Bishop's Stortford 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 Bishop's Stortford Sewage Treatment Centre (STC), EPR/CP3501MG/A001.

1.1 Site description

The Bishop's Stortford STC is located at Bishop's Stortford Sewage Treatment Works (STW), approximately 2.4 km Southeast of the town of Bishop's Stortford. The site is located within a rural area. There are fields on all sides of the STW, which is approximately 300m West of the M1 motorway, 200m East of the A1060 and 300m East of the River Stort.

There are residential and commercial properties located at the entrance to the wider site.

The area of the site is located entirely within a Flood Zone 1, indicating there is a with a low probability of flooding (>1:1000 annual probability of flooding).

The site is not located within or adjacent to the boundaries of an Air Quality Management Area (AQMA). The site is located outside of the boundaries of a Source Protection Zone (SPZ).

There are two statutory designated habitat sites within the relevant distances of the site. The closest is Thorley Flood Pound SSSI, which is 1.4km south-west of the site. The closest designated Local Nature Reserve (LNR) to the site is Flitch Way LNR located to the north-east of the site, at a distance of 1.9km. There is no SAC, MPA, SPA or RAMSAR sites within 10km of the site. There are two areas of Ancient Woodland within 2km of the site, both located approximately 1.9km to the North and Southwest of the site respectively comprising Birchanger Wood (Ancient and semi-natural woodland) and Thorley Wood (Ancient and semi-natural woodland). There are 10 non-statutory designated LWS's within 2km of the site, the closest of which is located approximately 200m to the East of the boundary of the wider STW site.

The address of the installation is:

Bishop's Stortford Sludge Treatment Centre;

Bishop's Stortford Sewage Treatment Works,

Jenkins Lane,

Great Hallingbury,

Bishop's Stortford,

Hertfordshire,

CM22 7QL.

1.2 Site Activities

Bishop's Stortford STC, is located at the Bishop's Stortford 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 engine and boilers 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 for treatment.
- Blending of indigenous sludges and imported wastes/waste sludge prior to treatment.

- Storage of digestate prior to dewatering.
- Dewatering of digested sewage sludge.
- Transfer of dewatering liquors via site drainage back to the head of the sewage treatment works.
- Transfer of surface water runoff via site drainage back to the head of the sewage treatment works.
- Storage of dewatered digested sludge cake prior to offsite recovery.
- Storage of biogas.
- Transfer of biogas condensate via site drainage back to the head of the sewage treatment works.
- Operation of a siloxane filter.
- Combustion of biogas in a biogas CHP Engine (that is a specified generator) and biogas or gas oil in two boilers.
- Operation of an emergency flare.
- Storage of diesel.
- Storage of wastes, including waste oils.
- Storage of raw materials.

The facility can treat up to 270,000m^3 of sludge per year (equating to approximately 270,000 tonnes). The sludge treatment facility has a total treatment input greater than 242m^3 per day (equating to approximately 242 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. These units treat the air through a variety of means, including 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 a Combined Heat and Power (CHP) engine or boilers at the site with excess biogas being subject to flaring. The biogas handling system is equipped with pressure relief valves (PRVs) which activate as a safety precaution when there is excess biogas over what the CHP engine and 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).

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 Bishop's Stortford STC 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 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.

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

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 group 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 Bishop's Stortford STC does not undertake any aerobic composting activities and the anaerobic digestion process on site, undertaken in the Primary Digester Tanks, 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 bioaerosols release at the Bishop's Stortford STC, which meets the M17 guidance, only the storage and handling (movement within the Cake Pad and during export) of sludge cake 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 Bishop's Stortford 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.
- Local wind direction data.

2.2 Processing equipment and techniques

2.2.1 Waste Reception

Waste is delivered to an offloading point for permitted imported tankered waste at the works inlet of the STW through an enclosed connection. The imported waste and incoming sewer flows are combined before being passed to the UWWTD permitted process for aerobic treatment, outside of the permit boundary.

Imports of sludge from other sites can also be made to Bishop's Stortford and the sludge is passed through a Sludge Screen to remove rag and inorganic material, which is discharged into a skip for offsite disposal, before the sludge is passed to the Sludge Buffer Tank and mixed with indigenous sludges. A data logger records the volume of sludge transferred.

If a sludge spillage occurs, spill kits are available on site and staff are trained in their use. Sludge is viscous and not highly mobile, and operators would clean-up in a timely manner.

2.2.2 Waste Treatment

The waste treatment process of the sludge covered by this assessment, starts at the Sludge Screens. Indigenous sludge from the Primary Settlement Tanks is drawn off, screened and pumped to a Sludge Buffer Tank where it is mixed with screened imported sludge. The Sludge Buffer Tank is covered and connected to an OCU. High-level alarms prevent sludge being transferred into the tank in the event of the sludge level being too high. From the Sludge Buffer Tank, sludge is pumped to Sludge Thickening Plant where it is thickened with liquid polymer and dewatered before passing to the Primary Digester Tanks (PDT). The Sludge Thickening Plant are subject to odour abatement via an OCU.

There are three PDTs at Bishop's Stortford STC which are covered with fixed roofs. The PDTs operate on a continuous basis, receiving batches of sludge that is pumped sequentially into each tank in turn. Each PDT is fitted with dual pressure relief valves (PRVs) and are monitored via the Site Supervisory Control and Data Acquisition (SCADA) system for daily sludge feed volume and sludge temperature. Additional heat input is provided to all three PDTs via dedicated heat exchangers, which use heat generated on site by either the CHP engine or by the two auxiliary boilers.

After the required duration, digested sludge is transferred from the PDTs and gravitates to the Secondary Digester Tanks. The normal retention time is approximately 7 days. External mixing is provided in all three Secondary Digester Tanks, which are uncovered.

Digested sludge is pumped to one of the two Digested Sludge Buffer Tanks, which operate in parallel. The Digested Sludge Buffer Tanks are uncovered and have high-level floats to monitor the level of sludge within each tank, which are connected to the site SCADA. In the event of a high-level alarm, sludge transfer pumps are inhibited to prevent over-filling of the Digested Sludge Buffer Tanks. Under normal conditions, pumps transfer digested sludge to the Digested Sludge Dewatering Plant located within the dewatering building. A polymer coagulant is then dosed to the duty belt press. Digested sludge cake is transferred via covered conveyors and is deposited on the engineered open Cake Pad.

Biogas produced within the three PDTs is captured and transferred to a double membrane Biogas Storage holder on site. The dual membrane Biogas Storage has an inner and outer bag that is fitted with biogas detection systems and PRVs that operate in an emergency as a safety precaution in the event of over pressurising the system. An ultrasonic level is fitted which measures the height of the internal biogas bag. Air blowers keep the Biogas Storage holder inflated and exhaust air is monitored by methane detectors to identify any leaks of biogas. Biogas is transferred in biogas pipeline equipped with condensate pots that capture entrained moisture from the generated biogas. Removing the condensate improves the quality of the biogas and reduces impurities that could reduce the efficiency of the CHP engine. Biogas is transferred for use in either the CHP engine, boilers, or emergency flare. A slam shut valve is present, which would automatically isolate the Biogas Storage holders in the event of an emergency situation. A siloxane filter is located upstream of the CHP engine on the biogas line to remove impurities from the biogas prior to combustion in the CHP engine. Use of siloxane filters reduces incidence of operational issues for the CHP engine. Biogas also passes through biogas boosters, one on the line to the CHP engine and boilers, and one on the line to the Emergency Flare.

In the event of there being excess biogas, i.e., more than the CHP engine or the boilers can utilise, or in the event that the CHP engine or boilers are unavailable, there is a ground mounted emergency flare, which automatically operates on a high level of biogas within the Biogas Storage holder. This is utilised under 10% of the year, less than 876 hours per year.

2.2.3 Digested cake

Digested sludge is transferred from under each of the covered conveyor belts and moved by a shovel loader or similar plant to another point on the Cake Pad for storage prior to removal from the site under the Sludge Use in Agriculture Regulations 1989 (SUiAR), and in accordance with the Biosolids Assurance Scheme (BAS). In the event of failure of processing plant, the standby machine will automatically take over operations and the duty machine will be taken out of operation.

The Cake Pad is of engineered concrete with drainage and is found on the southern extent of the installation. Gully drainage and surface water drains capture run-off which is returned to the works inlet via the site drainage.

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 odour 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 all OCUs with biofilters and within the permit installation boundary have 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 nine 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?
A1	CHP Engine 1	X
A2	Auxiliary Boiler 1	X
A3	Auxiliary Boiler 2	X
A4	Emergency Flare	X
A5 – A7	Primary Digester Tank PRV	X
A8	Biogas Storage PRV	X
A9	OCU 1	✓

The open Cake Pad is also illustrated in Appendix B. This is an additional potential source for consideration of bioaerosols release to atmosphere.

2.3.1 Source Assessment

The CHP engine, boilers, and emergency flare (points A1 – A4) 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 emission points to air (A9) serving the STC. OCU 1 (A9) serves the Sludge Buffer Tank and Sludge Thickening Plant. The OCU uses a single stage biofilter. The air from the headspace of these units is drawn through the media; the vented air discharges through a high-level stack. The configuration of the OCU means that bioaerosols could be emitted from the biofilter stage and therefore, the likelihood of bioaerosol release is anticipated to be medium.

The Pressure Relief Valves (PRVs) (points A5 – A8) 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 Engine, the PRV's 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 deposited from the covered conveyors onto the Cake Pad. The sludge cake is then moved from under the conveyors to an area of the Cake Pad for temporary storage. The site also receives digested sludge cake for storage from other facilities. The type of waste and its location within the pad is logged.

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.

There is a risk of exposure from bioaerosols emitted from the open Cake Pad and from fugitive releases due to handling operations as sludge cake is moved within the Cake Pad for storage or later disturbed for export. However, the cake at this stage, has low bioaerosol content as a result of the treatment processes and is moist on deposition to the Cake Pad. The cake is managed by dozer and deposited within the storage areas 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**.

All storage tanks (except the Secondary Digester Tanks and Digested Sludge Buffer Tanks), treatment tanks and associated pipework are enclosed. Contingency Storage Tanks are also uncovered, but not normally used. The wet wells used to receive incoming sludge are 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.

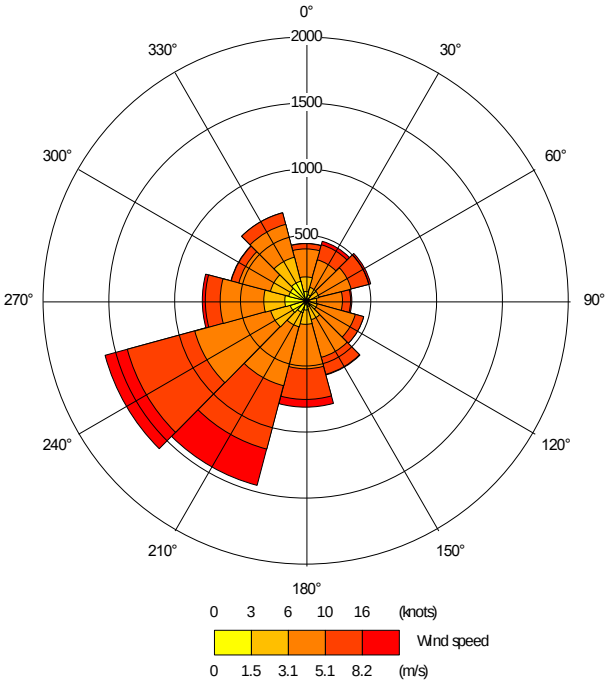
The single stage biofilter process fitted to the OCU makes the probability of exposure from this source, **medium**, under normal operating conditions.

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 2020 wind rose for the most representative meteorological site, Stanstead Airport (located approximately 5 km Northeast of the Site centre), is shown in figure 1.

The wind rose data shows that the site experiences West southwest to Southwest prevailing winds, predominantly in excess of 6 knots. The Bishop's Stortford STC and surrounding area has a relatively flat topography. The site is bound by trees/ hedgerows along its northern border. The rest of the site is surrounded by fields and hedgerow borders.

Figure 1 – Stanstead Airport Meteorological Windrose



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 any empirical evidence for the levels of bioaerosols that might be associated with the potential sources at their STCs.

As a responsible operator, Thames Water are arranging for bioaerosol monitoring at a number of typical STCs 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.

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

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

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 (identified for the Odour Management Plan (OMP)) and within 250m of potential bioaerosol sources, have been considered and are presented in Table 2 and shown in Appendix C. The distance and direction from each potential bioaerosol emission source to the closest sensitive receptor has been reported. R4 represents the closest dwelling of three residential properties within 250m of potential bioaerosol sources.

Table 2: Static Receptors within 250m of Potential Bioaerosol Sources

Receptor	Description	Source	Distance from closest source (m)	Direction from the source
R4	Residential and Commercial (Handmade Kitchen Company)	OCU 1 (A9)	164	North northwest
		Cake Pad and Conveyor	227	North northwest

2.6 Risk Assessment

The method used for this bioaerosols 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.

There are two potential sources of bioaerosols release within 250m of static receptors:

- Odour Control Unit (A9)
- Cake Pad.

The closest sensitive receptor R4 (representative of three residential properties) to potential bioaerosols emission sources is within 164m of the OCU (A9) and 227m of the Cake Pad and conveyors. R4 is representative of three residential properties within 250m of potential bioaerosol emission points and is situated North northwest of identified emission sources and is broadly upwind of the prevailing wind direction at the site, which is West southwest to Southwest. The frequency of an effective pathway is therefore small. The dilution effect as a result of the dispersion distance would reduce the concentration of a release and there is screening by vegetation at the site boundary prior to these sensitive receptors.

The daily throughput of sludge is greater than 242m^3/day (equivalent to 242 tonnes per day). The fully digested sludge is dewatered however, the sludge cake remains damp as it passes from the presses onto the Cake Pad. The moisture content in the cake prevents it drying out and the cake forms a crust after 24 hours in storage, so does not give rise to dust readily. The sludge cake is shovelled to storage areas within the walled Cake Pad and is not disturbed, until it is removed for export, further minimising the potential to generate bioaerosols emissions to air. The Cake Pad is further sheltered by buildings and structures within the STW site. The bioaerosol content within the digested sludge cake is also low as a result of the treatment processes prior to storage.

In addition to this, the storage tanks, treatment tanks and associated pipework are enclosed. The Secondary Digester Tanks and Digested Sludge Buffer Tank are open, and a wet process. Biogas is emitted, in small quantities, however, the bioaerosol content is low and releases are considered to be nominal. Where tanks are not biogas tight and vent to atmosphere, these are connected to an OCU.

There is one type of odour control, a single stage biofilter. The probability of a bioaerosol exposure is medium, but given the low bioaerosol content and the maintenance checks on this asset, the likelihood of bioaerosol release is anticipated to be low.

The overall probability of exposure from bioaerosols generated from the permitted processes on site is considered to be **Medium.** However, when considering the location of receptors, receptor distances from

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

source, the prevailing wind direction and the onsite management and mitigation measures in place, the overall risks of bioaerosols being generated from the permitted processes on site is likely to be **Low**.

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, set out within EA guidance.

Table 3 summarises the risk assessment.

Table 3: Risk Assessment of Potential Bioaerosols Sources

What has the potential to cause harm? Source	How can the source reach the receptor? Pathway	Who can be affected? Receptors	Assessing the risk Probability of Exposure	What is the harm that can be caused? Consequence	Control Measures Managing the Risk	Overall / Residual risk
Cake Pad and Conveyors	Inhalation via wind-borne transportation	R4	Receptor R4 is the closest receptor to the Cake Pad at approximately 227m. Other receptors are set further back and would receive lower concentrations in the event of a release. The closest receptors are upwind and frequency of wind directions from the East southeast to South is much smaller in relation to the prevailing wind direction. The concrete wall surrounding the Cake Pad and the Site's buildings reduces the likelihood of wind-blown transmissions during handling or export. Bioaerosols content is considered to be small and colony forming units anticipated to be within acceptable levels. Probability of exposure is considered to be **medium**.	Impact on human health (considered to be a sensitive receptor).	The cake conveyors are covered, reducing likelihood of bioaerosols release. The cake conveyor drop heights are minimised and dozer drop heights are also minimised to reduce wind borne transportation during deposition, handling, and movement off site. Water content in the cake reduces susceptibility of wind-borne releases. Sludge cake is moved when required to minimise disturbance on the Cake Pad. The Cake Pad is bunded and stockpile levels are managed so that under normal operating conditions sludge cake does not exceed the height of the surrounding bund wall. Spillages are cleaned up in a timely manner to reduce generating windblown bioaerosols. Staff are trained in managing spills.	Low

What has the potential to cause harm? Source	How can the source reach the receptor? Pathway	Who can be affected? Receptors	Assessing the risk Probability of Exposure	What is the harm that can be caused? Consequence	Control Measures Managing the Risk	Overall / Residual risk
Odour Control Unit	Inhalation via wind-borne transportation	R4	The closest receptor (R4) is approximately 164m from OCU (A9). It is broadly upwind (of prevailing WSW to SW wind direction). The frequency of winds from an East southeast to a South direction are small, therefore a lower probability of a release blowing towards sensitive receptors. Other receptors are set further back. No receptors within 250m of an OCU and downwind of the prevailing wind direction. Mature treeline/ hedgerow offers some screening between sensitive receptors and the site. Probability of exposure from the single stage biofilter OCU is considered to be **medium**	Impact on human health (considered to be a sensitive receptor).	Storage tanks (exception of secondary digester tanks), treatment tanks and associated pipework are enclosed. Where tanks are not gas tight and vent to atmosphere, these are connected to an OCU. The OCU is a single stage biofilter unit, with a high release point to air, thus increasing the dilution and dispersion distance. The OCU is monitored, and media is regularly maintained making the uncontrolled release of bioaerosols very unlikely. The control measures associated with the OCU are regularly maintained to sustain their efficacy and reduce the risk of equipment failure.	Low

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 Emergency Flare stack and/or CHP Engine. Such an event would result in releases of biogas from the PRVs located on the roofs of the Primary Digester Tanks and in the Biogas Storage holder compound, which would release bioaerosols. This occurs to prevent over pressurisation of the Primary Digester Tanks 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 Bishop's Stortford 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. These considered control measures in place to reduce the probability or magnitude of release.

A number of potential sources of bioaerosols within the site processes have been identified, connected to the storage and movement of treated digestate sludge cake at the site and the operation of the single stage bio-filter OCU. The risk from abnormal releases from pressure relief valves was scoped out.

Although only qualitative data is available at this stage, the overall bioaerosols risk to the identified receptors within 250m of potential bioaerosol sources associated with the sludge treatment process is considered to be **Low** based on the receptor distances, probability of exposure and onsite management and maintenance, which would minimise the magnitude and likelihood of any releases.

3.1 Sampling

Thames Water confirms it will use MCERTS accredited providers for the sampling from location A9 – OCU (NGR TL 50135 19800) and will sample the OCU on a bi-annual basis. In addition sampling will also take place in relation to the Cake Pad (NGR: TL 50092 19687 - approx. centre of cake pad).

Which are diffuse source and hence will be monitored purely by agar plates.

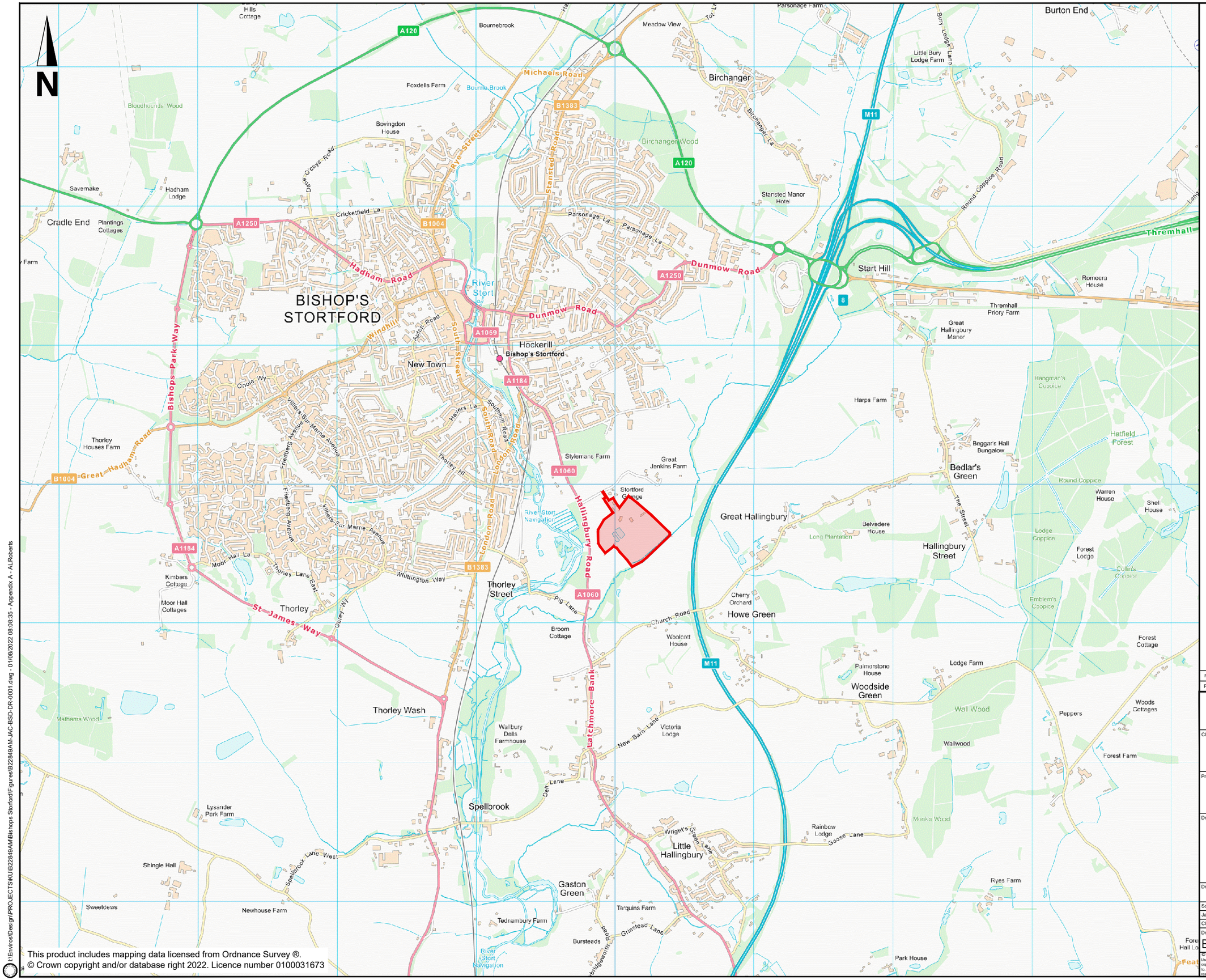
In line with M9, ambient sampling will be conducted to identify background emissions. A sampling round, consisting of four induvial sampling points, each with its own agar plate will be carried out. One point will be located 50m upwind of the OCU stack to give a background concentration, and three will be located in a fan like arrangement downwind and at the same distance to the nearest sensitive receptor (as per M9):

Source	Upwind Location NGR	Downwind Location 1 NGR	Downwind Location 2 NGR	Downwind Location 3 NGR
OCU (A)	TL 5008 1977	TL 5012 1996	TL 5027 1988	TL 5029 1980
Cake Pad	TL 5005 1966	TL 5020 1988	TL 5028 1980	TL 5032 1969

NGR's for sampling locations are only 8 digits at present, to allow the contractor flexibility as to precise location, taking into account the ability to safely locate and access (and security) of the sampling plates.

The upwind OCU monitoring location may be subject to change due to proximity of existing tanks/structures.

Appendix A. Site Location Plan



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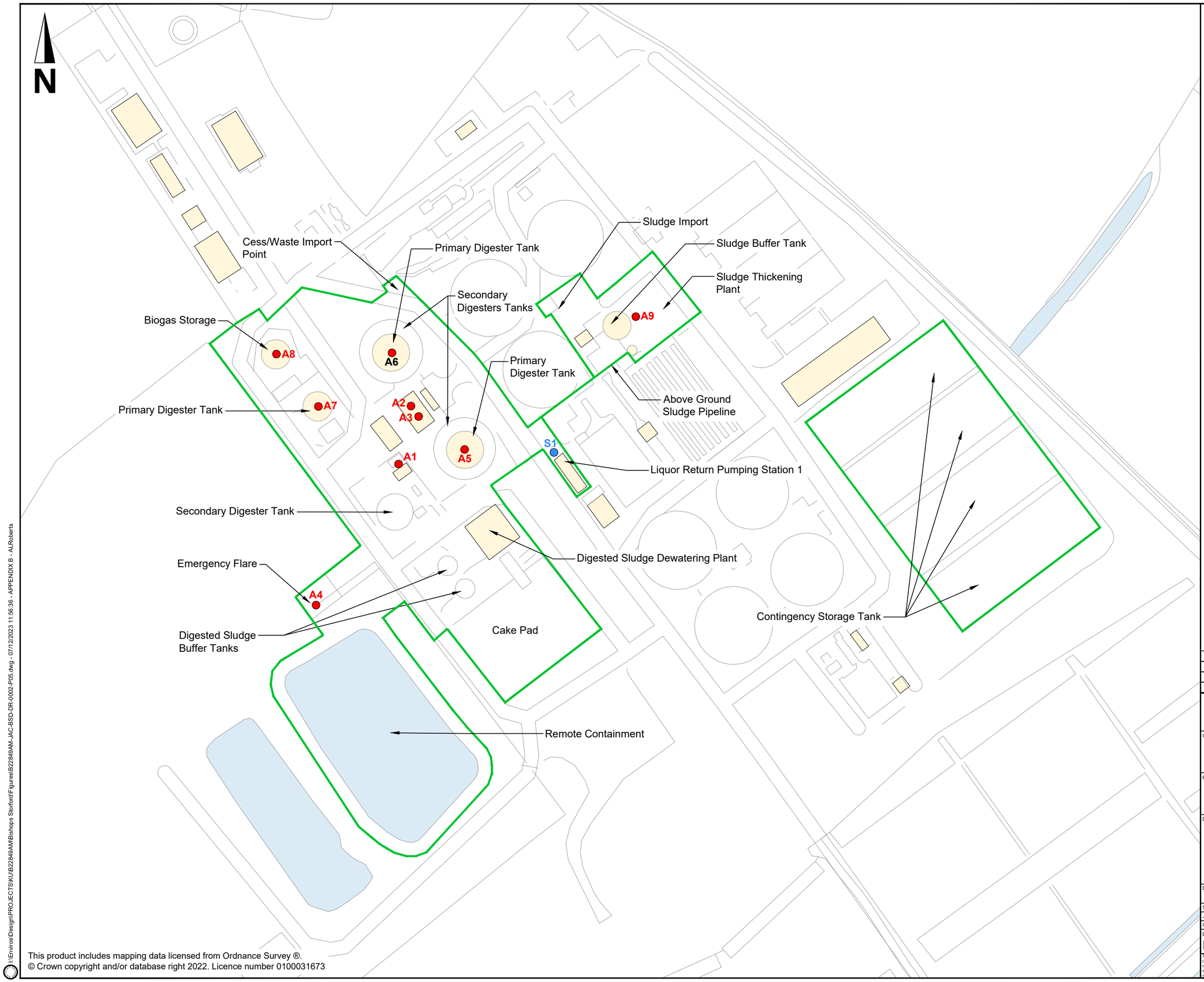
Appendix B. Installation Boundary and Air Emission Points



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KEY:

Installation Boundary

Air Emission Point

A1 - CHP Engine 1
A2 - Auxiliary Boiler 1
A3 - Auxiliary Boilter 2
A4 - Emergency Flare
A5 - Primary Digester PRV
A6 - Primary Digester PRV
A7 - Primary Digester PRV
A8 - Biogas Holder PRV
A9 - OCU 1

0 20 40 60
METRES

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

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www.jacobs.com

Client: Thames Water

Project: STC IED PERMIT
BISHOPS STORTFORD STW

Drawing title: APPENDIX B
INSTALLATION BOUNDARY
AND AIR EMISSION POINTS

Drawing status: PERMITTING

Scale	1:1250	DO NOT SCALE
Jacobs No.	B22849AM	Rev P03
Client no.		

Drawing number: B22849AM-JAC-BSD-DR-0002

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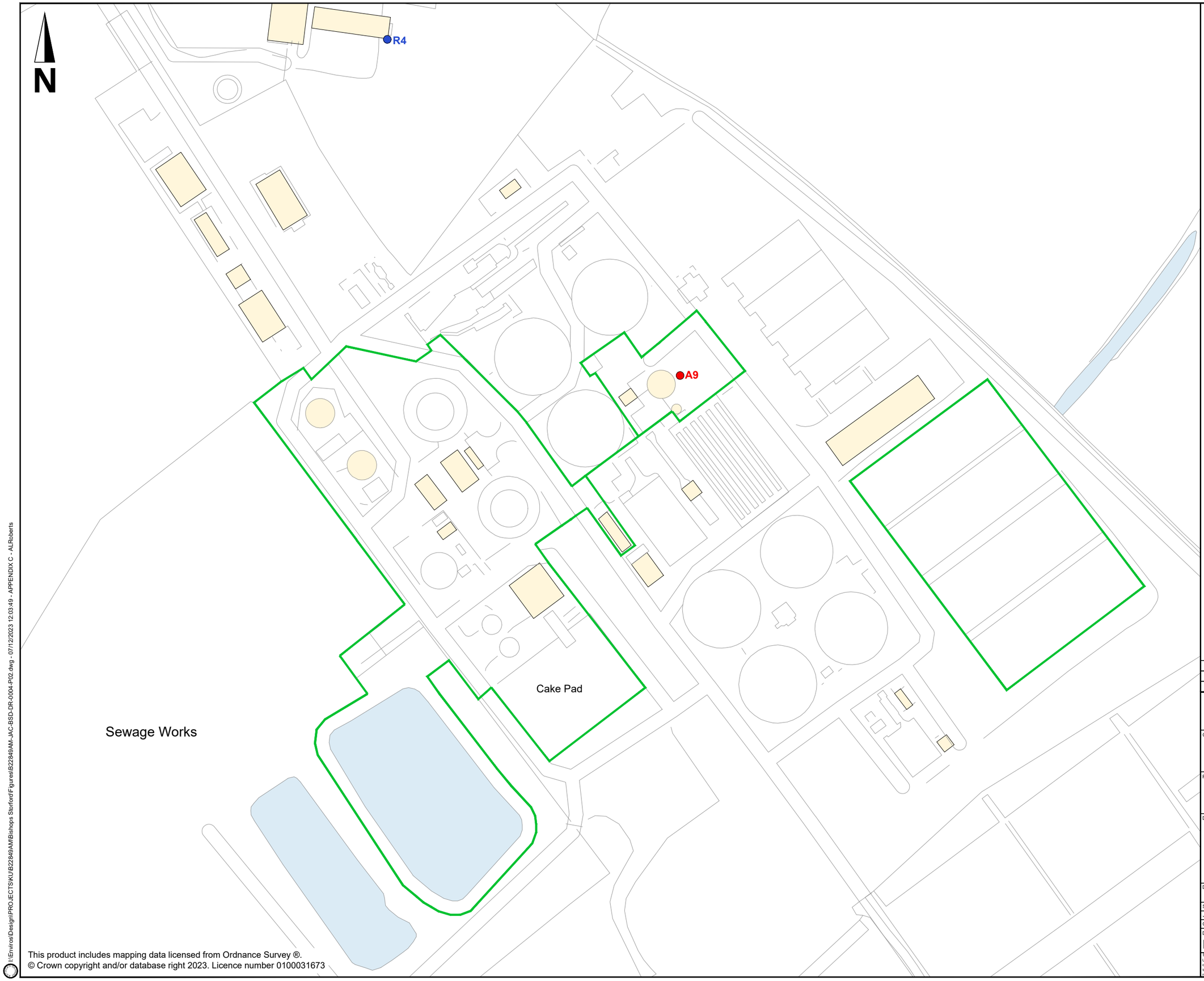
Appendix C. Receptors within 250m of Potential Bioaerosol Emission Sources



KEY:

- Installation Boundary
- Air Emission Point
- Receptor Point

A9 - OCU1

0 20 40 60

METRES

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

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Client: Thames Water

Project: STC IED PERMIT
BISHOPS STORTFORD STW

Drawing title: APPENDIX C
RECEPTORS WITHIN 250m OF POTENTIAL BIOAEROSOL EMISSION POINTS

Drawing status: PERMITTING

Scale	1:1250	DO NOT SCALE
Jacobs No.	B22849AM	Rev P02
Client no.		

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

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