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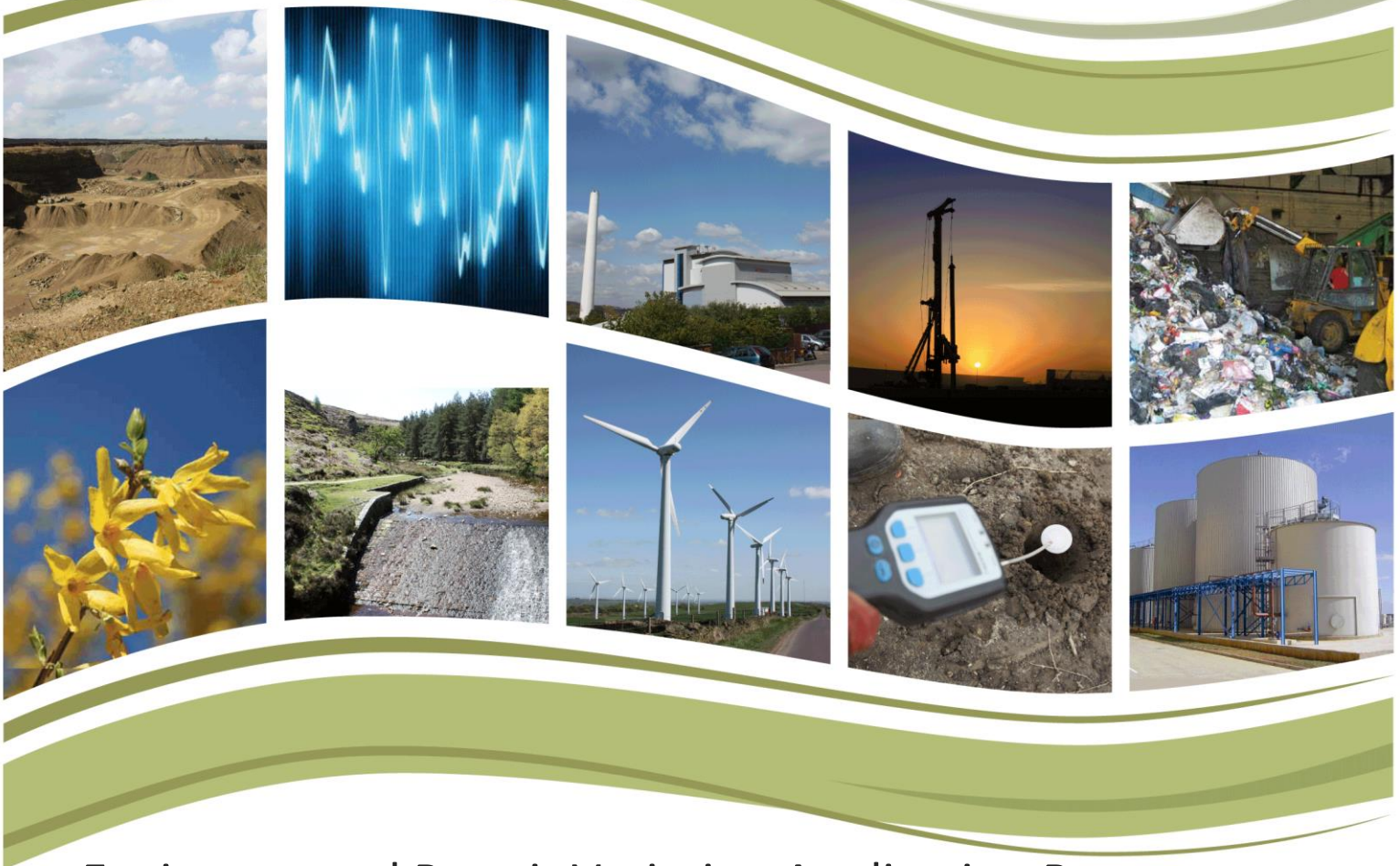

Environmental Permit Variation Application Report
EPR/VP3034RX/V001

Burton Agnes Biogas Plant

Future Biogas Limited

CRM.537.004.PE.R.003

'Experience and expertise working in union'

enzygo.com

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Environmental Permit Variation Application Report CRM 537 004 PE R 003

Project:	Burton Agnes Biogas Plant
For:	Future Biogas Limited
Status:	FINAL
Date:	October 2022
Author:	Steph Charnaud, Director of Permitting
Reviewer:	Jane Hall, Associate Consultant

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1.0 Non-Technical Summary

1.1 Introduction

1.1.1 This is a non-technical summary for an application submitted to the Environment Agency (EA) for a Variation to a Standard Rules Environmental Permit, SR 2012 No11 – Anaerobic digestion facility including the use of the resultant biogas, Permit Reference EPR/VP3034RX, for Burton Agnes Renewables Limited's (the 'Operator') Facility at Burton Agnes Biogas Plant (the 'Facility').

1.1.2 This Permit Variation is required as the Facility will no longer be able to meet all the requirements of the appropriate newly revised standard rules permit. This Permit Variation Application has been submitted to the EA to ensure that the site can remain operational.

1.1.3 There are no changes proposed to the current operation as a result of this Permit Variation Application.

1.2 Background

1.2.1 The Facility was regulated by the EA under a standard rules permit SR2012 No11 but following the recent revision of this standard rules permit, the facility no longer meets the revised standard rules. The Environment Agency have replaced standard rules permit SR2012 No11 with standard rules permit SR2021 No6 : anaerobic digestion facility, including use of the resultant biogas – installations.

1.2.2 Under standard rules permit SR2021 No6, the Facility cannot be located within a groundwater source protection zone I or II. As the eastern half of the facility is located within source protection zone II, the new standard rules cannot be met.

1.2.3 There are no changes to the Facility as a result of this variation application, specifically:

- The quantity of wastes received and associated European Waste Catalogue (EWC) codes.
- The Facility's operational hours.
- The infrastructure on site. Therefore, it is not proposed that a new site layout is submitted with this Permit Variation application.
- Emissions to land, air and water.
- The management of the site and its operations.

1.3 Planning Permission

1.3.1 Planning Permission for the Facility and its operations has been previously granted and is not required to be amended as a result of this Variation Application.

1.4 Relevant Legislation and Guidance

1.4.1 The proposed activities are subject to a number of National, European and International legislation and statutory and non-statutory guidance documents.

1.4.2 In relation to the proposed Anaerobic Digestion operations the following key pieces of legislation and guidance are relevant:

- Waste Framework Directive 2008/98/EC revised 05/07/2018;
- Environmental Permitting (England & Wales) Regulations 2016 (as amended);
- Environment Agency, Control and monitor emissions from your environmental Permit, 17th May 2021;
- Environment Agency, Develop a management system: environmental Permits, 4th August 2021;
- Environment Agency, Risk assessments for your environmental permit, March 2021;
- Environment Agency, Risk assessment for specific activities; environmental permits, 2nd February 2016;
- Environment Agency, Appropriate measures for the biological treatment of waste, consultation draft July 2020;
- Best Available Techniques (BAT) reference Document for Waste Treatment, 2018;
- Environmental Permitting Core Guidance, Defra; March 2020;
- Environment Agency, H4 Odour Management, March 2011;
- Environmental Permitting Guidance: The Waste Framework Directive, October 2009; and
- The Environment Agency (Environmental Permitting and Abstraction Licensing) (England) Charging Scheme 2022

1.5 Site Location and Environmental Setting

1.5.1 The Facility is located at:

Burton Agnes Biogas Plant
Harpham Grange Farm
Burton Agnes
East Riding of Yorkshire
YO25 4NQ

1.5.2 The National Grid Reference for the site is TA 09311 64064. The installation is in a rural area with agricultural land surrounding all boundaries.

1.5.3 The installation is a considerable distance away from any human or ecological receptors. The nearest residential property is approximately 931m, to the Southeast. The nearest surface watercourse is the Burton Agnes Pond and Mill Beck approximately 1.36km Southeast of the site.

1.5.4 The Facility lies within flood zone 1, which has a low probability of flooding.

1.5.5 The facility lies within designated Nitrate Vulnerable Zones, designations from 2017.

1.5.6 The Facility lies over a principal bedrock aquifer, with secondary superficial drift.

1.5.7 The groundwater vulnerability below the site is rated as high to the east of the site and medium to the west of the site due to soluble rock risk.

1.5.8 The site lies within a source protection zone 2 and 3 with a designated source protection zone 1 to the north of the northern site boundary.

1.5.9 The Facility does not lie within a designated air quality management area.

1.5.10 The prevailing wind direction at the facility is from the west southwest, west and west northwest according to observations taken at the Burton Fleming Weather Station from May 2013 – February 2022. www.windfinder.com

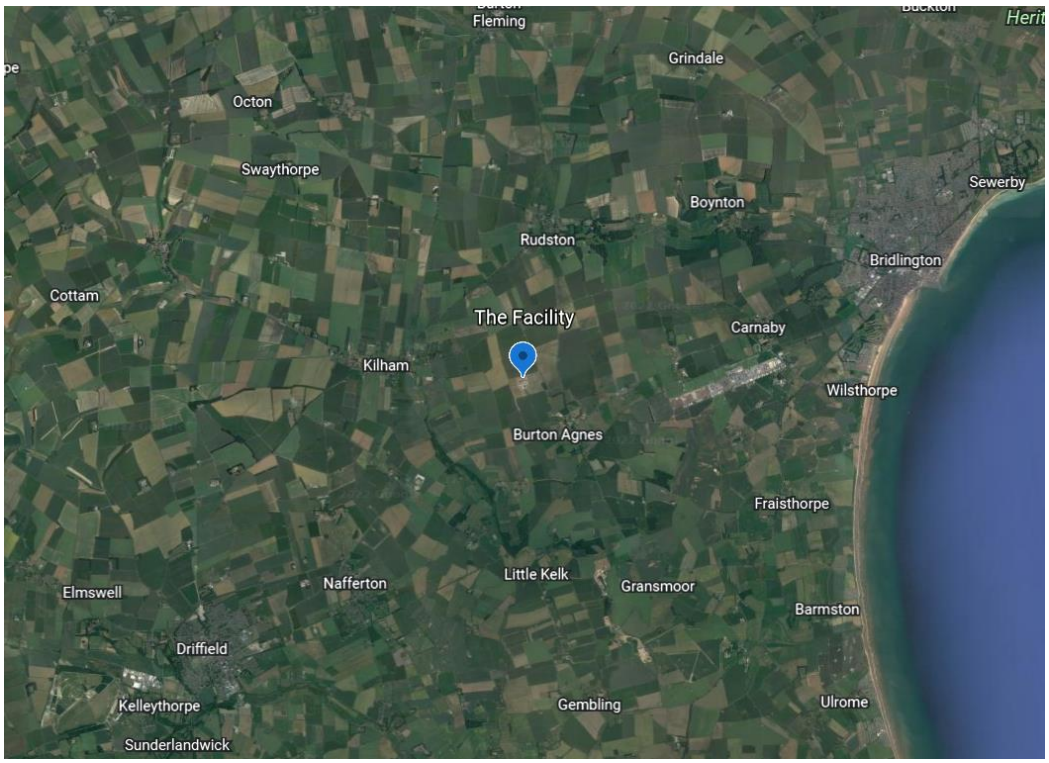
1.5.11 Table 2.5.1 below describes sensitive receptors which have been considered within this report.

Table 2.5.1: Sensitive Receptors

Receptor	Type	Distance (m)	Direction
Principal bedrock aquifer	Hydrogeological	On site	-
Source Protection Zone2/3	Hydrogeological	On Site	-
Undifferentiated secondary superficial geology aquifer	Hydrogeological	On site	-
Agricultural land	Agricultural	0	N, E, S & W
Bridleway	Recreational	602	SSW
Public right of way	Recreational	624	S
Public right of way	Recreational	660	SW
Recreational ground	Recreational	706	SE
Nearest residential property (Burton Agnes Village)	Residential	931	SE
Harpham Grange	Residential	1121	S
Burton Agnes primary school	Educational	1225	SE
Tuft Hill farm	Residential	1397	NNW
Agua House	Residential	1627	SE
Kilham Village	Residential	1726	WNW
Keeper's cottage	Residential	1781	SSE
Thornholme Village	Residential	1844	ESE
Commercial site	Commercial	1860	W

1.5.12 Figure 2.5.2 below shows the site location

Figure 2.5.2: Site Location



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1.5.13 The Facility will be operated by Burton Agnes Renewables Ltd whose company registration number is: 09701511.

1.5.14 The primary contact for the application is Jane Hall, Associate Consultant, Enzygo Limited, Jane.Hall@enzygo.com (Tel: 01454 269237).

1.6 Regulated Activities

1.6.1 The table below provides details of the current regulated activities, no changes to these activities are proposed for this permit variation application. There are also no changes to the waste received in terms of throughput, capacity or waste codes.

Table 2.7.1: Regulated Activities

Activity	Description of specified activity and WFD Annex I and II operations	Limits of specified activity and waste types
Activity listed in Schedule 1 of the EP Regulations		
Section 5.4 Part A(1)(b)(i) Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 75 tonnes per day (or 100 tonnes per day if the only waste treatment activity is anaerobic digestion) involving biological treatment	R3: Recycling of reclamation of organic substances that are not used as solvents.	From receipt of waste through to digestion and recovery of by-products (digestate). Anaerobic digestion of waste in three tanks (one buffer tank feeding one digester and a digestate storage tank) followed by burning of biogas produced from the process.

Activity	Description of specified activity and WFD Annex I and II operations	Limits of specified activity and waste types
		Waste types suitable for acceptance are limited to those specified in the Permit
Directly Associated Activities		
Description of activity	**Annex IIA or IIB Codes**	**Limits of specified activity and waste types**
Storage of waste pending recovery or disposal	R13: Storage of waste pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it is produced)	From the receipt of waste to dispatch off site for recovery and/or disposal. Storage of waste in silage clamps on an impermeable surface with sealed drainage. Storage of liquid digestate. Storage of solid digestate. Storage of dirty water from the process in dirty water lagoon prior to use in the AD process. Waste types are suitable for acceptance are limited to those specified within the Permit.
Physical treatment of non-hazardous waste	R3: Recycling/reclamation of organic substances which are not used as solvents	From the receipt of waste to dispatch for anaerobic digestion or dispatch off site for recovery and/or disposal. Storage of waste in clamps on an impermeable surface with sealed drainage. Waste types are suitable for acceptance are limited to those specified within the Permit.
Gas combustion in combined heat and power (CHP) engine to produce heat and power	R1: Use principally as a fuel to generate energy	From the receipt of biogas produced at the on-site anaerobic digestion process to combustion with the release of combustion gases.
Treating biogas and biomethane	R13: Storage of waste pending the operations numbered R3 (excluding temporary storage, pending collection, on the site where it is produced) R3: Recycling/reclamation of organic substances which are not used as solvents	From the receipt of biogas produced at the on-site anaerobic digestion process to dispatch for use within the facility's CHP.

Activity	Description of specified activity and WFD Annex I and II operations	Limits of specified activity and waste types
Gas upgrading plant	Clean and upgrade biogas using membrane separation technology and propane injection.	From receipt of biogas produced onsite to upgrading biogas to biomethane for export to the grid.
Emergency flare operation.	D10: Incineration on land Use of one auxiliary flare required for periods of breakdown or maintenance only	From the receipt of biogas produced at the on-site anaerobic digestion process to incineration with the release of combustion gases.
Biogas storage	Storage of biogas produced from anaerobic digestion of permitted waste in roof (headspace) of digesters.	From the storage of biogas produced from anaerobic digestion to point of use in the facility.
Digestate storage	Storage of liquid digestate in the secondary digestate tank and storage of solid digestate in a clamp	From the receipt of digestate produced from the on-site anaerobic digestion process to dispatch for use off site.
Raw material storage	Storage of raw materials including lubrication oil, antifreeze, ferric chloride, activated carbon, diesel	From the receipt of raw materials to dispatch for use within the Facility
Surface water collection and storage	Collection and storage of uncontaminated site surface water in a clean water lagoon	From the collection of uncontaminated site surface water from non-operational areas only for storage in the onsite clean surface water lagoon and discharge to land via soakaway
Emergency Diesel Generator Operation	Combustion of diesel in engine	Generator is used for <50 hours per annum, with usage recorded.

1.7 Process Description

1.7.1 Maize, hybrid rye and wheat straw is delivered to the site and ensiled after harvest. The material is covered to ensure that it is maintained in an anaerobic environment and to reduce the potential for odours and facilitate the silaging process. This feedstock is mechanically loaded into one of the two covered feeders which transfers the material into the primary digester.

1.7.2 Manure is typically brought onto the site once a week and stored in the clamps. The manure is mechanically loaded into one of the two covered feeders which transfers the manure into the primary digester.

1.7.3 Pig slurry is typically brought onto the site once a week and transferred directly to the Facilities' buffer tank then fed into the 7043m³ primary digester tank.

1.7.4 Upon the addition of further feedstock, the digestate transfers to the secondary digester via a gravity overflow system. The substrate is constantly mixed by rotating paddle stirrers in the

primary and secondary digesters. The material has a 70-day residence time within the AD process. Once the digestate has achieved its residence time it is fed into the 12268m³ digestate storage tank.

1.7.5 The solid and liquid fractions of the digestate are separated. The solid fraction of the digestate is stored in one of the facilities' silage clamps before being removed off site for use as a fertilizer. The liquid fraction of the digestate is stored in the digestate tank before being transported off-site for use as a fertilizer on local agricultural land. The digestate is periodically collected from the digestate storage tank for use as a fertiliser on local farmland.

1.7.6 Biogas produced during the process is stored within the roof space of the digestate storage tank before being fed to either the biogas upgrading plant or the CHP, with the heat and power being utilised both on site and power also exported off site. The volume of the double membrane gas holder is 8000m³.

1.7.7 A full description of the process is contained within section 3.0 of this report and a process flow diagram can be found in Appendix D.

1.8 Emissions from the Facility

1.8.1 There are no changes to the emissions from the Facility as a result of this Permit Variation application.

1.8.2 The point source emissions to air are detailed below.

1.8.3 There are no point source emissions to land.

1.8.4 Surface water is collected and directed to the surface water lagoon which acts as a large soakaway.

1.8.5 Dirty water is collected and directed to the lined dirty water lagoon. This is either used within the process or used to irrigate the local agricultural land.

1.9 Emission to Air

1.9.1 There are no additional point source emissions to air as a result of this permit variation application.

1.9.2 Emission points to air comprise the CHP engine stack, auxiliary boiler stack, emergency flare, biogas cleaning stack, emergency diesel generator, and pressure relief valves on the buffer tank, primary digester, secondary digester and digestate storage tank.

1.9.3 The point source emissions to air, which remain unchanged as a result of this permit variation, are listed in Table 2.9.1 below.

Table 2.9.1: Point Source Emissions to Air

Air Emission Point Reference	Source of Emission	Emissions
A5	CHP Engine	CO, CO_2, NOx, VOCs, SO_2.
A6	Standby Auxiliary Boiler	CO, NOx, SO_2, VOCs
A7	Emissions from the Auxiliary/Emergency High Temperature Flare Stack	CO, CO_2, NOx, SO_2, VOCs
A8	Biogas Upgrading Stack	CO_2, VOCs

Air Emission Point Reference	Source of Emission	Emissions
A9	Emergency Diesel Generator	CO, CO_2, SO_2, NOx, VOCs.
PRVs	One buffer tank PRV One primary digester PRV One secondary digester PRV One digester storage tank PRV One biogas holder PRV	CO_2 (44.5%), CH_4 (55%), H_2S, NH_4, VOCs

1.10 Emissions to Water

1.10.1 There are no other point source emissions to water, groundwater or sewer and all leachate and dirty water is captured by the sealed, on-site drainage system. The drainage system feeds into the lined dirty water lagoon where water is stored until it is either reused within the anaerobic digestion process or used as irrigation water. This arrangement is unchanged.

1.11 Fugitive Releases

1.11.1 Release of fugitive emissions to air will be prevented through infrastructure and management controls as per existing arrangements. As the input wastes comprise potentially odorous substances, they shall be covered at all times when material is not being added or removed.

1.11.2 It is considered highly unlikely that offsite nuisance as a consequence of dust will occur as a result of the operation of the Facility due to the mitigation measures which are in place and the distance between the Facility and the nearest receptor.

1.11.3 The potential for fugitive releases to water or land are limited to risks associated with the storage of liquids. Release of fugitive emissions to land and water will be prevented through infrastructure and management controls as per existing arrangements.

1.11.4 There are no additional fugitive emissions as a result of this Variation application.

1.12 Non-Permitted Activities

1.12.1 The operator is not proposing to undertake any activities at the site other than those which will be included in the Environmental Permit.

1.13 Management and Control

1.13.1 There are no changes to the personnel or the management of the on-site activities. The site's Technically Competent Manager (TCM), Andrew Saunders and Site Manager are unchanged. Andrew Saunders' WAMITAB Certificate and Continuing Competency Certificate is provided in Appendix B.

1.13.2 It is considered that current arrangements meet Environment Agency guidance in relation to management of the Facility.

1.13.3The Facility has in place an Environmental Management System which will be reviewed as part of the Permit Variation.

1.14 Environmental Risk Assessment

1.14.1 An Environmental Risk Assessment has been completed to support this permit variation application, to assess the impacts of the facility's operation. This assessment has been

completed in line with the Environment Agency's guidance documents, '*Risk assessments for your environmental permit, 25 March 2021*' and 'Risk assessments for specific activities: environmental permits, 2 February 2016',

1.14.2 The risk assessment has concluded that the activities at the facility will not result in an unacceptable risk to nearby sensitive receptors. The Environmental Risk Assessment is presented in full within section 5 of this permit variation application report.

1.15 Closure and Decommissioning

1.15.1 In the event that activities cease on site and decommissioning is required, the Facility's 'Closure plan' will be submitted to the Environment Agency. This will include details of how the Facility will be dismantled, how wastes produced from dismantling will be either recycled/reused or where appropriate disposed of. Finally, the site will be decontaminated to its pre-operational state i.e., agricultural status. As the proposed changes do not involve any changes to equipment, infrastructure or land use, the Facility's closure plan remains valid.

2.0 Process Description

2.1 Overview

2.1.1 This Permit Variation is to allow the Operator to continue to run the Facility due to the replacement of Standard Rules Permit, SR2012 no11 with Standard Rules Permit SR2021 no6 in. This variation application is for a bespoke permit.

2.1.2 There will be no changes to the operations at the plant as a result of this variation application.

2.2 Waste Acceptance and Pre-Acceptance

2.2.1 There are no changes to waste acceptance or pre-acceptance procedures or operations as part of this Variation. Techniques, controls, infrastructure, waste types and quantities accepted, and storage volumes all remain the same.

2.3 Waste Storage

2.3.1 There are no changes to the incoming waste storage facilities on-site. Incoming wastes are stored covered within the Facilities' sheeted clamps and tanks. The non-waste crops are stored in the silage clamps which are sheeted.

2.3.2 Pig slurry is transferred directly into the facilities' buffer tank, which is located, along with the digesters, within the facilities bund.

2.3.3 Manure is stored within any vacant silage clamps and is sheeted. A maximum of 3 days' worth of manure is stored on-site at any one time.

2.3.4 The digestate produced as a result of the anaerobic digestion process is not a waste. The solid fraction is stored within one of the Facilities' clamps prior to be taken off site. The liquid fraction is stored within the digestate tank before being taken off site. Both fractions of the digestate are utilised as a fertilizer on local agricultural land.

2.4 Waste Treatment

2.4.1 There are no changes to the treatment of waste imported onto the site. Wastes and non-wastes are loaded into the hopper then fed into the 7043m³ primary digester.

2.4.2 Upon the addition of further feedstock, the digestate transfers to the secondary digester via a gravity overflow system. The substrate is constantly mixed by rotating paddle stirrers in the primary and secondary digesters. The material has a 70-day residence time within the AD process. Once the digestate has achieved its residence time it is fed into the 12,268m³ digestate storage tank.

2.4.3 The solid and liquid fractions of the digestate are separated. The solid fraction of the digestate is stored in one of the facility's silage clamps before being removed off-site for use as a fertiliser. The liquid fraction of the digestate is stored in the digestate tank before being transported off-site for use as a fertilizer on local agricultural land. The digestate is periodically collected from the digestate storage tank for use as a fertiliser on local farmland.

2.4.4 Biogas produced during the process is stored within the roof space of the digestate storage tank before being fed to either the biogas upgrading plant or the CHP, with the heat and power being utilised both on site and exported off site. The volume of the double membrane gas holder is 8000m³.

2.4.5 The biogas which is sent to the biogas upgrading unit is treated for contaminants and tested for conformity before having odorant added and being injected into the National Grid via the network entry facility.

2.5 Management of the Facility

2.5.1 Operations at the site shall continue to be controlled within Burton Agnes Renewables Limited's EMS, to ensure that all activities are managed to minimise any emergency scenarios and potential environmental harm. A summary of the operator's EMS can be found in Appendix E.

2.5.2 There are no changes to the personnel or the management of the on-site activities. WAMITAB Certificates are provided in Appendix B.

2.6 Accident Prevention

2.6.1 As stated above, there are no changes proposed to the management of the Facility. The site's current Accident Management Plan is deemed satisfactory.

2.7 Energy Use

2.7.1 There is no change to the energy use at the site as a result of this Permit Variation application. The electrical energy demand for the Facility will continue to be met by both energy generated by combustion of biogas and imported electricity.

2.8 Raw Materials and Water

2.8.1 There will be no change in raw materials or water usage as a result of this Permit Variation application.

2.9 Waste Avoidance, Recovery and Disposal

2.9.1 The waste throughput and waste types are unchanged as a result of this Permit Variation application.

2.9.2 There is very minimal waste generated as part of the operations on the site and this Permit Variation application will not increase the quantity of waste produced.

2.10 Control of Emissions

2.10.1 There are no additional releases to air, water, sewer or land.

2.10.2 The waste input will not change as a result of this Variation.

2.10.3 Therefore, existing emissions controls are considered to adequately control emissions from the Facility following this proposed change.

2.11 Monitoring

2.11.1 There will be no change to the emissions monitoring which is carried out in line with Permit conditions at the Facility. There are no new emissions arising from this Permit Variation application, therefore no additional monitoring is required.

3.0 BAT Assessment

3.1 Introduction

3.1.1 BAT is determined by the Waste Treatment BATc. This section addresses the specific BATcs relevant to the Installation and compares the proposed techniques which will be employed on-site with the techniques described in the Waste Treatment BATc and provides an answer for question 3a on Application Form C3.

3.1.2 BAT is determined within the following documents:

- COMMISSION IMPLEMENTING DECISION (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council ('Waste BAT')
- Appropriate measures for the biological treatment of waste, Environment Agency, Consultation Draft July 2020.

3.1.3 The current operations are not changing from those described in the original Permit application, which established BAT for the installation. Therefore, as there are no changes, there is no required to complete a formal BAT assessment.

3.1.4 However, as no formal BAT assessment has been carried out previously, techniques in place to control any potential risks are described in this section and in section 4 are in accordance with BAT for this sector.

3.2 Environment Management System Summary

3.2.1 The Operator will operate in accordance with an Environmental Management System (EMS). The EMS will be developed to comply with EA guidance and includes a defined environmental policy as well as standard operating procedures, maintenance, clear reporting lines, staff training, process and environmental monitoring and incident/accident management.

3.2.2 There are no changes to the management of the Burton Agnes Biogas Plant as a result of this Permit Variation Application.

3.2.3 The EMS summary is included in Appendix E of this report which demonstrates how key elements required in an EMS meet standard Permit Condition 1.1:

The operator shall manage and operate the activities:

in accordance with a written management system that identifies and minimises risks of pollution, including those arising from operations, maintenance, accidents, incidents, non-conformances, closure and those drawn to the attention of the operator as a result of complaints; and

using sufficient competent persons and resources.

3.3 BAT 1 Environmental Management System

3.3.1 BAT 1 requires Operators to ensure that the sector specific features listed within this BATc are incorporated into the Facility's EMS.

Table 4.3.1: Requirements of BAT 1: EMS

Requirement	Mitigation measures proposed by Operator	Meets BATc for waste treatment
I. Commitment of the management, including senior management.	The Operator's Environmental Policy Statement is signed by the Company Director which demonstrates their commitment to environmental performance.	Yes
II. Definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation.	The Environmental Policy Statement will include a commitment to continually improving environmental performance.	Yes
III. Planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment.	The EMS will include setting objectives and targets. There will be a commitment to continuous improvement in the Policy Statement.	Yes
IV. Implementation of procedures paying particular attention to: (a) structure and responsibility, (b) recruitment, training, awareness and competence, c) communication, (d) employee involvement, (e) documentation, (f) effective process control, (g) maintenance programmes, (h) emergency preparedness and response, (i) safeguarding compliance with environmental legislation;	The EMS include all of these elements through procedures included within the EMS: (a) Roles and Responsibilities will be described in Policy reference. b) Training needs and training modules will be implemented through FB policy references DF-P-057 and DF-P-056. Training records are managed in accordance with FB policy. (c) Communications will be managed in accordance with various complaints procedures and in accordance with the Facility's Accident Management Plan (AMP) and Odour Management Plan (OMP). (e) Documentation will be managed in accordance with various procedures including the Document Control Procedure, and in accordance with the Facility's Permit, Accident Management Plan (AMP) and Odour Management Plan (OMP). (f) Process Control will be managed in accordance with various operational procedures and in accordance with the Facility's Permit, Accident Management Plan (AMP) and Odour Management Plan (OMP).	Yes

Requirement	Mitigation measures proposed by Operator	Meets BATc for waste treatment
	(g) Maintenance will be managed in accordance with the Operation Maintenance Plan DFP030, Maintenance Checklist DF-P-011 and other equipment-specific maintenance procedures. (h) Emergency procedures have been developed to cover specific scenarios, in addition to operation within the Facility's AMP. (i) The Legal Register for the facility will be incorporated within the EMS and updated routinely. A list of procedures within the EMS is included in Appendix E.	
V. checking performance and taking corrective action, paying particular attention to: (a) monitoring and measurement, (b) corrective and preventive action, (c) maintenance of records, (d) independent internal or external auditing	(a) Process Monitoring Procedure, Sampling Procedures and Statutory Monitoring and Reporting Procedure meets this requirement (b) Incident Reporting Procedures are in place to report and react to incidents, in addition to the AMP. (c) Various records are maintained in accordance with EMS procedures. (d) Annual Management Reviews and Audit Schedule stipulates how the EMS and facility operations are audited.	Yes
VI. review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness	Annual Management Reviews and the Facilities' Audit Schedule stipulates how the EMS and facility operations are audited.	Yes
VII. following the development of cleaner technologies	The EMS includes setting objectives and targets. There is a commitment to continuous improvement in the Policy Statement.	Yes
VIII. consideration for the environmental impacts from the eventual decommissioning of the plant at the stage of designing a new plant, and throughout its operating life	Closure and Decommissioning Plan is implemented and integrated as part of the Facility's EMS.	Yes
IX. application of sectoral benchmarking on a regular basis	The EMS will include setting objectives and targets. There will be a commitment to continuous improvement in the Policy Statement. The Burton Agnes Plant is	Yes

Requirement	Mitigation measures proposed by Operator	Meets BATc for waste treatment
	recently constructed and adopts a high level of environmental protection.	
X. waste stream management	See BAT 2	Yes
XI. an inventory of wastewater and waste gas streams	There are no changes to wastewater or waste gases as a result of this Permit variation. Records are maintained as required by the current Permit and EMS.	Yes
XII. residues management plan	There is minimal waste generated by the Facility. The main output is digestate arising from non-waste crops and manures which is a non-waste material. A residues plan is therefore not required as it is disproportionate to the nature of the waste generated on-site.	Yes
XIII. accident management plan	See BAT 21	Yes
XIV. odour management plan	See BAT 12	Yes
XV. noise and vibration management plan	See BAT 17	N/A
Measures Specified in EAs Appropriate Measures for the Biological Treatment of Waste Guidance		
Site Infrastructure Plan including: • buildings, and other main constructions; • storage facilities for hazardous materials, chemical stores, waste materials; • location of items for use in accidents and emergencies; • emergency entrances and exits; • points designed to control pollution, (inspection or monitoring points); • effluent discharge points;	These features are included in BAR's infrastructure plan, which is incorporated into the AMP showing all features listed (where relevant).	Yes

Requirement	Mitigation measures proposed by Operator	Meets BATc for waste treatment
• contaminated land; • receptors; • drainage (foul and surface water); and • utility services.		
Waste Storage	There are no changes to the waste storage facilities which are deemed suitable.	Yes
Normal and Abnormal Operation	The EMS considers both normal and abnormal/emergency scenarios. Actions taken to prevent accidents and actions to take in the event of an accident are included in the AMP.	Yes
Maintenance	BAR have a robust programme of planned preventative maintenance in place for all critical plant and equipment which includes using computerised systems to schedule inspections and activity and record defects. This is included in the overarching EMS. Spare parts are maintained on site.	Yes
Accidents and Incidents	An accident management plan is in place which describes the accident scenarios relating to the plant along with mitigation measures and controls.	Yes
Climate Change	The EMS considers the impact of climate change, and operation during extreme weather events such as flooding and heat waves. Any additional implications for the EMS in relation to the additional plant and equipment will also be incorporated.	Yes
Complaints	Complaints are investigated immediately using the complaints reporting form and all reasonable measures are taken to substantiate and alleviate the issue if substantiated.	Yes
Sufficient competent persons, resources and training	A training matrix and training plan forms part of the EMS. Records are kept for all training provided.	Yes

Requirement	Mitigation measures proposed by Operator	Meets BATc for waste treatment
	Critical roles at the site are identified along with staff who can fulfil the requirements of these roles.	
Record Keeping	Records are maintained for all documents associated with the Permit as required by Permit conditions. All records will be maintained for a period of six years, or as otherwise stated in the Permit.	Yes
Review of EMS	The EMS is reviewed routinely by senior plant management for suitability and in the event of a change to ensure that it adequately covers plant operations.	Yes
Closure	A site closure plan has been developed for the existing operations, which will be updated to include the proposed changes.	Yes
Access to Permit and EMS	The varied Permit and updated EMS will be made available to key staff and contractors.	Yes

3.3.2 In conclusion, the EMS in place at the Facility meets the requirements of the Waste Treatment BATc and relevant EA Guidance and is proportionate to the environmental risks associated with the activities carried out.

3.4 BAT 2 Waste Pre-Acceptance, Acceptance and Tracking

3.4.1 The operator only accepts manures, farm slurries and non-waste crops at the Facility which are unlikely to vary significantly in their nature. Waste Acceptance Procedures, Pre-Acceptance Procedures and Supply Agreement Forms for wastes and non-wastes are in place to control inputs. The risk of accepting any non-confirming loads is therefore minimal and will be controlled by these measures.

3.4.2 Non-conforming loads are rejected from site and records of any rejected loads are maintained.

3.4.3 BAT 2 requires Operators to improve the overall performance of their plants. Table 4.4.1 describes how the Facility meets these requirements.

Table 4.4.1: Requirements of BAT 2: Waste Pre-Acceptance, Acceptance and Tracking

Requirement	Measures in Place at Facility	Meets BATc for waste treatment
Set up and implement waste characterisation and pre-acceptance waste procedures	Waste Acceptance Procedure and Pre-Acceptance Procedures and supply agreement forms for wastes and non-wastes are in place to control inputs.	Yes

Requirement	Measures in Place at Facility	Meets BATc for waste treatment
Set up and implement waste acceptance procedures	The operator only accepts non-waste crops, manures and farm slurries at the Facility which are unlikely to vary significantly in their nature. Waste Acceptance Procedure and Pre-Acceptance Procedures and supply agreement forms for wastes and non-wastes are in place to control inputs.	Yes
Set up and implement a waste tracking system and inventory	Records are made of each load of waste that arrives at the site. Supply agreement forms for wastes and non-wastes are in place to control inputs. As materials arising from the treatment of waste leaving the site are not classed as 'waste', a tracking system would be disproportionate to the risks. Only minimal quantities of maintenance wastes are generated.	Yes
Set up and implement an output quality management system	As materials arising from the treatment of waste leaving the site are not classed as 'waste', an output quality system would be disproportionate to the risks. Only minimal quantities of maintenance wastes are generated. A Quality Policy is in place to maintain a high standard of operation.	Yes
Ensure waste segregation	Inputs are stored in specific clamps and tanks according to the material type.	Yes
Ensure waste compatibility prior to mixing or blending of waste	Pre-acceptance checks ensure that incompatible wastes and non-wastes will not be received at the site. Waste will be blended to optimise treatment.	N/A
Sort incoming solid waste	The only incoming solid wastes will be manures which will be stored in a designated area.	N/A

3.4.4 In conclusion, the waste pre-acceptance and acceptance procedures in place at the Facility meet the requirements of the Waste Treatment BATc.

3.5 BAT 3 Inventory of Wastewater and Waste Gas Streams

3.5.1 Point source emissions to air from the Facility arise from the following sources:

- CHP engine;
- Auxiliary boiler;
- Biogas upgrading stack;
- Emergency flare;
- Emergency diesel generator; and

- PRVs

3.5.2 Emissions points are listed on Table 4.5.1 below and marked on the installation boundary plan in the Drawings section of this Application. These point source emissions are unchanged as a result of this Permit Variation application.

Air Emission Point Reference	Source of Emission	Emissions
A5	CHP Engine	CO, CO_2, NOx, VOCs, SO_2.
A6	Auxiliary Boiler	CO, NOx, SO_2, VOCs
A7	Emissions from the Auxiliary/Emergency High Temperature Flare Stack	CO, CO_2, NOx, SO_2, VOCs
A8	Biogas Upgrading Stack	CO_2, VOCs
A9	Emergency Diesel Generator	CO, CO_2, SO_2, NOx, VOCs.
PRVs	One buffer tank PRV One primary digester PRV One secondary digester PRV One digester storage tank PRV One biogas holder PRV	CO_2 (44.5%), CH_4 (55%), H_2S, NH_4, VOCs

3.5.3 BAT 3 requires operators to establish and maintain an inventory of wastewater and waste gas streams as part of an EMS to facilitate the reduction in emissions to water and air.

3.5.4 As described in Section 2, the clamp storage areas will be serviced with a sealed drainage system which is drained to the dirty water lagoon. Any liquid leachate collected will be either fed into the AD Process or used for irrigation of the surrounding farmland. This is unchanged from existing arrangements.

3.5.5 Bund water will be pumped up to a diverter valve which is set to direct the flow to the dirty water lagoon. The pump station consists of a set of 2 submersible pumps set within a concrete sump within the bund.

3.5.6 Clean surface water run-off is directed to the on-site surface water lagoon which acts as a soakaway.

3.5.7 Table 4.5.2 below describes BAT requirements for wastewater and waste gases generated at the Facility.

Table 4.5.2: Requirements of BAT 3: Wastewater and Waste Gas Streams

Requirement	Measures in place at Facility	Meets BATc for waste treatment?
Information about the waste to be treated including; a. simplified process flow sheets that show the origin of the emissions b. descriptions of process-integrated techniques and wastewater / waste gas	The location of all point source emissions to air are shown on the plan in the Drawings section of this application. The Process Description is provided in Section 3.	Yes

Requirement	Measures in place at Facility	Meets BATc for waste treatment?
treatment at source including their performances	A Mass and Energy Balance is provided in Appendix I.	
Information about the characteristics of the wastewater streams.	Not applicable. There are no discharges to water from the facility.	N/A
Information about the characteristics of the waste gas streams, such as: a. average values and variability of flow and temperature b. average concentration and load values of relevant substances and their variability (e.g., organic compounds, POPs such as PCBs) c. flammability, lower and higher explosive limits, reactivity d. presence of other substances that may affect the waste gas treatment system or plant safety (e.g., oxygen, nitrogen, water vapour, dust)	An Air Quality Assessment has been provided in the Environmental Risk Assessment (ERA) submitted with this application.	Yes - see BAT 8

3.5.8 In conclusion, the Operator can demonstrate a good understanding of waste gas streams from the Facility and that requirements of the Waste Treatment BATc are met. There are no process emissions to water.

3.6 BAT 4 Storage Processes

3.6.1 BAT 4 requires operators to describe how they will reduce the environmental risks associated with the storage of waste. Table 4.6.1 describes BAT 4 requirements and the Operator's mitigation measures.

Table 4.6.1: Requirements of BAT 4: Storage of Waste

Requirement	Measures in Place at Facility	Meets BATc for waste treatment?
Optimised storage location	Wastes are stored as far as practically possible away from sensitive receptors such as watercourses. Double handling of waste will be avoided wherever operationally possible.	Yes
Adequate storage capacity	The digester tanks are designed to provide adequate capacity for the maximum permitted throughputs of waste accepted into the Facility. See Mass Balance in the Appendix I of this application. Incoming waste will be managed so that in the event the storage capacity of the site is reached, no additional wastes will be accepted. Storage capacities in treatment tanks cannot be exceeded as tanks are fitted with high level alarms and monitored by operatives.	Yes

Requirement	Measures in Place at Facility	Meets BATc for waste treatment?
	Filling will be supervised by site staff.	
Safe storage operation	All tanks are constructed of a material suitable for the containment of their contents. All tanks are subject to regular inspections to ensure their integrity and maintenance will be undertaken as necessary. All tanks are located within the main site bund which is designed in accordance with CIRIA C736 standards. See Section 6.	Yes
Separate area for storage and handling of hazardous waste	Not applicable. The Facility does not accept hazardous waste.	N/A

3.6.2 In conclusion, the waste storage facilities in place at the Facility meet the requirements of the Waste Treatment BATc.

3.7 BAT 5 Handling and Transfer Processes

3.7.1 BAT 5 requires Operators to consider the risks posed by the handling and transfer of waste at their Facilities, the likelihood of accidents and incidents posed by these activities along with their environmental impact. Table 4.7.1 describes the requirements and the Operator's mitigation measures.

Table 4.7.1: Requirements of BAT 5: Handling and Transfer of Waste

Requirement	Measures in Place at the Facility	Meets BATc for waste treatment?
Handling and transfer of waste is carried out by competent staff	A Technically Competent Manager (TCM) is present on-site. See Appendix B for copies of the WAMITAB Certification and Continuing Competency Certification. Staff are appropriately trained in site procedures and all waste management procedures are covered by the EMS.	Yes
Handling and transfer of waste are duly documented, validated prior to execution and verified after execution	The Operator maintains records of all wastes transferred to and from the Facility.	Yes
Measures are taken to prevent, detect and mitigate spills	The Operator has in place an AMP which describes measures to prevent, detect and mitigate spills. Key mitigation techniques include: • All filling points, vent and sight glasses are located within bunded areas.	Yes

Requirement	Measures in Place at the Facility	Meets BATc for waste treatment?
	• Secondary containment will be provided for all liquids stored on site. • Absorbents are used to soak up any spills. • Visual inspections are carried out to detect spills during vehicle movements and during the handling, storage, treatment and transfer of waste. • Storage tank levels are monitored by Supervisory Control and Data Acquisition software (SCADA) and operatives and alarms are in place. • Alarms are in place should the system fall outside of the set parameters or if failure should occur.	
Operation and design precautions are taken when mixing or blending wastes.	Risks from mixing and blending are minimal and involve mixing of non-waste crops, farm slurries and manure. AD treatment processes are carried out within sealed vessels which are sited within a dedicated bund.	N/A

3.7.2 In conclusion, waste handling and transfers meet the requirements of the Waste Treatment BATc.

3.8 BAT 6 and BAT 7 Emissions to Water and Monitoring

3.8.1 There are no process emissions to water resulting from activities at the Facility and as such BAT 6 and 7 are not applicable. Leachate and condensate are recirculated into the AD process.

3.9 BAT 8 Monitoring of Air Emissions

3.9.1 BAT 8 requires defined emissions to air to be monitored in accordance with EN standards. Point source emissions to air from the Facility are associated with the sources described in Section 4.5.

3.9.2 The Operator currently monitors the emissions from the CHP engine annually, from which there are quantifiable levels of pollutants, in accordance with frequencies, standards and methods specified in Table 3.1 of the Permit. Monitoring is undertaken by an external contactor who is MCERTS accredited. Table 4.9.2 below describes the monitoring which will be undertaken at the site.

Table 4.9.2: Monitoring Requirements

Emission Source	Parameter	Limit (including units)	Monitoring Frequency	Monitoring Standard
CHP Engine	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	500mg/m³	Annual	BS EN 14792
	Sulphur Dioxide	350mg/m³		BS EN 14791
	Carbon monoxide	1400mg/m³		BE EN 15058
	Total VOCs	1000mg/m³		BS EN 12619:2013
Standby Auxiliary Boiler	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	500mg/m³	Annual	BS EN 14792
	Sulphur Dioxide	350mg/m³		BS EN 14791
	Carbon monoxide	1400mg/m³		BE EN 15058
	Total VOCs	1000mg/m³		BS EN 12619:2013
Emergency High Temperature Flare Stack	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	150mg/m³	Monitoring to be undertaken in the event the emergency flare is operational for more than 105 of a year (876 hours)	BS EN 14792
	Carbon monoxide	50mg/m³		BE EN 15058
	Total VOCs	10mg/m³		BS EN 12619:2013
Biogas Upgrading Stack	VOCs including methane	No limit set		BS EN 15446
Emergency Diesel Generator	No parameter set	-	Recording of operating hours	-
Pressure relief Valves	No parameter set	No limit set	Recording of operating hours	-

3.9.3 In conclusion, air monitoring in place at the Facility meets the requirements of the Waste Treatment BATc.

3.10 BAT 10 Monitoring of Odorous Emissions

3.10.1 The applicability of BAT 10 is restricted to cases where an odour nuisance at sensitive receptors is expected and/or has been substantiated. The nature of the materials stored on-site has the potential to give rise to odour, therefore an OMP is in place at the Facility.

3.10.2 Odour monitoring is described in the OMP (see BAT 12). Principally the monitoring regime comprises olfactory field odour monitoring (sniff testing), which will be carried out by site

management (or other appropriately competent person), with records maintained. The odour monitoring includes:

- Daily sniff testing to a standard as defined by the EA's H4 Guidance.
- Daily monitoring of weather conditions.
- Monitoring of process conditions to give early warning of potential odour issues.
- Monitoring of complaints and other forms of community feedback.

3.10.3 Additional monitoring will be carried out during adverse meteorological conditions, plant breakdowns or if a compliant is received.

3.10.4 In conclusion, odour monitoring in place at the Facility meets the requirements of the Waste Treatment BATc.

3.11 BAT 11 Monitoring of Resource Use and Residues and (Wastes)

3.11.1 The Operator, as will be required by the Permit, will monitor the parameters specified by BAT 11:

- water;
- energy;
- raw materials; and
- wastes generated.

3.11.2 Leachate and condensate are re-used within the process therefore there are no emissions of wastewater.

3.11.3 In addition, the Operator will provide information on raw material use and waste generated in their annual Pollution Inventory returns.

3.11.4 In conclusion, monitoring of water, energy and raw materials use and generation of residues in place at the Facility meets the requirements of the Waste Treatment BATc.

3.12 BAT 12 Odour Management Plan

3.12.1 The Operator has a comprehensive OMP in place at the Facility which describes odour sources, mitigation measures, incident management, monitoring and record keeping. BAT 12 requires operators to implement an OMP to prevent, or where that is not practicable to reduce odour emissions to include the requirements described in Table 4.12.1 below.

3.12.2 The Operator's OMP was written in compliance with the EA's guidance note 'Additional guidance for H4 Odour Management: How to Comply with your Environmental Permit' March 2011.

Table 4.12.1: Requirements of BAT 12: OMP

Requirement	Measures in Place at the Facility	Meets BATc for waste treatment?
A protocol containing actions and timelines	The OMP includes a review which identifies whether odour control techniques remain appropriate for the site.	Yes
A protocol for conducting odour monitoring as set out in BAT 10	Monitoring is described in the OMP (see BAT 10 for details).	Yes
A protocol for responding to identified odour incidents	The OMP describes abnormal operation scenarios and actions to be taken to prevent, and in the event of accidental releases. The OMP includes the complaints procedure and review of complaints.	Yes
An odour prevention and reduction programme designed to identify the source(s): to characterise the contributions of the sources; and to implement the prevention and/or reduction measures.	The OMP describes the potential odour sources, potential odorous releases and measures in place to prevent or minimise releases.	Yes

3.12.3 In conclusion, the Operator has developed a comprehensive OMP to implement at the Facility which meets the requirements of BAT 12.

3.13 BAT 13 Prevent or Reduce Odour Emissions

3.13.1 Potentially odorous emissions from the Facility are minimal as treatment activities take place within treatment tanks. Silage camps are sheeted, except for when materials are being added or removed. BAT 13 is to minimise odour emissions, as described in Table 4.13.1 below.

Table 4.13.1: Requirements of BAT 13: Odour Emissions

Requirement	Measures in Place at the Facility	Meets BATc for waste treatment?
Minimise residence times	Residence times are limited where applicable. Solid manures are typically held on site for 3 days before input into the process.	Yes
Using chemical treatment to destroy or reduce the formation of odorous compounds.	There are no channelled odour sources where this treatment process could be applied.	NA
Optimising aerobic treatment – this may include use of pure oxygen, removal of scum in tanks, frequent maintenance of the aeration system.	Not applicable. All treatment of waste within the Facility is anaerobic.	N/A

3.13.2 In conclusion, measures in place at the Facility meet the requirements of BAT 13, where relevant.

3.14 BAT 14 Reduce Diffuse Emissions to Air

3.14.1 BAT 14 requires Operators to describe how they will prevent or reduce diffuse emissions to air from their operations. Table 4.14.1 sets out the requirements of BAT 14 and describes how operations at the Facility meets these requirements.

Table 4.14.1: Requirements of BAT 14: Diffuse Emissions to Air

Requirement	Measures Proposed by Operator	Meets BATc for waste treatment?
Minimising the number of potential diffuse emission sources	The Operator has in place an AMP which describes measures to prevent, detect and mitigate impacts from release of diffuse emissions to air. Key mitigation techniques include: • Diffuse sources (e.g., silage/manure) are sheeted to minimise odour. • A flare is installed for emergency use. PRVs are only operated in an emergency during instances when the flare is not operational. • The plant will be subject to PPM to prevent accidental releases.	Yes
Selection and use of high-integrity equipment	The plant and equipment used at the Facility is sourced from well-known suppliers, which have been widely used and tested at similar facilities within Europe and the UK.	Yes
Corrosion Prevention	Construction materials and those materials used within the plant and equipment include corrosion prevention where necessary.	Yes
Collection, containment and treatment of diffuse emissions	PRVs are only operated in an emergency if the flare is not available.	Yes
Dampening	Not applicable. Operations are not inherently dust-generating. Crops are sheeted to prevent odour and dust.	N/A
Maintenance	Plant and equipment on site are maintained in accordance with the manufacturer's instructions and will be subject to PPM.	Yes
Cleaning of waste treatment and storage areas	Cleaning is carried out as required with liquors recirculated within AD system or disposed of via authorised waste contractor.	Yes

Requirement	Measures Proposed by Operator	Meets BATc for waste treatment?
Leak Detection and Repair (LDAR) programme	Levels in digester tanks are monitored by a SCADA system and alarms are in place. Any leaks detected by the system will be investigated and rectified.	Yes

3.14.2 In conclusion, the measures in place at the Facility to prevent diffuse emissions to air meet the requirements of the Waste Treatment BATc.

3.15 BAT 15 and BAT 16 Flaring

3.15.1 BAT 15 requires Operators to use flaring for safety reasons only, or for non-routine operating conditions (e.g., start-ups, shutdowns). Table 4.15.1 sets out the requirements of BAT 15 and describes how operations at the Facility meets these requirements.

Table 4.15.1: Requirements of BAT 15: Flaring

Requirement	Measures Proposed by Operator	Meets BATc for waste treatment?
Correct Plant Design	Flare will only be used during emergencies. High integrity PRVs are installed on gas system.	Yes
Plant Management	Plant and equipment will be subject to PPM. Process variables are monitored using SCADA.	Yes

3.15.2 In order to reduce emissions to air from flares when flaring is unavoidable, BAT 16 is to use both of the techniques set out in Table 4.14.2 below.

Table 4.15.2: Requirements of BAT 16: Flaring

Requirement	Measures Proposed by Operator	Meets BATc for waste treatment?
Correct Design of Flaring Devices	Flare will only be used during emergencies. Stack height is 7.7m from the ground providing good dispersion and is a high temperature (1000°C) flare ensuring destruction of pollutants.	Yes
Monitoring and Recording as Part of Flare Management	Hours of operation will be recorded and reported to the EA annually.	Yes

3.15.3 In conclusion, operations in place at the Facility relating to the design and use of flares meet the requirements of BAT 15 and 16.

3.16 BAT 17 Noise and Vibration

3.16.1 BAT 17 is to set up, implement and regularly review a noise and vibration management plan. The applicability of BAT 17 is restricted to cases where noise or vibration nuisance at sensitive receptors is expected and/or has been substantiated.

3.16.2 There are no noise sensitive receptors within the immediate vicinity of the Facility. He nearest residence is 931m from the site. The engine is enclosed within a container to minimise noise levels and other operations are not inherently noise generating. Other plant and equipment are unlikely to generate levels of noise which may cause complaints. BAT 17 is therefore not considered to be relevant to the Facility.

3.17 BAT 18 Prevent or Reduce Noise and Vibration

3.17.1 BAT 18 requires Operators to prevent or reduce noise and vibration from their operations. As noted above in relation to BAT 17, activities are not inherently noise generating. BAT 17 is therefore not considered to be relevant to the Facility.

3.18 BAT 19 Emissions to Water

3.18.1 BAT 19 requires Operators to describe how they optimise water consumption, reduce the quantity of water generated and reduce emissions to soil and water. Table 4.18.1 describes how the Facility meets these requirements.

Table 4.18.1: Requirements of BAT 19: Emissions to Water

Requirement	Measures in Place at the Facility	Meets BATc for waste treatment?
Water management	Water is used in the following applications: • processing water; and • cleaning / maintenance. Site run-off is collected within an on-site lagoon and used within the AD facility or used for irrigation of the surrounding farmland. Leachate and condensate are collected in the on-site lagoon and either used within the process or used for irrigation of the surrounding farmland.	Yes
Water recirculation	Water is recirculated back into the waste processing operation with excess being used for the irrigation of surrounding farmland.	Yes
Impermeable surface	The processing activities are located on a concrete hardstanding surface which is provisioned with a perimeter bund.	Yes
Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels	The Operator has in place an AMP which describes measures to prevent and detect spills. Key mitigation techniques are described in response to BAT 5.	Yes
Roofing of waste storage and treatment areas	Treatment processes are carried out in tanks which are designed to operate externally to buildings.	Yes
Segregation of water streams	There is no process effluent. The only wastewater stream comprises uncontaminated surface water run-off.	Yes

Requirement	Measures in Place at the Facility	Meets BATc for waste treatment?
Adequate drainage infrastructure	There is no process effluent. The only wastewater stream comprises uncontaminated surface water run-off.	Yes
Design and maintenance provisions to allow detection and repair of leaks	Levels in storage tanks are monitored by SCADA and operatives, alarms are in place and wastes are transferred by an in-situ pipeline. Site equipment will be routinely inspected and subject to PPM.	Yes
Appropriate buffer storage capacity	Leachate from the silage clamps is stored within the dirty water lagoon which provides buffer storage. If excess water is generated, it will be used as irrigation water on surrounding farmland.	N/A

3.18.2 In conclusion, measures in place to minimise water use and emissions to water at the Facility meet the BAT requirements.

3.19 BAT 20 Reduce Emissions to Water

3.19.1 BAT 20 requires Operators to treat water using an appropriate combination of techniques provided in the BATc document.

3.19.2 There are no emissions to water from the facility. Surface water is collected and stored within the clean surface water lagoon, which acts as a large soakaway. Effluent produced by the storage of waste will be directed to the dirty water lagoon, and then either used within the process, or used as irrigation water for surrounding farmland.

3.20 BAT 21 Emissions from Accidents and Incidents

3.20.1 The Operator has in place an AMP which is an operational document to identify and minimise accidental risks.

3.20.2 BAT 21 requires Operators to describe how the environmental consequences from accidents and incidents will be prevented and/or limited. Table 4.20.1 describes how the Operator meets these requirements.

Table 4.20.1: Requirements of BAT 21: Accidents

Requirement	Measures in Place at the Facility	Meets BATc for waste treatment?
Protection measures	The Operator has in place an AMP which describes measures to prevent and mitigate impacts from accidents. Key mitigation techniques include: • Site security systems. • Containment of liquids. • Emergency drills and incident training.	Yes

Requirement	Measures in Place at the Facility	Meets BATc for waste treatment?
	• Inspections and PPM. • SCADA system to monitor process variables. • PRVs installed. • Site access will be secured when unoccupied.	
Management of incidental/accidental emissions	Procedures to manage the containment of accidental emissions are included in the AMP.	Yes
Incident/accident registration and assessment system	The EMS includes Incident Reporting Procedures which include measures to prevent recurrence.	Yes

3.20.3 In conclusion, the measures proposed at the Facility to prevent or limit the environmental consequences from accidents meet the requirements of the Waste Treatment BATc.

3.21 BAT 22 Material Efficiency

3.21.1 BAT 22 requires the Operator to substitute materials with waste where possible. Raw materials used in large quantities, and it is not currently considered feasible to replace any other non-waste materials used to operate the Facility with waste materials. However, opportunities to substitute a raw material with a waste material will continue to be reviewed by the Operator if future developments allow substitution to occur.

3.22 BAT 23 Energy Efficiency

3.22.1 BAT 23 requires Operators to use energy efficiently. Table 4.22.1 describes how the Facility will meet these requirements.

Table 4.3.22: Requirements of BAT 23: Energy Efficiency

Requirement	Measures Proposed by Operator	Meets BATc for waste treatment
Energy Efficiency Plan	An energy efficiency plan has not yet been produced for the site. An energy efficiency plan will be produced by the Operator prior to August 2022.	Not currently
Energy Balance Record	The Operator will monitor energy use as will be required by the Environmental Permit	Yes

3.23 BAT 24 Reuse of Packaging

3.23.1 BAT 24 is to minimise the quantity of waste sent for disposal and to maximise the reuse of packaging. There are minimal packaging materials used or generated by the Facility therefore this BAT requirement is not applicable.

3.23.2 Should packaging materials be used at the Facility, they will be re-used, recycled or recovered, where possible, rather than disposed of.

3.23.3 In conclusion, appropriate measures to re-use packing are in place at the Facility, so far as the Operator can control, which meet the requirements of the Waste Treatment BATc.

3.24 BAT 33 Control Waste Inputs

3.24.1 To reduce odour emissions and to improve overall environmental performance, BAT is to select the waste input.

3.24.2 The technique consists of carrying out the pre-acceptance, acceptance and sorting of the waste input (see BAT 2) to ensure the suitability of the waste input for the waste treatment process, e.g., in terms of nutrient balance, moisture or toxic compounds which may reduce the biological activity.

3.24.3 As described in response to BAT 2 and in Section 2 of this report, appropriate measures to control the waste inputs meet the requirements of the Waste Treatment BATc. Only non-waste crops and manure is treated at the Facility.

3.25 BAT 34 Emissions to Air

3.25.1 To reduce channelled emissions to air of dust, organic compounds and odorous compounds, BAT is to employ techniques to minimise such emissions.

3.25.2 Emissions from the CHP engine and Biogas Upgrading Plant are controlled in the Permit by emission limit values and monitoring will be carried out annually to demonstrate compliance. There are minimal other channelled emissions from the Facility. The requirements of BAT 34 are therefore not considered to be relevant to the Facility.

3.26 BAT 35 Emissions to Water and Water Usage

3.26.1 To reduce the generation of wastewater and to reduce water usage BAT is to use the techniques given in Table 4.26.1 below.

Table 4.26.1: Requirements of BAT 35: Emissions to Water

Requirement	Mitigation Measures in Place at the Facility	Meets BATc for waste treatment
Segregation of water streams	Uncontaminated site drainage is discharged to the clean surface water lagoon. Leachate and condensate are segregated and recirculated back into the AD process.	Yes
Water recirculation	Leachate and condensate are recirculated back into the AD process. Clean surface water is capture in used in the AD process	Yes
Minimisation of the generation of leachate	Not applicable. Leachate may be generated from within the covered silage clamps. Leachate will be recirculated into the AD process.	N/A

3.26.2 In conclusion, there is no process effluent to be released. The measures in place at the Facility to optimise water consumption and minimise emissions to water meet the requirements of the Waste Treatment BATc.

3.27 BAT 38 Monitor the Key Waste and Process Parameters

3.27.1 To reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and/or control the key waste and process parameters. Table 4.27.1 describes BAT for minimising emissions to air.

Table 4.27.1: Requirements of BAT 38: Emissions to Air

Requirement	Mitigation Measures in Place at the Facility	Meets BATc for waste treatment?
Implementation of a manual and/or automatic monitoring system to: ensure a stable digester operation; minimise operational difficulties, such as foaming, which may lead to odour emissions; provide sufficient early warning of system failures which may lead to a loss of containment and explosions.	SCADA is installed to carry out continuous analysis and control of both the liquid digestate and biogas system to ensure the site runs continuously at optimum efficiency. Only three sources of waste (pig and poultry manure and pig slurry) are accepted at the Facility minimising significant variations in the feed. Gas production will be carefully controlled and monitored by SCADA. Flare and PRVs are installed to prevent biogas build up in an emergency.	Yes
Monitoring and/or control of key waste and process parameters, e.g.: pH and alkalinity of the digester feed; digester operating temperature; hydraulic and organic loading rates of the digester feed; concentration of volatile fatty acids (VFA) and ammonia within the digester and digestate; biogas quantity, composition (e.g., H2S) and pressure; liquid and foam levels in the digester.	All parameters are monitored continuously by SCADA or periodically by in-house or third-party testing laboratories. All results are recorded.	Yes

3.27.2 In conclusion, measures to minimise emissions to air meet the requirements of the Waste Treatment BATc.

4.0 Environmental Risk Assessment

4.1 Scope

4.1.1 This risk assessment had been prepared in response to Question 6 of the Environment Agency's Environmental Permit Application Form Part C2.

4.1.2 There are no changes to the operation, plant, infrastructure or management of the Facility due to this Permit Variation application.

4.2 Nearby Receptors

4.2.1 The key receptors which may be impacted by the facility are summarised within Table 5.2.1 below.

Table 5.2.1: Nearby Receptors

Receptor	Type	Distance (m)	Direction
Principal bedrock aquifer	Hydrogeological	On site	-
Source Protection Zone2/3	Hydrogeological	On Site	-
Undifferentiated secondary superficial geology aquifer	Hydrogeological	On site	-
Agricultural land	Agricultural	0	N, E, S & W
Bridleway	Recreational	602	SSW
Public right of way	Recreational	624	S
Public right of way	Recreational	660	SW
Recreational ground	Recreational	706	SE
Nearest residential property (Burton Agnes Village)	Residential	931	SE
Harpham Grange	Residential	1121	S
Burton Agnes primary school	Educational	1225	SE
Tuft Hill farm	Residential	1397	NNW
Agua House	Residential	1627	SE
Kilham Village	Residential	1726	WNW
Keeper's cottage	Residential	1781	SSE
Thornholme Village	Residential	1844	ESE
Commercial site	Commercial	1860	W

4.2.2 The Facility is located to the northwest of the village of Burton Agnes, immediately bounded on all sides by agricultural fields. The closest residential receptor is Rectory Lodge approximately 931m southeast of the facility. The Facility is located entirely within a Flood Zone 1, which is designated as having a low risk of flooding.

4.2.3 None of the following types of ecological sites are located within 2,000m of the Facility:

- Areas of Outstanding Natural Beauty (AONB)
- Local or National Nature Reserves

- National Parks
- Ramsar sites
- Special Areas of Conservation (SAC)
- Special Protection Areas (SPA)
- Sites of Special Scientific Interest (SSSI)

4.2.4 The Facility is located over a Principal Aquifer in the bedrock and an undifferentiated Secondary aquifer in the superficial geology. The groundwater vulnerability is classified as High towards the north-eastern corner of site with the remainder of the site classified as Medium – High.

4.2.5 The site is located within a groundwater source protection zone, with the eastern half of site within Zone II and the western half of site within Zone III. The site is also located within a drinking water safeguard zone for groundwater and surface water.

4.3 Emissions to Air

4.3.1 The emission points to air remain unchanged as a result of this Permit Variation Application. There are 5 main emission point arising from:

- CHP engine;
- Auxiliary Boiler;
- Emergency Flare Stack;
- Emergency Diesel Generator;
- Biogas Upgrading Plant.

4.3.2 There are also emissions to air arising from PRV's from the buffer tank, primary digester, secondary digester, digester storage tank and the biogas holder

4.3.3 As part of this permit variation application an Air Quality Assessment has been completed modelling the air emissions from the CHP stack, auxiliary boiler stack and the biogas upgrading plant stack. A copy of the Air Quality Assessment is located in Appendix G of this report.

4.3.4 The emergency flare and emergency diesel generator have been screened out of the air quality assessment as they are only used in the case of an emergency.

4.3.5 The report concluded that Predicted annual mean PECs at all human receptor locations did not exceed 70% of the EQS. IN the case of short-term impacts PCs did not exceed 20% of the EQS minus twice the background concentration at any human receptor. Impacts on pollution concentrations at all human locations are therefore considered not significant.

4.3.6 The ecological impacts of NO_2, SO_2 and NH_3 were screened as being insignificant. The EQS for nitrogen and acid deposition was exceeded as baseline condition at all designations however the PC proportions from the Facility could be screened out as insignificant following the initial EA screening criteria. Therefore, it is unlikely that adverse impacts would be present at ecological designations as a result of the Facility.

4.4 Emissions to Water and Sewer

4.4.1 There are no emissions to sewer. This is unchanged.

4.4.2 Emissions to water will consist of clean site run off only, via the surface water lagoon which acts as a soakaway.

4.4.3 Effluent produced by the storage of waste is captured within the lined dirty water lagoon and used either within the process or as a fertilizer on the surrounding farmland. This is unchanged from what currently occurs.

4.5 Emissions to Land

4.5.1 There are no emissions to land. This is unchanged.

4.6 Bio-aerosols

4.6.1 The Environment Agency's guidance document *Bioaerosol monitoring at regulated facilities – use of M9:RPS 209,* states that if your Facility is located within 250 metres of a sensitive receptor you must monitor bioaerosols and undertake a specific bioaerosol risk assessment. As detailed above in Table 5.2.1, the nearest sensitive receptor which needs to be considered under this guidance is 931m away. Therefore, a bio-aerosols risk assessment is not required.

4.7 Fugitive Releases

4.7.1 There are no changes to the fugitive releases profile in relation to potential releases to land, water or air.

4.7.2 Activities on site will be managed in accordance with the operator's management systems. A summary of the EMS is included within Appendix E.

4.8 Global Warming Potential

4.8.1 The Global Warming Impact of this Facility is unchanged and therefore requires no further assessment.

4.9 Noise Emissions

4.9.1 There are no changes the noise profile of the Facility.

4.9.2 Due to the rural location of the site, none of the sensitive receptors identified are considered close enough to be affected by noise from the site, with the closest at 931m from the installation's noise sources. The operator has adopted good management practices to ensure that any incidents of noise are appropriately investigated and remedial action taken.

4.10 Odour Emissions

4.10.1 As there are no changes to the daily opening hours, or the nature, type or quantity of the waste, increase in emissions of odour are not anticipated. Existing procedures will be applied to continue to control emissions.

4.10.2 The system in place to manage odorous releases from the site is unchanged from current operations and it was deemed to adequately meet EA standards during determination of the Standard Rules Permit Application.

4.10.3 However, as this application is to vary the Standard Rules Permit to a Bespoke Permit, an odour assessment was carried out to support this Permit Variation Application. A dispersion model using ADMS5 and using 5 years of meteorological data was produced to determine impacts.

4.10.4 Impacts of the operations on site at sensitive receptor locations in the vicinity were quantified, the maximum predicted results compared with the appropriate odour benchmark level.

4.10.5 Predicted odour concentrations were below the EA benchmark level of 3.0 ou_E/m^3 at all sensitive receptors in the vicinity of the site for all modelling years. In addition, using the IAQM guidance significance criteria, worst case impacts were negligible at all representative sensitive receptors.

4.10.6 An odour assessment has been carried out as part of this Permit Variation Application and a copy can be found in Appendix H.

4.11 Summary and Conclusions

4.11.1 The emissions profile from the installation will not change as a result of this Permit Variation application.

4.11.2 It is considered unlikely that there will be additional noise impact on sensitive receptors because of these changes as there is no changes to the daily operating hours, or the nature or quantity of waste being brought into the site. The nearest sensitive receptors identified are approximately 931ms from the site boundary which is a significant distance from the Facility's operations.

4.11.3 The odour assessment undertaken as part of the Permit variation application concluded that given the robust assumptions made for odour emissions, the overall potential for odour impacts generated by the Facility can be considered as acceptable and not considered to be significant.

4.11.4 Based on the predictions and the use of conservative assumptions, such as worse case emission limit values and meteorological conditions over a 5-year period, it is considered that the overall air quality impacts of the Facility would be not significant.

4.11.5 The assessments presented in Appendix A conclude that the risks arising from the installation are 'low'.

5.0 CIRIA 736 Assessment

plandescil
consulting engineers

AD Plant/Compost Compliance and Snagging Report

Revision 0

Job No. 28395

Burton Agnes AD Plant
Harpham Grange Farm
Burton Agnes
YO25 4NQ

Client: Future Biogas Ltd

August 2022

pdc

civil / structural / environmental / surveying

REPORT CONTROL SHEET

Client: Future Biogas Ltd. **Job No.:** 28395

Project Name: Burton Agnes AD Plant
Harpham Grange Farm
Burton Agnes
YO25 4NQ

Issue		
Revision 0	August 2022	**Report Prepared by:** Joe Moorhouse B.Sc (Hons) Graduate Environmental Technician
		Report Reviewed & Authorised by: Oliver Jones B. Sc (Hons), CEng MIET, EngTech MICE, GCInstCES, AMIMechE Director - Projects and Civils

CONDITIONS OF INVESTIGATION & REPORTING

This report and its findings should be considered in relation to the terms of the brief and objectives agreed between Plandescil Ltd and the Client.

The details contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by Plandescil Ltd has not been independently verified by Plandescil Ltd, unless otherwise stated in the report.

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APPENDIX A
Snagging List – Rev 0 – August 2022
Photos to Accompany Snagging List August 2022
Plandescil Ltd Drawing No. 28395/1200 Rev 0 - Snagging List August 2022

APPENDIX B
Plandescil Ltd Site Walkover Checklist

1.0 INTRODUCTION

1.1 Scope

Plandescil Ltd have been commissioned by our Client, Future Biogas Ltd, to conduct a survey to review the condition of the Anaerobic Digestion (AD) Plant at Burton Agnes. This report assesses the compliance of the Plant against CIRIA Reports C736, C759 Part 1 and 2 and SSAFO Regulations and highlights areas necessitating remedial action to achieve conformity

The survey was carried out on 5th of August 2022. Conditions were clear and dry. The survey was undertaken by Plandescil Operatives Alex Fitzgerald, Joe Moorhouse and Joe Beales. The scope of the survey was defined prior to the site visit and all existing available information was reviewed to assess the potential risk of the site. DEFRA's Magic Maps website was utilised to provide information relating to receptors in the area and general information such as locations of sensitive areas including Sites of Special Scientific Interest (SSSIs) or nitrate vulnerable zones (NVZs). British Geological Survey maps were also assessed to provide information on ground conditions at the site.

Alex Fitzgerald has a Master of Science Degree in Civil Engineering and have overseen the design and construction of numerous Anaerobic Digestion Plants. Joe Moorhouse has direct experience with environmental issues and compliance having completed an Environmental Science Degree. Joe Beales has a HNC in Civil Engineering and eight years of experience. Plandescil has been working within the Anaerobic Digestion Industry for more than 10 years, with experience in designing and reviewing AD Plants.

A general methodology for the visual inspections Plandescil Ltd take can be found in **Appendix B**. It provides a guide of the types of observations which were made regarding CIRIA and SSAFO compliance during this site visit.

The changes introduced by the Environment Agency regarding Standard Rules permit state that:

Operators of existing facilities (permits issued before 20th December 2021) shall by the 1st of October 2022:

- *Undertake an inspection and works programme to ensure that all primary and secondary containment is fit for purpose and shall include:*
    - *a. An assessment and inspection of all primary containment, using a Written Scheme of Examination devised and undertaken by an appropriately qualified certified engineer.*
    - *b. An assessment and inspection of all secondary containment against the standards set out in CIRIA 736 by a chartered structural engineer.*
    - *c. Written reports of the findings of a) and b) shall be submitted to the Environment Agency. Where the reports do not demonstrate that critical primary and secondary containment is fit for purpose, the reports shall contain detailed proposals to bring the containment up to the required standard including timescales for the implementation of individual measures or shall propose alternative appropriate measures to ensure all polluting materials will be contained on site.*
    - *d. Where it contains proposals for work, the report recommendations shall be implemented by the operator in accordance with the Environment Agency's written approval.*

This report seeks to clarify and review against these imposed conditions and review the compliance of the plant against these conditions.

1.2 Background Information

Plandescil were not involved in any aspect of the design or construction of the Plant at Burton Agnes.

The Site is not within proximity of any Sites of Special Scientific Interest or Special Areas of Conservation. However, it is within a High Priority Countryside Stewardship Water Quality Protection Area, a High Priority Groundwater Nitrate Issues Area and just outside the boundary of the High Priority Phosphate Issue Area. The Site is constructed upon the Flamborough Chalk Bedrock Formation. These areas of high priority protection alongside the chalk bedrock mean that the Plant needs to be fully contained and low risk, due to the sensitive nature of the surrounding environment.

2.0 SURVEY

2.1 Tanks (Primary Storage)

Burton Agnes AD Plant is comprised of three tanks on site: one digester tank, one buffer tank and one digestate storage tank. The three tanks were inspected visually from the outside of the tanks and from the roof of the digester tank. The tanks have leak detection installed around their bases and around the base of the bund. The digester tank was fully clad, with no issues observed with the cladding on the day of survey. There were no issues observed with any of the tanks when they were inspected. The only remediations required involve removing vegetation from around the tanks and in the bund and removing the bird nest from the offtake point on the storage tank.

The use of leak detection around the bases of the tanks reduces the risk posed by the AD Plant on the surrounding environment. The detections system will provide warning of any leaks beneath the surface of the ground within the bund, alerting the Site Operatives who can deal with the issue accordingly.

2.2 Bund (Secondary Storage)

The tanks at Burton Agnes are contained within an excavated depression. The bund has been lined with 1.5mm thick HDPE liner, laid over a geofabric membrane. The excavated depression contains any liquid that falls within the bund through the use of the HDPE liner which prevents infiltration to the ground below. There are French filter drains that run around the edge of the bund and around the bases of the tanks that act as leak detection points and surface water drainage for the bund. The primary liner has been installed beneath the tanks and lines the whole bund, with a secondary liner installed beneath the primary liner. The leak detection pipes are located between the two liners, forming a leak detection zone.

The drainage system terminates in a manhole at the south of the bund which has a manually controlled pump. This is only utilised once the water within the bund has been tested and certified as clean water. The water is then discharged into one of the two lagoons to the south of the site. There are two access ramps into the bund, but they are graded similarly to the sides of the bund, so they do not affect the ability of the bund to contain liquid. The received .dwg file '2015-223-200-

C13-SES Version' states that the bund has been designed to provide a storage volume for 110% of the capacity of the Digestate tank (the largest tank) which is in accordance with the CIRIA C736 guidance.

On the day of survey, the bund appeared to be in generally good visual condition. The liner appeared to be in good condition and installed correctly, with no tears or holes observed. The drains appeared to be functioning as required and no major issues were observed. It is recommended however, that all vegetation is removed from the bund to prevent any root damage to the liner beneath the surface. Furthermore, any material overspill from the clamps or separator should also be cleared from the bund and returned to the relevant clamp.

The bund on site has the capacity to contain 110% of the volume of the largest tank on site, in accordance with CIRIA C736 guidance. This greatly reduces the risk posed by the site on the surrounding environment, as it ensures that in the event of catastrophic tank failure, the liquid ejected would be contained within the bund. This provides the Site Operatives with time to then clear any spillage without the threat of environmental contamination outside of the site. Furthermore, the French drain system which provides leak detection around the bund further reduces the risk, as it provides a warning system for the Site Operatives to any leak points within the bund. Using a manually pumped outfall point prevents any accidental discharge of potentially contaminated liquid and the testing point ensures that no contaminated liquid is unintentionally discharged. This further mitigates the risk posed by Burton Agnes AD Plant.

2.3 Clamps (Primary/Secondary Storage)

There are five concrete storage clamps on site at Burton Agnes AD Plant. On the day of survey, the storage clamps were visually inspected where possible, although due to harvest, two of the clamps were filled completely with material and the other three were partially filled.

The clamps appeared to be in working condition on the day of survey, although there were a number of minor issues observed when the inspection was undertaken. The walls appeared to have all been stripped of any bitumen coating. This leaves the wall panels exposed to erosion from leachate, which could undercut and undermine the integrity of the walls. It is recommended that the walls are cleaned and dried, and the lower 300mm of the walls are painted with a bitumen emulsion paint to provide a protective barrier from any standing leachate. This will prevent superficial erosion and undercutting, increasing the longevity of the wall panels.

There were joints between the wall panels that required resealing. It is important to keep the joints sealed, as leachate incursion into a joint can lead to erosion from within the wall joint, undermining the wall. The leachate could erode all the way through the wall joint, allowing the liquid to escape the clamp and potentially contaminate unsurfaced ground outside of the clamp. To prevent joint erosion, the wall joints should be cleaned, dried, and sealed with Sikaflex (or equivalent product). The joints should be monitored for any degradation of the sealant and resealed in the same way when required.

The surfaces of the clamps had become delaminated in a number of areas, with aggregate becoming exposed due to leachate erosion. With continual erosion, the leachate could erode through the surface of the clamps and infiltrate the bare ground beneath, contaminating the ground.

It is recommended that the surfaces are cleaned when the clamps are empty and then photographed. The surfaces should then be monitored for further delamination and degradation overtime. Currently, no further action is required, but when the delamination worsens the clamps may require resurfacing in the future.

Cracking was observed in the clamp walls, surfaces of the clamps and within the concrete apron throughout the site. Leachate incursion into the cracks can lead to the concrete becoming undermined by the leachate, allowing infiltration to the ground beneath the surface. Incursion into cracks in the walls can cause degradation of the wall and damage to the internal structure. It is recommended that any cracks are cleaned and dried. Sikaflex sealant (or equivalent product) should then be used to fill the cracks. Once sealed, the cracks should be photographed and monitored for any further expansion or extension of the cracks. If this occurs, the cracks should be remediated in the same way.

One of the end panels of the clamp wall was heavily damaged, assumed to be due to plant machinery. This panel had exposed rebar that had been oxidated. This panel should be repaired or replaced, as the oxidated rebar will be weakened and could expand within the wall, causing further damage. This will affect the integrity of the entire wall panel.

Finally, there was overspill of material from clamps observed on the day of survey in a number of places. This overspill should be cleared, to prevent leachate infiltration into bare, unsurfaced ground.

The remedials to the clamps will ensure they are functioning as effectively as possible and will increase the longevity of the surfaces and walls. The use of the silage clamps reduces the risk factor of the Plant they are watertight storage vessels for silage material. The clamps contain the leachate runoff and direct it into the drainage systems within the site to prevent any leachate infiltrating into unsurfaced areas, reducing the risk of any environmental contamination. Thus, it is crucial to maintain the quality of the storage clamps to mitigate the risk the Plant poses.

2.4 Drainage

The drainage at Burton Agnes AD Plant is comprised of both surface water and leachate water drainage systems. There is also a foul water tank located behind the site offices treating waste from the Site Operatives.

The leachate system within the site drains liquid from the bases of the feed hoppers, the clamps and concrete apron around the site. There is also a connection to the leachate system from the containment bund. The leachate run starts at the north of the site and is drained south, discharging into a dirty water lagoon to the south of the site.

The surface water drainage system collects water from in between the clamp wall panels, consisting of surface run-off from sheeted clamps. There is also surface water drainage in the concrete apron to the north of the site and around the barn in the northeast corner. The downpipes from the barn appeared to discharge straight to the ground, rather than being connected to the main surface run. The water collected by the surface water drainage system is discharged into a surface water infiltration basin at the south of the site.

On the day of survey, the drainage systems both appeared to be functioning as required. There were some minor snagging issues which, if addressed, will reduce the risk posed by the Plant further.

The manholes were predominantly sumps with catchpits below the level of the inlet and outlet pipes. These have been effective at collecting clamp material and preventing the material blocking the drains. However, it is recommended that these sumps are cleared out and the manholes and pipes are sludge gulped and jetted out, as the material was often either at the inlet level or above the level. This resulted in silage material in the entrances in a lot of the pipes within the manholes, so removing the material will allow the sumps to function again as catchpits. Once the manholes have been cleared, they should be repainted with bitumen emulsion paint to protect them from leachate erosion. This will ensure that the manholes remain watertight, reducing the risk of any unintended discharge of leachate to the surrounding environment.

There were a small number of gullies and manhole lids that were damaged, most likely due to vehicle movements over the lids. It is recommended that the damaged lids are replaced with new lids, to ensure that the manholes remain covered and allow access when necessary. There was also a ducting manhole on the east side of the bund that had a damaged manhole lid, which should also be replaced.

The two lagoons were both inspected on the day of survey; both looked to be in good working condition, with only minor remedials noted. Firstly, there was a small tear noted in the lining of the dirty water lagoon. This should be welded shut to ensure the rip does not expand and tear the liner further. The rip should be photographed and monitored to ensure there is no further damage.

The wildlife fencing around the lagoons was in good condition, although there was one panel missing. This should be replaced to ensure wildlife cannot access the lagoon and fall in, and people cannot access without permission. Escape ladders should be installed in the dirty water lagoon as there is currently no clear way out of the lagoon if someone fell in.

Finally, the vegetation growing around the headwalls of the lagoons should be removed, to prevent root damage to the concrete or lining of the lagoon.

The suggested remediations will reduce the risk posed by the Plant, by ensuring that the leachate is contained within the system, no leak points are generated through leachate or root erosion and everything this within full working order.

The use of separate drainage systems helps mitigate the risk posed by the site as it prevents cross-contamination of surface and leachate water. This ensures that no contaminated water is accidentally discharged into the environment around the Plant, instead keeping the leachate within the site's boundaries. Containing the leachate within the site allows the Plant Operators full control over the discharge points, preventing any accidental leachate discharge. The storage lagoon also holds liquid within the site, allowing for discharge to tanker or use in the AD process as required.

2.5 Receptors

On the day of survey, there was no visible staining or leakage observed around the boundary of the AD Plant or around the two lagoons. The full boundary of the AD site was walked and observed.

There were no rivers within close vicinity to the Plant, further reducing the risk it poses in the event of tank failure as the number of potential receptors is lower.

3.0 RECOMMENDATIONS TO IMPROVE (SNAGGING AND COMPLIANCE)

All snagging list recommendations can be found in Plandescil's Snagging List August 2022 in Appendix A. Snagging list remedials are to be completed by the relevant party, within any listed timescales.

All compliance-related snagging recommendations must be rectified or addressed before 1st October 2022. It is recommended Plandescil revisit the site prior to this date, in order to ensure all recommendations have been dealt with so the site can be signed off as compliant.

4.0 CONCLUSION

In conclusion, Plandescil find Burton Agnes AD Plant to be in good working order. There were no major issues observed with the tanks within the containment bund or with the leak detection around the bases of the tanks. The lining of the containment bund appeared to be in good condition. The clamps were in good working condition, with only minor remedials suggested to extend the lifespan of the walls and surfaces. There were a number of cracks within the concrete apron around the site, but they can be cleaned, sealed and monitored. Repainting the clamps walls and the walls around the feed hoppers will preserve the walls on site. The leachate and surface water drainage appeared to be working effectively. Clearing the catchment pits within the manholes and repainting the inside of the manholes will increase their effectiveness and preserve them for longer. Finally, the lagoons both appeared to be in good condition, with only minor remedials required in that area.

Burton Agnes AD Plant has a number of systems that help mitigate the risk posed by the AD Plant on the surrounding environment. The use of the containment bund greatly reduces the risk of the tanks. The bund has the capacity to hold 110% of the total volume of the largest tank on site in the event of catastrophic tank failure, as specified in CIRIA C736. A bund of this volume ensures that the liquid is contained, provides the operators time to clear the spillage and prevents any liquid being discharged out of the site. The leak detection around the base of the tanks and around the perimeter of the bund ensures that if any leakage underground or within the bund occurs, Site Operatives will be alerted at the earliest possible opportunity and can rectify the issue as required. Having a manual pump system to remove liquid from the bund ensures that any water leaving can be tested before being discharged, making sure that any liquid discharged as surface water to the infiltration lagoon can be considered clean. Due to the subsoil at the site consisting of chalk, it is vital that the Plant has these necessary systems to ensure any leaks are detected as soon as possible and any spillage is contained successfully within the site.

The drainage system is split into both leachate and surface water, which reduces the chance of contaminated water being accidentally discharged as clean by keeping them separate. It also means that the Plant can discharge as much clean water as possible, preventing the dirty water lagoon from being overfilled. The systems also contains any potentially contaminated liquid within the boundaries of the site and provides the Site Operatives with control over the discharge points. The dirty water holding lagoon allows leachate water to be discharged within the site boundaries and

held until its needed within the AD Process or until it is taken away via tanker, preventing accidental discharge to the surrounding environment. All these processes and systems mitigate any risk posed by the AD Plant on the area around the Plant.

If the Operatives at Burton Agnes AD Plant undertake the suggested remedials, the Plant will further reduce the risk it poses on the environment.

DRAWINGS APPENDIX

CONTENTS

GENERAL NOTES:

1. All dimensions noted are in millimetres unless stated otherwise.
2. All levels to be above Ordnance Survey Datum defined levels (A.O.Dm) unless noted otherwise.
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8. Please refer to Plandescil Ltd. Drawing '28394/301 Rev 0 - Reception Building Interal Drainage Survey'.
9. All setting out to be coordinated by the Contractor and to be checked onsite prior to construction.
10. Information displayed in red taken from received drawing '2015-223-200-C13-SES Version'.
11. Survey undertaken on 05/07/2022.
12. Refer to the following Plandescil Ltd. Drawings:
    - 12.1. 28395/301 Rev 0 - Leachate Drainage Survey Sheet 2 of 3
    - 12.2. 28395/302 Rev 0 - Surface and Foul Water Drainage Survey Sheet 3 of 3

LEGEND

- Foul Water Drainage (FW)
- Assumed Foul Water Drainage (FW)
- Surface Water Drainage (SW)
- Assumed Surface Water Drainage (SW)
- Leachate Water Drainage (LW)
- Pumped Leachate Water Drainage (LW)
- Assumed Leachate Water Drainage (LW)
- XX.XXX Information from Received Drawing

ISSUED FOR CLIENT REVIEW

Rev	Date	Rev By	Chkd	Description
0	29-09-22	-	OAJ	First Issue

1:250 - DRAWING SCALE REFERENCE (m)

10 5 0 5 10 15 20 25

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Client
Future Biogas Ltd.

Project
Burton Agnes AD Plant,
Harpham Grange Farm,
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Drawing Title
Drainage Survey
Overview Sheet 1 of 3

DRAFT

Scale U.N.O.	Date	Drawn By
1:250 (A0)	September 2022	JM

Drawing No.	Rev
28395/300	0

GENERAL NOTES:

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12. Refer to the following Plandescil Ltd. Drawings:
    - 12.1. 28395/300 Rev 0 -Drainage Survey Overview Sheet 1 of 3
    - 12.2. 28395/302 Rev 0 - Surface and Foul Water Drainage Survey Sheet 3 of 3
13. Abbreviations used within drawing:
    - IL. - Invert Level
    - SL. - Soffit Level
    - CL. - Cover Level
    - WL. - Water Level
    - BL. - Base Level
    - MH - Manhole
    - LW - Leachate Water

LW Gully.
CL. 47.91
BL. 47.01

<<1500

IL. 47.05
LW MH.
CL. 47.95
BL. 46.50
IL. 47.00

<<2250

LW Gully.
CL. 47.92
IL. 47.07
BL. 46.77

1500>>

<<3000Ø

IL. 46.84

LW Gully.
CL. 47.94
BL. 46.29

IL. 46.84

LW Gully.
CL. 47.92
IL. 47.07
BL. 46.52

IL. 46.50

LW Gully.
CL. 47.90
BL. 46.20

IL. 46.45

LW Gully.
CL. 47.91
IL. 47.00
BL. 46.91

LW MH.
CL. 47.91
ILs. 46.45
BL. 46.45

LW Gully.
CL. 47.90
IL. 47.00
BL. 46.70
Positioned indicatively.

IL. 46.48

LW MH.
CL. 47.93
BL. 46.43

IL. 46.43

IL. 46.39

LW MH.
CL. 47.94
BL. 46.34

IL. 46.34

1500>>

LW MH.
CL. 44.99
IL. 44.12
MH full on day of survey.

LW Gully full on day of survey. Positioned indicatively.

Assumed pumped connection to main leachate run when required.

LW MH.
CL. 45.04
IL. 43.88
MH full on day of survey.

LW Gully.
CL. 44.99
Gully full on day of survey.

Pipe entering bund at high level.

LW Gully.
CL. 47.95
IL. 47.25
BL. 46.85

dp

<<2250

LW Gully.
CL. 47.95
ILs. 47.25
BL. 46.65

<<1500

LW Gully.
CL. 47.89
IL. 47.04
BL. 46.69

IL. 46.95

LW Gully.
CL. 47.91
BL. 46.46

IL. 46.94

LW Gully.
CL. 47.91
IL. 47.01
BL. 46.86

LW Gully.
CL. 47.95
ILs. 46.75
BL. 46.35

Both pipes 100Ø.
Blocked at 0.50m.
ILs. 46.95

LW Gully.
CL. 47.89
IL. 46.99
BL. 46.99

LW Gully.
CL. 47.94
ILs. 46.64
BL. 46.14

LW Gully.
CL. 47.91
IL. 47.01
BL. 46.81

LW Gully.
CL. 47.96
ILs. 46.46
BL. 46.16

Both pipes 100Ø.
Unable to CCTV.
ILs. 46.56

Pipe bunged at 2.00m upstream from MH.
Unable to CCTV pipe.

LW MH.
CL. 48.00
ILs. 46.80
BL. 46.75
MH Indicatively positioned.

LW Gully.
CL. 47.92
ILs. 46.33

LW MH.
CL. 48.00
ILs. 46.30
BL. 46.30

LW MH.
CL. 47.99
SL. 46.49
BL. 45.89

IL. 46.41
LW MH.
CL. 48.06
BL. 45.81
IL. 46.36

LW MH.
CL. 48.03
SL. 46.53
BL. 45.83

LW Gully.
CL. 47.94
IL. 47.20
BL. 46.04

LW Gully.
CL. 47.97
ILs. 46.37
BL. 46.17

LW MH.
CL. 48.03
ILs. 46.38
BL. 46.33

3000Ø>>

<<3000Ø

<<1500

Assumed hydrobreak within manhole.

IL. 46.36
IL. 46.21

Assumed hydrobreak within manhole.

4500Ø>>

Discharge to dirty water retention lagoon.

LEGEND

- Leachate Water Drainage (LW)
- Pumped Leachate Water Drainage (LW)
- Assumed Leachate Water Drainage (LW)
- XX.XXX Information from Received Drawing

ISSUED FOR CLIENT REVIEW

Rev	Date	Rev By	Chkd	Description
0	29-09-22	-	OAJ	First Issue

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Project
Burton Agnes AD Plant,
Harpham Grange Farm,
East Yorkshire YO25 4NQ

Drawing Title
Leachate Drainage
Survey Sheet 2 of 3

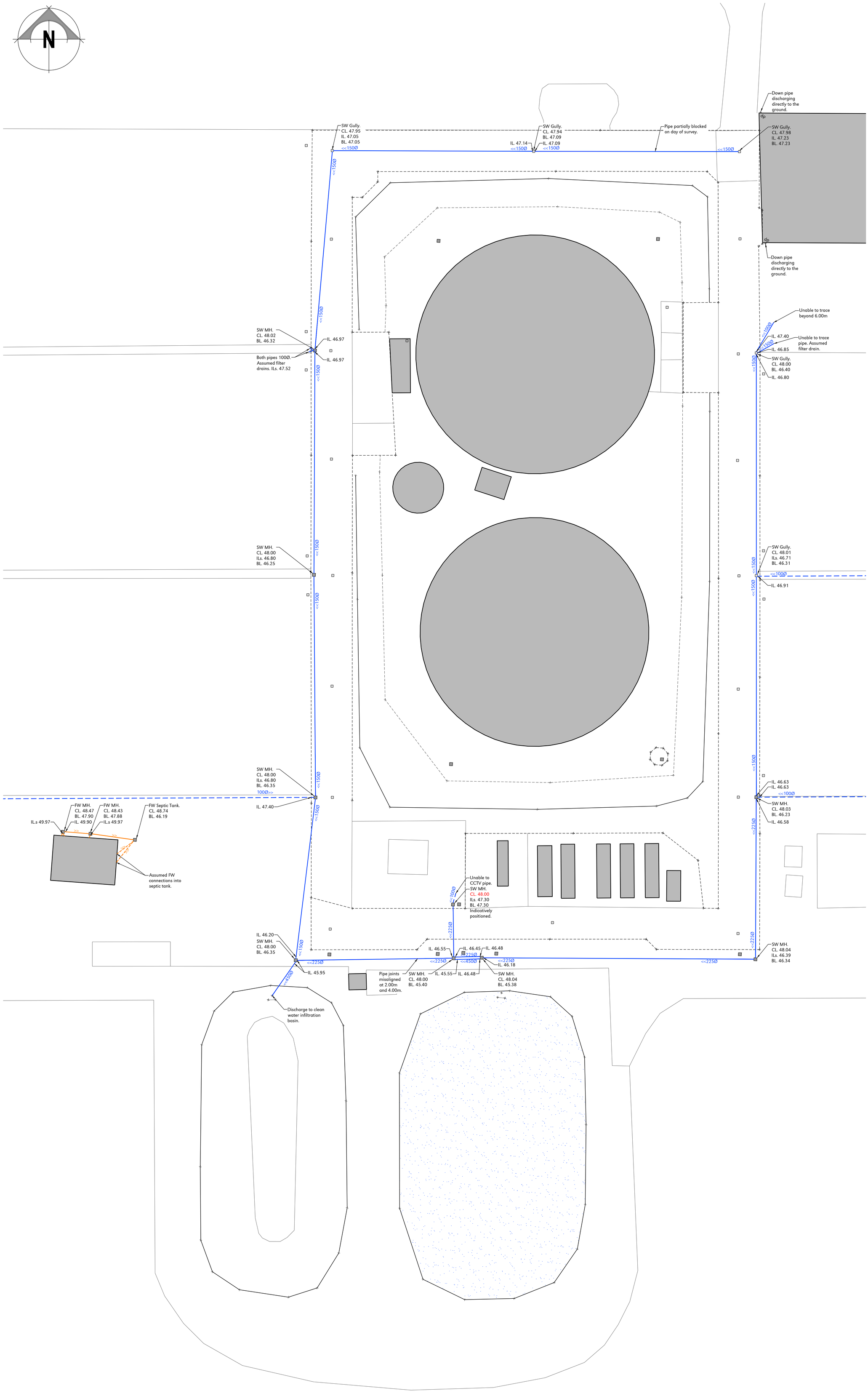
DRAFT

Scale U.N.O.	Date	Drawn By
1:250 (A0)	September 2022	JM

Drawing No. 28395/301 Rev 0

1:250 - DRAWING SCALE REFERENCE (m)

10 5 0 5 10 15 20 25



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5. Plandescil Ltd. to be immediately notified of any suspected omissions or discrepancies.
6. This drawing is to be read in conjunction with all other relevant documents relating to the project.
8. Please refer to Plandescil Ltd. Drawing '28394/301 Rev 0 - Reception Building Interal Drainage Survey'.
9. All setting out to be coordinated by the Contractor and to be checked onsite prior to construction.
10. Information displayed in red taken from received drawing '2015-223-200-C13-SES Version'.
11. Survey undertaken on 05/07/2022.
12. Refer to the following Plandescil Ltd. Drawings:
    - 12.1. 28395/300 Rev 0 - Drainage Survey Overview Sheet 1 of 3
    - 12.2. 28395/301 Rev 0 - Leachate Drainage Survey Sheet 2 of 3
13. Abbreviations used within drawing:
    - IL. - Invert Level
    - SL. - Soffit Level
    - CL. - Cover Level
    - WL. - Water Level
    - BL. - Base Level
    - MH - Manhole
    - SW - Surface Water
    - LW - Leachate Water
    - FW - Foul Water

LEGEND

- Foul Water Drainage (FW)
- Assumed Foul Water Drainage (FW)
- Surface Water Drainage (SW)
- Assumed Surface Water Drainage (SW)
- XX.XXX Information from Received Drawing

ISSUED FOR CLIENT REVIEW

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0	29-09-22	-	OAJ	First Issue

1:250 - DRAWING SCALE REFERENCE (m)

10 5 0 5 10 15 20 25

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Drawing Title
Surface and Foul Water Drainage Survey Sheet 3 of 3

DRAFT

Scale U.N.O.	Date	Drawn By
1:250 (A0)	September 2022	JM

Drawing No. 28395/302 Rev 0

APPENDIX A

CONTENTS

Snagging List

Job No: 28395 **Project:** Burton Agnes AD Plant **Date of Survey:** 05.07.22

plandescil consulting engineers

No.	Description	Remediation	Actionee	Complete
1	Fence panel missing from wildlife fence around lagoon.	Replace fencing panel to ensure lagoons are secure and to prevent wildlife entering the area.	Future Biogas	0%
2	No means of escape from the lagoon in the event of someone falling in.	Escape ladders to be installed at suitable intervals.	Future Biogas	0%
3	Tare in liner of lagoon.	Weld the liner to seal the hole.	Future Biogas	0%
4	Vegetation growing around outfall pipe to lagoon.	Remove vegetation to prevent any root damage to the lagoon liner.	Future Biogas	0%
5	Vegetation growing in gas compound.	Remove vegetation from the compound. Could help spread fire in the event of a fire in the compound.	Future Biogas	0%
6	Vegetation growing in bund area around tanks.	Remove vegetation from the bund to ensure the integrity of the liner beneath the surface.	Future Biogas	0%
7	Vegetation in ROV compound.	Remove vegetation from the compound. Could help spread fire in the event of a fire in the compound.	Future Biogas	0%
8	Birds nest in offtake point of tank.	Remove birds nest if it is not an active nest. Consult local wildlife officer/RSPB for guidance.	Future Biogas	0%
9	Concrete joints in need of resealing throughout the site.	Clean and dry joints. Seal with Sikaflex sealant (or equivalent product) and photograph for monitoring. Replacing sealant will protect joints and increase the longevity of surfaces and walls.	Future Biogas	0%
10	Cracking in concrete surfaces throughout the site.	Clean the cracks and dry. Seal with Sikaflex sealant (or equivalent product). Photograph the cracks and monitor for further cracking or expansion of existing cracks. Changes in cracks to be remediated in the same way.	Future Biogas	0%
11	Delaminated concrete surfaces throughout the site.	Clean and photograph surfaces. Monitor for further degradation. May require resurfacing in the future if delamination exposes rebar or slab is undermined.	Future Biogas	0%
12	Damage to concrete around gully pot lid. Surface cracked and degraded.	Clean damaged area and seal cracks with Sikaflex (or equivalent product). Monitor for further damage.	Future Biogas	0%
13	Gully pot lid dropped below surface of rim.	Replace gully pot lid so that it sits at correct level and access is maintained to the gully pot beneath.	Future Biogas	0%
14	Gullies filled with silage material and blocked. Bitumen coating has been stripped in most of the manholes.	Clear all sumps of silage material and sludge gulp drains. Drains and manholes then to be jetted clean and cleared. Manholes to be recoated with bitumen to prevent leachate erosion within the manhole.	Future Biogas	0%
15	Ducting chamber lid damaged. Ducting manhole with metal gate across the top to prevent access.	Replace manhole lid to ensure manhole is covered.	Future Biogas	0%
16	Bitumen coating worn from concrete walls around feed hopper. Metal joining wall from feed hopper badly damaged.	Clean and repaint with bitumen emulsion to protect wall from further degradation. Metal to be replaced to ensure overspill is caught and does not settle around the base of the Feed hopper.	Future Biogas	0%

17	Overspill of material onto unsurfaced ground beyond concrete pad.	Clear all overspill to prevent leachate infiltration into unsurfaced ground.	Future Biogas	0%
18	Gas pipe channel filled with silage material.	Clear silage material to allow full access to the gas pipe at all times.	Future Biogas	0%
19	Overspill of material and standing leachate at base of feed hopper.	Clear material to prevent leachate generation and erosion of Feed hopper slab.	Future Biogas	0%
20	Earthing rod connecting wire broken and hanging off the side of the tank.	Repair earthing rod and reattach to the side of the tank.	Future Biogas	0%
21	Surface delamination in clamps.	Clean and photograph surfaces. Monitor for further degradation. May require resurfacing in the future if delamination exposes rebar or slab is undermined.	Future Biogas	0%
22	End panel of clamp wall damaged with rebar exposed.	Repair or replace end wall panel as the exposed rebar has been oxidised and can cause further damage to the internal structure of the wall.	Future Biogas	0%
23	Bitumen coating stripped from clamp walls.	Clean and repaint the lower 300mm of the clamp walls with bitumen emulsion paint. This will protect the wall from undercutting and surface degradation.	Future Biogas	0%
24	Material overspilling clamp walls onto unsurfaced ground.	Clear all overspill to prevent leachate infiltration into unsurfaced ground.	Future Biogas	0%

Item 1

Item 2

Item 3

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Item 5

Item 6

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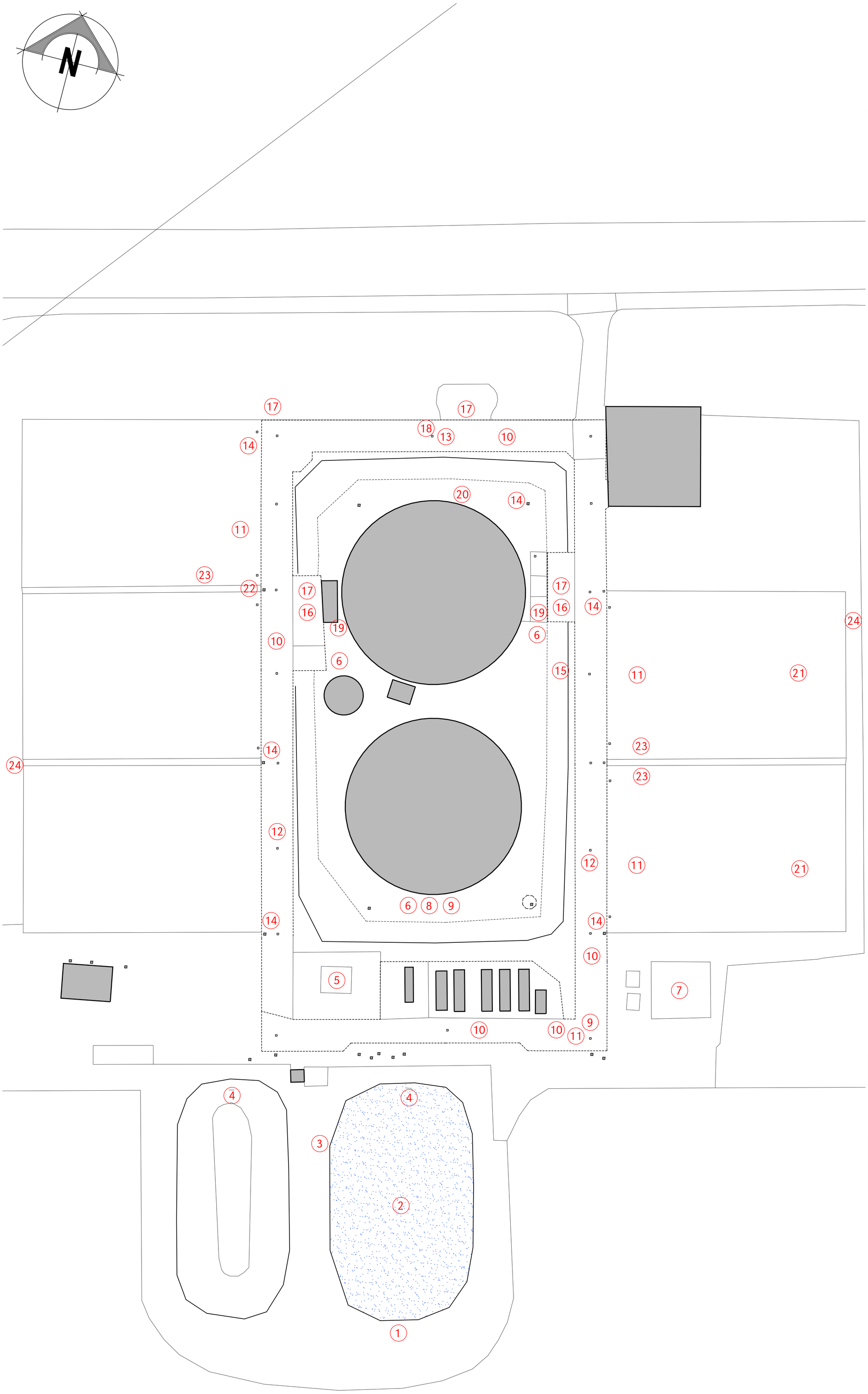
6. This drawing is to be read in conjunction with all other relevant documents relating to the project.
7. Please refer to Plandescil Ltd. Documents:
   - 7.1. 28395 Snagging List July 2022
   - 7.2. 28395 Photos to Accompany Snagging List



Legend

(XX) Snagging List Item Reference Number

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Rev	Date	Rev By	Chkd	Description
	29-09-22	-	OAJ	First Issue

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Project

Burton Agnes AD Plant,
Harpham Grange Farm,
Burton Agnes, YO25 4NQ

Drawing Title

Snagging List
July 2022

1:200 - DRAWING SCALE REFERENCE (m)

10 5 0 5 10 15 20 25

Scale U.N.O.	Date	Drawn By
1:500 (A1)	September 2022	JM

Drawing No.	Rev
28395/1200	0

APPENDIX B

CONTENTS

TYPICAL SITE WALKOVER CHECKLIST

Plandescil Ltd general anaerobic digestion site checklist.

General Site Checks and Notes:

AD Plants	Do they contain agricultural Waste, food Waste or combination? Is the yard area clean or dirty?
Permits	Do Standard Rules or Bespoke apply? Are they displayed anywhere?
Health and Safety	Check sign in procedures and PPE. RAMS.
Surfacing	Is it maintained? Condition Asphalt – cracked, delaminating, open pores, movement? Concrete – cracked, joint condition?

Drainage –CIRIA C759, C736 & SSAFO

Survey	Has a drainage survey been undertaken?
Manholes	Manhole condition – have they been coated with bitumen? Is the differentiation between clean and dirty manholes apparent? Are the manholes labelled?
Gullies	Are the gullies blocked visually? Are the gullies labelled?
Pipework	Pipe condition – Are they dropped, broken, blocked or scored/burnt? Is there above ground or below ground pipework? Check end points – trace to exit/outfall.
Standing water	Is there standing water? Is it stagnant or fresh?
Digestate pumps	Check that pipes and valves are all locked off and secure.
Foul Water (offices)	Is there a septic tank or treatment plant? Does is have discharge consent?
Valves	Are the valves obviously positioned?

Silage Clamps – CIRIA C759 & SSAFO

Wall Type	L, U, T, Bock, Kerb, none?
External drainage	Examine Condition, channel (above or below ground) and gullies. Monitoring points?
Clamp walls	Has the lower half of panel been painted with bitumen emulsion? Are they cracked, hazing? Are there dropped panels or damage?
Sealant	Are the walls sealed to the surfacing? Has it perished? Condition, colour, has it reacted?
Surfacing	What type? Open or closed pore? Cracked? Dips? Settlement?
Walkway	Are walkways clear for sheeting?
Sheeting	Is sheeting being used correctly?

Containment Bund – CIRIA C736

Compliancy	Is it compliant?
Construction	What is the construction type?
Primary containment	Are tanks visible? Is there any tertiary containment?
Containment Condition	Are there rips or tears in liners? Damage to concrete? Cracks to asphalt? Are there any leaks, staining or damage to primary, secondary or tertiary containment? Are there any penetrations?
Pipework	Is it safe? Is it labelled? Is all pipework above ground?
Monitoring	Is there a monitoring system in place?
Tech Room	Check structures.
Drainage	Where and how does it drain? What is the condition of the drainage?

Digestate Lagoon –SSAFO, C746 & C759

Type	Waste or Agricultural? Is it covered?
Banks	Are the banks seeded? Is the bank showing signs of slipping?
Lining	Are the liners whaling?
Ventilation	Are there appropriate gas vents?
Structure	Is the crown and walkway intact?
Network	Are there pumped routes? How/does it link to AD?

Surface Water Lagoon (where applicable):

Surface Water	Is it clean? Take sample for analysis
Banks	Are the banks seeded? Is the bank showing signs of slipping?
Lining	Is it Lined? Are the liners whaling?
Ventilation	Are there gas vents?
Structure	Is the crown and walkway intact?
Network	Are there pumped routes? How/does it link to AD? Does it Discharge? Is discharge clean?

Dirty Water Lagoon (where applicable):

Banks	Are the banks seeded? Is the bank showing signs of slipping?
Lining	Is it Lined? Are the liners whaling?
Ventilation	Are there gas vents?
Structure	Is the crown and walkway intact?
Network	Are there pumped routes? How/does it link to AD? Where does it discharge to? What is the source of water?

General:

- What is the state of plant and housekeeping?
- Are there any obvious concerns?
- Walkover entire site.
- Look for exposed surfaces and check construction.
- Look for any additional utility issues.
- Is overhead pipework intact?
- Is there any new kit?
- Is there any failing kit or replacements?
- Is there any damage?
- Is there any deterioration requiring maintenance?

Please Note: This list is not extensive but a general list used for reviewing AD sites.

civil engineering and building

- Industrial, Commercial, Agricultural and Domestic building design
- Foundation Design and ground improvements
- Highway Engineering including PDS/Civil 3D
- Retaining walls
- Sheet Piling
- Infrastructure planning and design
- Design of sustainable drainage system (SUDS)
- Soakaway design
- Architectural design of industrial buildings
- Planning and building regulation applications
- 3D conceptual models
- Renewable Energy Civil Engineering design and project management
- Anaerobic Digestion and Waste to Energy Project design and detail

environmental engineering

- Contaminated Land investigations (intrusive & non-intrusive)
- Land remediation verification
- Environmental impact assessments (EIA)
- Flood Risk Assessments
- Water supply, treatment, storage and distribution
- Foul and surface water & effluent/leachate drainage design
- Drainage network modelling
- 1D & 2D flood modelling
- Hydraulic river modelling
- Flood Alleviation
- Breach & overtopping analysis
- Reservoir flood inundation modelling
- Consent to discharge applications
- Landscaping design
- Tree surveys
- Environmental Permits

structural engineering

- Structural calculations for Commercial, Agricultural and Domestic building design
- Structural design using steel, stainless & carbon steel, concrete, timber, alloys and masonry
- Maritime and Hydraulic structures
- Structural surveys and structural suitability surveys
- Structural failure studies
- Subsidence claims
- Temporary works design
- 3D Finite Element Analysis
- Structural monitoring
- Structural enhancement/ remedial work
- Historic building advice
- 3D Revit & Level 2 BIM structural design & modelling

surveying land and buildings

- Geomatic / topographical site surveys
- Building, Road, and Earthworks Setting out
- Engineering Setting out
- Establish precise site survey control
- 3D digital terrain modelling
- Volumetric analysis
- Site area computations
- Flood risk surveys using GPS active network
- Measured building floor plans and elevation surveys
- Land transfer plans to Land Registry requirements
- Drainage network surveys
- Assistance/Expert witness in land boundary disputes
- Deterioration monitoring
- Preparation of asset plans
- As built record surveys

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Accidents

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual risk
Burton Agnes Biogas Plant								
Vehicle Collision/impact	All on-site hazards: wastes, machinery and vehicles	Direct Physical Contact	Drivers, site employees, local environmental receptors	Low	Medium	Medium	Vehicle movements are limited to deliveries of feedstock only, which are scheduled and directed onto site by staff. Activities on-site are managed and operated in accordance with a management system (which includes site security measures to prevent unauthorised access). A speed limit of 10mph is enforced across the site and signage is clearly displayed at the entrance.	Low
Explosion of biogas	Digester tanks. Post digester tank. Gas upgrading compound	Transportation through air	Site employees; Ecological receptors; and Surrounding farmland.	Low	Medium	Low	Activities are managed and operated in accordance with the Operator's management system and monitored with SCADA systems. If abnormal operation occurs, or an issue is perceived, gas will be directed to the site's emergency flare. Should the emergency flare fail, digesters and upgrading unit are fitted with emergency pressure release valves to avoid overpressure. All records of the	

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual risk
							use of PRVs will be kept on site and the reason for use documented. Should an explosion compromise the integrity of any tank, the tanks are located within an area of bunding sized to contain 110% of the largest tank and 25% of the combined tank volume. Containment systems are designed, manufactured and installed in accordance with CIRIA 736 guidance. The explosion of biogas is highly unlikely.	
Arson and / or vandalism causing the release of polluting materials to air (smoke or fumes), water or land.	Unauthorised Access	Transportation through air then inhalation OR Transportation through air then deposition Surface water drainage system.	Site employees Local residents at nearest farms and IT business Local Wildlife Sites and Ecological areas	Medium	Medium	Medium	The site is fenced to prevent unauthorised access and is under 24hr surveillance from a security contractor. Oils and fuels are stored in a lockable secure unit. Activities are managed and operated in accordance with a management system which includes fire and spillage procedures. Process areas where liquids are stored are constructed of concrete hardstanding. Digestate and other liquids are contained within sealed tanks. The tanks are located within an area of bunding sized to contain 110% of the largest tank and 25% of the combined tank volume.	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual risk
							Containment systems are designed, manufactured and installed in accordance with CIRIA 736 guidance.	
Contaminated run-off from site surfaces mobilising pollutants off site	Loss of containment on site, spillage or leakage of liquids, oils or fuels	Percolation through soils or direct run-off from site entering surface watercourses	Watercourses and surrounding farmland.	Low	Medium	Low	Process areas where liquids are stored are constructed of concrete hardstanding. Uncontaminated surface water run-off is directed to the clean surface water lagoon. Any spills on site will be cleaned up immediately with spill kits available for this purpose and staff trained in spill response procedures. Digestate and other liquids are contained within sealed tanks. The tanks are located within an area of bunding sized to contain 110% of the largest tank and 25% of the combined tank volume. Containment systems are designed, manufactured and installed in accordance with CIRIA 736 guidance. All maintenance fluids stored on site will be in sealed, leak-resistant containers with appropriate secondary containment. Containers are regularly inspected for leaks, located on impermeable concrete	

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual risk
							hardstanding and incompatible chemicals are stored in separate locations.	
Accidental fire causing the release of pollution to air, water or land	On site machinery. Combustion of feedstock or digestate. Smoking on site	Transportation through air. Surface water or percolation through soil	Commercial and residential receptors Site employees. Watercourses. Ecological receptors. Surrounding farmland.	Medium	Medium	Medium	All plant and equipment on site are maintained to the manufacturer's specification, with details incorporated into the site's EMS. The main plant areas are provided with secondary containment. Drainage can be sealed to contain firewater on-site and can be directed to and stored in the on-site dirty water lagoon to ensure contaminated water will not be released to the local environment in the case of a fire. Firewater will be evaluated and disposed of by authorised waste contractor. Smoking is prohibited anywhere on site and is clearly signed. Any abnormal operation of the gas upgrading equipment will be detected by the SCADA system and if necessary, biogas can be directed to the emergency flare. If for any reason this fails, pressure release valves will be utilised to release excess gas. All records of their use will be maintained. Risk of self-combustion of waste is low, as the majority of material feedstock into	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual risk
							the installation has a high-water content and is pumped directly into the plant for processing. Crops (maize, hybrid rye and wheat straw) are unloaded into the clamps when they arrive on site and are covered using protective sheeting. Manure is delivered to the site on a weekly basis and stored in the clamps and covered where possible. Input materials will be processed on a first-in first-out basis. The risk of self-combustion is therefore considered to be low.	
Plant and equipment breakdown and/or failure causing releases of potentially polluting substances	On site infrastructure (digestion tank, biogas upgrading unit, CHP, auxiliary boiler, digestate and surface water and dirty water storage lagoons)	Transportation through air, Surface water drainage system, percolation through soil	Commercial and residential receptors Site employees. Watercourses. Ecological receptors. Surrounding farmland.	Medium	Medium	Medium	All plant and equipment on site are maintained to manufacturer's specification and regularly integrity checked. All details are incorporated into the site's EMS. The SCADA system will identify any abnormal operations prior to any catastrophic failure and automatically notify the operator. The programme will shut off equipment if it reaches unsafe limit set points. If necessary, gas can be directed to the emergency flare. All operations will cease in the event of plant failure, with waste directed to an alternative site where necessary.	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual risk
							Digestate and other liquids are contained within sealed tanks. The tanks are located within an area of bunding sized to contain 110% of the largest tank and 25% of the combined tank volume. Containment systems are designed, manufactured and installed in accordance with CIRIA 736 guidance. The dirty water lagoon is constructed of chalk but benefits from being double lined.	
Spillage of feedstock from tankers during delivery or off loading	Feedstock delivery vehicles; Site operatives	Surface water drainage system, percolation through soils	Watercourses. Ecological receptors. Surrounding farmland.	Low	Low	Low	Activities are managed and operated in accordance with the Operator's management system, with trained operatives directing tankers to input liquid feedstock directly into the plant for processing. The waste reception areas comprise concrete hardstanding with sealed drainage, preventing any spillages reaching soils or surface water drains. The covered feeding system for solid feedstocks is located on impermeable concrete in the main plant area within the bund. Spill kits will be on hand to address minor spills and site operatives will be trained in their use.	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of Risk	Risk Management	Residual risk
Accidental release of potentially polluting substances through flooding	Loss of containment, contaminated flood water	Percolation through soils or direct run-off from site entering surface watercourses	Watercourses. Ecological receptors. Surrounding farmland.	Very low	Low	Low	The site does not lie in an area at risk of flooding (Flood Zone 1). Chemicals and oils are stored in impermeable containers and are provided with secondary containment. All site areas are constructed of impermeable concrete surfacing. Drainage systems divert all surface water flows to the on-site clean water soakaway lagoon.	Low
Failure of buffer tank, digester tanks or digestate storage tank	Loss of containment	Direct physical contact. Percolation through soils, direct run-off from site across the ground	Site employees, underground water and land	Medium	Medium	Medium	The buffer tank and digester tanks are inspected regularly in line with the Facility's EMS to identify any leaks. The tanks are connected to the Facility's SCADA system and telemetry systems which monitor levels, pressure and foam within the tank continuously. A spill clean-up procedure is in place which is designed to minimise the impact on the environment in the case of any spills. The tanks are located within their own bund which is sized to contain 100% of the volume of the tanks.	Low

Table 2: Fugitive Emissions to Air

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of risk	Risk Management	Residual Risk
Releases of gaseous emissions above permit limits	Point Source Emissions	Transportation through air then inhalation or deposition	Commercial and residential receptors Site employees. Watercourses. Ecological receptors. Surrounding farmland.	Low	Medium	Medium	Activities on site are managed in accordance with the Operator's management systems, including regular inspections and maintenance of the CHP, Emergency Flare, Auxiliary Boiler and Biogas Upgrading Unit. The CHP, Biogas Upgrading Plant and Auxiliary Boiler will be monitored annually using MCERTS methods to ensure compliance with permitted limits. SCADA monitoring systems will be used to ensure all equipment is operating at optimal levels.	Low
Releases of particulate matter (dust) and bioaerosols	Fugitive releases of dust and/or bio-aerosols from the Facility	Transportation through air then inhalation or deposition	Commercial and residential receptors Site employees. Watercourses. Ecological receptors. Surrounding farmland.	Low	Medium	Medium	With controls in place, there is a limited potential for the release of dusts and/or bio aerosols from the silage and manure storage areas during acceptance of feedstocks with lower moisture content. Drier feedstocks within the clamps will be covered with protective sheeting. This will form an airtight layer to minimise emissions and will only be removed while feedstock is being added. Manure is sheeted to prevent release of dusts, odour and bioaerosols. Activities on site are managed in accordance with the operator's management systems. This includes regular inspections and maintenance of equipment to ensure they continue to operate at optimum conditions. Good housekeeping practices are applied, such as: Minimising any dust generating activities (such as loading the dry feedstocks) on very dry or	Low

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of risk	Risk Management	Residual Risk
							windy days, regular inspection and cleaning/sweeping of all paved areas on site and sealed deliveries of feedstock. The site area and access road comprise concrete and asphalt hardstanding minimising the potential for dust to be generated by vehicles entering and exiting the site.	
Releases of VOC's	Fugitive emissions; Releases from digestate storage lagoon surface; Feedstock delivery vehicles	Transportation through air then inhalation or deposition	Commercial and residential receptors Site employees. Watercourses. Ecological receptors. Surrounding farmland.	Low	Medium	Medium	The CHP plant, biogas upgrading plant and auxiliary boiler will be maintained to ensure they are operating at optimal conditions, and not releasing VOC's above normal/permitted limits. Emissions of VOCs from the pressure release valves will only occur in emergency situations, where the emergency flare has failed. The loss of biogas through the release valves has financial and operational consequences for the operator and as such, it is in their interest to ensure they are used as infrequently as possible. All records of their use will be maintained. Solid digestate will be stored in one of the on-site clamps before being transferred off-site. All liquid digestate will be transported off site via tanker to be spread on local fields, eliminating releases to atmosphere.	Low

Table 3: Fugitive Emissions to Water

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of risk	Risk Management	Residual Risk
Contaminated run-off from site surfaces	Loss of containment on site	Percolation through soils, direct run-off from site across the ground	Underlying groundwater and land	Low	Medium	Low	All potentially polluting materials are contained within bunded areas and located on sealed surfaces. All main liquid storage and treatment vessels are located within a sealed bunded area sized to contain 110% of the largest tanks capacity or 25% of the maximum volume of all the material stored within the bund. All process water from within the AD system will be fully contained within the plant and/or associated pipework.	Low
Liquor from digestate tanks	Loss of Containment on site	Percolation through soils, direct run-off from site across the ground	Underlying groundwater and land	Low	Medium	Low	Regular inspection of the storage tank will identify leaks. Spill clean-up procedure in place to minimise the impact from spills and leaks. All main liquid storage vessels are designed to withstand catastrophic failure and are located within a sealed bunded area sized to 110% of the largest tanks capacity or 25% of the maximum volume of all the material stored within the bund.	Low

Table 4: Odour

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of risk	Risk Management	Residual Risk
Odour from feedstock while transported to the Facility	Vehicles	Air, prevailing wind direction is from the southwest	Other road users Site employees Members of the Public	Low	Medium	Medium	Feedstock will be delivered to the site via road. Any liquid waste will be delivered directly to the preliminary tank. OMP in place to prevent and minimise odorous releases.	Low
Release of odours from stored materials and AD plant operations	Fugitive releases of dust and/or bio-aerosols from the Facility	Transportation through air then inhalation or deposition	Commercial and residential receptors Site employees. Watercourses. Ecological receptors. Surrounding farmland.	Low	Medium	Medium	With controls in place, there is a limited potential for the release of odour from the silage and manure storage areas during acceptance of feedstocks with lower moisture content. Drier feedstocks (including maize and rye) will be transferred to the clamps and covered with protective sheeting. This will form an airtight layer to minimise emissions and will only be removed while feedstock is being added minimising odorous release. Manure is sheeted to prevent release of dusts, odour and bioaerosols. The digestion process is largely sealed minimising the potential for odour releases. Activities on site are managed in accordance with the operator's management systems. This includes regular inspections and maintenance of equipment to ensure they continue to operate at optimum conditions. The site area and access road comprise concrete and asphalt hardstanding minimising the potential for dust to be generated by vehicles entering and exiting the site. OMP in place to prevent and minimise odorous releases.	Low

Table 5: Pests

Hazard	Source	Pathway	Receptor	Probability of Exposure	Consequence	Magnitude of risk	Risk Management	Residual Risk
Vermin, flies and birds attracted to feedstocks	Pests	Travel across air and/or land	Site employees, local businesses	Low	Low	Low	The primary areas at most AD facilities that attract pests are the feedstock reception and storage areas. The silage and manure storage areas are sheeted apart from during feedstock deliveries. Slurry is fed directly into the system which is enclosed. Cleaning procedures ensure any spills and litter around the site are cleared up immediately. A vermin/pest control contract will be set up with a pest control contractor should pests be found to be inhabiting the facility. Records of all vermin and pest control visits and incidents are maintained and available for inspection.	Low

Appendix B – WAMITAB Certification

Certificate No. OCC66455

Operator Competence Certificate

Title:

Anaerobic digestion facility including use of the resultant biogas (4MBTAD6)

This Certificate is awarded to

Andrew Saunders

Awarded: 24/12/2015

Authorised

WAMITAB Chief Executive Officer

CIWM Chief Executive Officer

The Chartered Institution of Wastes Management

This certificate is jointly awarded by WAMITAB and the Chartered Institution of Wastes Management (CIWM) and provides evidence to meet the Operator Competence requirements of the Environmental Permitting (EP) Regulations, which came into force on 6 April 2008.

00100530

wamitab

Continuing Competence Certificate

This certificate confirms that

Andrew Saunders

Has met the relevant requirements of the Continuing Competence scheme for the following award(s) which will remain current for two years from 25/11/2020

AD Anaerobic Digestion

Expiry Date: 25/11/2022

Verification date: 20/11/2020

Authorised:

Director of Qualifications and Standards

Learner ID: 26091

Certificate No.: 5171866

Date of Issue: 25/11/2020

CIWM Chief Executive Officer

The Chartered Institution of Wastes Management

00152977

Installations basic general pre-application advice

Check if you need an environmental permit

If you are unsure whether your activity requires an environmental permit or what kind of permit you require, you should read our guidance on whether you need an environmental permit.

How do I apply for a new permit?

To apply for a new permit, you must complete the relevant application forms and provide the required supporting information.

For some operations you can apply for a standard rules environmental permit. These have fixed conditions and are only suitable for a limited number of activities and locations. For all other activities and locations, you need to apply for a bespoke permit.

Standard rules:

- Apply for a new standard rules online
- You can also use the application forms for a new standard rules permit. You need to email the completed forms, along with supporting documentation, to psc@environment-agency.gov.uk

Bespoke permit:

- To apply for a bespoke installation permit you must complete application forms A, B2, B3 and F1.
- You will also need to complete application form part B6 if your installation includes a point source emission(s) to water, groundwater or sewer.

You should read the guidance notes that accompany each form. You should download the application forms and open with an Adobe Acrobat Reader. You may not be able to complete the form using other pdf readers, such as the one built into your internet browser.

Application forms and guidance for a bespoke permit application.

You need to email the completed forms, along with supporting documentation, to psc@environment-agency.gov.uk

How do I change, transfer or cancel my permit?

If you already have a permit, and want to change (vary) it, transfer it to another person or business, or surrender it, you must provide the correct forms and supporting information.

How to change details of your environmental permit, transfer it to somebody else or surrender it.

How much will my permit cost?

Before applying, you should read the Environmental permitting charges guidance. This sets out how to calculate the relevant charge and when certain charges apply.

Baseline charge

You can find a full list of activity charges in table 1 in the tables of charges in the Environmental permitting charging scheme. The baseline charge for an application covers the work the Environment Agency carries out each time they determine a typical permit application.

There are fixed baseline charges for new applications, variations to permits, transfer applications and surrender applications.

Add-on charges

You may have to pay an add-on assessment charge for the assessment of plans, for example an odour management plan.

If we need to carry out additional assessments, for example a habitats assessment, we may charge extra for this work.

You must pay the add-on charge when applying for a new permit or if you need to submit a new plan when applying for a permit variation.

In some cases, the costs of assessing these plans is included in the baseline application charge. The activity description in table 1 in the tables of charges will say if this is the case.

The plans and assessments are listed in table 1.19 in the tables of charges in the charging scheme.

Habitats assessment

For certain protected sites we need to carry out a habitats assessment. For these sites we charge a fixed amount of £779.

This is an assessment of the risks to one or more of these sites, a:

- European Site within the meaning of the Conservation of Habitats and Species Regulations 2017
- site referred to in the National Planning Policy Framework 2018 as requiring the same assessment as a European Site
- site of special scientific interest within the meaning of the Wildlife and Countryside Act 1981
- marine conservation zone within the meaning of the Marine and Coastal Access Act 2009

We have included further information on when this is required in the supporting documents section below.

Subsistence

If we grant a permit, you will need to pay an annual subsistence charge to cover the ongoing costs of regulating the permit. The subsistence charges are in listed in the tables of charges in Part 3 of the charging scheme.

Sites of High Public Interest (SHPI)

If your site is designated as a SHPI a different charging processes is applied. Additional information on SHPI is included in section 2.5 of the Environmental Permitting Charges Guidance.

- An application for a SHPI is subject to a newspaper advertising charge of £500.
- The number of hours it takes to determine the application will be calculated at £100 per hour (commonly referred to as a 'time and materials' charge). If this is higher than the standard application charge listed in the Charging Scheme, the additional charge component will be applied – please see section 2.5 of the Environmental Permitting Charges Guidance.

Declaration

Please ensure the Declaration section is completed by each "relevant person".

- For an application from an individual, a relevant person is the person to be named on the permit.
- For an application from more than one individual, each person who is applying for their name to be on the permit must complete the declaration – you will have to complete a separate copy of the declaration page for each additional individual.
- In the case of a company a relevant person must be an active director/company secretary as listed on Companies House.
- For a limited liability partnership, the declaration must be completed by a partner.
- For a charity, a relevant person is a key post holder: chair, chief executive, director or trustee.

Further information on who should complete the declaration can be found in section 5 of the guidance notes for the F1 application form.

Supporting documents

You need to supply supporting documents with your application. The online guidance and application form guidance explain what documents you need to provide. Depending on the type of application, you might not be required to provide all the documents listed below.

If you do not provide the correct supporting information this may delay the processing your application.

We will check your application to make sure it is complete. We refer to these checks as 'duly making'. This is to ensure we have enough information to start to determine your permit application. We will contact you if information is missing.

If we cannot progress your application past this stage for any reason, we will return it and refund the application charge minus 20% to cover our costs to that point.

We will not charge this if we return an application after having done very little work – for example, because it contained obvious errors or omissions.

The amount we will keep is capped at £1,500.

Once we have duly made an application, we will start to determine it. This is when we do our technical checks. We may need to ask you for further information or additional documents at this stage.

Non-Technical Summary

For new bespoke permits and most variation applications you need to send us a simple explanation of your proposed activities (or in the case of a variation, what changes you propose to make). This should include a summary of your operations and a summary of the key technical standards and control measures arising from your risk assessment.

As a guide, this summary document should be no more than one to two pages in length.

Site plan

New installations applications require a site plan. It is also required when you propose to increase or reduce your site boundary.

The plan must clearly show the full site boundary in a single unbroken line. For standard rules permits, the boundary must be in green.

Your plan should clearly mark the site layout, infrastructure and drainage arrangements.

Environmental Management System

For new bespoke permit applications and transfer applications you must send a summary of your environmental management system (EMS). An update to your EMS may also be required for some variation applications. You should follow the guidance on developing a management system.

Habitats risk assessment

You should check if your site is located within the relevant screening distance of a designated site. If so, you need to assess the risk to the site(s) from your activity. You may need to pay an additional charge to cover the assessment of the risk. Further information is included in the 'How much will my permit cost' section above.

To help you identify relevant sites, you can ask us to complete a Nature and Heritage Conservation Screening assessment for you, using the online pre-application service. The screening assessment service is free of charge.

If you are applying for a variation and emissions or impacts are increasing as a result of that change then depending on the location of the facility you may need to assess how the increased impact will affect habitat sites.

Environmental Risk Assessment

For new applications or when you make changes, you must consider the environmental risk posed by your proposals. This must take the form of an environmental risk assessment which should follow the methodology set out in risk assessments for your environmental permit.

You should read our guide to risk assessments for specific activities and consider using our assessment tool to evaluate your environmental risk. Our assessment tool will inform you when more detailed modelling is required.

You should check if your site is located in a flood risk zone. If the site is in a flood zone, you should assess the risk of pollution in the event of a flood.

Depending on the outcome of your initial environmental assessment, you may be required to undertake detailed modelling of your environmental risk.

- If you need to assess the risk of emissions to air, use the air emissions risk assessment for your environmental permit guidance.

You must carry out detailed modelling assessment on any emissions that you didn't screen out through your air emissions risk assessment. Your modelling report needs to follow the air dispersion modelling reports guidance.

- If you need to assess the risk of hazardous pollutants to surface water, you need to follow the surface water pollution risk assessment guidance.
- If you need to assess the risk from sanitary determinands you should follow the assessment of sanitary and other pollutants in surface water discharges methodology.
- If you need to undertake detailed modelling of the risk to surface water you should follow the surface water pollution risk assessment methodology.
- If you need to undertake an assessment of the risk to groundwater you should follow the groundwater risk assessment guidance.

Technical Description and BAT assessment

For new permit applications, you will need to provide a technical description of the activity (or in the case of a variation, the changes you propose to make).

You need to detail the plant, equipment and infrastructure, including design capacities. You must demonstrate how you will meet any relevant Best Available Techniques (Including compliance with BAT conclusions where these have been published for your activity). This should include consideration for any relevant Directives, such as Medium Combustion Plant Directive (MCPD), Energy Efficiency Directive and Waste Framework Directive (WFD).

The technical assessment should also include details of your operating techniques and the infrastructure you are using to minimise the risk of pollution, including any details of secondary containment used (such as bunds) and how this meets any relevant standards. Please see the pollution prevention guidance for additional advice.

If you are varying your permit, you should detail any existing operating techniques (as listed in table S1.2 of your permit) that are subject to change by the application being made and demonstrate how they will meet any relevant BAT. Note any new equipment or activities are likely to need to meet any new and relevant BAT standards.

Amenity management plans

You must read our guidance on how to control and monitor emissions for your environmental permit.

This includes guidance on controlling pollution from odour, dust, noise, pests and other 'fugitive emissions' (emissions without set emission limits).

You may be required to produce standalone management plans to demonstrate how you will control and monitor emissions. These will be assessed as part of your application. For odour and dust, we can supply a management plan template. The templates have been designed to cover the aspects of your operations that we will assess. You do not have to use this template, but if you do and provide all the information requested, it makes it more likely your plans will be accepted. You should contact the following teams to request a copy the template:

- Odour: odourteam@environment-agency.gov.uk
- Dust: air.quality@environment-agency.gov.uk

For activities where dust and or odour has the potential to be a high risk, we have included the relevant templates with this advice. You may need to pay an additional charge for the assessment. Further information on this is included in the 'How much will my permit cost' section above.

This also applies to variations which may lead to an increase in emissions as a result of the changes being proposed.

We have included additional notes below on specific considerations for noise impact assessments below.

Risks from Noise and Vibration, Industrial and Commercial Sound and Noise Management Plans

If your risk assessment shows your operation is likely to cause pollution from noise or vibration beyond your site boundary you must provide a noise impact assessment (NIA) based on BS4142:2014+A1:2019 – 'Methods for rating and assessing industrial and commercial sound'.

Where your assessment has used calculations or modelling to predict sound pressure levels at receptors, you must follow our guidance on the presentation of your acoustic data: Noise impact assessments involving calculations or modelling.

We have attached some supplementary advice on producing a NIA.

Your NIA must be accompanied by a Noise Management Plan based on the results of your NIA. We have attached a template to help you produce a noise management plan.

Fire Prevention Plan (FPP)

If you store combustible wastes at your site you need to provide an FPP. You must follow our guidance on Fire Prevention Plans. This tells you what to include in your FPP and the fire prevention measures you must put in place. We have also produced a template to help you prepare your plan.

If you are varying your permit and this will lead to an increased fire risk, then a new or updated plan will be required.

Accident prevention and management plan

Your EMS should include a plan for dealing with any incidents or events that could result in pollution. This should follow our guidance on producing an accident prevention and management plan. If applying for a variation, you may need to update this plan to incorporate the proposed changes.

Climate Change Risk Assessment

For new bespoke applications you will need to complete the screening questions in part B2 of the application form. As a result you may need to submit a climate change risk assessment. Part B2 guidance provides more information on this.

Technical Competence

If your activities include waste management, you must meet legal operator and competence requirements. You will need to send in evidence of appropriate technical competence for the proposed activities (or in the case of variations, the proposed changes). You will need to include valid certificates or other acceptable evidence.

Site condition report

For new bespoke permits or variations to increase the area of your facility you should send us a site condition report which covers the area that will be covered by the permit. This should be in line with our guidance H5 Site condition report – guidance and templates.

This needs to include a conceptual site model and identify any relevant hazardous substances on site. Quantitative baseline soil and groundwater monitoring data on the condition of the site should be included or a justification on why this is not required should be provided. You should also consider if you need to undertake soil gas monitoring.

Water Discharges

If your application will include water quality discharges which form part of the same installation facility you must complete the installation application forms and water quality application forms. If

the discharge is standalone (not technically linked to the installations facility) on another separate permit you can access pre-application advice here or follow the guidance here.

Waste Activities

If you require pre-application advice about a standalone waste activity, then you can access advice here. If the waste activity will be included with your installations permit application, and is not a directly associated activity, you should follow the guidance here and complete application form's part B4 or B1 as appropriate.

Other permissions required

The above advice covers installations activities only. Other permissions from the Environment Agency and/or other bodies may be required for your activity or if you carry out any associated or additional activities, for example:

- List of activities that need an environmental permit
- If you abstract or impound water
- Planning permission
- If you work on or near a river, flood defence or sea defence

Submitting an application

Please submit your application by email or, if applicable, by using the online form as detailed in the 'How do I apply for a new permit?' section above.

Application Timescales

Our current queues are large, and we are taking longer than usual to allocate work for initial assessment, known as duly making. The table below shows our estimated queue times by application type. Please note, this is based on our average times and some applications may be picked up before or after the timescales listed below.

Application type	Estimated time to allocation
New bespoke	24-28 weeks
New standard rules	21-25 weeks
Admin variation	15-19 weeks
Minor variation	21-25 weeks
Normal variation	25-27 weeks
Substantial variation	41-45 weeks
Transfer	25-29 weeks
Surrender	21-25 weeks

Once an application is duly made, the amount of time taken to determine your application will vary. It will be impacted by factors such as:

- The quality of the application
- The complexity of the application
- Whether an application is of high public interest
- Whether the application includes novel technologies or techniques
- Whether the determination requires input from others, both internal and external to the Environment Agency
- Whether modelling and/or monitoring and assessment is required, for example Air Quality modelling and assessment

The Permitting Officer determining your application will be able to keep you updated with the progress of your application.

I still have questions about my application, and I'd like further advice

If you have remaining basic questions about your application which have not been answered by.gov.uk guidance pages or the advice given in this document (and any supplementary activity document) you can email us with your application specific question to: preapplicationservice@environment-agency.gov.uk

Please quote your unique Environment Agency EPR number found in your pre-app response email. Please note this basic free advice is limited to:

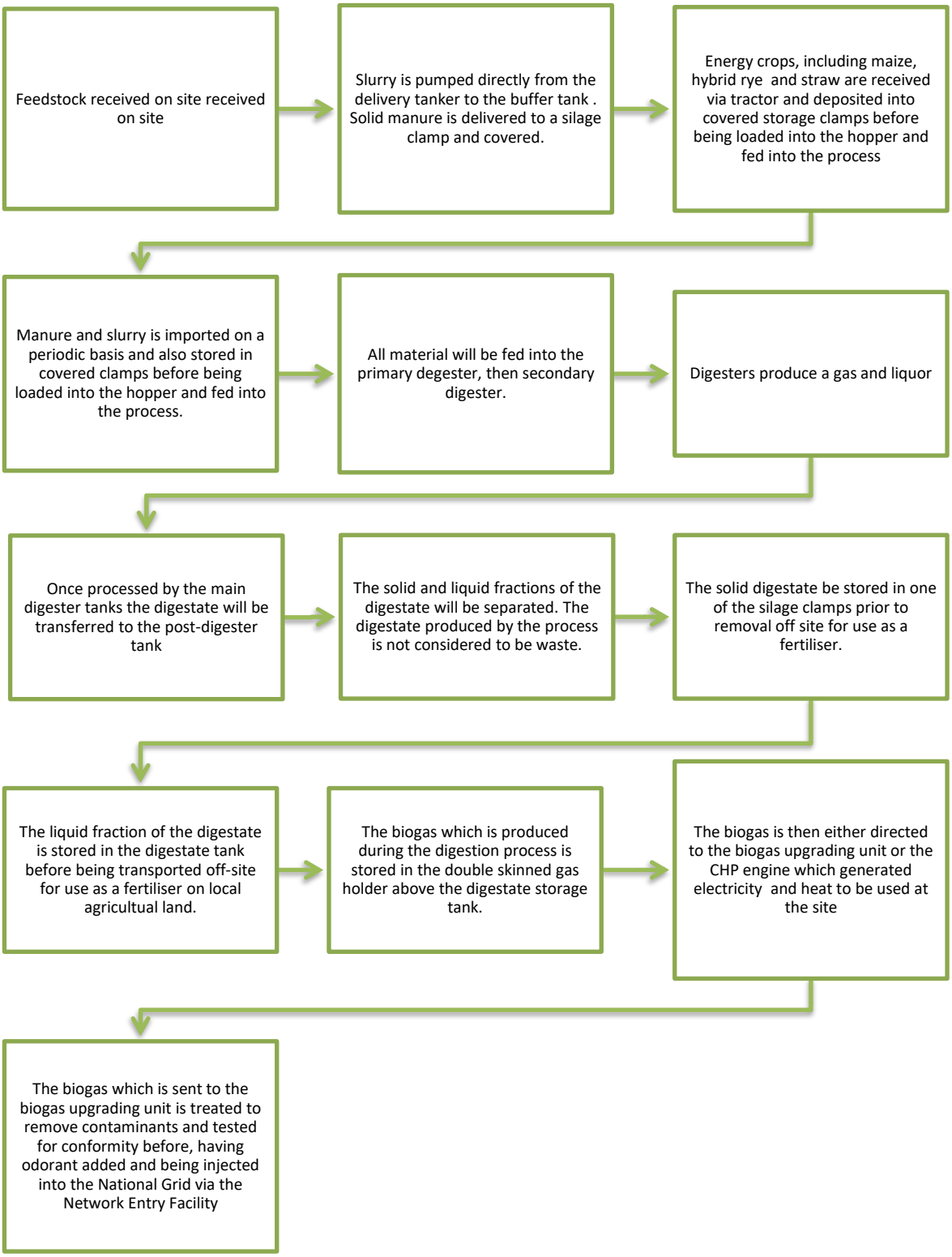
- The correct application charges
- The correct application forms to use
- What guidance you must follow
- Information about administrative tasks the Environment Agency may need you to do as part of your application
- If there are standard rules sets relevant to your activities and if you meet the criteria for them
- Information about risks assessment you may need to do to accompany your application

Alternatively, if you have decided that you now need chargeable enhanced pre-application advice to ask more detailed site-specific technical questions about your application then you will need to complete this form to access this service, insert your unique EPR number found in the basic pre-app response email when prompted by the form.

This enhanced service could include advice on:

- the type of permit you need
- complex modelling
- preparing risk assessments
- parallel tracking for complex permits with planning applications
- specific substances assessments
- monitoring requirements (including baseline)
- what guidance you must follow before you submit your application
- the correct application charge

Appendix D – Process Flow Diagram



Appendix F – List of wastes accepted

Burton Agnes Biogas Plant - Waste Types	
Waste Codes	**Description**
02	**WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AN FOOD PREPARATION AND PROCESSING**
02 01	**wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing**
02 01 06	animal faeces, urine and manure (include spoiled straw), effluent, collected separately and site

enzygo
environmental consultants

Air Quality Assessment

Burton Agnes Biogas Plant

Future Biogas Limited

CRM.537.004.AQ.R.001

'Experience and expertise working in union'

enzygo.com

Contact Details:

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email: conal.kearney@enzygo.com
www: enzygo.com

Environmental Permit Variation – Air Quality Assessment
CRM.537.004.AQ.R.001

Project:	Burton Agnes Biogas Plant
For:	Future Biogas Limited
Status:	Final
Date:	October 2022
Author:	Josh Davies, Senior Air Quality Consultant
Reviewer:	Conal Kearney, Director of Air Quality

Contents

Tables and Figures

Drawings and Appendices

Non-Technical Summary

i. Enzygo Limited was commissioned by Future Biogas Limited to undertake an air quality dispersion modelling assessment to support a permit variation application for an Anaerobic Digestion facility located at Harpham Grange Farm, Burton Agnes.

ii. Enzygo understands the variation is required as the Facility will no longer be able to meet the requirements of the appropriate newly revised standard rules permit. In order to keep operating this application to vary the Permit to a Bespoke Installations Environmental Permit is being submitted.

iii. This report should be read in conjunction with the facility's Environmental Permit, EPR/VP3034RX.

iv. During the operation of the plant there is the potential for impacts at sensitive locations due to combustion and ammonia emissions associated with the facility. Air Quality dispersion modelling was undertaken to consider impacts in the vicinity of the site. Emissions concentrations were defined based on the plant operations, stack monitoring and where necessary a review of technical data sheets.

v. Model inputs were based on robust operating parameters. Results were then processed and assessed against industry standard significance criteria.

vi. The dispersion modelling results indicated that the relevant screening criteria was met at all sensitive human receptors therefore impacts could be screened as insignificant.

vii. Impacts on ecological receptors as result of ambient nitrogen oxide and sulphur dioxide concentrations predicted as insignificant at all assessed sensitive ecological receptor locations.

viii. Impacts resulting from ammonia concentration and deposition rates for nutrient nitrogen and acidity could not be directly screened as insignificant. It is recommended that impacts are reviewed by a qualified ecologist to make a judgement on whether there is a likely significant effect or an adverse effect on the integrity of a site

1.0 Introduction

1.1 Background

1.1.1 Enzygo Limited was commissioned by Future Biogas Limited (Ltd) to undertake dispersion modelling to support a permit variation for an Anaerobic Digestion (AD) plant at Harpham Grange Farm, Burton Agnes, (the 'Facility').

1.1.2 The facility will process non-waste energy crops, including rye, grass and maize sileage and agricultural manures and slurry. The biogas produced during the process will be upgraded injected into the gas transmission grid. Proportions of biomass will also be combusted on site to provide electricity and heat to the AD process via a Combined Heating and Power (CHP) Plant. In situations where the CHP unit is offline, an auxiliary boiler will operate to ensure demand is maintained.

1.1.3 The Facility comprise will comprise of the following primary elements:

- Acceptance and storage of energy crops in silage clamps;
- Acceptance and storage of agricultural manure and straw;
- Acceptance of liquid slurry via the filling station and storage of slurry in the prelim tank;
- Digestion of crops agricultural manures and slurry;
- Biogas collection, storage and treatment;
- Combustion of biogas in biogas boiler (emergency and backup use only);
- Injection of upgraded biogas into grid;
- Combustion of biogas in a CHP plant and auxiliary boiler;
- Emergency flare operation; and
- Transfer of digestate via pipes to tankers.

1.1.4 Combustion emissions associated with the CHP, biogas boiler and flare and ammonia emissions from the feedstock and digestate have the potential to cause increases in ground level pollutant concentrations and cause impacts at sensitive locations within the vicinity of the site. In addition, ammonia (NH_3) emissions from feedstock and digestate have the potential to cause impacts at ecological sensitive receptors.

1.1.5 An Air Quality Assessment has therefore been undertaken to assess the significance of these impacts in line with the requirements of the Environmental Permitting (England & Wales) (Amendment) (No.2) Regulations 2016.

1.1.6 This report details the results and conclusions of the quantitative air quality impact assessment.

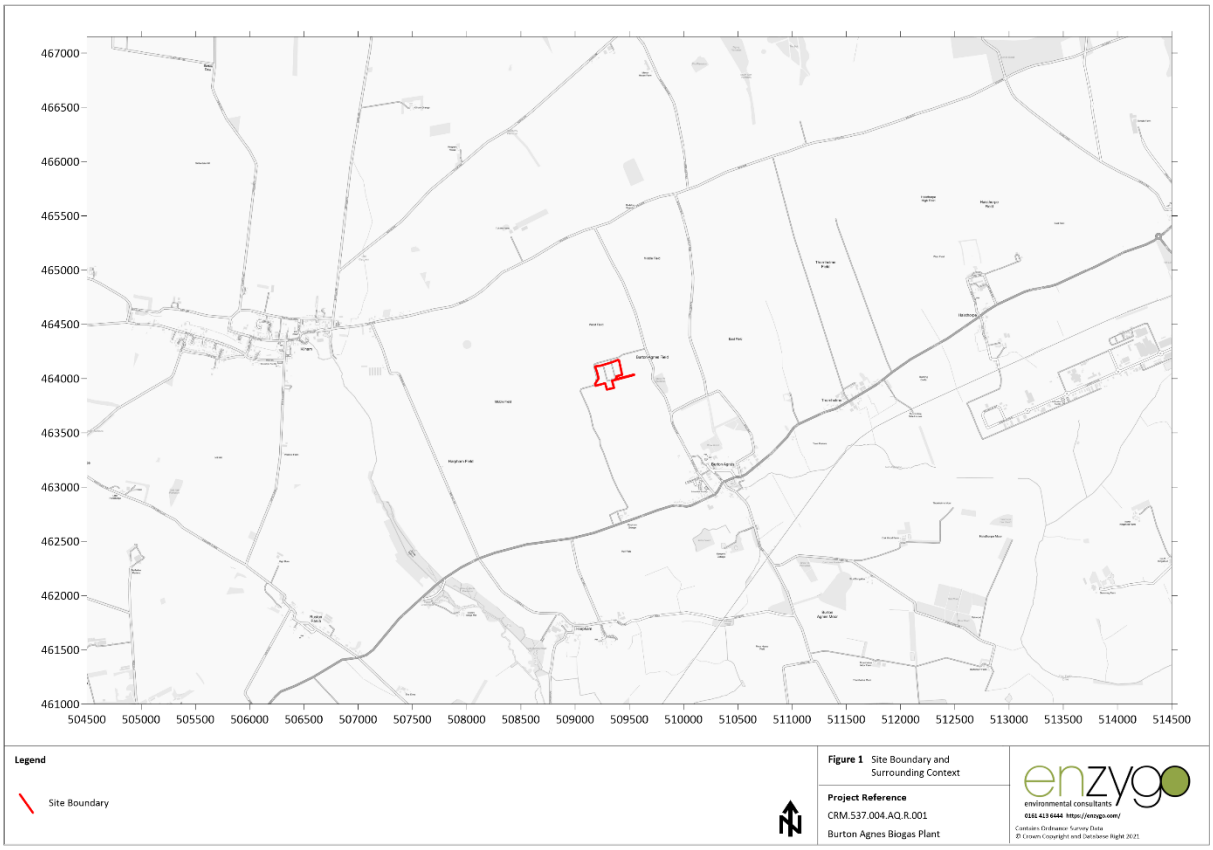
1.2 Site Location and Context

1.2.1 The Facility is located on land at Harpham Grange Farm, Burton Agnes, YO25 4NQ, at the approximate National Grid Reference (NGR): 509310, 464065. The site is located in a predominantly agricultural area with a sparse working farms and residential properties in the

vicinity of the site. The nearest residential property is The Rectory situated on Rudston Road, approximately 1.1 km southeast of the Facility.

1.2.2 Figure 1 shows a map of the site location and surrounding area.

Figure 1– Site Surrounding



2.0 Legislation, Guidance and Environmental Standards

The following legislation and guidance will be considered during the preparation of the Air Quality Assessment:

- The Environmental Permitting (England and Wales) (Amendment) Regulations 2016;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs (DEFRA), 2007[1];
- The Air Quality Standards (Amendment) Regulations, updated on 31st December 2016;
- Local Air Quality Management Technical Guidance 2016 LAQM (TG16), DEFRA, 2016[2];
- Air emissions risk assessment for your environmental permit, EA, updated on 3rd September 2021[3]; and
- Environmental permitting: air dispersion modelling reports, EA, updated on 19th January 2021[4].

2.1 Ecological Critical Loads and Levels

2.1.1 The modelling assessment will be undertaken against relevant long-term and short-term environmental standards. The assessment levels, limit values, objectives and target values which are applicable to this assessment are summarised in Table 1 with relation to human health receptors.

Table 1 Environmental Quality Standards for Human Exposure

Pollutant	Environmental Quality Standards	
	Concentration (µg/m³)	Averaging Periods
Nitrogen dioxide (NO_2)	40	Annual mean, not to be exceeded
	200	1-hour mean; not to be exceeded more than 18 times a year
Sulphur Dioxide (SO_2)	125	24-hour mean; not to be exceeded more than 3 times a year
	350	1-hour mean; not to be exceeded more than 24 times a year
	266	15-min mean; not to be exceeded more than 35 times a year
Carbon monoxide (CO)	10,000	8-hour running mean, not to be exceeded
Hydrogen Sulphide (H_2S)	140	Annual limit
	150	1 hour limit
Volatile Organic Compounds (VOCs)	5	Annual limit
	30	24-hour mean limit
Ammonia (NH_3)	180	Annual limit
	2,500	1 hour limit

2.1.2 The annual and hour limits set out for H_2S and NH_3 are Environmental Assessment Levels (EALs) set out in the EA guidance[3]. EALs represent a pollutant concentration in ambient air at which no

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007
[2] Local Air Quality Management Technical Guidance 2016 LAQM (TG16), DEFRA, February 2018.
[3] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit
[4] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

significant risks to human health are expected. The remaining pollutants are assessed against their respective Ambient Air Directive (AAD) Limit Values, either under EU directives or UK law.

2.1.3 These criteria are collectively referred to as Environmental Quality Standards (EQSs). Table 2 summarises the advice provided in the DEFRA guidance LAQM (TG16)[2] on where the EQSs apply.

Table 2 Environmental Assessment Levels

Averaging Period	Objectives Should Apply At	Objectives Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour and 8 hour mean	As above together with hotels, and gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	As above, kerbside sites (for example, pavements of busy shopping streets), parts of car parks, bus stations and railway stations etc. which are not fully enclosed, and any location where members of the public might reasonably be expected to spend one hour or more	Kerbside sites where the public would not be expected to have regular access

2.2 Ecological Critical Levels

2.2.1 The assessment will also assess impacts upon ecological designations in accordance with the EA guidance[3]. The significance of impacts will be compared against the relevant critical loads and levels obtained from the UK Air Pollution Information System (APIS)[5] .

2.2.2 Table 3 presents the Critical Levels (CLv) for the protection of vegetation for pollutants considered within this assessment.

2.2.3 Impacts on ecological designations will be assessed in accordance with the EA guidance[3]. CLv have been designated based on the sensitivity of the receiving habitat. Table 3 presents the CLv considered within this assessment.

Table 3 Critical Levels for the Protection of Vegetation

Pollutant	Critical Level	
	Concentration (µg/m³)	Averaging Periods
NO_x	30	Annual mean
	75	24-hour mean
SO_2	10[a]	Annual mean
	20[b]	Annual mean

[5] http://www.apis.ac.uk/

Pollutant	Critical Level	
	Concentration (µg/m³)	Averaging Periods
NH_3	1[a]	Annual mean
	3[b]	Annual mean

a: Sensitive lichen communities & bryophytes and ecosystems where lichens & bryophytes are an important part of the ecosystem's integrity

b: For all higher plants (all other ecosystems)

2.2.4 Critical Loads (CLo) used in this assessment are detailed in Section 4.2 for nutrient nitrogen and acidity which refers to deposition of pollutants, while a CLv refers to pollutant concentrations in the atmosphere.

2.2.5 The significance of impacts will be compared against the relevant CLv and CLo.

3.0 Dispersion Modelling Inputs

3.1 Emission Sources

3.1.1 The following sources have been considered in the assessment and reflect the relevant emission points listed in EPR/VP3034RX/001 and additional process emissions.

- A1 – A4 - Pressure relief Devices
- A5 - Combined Heat and Power (CHP) Engine 1 Stack
- A6 - Auxiliary Boiler Stack
- A7 - High Temperature Flare
- A8 - Biogas Cleaning Stack
- Feedstock Clamps (Farmyard Manure and Silage); and
- Solid Digestate Storage

3.1.2 Feedstock and digestate storage are sources of NH_3 emissions and have been included within the modelled to assess NH_3 contributions on ecological receptors. Such areas have been reflected in the modelling as area sources and given than emissions monitoring has not been undertaken emission rates have been obtained following a literature review.

3.1.3 With regards to emission sources A1-A4 (Pressure Relief Devices) and A7 (High Temperature Flare) and it is understood these will only operate during emergency scenarios, either a result of system failure or abnormal gas production and are expected to operate infrequently. Given their reduced operating schedules, impacts from A1-A4 and A7 are considered insignificant and are not subject to detailed modelling.

3.1.4 Table 4 details the identifications and locations of modelled emission sources.

Table 4 Stack Locations

ID	Description	NGR	
		X	Y
A5	CHP Engine	509331.7	463996.6
A6	Auxiliary Boiler Stack	509335.8	464001.8
A8	Biogas Cleaning Stack	509349.4	463994.2

3.1.5 For further information regarding emission sources please review EPR/VP3034RX.

Table 5 Ammonia Sources

Description	Centre NGR		Modelled Area (m^2)
	X	Y	
Silage Clamp 1	509266.4	464060.1	89.8
Silage Clamp 2	509278.2	464017.5	89.9
Silage Clamp 3	509350.7	464081.1	89.6
Silage Clamp 4	509361.7	464039.0	88.1
Manure Clamp 1	509244.4	464078.4	33.8
Digestate Storage	509349.4	464128.8	172.08

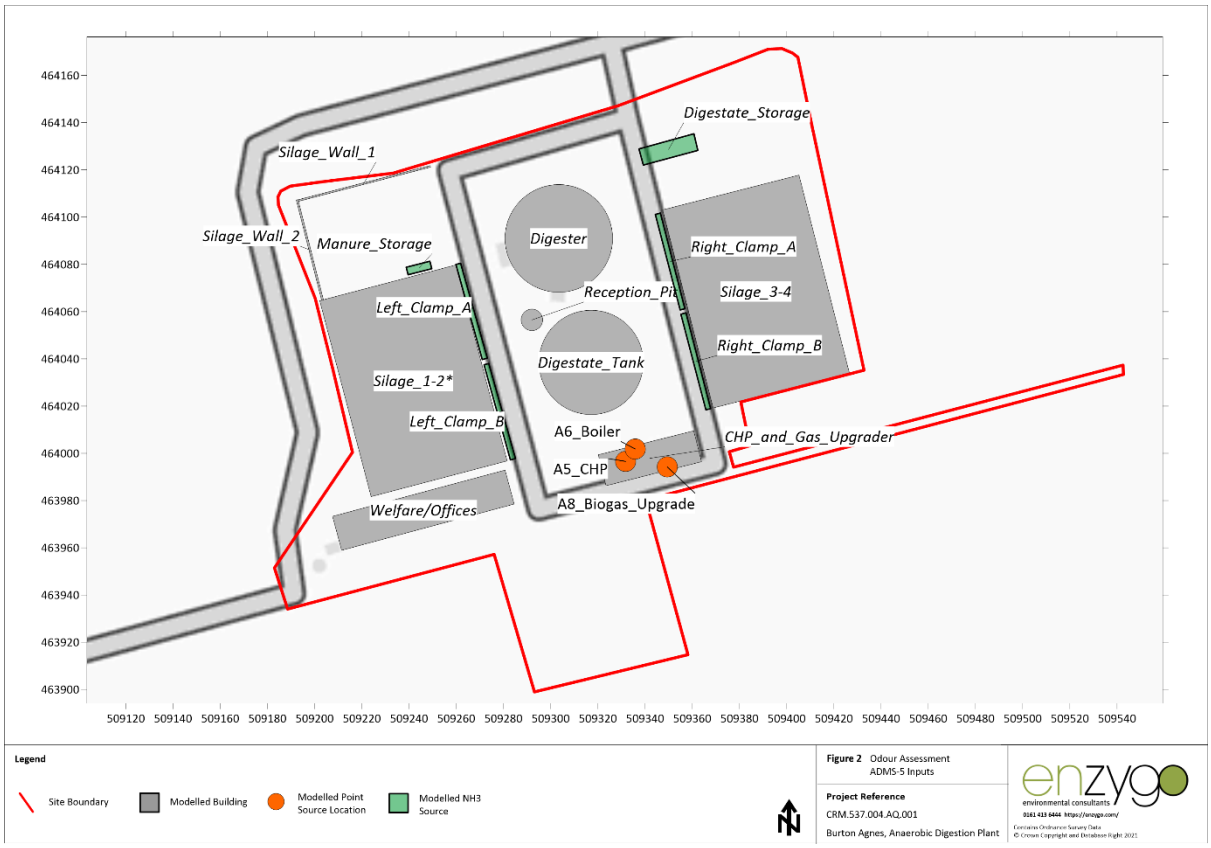
3.1.6 It should be noted that the on-site lagoon does not serve as a liquid digestate storage area and consists primarily of rainwater with proportions of surface runoff. As such, it is not considered a source of significant NH_3 emissions and has not been considered further during the assessment.

3.2 Dispersion Modelling

3.2.1 The information detailed in this section was entered into the ADMS 5.2 (v5.2.2.0) software, which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. Outputs were processed to determine pollutant concentrations in the vicinity of the site and compared against the relevant assessment criteria to determine impact significance.

3.2.2 The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected long-term and short-term averages. Figure 2 shows a graphical representation of the modelled Air Quality sources.

Figure 2– ADMS-5 Modelling Inputs



3.3 Modelling Scenarios and Emissions

3.3.1 The modelled pollutant scenarios considered in the modelling assessment are summarised in Table 6. Unless stated modelled pollutant species and average periods relate to human exposure.

Table 6 Dispersion Modelling Scenarios

Pollutant	Modelled As	
	Long Term	Short Term
NO_2	Annual mean	99.79th percentile (%ile) 1-hour mean

Pollutant	Modelled As	
	Long Term	Short Term
NO_x	Annual mean *(Ecological Impacts)*	24-hour mean (Ecological Impacts)
SO_2	-	99.9%ile 15-minute mean
	-	99.73%ile 1-hour mean
	-	99.18%ile 24-hour mean
	Annual mean (*Ecological Impacts)*	-
CO	8-hour rolling mean	-
VOC as Benzene	Annual mean	-
	24-hour mean	-
H_2S	Annual mean	-
	1-hour limit	-
NH_3	Annual mean (Ecological Impacts)	-
Nitrogen Deposition	Annual mean (Ecological Impacts*)*	-
Acid Deposition	Annual mean (Ecological Impacts)	-

Process Conditions

3.3.2 Process conditions for source A5 has been obtained from the MCERTs stack monitoring carried out by SOCOTEC UK Ltd [6] and Element UK [7]. Parameters for A6 were informed by the manufacturer's data sheet, and A8 from heat and mass balance data. Further specifications were provided by Future Biogas Limited.

3.3.3 Reference should be made to Table 7 for the parameters for each emission stack.

Table 7 Process Stack Conditions

Parameter	Unit	A5[(a)]	A6[(b)]	A8[(c)]
Stack height	m	10.05	6.00	4.20
Stack diameter	m	0.25	0.30	0.15
Flue gas efflux velocity	m/s	17.7	5.30	4.88
Volumetric flow rate	m^3/s	0.867	0.374	0.092
Temperature	˚C	126	185	19.5
Moisture Content	%	7.7	-	-
Oxygen Content	%	6.6	-	-

[a] Data from SOCOTEC UK Ltd report LNO 16216
[b] Technical Specification – ICI Caldaie REX 62 K F 7130 Boiler
[c] Air Products Heat and Mass Balance Report – 20150722-1604-031

Emissions

Stack Emissions

3.3.4 Emission concentrations associated with A5 have been obtained from MCERTs stack monitoring provided by SOCOTEC UK Ltd[6] and Element[7]. Emission concentrations associated with A6 are based on maximum Emission Limit Values (ELVs) specified by the EAs statutory guidance[8] with

[6] MCERTS Monitoring Report LNO 16216, SOCOTEC UK Ltd, 28th January 2021
[7] MCERTS Monitoring Report ERP-3320, Element, 7th December 2021
[8] SR2021 No 6: Anaerobic digestion facility, including use of the resultant biogas – installations, 17th May 2022.

A8 emissions calculated from Heat and Mass Balance data provided by Future Biogas Ltd[9].

3.3.5 Emission concentrations detailed in Table 8 are referenced at standard temperature (273K) and pressure (101.3kPa) and, in the case of A5 as a dry gas at 5% oxygen, and A6 as a dry gas at 3%.

Table 8 Monitored Emission Concentrations

Pollutant	Emission Concentrations (Nmg/m^3)		
	A5	A6	A8
NO_x (as NO_2)	582.00	250.00	-
SO_2	348.00	200.00	-
CO	628.00	1,400.00	-
VOC (as Benzene)	2,214.00	1,000.00	392.97*
H_2S	-	-	2.79*

* Calculation based on monitored PPM.

3.3.6 The mass emissions rate in grams per second is shown in Table 9. Emission rates have been calculated to using actual conditions including temperatures, O_2% and moisture content provided in Table 7.

Table 9 Emission Rates

Pollutant	Emission Rate (g/s)		
	A5	A6	A8
NO_x (as NO_2)	0.287	0.038	-
SO_2	0.172	0.031	-
CO	0.310	0.215	-
VOC (as Benzene)	1.091	0.154	0.0363
H_2S	-	-	0.0003

Ammonia Emissions

3.3.7 NH_3 emission rates were considered for the silage/FYM clamps and solid digestate storage. Feedstock emissions based on emission factors taken from the Natural Resource Wales website 'Emission factors for anaerobic digestion feedstock and digestate for modelling and reporting' as the most relevant and detailed available factors in the UK at the time of writing the report.

3.3.8 Emission rates are based approximate weights and volumes of feedstocks, confirmed by Future Biogas Ltd, as detailed below:

- Poultry Manure – 1,800 tonnes per annum (tpa);
- Pig Slurry - 16,000 m^3 per annum;
- Maize and Hybrid Rye – 40,000 tpa; and
- Wheat Straw – 1,500 tpa.

3.3.9 Waste masses were based on the proposed mix detailed above. According to a literature review[10] pig slurry has a density of approximately 1 kg/l which has been used to convert the

[9] Air Products Heat and Mass Balance Report – 20150722-1604-031.

[10] Evaluation of mechanical separation of pig and cattle slurries by a decanting centrifuge and a brushed screen separator, Agri-Environmental Technologies, Stephen Gilkinson and Peter Frost, September 2007

annual slurry volume into an appropriate weight. Future Biogas Limited confirmed the annual digestate output of 7,500 tonnes of dry digestate, and 40,000 tonnes of liquid digestate.

3.3.10 A number controlling methods have been proposed for the feedstock clamps and digestate storage. The emission control methods will be fully reviewed during the environmental permitting application.

3.3.11 The FYM manure clamp and digestate stores will be fully covered by a Silostop Max silage film which provides a robust impermeable 80 micron oxygen barrier film and blocks the entry of oxygen into the covered material. FYM manure and digestate stores will be kept covered all times except when loading or unloading. This alone would provide an ammonia reduction of up to 95%[11]. As such a conservative overall reduction of 50% has been assumed in this assessment, this accounts for periods of loading and unloading where material is agitated and uncovered.

3.3.12 Emissions associated with silage, manure and digestate storage has been based on information provides Future Biogas Ltd, with relation to coverage areas and tonnages. Silage clamps have been modelled based on the exposed area representing the front face which is constantly uncovered for loading access.

3.3.13 Table 9 shows NH_3 emission rates for the digestate storage. All NH_3 emissions were assumed to be at ambient temperate and zero velocity.

[11] https://extension.umn.edu/manure-air-and-water-quality/covers-manure-storage

Table 10 NH_3 Emission Calculations

Source	NRW Feedstock Type	N content of fresh matter (kg kg–1)	N in feedstock (kg/kg)	Fresh Mass (kg/day)	Ammonia Emission per kg N	Emission Characteristic	Emission ($g/m^2/s$)
Silage Clamps 1-4	Maize Silage	0.005	0.003	c.13,698 in each clamp	0.009	Emitted over separate silage clamps over c 90 m^2	0.0000039 (per silage clamp)
	Grass Silage	0.009	0.006	c.13,698 in each clamp	0.009		
	Straw	0.005	0.001	c.1,027 in each clamp	0.009		
FYM Clamp	Poultry manure	0.018	0.009	c.4,931	0.009	Emitted over c.33 m^2	0.00013
Solid Digestate[a]	Poultry Manure	0.018	0.009	c.3,950[b]	0.0276	Emitted over c.1720 m^2	0.000013 (combined)
	Maize Silage	0.005	0.003	c.43,891[b]	0.0276		
	Grass Silage	0.009	0.006	c.43,891[b]	0.0276		
	Straw	0.005	0.001	c.3,292[b]	0.0276		
	Pig Slurry	0.005	0.009	c.35,113[b]	0.0276		

a: Solid digestate includes all feedstocks and therefore NH_3 emissions are based on content of all relevant throughputs

b: Tonnage based on annual output of solid digestate

3.4 Time Varied Emissions

3.4.1 Emissions for the silage and FYM clamps and solid digestate storage were assumed to be constant, with the plant in operation 24-hours per day, 365-days per year. Future Biogas Ltd confirmed that the filling of the feeder hoppers, as well as the transfer of feedstock from the silage and FYM clamps would occur for approximately 4-6 hours per day. A time-varied file was therefore applied to represent these conditions.

3.4.2 Future Biogas Ltd also confirmed that the collection of liquid digestate from the designated points will occur for a maximum of 11 hours per week. A time-varied file was therefore applied to represent a collection from tanker locations each week.

3.4.3 The auxiliary boiler (A6) will only operate when the CHP is offline. Future Biogas have confirmed this is likely to occur annually for approximately 260 hours. However, to provide a robust assessment, annual boiler operating hours were modelled for 500 hours. Annual mean PCs associated with the boiler was scaled down using a factor of 0.05 in line with the EA guidance[4]. The factor equates to the operational hours of 500 divided by the maximum operational envelope of 8760 hours. Short term impacts were modelled with the boiler running continuously to consider peak hour contributions.

3.4.4 Modelling of all other sources was assumed to be constant, with the plant in operation 24-hours per day, 365-days per year.

3.5 Terrain Data

3.5.1 Areas of complex terrain have potential to affect the dispersion of pollutants which vary dependent on the height and location of modelled emission sources. The ADMS-5 user guidance suggest that terrain height effect should only be included where gradients exceed 1:10.

3.5.2 Ordnance Survey Landform Panorama terrain data was pre-processed within the ADMS-5 model and covers the Facility and surrounding receptor locations.

3.6 Building Effects

3.6.1 Buildings can influence the dispersion of pollutants and may lead to increases to ground level concentrations. A review of adjacent buildings was therefore undertaken and subsequently included within the model and are summarised in Table 11.

3.6.2 Onsite building heights were provided by Future Biogas Ltd. It should be noted that the effect of buildings on dispersion can only be modelled for points source. As such the modelled area/line sources do not take account of building effects.

Table 11 Building Geometries

Building		NGR (m)		Height (m)	Length/ Diameter (m)	Width (m)	Angle (°)
		X	Y				
1	Silage 1	509241.8	464030.7	4.0	59.6	85.8	255.3
2	Silage 2	509387.0	464068.5	4.0	86.6	59.6	165.7
3	Digestate Tank	509303.4	464091.0	7.7	45.6	Circular	N/A
4	Digester	509317.1	464038.5	19.0	44.2	Circular	N/A
5	Reception Pit	509292.0	464056.5	4.0	9.1	Circular	N/A
6	Offices &Welfare Block	509246.0	463975.9	4.0	14.9	75.7	165.0
7	CHP & Gas Upgrade Unit	509342.0	463997.9	5.0	13.5	41.7	165.9

Building		NGR (m)		Height (m)	Length/ Diameter (m)	Width (m)	Angle (°)
		X	Y				
8	Silage Walls 1	509220.7	464114.2	4.0	0.7	58.5	165.5
9	Silage Walls 2	509197.9	464086.1	4.0	43.8	0.8	165.8

3.6.3 Reference should be made to Figure 2 for a graphical representation of the modelled building layout. and the ADMS 5 model input. A three-dimensional representation of the modelled building layout is provided below.

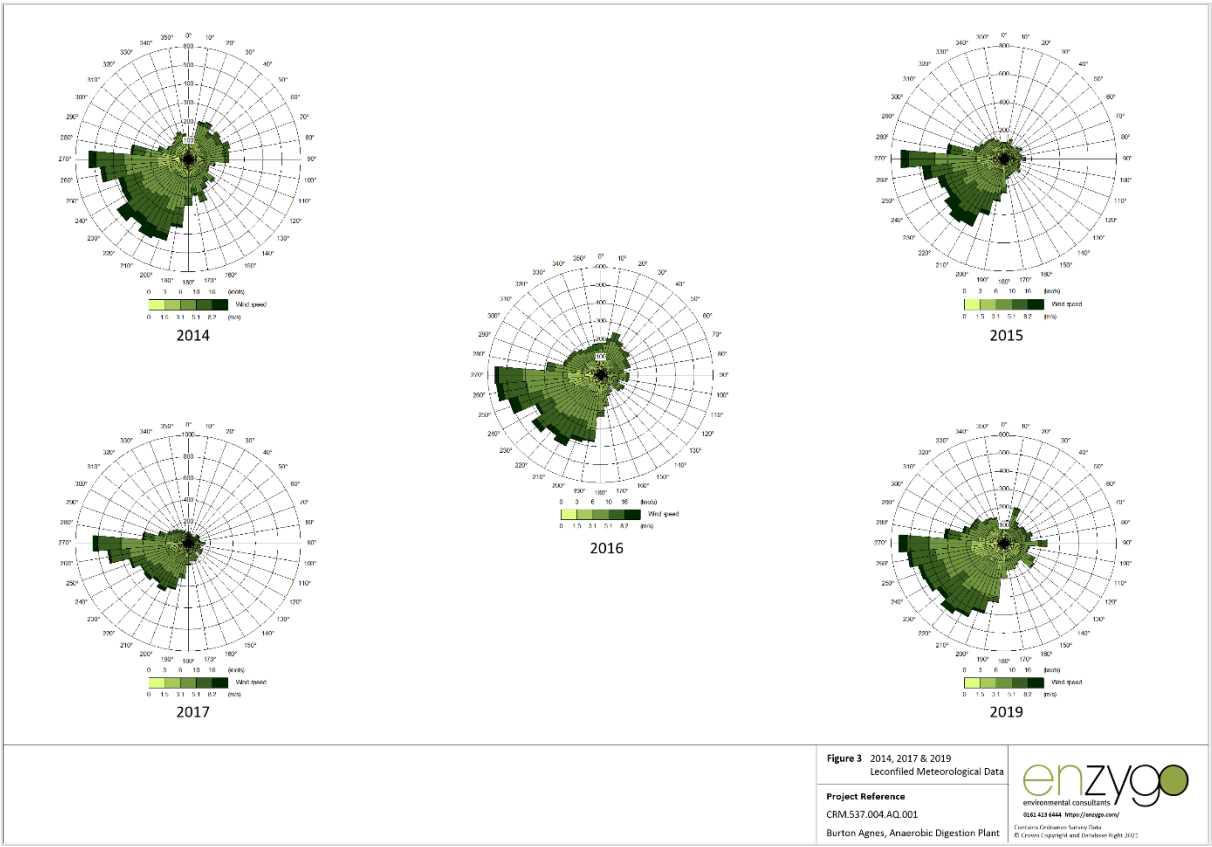
3.7 Meteorological Data

3.7.1 Hourly sequential data used in this assessment was obtain from Leconfield meteorological station, located 22 km southwest of the Facility at the approximate NGR: 503329, 442674.

3.7.2 Although there is some distance between the application site and meteorological station, both sites are located within similar rural contexts and share comparable topographies. The use of this parameter therefore provides a suitable representative of metrological conditions across the modelled domain.

3.7.3 Maximum emissions across the five years of meteorological data (2014 – 2017, 2019) were utilised to ensure a worse case assessment. In reality it is unlikely that a combination of worse case meteorological conditions, which give rise to maximum pollutant concentrations, would occur during any one meteorological year. The application of this method ensures a worse case approach which is likely to overestimate actual conditions. Figure 3 shows the meteorological wind roses.

Figure 3– Meteorological Wind Roses



3.7.4 All meteorological data was provided by ADM Ltd.

3.8 Roughness Length

3.8.1 The specific roughness length (z_0) values specified with the ADMS-5 model are summarised in Table 12.

Table 12 Utilised Roughness Length

Location	Roughness length (m)	ADMS Description
Application Site and Meteorological Station	0.2	Agricultural (min)

3.8.2 Both the Facility and meteorological station are located within rural locations and surrounded by agricultural fields. Given their surrounding areas are void of significant building structures, which could increase turbulence, a value of 0.2 m is considered appropriate for the morphology of the assessment area.

3.9 Monin-Obukhov Length

3.9.1 The Monin-Obukhov length values are summarised in Table 13.

Table 13 Utilised Monin-Obukhov Lengths

Location	Monin-Obukhov length (m)	ADMS Description
Application Site and Meteorological Station	10	Small Towns <50,000

3.9.2 The application of Monin-Obukhov values considers the effect of heat production in populated areas which will influence atmospheric stability. The rural context of both the Facility and meteorological site suggest a stable conditions and a value of 10 m is deemed appropriate.

3.10 Surface Albedo and Priestley-Taylor Parameter

3.10.1 The surface albedo and Priestley-Taylor parameters used in the assessment were the model default values of 0.23 and 1 respectively.

3.11 NO_x to NO_2 Conversion

3.11.1 Ground level NOx concentrations were predicted through dispersion modelling. NO_2 concentrations reported in the results section assume conversion from NO_x to NO_2, based upon EA guidance[3] detailed below:

- 35% for short-term average concentrations; and
- 70% for long-term average concentrations.

3.12 15-minute Sulphur Dioxide Concentration Predictions

3.12.1 Throughout the assessment, 15-minute mean SO_2 concentrations have been calculated using the following correction factor based upon empirical relationships with the 99.9th percentile of 1-hour means, as described in EA guidance :

- *99.9th* percentile *of 15-minute means = 1.34 x 99.9th percentile of 1-hour means*

4.0 Baseline and Sensitive Receptors

4.1 Human Receptors

4.1.1 A sensitive receptor is defined as any location which may be affected by changes in air quality. A desk-top study was undertaken in order to identify any sensitive receptor locations that required consideration during the assessment. Identified receptors were modelled at the minimum height of relevant exposure. The modelled receptors are summarised in Table 14.

Table 14 Sensitive Human Receptors

Receptor		Use	NGR (m)		Distance from Centre of Site (m)	Height (m)
			X	Y		
R1	Tuft Hill Farm, Woldgate	Commercial	508423.1	465341.4	1,573	1.5
R2	Sunset Cottage, Thornholme	Residential	511290.0	463726.8	2,010	1.5
R3	Home Farm, Burton Agnes	Residential	510434.8	463162.0	1,430	1.5
R4	Rectory, Rudston Road	Residential	510063.3	463213.3	1,121	1.5
R5	Phos-n-las, Main Street	Residential	509907.3	462860.0	1,323	1.5
R6	Harpham Grange, Main Road	Residential	509411.9	462738.9	1,303	1.5
R7	Harpham Lane Farm	Commercial	507244.0	464106.0	2,061	1.5
R8	East End Cottages, East End	Residential	507455.7	464580.2	1,926	1.5

4.1.2 Figure 4 shows a graphical representation of the receptor locations.

Figure 4– Modelled Sensitive Human Receptor Locations

4.1.3 Many of the receptors are working farms however receptors represent a group of properties and range of uses. In all cases, receptors have been classified as the highest sensitivity in that group, such as a residential farmhouse within the curtilage of the farm.

Human Receptor Baseline

4.1.4 A desktop study was undertaken to define the baseline air quality within the vicinity of the Facility. The baseline year will correspond with either the current year or the most recent year that monitoring data is available. Background concentrations are summarised in Table 15.

Table 15 Predicted Long Term Background Pollutant Concentrations

Receptor	Predicted Background Concentration (µg/m³)					
	NO_x	NO_2	SO_2	CO	VOC	H_2S
R1	6.01	4.79	3.17	197.00	0.12	1.49
R2	6.84	5.43	3.14	198.00	0.12	1.49
R3	6.80	5.40	3.19	198.00	0.12	1.49
R4	6.80	5.40	3.19	198.00	0.12	1.49
R5	6.67	5.30	3.14	203.00	0.12	1.49
R6	6.67	5.30	3.14	203.00	0.12	1.49
R7	6.19	4.93	3.22	197.00	0.12	1.49
R8	6.19	4.93	3.22	197.00	0.12	1.49

4.1.5 Background concentrations of NO_x and NO_2, were obtained from DEFRA website[12] for 2022, with CO, SO_2 and benzene predictions obtained from the 2001 base maps.

4.1.6 Background data for H_2S was obtained via a literature review which indicated background concentrations typically range between 0.11 ppb and 0.33 ppb, although concentrations in urban areas can be as high as 1 ppb[13]. A background concentration of 1.49 µg/m³ (1 ppb) was therefore utilised in the absence of data from DEFRA prediction or monitored sources.

4.1.7 These are the most reliable and recent predictions available and are therefore considered to provide a reasonable representation of background concentrations in the vicinity of the site.

Short term Background Concentrations

4.1.8 With reference to short-term background concentrations, it was assumed that the short-term concentration of a substance is twice its long-term concentrations provided in Table 15 as suggested within EA risk assessment for your environmental permit guidance[3].

4.2 Ecological Sensitive Receptors

4.2.1 With regard to receptors of ecological sensitivity, the EA guidance 'Air emissions risk assessment for your environmental permit'[3] states:

"Note that conservation sites need only be considered where they fall within set distances of the activity:

[12] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

[13] Environmental Toxicology of Hydrogen Sulphide, Nitric Oxide, Samantha L. Malone et al, 2017

- *Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or RAMSAR sites within 10km of the installation; and*
- *Site of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs), Local Nature Reserves (LNRs), Local Wildlife Site (LWS) and Ancient Woodlands (AW) within 2km of the location."*

4.2.2 A study was undertaken to identify any statutory designated sites of ecological or nature conservation importance within the distances stated above. This was completed using the Multi-Agency Geographic Information for the Countryside (MAGIC)[14] web-based interactive mapping service[14], which draws information on key environmental schemes and designations.

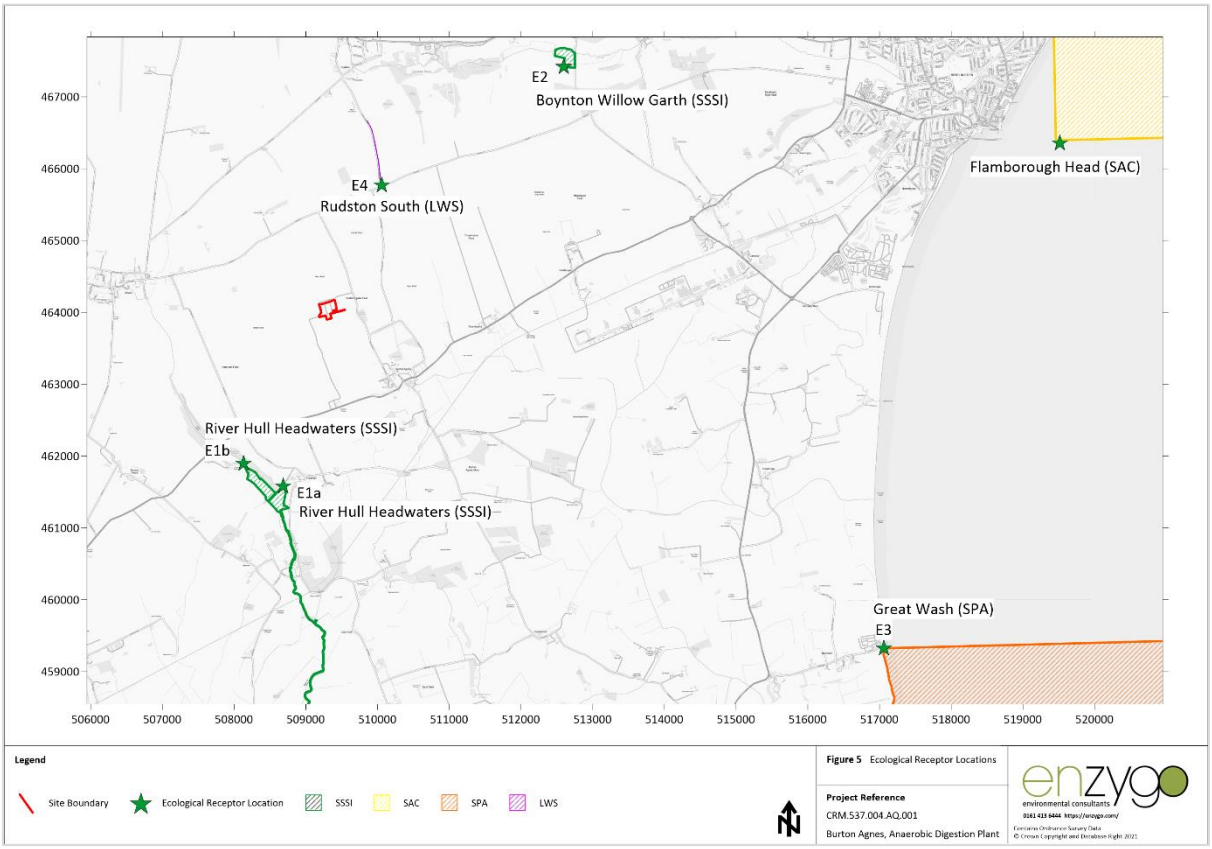
4.2.3 The choice of receptor locations also accords with the Nature and Heritage Conservation Screening document (ref: EPR/VP3034RX/V002) issued by the EA on the 25th of March 2022. Whilst the River Hull Headwater and Boynton Willow Garth SSSI are located outside the screening zones they have been included for completeness. Identified designations which fall within the buffer zones are displayed in Table 16 and Figure 5.

Table 16 Ecological Sensitive Receptors

ID	Ecological Receptor	NGR		Closest Distance to Facility (m)
		X	Y	
E1a	River Hull Headwaters (SSSI)	508683.4	461579.9	2,548
E1b	River Hull Headwaters (SSSI)	508133.0	461895.0	2,454
E2	Boynton Willow Garth (SSSI)	512594.0	467417.5	4,707
E3	Great Wash (SPA)	517061.0	459326.0	9,082
E4	Rudston South (LWS)	510059.9	465768.1	1,876

[14] Multi-Agency Geographic Information for the Countryside, www.magic.gov.uk

Figure 5– Modelled Sensitive Ecological Receptor Locations



Ecological Receptor Baseline

4.2.4 CLo are designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of the APIS website was undertaken to identify suitable habitat descriptions and associated CLo. For the receptors with multiple habitats, the most sensitive habitat has been taken for both nitrogen and acid deposition. The CLo for nitrogen deposition are presented in Table 17.

Table 17 Nitrogen Critical Load

ID	Designation	APIS Habitat	Nitrogen Critical Load (kgN/ha/yr)	
			Min	Max
E1a	River Hull Headwaters	Broadleaved deciduous woodland	10	20
E1b	River Hull Headwaters	Rich fens	15	30
E2	Boynton Willow Garth	Broadleaved deciduous woodland	10	20
E3	Great Wash	Coastal stable dune grasslands	8	10
E4	Rudston South	No Priority Habitat		

4.2.5 As confirmed by the North & East Yorkshire Ecological Data Centre, Rudston South LWS has no stated priority habitat and therefore an assessment of impacts was not possible. Additionally, North & East Yorkshire Ecological Data Centre confirmed the site is a road verge site and therefore does not present a high sensitivity with regard to nutrient nitrogen or acidity. This LWS has not been considered further during the assessment.

4.2.6 Table 18 shows the relevant critical loads for acid deposition.

Table 18 Acid Critical Load

ID	Designation	APIS Habitat	Critical Load (ke/ha/yr)		
			CLmaxS	CLmax N	CLminN
E1a	River Hull Headwaters	Unmanaged Broadleafed Woodland	0.809	0.142	1.166
E1b	River Hull Headwaters	Acid Grassland	0.17	0.223	0.608
E2	Boynton Willow Garth	Unmanaged Broadleafed Woodland	10.782	0.142	10.924
E3	Great Wash	Acid Grassland	0.47	0.223	0.693

4.2.7 Background deposition rates and concentrations for these locations were downloaded from the APIS website and are summarised in Table 19 and represent the maximum predicted concentrations at each designation.

Table 19 Background Deposition Rates

ID	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)		Background Concentration ug/m_3		
		N	S	NO_x	SO_2	NH_3
E1a	41.50	3.00	0.20	7.00	0.90	3.10
E1b	24.40	1.70	0.20	7.00	0.90	3.10
E2	47.50	3.40	0.20	6.70	0.70	3.60
E3	21.40	1.50	0.20	7.20	0.90	2.70

Deposition Rates

4.2.8 Deposition rates were calculated using the conversion factors provided within EA document 'Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06[15]. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the speciated dry deposition flux. The conversion factors used are presented within Table 20.

Table 20 Conversion Factors to Determine Dry Deposition Flux

Pollutant	Grassland Deposition Velocity (m/s)	Forest Deposition Velocity (m/s)	Conversion Factor (µg/m^2/s to kg/ha/yr)	Conversion Factor (µg/m^2/s to keq/ha/yr)
NO_2	0.0015	0.003	96	6.84
SO_2	0.012	0.024	157.7	9.84
NH_3	0.020	0.030	260	18.50

4.2.9 Predicted ground level pollutant concentrations were converted to kilo-equivalent ion depositions (keq/ha/yr) for comparison with the critical load for acid deposition at each of the identified ecological receptors. The standard conversion factors are shown in Table 21.

Table 21 Conversion Factors to Units of Equivalents

Species	Conversion Factors from kg/ha/yr to keq/ha/yr
N	0.07143
S	0.06250

[15] AQTAG 06: Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air, EA, 2014

Species	Conversion Factors from kg/ha/yr to keq/ha/yr
NH_3	0.07143

4.2.10 The total N proportion was calculated from NO_x and NH_3 PCs. The proportion of the EQS consisting of the PC and PEC were then calculated using the tool available on the APIS website.

4.3 Assessment Criteria and Significance of Impacts

4.3.1 Predicted ground level pollutant concentrations and deposition rates were compared with the relevant AQOs identified within Table 1. These criteria are collectively referred to as Environmental Quality Standards (EQSs).

EA Guidance Criteria

4.3.2 Guidance for assessing the significance of emissions impacts from point sources are also given in the EA's guidance[3]. Predicted pollutant concentrations are summarised in the following formats:

- Process contribution (PC) - Predicted pollutant concentration as a result of emissions from the site only; and
- Predicted environmental concentration (PEC) - Total predicted pollutant concentration as a result of emissions from the site and existing baseline levels.

Initial Screening Stage

4.3.3 The significance of predicted impact was assessed in accordance with EA criteria and through consideration of likely effects as a result of the proposals. The EA guidance states that process contributions can be considered insignificant 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.

4.3.4 If both criteria are met predicted impacts can be considered insignificant and no further analysis is required. It is critical to note that exceedances of the 1% or 10% insignificance criteria does not by itself correspond to significant risk or adverse harm.

Second Screening Stage

4.3.5 If the above criteria are not met, then a second stage of screening is required to determine the impact of the PEC

- The short-term PC is less than 20% of 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.

4.3.6 If both criteria are met during the second stage of screening, then predicted impacts can be considered insignificant. Should these criteria be exceeded then the PEC should be checked against the EQS.

Ecological Screening

4.3.7 If emissions that affect SPAs, SACs, RAMSAR sites or SSSIs meet both of the following criteria, they can be considered insignificant:

- the short-term PC is less than 10% of the short-term environmental standard for protected conservation areas; and
- the long-term PC is less than 1% of the long-term environmental standard for protected conservation areas.

4.3.8 If the predicted long-term PC is greater than 1% and the PEC is less than 70% of the long-term environmental standard, the emissions can be considered insignificant. Should the predicted PEC be greater than 70% of the long-term environmental standard, the PEC should be checked against the EQS for the ecological receptor.

4.3.9 When considering impacts at local nature sites and the emissions meet both of the following criteria, impacts can be considered insignificant if:

- The short-term PC is less than 100% of the short-term environmental standard; and
- The long-term PC is less than 100% of the long-term environmental standard.

4.3.10 In addition, the EA guidance also states that the APIS critical load function tool should be used to determine whether there is an exceedance of deposition of nutrient nitrogen or acidity, as the standard of exceedance is site-specific.

4.3.11 It is again critical to note that exceedances of the above insignificance criteria do not directly correspond to significant risk or adverse harm.

4.4 Modelling Uncertainties

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

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emission concentration estimates, operational procedures, land use characteristics and meteorology; and
- Variability - randomness of measurements used.

4.4.2 Whilst uncertainty in the model inputs and parameters cannot be fully reduced, the analysis of maximum emissions across the five years of meteorological data (2014 - 2017 and 2019) provides sensitivity analysis which sufficiently accounts for variations in modelled predictions. Additionally, worse case assumptions regarding the application of emission rates within the model also minimise podetial uncertainties. As such, a sufficient degree of confidence can be placed in the results.

4.4.3 The application of monitored emission concentrations as well as the concurrent and continuous operation of all pollutant sources minimises potential uncertainties. As such, a sufficient degree of confidence can be placed in the results .

4.4.4 It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

4.5 Assumptions

4.5.1 The following assumptions were made during the completion of the dispersion modelling assessment:

- Concurrent and continuous operation throughout the year for emission sources A5, A8 and NH_3 sources;
- All combustion sources assumed at 100% loading;
- Worse case monitored emission concentrations applied to A5, this includes a combination of maximum concentrations and worse case referenced/actual conditions from the 2020 and 2021 MCERT reports.
- Emission concentrations associated with A6 are based on maximum ELV provided by the EAs statutory guidance - *SR2021 No 6: Anaerobic digestion facility, including use of the resultant biogas – installations, 17th May 2022*[8]. The application of such ELV is likely to provide an overestimation of actual conditions.
- Emission rates for A8 based on mass balance and heating report for the Facility undertaken during 2015;
- In accordance with the EA guidance it was assumed that the entire VOC emissions consisted of only C_6H_6 benzene given that all the substances are unknown. However, It is anticipated that benzene emissions would represent a much smaller proportion of the total VOC content.
- it is considered that a proportion of the Proposed Development's contributions will already be accounted for in background levels and loads as the Facility is currently operational;
- It is understood that the flare and PRV will only operate during emergency scenarios, either a result of system failure or abnormal gas production. Given the reduced operating schedule, impacts are considered insignificant and have not been assessed.
- Following a review of the ERC Planning Portal and EAs Public Register no significant proposed livestock or agricultural activities are located with 3 km of the Facility. Therefore, potential in combination effects have been screened out of the assessment. Furthermore, it is considered the background concentrations and levels used in the assessment account for PC from local activities up to 2019.

4.6 Dispersion Modelling Report Requirements

4.6.1 Table 22 provides the checklist of dispersion modelling report requirements.

Table 22 Dispersion Modelling Report Requirements

Item	Location within Report
Location map	Figure 1
List of pollutants modelled and relevant guidelines	Table 1, Table 2 and Table 3
Details of modelled scenarios	Section 3.3
Details of relevant ambient concentrations used	Table 15 and Table 19
Model description and justification	Section 3.1.6
Special model treatments used	Section 3.3 to 3.12
Table of emission parameters used	Table 8
Details of modelled domain and receptors	Section 4.0 and Figure 4 and 5

Item	Location within Report
Details of meteorological data used	Section 3.7
Details of terrain treatment	Section 3.5
Details of building treatment	Section 3.6 and Table 11

5.0 Results

Dispersion modelling was undertaken with the inputs described in Section 3.0.

Predicted pollutant concentrations were predicted separately for 5 assessment years and the maximum concentration reported in the following sections for each relevant substance and metric. Concentrations were assessed in the following sections against and EA guidance[4] criteria. Pollutant contours are displayed in Figure 6 to 15 of Appendix A.

Impacts upon human receptor locations relate to the operation of onsite combustion process associated with emission sources A5 and A6, as well as gas upgrading processes associated with emission source A8. With regards to ecological receptor impacts relate to NO_x, and SO_2 emissions associated with combustion sources A5 and A6, and the NH_3 emissions with the storage of feedstocks and digestate.

5.1 Human Receptors

NO_2

Annual Mean

Table 23 Predicted Annual Mean NO_2 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
AQ1	0.04	4.8	0	12
AQ2	0.09	5.5	0	14
AQ3	0.06	5.5	0	14
AQ4	0.07	5.5	0	14
AQ5	0.05	5.3	0	13
AQ6	0.07	5.4	0	13
AQ7	0.04	5.0	0	12
AQ8	0.04	5.0	0	12

Predicted concentrations assessed against the relevant annual mean EQS of 40 µg/m³.

1-hour Mean NO_2

Table 24 Predicted 1-Hour Mean NO_2 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
AQ1	1.33	10.91	1	1
AQ2	1.22	12.08	1	1
AQ3	1.46	12.26	1	1
AQ4	1.72	12.52	1	1
AQ5	1.39	11.99	1	1
AQ6	1.59	12.19	1	1
AQ7	1.23	11.10	1	1
AQ8	1.29	11.16	1	1

Predicted concentrations were assessed against the relevant 99.79%ile 1-hour mean EQS of 200 µg/m³
a: PC proportion of the EQS minus twice the long-term background.

5.1.1 As presented in Table 23 and Table 24, PC proportions of the annual and 1-hour EQS are less than 1% and 10%, respectively, at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria and no further analysis is required for this pollutant. Based on these predictions no unacceptable adverse impacts are associated with NO_2 emissions.

SO_2

24-Hour Mean (99.18%ile)

Table 25 Predicted 24-Hour SO_2 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
AQ1	0.68	13.36	0	1
AQ2	1.05	13.61	1	1
AQ3	1.06	13.82	1	1
AQ4	1.49	14.25	1	1
AQ5	1.10	13.66	1	1
AQ6	1.25	13.81	1	1
AQ7	0.77	13.65	1	1
AQ8	0.81	13.69	1	1

Predicted concentrations assessed against the 24-hour mean EQS of 125 µg/m³.
a: PC proportion of the EQS minus twice the long-term background

1-Hour Mean (99.73%ile)

Table 26 Predicted 1-Hour SO_2 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
AQ1	3.63	16.31	1	1
AQ2	3.97	16.53	1	1
AQ3	5.17	17.93	1	2
AQ4	5.55	18.31	2	2
AQ5	4.11	16.67	1	1
AQ6	5.45	18.01	2	2
AQ7	3.68	16.56	1	1
AQ8	3.92	16.80	1	1

Predicted concentrations assessed the 1-hour mean EQS of 350 µg/m³.
a: PC proportion of the EQS minus twice the long-term background

15-Minute Mean (99.90%ile)

Table 27 Predicted 15-minute SO_2 Concentrations

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
AQ1	5.47	18.15	2	2
AQ2	5.90	18.46	2	2
AQ3	7.75	20.51	3	3

ID	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PC[a]
AQ4	9.65	22.41	4	4
AQ5	6.72	19.28	3	3
AQ6	7.86	20.42	3	3
AQ7	5.26	18.14	2	2
AQ8	5.79	18.67	2	2

Predicted concentrations assessed against the 15-minute mean EQS of 266 µg/m³.
a: PC proportion of the EQS minus twice the long-term background

5.1.2 As presented in Table 25, Table 26 and Table 27, PC proportions of the 24-hour, 1-hour and 15 minute mean EQS are less than 10% at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria and no further analysis is required for this pollutant. Considering the above no unacceptable adverse impacts are associated with SO_2 emissions.

CO

8-hour Rolling Mean

5.1.3 Predicted 8-hour rolling mean CO concentrations are summarised in Table 28.

Table 28 Predicted 8-Hour Rolling Mean CO Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
AQ1	6.55	400.55	0	0
AQ2	6.75	402.75	0	0
AQ3	5.45	401.45	0	0
AQ4	7.07	403.07	0	0
AQ5	4.91	410.91	0	0
AQ6	5.86	411.86	0	0
AQ7	6.23	400.23	0	0
AQ8	4.96	398.96	0	0

Concentrations assessed against 8-hour rolling mean EQS of 10,000µg/m³.
a: PEC proportion of the EQS minus twice the long-term background

5.1.4 As presented in Table 28, the PC proportion of the 8-hour rolling mean EQS is less than 10% at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria and no further analysis is required for these averaging periods. Based on these predictions no unacceptable adverse impacts are associated with CO emissions.

Benzene

Annual Mean

Table 29 Predicted Annual Mean Benzene Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
AQ1	0.22	0.32	**4**	6

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
AQ2	0.50	0.60	**10**	12
AQ3	0.33	0.43	**7**	9
AQ4	0.42	0.52	**8**	10
AQ5	0.28	0.38	**6**	8
AQ6	0.38	0.49	**8**	10
AQ7	0.22	0.32	**4**	6
AQ8	0.22	0.32	**4**	6

Predicted concentrations were assessed against annual mean EQS of 5 µg/m³.

24-hour Mean

Table 30 Predicted 24-Hour Mean Benzene Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
AQ1	4.66	4.86	**16**	16
AQ2	4.34	4.54	**14**	15
AQ3	4.81	5.01	**16**	16
AQ4	5.55	5.75	**18**	19
AQ5	4.28	4.48	**14**	14
AQ6	6.44	6.65	**21**	**22**
AQ7	8.57	8.77	**29**	**29**
AQ8	10.38	10.58	**35**	**35**

Predicted concentrations were assessed against 24-hour mean EQS of 30 µg/m³.

a: PEC proportion of the EQS minus twice the long-term background

5.1.5 As presented in Table 29, PC proportions of the annual and 24-hour EQS are greater than 1% and 10%, respectively, at all receptor locations. Impacts cannot be screened out as insignificant based on the initial EA screening criteria and further analysis is required.

5.1.6 Proceeding with the second stage of EA screening, PEC proportions of the annual mean EQS are predicted to be well below 70% of the EQS at all receptor locations and annual mean impacts can be considered insignificant.

5.1.7 PC proportions of the 24-hour mean EQS, as shown in Table 30, are greater than 20% of the EQS minus twice the long-term background concentration at AQ6 to AQ8 and impacts cannot be screened out as insignificant. Further analysis is required for this averaging period.

5.1.8 While impacts upon 24-hour mean concentrations cannot be screened as insignificant using the EA guidance, professional judgment has been applied to determine the significance of impacts. As detailed in Section 4.5 the composition of VOCs is unknown and was assumed to consist entirely of benzene in line with the EA's permitting guidance[3]. Actual emissions of VOCs are likely to consist of a varied composition of compounds, with a significantly smaller proportion of benzene. Therefore, impacts presented in Table 29 and Table 30 are considered significant overestimations which would not reflect actual VOC content.

5.1.9 Critically the PEC is well below the EQS (as EAL) at all sensitive location and impacts are not considered unacceptable or significant. As such, no adverse risk to human health is expected from benzene concentrations.

5.1.10 Considering the above no unacceptable adverse impacts are associated with VOC emissions.

H_2S

Annual Mean

Table 31 Predicted Annual Mean H_2S Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
AQ1	6.04 E^{-05}	1.49	0	1
AQ2	1.67E^{-04}	1.49	0	1
AQ3	1.12E^{-04}	1.49	0	1
AQ4	1.24E^{-04}	1.49	0	1
AQ5	8.21E^{-05}	1.49	0	1
AQ6	1.76E^{-04}	1.49	0	1
AQ7	6.53E^{-05}	1.49	0	1
AQ8	7.15E^{-05}	1.49	0	1

Predicted concentrations were assessed against the annual mean EQS of 140 µg/m³

1-hour Mean

Table 32 Predicted 1-Hour Mean H_2S Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC[a]
AQ1	4.37E^{-03}	2.99	0	0
AQ2	5.36E^{-03}	2.99	0	0
AQ3	1.05E^{-02}	3.00	0	0
AQ4	8.91E^{-03}	2.99	0	0
AQ5	5.69E^{-03}	2.99	0	0
AQ6	1.05E^{-02}	3.00	0	0
AQ7	5.06E^{-03}	2.99	0	0
AQ8	5.19E^{-03}	2.99	0	0

Predicted concentrations were assessed against the 1-hour mean EQS of 150 µg/m³
a: PEC proportion of the EQS minus twice the long-term background.

5.1.11 As presented in Table 31 and Table 32, PC proportions of the annual and 1-hour EQS are less than 1% and 10%, respectively, at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria and no further analysis is required for these averaging periods.

5.1.12 Based on these predictions no unacceptable adverse impacts are associated with H_2S emissions.

5.2 Ecological Receptors

Oxides of Nitrogen

Annual Mean

Table 33 Predicted Annual Mean NO_x Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
E1a	0.04	7.04	0.1	23.5
E1b	0.04	7.04	0.1	23.5
E2	0.03	6.73	0.1	22.4
E3	0.01	7.21	0.0	24.0

Predicted concentrations assessed against the relevant CL: 30 µg/m³.

24-hour Mean

Table 34 Predicted 24-Hour Mean NO_x Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
E1a	0.66	14.66	0.9	19.5
E1b	0.70	14.70	0.9	19.6
E2	0.27	13.67	0.4	18.2
E3	0.13	14.53	0.2	19.4

Predicted concentrations assessed against the relevant CL: 75 µg/m³.

5.2.1 As presented in Table 33 and Table 34, PC proportions of the annual and 24-hour EQS are less than 1% and 10%, respectively, at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria and no further analysis is required for these averaging periods.

5.2.2 Based on these predictions no unacceptable adverse ecological impacts are associated with NO_x emissions.

SO_2

Annual Mean

Table 35 Predicted Annual Mean SO_2 Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
E1a	0.02	0.92	0.2	9.2
E1b	0.02	0.92	0.2	9.2
E2	0.02	0.72	0.2	7.2
E3	0.00	0.90	0.0	9.0

Predicted concentrations assessed against the CL of 20 µg/m³

5.2.3 As presented in Table 35, PC proportions of the annual mean EQS are below 1% at all receptor locations and can be screened as insignificant based on the initial EA screening criteria.

5.2.4 Based on these predictions no adverse ecological impacts are associated with SO_2 emissions.

NH_3

Annual Mean

Table 36 Predicted Annual Mean NH_3 Concentrations

Receptor	Predicted Concentration (µg/m³)		Proportion of EQS (%)	
	PC	PEC	PC	PEC
E1a	0.02	3.12	0.2	**310.2**
E1b	0.02	3.12	0.1	**103.4**
E2	0.01	3.61	0.1	**360.1**
E3	0.00	2.70	0.0	**90.0**

Predicted concentrations assessed against the CL of 1 µg/m³, to reflect the presence of Lichen or Bryophytes

5.2.5 As presented in Table 35, PC proportions of the annual mean EQS are below 1% at all receptor locations. Impacts can be screened out as insignificant based on the initial EA screening criteria and no further analysis is required for these averaging periods.

5.2.6 Based on these predictions no unacceptable adverse ecological impacts are associated with NH_3 emissions.

Nitrogen Deposition

5.2.7 Predicted annual mean nitrogen deposition rates are summarised in Table 37.

Table 37 Predicted Annual Mean Nitrogen Deposition Rates

Receptor	Predicted Deposition Rate (kgN/ha/yr)		Proportion of EQS (%)			
			Low EQS		High EQS	
	PC	PEC	PC	PEC	PC	PEC
E1a	0.17	41.67	0.2	**415.2**	0.1	**207.6**
E1b	0.12	24.52	0.1	**162.8**	0.0	**81.4**
E2	0.10	47.60	0.2	**475.2**	0.1	**237.6**
E3	0.02	21.42	0.0	**267.5**	0.0	**214.0**

5.2.8 As presented in Table 37, the PC proportions of the Low EQS are below 1% at all receptor locations. Analysis of the PECs indicate that all CLo are exceeded; however, this as a result of existing elevated background concentrations. Notwithstanding this, impacts can be screened out as insignificant and no further analysis is required.

5.2.9 Based on these predictions it is judged that no unacceptable adverse ecological impacts are associated with annual mean N deposition.

Acid Deposition

Table 38 Predicted Annual Mean Acid Deposition Rates

ID	Predicted Deposition Rate (keq/ha/yr)			% of Critical Load Function		Exceedance of CL Function (keq/ha/yr)
	S	N	Total	PC	PEC	
E1a	0.006	0.012	0.018	0.7	270.8	Exceedance of Background and PEC (1.98, 1.99). No exceedance of PC
E1b	0.003	0.008	0.011	0.7	309.9	Exceedance of Background and PEC (1.27,1.28). No exceedance of PC

ID	Predicted Deposition Rate (keq/ha/yr)			% of Critical Load Function		Exceedance of CL Function (keq/ha/yr)
	S	N	Total	PC	PEC	
E2	0.005	0.007	0.012	0.0	32.7	No Exceedances
E3	0.001	0.001	0.002	0.1	245.4	Exceedance of Background and PEC (1.01, 1.01). No exceedance of PC

5.2.10 As presented in Table 38, the PC proportion of the EQS are below 1% at all receptor locations and impacts can be screened as insignificant based on the initial EA screening criteria.

5.2.11 Based on these predictions it is judged that no unacceptable adverse ecological impacts are associated with annual mean acid deposition.

6.0 Conclusions

6.1.1 Dispersion modelling was therefore undertaken using ADMS 5 (v5.2) to predict the impacts from the plant emissions from the Facility. Impacts at sensitive human and ecological receptors were quantified and the results compared with the relevant EQS and criteria provided by the EA and APIS.

6.1.2 Impacts were based on the plant emitting the worse case emission concentrations, as well the use of the maximum concentrations over 5 assessment years.

6.1.3 Predicted annual mean PECs at all human receptor locations did not exceed 70% of the EQS. In the case of short-term impacts PCs did not exceed 20% of EQS minus twice the background concentration at any human receptor. Impacts on pollutant concentrations at all human locations are therefore considered not significant.

6.1.4 Concerning ecological impacts, NO_x, SO_2 and NH_3 PC proportions were screened as insignificant. The EQS for nitrogen and acid deposition was exceeded as a baseline condition at all designations however the PC proportions from the Facility could be screened out as insignificant following the initial EA screening criteria. Therefore, it is unlikely that adverse impacts would be present at ecological designations as a result of the facility.

6.1.5 Based on the predictions and the use of conservative assumptions, such as worse case emission limit values and meteorological conditions over a 5-year period, it is considered that the overall air quality impacts of the Facility would be not significant.

6.1.6 In terms of air quality, the proposal is therefore considered acceptable for planning and permitting purposes.

7.0 Abbreviations

%ile	Percentile
AAD	Ambient Air Directive
AD	Anaerobic Digestion
ADM	Atmospheric Dispersion Modelling
ADMS	Atmosphere Dispersion Modelling Software
APIS	Air Pollution Information System
AQA	Air Quality Assessment
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
AQTAG	Air Quality Technical Advisory. Group.
AW	Ancient Woodland
BAT	Best Available Techniques
C_6H_6	Benzene
CERC	Cambridge Environmental Research Consultants
CHP	Combined Heat and Power
CL	Critical Load/Level
CO	Carbon Monoxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EAL	Environmental Assessment Levels
ELV	Emission Limit Value
EP	Environmental Permit
EQS	Environmental Quality Standard
FYM	Farmyard Manure
H_2S	Hydrogen Sulphide
LNR	Local Nature Reserve
LWS	Local Wildlife Site
MAGIC	Multi-Agency Geographic Information for the Countryside
MCERT	Monitoring Certification Scheme
N	Nitrogen
NGR	National Grid Reference
NH_3	Ammonia
NNR	National Nature Reserve
NO_2	Nitrogen Dioxide
O_2	Oxygen
PC	Process Contribution
PEC	Predicted Environmental Concentration
PPM	Part per Million
PRV	Pressure Release Valve
S	Sulphur
SAC	Special Area of Conservation
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Importance
VOC	Volatile Organic Compounds
z_0	Roughness Length
%ile	Percentile

Appendix A Pollutant Contours

Legend

Site Boundary

Modelled Building Layout

Predicted Annual Mean NO_2 Concentration (µg/m³)

7.0 8.5 10.0 11.5 13.0 14.5 16.0 17.5

Figure 6 Predicted Annual Mean NO_2 Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

Burton Agnes Biogas Plant

enzygo environmental consultants
0161 413 6444 https://enzygo.com/

Figure 7 Predicted 1-hour Mean NO_2 Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

Burton Agnes Biogas Plant

enzygo environmental consultants

0161 413 6444 https://enzygo.com/

Figure 8 Predicted 24-hour Mean SO_2 Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

Burton Agnes Biogas Plant

enzygo environmental consultants

0161 413 6444 https://enzygo.com/

Figure 9 Predicted 1-hour Mean SO_2 Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

Burton Agnes Biogas Plant

enzygo environmental consultants

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Figure 10 Predicted 15-minute Mean SO_2 Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

Burton Agnes Biogas Plant

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Legend

Site Boundary

Modelled Building Layout

Predicted 8-hour Mean CO Concentration (µg/m³)

425 600 800 1000 1200 1350

Figure 11 Predicted 8-hour Mean CO Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

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Figure 12 Predicted Annual Mean VOC Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

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environmental consultants
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Figure 13 Predicted 24-hour Mean VOC Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

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Legend

Site Boundary

Modelled Building Layout

Predicted Annual Mean H_2S Concentration (µg/m³)

1.50 1.55 1.60 1.65

Figure 14 Predicted Annual Mean H_2S Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

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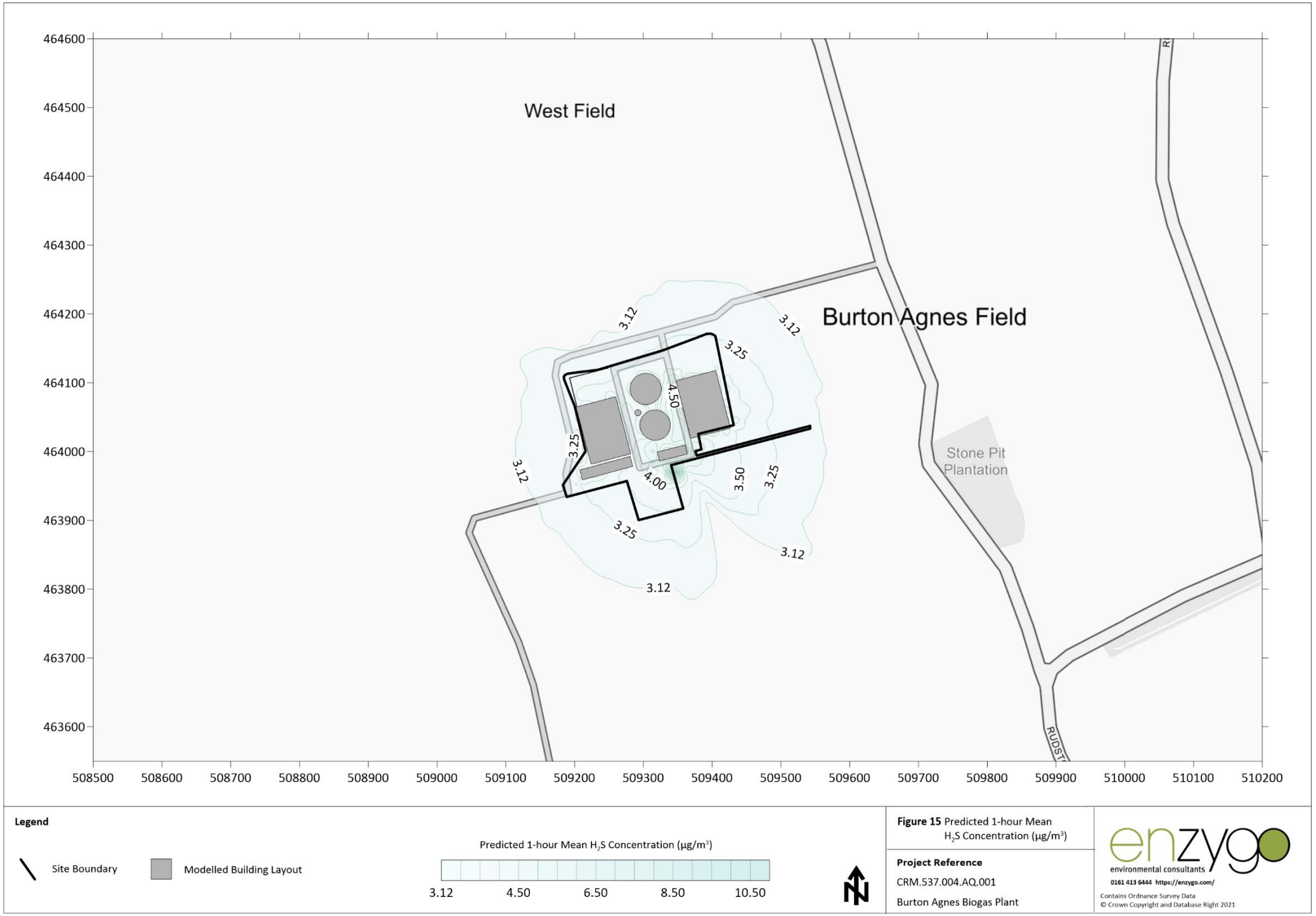

Legend

Site Boundary

Modelled Building Layout

Predicted 1-hour Mean H_2S Concentration (µg/m³)

3.12 4.50 6.50 8.50 10.50

Figure 15 Predicted 1-hour Mean H_2S Concentration (µg/m³)

Project Reference

CRM.537.004.AQ.001

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Enzygo specialise in a wide range of technical services:

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Flooding, Drainage and Hydrology
Landscape Architecture
Arboriculture
Permitting and Regulation
Waste Technologies and Renewables
Waste Contract Procurement
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Odour Assessment

Burton Agnes Biogas Plant

Future Biogas Limited

CRM.537.004.AQ.R.002

'Experience and expertise working in union'

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Environmental Permit Variation – Odour Assessment
CRM.537.004.AQ.R.002

Project:	Burton Agnes Biogas Plant
For:	Future Biogas Limited
Status:	Final
Date:	October 2022
Author:	Josh Davies, Senior Air Quality Consultant
Reviewer:	Conal Kearney, Director of Air Quality

Contents

Tables and Figures

Non-Technical Summary

i. Enzygo Limited was commissioned by Future Biogas Limited to undertake odour dispersion modelling to support a permit application relating to an Anaerobic Digestion facility located at Harpham Grange Farm, Burton Agnes.

ii. Enzygo understands the permit is required as the facility will no longer be able to meet the requirements of the appropriate newly revised standard rules permit regulations. In order to keep operating a variation to a Bespoke Installations Environmental Permit is being submitted

iii. This report should be read in conjunction with the facility's current Environmental Permit, EPR/VP3034RX.

iv. During the operation of the Facility there is the potential for impacts to occur at sensitive locations due to odour emissions from the facility. Odour dispersion modelling was therefore undertaken to consider amenity effects in the vicinity of the site.

v. Potential odour emissions were defined based on information provided by Future Biogas Limited on the facilities operation and a review of literature and emissions used at similar facilities.

vi. Predicted maximum odour concentrations were below the appropriate benchmark level at all sensitive receptors in the vicinity of the site for all modelling years. In addition, using industry standard guidance significance criteria, associated impacts were deemed negligible at all representative sensitive receptors.

vii. Based on the modelling results overall potential for odour impacts generated by the facility can be considered acceptable in accordance with the relevant significance criteria.

1.0 Introduction

1.1 Background

1.1.1 Enzygo Limited was commissioned by Future Biogas Limited (Ltd) to undertake odour dispersion modelling to support a permit application relating to an Anaerobic Digestion (AD) plant at Harpham Grange Farm, Burton Agnes, (the 'Facility').

1.1.2 During the operation of the Facility there is potential for impacts to occur at sensitive locations due to odour emissions from a number of sources at the Facility. Odour dispersion modelling was therefore undertaken to consider effects in the vicinity of the site.

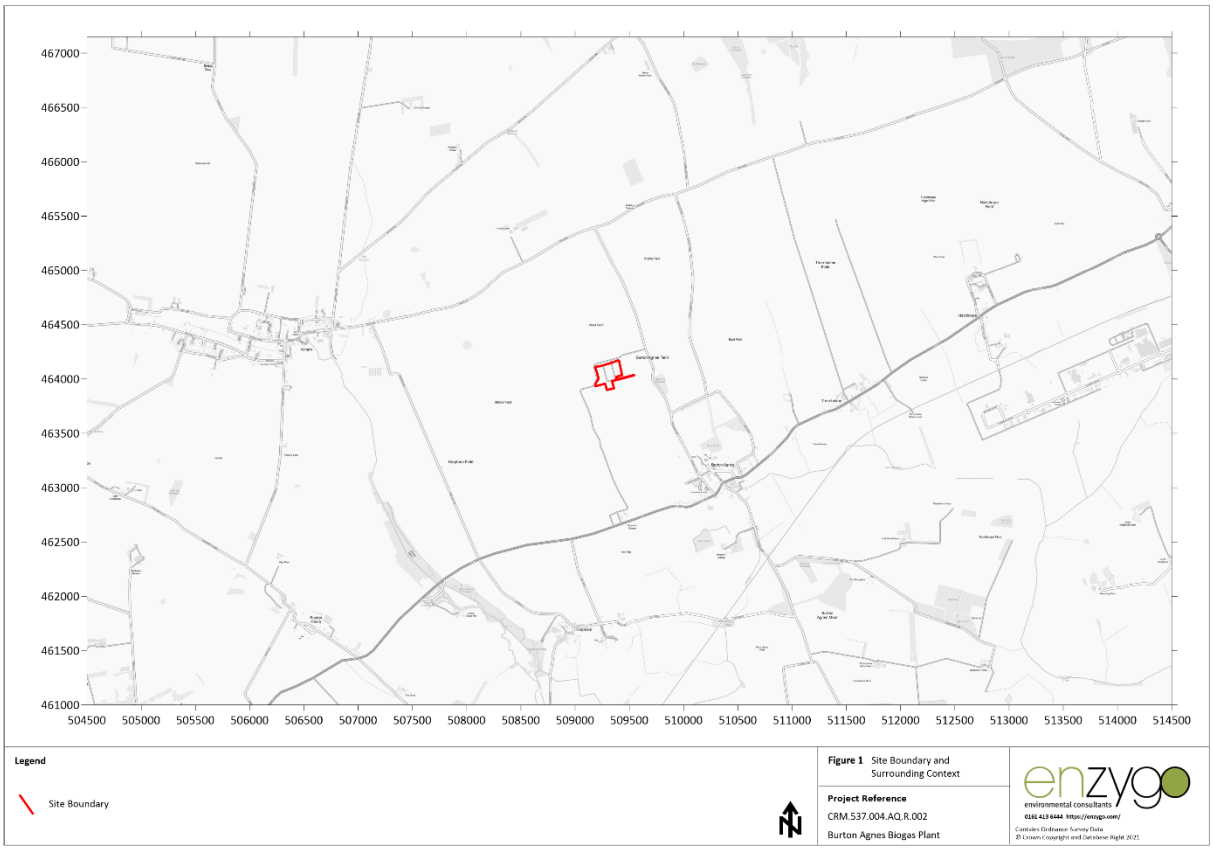
1.2 Site Location and Context

1.2.1 The Facility is located on land at Harpham Grange Farm, Burton Agnes, YO25 4NQ, at the approximate National Grid Reference (NGR): 509310, 464065.

1.2.2 The site is located in an agricultural area surrounded by fields with a mixture of working farms and residential properties in the vicinity of the site. The nearest residential property is "The Rectory" situated on Rudston Road, approximately 1.1 km to the southeast of the facility.

1.2.3 Reference should be made to Figure 1 for a map of the site location and surrounding area.

Figure 1– Site Surrounding



1.3 Facility Operations

1.3.1 The Facility currently operates an AD process fuelled by biomass feedstock in form of energy crops and farmyard manures (FYM). The majority of the biogas produced by the AD process will be upgraded for injection into the gas grid. A proportion of the upgraded biogas will be

combusted within a Combined Heat and Power (CHP) and Auxiliary Boiler to generate electricity.

1.3.2 The annual mass of waste types inputted to the site are known and the approximate weights and volumes are as follows:

- Poultry Manure – 1,800 tonnes per annum (tpa);
- Pig Slurry - 16,000 m^3 per annum;
- Maize and Hybrid Rye – 40,000 tpa; and
- Wheat Straw – 1,500 tpa.

1.3.3 The process can briefly be described as follows:

Feedstock

- The site will operate using biomass feedstock in the form of non-waste energy crops (maize, rye), straw, FYM and slurries (poultry and pig). The crops will be transported to site during typical harvest periods prior to unloading within the four silage clamps. FYM is also stored within a separate clamp.
- The silage clamps are covered using protective sheeting. This will form an airtight layer to minimise emissions, ensuring the silaging process can complete and preserve the feedstock throughout the year. The clamp cover will be open at one end to allow access to the feedstock for transportation into the feed hopper.
- FYM is not currently covered and is imported to site and deposited in the open storage clamp before transfer into the feed system.
- Pig slurry is transferred directly into the Facilities buffer tank via sealed pipes, which is located adjacent to the digester and digestate tank.

Operation

- All feedstock material will be fed into the primary digester, then secondary digester which are completely sealed. The biogas produced (a mixture of methane (CH_4) and carbon dioxide (CO_2) will be stored prior to upgrade for export to the grid or use in the CHP unit and boiler where it will be combusted for the generation of electricity. The heat from the CHP and boiler will be used to provide heat to the digesters when required.
- A flare is also included at the Facility for emergency venting of biogas during abnormal operation, as well as a diesel generator to provide emergency backup.

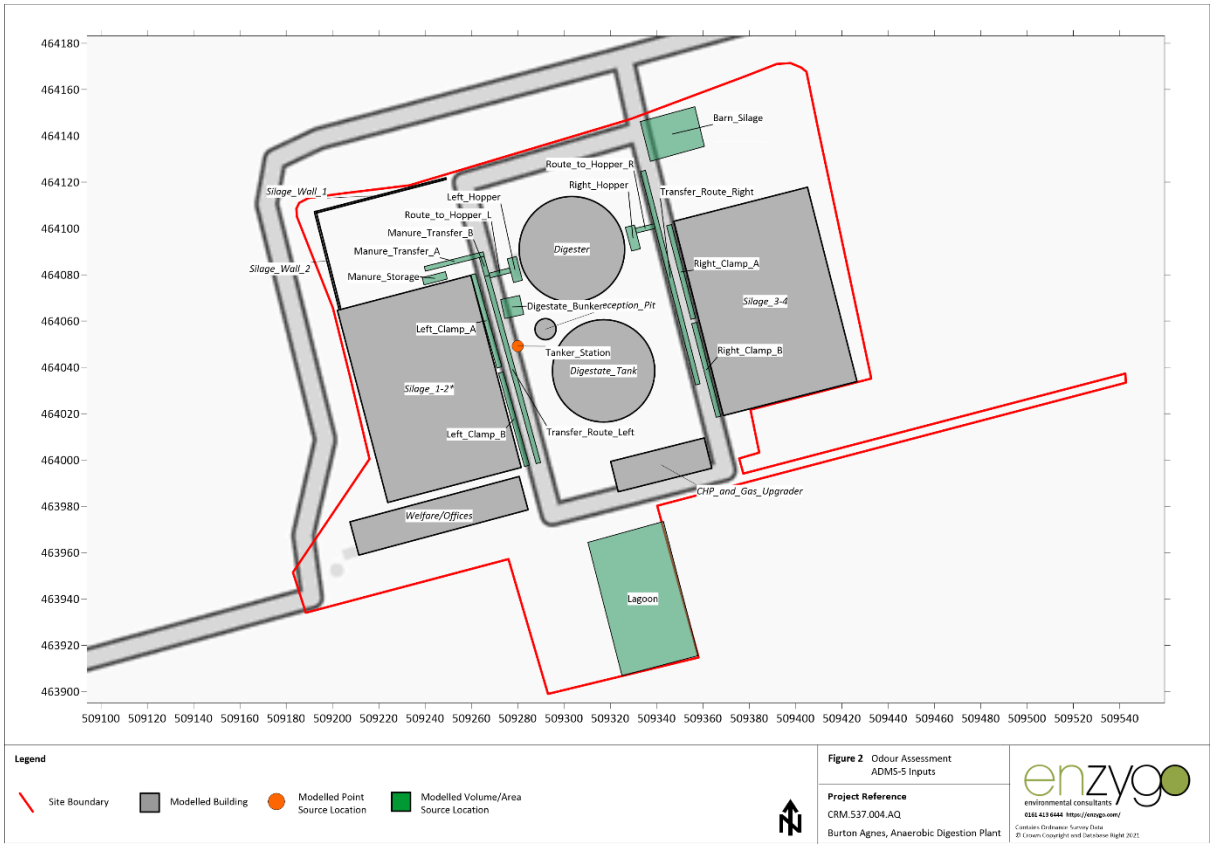
Digestate

- The solid and liquid fractions of the digestate will be separated. The digestate produced by the process is not considered to be waste. The solid digestate be stored temporarily prior to removal off site for use as a fertilizer.
- The liquid fraction of the digestate is stored in the residual tank before being transported off-site via tanker for use as a fertiliser on local agricultural land.

- The biogas which is produced during the digestion process is stored in the double skinned gas holder above the digestate storage tank. The biogas is then either directed to the biogas upgrading unit or the CHP engine which generates electricity and heat to be used at the site. The biogas which is sent to the biogas upgrading unit is treated to remove contaminants and tested for conformity before being injected into the National Grid via the Network Entry Facility.

1.3.4 Reference should be made to Figure 2 for a site layout plan and identification of modelled odour sources.

Figure 2– ADMS-5 Modelling Inputs



2.0 Legislation Guidance and Policy

2.1 Odour Impact

2.1.1 The following legislation and guidance will be considered and adhered to during the preparation of the odour dispersion modelling assessment:

- The Environmental Permitting (England and Wales) (Amendment) Regulations 2016;
- H4: Odour Management, Environment Agency (EA), 2011[1];
- Odour Guidance for Local Authorities (withdrawn), Department for Environment, Food and Rural Affairs (DEFRA), 2010[2]; and
- Guidance on the Assessment of Odour for Planning, IAQM, 2018[3].

2.2 Odour Benchmark Levels

Environment Agency: H4

2.2.1 The H4 guidance provides benchmark levels to assess relevant exposure to determine impacts from potential operations and practices regulated under the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments.

2.2.2 Modelled concentrations above the relevant benchmark levels detailed in Table 1 would therefore indicate unacceptable odour exposure. Benchmark levels are stated as the 98th percentile (%ile) of hourly mean concentrations in ou_E over a year. This means benchmarks should not be exceeded for more than 2% of the hours in a year or approximately 175 hours per year. This takes account of a reasonable amount of tolerance that can be expected by subjects to occasional odours. EA odour benchmark levels are summarised in Table 1.

Table 1 Odour Benchmark Levels

Relative Offensiveness of Odour	Benchmark Level as 98th%ile of 1-Hour Means (ou_E/m^3)
Most Offensive Odours: Processes involving decaying animal or fish Processes involving septic effluent or sludge Biological landfill odours	1.5
Moderately Offensive Odours: ***Intensive livestock rearing*** Fat frying (food processing) Sugar beet processing ***Well aerated green waste composting***	3.0

[1] H4: Odour Management, Environment Agency (EA), 2011

[2] Odour Guidance for Local Authorities, DEFRA, 2010

[3] Guidance on the Assessment of Odour for Planning, IAQM, 2018 – Version 1.1.

Relative Offensiveness of Odour	Benchmark Level as 98th%ile of 1-Hour Means (ou_E/m^3)
Less Offensive Odours: Brewery Confectionery Coffee roasting Bakery	6.0

2.2.3 To use a worst-case approach for the purposes of this assessment it was considered that odours from the Facility would be similar to those for "intensive livestock" and "well aerated green waste composting". Odours generated by the facility are therefore classified as 'moderately offensive', in accordance with the EA assessment criteria shown in Table 1.

2.2.4 Assessment against the EA benchmarks indicates whether an odour should be considered as unacceptable.

2.2.5 To provided context to the above benchmarks the EA guidance "Review of Odour Character & Thresholds[4]" states that the point of odour detection is $1ou_E/m^3$ based on laboratory testing of a panel of qualified assessors, with concentrations of $5ou_E/m^3$ and $10ou_E/m^3$ considered as faint and distinct odours, respectively. The guidance also states that It is important to recognise that published odour detection thresholds apply to population averages, not to individuals.

2.3 Institute of Air Quality Management Guidance

2.3.1 The IAQM guidance[3] specifically deals with assessing odour impacts for planning purposes, namely potential effects on amenity. The significance of impacts was also assessed through the interaction of the predicted 98th%ile of 1-hour mean odour concentrations and receptor sensitivity, as outlined below in Table 6.

Table 2 Odour Receptor Sensitivity

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

[4] Review of Odour Character and Thresholds, Science Report: SC030170/SR2, Environment Agency, March 2007

2.3.2 The receptor sensitivity detailed above is the combined with predicted 1-hour mean odour concentrations to determine the odour impact which enables a judgment of overall significance.

3.0 Dispersion Modelling Inputs

The operation of the facility will result in odour emissions during normal operations. These were assessed in accordance with the following stages:

- Identification of odour sources;
- Identification of odour emission rates;
- Dispersion modelling of odour emissions; and
- Comparison of modelling results with relevant criteria.

The following Sections outline the methodology and inputs used for the assessment.

3.1 Odour Sources

3.1.1 Potential odour sources were identified the following process. These included:

- Exposed maize, rye, and wheat straw within silage clamps;
- FYM stored with the manure clamp;
- Agitated maize, rye, wheat straw and FYM during transfer to the feed hoppers;
- Exposed and agitated material within the feeder hopper;
- Emissions from dirty rainwater lagoon; and
- Emission from road tankers at digestate import/export points.

3.1.2 The AD process is sealed and therefore does not form a source of odour, or other emissions such as CH_4 or Hydrogen Sulphide (H_2S), under normal operation. Should releases of these species occur then this would indicate a fault with the plant and immediate remedial measures would be taken to eliminate the problem to avoid seriously affecting the AD process, with associated financial consequences for the operator.

3.1.3 Delivery of FYM occurs 1-2 times per week, with a maximum of 3 days of throughput stored at the Facility at any one time. FYM is deposited in the manure clamps where it remains covered. Farmyard slurry arrives to the site on a daily basis and transferred immediately to the separation tank which is sealed. Energy crops and wheat straw arrive on site on a daily basis and stored within silage clamps. Feedstocks are transferred from respective clamps by loader and into feeder hoppers for approximately 4-6 hours per day.

3.1.4 Liquid digestate created by the process is stored with the sealed residual tank and will be transported off the site via tanker at the dedicated collection points.

3.1.5 The tanker collection points will be used a maximum of 11 times per week. During tanker filling there is the potential for short term odour emissions from displaced air within the tanker. These emissions have been included within this assessment as they have the potential to affect the immediate locality over a short period although the contribution to annual mean concentrations will be very low.

3.1.6 Separated solid digestate drops into a covered concrete bunker, digestate is then transferred to a barn to the northeast boundary of the Facility, where it remains until it is collected for off-site uses.

3.1.7 The combined heating and power unit, auxiliary boiler, emergency flare and backup diesel generator will only emit products of combustion which do not typically have any significant odours. As such, they have not been considered as potential sources in the context of this assessment. Reference should be made to CRM.537.004.AQ.R.001 for the assessment of associated on-site combustion pollutant emissions.

3.1.8 The FYM manure clamp and digestate stores will be fully covered by a Silostop Max silage film which provides a robust impermeable 80 micron oxygen barrier film and blocks the entry of oxygen into the covered material. FYM manure and digestate stores will be kept covered all times except when loading or unloading. This alone would provide an ammonia reduction of up to 95% . However, to ensure a robust assessment no reduction to odour emissions has been applied.

3.2 Dispersion Modelling

3.2.1 Dispersion modelling was undertaken using ADMS 5 (v5.2), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd which is widely accepted by the EA.

3.2.2 Reference should be made to Figure 2 for a graphical representation of the modelled odour sources.

3.3 Modelling Scenarios and Emissions

3.3.1 The scenarios considered in the modelling assessment are summarised in Table 3.

Table 3 Dispersion Modelling Scenarios

Pollutant	Modelled As	
	Short Term	Long Term
Odour	98th%ile 1-hour mean	n/a

3.3.2 Information for specific odour sources were based on a review of existing literature and odour monitoring data reported at similar facilities and are therefore considered to provide representative inputs for an assessment of this nature.

3.3.3 Odour emission rates are summarised in Table 4. Where a variation in odour rates was researched, the higher rate was used to provide a robust assessment.

Table 4 Odour Emission Rates

Source	Odour Emission Rate	Unit	Reference
Maize Silage	20.0	$ou_E/m^2/s$	Odournet UK Ltd(1)
Maize	18.7	$ou_E/m^2/s$	REC Ltd(2)
Maize, Rye, and other whole crops	**20.0**	$ou_E/m^2/s$	ADAS(3)
Poultry Manure	**77.0**	$ou_E/m^2/s$	Sniffer(4)
Poultry Manure	75.0	$ou_E/m^2/s$	Odournet UK Ltd(5)
Dewatered Digestate	2.8	$ou_E/m^2/s$	Odournet UK Ltd(6)
Dewatered Digestate	**10.0**	$ou_E/m^2/s$	Odournet UK Ltd(5)
Liquid Digestate	**1.0**	$ou_E/m^2/s$	University of Liège and Universidad Politécnica de Valencia(7)
Liquid digestate tanker vehicle	**10,000**	ou_E/m^3	Odournet UK Ltd(6)

Notes:

(1) Odour Impact Assessment for a proposed Crop CHP Plant at Stoke Bardolph, Nottinghamshire, Odournet UK Ltd;

(2) Odour Assessment Biomass Renewable Energy Unit Spring Farm, Taverham, Resource and Environmental Consultants Ltd.

(3) An Odour Impact Study for a Proposed Agricultural Anaerobic Digester at Cleat Hill Farm, Haunton,ADAS;

(4) Sniffer ER26: Final Report March / 2014, SCAIL-Agriculture update;

(5) Odour Impact Assessment for a proposed Anaerobic Digestion facility near Kenninghall, Norfolk, Odournet UK Ltd

(6) Odour Impact Assessment for a proposed Anaerobic Digestion facility in Chatteris, Cambridgeshire, Odournet UK Ltd

(7) Multi-method Monitoring of Odor Emissions in Agricultural Biogas Facilities, Jacques Nicolas, Gilles Adam, Yolanda Ubeda, Anne-Claude Romain, University of Liège and Universidad Politécnica de Valencia

3.3.4 To use a highly conservative approach an emission of 1 $ou_E/^{m2}/s$ has been used to represent the dirty water lagoon odour emissions. The referenced rate reflects emissions relating to liquid digestate from a comparable site and considers quantities of leachate runoff from feedstocks.

3.3.5 Table 4 shows that maize, grass and rye and similar feedstocks are likely to have comparable odour generating characteristics. As such, an emission rate of 20 $ou_E/^{m2}/s$ was applied to all energy crops in the dispersion model.

3.3.6 The emission rates shown in Table 4 were utilised with additional information provided by Future Biogas Limited to define emissions within the dispersion model. These are summarised in Table 5.

Table 5 Emissions

Source	Odour Emission	Unit	Characteristics
Silage Clamps	20.0	$ou_E/^{m2}/s$	c. 180^{m2} of silage exposed constantly within two of four clamps
Manure Clamp	77.0	$ou_E/^{m2}/s$	c. 33.8^{m2} of manure exposed within the clamp
Silage Clamps	200.0	$ou_E/^{m2}/s$	c. 180^{m2} of agitated silage exposed constantly within two of four clamps
Manure Clamp Delivery	770.0	$ou_E/^{m2}/s$	c. 33.8^{m2} of manure exposed within the clamp, agitated emission rate once per week
Barn Silage Storage	20.0	$ou_E/^{m2}/s$	c. 430^{m2} of silage exposed constantly within clamp
Agitated feedstock material within Feeder Hopper	770.0	$ou_E/^{m2}/s$	c. 85^{m2} of feedstock disturbed within two clamps for 7 hour per week
Transfer routes from Manure Clamps to Feeder Hoppers	77.0	$ou_E/^{m2}/s$	1 hour transfer from clamps to feeder hoppers eight times per day
Transfer routes from Silage Clamps to Feeder Hoppers	20.0	$ou_E/^{m2}/s$	1 hour transfer from clamps to feeder hoppers eight times per day
Solid digestate bunker	10.0	$ou_E/^{m2}/s$	c.70^{m2} of solid digestate exposed within the bunker
Dirty water lagoon	1.0	$ou_E/^{m2}/s$	c.2025 ^{m3} of exposed lagoon areas
Liquid digestate tanker filling point	122.22	ou_E/s	22^{m3} tank air expelled over 1,800 seconds.

3.3.7 The emission characteristics summarised within Table 5 include the following assumptions:

Exposed maize, rye, and wheat straw within silage clamps

- The area of the silage clamps constantly uncovered represents an exposed face of the silage along its entire length. The uncovered clamp area will vary throughout operation depending on the levels and type of stored feedstock. As such, the

assumption that four clamps will be exposed at all times is considered to provide an overestimation of emissions. Future Biogas Ltd has confirmed the clamps are 41m wide and feedstocks range between 4m and 10m in height.

FYM stored with the manure clamp

- The emissions for FYMs are given for pure and raw manures and based on 100% poultry manure. Future Biogas Ltd have confirmed that FYM clamps are covered. It is understood the storage are of FYM is approximately 5 m x 5 m and holds a maximum of 3 days of feedstock at any one time.

Exposed and agitated material within the feeder hopper

- The agitation of FYMs and silage during loading into the feeder hoppers was represented by an increased emission rate of 10 times that of the respective emission rate. The feeding process of all feedstocks occurs 8 hour per day;
- The feedstock transfer routes from the clamps to the feeder hoppers were modelled as a 2.0 m wide area source, the maximum distance was used from the path from the FYM/silages clamps to the feeder hopper.

Emissions from solid digestate storage

- Processed solid digestate is separated and stored within a concrete bunker. The digestate is then stored adjacent to the silage barn and transported offsite to be used as a high-quality fertiliser.

Emissions from dirty water storage lagoons

- The dirty water lagoon is currently exposed and consists primarily of rainwater but may also consist of leachate runoff from the silage and manure feedstocks.

Emission from road tankers at digestate filling points.

- The liquid fraction of the digestate is stored in the digestate tank before being transported off-site by tankers to use as a fertiliser on local agricultural land. Tankers are assumed to have a 22 ^{m3} capacity and a filling time of 30 minutes has been used to calculate an air flow rate.

3.3.8 All odour emissions were at ambient velocity and temperature as a robust assumption.

3.4 Time Varied Emissions

3.4.1 Emissions for the silage and FYM clamps, dirty water lagoon and solid digestate storage were assumed to be constant, with the plant in operation 24-hours per day, 365-days per year.

3.4.2 Future Biogas Ltd confirmed that the filling of the feeder hoppers, as well as the transfer of feedstock from the silage and FYM clamps would occur for approximately 7 hours per day. A time-varied file was applied to represent these emissions.

3.4.3 Future Biogas Ltd confirmed that the collection of liquid digestate from the designated points will occur for a maximum of 11 per week. There a time-varied file was applied to represent a collection from both locations each week.

3.4.4 Modelling of all sources is therefore considered to provide conservative short-term pollutant concentration predictions which do not account for periods of reduced workload.

3.5 Assessment Extents

3.5.1 Ambient concentrations were modelled over the following area using the gridded output function with ADMS-5 model:

- NGR: 507130, 462660 to 511610, 465440

3.5.2 One Cartesian grid with a resolution of 10 m and a height of 1.5 m was included in the model. Results were subsequently used to produce contour plots within the Surfer® visualisation software package. Sensitive receptor locations in the vicinity of the Facility were identified following a desk top survey and assigned a relevant sensitivity based on the appropriate land use category.

3.5.3 The IAQM document Guidance on the Assessment of Odour for Planning[3] provides descriptions of relevant sensitivity as summarised in Table 6.

Table 6 Odour Receptor Sensitivity

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

3.5.4 Relevant sensitive receptors are summarised in Table 7. Reference should be made to Figure 3 for a graphical representation of the receptor locations.

Table 7 Human Sensitive Receptors

Receptor		Use	NGR (m)		Distance from Facility (m)	Sensitivity
			X	Y		
R1	Tuft Hill Farm, Woldgate	Commercial	508423.1	465341.4	1,573	High
R2	Sunset Cottage, Thornholme	Residential	511290.0	463726.8	2,010	High
R3	Home Farm, Burton Agnes	Residential	510434.8	463162.0	1,430	High
R4	Rectory, Rudston Road	Residential	510063.3	463213.3	1,121	High
R5	Phos-n-las, Main Street	Residential	509907.3	462860.0	1,323	High
R6	Harpham Grange, Main Road	Residential	509411.9	462738.9	1,303	High
R7	Harpham Lane Farm	Commercial	507244.0	464106.0	2,061	High

Receptor		Use	NGR (m)		Distance from Facility (m)	Sensitivity
			X	Y		
R8	East End Cottages, East End	Residential	507455.7	464580.2	1,926	High
R9	Playing Fields, Rudston Road	Recreational	509838.6	463379.0	848	Low

3.5.5 It should be noted that surrounding land use is predominantly agricultural so silage and FYM odours would reasonably be expected. Many of the receptors are working farms however receptors represent a group of properties and range of uses. In all cases, receptors have been classified as the highest sensitivity in that group, such as a residential farmhouse within the curtilage of the farm.

Figure 3– Modelled Sensitive Receptor Locations

3.6 Terrain Data

3.6.1 Areas of complex terrain have potential to affect the dispersion of pollutants which vary dependent on the height and location of modelled emission sources. The ADMS-5 user guidance suggest that terrain height effect should only be included where gradient exceed 1:10.

3.6.2 Ordnance Survey Landform Panorama terrain data processed within the ADMS-5 model and covers the Facility and surround receptor locations.

3.7 Building Effects

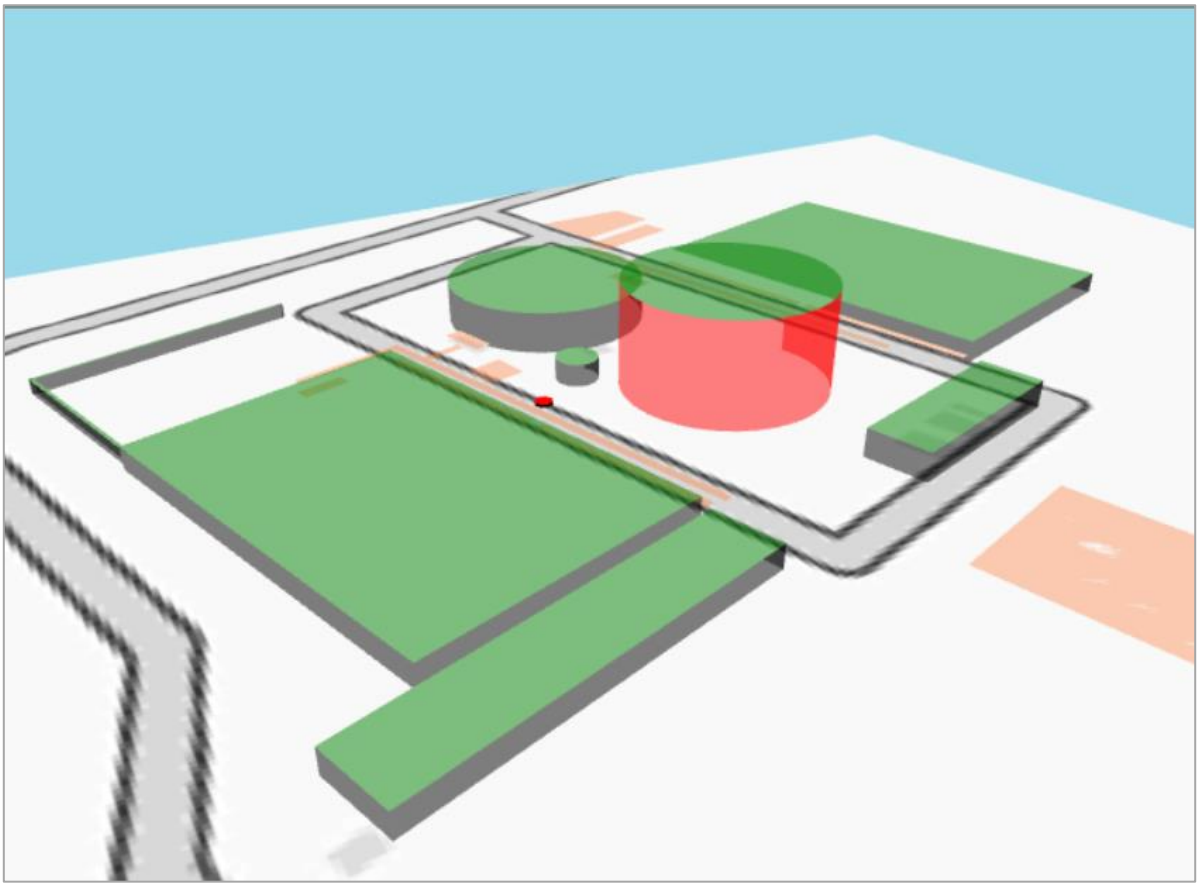
3.7.1 Buildings can influence the dispersion of pollutant and may lead to increases to ground level concentrations. A review of adjacent buildings was therefore undertaken and subsequently included within the model and are summarised in Table 8.

3.7.2 Onsite building heights were provided by Future Biogas Ltd. It should be noted that the effect of buildings on dispersion can only be modelled for points source. As such the modelled area/line sources do not take account of building effects.

Table 8 Building Geometries

Building		NGR (m)		Height (m)	Length/ Diameter (m)	Width (m)	Angle (°)
		X	Y				
1	Silage 1	509241.8	464030.7	4.0	59.6	85.8	255.3
2	Silage 2	509387.0	464068.5	4.0	86.6	59.6	165.7
3	Digester	509303.4	464091.0	7.7	45.6	Circular	N/A
4	Digestate/Residual Tank	509317.1	464038.5	19.0	44.2	Circular	N/A
5	Reception Pit	509292.0	464056.5	4.0	9.1	Circular	N/A
6	Offices &Welfare Block	509246.0	463975.9	4.0	14.9	75.7	165.0
7	CHP & Gas Upgrade Unit	509342.0	463997.9	5.0	13.5	41.7	165.9
8	Silage Walls 1	509220.7	464114.2	4.0	0.7	58.5	165.5
9	Silage Walls 2	509197.9	464086.1	4.0	43.8	0.8	165.8

3.7.3 Reference should be made to Figure 2 for a graphical representation of the modelled building layout. And the ADMS 5 model input. A three-dimensional representation of the modelled building layout is provided below.



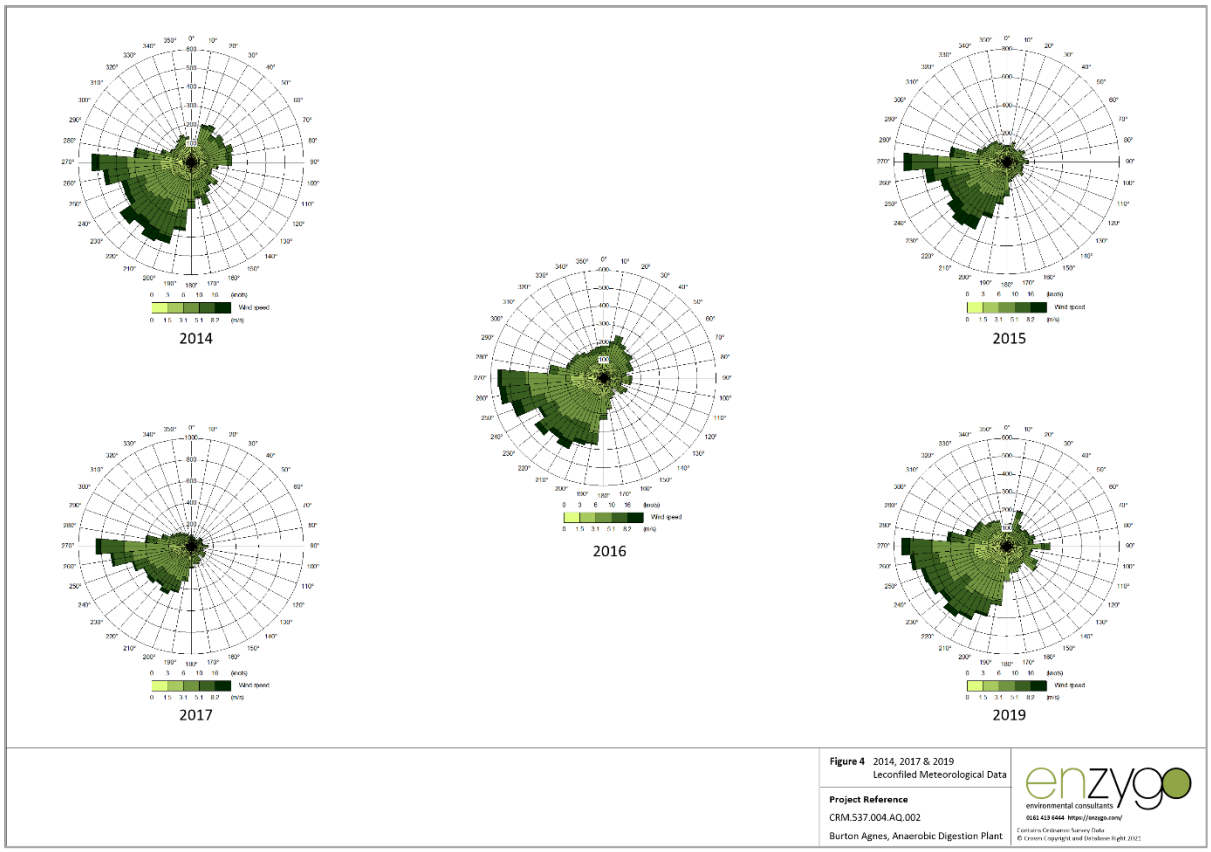
3.8 Meteorological Data

3.8.1 Hourly sequential data used in this assessment was obtain from Leconfield meteorological station, located 22 km southwest of the Facility at the approximate NGR: 503329, 442674.

3.8.2 Although there is some distance between the application site and meteorological station, both sites are located within similar rural contexts and share comparable topographies. The choice of this parameter therefore provides a suitable representative of metrological conditions across the modelled domain.

3.8.3 Maximum emissions across the five years of meteorological data (2014 – 2017, 2019) were utilised to ensure a worse case assessment. Reference should be made to Figure 4 for the meteorological wind roses.

Figure 4– Meteorological Wind Roses



3.8.4 All meteorological data was provided by ADM Ltd.

3.9 Roughness Length

3.9.1 The specific roughness length (z_0) values specified with the ADMS-5 model are summarised in Table 9.

Table 9 Utilised Roughness Length

Location	Roughness length (m)	ADMS Description
Application Site and Meteorological Station	0.2	Agricultural (min)

3.9.2 Both the Facility and meteorological station are located within rural locations and surround by agricultural fields. Given their surrounding areas are void of significant building structures, which could increase turbulence, a value of 0.2m is considered appropriate for the morphology of the assessment area.

3.10 Monin-Obukhov Length

3.10.1The Monin-Obukhov length values are summarised in Table 10.

Table 10 Utilised Monin-Obukhov Lengths

Location	Monin-Obukhov length (m)	ADMS Description
Application Site and Meteorological Station	10	Small Towns <50,000

3.10.2 The application of Monin-Obukhov values considers the effect of heat production in populated areas which will influence atmospheric stability. The rural context of both the Facility and meteorological site suggest a stable conditions and a value of 10 is deemed appropriate.

3.11 Surface Albedo and Priestley-Taylor Parameter

3.11.1 The surface albedo and Priestley-Taylor parameters used in the assessment were the model default values of 0.23 and 1 respectively.

3.12 Significance of Odour Impacts

3.12.1 Modelled 98th%ile of 1-hour mean odour concentrations were compared against the EA benchmark levels to determine the acceptability of the impacts.

3.12.2 To provide a further examination of significance, the impacts was also assessed through the interaction of the predicted 98th%ile of 1-hour mean odour concentrations and receptor sensitivity, as outlined in the IAQM guidance[3]. The relevant assessment matrix for "moderately offensive odours" as defined in Section 2.2 is summarised in Table 11.

Table 11 IAQM Odour Impact Descriptors

Odour Exposure Level as 98th%ile of 1-Hour Means (ou_E/m^3)	Receptor Sensitivity		
	Low	Medium	High
Greater than 10	Moderate	Substantial	Substantial
5 – 10	Slight	Moderate	Moderate
3 – 5	Negligible	Slight	Moderate
1.5 – 3	Negligible	Negligible	Slight
0.5 – 1.5	Negligible	Negligible	Negligible
Less than 0.5	Negligible	Negligible	Negligible

3.12.3 The IAQM guidance states that an assessment must reach a conclusion on the likely significance of the predicted impact. Where the overall effect is moderate or substantial, the effect is likely to be considered significant, whilst if the impact is slight or negligible, the impact is likely to be considered not significant.

3.13 Modelling Uncertainties

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

- Model uncertainty – due to model limitations;
- Data uncertainty – due to errors in input data, including emission estimates, operational procedures, land use characteristics and meteorology; and
- Variability – randomness of measurements used.

3.13.2 Whilst uncertainty in the model inputs and parameters cannot be fully reduced, the analysis of maximum emissions across the five years of meteorological data (2014 – 2017 and 2019) provides sensitivity analysis which sufficiently accounts for variations in modelled predictions.

Additionally, worse case assumptions regarding the application of emission rates within the model also minimise podetial uncertainties.

3.13.3As such, a sufficient degree of confidence can be placed in the results.

3.14 Dispersion Modelling Report Requirements

3.14.1Table 12 provides the checklist of dispersion modelling report requirements.

Table 12 Dispersion Modelling Report Requirements

Item	Location within Report
Location map	Figure 1
List of odours modelled and relevant odour guidelines	Section 3.1, Section 2.2
Details of modelled scenarios	Section 3.3
Details of relevant ambient concentrations used	Not relevant to odour
Model description and justification	Section 3.2
Special model treatments used	Section 3.0
Table of emission parameters used	Table 4 and Table 5
Details of modelled domain and receptors	Section 3.5, Table 7 and Figure 3
Details of meteorological data used	Section 3.8
Details of terrain treatment	Section 3.6
Details of building treatment	Section 3.7, Table 8, and Figure 2

4.0 Assessment

4.1 Sensitive Receptor Results

4.1.1 Predicted odour concentrations at receptor locations are summarised in Table 13. Odour concentrations are presented as a 98th%ile of 1-hour mean values over the relevant assessment year. The maximum concentration over the 5 year meteorological dataset has been used to determine the overall assessment significance.

Table 13 Predicted Odour Concentrations

Receptor		Predicted 98th%ile 1-hour Mean Concentration (ou_E/m^3)					
		2014	2015	2016	2017	2019	5-Year Max Mean
R1	Tuft Hill Farm, Woldgate	0.313	0.290	0.306	0.313	0.361	0.361
R2	Sunset Cottage, Thornholme	0.602	0.602	0.602	0.602	0.535	0.602
R3	Home Farm, Burton Agnes	0.456	0.539	0.539	0.418	0.597	0.597
R4	Rectory, Rudston Road	0.794	0.822	0.803	0.510	0.910	0.910
R5	Phos-n-las, Main Street	0.596	0.660	0.596	0.373	0.576	0.660
R6	Harpham Grange, Main Road	0.760	0.726	0.726	0.323	0.474	0.760
R7	Harpham Lane Farm	0.226	0.196	0.211	0.209	0.217	0.226
R8	East End Cottages, East End	0.230	0.187	0.218	0.251	0.266	0.266
R9	Playing Fields, Rudston Road	1.373	1.373	1.609	0.853	1.395	1.609

4.1.2 As indicated in Table 13, predicted odour concentrations were below the appropriate odour benchmark of 3.0ou_E/m^3 at all highly sensitive receptor locations throughout the considered modelling years.

4.2 IAQM Guidance Impact Significance

4.2.1 The significance of predicted odour impacts at the sensitive receptors based on 5-year maximum concentrations using IAQM guidance[3] is summarised in Table 14. Impacts are based on the criteria given in Table 11.

Table 14 Predicted Impact Significance at Receptors

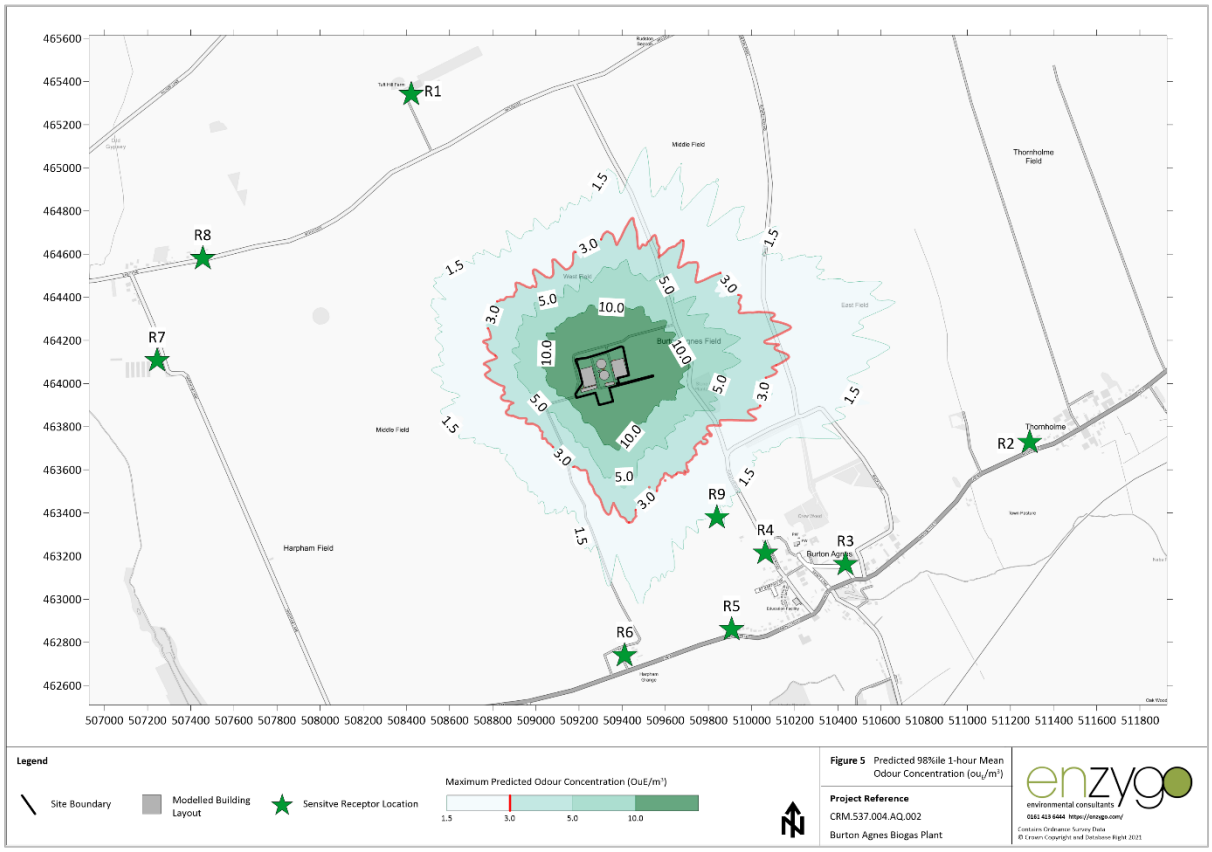
Receptor		Maximum Concentration (ou_E/m^3)	Odour Exposure Level (ou_E/m^3)	Receptor Sensitivity	Significance of Impact
R1	Tuft Hill Farm, Woldgate	0.36	Less than 0.5	High	Negligible
R2	Sunset Cottage, Thornholme	0.60	0.5 – 1.5	High	Slight
R3	Home Farm, Burton Agnes	0.60	0.5 – 1.5	High	Slight
R4	Rectory, Rudston Road	0.91	0.5 – 1.5	High	Slight
R5	Phos-n-las, Main Street	0.66	0.5 - 1.5	High	Slight
R6	Harpham Grange, Main Road	0.76	0.5 - 1.5	High	Slight
R7	Harpham Lane Farm	0.23	Less than 0.5	High	Negligible
R8	East End Cottages, East End	0.27	Less than 0.5	High	Negligible
R9	Playing Fields, Rudston Road	1.61	1.5 - 3	Medium	Slight

4.2.2 As indicated in Table 14, the significance of odour impacts as a result of the Facility was predicted to be negligible at 3 sensitive receptor locations and slight at 6 sensitive receptor locations.

4.2.3 Based on the assessment results, the overall odour impact associated with the Facilities activities are not considered unacceptable or significant in accordance with the stated methodology and the IAQM impact descriptors listed in Table 10.

4.2.4 Figure 5 provide a contour plot of the 5-year maximum odour concentrations across the modelling domain. The red contour represents the 3.0 ou_E/m^3 benchmark.

Figure 5– Maximum 5-year Odour Concentrations



5.0 Conclusions

5.1.1 Enzygo Limited was commissioned by Future Biogas Ltd odour dispersion modelling to support a permit application relating to an AD plant at Harpham Grange Farm, Burton Agnes.

5.1.2 During the operation of the Facility there is the potential for impacts at sensitive locations due to odour emissions from a number of sources at the plant. An Odour Assessment was therefore undertaken to consider effects in the vicinity of the site.

5.1.3 Potential odour emissions were defined based on information provided by Future Biogas Limited on the facilities operation and a review of literature and emissions used at similar facilities. Where necessary robust assumptions were made to give an increased confidence in the results.

5.1.4 A dispersion model using ADMS 5 and using 5 years' meteorological data was produced to determine associated impacts.

5.1.5 Impacts at sensitive receptor locations in the vicinity of the site were quantified, the maximum predicted results compared with the appropriate odour benchmark level.

5.1.6 Predicted odour concentrations were below the EA benchmark level of 3.0 ou_E/m^3 at all sensitive receptors in the vicinity of the site for all modelling years. In addition, using the IAQM guidance[3] significance criteria, worst case impacts were negligible at all representative sensitive receptors.

5.1.7 As such, given the robust assumptions made for odour emissions, the overall potential for odour impacts generated by the Facility can be considered as acceptable and not considered to be significant. The facility is therefore not considered to represent a constraint to environmental permitting permission with regard to odour.

6.0 Abbreviations

%ile	Percentile
AD	Anaerobic Digestion
ADM	Atmospheric Dispersion Modelling
ADMS	Atmospheric Dispersion Modelling Software
CERC	Cambridge Environmental Research Consultants
CH_4	Methane
CHP	Combined Heating and Power
CO_2	Carbon Dioxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EPUK	Environmental Protection UK
FYM	Farmyard Manure
H_2S	Hydrogen Sulphide
IAQM	Institute of Air Quality Management
NGR	National Grid Reference
ou_E	European Odour Unit
tpa	Tonnes Per Annum
z_0	Roughness Length

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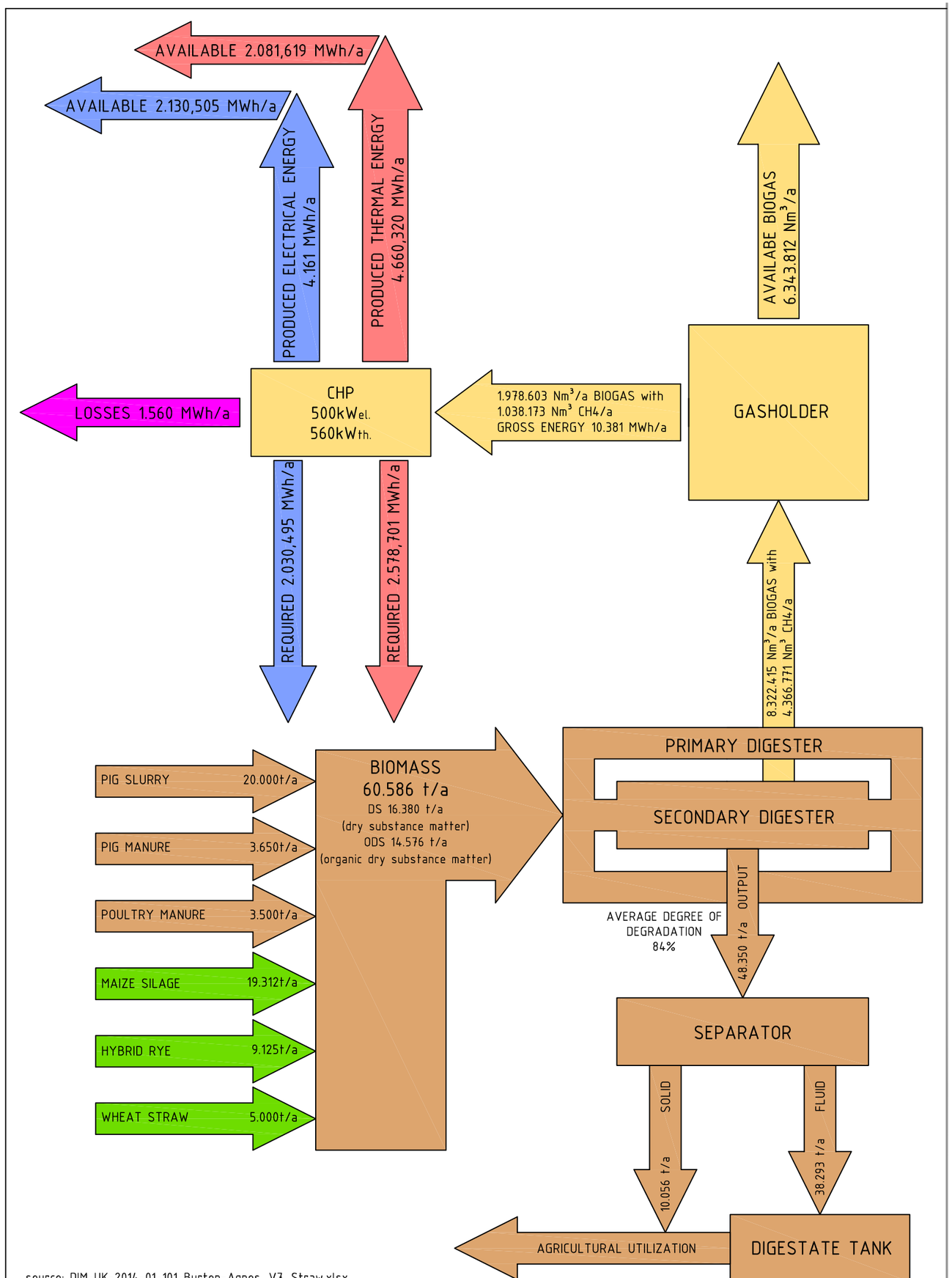

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office@biogest.at www.biogest.at

PROJECT-LOCATION:
United Kingdom

PROJECT-NAME:
UK-2015-01-101-Burton-Agnes

PLANNED CONSTRUCTION:
NEW AD PLANT
IN BURTON AGNES

CONTENT:
MASS & ENERGY BALANCE

PROJECT-ENGINEER: DI Gerald Bartl

DESIGNED BY: Turcaș Cătălin Ștefan August 25, 2015

VERIFIED BY: DI Gerald Bartl

SCALE
1:100

DRAWING-NO. UK-2015-01-101-DP-A-06

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