Sheet.pdf

Mike Thompson Partnership Ltd E:mike.thompson@mikethompsonpartnership.co.uk

Appendix 3 – Hahn Air Floor Details

Attached as HAHN UK TS Biofilter Raised Flooring System.pdf

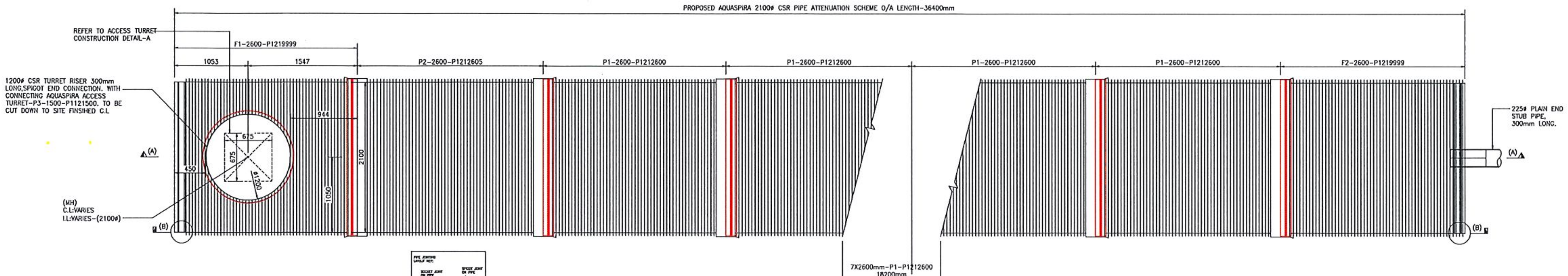
Appendix 4 – Ducting and Fan Manual, Details and Drawings

Details supplied by KVS Ltd

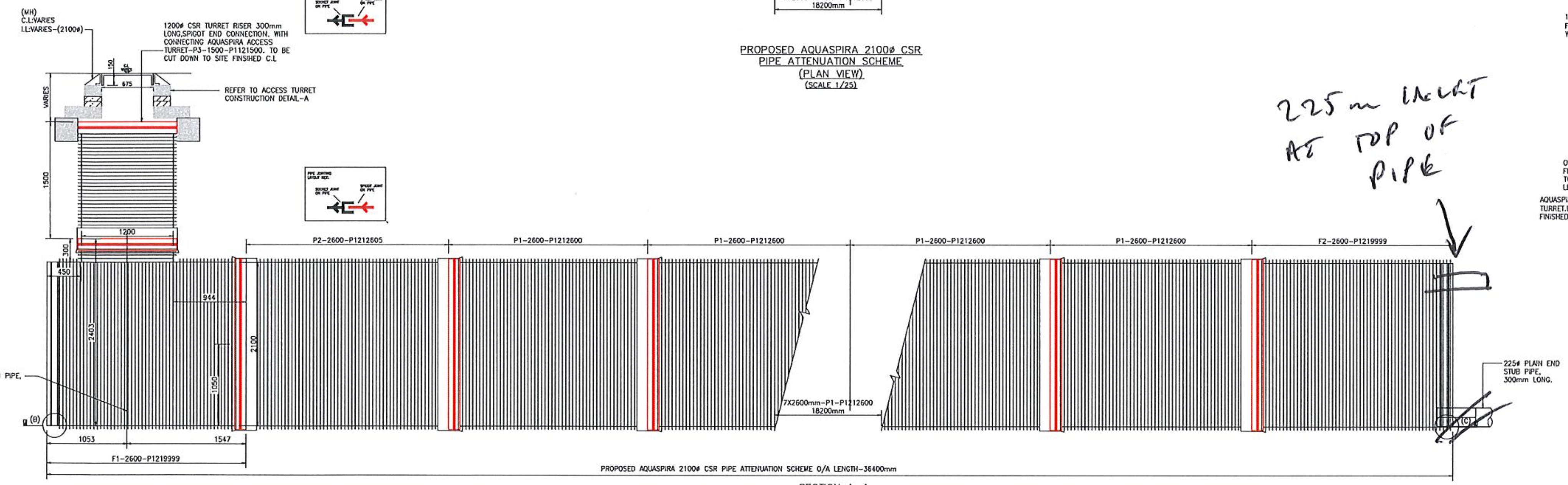
Appendix K Leachate tank drawing, Aquaspira Undertank

DO NOT SCALE

REV	DESCRIPTION	DATE	BY

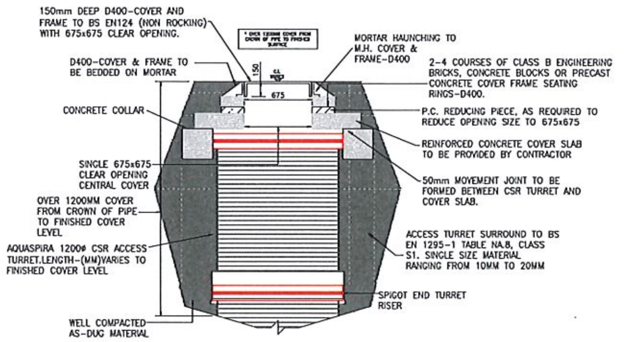


PROPOSED AQUASPIRA 2100ø CSR PIPE ATTENUATION SCHEME (PLAN VIEW) (SCALE 1/25)



SECTION A-A (SCALE 1/25)

225mm INLET AT TOP OF PIPE



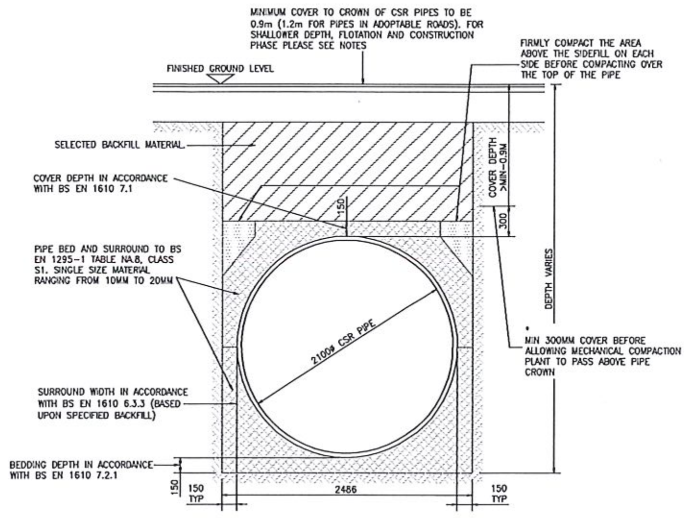
ACCESS TURRET CONSTRUCTION DETAILS 1200ø-(A) (SCALE 1/25)

APPROVED SUBJECT TO RELOCATION OF INLET PIPE.

25/3/22

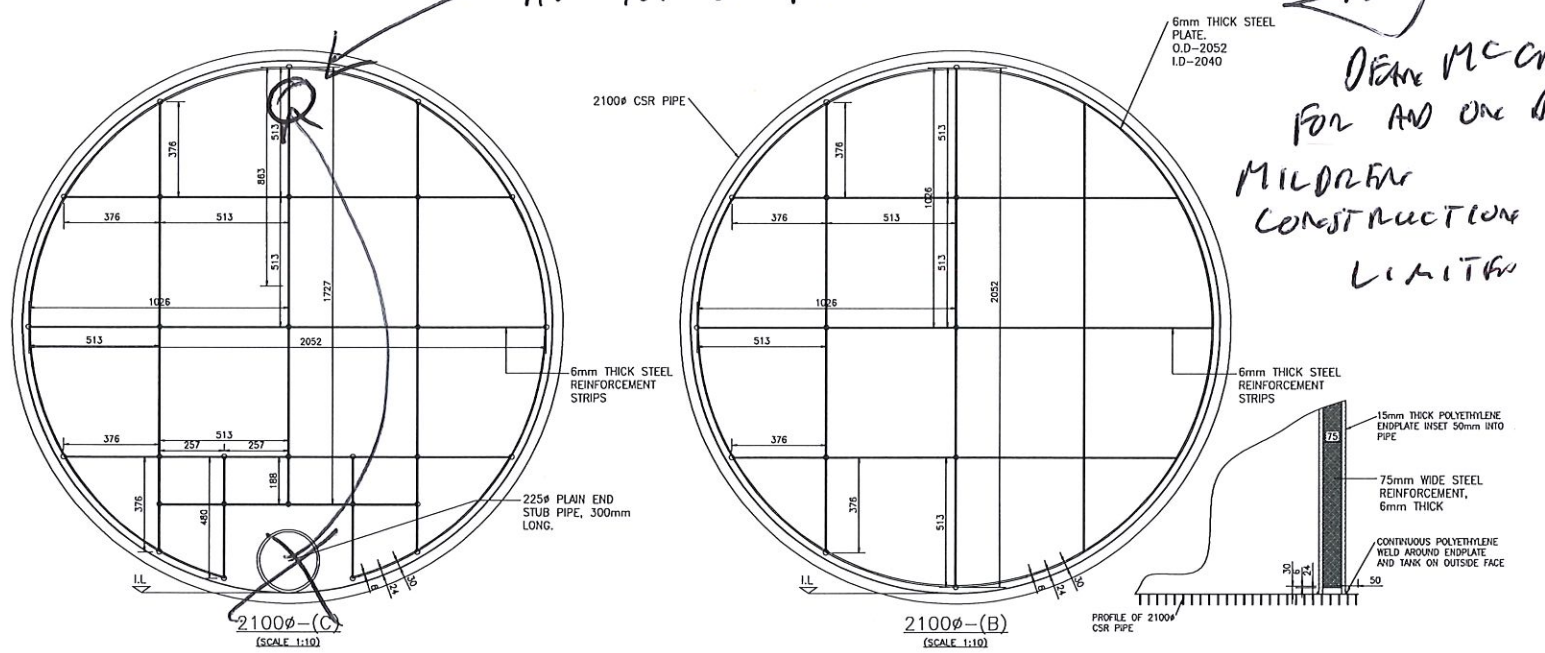
DEAN McCARTHY
FOR AND ON BEHALF OF
MILDREN CONSTRUCTION LIMITED

225mm INLET AT TOP OF PIPE



SECTION BED AND SURROUND DETAILS FOR HARD LANDSCAPED/TRAFFICKED AREAS (SCALE 1/25)

BACKFILL TO BE IN ACCORDANCE WITH 'SPECIFICATION FOR HIGHWAY WORKS' VOLUME 1, TABLE 6/2



2100ø ENDPLATE WELDING DETAIL-(1) (SCALE 1:10)

CUTTING/PARTS LIST							
PART REF.	PRODUCT CODE	PIPE SIZE	PIPE LENGTH	END 1 FINISH	END 2 FINISH	DESCRIPTION	QUANTITY
P1	P1212600	2100ø CSR	2.6m	PUSH FIT SPIGOT	PUSH FIT SOCKET	STANDARD AQUASPIRA CSR PIPE-SOCKET/SPIGOT	11
P2	P1212605	2100ø CSR	2.6m	PUSH FIT SOCKET	PUSH FIT SOCKET	STANDARD AQUASPIRA CSR PIPE-SOCKET/SOCKET	1
P3	P1121500	1200ø CSR	1.5m	PUSH FIT SPIGOT	PUSH FIT SOCKET	STANDARD AQUASPIRA CSR PIPE-SPIGOT/SOCKET-ACCESS TURRET	1
F1	P1219999	2100ø CSR	2600mm	PUSH FIT SPIGOT	CSR ACCESS PIPE	CSR ACCESS END PIPE-2100ø + 1X1200ø TURRET RISER + ENDPLATE	1
F2	P1219999	2100ø CSR	2600mm	PUSH FIT SPIGOT	ENDPLATE	2100ø CSR PIPE + END PLATE	1

NOTE:

1. FOR DETAILS OF TRADITIONAL MANHOLE CONSTRUCTION REFER TO SEWERS FOR ADOPTION 7TH EDITION.
2. ALL DIMENSIONS ARE NOMINAL AND IN MILLIMETERS
3. PLEASE REFER TO AQUASPIRA PIPE INSTALLATION GUIDE FOR DETAILED INFORMATION ON PIPE INSTALLATION
4. ALL STAINLESS STEEL SPECIFIED TO BE GRADE 304,4mm THICK.
5. ALL PIPE SPECIFIED TO BE AQUASPIRA CSR PIPE

PIPE BEDDING NOTES:

1. ALL DIMENSIONS ARE NOMINAL AND IN MILLIMETERS
2. PROCESSED GRANULAR MATERIALS TO INCLUDE AGGREGATES TO BS 882, AIR-COOLED BLAST FURNACE SLAG TO BS 1047 AND LIGHTWEIGHT AGGREGATES TO BS 3797.
3. ALL TEMPORARY ENABLING WORKS ARE BY OTHERS
4. PROJECT ENGINEERS TO CONFIRM THE BACKFILL DETAILS ARE APPROPRIATE FOR THE SITE GROUND CONDITIONS AND LOADING CRITERIA.
5. SINGLE SIZE BACKFILL TO BE IN ACCORDANCE WITH 'SPECIFICATION FOR HIGHWAYS WORKS' VOLUME 1, TABLE 6/2.
6. IF RECLAIMED AND SITE WON MATERIAL TO BE USED AS BACKFILL DCC MATERIALS LABORATORY TO BE CONSULTED IN THE SELECTION, AND APPROVAL OF THE MATERIAL PRIOR TO USE BELOW HIGHWAY
7. WHERE MINIMUM COVER DEPTHS SHOWN CANNOT BE ACHIEVED, A REINFORCED CONCRETE PROTECTION SLAB IS REQUIRED. FOR DETAILS PLEASE SEE 'Your Questions Answered' IN THE TECHNICAL SECTION OF OUR WEBSITE-www.aquaspira.com

FLOTATION

PIPES ABOVE 1500ø MAY REQUIRE MORE THAN 900mm COVER. PLEASE REFER TO THE HYDRAULIC PAGE IN THE 'TECHNICAL' SECTION OF OUR WEBSITE-www.aquaspira.com

APPROVAL ISSUE

NOTES:

THIS DRAWING HAS BEEN PRODUCED FOR THE PURPOSE OF OFFERING DESIGN AND LAYOUT INFORMATION TO ASSIST THE PROJECT ENGINEER WHEN ASSESSING THE SUITABILITY OF AQUASPIRA PRODUCTS. THE INFORMATION CONTAINED IN THIS DRAWING IS APPROPRIATE TO AQUASPIRA PRODUCTS ONLY, AND ALL REFERENCES TO ASSOCIATED CONSTRUCTION DETAILS ARE OFFERED AS TYPICAL DETAILS AND DO NOT TAKE ACCOUNT OF PROJECT CONDITIONS. THE PROJECT ENGINEER/S MUST SATISFY THEMSELVES THAT THE INFORMATION PROVIDED IN THIS DRAWING IS SATISFACTORY.

Client
MILDREN CONSTRUCTION Ltd
HERRIARD BOIMASS PLANT, BUSHY WARREN LANE, BASINGSTOKE

Drawing Title.
PROPOSED AQUASPIRA 2100ø CSR PIPE ATTENUATION SCHEME & CONSTRUCTION DETAILS

AquaSpira

Date	Scale	Drawn	Checked
22.03.22	AS SHOWN	JH	CG

Drawing No 22.80610-D1 -

Appendix L Hampshire Biodiversity Information Centre data

Hampshire Biodiversity Information Centre

HBIC Ref: 12053

Statutory and non-statutory designated sites within 2km of North of Herriard:

Legend

- 2km Search Area
- Herriard Boundary
- SINCs (Labelled pink)
- Surrounding SINCs
- RVEIs (Labelled purple)
- Surrounding RVEIs

Ancient Woodland Inventory

- Semi-Natural
- Replanted

Created: 09/11/2023
Scale at A3: 1:19,000

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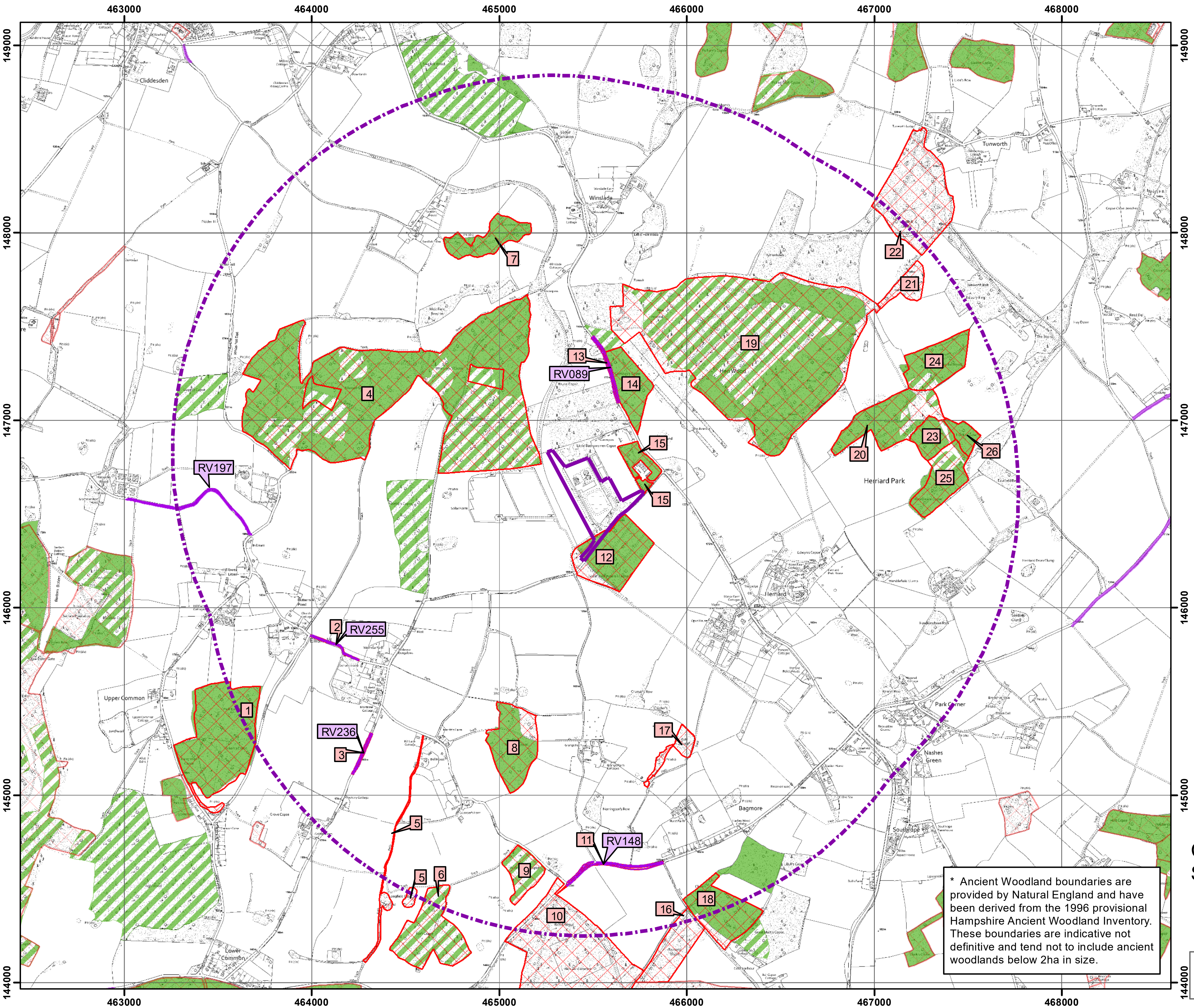

Please note: The boundaries for statutory sites have been provided as digital data from Natural England (NE); this digital data is indicative not definitive. Paper maps produced by NE at the time the sites were designated show the official site boundaries.

Details of Sites of Importance for Nature Conservation (SINCs) within the search area:

Map Label	Status	SINC Ref	SINC Name	Central Grid Ref.	SINC Criteria	Species supported that meet Section 6 of SINC Selection Criteria	Area (ha)
1	SINC	BD0535	Parkfield Copse Complex & Lower Common Pit	SU63504530	1A		19.04
2	SINC	BD0790	U253 Church Lane, Ellisfield	SU64194575	1B		0.13
3	SINC	BD0762	Ellisfield Road Verge	SU64274523	6A	Epipactis purpurata	0.24
4	SINC	BD0558	Kingsmore, Allwood & Fryingdown Copses	SU64304730	1A/1B		80.28
5	SINC	BD0564	Kit Lane & Longfield Dells	SU64404460	1A		1.92
6	SINC	BD0576	Ham Copse, Ellisfield	SU64604430	1B		9.97
7	SINC	BD0588	Buckshorn Copse	SU64904790	1A		5.10
8	SINC	BD0593	Merritt's Copse	SU65104530	1A		8.69
9	SINC	BD0594	Bushy Leane Copse	SU65204460	1B		3.73
10	SINC	BD0606	Herriard Common	SU65504400	1D/6A	Dipsacus pilosus	36.47
11	SINC	BD0607	C12 Bagmore Lane	SU65504463	1B		0.63
12	SINC	BD0608	Great Bushywarren Copse	SU65504630	1A/1B/6A	Muscardinus avellanarius	10.16
13	SINC	BD0611	A339 Alton Road, Herriard	SU65584727	6A	Epipactis purpurata	0.41
14	SINC	BD0614	Cowdray's Copse 1	SU65704720	1A		5.58
15	SINC	BD0618	Little Bushywarren Copse	SU65804680	1A		2.42
16	SINC	BD0622	Nursery Copse	SU65904410	1D/6A	Epipactis purpurata	6.04
17	SINC	BD0757	Platts Copse	SU65944524	1A		1.86
18	SINC	BD0630	Great Matts Copse	SU66204430	1A/1B		7.95
19	SINC	BD0635	Hen Wood	SU66404740	1A/1B/2B/6A	Cynoglossum officinale, Crataegus laevigata	79.48
20	SINC	BD0643	Guy's Copse	SU67104700	1A/1B		10.18

Map Label	Status	SINC Ref	SINC Name	Central Grid Ref.	SINC Criteria	Species supported that meet Section 6 of SINC Selection Criteria	Area (ha)
21	SINC	BD0756	Hummocks Clump	SU67174774	2D*/6A	Cephalanthera longifolia, Cephalanthera damasonium, Neottia nidus-avis	2.52
22	SINC	BD0648	Smallhill Clump	SU67204820	1B/2A		16.53
23	SINC	BD0650	Tom's Copse	SU67304690	1A		3.32
24	SINC	BD0651	Coombe Wood, Tunworth	SU67304730	1A/1B		6.78
25	SINC	BD0654	Honeyleaze Copse	SU67404670	1A/1B		6.33
26	SINC	BD0657	Hook's Copse, Weston Corbett	SU67504690	1A		1.78

*Please note SINC criteria 2D is no longer valid, however it is being retained on existing SINCs until they are re-evaluated. 2D SINCs are Grasslands which have become impoverished through inappropriate management, but which retain sufficient elements of relic unimproved grassland to enable recovery.

Appendix M Odour nuisance Freedom of Information requests

FOI 749/23 Freedom of Information Request: Herriard BioMass Plant

Freedom of Information <foi@basingstoke.gov.uk>
Wed 29/11/2023 10:13
To:Christine McHugh

Dear Christine,

Further to your recent request made under the Freedom of Information Act 2000, **we confirm we do hold the information requested:**

I am writing with respect to **Herriard BioMass Plant, Bushywarren Lane, Basingstoke, RG25 2NS**
Please can you let me know if you have had any odour or other nuisance reports / complaints about this site since 01/01/2015. I am looking for a list of the complaints and for each one: when they were, what the nature of the complaint was and if possible, the location of the complaint e.g. which direction from the site.

There have been no odour or other nuisance reports / complaints about the site of Herriard BioMass Plant, Bushywarren Lane, Basingstoke, RG25 2NS between 01/01/2015 and current day.

If you are unhappy with the handling of your request, you have the right to request an internal review within 40 days of our initial response and please note that we are not obliged to accept internal reviews after this date.

If you wish to request an internal review, please write to:

> The Data Protection Officer, Basingstoke and Deane Borough Council, Civic Offices, London Road, Basingstoke, Hampshire RG21 4AH.
>
> Or via email to foi@basingstoke.gov.uk

If you are not content with the outcome of the internal review, you have the right to apply directly to the Information Commissioner for a decision. The Information Commissioner can be contacted at:

> Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF
>
> www.ico.org.uk

Please remember to quote the reference number above in any future communications.

Information released under FOI or EIR will be done so in accordance with the Reuse of Public Sector Information Regulations under the Open Government Licence. For further information on how these regulations affect the data you have requested please refer to our Re-use of Public Information Regulations Webpage on the link below:

Re-Use of Public Sector Information

For your information, we are publishing FOI requests and responses on the council's website so the response to this request may be published at a later date. To view published responses please follow the link below:

FOI Disclosure Log

Kind regards

Cheryl Wiltshire
Data Protection Planning and Litigation Paralegal
Shared Legal Services
Basingstoke and Deane Borough Council
and Hart District Council

Tel (Direct): 01256 845225
Fax: 01256 845200.
Email: **cheryl.wiltshire@basingstoke.gov.uk**
www.basingstoke.gov.uk
www.hart.gov.uk
Follow us on Twitter **@BasingstokeGov**

Reference: 054406 / 00874592

From: DPO <dpo@basingstoke.gov.uk>
Sent: 08 November 2023 07:55
To: Freedom of Information <foi@basingstoke.gov.uk>
Subject: FW: Freedom of Information Request: Herriard BioMass Plant

---

From: Christine McHugh
Sent: 07 November 2023 19:22
To: DPO <dpo@basingstoke.gov.uk>
Subject: Freedom of Information Request: Herriard BioMass Plant

---

My name is Christine McHugh
My email is
The purpose of the request is to gather information to inform an environmental permit application.

Request:

I am writing with respect to **Herriard BioMass Plant, Bushywarren Lane, Basingstoke, RG25 2NS**
Please can you let me know if you have had any odour or other nuisance reports / complaints about this site since 01/01/2015. I am looking for a list of the complaints and for each one: when they were, what the nature of the complaint was and if possible, the location of the complaint e.g. which direction from the site.
I understand that people's personal details of complainants are protected and that you may not have records going back as far as 2015.

Kind Regards
Christine

Dr Christine McHugh

FOI 748/23 - Response

Freedom of Information <foi@basingstoke.gov.uk>
Thu 23/11/2023 14:49
To:Christine McHugh

Dear Christine,

Further to your recent request made under the Freedom of Information Act 2000, **we confirm we do hold the information requested:**

> Please can you let me know if you have had any odour or other nuisance reports / complaints about this site since 01/01/2015. I am looking for a list of the complaints and for each one: when they were, what the nature of the complaint was and if possible, the location of the complaint e.g. which direction from the site.
>
> **There have been no complaints about the operation of Veolia Environmental Services, Green Waste Composting Facility, Basingstoke RG25 2NS between 2015 and current day.**

If you are unhappy with the handling of your request, you have the right to request an internal review within 40 days of our initial response and please note that we are not obliged to accept internal reviews after this date.

If you wish to request an internal review, please write to:

> The Data Protection Officer, Basingstoke and Deane Borough Council, Civic Offices, London Road, Basingstoke, Hampshire RG21 4AH.
>
> Or via email to foi@basingstoke.gov.uk

If you are not content with the outcome of the internal review, you have the right to apply directly to the Information Commissioner for a decision. The Information Commissioner can be contacted at:

> Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF
>
> www.ico.org.uk

Please remember to quote the reference number above in any future communications.

Information released under FOI or EIR will be done so in accordance with the Reuse of Public Sector Information Regulations under the Open Government Licence. For further information on how these regulations affect the data you have requested please refer to our Re-use of Public Information Regulations Webpage on the link below:

Re-Use of Public Sector Information

For your information, we are publishing FOI requests and responses on the council's website so the response to this request may be published at a later date. To view published responses please follow the link below:

FOI Disclosure Log

Kind regards

Fola Esan
Data Protection Planning and Litigation Paralegal
Shared Legal Services
Basingstoke and Deane Borough Council
and Hart District Council
Tel (Direct): 01256 845707
Fax: 01256 845200.
Email: **fola.esan@basingstoke.gov.uk**
www.basingstoke.gov.uk
www.hart.gov.uk
Follow us on Twitter **@BasingstokeGov**

Reference: 054405 / 00868146

From: Christine McHugh
Sent: 07 November 2023 19:28
To: DPO <dpo@basingstoke.gov.uk>
Subject: Freedom of Information Request: Veolia Environmental Services, Green Waste Composting Facility

---

My name is Christine McHugh
My email is
The purpose of the request is to gather information to inform an environmental permit application.

Request:

I am writing with respect to **Veolia Environmental Services, Green Waste Composting Facility, Basingstoke RG25 2NS**
Please can you let me know if you have had any odour or other nuisance reports / complaints about this site since 01/01/2015. I am looking for a list of the complaints and for each one: when they were, what the nature of the complaint was and if possible, the location of the complaint e.g. which direction from the site.
I understand that people's personal details of complainants are protected and that you may not have records going back as far as 2015.

Kind Regards
Christine

Dr Christine McHugh

Appendix N Human receptor results

Table 30 Long-term and short-term results NO_2

ID	Receptors	Comparison with annual mean AQS: 40µg/m³				Comparison with 99.79th percentile 1-hour threshold 200µg/m³			
		PC (µg/m³)	PC/AQS (%)	PEC (µg/m³)	PEC/AQS (%)	PC (µg/m³)	PC/AQS (%)	Headroom (µg/m³)	PC/Headroom (%)
H1	Little Bushy Warren Composting Facility	n/a	n/a	n/a	n/a	19.4	10%	185.2	10%
H2	Herriard Estates office	n/a	n/a	n/a	n/a	5.2	3%	185.2	3%
H3	Manor Court, Herriard	n/a	n/a	n/a	n/a	4.2	2%	185.1	2%
H4	Manor Farmhouse	0.1	0.3%	7.5	19%	3.9	2%	185.1	2%
H5	Houses on Scratchface Lane	0.1	0.2%	7.5	19%	4.2	2%	185.2	2%
H6	3 Parsonage Cotthaes	0.1	0.2%	7.5	19%	3.1	2%	185.1	2%
H7	Winslade Cottages	0.1	0.3%	7.8	19%	3.5	2%	184.6	2%
H8	Widmoor bungalows	0.1	0.2%	7.3	18%	4.3	2%	185.6	2%

Table 31 Short-term results, 15-minute and 1-hour, SO_2

ID	Receptors	Comparison with 99.9th percentile 15-min threshold: 266µg/m³				Comparison with 99.73rd percentile 1-hour threshold: 350µg/m³			
		PC (µg/m³)	PC/AQS (%)	Headroom (µg/m³)	PC/Headroom (%)	PC (µg/m³)	PC/AQS (%)	Headroom (µg/m³)	PC/Headroom (%)
H1	Little Bushy Warren Composting Facility	40.3	15%	261.2	15%	24.5	7%	345.2	7%
H2	Herriard Estates office	17.7	7%	261.1	7%	7.9	2%	345.1	2%
H3	Manor Court, Herriard	9.3	3%	261.2	4%	5.2	1%	345.2	2%
H4	Manor Farmhouse	8.9	3%	261.2	3%	5.3	2%	345.2	2%
H5	Houses on Scratchface Lane	11.2	4%	261.1	4%	6.0	2%	345.1	2%
H6	3 Parsonage Cotthaes	6.9	3%	261.2	3%	4.2	1%	345.2	1%
H7	Winslade Cottages	8.5	3%	261.3	3%	4.2	1%	345.3	1%
H8	Widmoor bungalows	12.8	5%	261.2	5%	5.4	2%	345.2	2%

Table 32 Short-term results, 24-hours, SO_2

ID	Receptors	Comparison with maximum 24h average AQS: 125μg/m³			
		PC (μg/m³)	PC/AQS (%)	Headroom (μg/m³)	PC/Headroom (%)
H1	Little Bushy Warren Composting Facility	8.7	7%	120.2	7%
H2	Herriard Estates office	2.0	2%	120.1	2%
H3	Manor Court, Herriard	1.7	1%	120.2	1%
H4	Manor Farmhouse	1.6	1%	120.2	1%
H5	Houses on Scratchface Lane	1.6	1%	120.1	1%
H6	3 Parsonage Cotthaes	1.0	1%	120.2	1%
H7	Winslade Cottages	1.4	1%	120.3	1%
H8	Widmoor bungalows	1.9	2%	120.2	2%

Table 33 Short-term results, CO

ID	Receptors	Comparison with maximum 8-hour running AQS: 10,000μg/m³			
		PC (μg/m³)	PC/AQS (%)	Headroom (μg/m³)	PC/Headroom (%)
H1	Little Bushy Warren Composting Facility	162	2%	9,777	2%
H2	Herriard Estates office	42	0%	9,780	0%
H3	Manor Court, Herriard	37	0%	9,784	0%
H4	Manor Farmhouse	29	0%	9,784	0%
H5	Houses on Scratchface Lane	32	0%	9,780	0%
H6	3 Parsonage Cotthaes	24	0%	9,784	0%
H7	Winslade Cottages	29	0%	9,775	0%
H8	Widmoor bungalows	36	0%	9,780	0%

Table 34 Long-term and short-term results, NH_3

ID	Receptors	Comparison with annual mean AQS: 180µg/m³				Comparison with maximum hourly AQS: 2,500µg/m³			
		PC (µg/m³)	PC/AQS (%)	PEC (µg/m³)	PEC/AQS (%)	PC (µg/m³)	PC/AQS (%)	Headroom (µg/m³)	PC/Headroom (%)
H1	Little Bushy Warren Composting Facility	n/a	n/a	n/a	n/a	4.9	<1%	2,497	<1%
H2	Herriard Estates office	n/a	n/a	n/a	n/a	1.6	<1%	2,497	<1%
H3	Manor Court, Herriard	n/a	n/a	n/a	n/a	1.7	<1%	2,497	<1%
H4	Manor Farmhouse	0.01	<1%	1.4	1%	1.6	<1%	2,497	<1%
H5	Houses on Scratchface Lane	0.01	<1%	1.4	1%	1.5	<1%	2,497	<1%
H6	3 Parsonage Cotthaes	<0.01	<1%	1.4	1%	1.0	<1%	2,497	<1%
H7	Winslade Cottages	<0.01	<1%	1.4	1%	0.9	<1%	2,497	<1%
H8	Widmoor bungalows	<0.01	<1%	1.3	1%	0.9	<1%	2,497	<1%

Table 35 Long-term and short-term results, TVOC as 10% Benzene

ID	Receptors	Comparison with annual mean AQS: 5µg/m³				Comparison with maximum hourly AQS: 30µg/m³			
		PC (µg/m³)	PC/AQS (%)	PEC (µg/m³)	PEC/AQS (%)	PC (µg/m³)	PC/AQS (%)	Headroom (µg/m³)	PC/Headroom (%)
H1	Little Bushy Warren Composting Facility	n/a	n/a	n/a	n/a	4.7	16%	30	16%
H2	Herriard Estates office	n/a	n/a	n/a	n/a	1.0	3%	30	3%
H3	Manor Court, Herriard	n/a	n/a	n/a	n/a	0.8	3%	30	3%
H4	Manor Farmhouse	0.03	<1%	0.20	4%	0.9	3%	30	3%
H5	Houses on Scratchface Lane	0.02	<1%	0.20	4%	0.9	3%	30	3%
H6	3 Parsonage Cotthaes	0.02	<1%	0.19	4%	0.7	2%	30	2%
H7	Winslade Cottages	0.03	<1%	0.21	4%	0.9	3%	30	3%
H8	Widmoor bungalows	0.02	<1%	0.20	4%	0.9	3%	30	3%

Table 36 Long-term and short-term results, H_2S

ID	Receptors	Comparison with annual mean AQS: 140μg/m³				Comparison with maximum hourly AQS: 150μg/m³			
		PC (μg/m³)	PC/AQS (%)	PEC (μg/m³)	PEC/AQS (%)	PC (μg/m³)	PC/AQS (%)	Headroom (μg/m³)	PC/Headroom (%)
H1	Little Bushy Warren Composting Facility	n/a	n/a	n/a	n/a	1.6	1.1%	150	1.1%
H2	Herriard Estates office	n/a	n/a	n/a	n/a	0.4	<1%	150	<1%
H3	Manor Court, Herriard	n/a	n/a	n/a	n/a	0.4	<1%	150	<1%
H4	Manor Farmhouse	<0.01	<1%	<0.01	<1%	0.4	<1%	150	<1%
H5	Houses on Scratchface Lane	<0.01	<1%	<0.01	<1%	0.4	<1%	150	<1%
H6	3 Parsonage Cotthaes	<0.01	<1%	<0.01	<1%	0.3	<1%	150	<1%
H7	Winslade Cottages	<0.01	<1%	<0.01	<1%	0.3	<1%	150	<1%
H8	Widmoor bungalows	<0.01	<1%	<0.01	<1%	0.3	<1%	150	<1%

Appendix O Ecological receptor results

Table 37 Results: Ecological receptors, long-term AQS for NH_3

ID	Receptors	Comparison with annual mean AQS: 1μg/m³				
		AQS (μg/m³)	PC (μg/m³)	PC/AQS (%)	PEC (μg/m³)	PEC/AQS (%)
E12.1	Great Bushywarren Copse	1	0.117	11.7%	1.517	152%
E12.2	Great Bushywarren Copse	1	0.119	11.9%	1.519	152%
E12.3	Great Bushywarren Copse	1	0.034	3.4%	1.434	143%
E15.1	Little Bushywarren Copse	1	0.076	7.6%	1.476	148%
E15.2	Little Bushywarren Copse	1	0.085	8.5%	1.485	148%
E14.1	Cowdray's Copse 1	1	0.053	5.3%	1.453	145%
E14.2	Cowdray's Copse 1	1	0.016	1.6%	1.416	142%
E14.3	Cowdray's Copse 1	1	0.013	1.3%	1.413	141%
E4.1	Kingsmore, Allwood & Fryingdown Copses	1	0.070	7.0%	1.470	147%
E4.2	Kingsmore, Allwood & Fryingdown Copses	1	0.017	1.7%	1.417	142%
E4.3	Kingsmore, Allwood & Fryingdown Copses	1	0.009	0.9%	1.409	141%
E4.4	Kingsmore, Allwood & Fryingdown Copses	1	0.007	0.7%	1.407	141%
E4.5	Kingsmore, Allwood & Fryingdown Copses	1	0.004	0.4%	1.404	140%
E4.6	Kingsmore, Allwood & Fryingdown Copses	1	0.003	0.3%	1.403	140%
E4.7	Kingsmore, Allwood & Fryingdown Copses	1	0.013	1.3%	1.413	141%
E4.8	Kingsmore, Allwood & Fryingdown Copses	1	0.011	1.1%	1.411	141%
E4.9	Kingsmore, Allwood & Fryingdown Copses	1	0.003	0.3%	1.403	140%
E7.1	Buckshorn Copse	1	0.006	0.6%	1.406	141%
E7.2	Buckshorn Copse	1	0.005	0.5%	1.405	140%
EX.1	Swallick Wood	1	0.003	0.3%	1.403	140%
EX.2	Swallick Wood	1	0.003	0.3%	1.403	140%
E19.1	Hen Wood	1	0.009	0.9%	1.409	141%
E19.2	Hen Wood	1	0.020	2.0%	1.420	142%
E19.3	Hen Wood	1	0.012	1.2%	1.412	141%

ID	Receptors	Comparison with annual mean AQS: 1µg/m³				
		AQS (µg/m³)	PC (µg/m³)	PC/AQS (%)	PEC (µg/m³)	PEC/AQS (%)
E19.4	Hen Wood	1	0.005	0.5%	1.405	141%
E19.5	Hen Wood	1	0.007	0.7%	1.407	141%
E20.1	Guy's Copse	1	0.008	0.8%	1.408	141%
E23.1	Tom's Copse	1	0.005	0.5%	1.405	140%
E25.1	Honeyleaze Copse	1	0.005	0.5%	1.405	140%
E26.1	Hook's Copse, Weston Corbett	1	0.004	0.4%	1.404	140%
E24.1	Coombe Wood, Tunworth	1	0.005	0.5%	1.405	140%
E24.2	Coombe Wood, Tunworth	1	0.004	0.4%	1.404	140%
E18.1	Great Matts Copse	1	0.004	0.4%	1.404	140%
E18.2	Great Matts Copse	1	0.003	0.3%	1.403	140%
E9.1	Bushy Leane Copse	1	0.005	0.5%	1.405	140%
E8.1	Merritt's Copse	1	0.009	0.9%	1.409	141%
E8.2	Merritt's Copse	1	0.006	0.6%	1.406	141%
E1.1	Parkfield Copse Complex & Lower Common Pit	1	0.003	0.3%	1.303	130%
RV089	A339 Alton Road, Herriard	1	0.029	2.9%	1.329	133%
RV255	Ellisfield Road Verge	1	0.005	0.5%	1.305	131%
RV236	U259 College Lane, Ellisfield	1	0.004	0.4%	1.304	130%
RV148	C12 Bagmore Lane	1	0.005	0.5%	1.305	130%
E5.1	Kit Lane & Longfield Dells	1	0.003	0.3%	1.303	130%
E6.1	Ham Copse, Ellisfield	1	0.003	0.3%	1.303	130%
E10.1	Herriard Common	1	0.004	0.4%	1.304	130%
E17.1	Platts Copse	1	0.007	0.7%	1.307	131%
E21.1	Hummocks Clump	1	0.005	0.5%	1.305	130%
E22.1	Smallhill Clump	1	0.004	0.4%	1.304	130%
EY.1	Picked Craft Copse	1	0.003	0.3%	1.303	130%

Notes: *No further analysis required if PC/AQS < 100%

Table 38 Results: Ecological receptors, long-term and short-term AQS for NOx

ID	Receptors	Comparison with annual mean AQS: 30μg/m³				Comparison with maximum daily AQS: 75μg/m³			
		PC (μg/m³)	PC/AQS (%)	PEC (μg/m³)	PC/AQS (%)	PC (μg/m³)	PC/AQS (%)	Headroom (μg/m³)	PC/ Headroom (%)
E12.1	Great Bushywarren Copse	0.84	3%	10.3	34%	20.5	10%	181.0	11%
E12.2	Great Bushywarren Copse	0.79	3%	10.3	34%	26.1	13%	181.0	14%
E12.3	Great Bushywarren Copse	0.29	1%	9.8	33%	10.4	5%	181.0	6%
E15.1	Little Bushywarren Copse	0.90	3%	10.4	35%	22.6	11%	181.0	12%
E15.2	Little Bushywarren Copse	2.77	9%	12.3	41%	34.7	17%	181.0	19%
E14.1	Cowdray's Copse 1	1.49	5%	11.4	38%	23.9	12%	180.2	13%
E14.2	Cowdray's Copse 1	0.37	1%	10.3	34%	8.2	4%	180.2	5%
E14.3	Cowdray's Copse 1	0.29	1%	10.2	34%	6.1	3%	180.2	3%
E4.1	Kingsmore, Allwood & Fryingdown**	0.75	2%	10.2	34%	33.5	17%	181.0	19%
E4.2	Kingsmore, Allwood & Fryingdown**	0.23	1%	10.1	34%	8.2	4%	180.2	5%
E4.3	Kingsmore, Allwood & Fryingdown**	0.13	0%	10.0	33%	5.2	3%	180.2	3%
E4.4	Kingsmore, Allwood & Fryingdown**	0.08	0%	9.8	33%	5.7	3%	180.6	3%
E4.5	Kingsmore, Allwood & Fryingdown* *	0.05	0%	9.8	33%	4.7	2%	180.4	3%
E4.6	Kingsmore, Allwood & Fryingdown**	0.04	0%	9.8	33%	4.7	2%	180.4	3%
E4.7	Kingsmore, Allwood & Fryingdown**	0.16	1%	9.5	32%	9.2	5%	181.4	5%
E4.8	Kingsmore, Allwood & Fryingdown**	0.17	1%	9.5	32%	7.9	4%	181.4	4%
E4.9	Kingsmore, Allwood & Fryingdown**	0.04	0%	9.8	33%	3.3	2%	180.4	2%
E7.1	Buckshorn Copse	0.09	0%	9.8	33%	4.3	2%	180.6	2%
E7.2	Buckshorn Copse	0.08	0%	10.9	36%	3.4	2%	178.4	2%
EX.1	Swallick Wood	0.06	0%	10.9	36%	2.2	1%	178.4	1%
EX.2	Swallick Wood	0.05	0%	10.8	36%	1.7	1%	178.4	1%
E19.1	Hen Wood	0.19	1%	10.1	34%	4.0	2%	180.2	2%
E19.2	Hen Wood	0.53	2%	10.0	33%	11.5	6%	181.0	6%
E19.3	Hen Wood	0.23	1%	9.8	33%	5.3	3%	180.8	3%
E19.4	Hen Wood	0.14	0%	9.6	32%	5.0	2%	181.0	3%
E19.5	Hen Wood	0.19	1%	9.7	32%	6.6	3%	181.0	4%
E20.1	Guy's Copse	0.15	1%	9.8	33%	3.7	2%	180.8	2%
E23.1	Tom's Copse	0.09	0%	9.4	31%	2.5	1%	181.4	1%
E25.1	Honeyleaze Copse	0.09	0%	9.4	31%	2.8	1%	181.4	2%

ID	Receptors	Comparison with annual mean AQS: 30µg/m³				Comparison with maximum daily AQS: 75µg/m³			
		PC (µg/m³)	PC/AQS (%)	PEC (µg/m³)	PC/AQS (%)	PC (µg/m³)	PC/AQS (%)	Headroom (µg/m³)	PC/ Headroom (%)
E26.1	Hook's Copse, Weston Corbett	0.08	0%	9.5	32%	2.5	1%	181.2	1%
E24.1	Coombe Wood, Tunworth	0.11	0%	9.5	32%	4.1	2%	181.2	2%
E24.2	Coombe Wood, Tunworth	0.08	0%	9.5	32%	3.4	2%	181.2	2%
E18.1	Great Matts Copse	0.05	0%	9.5	32%	3.0	2%	181.0	2%
E18.2	Great Matts Copse	0.05	0%	9.1	30%	2.3	1%	182.0	1%
E9.1	Bushy Leane Copse	0.06	0%	9.1	30%	3.4	2%	182.0	2%
E8.1	Merritt's Copse	0.14	0%	9.3	31%	6.0	3%	181.6	3%
E8.2	Merritt's Copse	0.08	0%	9.3	31%	3.5	2%	181.6	2%
E1.1	Parkfield Copse Complex & Lower Common Pit	0.06	0%	9.3	31%	3.0	2%	181.6	2%
RV089	A339 Alton Road, Herriard	0.72	2%	9.9	33%	11.6	6%	181.6	6%
RV255	Ellisfield Road Verge	0.08	0%	9.3	31%	3.9	2%	181.6	2%
RV236	U259 College Lane, Ellisfield	0.08	0%	9.3	31%	3.7	2%	181.6	2%
RV148	C12 Bagmore Lane	0.07	0%	9.3	31%	4.3	2%	181.6	2%
E5.1	Kit Lane & Longfield Dells	0.06	0%	9.3	31%	4.0	2%	181.6	2%
E6.1	Ham Copse, Ellisfield	0.06	0%	9.3	31%	3.6	2%	181.6	2%
E10.1	Herriard Common	0.06	0%	9.3	31%	3.2	2%	181.6	2%
E17.1	Platts Copse	0.08	0%	9.3	31%	3.7	2%	181.6	2%
E21.1	Hummocks Clump	0.13	0%	9.3	31%	4.7	2%	181.6	3%
E22.1	Smallhill Clump	0.12	0%	9.3	31%	4.6	2%	181.6	3%
EY.1	Picked Craft Copse	0.08	0%	9.3	31%	3.0	2%	181.6	2%

Notes: *No further analysis required if PC/AQS < 100%

**Copses

Table 39 Results: Ecological receptors, long-term AQS for SO_2

ID	Receptors	Comparison with annual mean AQS: 20μg/m³				Comparison with annual mean AQS: 10μg/m³			
		PC (μg/m³)	PC/AQS (%)	Background (μg/m³)	PEC/AQS (%)	PC (μg/m³)	PC/AQS (%)	Background (μg/m³)	PEC/AQS (%)
E12.1	Great Bushywarren Copse	0.2	1%	1.0	5%	0.2	2%	1.0	10%
E12.2	Great Bushywarren Copse	0.2	1%	1.0	5%	0.2	2%	1.0	10%
E12.3	Great Bushywarren Copse	0.1	0%	0.9	4%	0.1	1%	0.9	9%
E15.1	Little Bushywarren Copse	0.2	1%	1.0	5%	0.2	2%	1.0	10%
E15.2	Little Bushywarren Copse	0.6	3%	1.4	7%	0.6	6%	1.4	14%
E14.1	Cowdray's Copse 1	0.3	2%	1.1	6%	0.3	3%	1.1	11%
E14.2	Cowdray's Copse 1	0.1	0%	0.9	4%	0.1	1%	0.9	9%
E14.3	Cowdray's Copse 1	0.1	0%	0.9	4%	0.1	1%	0.9	9%
E4.1	Kingsmore, Allwood & Fryingdown**	0.1	1%	0.9	5%	0.1	1%	0.9	9%
E4.2	Kingsmore, Allwood & Fryingdown**	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E4.3	Kingsmore, Allwood & Fryingdown**	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E4.4	Kingsmore, Allwood & Fryingdown**	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E4.5	Kingsmore, Allwood & Fryingdown* *	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E4.6	Kingsmore, Allwood & Fryingdown**	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E4.7	Kingsmore, Allwood & Fryingdown**	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E4.8	Kingsmore, Allwood & Fryingdown**	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E4.9	Kingsmore, Allwood & Fryingdown**	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E7.1	Buckshorn Copse	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E7.2	Buckshorn Copse	0.0	0%	0.9	5%	0.0	0%	0.9	9%
EX.1	Swallick Wood	0.0	0%	0.9	5%	0.0	0%	0.9	9%
EX.2	Swallick Wood	0.0	0%	0.9	5%	0.0	0%	0.9	9%
E19.1	Hen Wood	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E19.2	Hen Wood	0.1	1%	0.9	5%	0.1	1%	0.9	9%
E19.3	Hen Wood	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E19.4	Hen Wood	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E19.5	Hen Wood	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E20.1	Guy's Copse	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E23.1	Tom's Copse	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E25.1	Honeyleaze Copse	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E26.1	Hook's Copse, Weston Corbett	0.0	0%	0.8	4%	0.0	0%	0.8	8%

ID	Receptors	Comparison with annual mean AQS: 20μg/m³				Comparison with annual mean AQS: 10μg/m³			
		PC (μg/m³)	PC/AQS (%)	Background (μg/m³)	PEC/AQS (%)	PC (μg/m³)	PC/AQS (%)	Background (μg/m³)	PEC/AQS (%)
E24.1	Coombe Wood, Tunworth	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E24.2	Coombe Wood, Tunworth	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E18.1	Great Matts Copse	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E18.2	Great Matts Copse	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E9.1	Bushy Leane Copse	0.0	0%	0.7	4%	0.0	0%	0.7	7%
E8.1	Merritt's Copse	0.0	0%	0.7	4%	0.0	0%	0.7	7%
E8.2	Merritt's Copse	0.0	0%	0.7	4%	0.0	0%	0.7	7%
E1.1	Parkfield Copse Complex & Lower Common Pit	0.0	0%	0.8	4%	0.0	0%	0.8	8%
RV089	A339 Alton Road, Herriard	0.1	1%	0.9	5%	0.1	1%	0.9	9%
RV255	Ellisfield Road Verge	0.0	0%	0.8	4%	0.0	0%	0.8	8%
RV236	U259 College Lane, Ellisfield	0.0	0%	0.8	4%	0.0	0%	0.8	8%
RV148	C12 Bagmore Lane	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E5.1	Kit Lane & Longfield Dells	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E6.1	Ham Copse, Ellisfield	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E10.1	Herriard Common	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E17.1	Platts Copse	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E21.1	Hummocks Clump	0.0	0%	0.8	4%	0.0	0%	0.8	8%
E22.1	Smallhill Clump	0.0	0%	0.8	4%	0.0	0%	0.8	8%
EY.1	Picked Craft Copse	0.0	0%	0.8	4%	0.0	0%	0.8	8%

Notes: *No further analysis required if PC/AQS < 100%

**Copses

Table 40 Results: Ecological receptors, nutrient nitrogen deposition, nationally designated sites

Receptors	Comparison with nutrient nitrogen critical loads								
	Deposition velocity type	PC (kgN/ha/yr)	CLmin (kgN/ha/yr)	CLmax (kgN/ha/yr)	PC/CLmin (%)	PC/CLmax (%)	Background (kgN/ha/yr)	PEDR/CLmin (%)	PEDR/CLmax (%)
E12.1	Forest	1.077	10	15	11%	7%	27.30	284%	189%
E12.2	Forest	1.087	10	15	11%	7%	27.30	284%	189%
E12.3	Forest	0.324	10	15	3%	2%	27.30	276%	184%
E15.1	Forest	0.772	10	15	8%	5%	27.30	281%	187%
E15.2	Forest	1.200	10	15	12%	8%	27.30	285%	190%
E14.1	Forest	0.711	10	15	7%	5%	27.50	282%	188%
E14.2	Forest	0.199	10	15	2%	1%	27.50	277%	185%
E14.3	Forest	0.160	10	15	2%	1%	27.50	277%	184%
E4.1	Forest	0.698	10	15	7%	5%	27.30	280%	187%
E4.2	Forest	0.178	10	15	2%	1%	27.50	277%	185%
E4.3	Forest	0.094	10	15	1%	1%	27.50	276%	184%
E4.4	Forest	0.073	10	15	1%	0%	27.90	280%	186%
E4.5	Forest	0.039	10	15	0%	0%	28.20	282%	188%
E4.6	Forest	0.034	10	15	0%	0%	28.20	282%	188%
E4.7	Forest	0.133	10	15	1%	1%	27.60	277%	185%
E4.8	Forest	0.121	10	15	1%	1%	27.60	277%	185%
E4.9	Forest	0.030	10	15	0%	0%	28.20	282%	188%
E7.1	Forest	0.064	10	15	1%	0%	27.90	280%	186%
E7.2	Forest	0.053	10	15	1%	0%	27.90	280%	186%
EX.1	Forest	0.037	10	15	0%	0%	27.90	279%	186%
EX.2	Forest	0.031	10	15	0%	0%	27.90	279%	186%
E19.1	Forest	0.106	10	15	1%	1%	27.50	276%	184%
E19.2	Forest	0.259	10	15	3%	2%	27.30	276%	184%
E19.3	Forest	0.141	10	15	1%	1%	27.00	271%	181%
E19.4	Forest	0.069	10	15	1%	0%	27.30	274%	182%
E19.5	Forest	0.096	10	15	1%	1%	27.30	274%	183%
E20.1	Forest	0.091	10	15	1%	1%	27.00	271%	181%
E23.1	Forest	0.055	10	15	1%	0%	26.80	269%	179%
E25.1	Forest	0.055	10	15	1%	0%	26.80	269%	179%
E26.1	Forest	0.049	10	15	0%	0%	26.70	267%	178%

Receptors	Comparison with nutrient nitrogen critical loads								
	Deposition velocity type	**PC (kgN/ha/yr)**	**CLmin (kgN/ha/yr)**	**CLmax (kgN/ha/yr)**	**PC/CLmin (%)**	**PC/CLmax (%)**	**Background (kgN/ha/yr)**	**PEDR/CLmin (%)**	**PEDR/CLmax (%)**
E24.1	Forest	0.060	10	15	1%	0%	26.70	268%	178%
E24.2	Forest	0.045	10	15	0%	0%	26.70	267%	178%
E18.1	Forest	0.039	10	15	0%	0%	27.00	270%	180%
E18.2	Forest	0.035	10	15	0%	0%	27.00	270%	180%
E9.1	Forest	0.049	10	15	0%	0%	27.10	271%	181%
E8.1	Forest	0.102	10	15	1%	1%	27.30	274%	183%
E8.2	Forest	0.061	10	15	1%	0%	27.30	274%	182%
E1.1	Forest	0.039	10	15	0%	0%	27.50	275%	184%
RV089	Forest	0.374	10	15	4%	2%	27.50	279%	186%
RV255	Forest	0.056	10	15	1%	0%	27.50	276%	184%
RV236	Forest	0.049	10	15	0%	0%	27.50	275%	184%
RV148	Forest	0.049	10	15	0%	0%	27.50	275%	184%
E5.1	Forest	0.036	10	15	0%	0%	27.50	275%	184%
E6.1	Forest	0.037	10	15	0%	0%	27.50	275%	184%
E10.1	Forest	0.044	10	15	0%	0%	27.50	275%	184%
E17.1	Forest	0.074	10	15	1%	0%	27.50	276%	184%
E21.1	Forest	0.063	10	15	1%	0%	27.50	276%	184%
E22.1	Forest	0.054	10	15	1%	0%	27.50	276%	184%
EY.1	Forest	0.042	10	15	0%	0%	27.50	275%	184%

Notes: *No further analysis required if PC/AQS < 100%

Table 41 Results: Ecological receptors, acid deposition

ID	Receptors	PC (keqN/ha/yr)	CLomaxN (keqN/ha/yr)	PC/CLomax (%)
E12.1	Great Bushywarren Copse	0.077	2.993	2.6%
E12.2	Great Bushywarren Copse	0.078	2.993	2.6%
E12.3	Great Bushywarren Copse	0.023	2.993	0.8%
E15.1	Little Bushywarren Copse	0.055	2.993	1.8%
E15.2	Little Bushywarren Copse	0.087	2.993	2.9%
E14.1	Cowdray's Copse 1	0.051	2.993	1.7%
E14.2	Cowdray's Copse 1	0.014	2.993	0.5%
E14.3	Cowdray's Copse 1	0.011	2.993	0.4%
E4.1	Kingsmore, Allwood & Fryingdown Copses	0.050	2.993	1.7%
E4.2	Kingsmore, Allwood & Fryingdown Copses	0.013	2.993	0.4%
E4.3	Kingsmore, Allwood & Fryingdown Copses	0.007	2.993	0.2%
E4.4	Kingsmore, Allwood & Fryingdown Copses	0.005	2.993	0.2%
E4.5	Kingsmore, Allwood & Fryingdown Copses	0.003	2.993	0.1%
E4.6	Kingsmore, Allwood & Fryingdown Copses	0.002	2.993	0.1%
E4.7	Kingsmore, Allwood & Fryingdown Copses	0.010	2.993	0.3%
E4.8	Kingsmore, Allwood & Fryingdown Copses	0.009	2.993	0.3%
E4.9	Kingsmore, Allwood & Fryingdown Copses	0.002	2.993	0.1%
E7.1	Buckshorn Copse	0.005	2.993	0.2%
E7.2	Buckshorn Copse	0.004	2.993	0.1%
EX.1	Swallick Wood	0.003	2.993	0.1%
EX.2	Swallick Wood	0.002	2.993	0.1%
E19.1	Hen Wood	0.008	2.993	0.3%
E19.2	Hen Wood	0.019	2.993	0.6%
E19.3	Hen Wood	0.010	2.993	0.3%
E19.4	Hen Wood	0.005	2.993	0.2%
E19.5	Hen Wood	0.007	2.993	0.2%
E20.1	Guy's Copse	0.006	2.993	0.2%
E23.1	Tom's Copse	0.004	2.993	0.1%
E25.1	Honeyleaze Copse	0.004	2.993	0.1%
E26.1	Hook's Copse, Weston Corbett	0.003	2.993	0.1%
E24.1	Coombe Wood, Tunworth	0.004	2.993	0.1%

ID	Receptors	PC (keqN/ha/yr)	CLomaxN (keqN/ha/yr)	PC/CLomax (%)
E24.2	Coombe Wood, Tunworth	0.003	2.993	0.1%
E18.1	Great Matts Copse	0.003	2.993	0.1%
E18.2	Great Matts Copse	0.003	2.993	0.1%
E9.1	Bushy Leane Copse	0.003	2.993	0.1%
E8.1	Merritt's Copse	0.007	2.993	0.2%
E8.2	Merritt's Copse	0.004	2.993	0.1%
E1.1	Parkfield Copse Complex & Lower Common Pit	0.003	2.993	0.1%
RV089	A339 Alton Road, Herriard	0.027	2.993	0.9%
RV255	Ellisfield Road Verge	0.004	2.993	0.1%
RV236	U259 College Lane, Ellisfield	0.004	2.993	0.1%
RV148	C12 Bagmore Lane	0.003	2.993	0.1%
E5.1	Kit Lane & Longfield Dells	0.003	2.993	0.1%
E6.1	Ham Copse, Ellisfield	0.003	2.993	0.1%
E10.1	Herriard Common	0.003	2.993	0.1%
E17.1	Platts Copse	0.005	2.993	0.2%
E21.1	Hummocks Clump	0.005	2.993	0.2%
E22.1	Smallhill Clump	0.004	2.993	0.1%
EY.1	Picked Craft Copse	0.003	2.993	0.1%