

Maple Lodge STC Bioaerosol Risk Assessment

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Thames Water Utilities Ltd
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Maple Lodge 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 Maple Lodge Sludge Treatment Centre (STC), EPR/FP3435LA.

1.1 Site description

The Maple Lodge site is located to the east of the village of Maple Cross in Hertfordshire in a largely rural environment. The site is bounded on the north and east by the River Colne. To the south is Lynsters Lake and to the west is farmland and Maple Lodge Nature Reserve.

The site location plan is shown in Appendix A and the address of the installation is:

Maple Lodge STW;

Denham Way

Maple Lodge

Rickmansworth

WD3 9SQ

The site is not within an Air Quality Management Area (AQMA). The nearest AQMA is more than 2.5 km to the south-west of the site.

Part of the site benefits from flood defences on the River Colne but parts of the site are within a Flood Zone 3, including some of the sludge thickening plant from within the permitted area; these assets are subject to a 1:100 or greater annual probability of river flooding. Other areas of the site including waste import points, sludge thickening assets, sludge blending assets, some Secondary Digester Tanks, boilers and standby generators are located within areas of Flood Zone 2 with between a 1:100 and 1:1000 annual probability of flooding. Primary digesters, most of the secondary digesters, the cake pad and CHP engines all sit within Flood Zone 1 meaning that there is a less than 1:1000 annual probability of flooding in these areas.

There are a total of five designated habitat sites within the relevant distances of the site. The closest is the Old Park Wood Site of Special Scientific Interest (SSSI), which is located approximately 450 m to the South-East of the site.

1.2 Site Activities

Maple Lodge Sludge Treatment Centre (STC), is located at the Maple Lodge Sewage Treatment Works (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 (DAA), including the operation of a biogas fuelled CHP engine for the generation of electricity and heat at the site.

The site includes the following DAAs:

- Imports of waste, including sludge from other sewage treatment works and imports of municipal liquid or sludges similar in composition to UWWTD derived materials;
- Blending of indigenous sludges and imported wastes/waste sludge prior to treatment;
- Storage of digestate prior to de-watering;
- 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 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;
- Combustion of biogas (or fuel oil) in a Medium Combustion Plant Directive (MCPD) and Specified Generator (SG) compliant biogas CHP engine and boilers units;
- Storage of wastes; including waste oils;
- Operation of siloxane filter plant;
- Operation of biogas flare stack;
- Storage of diesel;
- Storage of fuel oil; and,
- Storage of raw materials.

The STC can treat up to 2,500,000m³ of sludge per year (equating to approximately 2,500,000 wet tonnes). The STC has a total maximum treatment input of 1,514m³ per day (equating to approximately 1,514 wet 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.

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 gas over what the CHP engines 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 permissible 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 note¹ '*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 Maple Lodge Sludge Treatment Centre 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.

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

¹ Environment Agency. July 2018. M9: Environmental monitoring of bioaerosols at regulated facilities v2, July 2018

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 note² 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 Maple Lodge Sludge Treatment Centre 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 (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 release at the Maple Lodge STC, only the storage of sludge cake and export i.e. the handling and storage of waste (under certain conditions) and wind scouring of waste surfaces would apply. Sewage waste to site is received via pipes and is contained and shredding of waste or turning of stockpiles is not undertaken

1.4.2 Relevant Thresholds

Based on the accepted Levels at sensitive receptors as set out in the Environment Agency M17 guidance³ '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 M9⁴; key bioaerosols of interest and their respective threshold Levels (including background) at sensitive receptors are outlined below:

- Total bacteria: 1000 cfu/m³
- *Aspergillus Fumigatus*: 500 cfu/m³

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 Maple Lodge 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 vegetation 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 permitted imported wastes which can be found at the entrance to the wider STW, outside of the perimeter fence. These wastes are imported by road, normally from tankers and tanker vehicles, and consist of liquids and associated sludges from domestic and municipal sources that are similar in composition to those materials derived from the sewer network and managed via the UWWTD route.

The UWWTD treatment process is then followed, where the imported material passes through an inline muncher and passes through both a stone trap and screen in order to remove stones and inorganic material before entering a wet well. The imported material then joins the incoming Maple Cross sewer before all of the material is pumped via the adjacent pumping station to the works inlet via a below ground sewer to a rising main at the head of the STW. The UWWTD Process wet well is connected to an Odour Control Unit.

At the head of the works, sewer derived materials from other pumping stations joins with the Maple Cross sewer and returns from the site drainage, passing through four screens which remove rags and other inorganic materials that are discharged into skips for offsite disposal, passes through detritors to remove grit and then passes into the Primary Settlement Tanks (PSTs) where it is subject to aerobic treatment.

Primary sludge is removed from the PSTs and can follow two routes for thickening. The normal route is for sludge from the PSTs to be pumped through a mainly aboveground sludge pipe to one of four Primary Sludge Picket Fence Thickeners (PFTs) via a high-level distribution chamber. Sludge gravitates from the high-level distribution chamber evenly between the four Primary Sludge PFTs which are above ground tanks, are of steel construction on a raised concrete base. The tanks are uncovered. A rotating fence moves around the inside of the tank and sludge gravitates to the bottom of the tank where it is removed and pumped into the Sludge Blending Tank through a partially subsurface sludge pipe. Liquor from the Primary Sludge PFTs weirs out of the tank and gravitates via site drainage to a Liquor Return Pumping Station and is pumped back to the inlet, downstream of the storm weir and is treated through the STW.

A second route for primary sludge, used when there is excess sludge being handled, is via a Primary Sludge Tank (which is outside of the scope of the IED permit) where sludge is sent to either the Primary Sludge PFTs or to a Primary Sludge Drum Thickener. Some sludge is pumped to a Primary Sludge Drum Thickener, which is located adjacent to the Sludge Blending Tank, and is dewatered with the addition of a polymer (from an Integrated Bulk Container (IBC)) to aid coagulation. The liquors drain to the site drainage system, via a Liquor

Return Pumping Station, where they are returned to the works for additional treatment. Dewatered sludge is pumped to the Sludge Blending Tank. Some sludge is pumped to the Primary Sludge PFTs with operations taking place as described above.

SAS from the aeration lanes is pumped from the Return Activated Sludge (RAS) well to a SAS PFT, where the sludge is drawn off the bottom and pumped to one of three belt thickeners located within the SAS dewatering building. Liquors from the SAS PFT weir over the tank and return to the UWWTD process. The SAS thickening belts dewater SAS with the addition of a polymer (from an IBC) to aid coagulation; polymer is made up in a polymer silo and is pumped to each belt separately. Liquors from the process drain to a sump and are pumped back to the works for additional treatment, via a Liquor Return Pumping Station. Dewatered SAS is pumped to the Sludge Blending Tank where it mixes with indigenous primary sludges and imported sludge.

Imported sludge, normally with a dry solid content greater than 2%, from other waste water treatment sites is imported via two import lines through a sludge logger and into the top of an imported Import Reception Tank. The Import Reception Tank is an aboveground tank of steel construction. The Import Reception Tank is uncovered and not connected to any odour abatement. Sludge is then pumped through chopper pumps to screens which removes additional rag and inorganic material and then the sludge passes into the Sludge Blending Tank.

2.2.2 Waste Treatment

The Sludge Blending Tank is an aboveground, uncovered tank of steel construction that receives indigenous primary sludge, SAS and imported sludge fitted with air mixing to prevent settling of sludge. Sludge is received into the top of the tank and is removed via pumps from a sump in the base of the tank. There are three pumps which transfers sludge via a subsurface pipe with one duty pump for Primary Digester Tanks 1-4, one duty pump for Primary Digester Tanks 5-8 and one standby pump that can be configured to feed either set of digesters.

There are eight floating roof Primary Digester Tanks at Maple Cross STC. All eight Primary Digester Tanks are of concrete construction that extend slightly subsurface with a slightly conical base.

Sludge is pumped from the Sludge Blending Tank in turn into the bottom of each Primary Digester Tank in turn via a subsurface sludge line, controlled by the SCADA system,. Sludge pumped to Primary Digester Tanks 5-8 passes above an engineered surface water channel (known as 'Flakes Channel', which was the former STW outfall) within a sludge pipeline. External heat is supplied via four heat exchanges per Primary Digester Tank to maintain digester temperatures, with the heat normally supplied via heat from the CHP engines but this can be supplemented by heat from auxiliary boilers, as required.

After approximately 21 days residence time, digested sludge weirs out of each Primary Digester Tank, gravitates to Pumping Station 2 and is pumped to the Secondary Digester Tanks via a subsurface sludge pipe. Sludge from Primary Digester Tanks 5-8 passes back above an engineered surface water channel in a sludge pipeline.

There are a total of 14 tanks (in two rows of seven), of which nine are routinely used as Secondary Digester Tanks, two are routinely used as centrifuge holding tanks and three are not normally used. Sludge has a residence time of approximately six days and is subject to air mixing. Each tank is an aboveground, concrete tank that is unenclosed and extends slightly subsurface. Dewatering valves are present on the sides of the tanks but have been decommissioned.

After the appropriate duration to ensure the necessary level of pathogen removal, sludge is automatically discharged from the tank via gravity to tank number 5 – this is hydraulically link with tank number 7 – and the sludge is evenly distributed between tanks numbers 5 and 7. Digested sludge is pumped from tank number 7 to the site centrifuges for dewatering.

Pumps feed sludge, via macerators, through a common line to the duty centrifuge which is manually selected by the Process Controller. There are two centrifuges which operate independently to dewater digested sludge with the use of a polymer to aid coagulation. Polymer powder is delivered by bulk tankers and blown into a 25 tonne banded bulk polymer silo. It is then mixed with water within a mixing tank and stored in a dosing tank before being pumped to each centrifuge individually.

Biogas is combusted within one of the two CHP engines at the site, generated electricity is used within the site and exported to the National Grid. Heat generated by the CHP engines is used to maintain primary digester temperatures via heat exchange with auxiliary boilers available to provide additional heating as required. Boilers are dual fuelled by both biogas and fuel oil. CHP engines are classified as 'existing' combustion plant under the Medium Combustion Plant Directive. In the event there is excess biogas, i.e. more than the CHP engines or boilers can utilise, or in the event that the CHP engines or boilers are unavailable, there is a ground mounted emergency flare. This is utilised under 10% of the year or less than 876 hours per year.

2.2.3 There are no odour control units associated with the sludge process at Maple Lodge STC. Digested cake

Digested sludge cake is conveyed to the adjacent open cake pad, dropping off the conveyor and being moved by shovel loading vehicles to the far side of the cake pad as required. Centrate drains from the centrifuge to a wet well. The cake pad is an engineered concrete pad that is enclosed on all sides by a low-level wall but open to the air.

Gully drainage channels prevent run off through the vehicle entrance/exit and the pad falls towards the far side where drainage holes direct runoff to the centrate sump, where along with centrate from the two centrifuges, liquors are pumped back to the works inlet for further treatment through the aerobic process.

Digested sludge cake is removed from the site by lorry and is subject to removal from site under the Sludge Use in Agriculture Regulations 1989 (SUiAR), and in accordance with the BAS. Digested sludge cake is collected from site every few days and the exiting lorries pass through a wheel wash before leaving the cake pad area and wider STW.

The risk of bioaerosols from the cake pad is considered to be low due to the lack of proximity of sensitive receptors where people live or work for more than 6 hours at a time. Although there are commercial premises (a visitors building for the TWUL owned adjacent nature reserve) and the cess/waste import point within 250 m of the cake pad, receptors will only be at these locations for short durations of time. The nearest residential receptors are over 400 m away.

Anaerobic digestion of sludge takes place within a closed system, so the risk of bioaerosols from this source is low.

2.2.4 Odour Control Units

Sewage treatment works have a number of potentially odorous sources within their boundary. During site assessment and design, some of these sources may be linked to odour control units (OCUs) to treat potentially odorous compounds given off by the process. These units take air extracted from above tanks or process areas, and treat the odours compounds by means of different methodologies dependent upon the nature of the odours 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. Biofilters are considered to be a potential emission source for bioaerosols, whether used in isolation or with a second methodology.

There are no OCUs associated with the sludge process at Maple Lodge STC.

2.2.5 Seasonality

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

However, digested sludge cake storage on site, both in relation to duration and volume, varies across time. Digested sludge 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, digested sludge cake 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 digested sludge cake within the storage bays during the autumn and winter, under normal conditions, than during the summer period.

2.3 Potential Sources

There are 16 point-source emissions to air from the processes within the installation boundary, at the following locations as described in the main permit. The references and source descriptions match those in the permit:

Table 1: Point source emissions to air

Air emission reference	Source	In scope as a source?
A5a	Boiler 2a	x
A5b	Boiler 2b	x
A5c	Boiler 2c	x
A5d	Boiler 2d	x
A8a	CHP Engine 2a	x
A8b	CHP Engine 2b	x
A9	Biogas Flare	x
A13 – A20	Digester PRVs	x

The location of these emission points is shown on the site layout plan at the emission plan in Appendix B.

The cake pad and storage area is also considered a source of bioaerosols emissions and is shown on the plan in Appendix B, however this is considered a diffuse source and not a point source and is therefore not included within the above table.

2.3.1 Source Assessment

The CHP engines, boilers and emergency flare 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 are no OCUs associated with the sludge process at Maple Lodge STC.

The Pressure Relief Values (PRVs) (points A13 – A20) 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, the PRV's would open to relief excess biogas pressure, potentially resulting in the release of bioaerosols, while the problem is rectified. While the problem is rectified, biogas generation is reduced 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 (diffuse source) from treated, dewatered sewage cake which is stored on the cake pad at the site.

2.3.2 Risk

The overall treatment process is considered to be a low source of bioaerosols as discussed above, there are a number of 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

greatest probability of exposure from bioaerosols emitted from the site is from uncovered operations such as the cake pad.

Digested sludge cake is conveyed to the adjacent open cake pad, dropping off the conveyor and being moved by shovel loading vehicles to the far side of the cake pad as required. Centrate drains from the centrifuge to a wet well.

Digested sludge cake retains a high moisture content and is not prone to being dusty. A wheel wash is used for vehicles exiting the digested sludge cake pad and roads will be maintained to avoid the production of dust.

Anaerobic digestion of sludge takes place within a closed system.

Digested sludge cake is stored on the cake pad on the north-western corner of the site, more than 100m away from sensitive receptors and the risk from bioaerosols is considered to be low.

In addition, the majority of storage tanks, treatment tanks and associated pipework are enclosed. There are no OCUs associated with the sludge process at Maple Lodge STC. PRVs are only opened in abnormal situations which are temporary and unlikely.

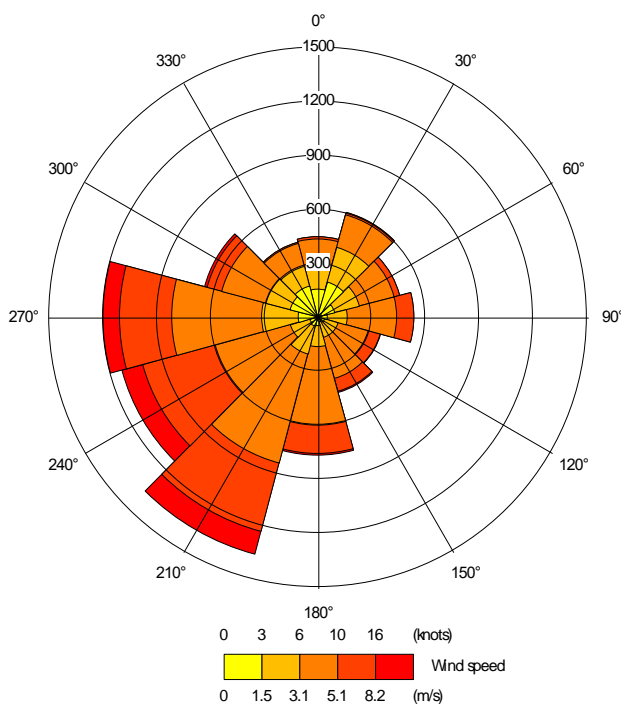
2.4 Pathways

Bioaerosols are very small and light in weight so can easily be transported by the wind from their source to a human health receptor where they may be inhaled.

The 2019 wind rose for the most representative meteorological site, Heathrow airport (located approximately 15.9 km South of the Site), 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.

Figure 1 – Heathrow 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 HSE⁵ 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. RR786 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.

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.

There are two sensitive receptors found within 250m of potential bioaerosol emission sources at the site, as shown on the site plan found in Appendix C.

For each of these receptors, the distance and direction from each potential bioaerosol emission source to the closest sensitive receptor has been identified. Where multiple assets exist for the same process, such as cake bays, only the closest location has been presented. The receptor closest to a potential emission source are buildings associated with Springwell Reedbed/Lake, approximately 100m North-East of the Cake Pad.

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

Receptor	Description	Source	Distance from closest source (m)	Direction from the Source
R1	Recreational: Springwell Reedbed/Lake*	Cake pad	100m	North- East
R2	Recreational: Maple Lodge Nature Reserve**	Cake Pad	115m	West

*The relevant receptor here would be anglers, which may have the potential to be present for >6hours in one location on the bank of the lake, and so the closest point of the lake has been used to measure the distance to the receptor.

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

** The Maple Lodge Nature Reserve has been included as a receptor as there is the possibility that people may stay here for a number of hours given that events are organised here and manned for the day by the conservation society. The distance taken from the cake pad is the closest path.

The Grand Union Canal is home to a number of houseboats with residents who permanently live in the location, the closest point of the canal to sources is >250m and so these have been excluded from the assessment.

The River Colne is located close to the site and aerial photography shows boats along the stretch of river near the site, however these appear disused, and so this location has been excluded as a receptor.

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 model⁶ to help determine the magnitude of the risk associated with bioaerosol emissions from a facility.

There is one potential source of bioaerosol releases within 250m of static receptors:

- Cake Pad

The receptors are situated to the North-East and West of the release point and the prevailing wind direction is from the South-west. There is potential for wind-borne transportation of bioaerosols, more so in the direction of Receptors R1, less so for R2.

Most storage tanks, treatment tanks and associated pipework are enclosed. Where tanks are not gas tight and vent to atmosphere, these are either connected to an OCU, or the moisture content is not low enough that there is not considered to be a risk of release of bioaerosols.

The maximum daily throughput of sludge is 1,514m³/day.

The cake pad is approximately 100m from the Springwell lake (R1) at the closest point and is the closest sensitive receptor. This is downwind from the potential emission source however the presence of vegetation is likely to provide significant protection against any bioaerosols. The probability of exposure to users of the lake from bioaerosols emitted from the site is likely to be **low** (if releases occur at all).

Maple Lodge Nature Reserve members building (R2) is located 115m West of the cake pad. The workers and visitors at this location are within the relevant distance of this potential emission source however the magnitude of any bioaerosol release is likely to be **low**. This is because there is some vegetation in between which may provide some protection and the prevailing wind is also not blowing in the direction of the members building, which may provide some protection.

The **likelihood** of bioaerosols being emitted from the permitted processes on site is considered to be **low**, and taking into account the location of receptors, their distance from source, and the control measures in place the overall risk is considered to be **low** or **minimal**.

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

Table 3 summaries the risk assessment.

⁶ [Risk assessments for your environmental permit - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit)

Table 3: Risk Assessment of Potential Bioaerosols Sources

What has the potential to cause harm?	How can the source reach the receptor?	Who can be affected?	Assessing the risk	Consequence (what is the harm that can be caused)	Managing the risk (Control Measures)	Overall/residual risk
Source	Pathway	Receptors	Probability of Exposure			
Cake Pad	Inhalation via wind-borne transportation	R1, R2	<p>Receptors downwind are >100m away from the cake pad and generally screened by vegetation. Only the lake is in the direction of the prevailing wind, however visitors (such as anglers) should be well protected by vegetation covering most of the intervening distance.</p> <p>Probability of exposure from the cake pad is considered to be low.</p>	Impact on human health (considered to be a sensitive receptor).	The cake pad is enclosed on all sides by a low level wall to protect from the wind. Digested sludge cake retains a high moisture content and is not prone to being dusty. Digested cake is removed from the pad every few days with lorries passing through a wheel wash to avoid the production of dust.	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 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 gas holder compound, which would release bioaerosols. This occurs to prevent over pressurisation of the digesters and gas 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 from bioaerosols arising from operations at the Maple Lodge 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 of exposure. This considered control measures in place to reduce the probability or magnitude of release.

A small number of potential sources of bioaerosols within the site processes have been identified, however only two are within 250m of a static receptor, the cake pad. However, given the distance from the emission points, the trees and vegetation which are likely to be protective of the receptors and the control measures in place to contain bioaerosols, meaning their release is likely to be minimal, the overall (residual risk) to receptors is considered to be low.

Sampling will take place in relation to TQ 03923 92407 (approx. NGR of centre of cake pad) which is a diffuse source and hence will be monitored purely by agar plates.

Downwind samples will tend to be towards the north of the site, as the closest receptors to the cake pad is point R1. The prevailing wind is from the SW, so receptor R2 is less likely to be impacted.

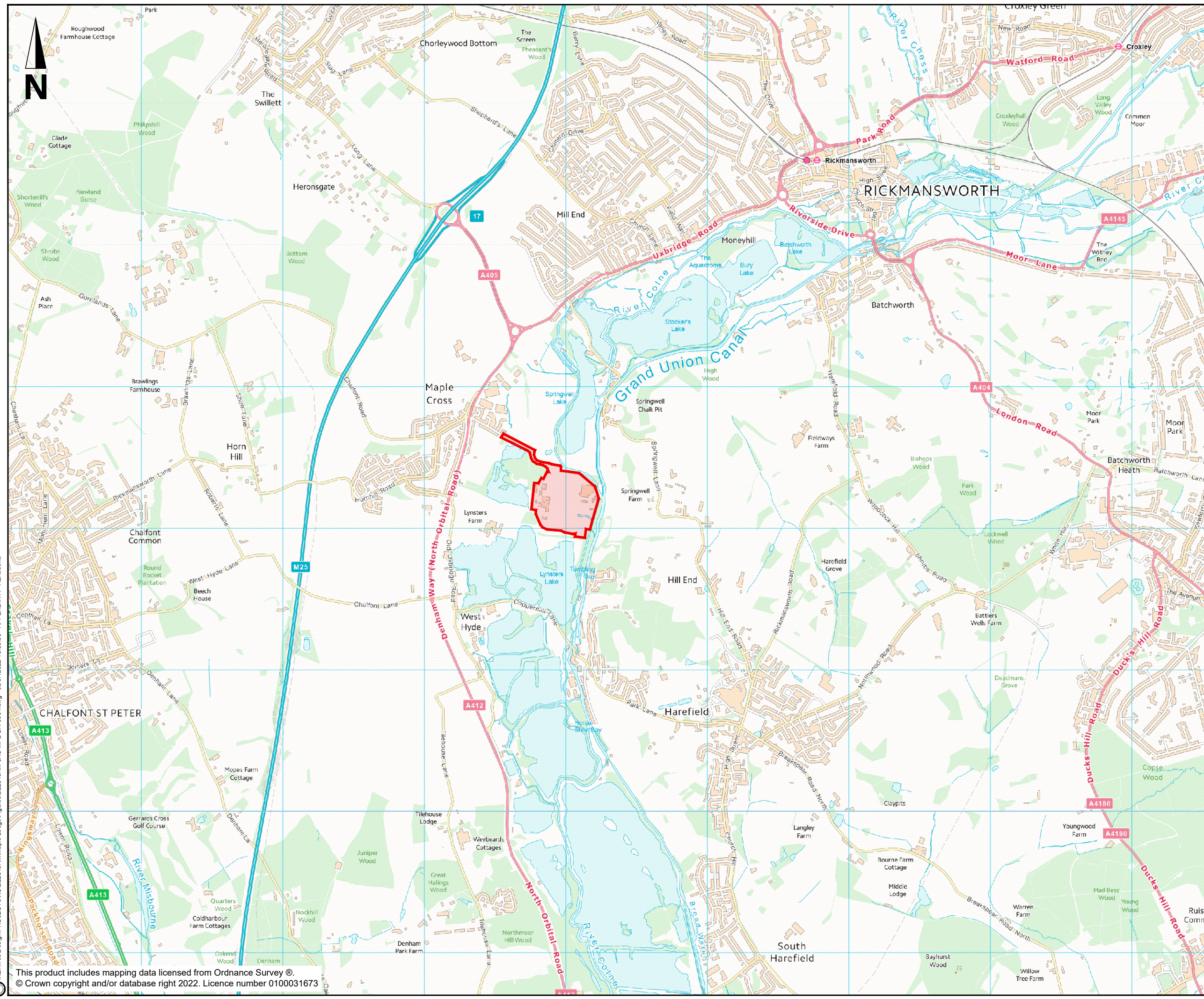
Cake pad


- Upwind sample location which is approx. 50m SW of the cake pad: TQ 0385 9234
- Downwind sample location 1 which is approx. 110m N of the pad: TQ 0399 9253*
- Downwind sample location 2 which is approx. 85m NE of the pad: TQ 0402 9248
- Downwind sample location 3 which is approx. 185 NW of the pad: TQ 0373 9252*

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



*shared sampling points.

Appendix A. Site Location Plan



KEY:
 Site Location

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Rev	P01	JUL 2022	FOR INFORMATION	AR	HEK	JK	MM
			Purpose of revision	Drawn	Checked	Rev'd	Approved
 Jacobs House, Shrewsbury Business Park, SY2 6GG Tel: +44(0)1743 284 8000 Fax: +44(0)1743 284 800 www.jacobs.com							
							
Project STC IED PERMIT MAPLE LODGE							
Drawing title APPENDIX A SITE LOCATION PLAN							
Drawing status PERMITTING							
Scale				DO NOT SCALE			
Jacobs No. B22849AM				Rev P01			
Drawing number B22849AM-JAC-MPL-DR-0001							
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Appendix B. Potential Bioaerosol Emission Points



Cess/Waste Import Point

Cake Pad

Sludge Dewatering Plant

Liquor Return Pumping Station 1

CHP Engines 2a and 2b

Old Power House

Decommissioned fuel oil supply line

Decommissioned fuel oil tanks

Secondary Digester Tanks

Decommissioned Compressors

Boilerhouse

Biogas Pipeline

Primary Digester Tanks 1 - 4

Biogas Flare

Sludge Blending Tank

Liquor Return Pumping Station 2

Import Reception Tank

SAS Thickening Belts

Sludge Import Point

SAS Picket Fence Thickener

Primary Sludge Tank

Primary Sludge Drum Thickeners

Primary Sludge Picket Fence Thickeners

Primary Digester Tanks 5 - 8

Path

Pit (dis)

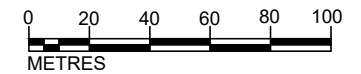
KEY:

Installation Boundary

Tanks Excluded from Permit Scope

Air Emission Point

- A5a - Boiler 2a
- A5b - Boiler 2b
- A5c - Boiler 2c
- A5d - Boiler 2d
- A8a - CHP Engine 2a
- A8b - CHP Engine 2b
- A9 - Biogas Flare
- A13 - Primary Digester PRV
- A14 - Primary Digester PRV
- A15 - Primary Digester PRV
- A16 - Primary Digester PRV
- A17 - Primary Digester PRV
- A18 - Primary Digester PRV
- A19 - Primary Digester PRV
- A20 - Primary Digester PRV



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P04	JUN 2023	FOR INFORMATION	AR	HEK	JK	MM
P03	JUN 2023	FOR INFORMATION	AR	HEK	JK	MM
P02	FEB 2023	FOR INFORMATION	AR	HEK	JK	MM
P01	JUL 2022	FOR INFORMATION	AR	HEK	JK	MM
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Client

Project
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Drawing title
APPENDIX B
POTENTIAL BIOAEROSOL
EMISSION POINTS

Drawing status
PERMITTING

Scale
1:2500
DO NOT SCALE

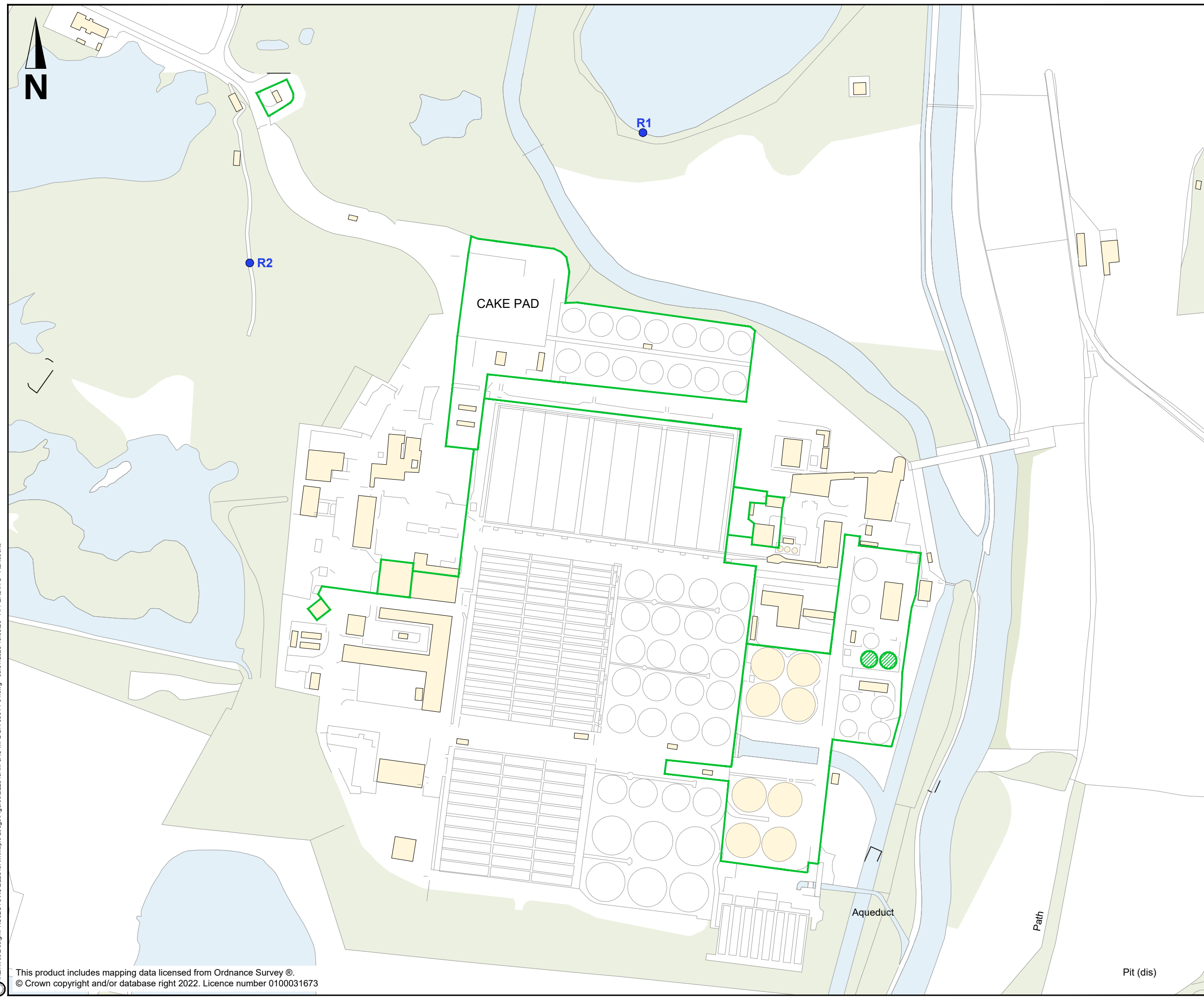
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


Drawing number
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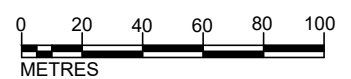
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Appendix C. Receptors within 250m of potential emission points



- KEY:**
-  Installation Boundary
 -  Tanks Excluded from Permit Scope
 -  Receptor Point
- R1 - Springwell Reedbed/Lake
R2 - Maple Lodge Nature Reserve
R3 - Maple Lodge Close (Residential)



P04	JUN 2023	FOR INFORMATION	AR	HEK	JK	MM
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P02	FEB 2023	FOR INFORMATION	AR	HEK	JK	MM
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Drawing title
**APPENDIX C
RECEPTORS WITHIN 250m OF
POTENTIAL EMISSION POINTS**

Drawing status
PERMITTING

Scale
1:2500 **DO NOT SCALE**

Jacobs No. B22849AM Rev
Client no. **P04**

Drawing number
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