Basingstoke STC Bioaerosol Risk Assessment

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Thames Water Utilities Ltd
EPR/CB3201GE/V002

IED STC Permitting
27 November 2023

Basingstoke STC Bioaerosol Risk Assessment

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1. Introduction

The purpose of this Bioaerosols Risk Assessment is to provide supplementary information to support the permit variation application for a bespoke installation permit for the Basingstoke Sludge Treatment Centre (STC), EPR/CB3201GE/V002.

1.1 Site description

The Basingstoke Sewage Treatment Works (STW) is located in a rural area, approximately 5 km northeast of the town of Basingstoke, Hampshire and east of the village of Chineham and the A33. The Chineham Energy Recovery Facility is located immediately to the west of the STW, otherwise the site is surrounded by open fields and tree cover. The nearest receptors are a farm approximately 375m north of the site and residential receptors approximately 650m to the northwest. Farms can also be found approximately 750m southwest and southeast of the site. A small stream, Petty's Brook, runs approximately west to east along the STW's northern perimeter and flows to the River Loddon, which is found to the east and south-east, approximately 120m from the site at the nearest point.

Most of the STW and STC is within Flood Zone 1, indicating that there is a low probability of river flooding (<1:1000 annual probability of flooding). However, peripheral parts of the STW including assets within the STC are within a Flood Zone 2 indicating an increased risk of flooding on northern and eastern parts of the site, with between a 1 in 100 and 1 in 1,000 annual probability of river flooding.

There are four statutory designated habitat sites within the relevant distances of the site. The closest is a Local Nature Reserve (LNR), Chineham Woods LNR, approximately 700m west of the site. The Mill Field LNR and Daneshill Park Woods LNR are both southwest of the site, at a distance of1.5 km and 1.8 km respectively. There is one Special Protection Area (SPA), Thames Heath Basins, which is 7.5 km to the northeast. There are no Special Areas of Conservations (SAC) or Ramsar sites within 10 km of the site and no Sites of Special Scientific Interest (SSSI) within 2 km of the site. There 11 areas of Ancient Woodland within 2 km of the site, the closest is approximately 60m to the northeast, Forked Copse Ancient and Semi-natural Woodland. There are 49 non-statutory designated local wildlife sites (LWS) within 2 km of the site including LWS that are within 50m of the STC.

The site is not within a Source Protection Zone (SPZ) and is not within an Air Quality Management Area (AQMA).

The address of the installation is:

Basingstoke Sludge Treatment Centre;

Basingstoke Sewage Treatment Works,

Whitmarsh Lane,

Chineham,

Basingstoke,

Hampshire,

RG24 8LL

1.2 Site Activities

Basingstoke STC, is located at the Basingstoke STW, operated by Thames Water Utilities Ltd (Thames Water). The STC undertakes the biological treatment of sewage sludge, both indigenous and imported from other wastewater treatment sites, by anaerobic digestion, with a capacity above the relevant thresholds for requiring an environmental permit. It also includes the importation of specified wastes to the works inlet for treatment through the Urban Waste Water Treatment directive (UWWTD) regulated works.

There are a number of directly associated activities, including the operation of a biogas fuelled CHP Engines and boiler for the generation of electricity and heat at the site.

The site includes the following Directly Associated Activities (DAA):

- Imports of waste, including sludge from other sewage treatment works.
- Blending of indigenous sludges and imported wastes/waste sludge prior to treatment.
- Pre-treatment of sewage sludge by thermal hydrolysis plant (THP)
- Storage of digestate prior to dewatering.
- Dewatering of digested sewage sludge.
- Transfer of treated dewatering liquors back to the head of the sewage treatment works.
- Transfer of surface water runoff back to the head of the sewage treatment works.
- Storage of dewatered digested sludge cake prior to offsite recovery.
- Storage of biogas.
- Transfers of biogas condensate via site drainage back to the head of the sewage treatment works.
- Combustion of biogas in Medium Combustion Plant Directive (MCPD) and Specified Generator (SG) compliant biogas Combined Heat and Power (CHP) Engines and boiler.
- Operation of an Emergency flare.
- Operation of siloxane filter plant.
- Storage of diesel.
- Storage of wastes, including waste oils.
- Storage of raw materials.

The STC can treat up to 730,000m^3 (equating to approximately 730,000 tonnes) of sludge per year (including indigenous UWWTD derived sludge from the wider STW). The STC has a total maximum treatment input of 808m^3 per day (equating to approximately 808 tonnes per day).

Some of this throughput is sludge, which is subject to dewatering and storage as treated sludge cake at the site prior to removal from site for application to land. Within the area covering the permitted activities, there is one Odour Control Unit (OCU) linked to specific tanks or processes which produce potentially odorous air. This unit treats the air through a variety of means, including the use of biofilters.

The anaerobic digestion process gives rise to biogas, a mixture of biomethane and carbon dioxide, in a mixture with trace components. This biogas is combusted through CHP engines at the site with excess biogas being subject to flaring. The biogas handling system is equipped with a number of Pressure Relief Valves (PRVs) which activate as a safety precaution when there is excess biogas over what the CHP engines and emergency flare can handle.

1.3 Regulatory requirements

The sludge treatment activity has not previously required an environmental permit as the digested sewage sludge from the site is normally sent for recovery to land. However, a permit application has been submitted based on the Environment Agency's recent conclusion that sewage sludge is a waste and therefore the treatment of sewage sludge by anaerobic digestion for recovery is a permittable activity under Schedule 1 of the EPR 2016, specifically Chapter 5, Section 5.4, Part A 1(b)(i) and the treatment of liquors prior to disposal above the relevant threshold, Chapter 5, Section 5.4, Part A 1(a)(i).

For new permits, if the site is within 250m of sensitive receptors then there is a requirement to monitor bioaerosols in accordance with the EA technical guidance note[1] '*M9: environmental monitoring of bioaerosols at regulated facilities*'. M9 describes bioaerosols and the risks that they pose, as well as identifying potential sources within biological treatment facilities.

The Basingstoke Sludge Treatment installation is within 250m of sensitive receptors, as defined by M9. These are detailed in Section 2.5 of this report.

1.4 Bioaerosols

Bioaerosols are found naturally within the environment. They consist of airborne particles that contain living organisms, such as bacteria, fungi and viruses or parts of living organisms, such as plant pollen, spores and endotoxins from bacterial cells or mycotoxins from fungi. The components of a bioaerosol range in size from

[1] Environment Agency. 2018. Technical Guidance Note (Monitoring) M9: Environmental monitoring of Bioaerosols at regulated facilities, v2, July 2018.

around 0.02 to 100 micrometres (µm) in diameter. The size, density, and shape of a bioaerosol will affect its behaviour, survivability and ultimately its dispersion in the atmosphere.

Bioaerosols are easily breathed into the human respiratory system, potentially causing allergic responses and inflammation. They also have the potential to cause eye irritation, gastrointestinal illness, and dermatitis.

Bioaerosols are associated with composting, anaerobic digestion and mechanical biological treatment, which are the main processes used to treat organic wastes in the UK. As organic waste material breaks down it goes through different temperature dependent stages that are dominated by certain groups of bacteria and fungi. Bacteria are the most numerous groups of microorganisms. Aspergillus fumigatus is a mesophilic fungus that is thermotolerant and is present throughout the different stages of the organic breakdown process. This fungus can cause severe respiratory infection if inhaled.

The dependence on microorganisms to degrade organic material and the way in which the material is processed make biological treatment facilities a potential source of bioaerosols. However, we note that the 2012 EA guidance note[2] for developments requiring planning permission and environmental permits states that the EA do not consider bioaerosols from anaerobic digestion to be a serious concern. This is due to the fact, that anaerobic digestion is generally a wet process undertaken in enclosed tanks and equipment, whereas composting is often undertaken using open systems such as windrows and static piles.

The Basingstoke STC does not undertake any aerobic composting activities and the anaerobic digestion process on site, undertaken in the primary digesters, is an enclosed process with all produced gases captured within the biogas system.

1.4.1 High Risk Activities

The M17 guidance document, in section 3.3.3, outlines a number of potential sources and release mechanisms of particulate matter, including bioaerosols from waste management facilities. These potential sources are not graded for importance within M17 and include: the movement of waste to and from the facility; storage of waste (under certain conditions) on site; the handling and processing of waste materials e.g., shredding of green waste, turning of windrows, daily cover; and wind scouring of waste surfaces.

In terms of potential sources of bioaerosol releases at the Basingstoke STC, which meets the M17 guidance, only the storage of sludge cake, the handling of sludge cake (movement into storage and during export) and wind scouring of waste surfaces would apply. There is no shredding of waste or turning of stockpiles as part of the management process and all sewage waste is contained and received via pipes.

1.4.2 Relevant Thresholds

Based on the accepted Levels at sensitive receptors as set out in the Environment Agency M17 guidance[3] '*M17 Monitoring of particulate matter in ambient air around waste facilities*', and in line with the Governments regulatory position statement (RPS) 209 outlining when a specific bioaerosol risk assessment and/or monitoring is required and use of the Environment Agency Technical Guidance Note M9[4]; key bioaerosols of interest and their respective threshold Levels (including background) at sensitive receptors are outlined below:

- Total bacteria: 1000 cfu/m^3
- Aspergillus Fumigatus: 500 cfu/m^3

[2] Environment Agency. October 2012. Guidance for developments requiring planning permission and environmental permits

[3] Environment Agency. 2013. Technical Guidance Note (Monitoring) M17: Monitoring Particulate Matter in Ambient Air around Waste Facilities, v2, July 2013 https://www.gov.uk/government/publications/m17-monitoring-of-particulate-matter-in-ambient-air-around-waste-facilities

[4] Environment Agency. 2018. Technical Guidance Note (Monitoring) M9: Environmental monitoring of Bioaerosols at regulated facilities, v2, July 2018.

2. Bioaerosol risk assessment

2.1 Introduction

A source-pathway-receptor risk assessment has been undertaken to appraise the potential for risk to human health at sensitive receptors within the relevant distance from operations at the Basingstoke STC. This risk assessment follows a standardised approach, namely:

- Hazard identification: what sources of bioaerosols are present on site;
- Exposure assessment: what are the mechanisms or pathways allowing bioaerosols to migrate off site and reach a sensitive receptor; and
- Risk evaluation: who is potentially exposed to bioaerosols; what is the probability, magnitude, and duration of that exposure.

The assessment describes:

- The processing techniques and equipment used within the installation;
- Feedstock, tonnages processed and any seasonal variations;
- Potential sources of bioaerosols;
- The site layout, including any screens, bunds, or trees around the site;
- What is beyond the site boundaries and the location of sensitive receptors; and
- Local wind direction data.

2.2 Processing equipment and techniques

2.2.1 Waste Reception

The STC comprises an offloading point for imported permitted tankered wastes close to the main entrance to the wider STW on land owned by Thames Water. This material is passed to the inlet where it joins the main works flow and via screens to the Primary Settlement Tanks. Sludge is then pumped to two Picket Fence Thickeners (PFTs) and is thickened.

If a sludge spillage occurs, operators will follow the site's spillage response plan in a timely manner and inform the relevant site personnel and authorities. Sludge is relatively viscous and not highly mobile. Spill kits are available around the site to contain a spill and direct it to the site drainage.

2.2.2 Waste Treatment

The waste treatment process of the sludge covered by this permit, starts at the two PFTs, which thicken sludge separated from the main flow. Surplus Activated Sludge (SAS) from elsewhere in the process is thickened with SAS Thickening Plant and liquors are returned to the site drainage for further treatment.

Indigenous thickened primary sludge and SAS is mixed in the Indigenous Sludge Blending Tank and is then pumped to the Sludge Buffer Tank and pumped to the Pre-THP Dewatering Feed Tank where it is mixed with imported sludge from other works. From the Pre-THP Dewatering Feed Tank, sludge is dewatered in Pre-THP Dewatering Plant and pumped to the THP Feed Silo.

Imports of permitted sludges are received via a data logger into the Sludge Import Tank and are subject to screening (to remove inorganic material). Screened sludge is pumped to the Pre-THP Dewatering Feed Tank, where it is blended with indigenous sludges and then dewatered in the Pre-THP Dewatering Plant with the use of a thickener, powder polymer coagulant. The dewatered sludge is then pumped to the THP Feed Silo to be mixed with imported Undigested Sludge Cake Imports. The Pre-THP Dewatering Plant and the THP Feed Silo are subject to odour abatement via a 2-stage OCU.

Undigested Sludge Cake can also be imported to Basingstoke STC via a dedicated Cake Import Facility. Lorries tip the imported cake into a bunker, which is weighed and then transferred via two screw pumps to the THP Feed Silo to be mixed with indigenous sludge. Sludge is re-wetted as required with liquid sludge.

Thickened, blended sludges from the THP Feed Silo are subjected to a THP process with the application of temperature and pressure, used to enhance the digestion of the sludge, in an enclosed system. The process also sterilises the sludge and removes harmful pathogen levels, so it can subsequently be used in agriculture.

From the THP, sludge is transferred to one of the three Primary Digester Tanks at the site, via THP Coolers. The Primary Digester Tanks operate on a continuous basis, with fresh, hydrolysed sludge introduced at mid-level of the Primary Digester Tank with mixing of the sludge via external recirculation pumps. Digested sludge is continuously transferred by gravity through a limpet chamber at the top of each digester into the Digested Sludge Transfer Tank. Each of the Primary Digester Tanks are monitored via the site SCADA system for high and low pressure, presence of a vacuum and the level of sludge within the tank via float switches and ultrasonic levels. In the event of abnormal conditions, the digester feed pumps would be inhibited to prevent further sludge feeding from the THP. From the Digested Sludge Transfer Tank, digested sludge is pumped via a partially sub surface sludge line to one of two concrete Digested Sludge Buffer Tanks. The sludge is transferred the Digested Sludge Dewatering Plant located within the sludge dewatering area of the Cake Barn, a semi-enclosed and covered building. Three belt presses dewater the sludge with the aid of a polymer coagulant. Liquor from the Digested Sludge Dewatering Plant is pumped to the Liquor Treatment Plant (LTP) Reactor Tank for treatment before returning to the works inlet.

A second listed activity at the site is for a LTP to aerobically treat the dewatering liquors generated by the dewatering of sludge. The liquors are passed to the LTP, and ammonia levels are reduced through biological treatment. Following treatment, the treated liquor is returned to the works inlet for treatment through the UWWTD flow.

Biogas from the Primary Digester Tanks is captured and transferred to the Biogas Storage holder, a double membrane biogas holder. The biogas transfer pipeline is equipped with condensate pots that capture entrained moisture from the generated biogas and allow it to be drained into the site drainage system for treatment. The Biogas Storage holder, THP vessels and Primary Digester Tanks are fitted with Pressure Release Valves (PRVs) as a safety precaution in the event of over pressurising the system. The biogas is taken from the Biogas Storage holder for combustion in CHP engines, generating electricity for use both within the site and for export to the grid, and steam to the THP process. In the event that additional steam is required by the THP process, biogas or diesel may be used in the onsite dual-fuelled boiler.

An emergency flare is available for use during periods of essential maintenance and for emergency use. The flare is utilised under 10% of the year or less than 876 hours per year.

2.2.3 Digested cake

Dewatered sludge is conveyed into the semi-enclosed Cake Barn and deposited beneath the conveyor for temporary storage. The cake is moved for general storage within the Cake Barn and kept within bays prior to removal from the site under the Sludge Use in Agriculture Regulations 1989 (SUiAR), and in accordance with the Biosolids Assurance Scheme (BAS). A separate Cake Pad is also used during planned downtime for the THP and to isolate non-compliant sludge, should it be produced at Basingstoke STC.

Undigested cake is also imported and received at the odour abated Cake Import Facility, where it is deposited by lorry, into hoppers and pumped via pipework into the THP process. Undigested sludge cake may also be imported to the cake pad for temporary storage in a contingency prior to digestion via the Cake Import Facility, for example, in the event that the Cake Import Facility is temporarily unavailable for use.

2.2.4 Odour Control Units

Sewage treatment works have a number of potentially odorous sources within their boundary. Some of these sources may be linked to OCUs to treat potentially odorous compounds given off by the process. These units take air extracted from the above-mentioned tanks or process areas and treat the odour compounds by means of different methodologies dependent upon the nature of the compounds. Treatment methodologies include activated carbon systems; biofilters or other biological treatment; and chemical scrubbing. Individual OCUs may use one or more of these methodologies in series.

Under the M9 guidance documents, the Environment Agency has identified that biofilters may give rise to bioaerosols during operation. For completeness, the OCU with biofilters and within the permit installation boundary has been included in this assessment.

2.2.5 Seasonality

Sewage treatment is undertaken at the STC on a continuous basis, 24 hours a day 365 days of the year. Sludge cake is, therefore, produced daily and at similar levels across the whole year.

However, cake storage on site, both in relation to duration and volume, varies across time. Cake is removed from site for spreading to land. Land spreading is controlled under the Biosolids Assurance Scheme and Sludge Use in Agriculture Regulations (1989), as well as the Farming Rules for Water. As such, sludge will remain on site longer during wet periods and during autumn and winter periods where there would be limited uptake of nutrients from the solids. This means that there will be more cake within the storage bays during the autumn and winter, under normal conditions, than during the summer period.

2.3 Potential Sources

There are eleven point-source emissions to air from the processes within the installation boundary, as presented in Table 1 and illustrated in Appendix B. The references and source descriptions match those in the permit:

Table 1: Point source emissions to air

Air emission reference	Source	In scope?
A1a	CHP Engine A	X
A1b	CHP Engine B	X
A1c	Boiler	X
A2	Emergency Flare	X
A6	THP PRV	X
A7	Primary Digester Tank PRV	X
A8	Primary Digester Tank PRV	X
A9	Primary Digester Tank PRV	X
A10	Sludge Buffer Tank PRV	X
A11	Biogas Storage PRV	X
A12	THP OCU	✓

The Cake Pad, Cake Barn and Cake Import Facility are also illustrated in Appendix B. These are additional sources for consideration of bioaerosol releases to atmosphere.

2.3.1 Source Assessment

The CHP engines, boilers and emergency flare (points A1a, b, c and A2) combust the produced biogas at high temperatures (in excess of 450°C). Due to the combustion of the biogas, these points can be discounted as sources of bioaerosols emissions.

There is one OCU (A12) serving the STC. The unit extracts odorous air from the Sludge Import Tank, Sludge Screens, Indigenous Sludge Blending Tank, Sludge Buffer Tank, Pre-THP Dewatering Plant, Pre-THP Dewatering Feed Tank, Cake Import Facility, THP Feed Silo, and Return Liquor Pumping Station 2.

The OCU is a two stage biofilter and scrubber system. Extracted air from the tanks is passed through the support media (pumice stone), within the biofilter, while water is irrigated from above. The microbes on the

support media, remove potentially odorous contaminants and the partially treated air from the bio-trickling filter is passed to Activated Carbon adsorbers to achieve a stack emission standard of <= 1000 $OuEm^3$ at the outlet. Treated air discharges via the stack. The configuration of the OCU means that any bioaerosols emitted from the biofilter stage should be captured by the activated carbon stage, and therefore, the likelihood of bioaerosol release is anticipated to be minimal.

The Pressure Relief Valves (PRVs) (A6 – A11) are normally closed and do not emit to atmosphere. However, in the event of an abnormal situation such as the failure of the flare stack and/or CHP Engines, the PRVs would open to relieve excess biogas pressure, potentially resulting in the release of bioaerosols. While the problem is rectified, biogas generation would be limited by reducing or inhibiting the digester feed. These abnormal events are unlikely, temporary, and infrequent due to the extensive monitoring and maintenance programmes undertaken at the site, as well as the procedures and warning systems in place.

In addition to the point sources identified above, there is also an unchanneled potential release from treated, dewatered sludge cake which is transferred via conveyor and deposited in the semi enclosed Cake Barn for temporary storage. Undigested Sludge Cake is also imported to a Cake Import Facility and directed from delivery vehicle into a hopper. This is then piped using dedicated pumps into the THP process. During periods of abnormal, undigested sludge cake may also be imported to the Cake Pad temporarily before it is transferred to the Cake Import Facility for processing via the THP process.

2.3.2 Risk

The overall treatment process is considered to be a low source of bioaerosols. As discussed above, there are control measures in place at the site to reduce and contain emissions of bioaerosols. These control measures are regularly maintained to sustain their efficacy and reduce the risk of equipment failure.

The Cake Import Facility is fully enclosed, and odour abated by the OCU at Basingstoke STC. Any bioaerosols generated during the transfer of undigested sludge cake into the cake hopper will be treated and therefore the probability of exposure from this source is low.

The greatest probability of exposure from bioaerosols emitted from the site is from uncovered operations such as the Cake Pad and semi enclosed Cake Barn (as shown in Appendix B). The semi-enclosed nature of the Cake Barn reduces the likelihood and effectiveness of wind abrasion as the cake would be less exposed to the elements when handled at this location. The movement and handling of sludge cake could give rise to fugitive releases to atmosphere and the potential for entrainment and resuspension of material from vehicle tyres.

The sludge cake during this transfer is likely to have low concentrations of bioaerosols as a result of the treatment processes and is moist on deposition from the conveyor within the Cake Barn. The cake is managed by dozer and deposited within the storage bay where it forms a crust within 24 hours. The cake storage areas are monitored for row height and arrangement and require no further treatment or disturbance prior to export onto agricultural land. The probability of exposure from this source is medium.

Undigested sludge cake is delivered to the Cake Import Facility which is odour abated. Occasionally, undigested sludge may be stored on the cake pad at Basingstoke and may have a higher concentration of bioaerosols. However the undigested sludge cake is moist on deposition and forms a crust within 24 hours. Undigested cake storage is monitored for row height and arrangement and is transferred to the Cake Import Facility as soon as possible following resumption of normal activities. The probability of exposure from this source is medium.

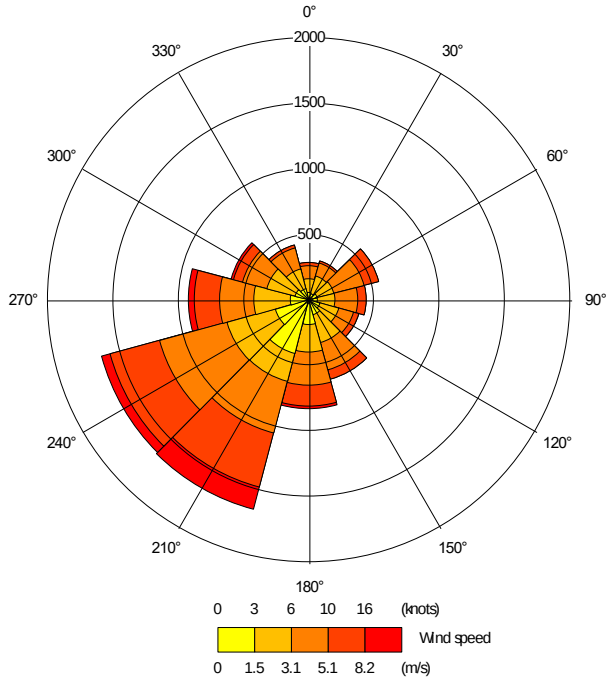
All treatment tanks and associated pipework are enclosed. Storage tanks prior to digestion are not all enclosed. The Digested Sludge Buffer Tanks and the LTP are not enclosed. The wet wells used to receive incoming sludge are below ground and covered. Sludge screening and dewatering takes place in enclosed units. In addition, the PRVs are only open in abnormal situations which are temporary and unlikely. The two-stage biofilter process fitted to the OCU and the maintenance of this asset makes the probability of exposure from this source as low under normal operating conditions.

2.4 Pathways

Bioaerosols are very small and light in weight so can easily be transported by the wind from their source to a receptor. The 2019 wind rose for the most representative meteorological site, Farnborough airport (located approximately 17.8 km East of the Site centre), is shown in figure 1.

The wind rose data shows that the site experiences strong prevailing south westerly winds, predominantly in excess of 6 knots. The Basingstoke STC and surrounding area has a relatively flat topography. The site is surrounded to the North, East and West by mature trees that provide some screening. The southern boundary is open farmland.

Figure 1 – Farnborough Airport Wind rose (2019)



Because of the dilution effect in open air, bioaerosol concentrations fall away rapidly with distance from the source. It has been shown by research by the HSE[5] that by 100 to 200m away, the bioaerosol concentration has mostly returned to background levels. Between 50m and 100m distances downwind of the process, bioaerosol concentrations were substantially reduced by comparison to those level measurements at source. Research Report (RR)786 confirmed previous published studies which showed that at a distance of 250m from composting activity, in most cases, the bioaerosol concentrations will be reduced to background levels. Note that this research was undertaken on aerobic composting sites, which generate higher levels of bioaerosols than anaerobic digestion sites, although the 250m separation distance has been retained.

At present, Thames Water do not have quantitative data for the levels of bioaerosols that might be associated with the potential sources at their sludge treatment centres. As a responsible operator, Thames Water are arranging for bioaerosol monitoring at a number of typical STC's in order to confirm that the understanding of the wider waste water treatment industry, that sewage sludge treatment processes do not give rise to elevated levels of bioaerosols, is correct. The sampling will be in accordance with the requirements of M9 and M17 and consist of a series of agar gel plates being placed downwind and upwind of the cake pad, including sampling points both directly upwind of the downwind sampling point and additional samples in the direction of the nearest sensitive receptors.

[5] Research Report 786 - Bioaerosol emissions from waste composting and the potential for workers' exposure https://www.hse.gov.uk/research/rrhtm/rr786.htm

2.5 Receptors

Environment Agency guidance note M9 recommends a screening distance of 250m from bioaerosol emission sources to static receptor locations. Sensitive receptors are defined as: 'permitted activities where people are likely to be for prolonged periods. This term would therefore apply to dwellings (including any associated gardens) and to many types of workplaces. We would not normally regard a place where people are likely to be present for less than 6 hours at one time as being a sensitive receptor. The term does not apply to those controlling the permitted facility, their staff when they are at work or to visitors to the facility, as their health is covered by Health and Safety at Work legislation, but would apply to dwellings, commercial or industrial premises nearby where people might be exposed for the requisite period.

Sensitive receptors (as identified for the OMP) have been considered. Whilst the Veolia Energy from Waste (EfW) facility is adjacent to the STC site, the façade of the building is greater than250m from the identified potential bioaerosol emission sources. These are presented in Table 2 for completeness and shown in Appendix C. All other sensitive receptors in proximity of the site are also greater than 250m away. The distance and direction from each potential bioaerosol emission source to the closest sensitive receptor has been reported.

Table 2: Static Receptor closest to identified Potential Bioaerosol Sources

Receptor	Description	Source	Distance from closest source (m)	Direction from the source
R2	Industrial / workplace (Veolia EfW facility)	Cake Barn	254	West
		Cake Pad	335	West
		A12 OCU	507	West
		Cake Import Facility (Reception)	532	West

2.6 Risk Assessment

The method used for this bioaerosol risk assessment is adapted from the EA's standard guidance on risk assessments for environmental permitting, which recommends using a Source-Pathway-Receptor model[6] to help determine the magnitude of the risk associated with bioaerosol emissions from a facility.

Four potential bioaerosol emission sources have been identified:

- OCU (emission points A12);
- Cake Import Facility;
- Cake Barn; and
- Cake Pad.

There are no sensitive receptors within 250m of the release points.

The assessment has demonstrated that the potential sources of bioaerosol emissions are more than 250m from the closest sensitive receptor (R2). A dispersion distance greater than 250m would likely result in concentrations of bioaerosols falling to within background levels i.e., 'acceptable level' thresholds set out within the EA guidance. Receptors beyond 250m are not required to be considered. The location of R2 is also upwind of the prevailing South westerly wind direction, so frequency of a bioaerosol event at this receptor would also be low.

The magnitudes of release from the sources considered would be small, by the nature of the releases and the site's monitoring, maintenance, mitigation, and management practices undertaken (as presented in Section 2.3.1). The probability of exposure under normal operating conditions would therefore be low.

[6] Risk assessments for your environmental permit - GOV.UK (www.gov.uk)

Planned monitoring of bioaerosol emissions by Thames Water is expected to validate the expectation that process contributions of bioaerosols from sewage sludge treatment works, would comply with the 'acceptable level' thresholds.

2.7 Abnormal Situations

In the event of plant failures or abnormal situations, an alarm would be raised on the Site Supervisory Control and Data Acquisition (SCADA) or telemetry systems, which will be reacted to by on-site or regional control room operators and Duty Managers. Depending upon the nature of the fault or emergency, where required, an operator would contact a mechanical or electrical technician, both of whom are on-call 24-hours, to attend site as soon as practicable.

If the on-call technicians are already engaged upon other response work, there is the facility to access staff from other TW geographic divisions, coordinated by the Duty Manager. All faults, breakdowns and emergencies are logged electronically together with records of the action taken and the solutions reached. One such abnormal event would be failure of the flare stack and/or CHP. Such an event would result in releases of biogas from the PRV's located on the roofs of the digesters and in the biogas holder compound, which would release bioaerosols. This occurs to prevent over pressurisation of the digesters and biogas systems. While the problem is rectified, biogas generation is reduced by reducing or inhibiting the digester feed.

3. Conclusions

A source-pathway-receptor risk assessment has been undertaken to appraise the potential for risk to human health in dwellings and other nearby buildings/ community spaces from bioaerosols arising from operations at the Basingstoke STC. The risk assessment followed a standardised approach, namely:

- Hazard identification: what sources of bioaerosols are present;
- Exposure assessment: what are the mechanisms or pathways allowing bioaerosols to migrate off site and reach a receptor; and
- Risk evaluation: what is the probability, magnitude, and duration of exposure. This considered control measures in place to reduce the probability or magnitude of release.

Four potential sources of bioaerosols within the site processes have been identified, connected to the storage and movement of treated digested sludge cake at the site, the Cake Import Facility and the operation of the 2-stage biofilter OCU. These sources were considered to have a small magnitude potential for release. The risk from abnormal releases from PRVs was scoped out.

The assessment identified no receptors within 250m of these potential sources. The closest receptor was noted as an upwind location to the prevailing wind direction.

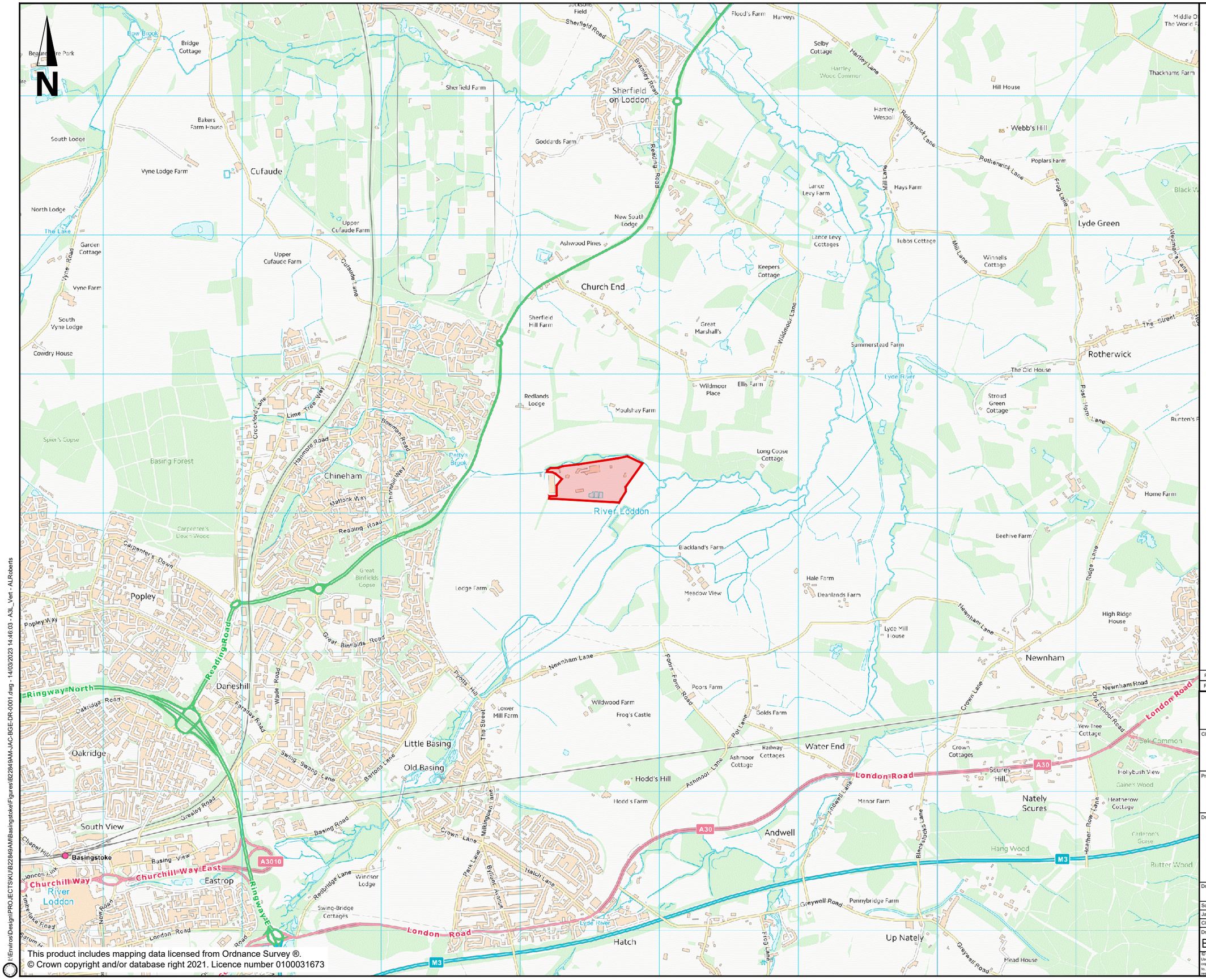
Taking the site control measures, maintenance and management practices into consideration, the probability of exposure would likely be low.

Therefore, with the dispersion distances being equivocal to a likely 'background concentration' of bioaerosols, the risk of bioaerosol effects at sensitive receptors, from normal operating conditions at Basingstoke would be negligible.

3.1 Sampling

Due to the lack of sensitive receptors within 250m of potential bioaerosol emissions at Basingstoke STC, no sampling locations are proposed.

Appendix A. Site Location Plan



KEY:

Site Location

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P01	JUL 2021	FOR INFORMATION	AR	MM	JK	MM

Jacobs
1180 Eskdale Road, Winnersh, Wokingham, RG41 5TU
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www.jacobs.com

Client: Thames Water

Project: STC IED PERMIT
BASINGSTOKE STW

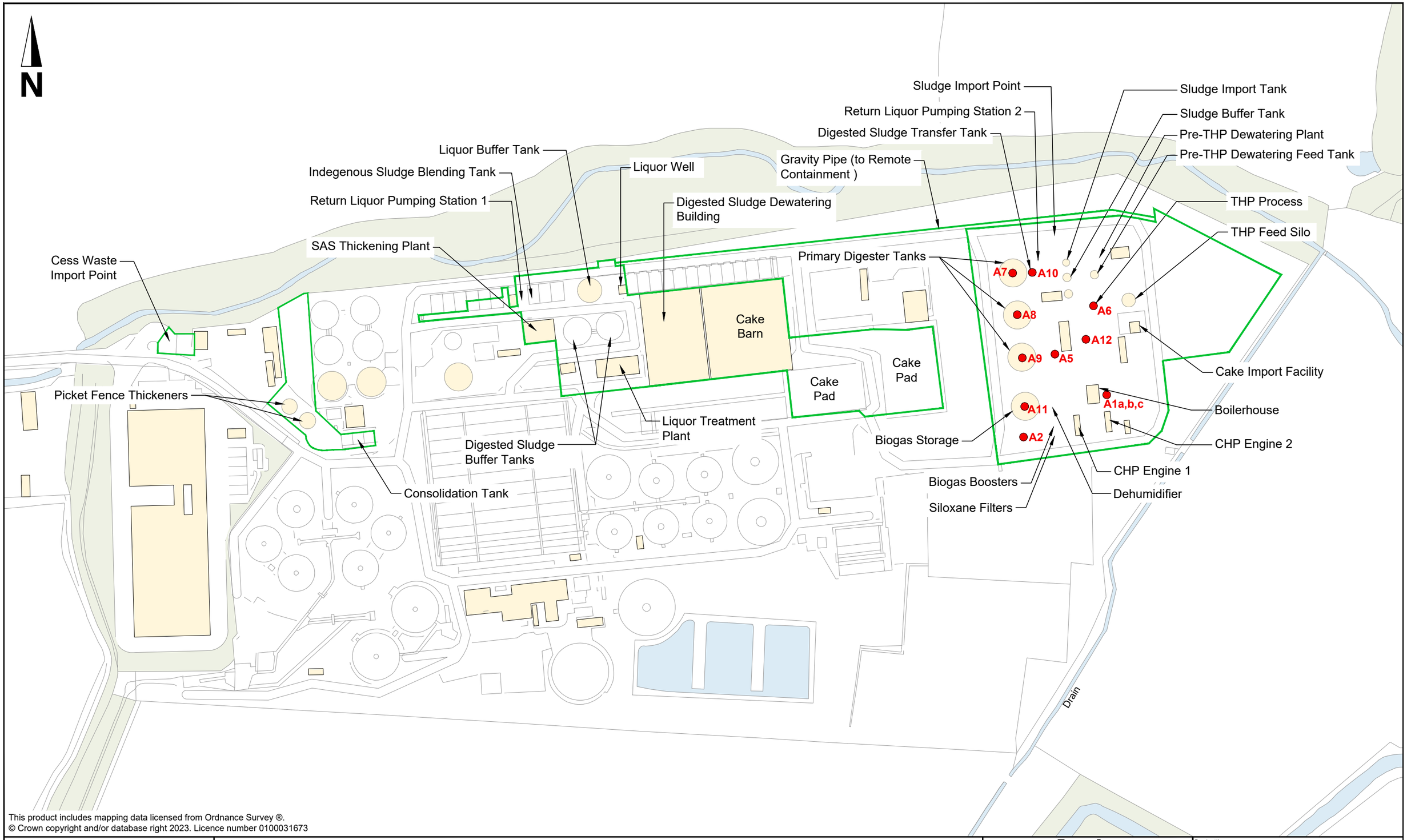
Drawing title: FIGURE 1
SITE LOCATION PLAN

Drawing status: PERMITTING

Scale	1:25,000	DO NOT SCALE
Jacobs No.	B22849AM	Rev P01
Client no.		

Drawing number: B22849AM-JAC-BGE-DR-0001

Appendix B. Installation Boundary and Air Emission Points



KEY:

Installation Boundary

Air Emission Point

A1a - CHP Engine A
A1b - CHP Engine B
A1c - Boiler
A2 - Emergency Standby Biogas Flare
A5 - Emergency Generator (THP Plant)
A6 - THP PRV
A7 - Primary Digester PRV
A8 - Primary Digester PRV
A9 - Primary Digester PRV
A10 - Sludge Buffer Tank PRV
A11 - Biogas Holder PRV
A12 - THP OCU

0 20 40 60 80 100
METRES

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P03	NOV. 2023	FOR INFORMATION	AR	JK	JK	MM
P02	AUG. 2023	FOR INFORMATION	AR	SK	JK	MM
P01	JUN. 2022	FOR INFORMATION	AR	SK	JK	MM

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Project: STC IED PERMIT
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Drawing title: APPENDIX B
INSTALLATION BOUNDARY
AND AIR EMISSION POINTS

Drawing status: PERMITTING

Scale	1:2000 @ A3	DO NOT SCALE
Jacobs No.	B22849AM	Rev P03
Client no.		

Drawing number: B22849AM-JAC-BGE-D-0002

Appendix C. Closest Receptors to Potential Bioaerosol Emission Sources

N

Cake Barn

Cake Pad

Cake Pad

Cake Import Facility

A12

R1

Sewage Works

Track

Drain

KEY:

Installation Boundary

Air Emission Point

Receptor Point

A12 - THP OCU

0 20 40 60 80 100
METRES

Rev	Rev. Date	Purpose of revision	Drawn	Checkd	Rev'd	Apprv'd
P02	SEP. 2023	FOR INFORMATION	AR	SK	JK	MM
P01	JUN. 2022	FOR INFORMATION	AR	SK	JK	MM

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Project: STC IED PERMIT
BASINGSTOKE STW

Drawing title: APPENDIX C
CLOSEST RECEPTORS TO POTENTIAL BIOAEROSOL EMISSION SOURCES

Drawing status: PERMITTING

Scale	1:2000 @ A3	DO NOT SCALE
Jacobs No.	B22849AM	Rev P02
Client no.		

Drawing number: B22849AM-JAC-BGE-DR-0004