ANGLIAN WATER SERVICES LTD.

Whitlingham Water Recycling Centre And Sludge Treatment Centre

Odour Management Strategy

This document must be reviewed at intervals not exceeding 12 months

Revision	Authors	Date of Issue	Comments
1.0	J Van de Moortel & A Paskins Mott MacDonald	2 Dec 2011	First draft
2.0	Pete Holland	17 Dec 2011	Following EA review
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9.0	A. Pope	10/05/2018	Update
10.0	S Spencer	16/03/21	Review

Note: This document is one part of a four part document and should not be issued separately. The sub Odour Management Plans should always be read in conjunction with the Odour Management Strategy and the General Information Section

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1 Overview

1.1 Introduction

The Anglian Water site at Whitlingham is located at:

Whitlingham Water Recycling Centre
Kirby Bedon Road
Trowse
Norwich
NR14 8TZ

Grid Reference: OS: X 627604 Y 307694
NGR: TG 27900 07602

Figure 1.1. Location map for Whitlingham WRC

The site consists of two plants:

- Water Recycling Centre (WRC).
- Sludge Treatment Centre (STC).

Whitlingham WRC serves a population equivalent in excess of 375,000 including several large traders (Major traders Briar Chemicals and

Colmans). This includes the entire city of Norwich and its suburbs and the outlying villages of Hethersett, Horsford, Horsham St. Faiths, Spixworth, Brundall, Blolfield and Rackheath. Treated effluent is discharged to the adjacent River Yare. The treatment plant consists of primary settlement secondary treatment in a biological nutrient removal activated sludge process. The odour emissions from WwTW are subject to legislation relating to Statutory Nuisance.

The STC provides enhanced digestion, treating indigenous as well as imported sludges from satellite sites (see the appendix at the end of this document). Treated sludge is an enhanced product suitable for recovery to agriculture. The biogas produced from the digestion process is used in Combined Heat and Power (CHP) plants to produce power for both the STC and WRC. The CHP is regulated under a separate Environmental Permit, including emissions data and monitoring.

The Whitlingham site also has a sludge liming plant which has been taken out of service and will only be used in the event that the Cambi process experiences a significant long-term failure.

The permitted activity at the STC is subject to an Environmental Permit which requires an Odour Management Plan (OMP) specific to this activity.

Planning permission has been granted for a Green Waste Co-composting Facility (GWCF) to be operated on a large concrete pad to the south west of the STC see Appendix D. This facility combines composting of green waste with that of enhanced digested sludge cake and limed sludge (from other works).

Operation of the proposed co-composting facility requires the provision of an OMP specific to the GWCF.

A Cake import building was commissioned into use in 2016 to allow dewatered cake to be imported into the site for treatment.

The Whitlingham Site is located close to the boundary between Broadland District Council (BDC) and South Norfolk Council (SNC) and therefore liaison with both Environmental Health Departments is required.

1.2 Odour Management Plan structure

The OMPs outline the management systems in place to ensure comprehensive and coherent management of odour issues on the Whitlingham site. They outline the procedures for odour monitoring,

dealing with complaints and guidelines to ensure a common approach to resolving odour problems from the different sites.

These OMPs follow the following structure:

- Overview of operations.
- Management structure and responsibilities.
- Summary of potential receptors.
- Summary of potential odour sources.
- Summary of control measures for each site.

To satisfy the Environmental Permit requirements, the STC has a site specific OMP covering the relevant plant, processes and risks on site. An OMP for the WRC has also been produced to complete the information for the Whitlingham site.

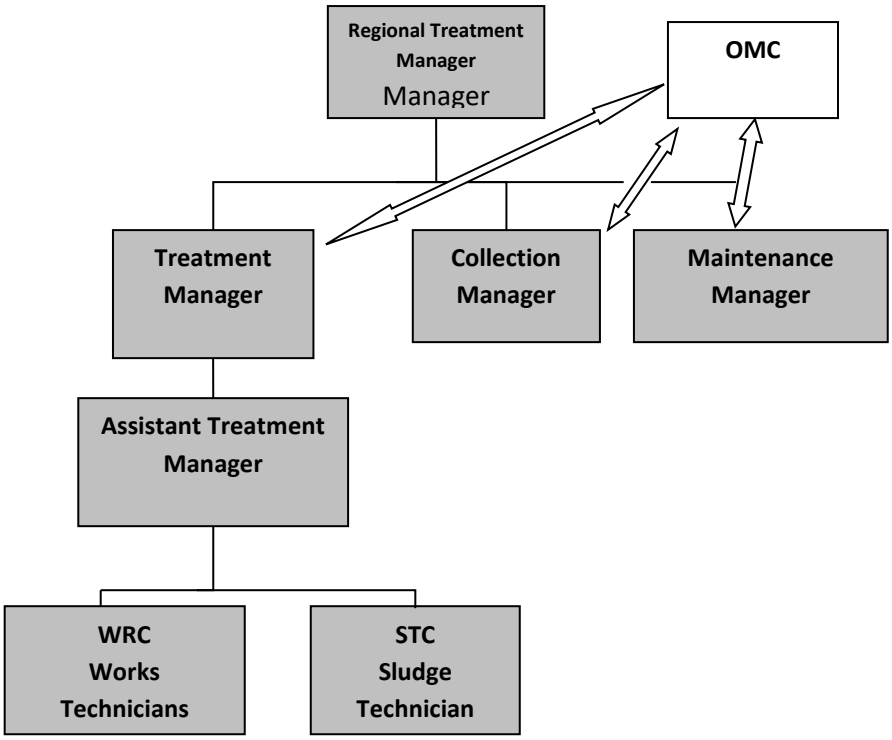
2 Site Management

2.1 Management Structure

The WRC and STC have a single Site Manager, owing to the considerable interactions between the two plants. The WRC is also closely linked to the sewerage network in the catchment, under the Collection Manager. The pumping stations in the catchment are managed by the Maintenance Manager. The Treatment Manager reports to the AW Regional Treatment Manager.

The Operational Management Centre, open 24 hours per day, 365 days per year, monitors operations for all AW sites and collects and feeds back operational problems and their wider implications to the site managers. This allows for a global view of the state of AW Operations.

Site Management Structure



2.2 Roles and Responsibilities

Each plant is managed by the site based manager and Assistant Manager plus permanent staff − six works technicians for the WRC, four sludge technicians for the STC.

Technicians are responsible for ensuring all assets associated with effective operation of the site are operating correctly and are also responsible for minor maintenance. Technicians are also responsible for clearing up accidental spillages of materials which could give rise to odours if left.

In addition to the site based staff, a team of electricians and fitters under a Maintenance Manager carry out electrical and mechanical maintenance. Planned inspections of plant and machinery are carried out periodically (varying depending on criticality) as part of AWs maintenance strategy.

The Treatment Manager is responsible for ensuring adequate communications are maintained with personnel responsible for other plants and services which impact on the treatment process, and ensure that necessary measures are taken to resolve operational problems impacting on the Whitlingham site.

They are also responsible for ensuring that a combined approach to monitoring and resolving odour issues is taken and that OMPs are updated

on a regular basis to include upgrades to the plant or to manage new odour issues.

The Correspondence Team is responsible for logging odour complaints that are called in to the Anglian Water contact centre. They log actions and outcomes on the Systems, Applications and Products in Data Processing Database (SAP) which is reviewed regularly by the company to perform a root cause analysis for odour problems. Any odour complaints received by the site manager via the EA/EHO are investigated using the 'odour complaint investigation form' logged in the site diary including the outcome of the investigation completed at the time.

2.3 Training

Site operators should receive the training relevant to the site specific processes including odour control measures.

Job Role	Number Of Staff	Training Completed	Future Training
Treatment Manager	1	Process Qualifications (2 X mandatory, 8 X optional internal AW qualifications) N.E.B.O.S.H. Manager Steam Awareness Sludge Treatment (HACCP) Process Qualification Licence to Operate (Internal AW competency assessment) CoTC (Level 4) – Biodegradable Waste	Refresher training
Assistant Manager	1	Licence to Operate (Internal AW competency assessment)	CoTC (Level 4) – Biodegradable Waste Refresher training Manager Steam Awareness Sludge Treatment (HACCP) I.O.S.H.
Works Technician - Process Controllers	6	Process Qualifications (2 X mandatory, various optional) Steam awareness training Appointed Boiler attendant Sludge Treatment (HACCP) Process Qualification Licence to Operate (Internal AW competency assessment) 1x Works tech COTC (Level 4) - Biodegradable waste	1 x technicians are planned to complete all courses in 2017/18. Any new starters would be trained to the same level as this.

Sludge Technicians	4	Sludge Treatment (HACCP) Process Qualification	Licence to operate

3 Summary of Potential Odour Risks at Whitlingham

3.1 Identification of Potential Receptors

As part of the Odour Risk Assessments for the different treatment plants, potential receptors of odour nuisance have been identified.

The main receptors for odour within the immediate vicinity of the Whitlingham site are:

1. Whitlingham cottages
2. Whitlingham Hall
3. Boundary lane
4. A47 (complaints from people passing the site)
5. Yarmouth Road
6. Whitlingham Hall, Kirby Road
7. Postwick (village)

These can be found on the map in the Common Information Section (pg 10).

The pathway for odour to reach receptors is by air. The predominant wind direction is SW with an average speed of 4.3 m/s. Meteorological wind data and roses for Whitlingham are based on RAF Coltishall for 2003 and Norwich for 2007, see Appendix D. This data is the most representative for Whitlingham site.

An odour risk assessment was completed for the site. The purpose of the assessment is to identify potential sources of odour and the receptors, to quantify the risk associated with the odour source and the management controls required to minimise this risk.

The initial risk is based on the probability of a receptor being exposed to the nuisance and the consequences of such exposure (undertaken assuming no management controls are in place). The resultant magnitude of risk then prioritises the areas that need attention and the level of management control required to reduce this risk. Once these management controls are instigated then the residual risk can then be assessed.

A matrix is used to determine the overall risk and uses the following definitions:

Probability

HIGH	Exposure is probable: direct exposure with few/no barriers between hazard and receptor
MEDIUM	Exposure is fairly probable: feasible exposure possible, barriers to exposure less controllable
LOW	Exposure is unlikely: several barriers exist between hazard and receptors to mitigate against exposure
VERY LOW	Exposure is very unlikely: effective multiple barriers in place to mitigate against exposure

Consequence

SEVERE	Sufficient evidence that short or long term exposure may result in serious damage
SIGNIFICANT	Sufficient evidence that exposure to hazard may result in damage that is not severe in nature and is reversible once exposure ceases
MINOR	Damage not apparent though reversible adverse changes may occur
NEGLIGIBLE	No evidence of adverse changes following exposure

The comparison between the probability and consequence provides the following level of risk:

		CONSEQUENCES			
		Negligible	Minor	Significant	Severe
PROBABILITY	High	MEDIUM	MEDIUM	HIGH	HIGH
	Medium	LOW	MEDIUM	MEDIUM	HIGH
	Low	LOW	LOW	MEDIUM	MEDIUM
	Very low	Very Low	LOW	LOW	MEDIUM

3.2 Summary of Main Risks

All stages of the WRC have been identified as potential sources of odour. From the Summer 2010 survey the main odour sources are:

- Inlet sewer and pumping station
- Storm tanks & cleaning
- Screenings & grit handling
- Primary tanks and desludge wells

Chemicals are dosed at key pumping stations in the catchment and at the works inlet to suppress septicity and thus reduce odour production. Also odour suppressant sprays are installed in the vicinity of the inlet works, to suppress emissions should they occur. The odour risk assessments for each area of site can be found within the relevant sections sub-document.

All stages in the STC have been identified as potential sources of odour. The main odour sources from the Summer 2010 survey are:

- Sludge import facilities.
- Sludge thickening.
- Blending tanks.
- Sludge storage tanks.

Since the 2010 Summer odour survey, odour control units have been installed in the STC at key locations to minimise the potential for odour nuisance. The last odour survey was completed in August 2014 to review the efficacy of the new installations. A new odour survey is planned for 2017.

The sludge cake pad is equipped with an odour suppressant spray facility to suppress emissions from this area should this be needed. Emissions are very low from this area and the suppressant spray system is not routinely used. The spray system was previously installed in this location when limed sludge was stored here.

Existing measures for each area of site are documented within the site specific OMP.

The OMPs will be subject to periodic review at least once per year, or in light of any operational changes likely to affect odour impacts.

3.3 Incidents and Emergencies

Anglian Water follows a company-wide emergency planning and procedures policy (EMPROC), this details incident response at each level in the company including local incident management right up to strategic incident management.

For Whitlingham, examples of incidents that we would expect the local manager to use Emproc to resolve are significant and prolonged power failure, significant plant failure. The procedure does not outline specific contingencies for every eventuality but rather contains key contact details, trigger levels to open up local and regional (and potentially company) incident rooms.

On top of this, Whitlingham also has procedures in place for emergency alarms including potential Gas leak and potential Fire.

4 Monitoring and Control

4.1 Summary of Control Measures within OMPs

Monitoring of odours will be a combined effort by the Treatment Manager and site staff. Procedures for odour monitoring have been detailed in the site specific odour management plans.

Control measures have been provided for each treatment plant as detailed in the site specific OMPs. A summary of these is presented below. A map of the site with odour monitoring points can be found in the Common Information Section (pg11).

WRC

- Operation of Nutriox dosing in the network to reduce septicity in the influent wastewater.
- Weekly records of primary tanks desludging
- Good house keeping including timely cleanup of spillages.
- Operation and monitoring of performance of odour scrubbing systems.
- Emptying & cleaning of storm tanks after use.

STC

- Six monthly odour monitoring surveys at specific locations.
- Routine monitoring once per week by a walk round Sniff test and checking all potential sources of odour, security of covers etc.
- Wind direction will be considered before any non routine work likely to release odour is carried out.
- Good house keeping including timely cleanup of spillages.
- Operation and monitoring of performance of OCUs.

5 Complaint Management

All complaints directly received by Anglian Water through the contact centre are recorded on SAP and assigned a job type and priority (depending on the details received from the customer at the time). These complaints are then passed to the local team for investigation and action. Complaint numbers/dates are shared with the Environment Agency and the District Councils.

5.1 Dealing with Complaints

Anglian Water employs Custom Liaison Managers (CLMs) who handle customer contacts on a day to day basis. Any complaints received by the Contact Centre are passed to the CLMs to gather the relevant information

and reply to the customer. Complaints that are sent directly to the Treatment Manager are investigated and responded to by the Treatment Manager.

5.2 Record Keeping

Details of all complaints raised by the Contact Centre are stored on SAP. This includes the actions taken by the field agents and details of conversations with the public. Details of all complaints received by the Treatment Manager are kept and maintained in a site diary, this includes all the relevant atmospheric data and operational activities on the day of complaint.

5.3 Community Engagement

Community engagement has historically been and is currently extensive regarding the Whitlingham Site. A full description can be found in the Common Information Section (Section 3.3 pg6). The site is treated holistically and so any open days/public meetings etc are represented by all parties involved with the current and future activities on the site.

ANGLIAN WATER SERVICES LTD.

Whitlingham Water Recycling Centre

Odour Management Plan

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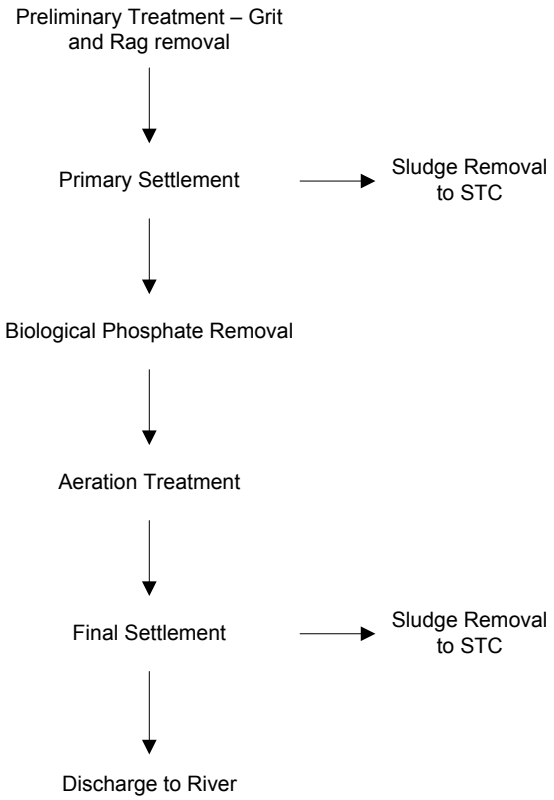
1 Overview

1.1 Introduction

Whitlingham WRC serves a population equivalent of 375,000 including several large traders (currently the two most significant traders are Briar Chemicals and Colmans). This includes the entire city of Norwich and its suburbs and the outlying villages of Hethersett, Horsford, Horsham St. Faiths, Spixworth, Brundall, Blofield and Rackheath. The Norwich Catchment is a mixture of combined and foul only sewers with the majority being combined. The treated effluent from Whitlingham discharges to the tidal River Yare.

An annotated plan of the WRC is shown in Figure 1

Figure 1



The main sensitive receptors are located within the immediate vicinity of the Whitlingham. (See Sensitive receptor locations in the Common Information Section pg10).

This OMP has been produced taking account of the Defra Code of Practice and current EA guidance.

1.2 Wastewater Treatment Processes

General

Wastewater from the catchment is collected via a system of gravity sewers and rising mains for delivery to the Water Recycling Centre. Septic waste is also discharged from tankers to the inlet channel.
Treatment on site includes the following processes;

- Preliminary treatment
    - Screening
    - Grit removal
    - Storm water separation
    - Storm water storage and treatment
- Primary settlement
- Biological treatment by the activated sludge process to remove organic pollutants, and nutrients (nitrogen and phosphorus)
- Final settlement

The treated effluent is discharged by gravity to the River Yare.

Primary and secondary sludge from the wastewater treatment process is transferred to the Sludge Treatment Centre (STC) for thickening and further treatment. This is described in the Sub-OMP for the STC.

Sewerage Network System with Chemical Dosing

A simple schematic of the collection system can be found in Appendix 3 of this document showing the Terminal Pumping Stations (TPS's).

The sewerage network includes seven terminal pumping stations that discharge to the inlet works at Whitlingham and several in-line pump stations located in the catchments that feed into these seven TPS's.

80% of the crude sewage inflow originates from the Trowse TPS. This TPS takes the flow from Norwich city and most of the suburban areas.

A second TPS located adjacent to the Blue Boar Public House drains the catchment area of Sprowston: this TPS pumps directly to the works via a 5km rising main and discharges into the Trowse gravity main. A third TPS drains the outlying villages of Brundall: this TPS also pumps directly to the works via a 5 km rising main and discharges into the inlet works. There are a further three TPS's which pump directly into the inlet works: these

drain the area of Thorpe (Bungalow Lane), Thorpe (Business Park) and the village of Bramerton.

Owing to septicity generated within the rising mains, chemical dosing is undertaken at 16 locations to suppress septicity (See Appendix 2 of this document), and reduce odour emissions at the inlet works. The main dosing points (in terms of applied dose rates) are at the Terminal Pumping Stations and are as follows:

SITE	SHORT CODE	Typical Dose rate L/Day	Maintenance Frequency	Fixed dose rate or flow proportional
Brundall Bay Bridge	BDBASM	360	6 Monthly	Proportional
Bramerton Woods End	BMTWSM	198	12 monthly	Fixed
Little Plumstead	LPLUSM	421	12 monthly	Fixed
Sprowston Blue Boar	SPRBSM	472	6 Monthly	Proportional
Thorpe Bungalow Ln	THRPSM	262	12 monthly	Fixed
Thorpe Yarmouth Rd	THYRSM	19	12 monthly	Fixed

NB Dosing is not carried out at Trowse due to the short retention time.

Preliminary Treatment

Preliminary treatment comprises:

- Screening (6mm aperture cup screens)
- Screenings washing, compaction and discharge to skip for disposal off-site. The skips are replaced 3 times per week.
- Grit removal in 2 No detritors
- Grit washing and disposal to skip for disposal off-site, replaced twice a week
- storm water separation for flows >3DWF
- Storm settlement in 6 No rectangular storm tanks

Screened and de-gritted sewage passes to a weir controlled by two hunting penstocks: at this point excess flows above 3 Dry Weather Flow (3 DWF), are separated and discharged to the storm tanks, where the sewage is retained. Stored settled storm sewage is then pumped back through the treatment processes after the storm has abated. If the storm is heavy and/or prolonged, the storm tanks discharge the settled storm sewage direct to the River Yare via a consented overflow. Flows passed by the 3 DWF weir proceed to primary treatment.

Primary Treatment

Preliminary treated sewage is distributed to 8 No radial flow primary settlement tanks arranged in two banks of 4 tanks each. Suspended solids in the sewage are settled by gravity in these tanks, producing raw sludge, which is removed daily by gravity for further treatment. The partially clarified sewage (settled sewage) overflows the primary tank weirs and flows to the biological treatment stage.

Activated Sludge (Biological) Treatment

Settled sewage from the primary settlement tanks then flows by gravity to the Biological Nutrient Removal plant. This plant consists of a series of zoned tanks, both aerated and unaerated, through which flows a mixture of settled sewage and activated sludge (termed 'mixed liquor', or 'ML'). Nutrient removal is achieved by the provision of anaerobic treatment and subsequent anoxic treatment of the sewage and recycled flows upstream of the aerobic reactors that provide for aerobic biological oxidation of the organic pollutants, and ammonia.

The settled sewage first flows to the anaerobic zone, where the activated sludge, releases phosphorus into solution. It then passes through to 2 anoxic zones, where nitrate returned from the aerobic section of the plant, in returned and recycled activated sludge, is metabolised by denitrification to nitrogen gas and water. In the anaerobic and anoxic zones, the sludge is maintained in suspension by submerged mechanical mixers but not aerated. The ML then passes to the aerated zone, comprising 6 lanes, each lane consisting of 2 pockets aerated by mechanical surface aeration followed by a diffused air section. In the aeration zone, the BOD is removed, the ammonia is nitrified to nitrate and the soluble phosphate is taken up into the activated sludge biomass.

Clarification

Mixed liquor from the aeration tanks is settled by gravity in 4 radial flow clarifiers, which separate the activated sludge from the clarified effluent. The latter is discharged to the River Yare. Activated sludge settled in the clarifiers is returned to anoxic zone 1 to treat more sewage. This is known as Returned Activated Sludge (RAS). RAS flows from the collection hoppers of the clarifiers and is discharged from a pipe that terminates in an adjacent chamber. RAS from all four clarifiers is passed into this chamber where it flows to the RAS pumping station to be pumped back to anoxic zone 1.

Surplus Activated Sludge

Surplus Activated Sludge (SAS) is produced due to growth of the biomass in the aeration tanks. To maintain the required MLSS concentration in the aeration tanks, SAS is transferred from the RAS pumping station in a controlled fashion to the sludge treatment centre for thickening and treatment prior to its use as a soil conditioner for agricultural land.

2 Site Management

The management structure including responsibilities and training is included in the Common Information Section.

3 Odour Risk Assessment

3.1 Summary of Main Risks and Controls

An Inventory of odorous materials on site has been completed and can be found in Appendix 1.Control Measures

3.2 Management of Odorous Materials

It is not possible for the Works Technicians to divert sewage away from the site if there is a problem. It is therefore essential for the treatment processes on site to remain operational at all times. It is possible however to reduce septicity in the incoming sewage by adjusting chemical dosing in rising mains.

Good house keeping plays an essential part in reducing odour emissions from the site. Works Technicians perform daily site inspections to ensure there are no spillages from tanks and tanker deliveries and are instructed to clean spillages as soon as possible. Tanker drivers have been instructed to clear their discharge pipes with the tanker still connected so that any remaining odorous gases are contained within the import tank and odour abated. Any sludge spillages during discharge are immediately hosed into the adjacent drain and returned to the WRC. Tanks that have been taken out of service must be kept empty and clean to avoid odour.

All Works Technicians at Whitlingham WRC have a responsibility to maintain good housekeeping and clean up spillages at the earliest opportunity to prevent unnecessary odour. Anglian Water has an in house tankering team (RES) who can provide additional clean up services at short notice. Works Technicians have been given specific authority for out of hours contact.

<u>Key areas at risk from spillage and control measures</u>

Septic Waste Discharge point:C
Tanker drivers instructed to clean up spillages after every load. Hose supplied. Daily inspections by Works Technicians and routine site inspections by Treatment Manager/Assistant Manager – a minimum of once per month. This will be logged and recorded by the Treatment Manager from 1st January 2012.

Screenings and Grit Skips:
Rag skips are replaced three times a week and Grit skips twice. Works Technicians are instructed to clean up spillages on a daily basis. Daily inspections by site operators and routine site inspections by Treatment Manager/Assistant Manager – a minimum of once per month.

Works Technician shifts are managed by Anglian Water's Operations Management Centre (OMC) to ensure that sickness and holidays are managed centrally across all sites and critical activities are given the highest priority. The shift system implemented on the site ensures 12 hours per day of coverage, 6 days per week. In addition, the Sludge Technicians operating the STC work a longer working day than the Works Technicians and are also involved in ensuring the smooth operation of the WwTW when Works Technicians are not on site.

Scheduled daily jobs include the routine operational maintenance and monitoring of all odour abatement equipment. Odour reducing equipment is maintained by site staff in accordance with suppliers' instructions. Additional maintenance beyond the scope of site staff is scheduled as part of the Whitlingham Planned maintenance Team and instructions are passed to maintenance staff via the 'Click' system. 'Click' is a computer based scheduling system that deploys work directly to Works Technicians laptops and records jobs completed onto a central SAP (Systems, Applications and Products in Data Processing Database) system

3.3 Reduction of Emissions

In the Sewerage Network, the Chemical dosing plant is telemetered and controlled by the local Maintenance Manager.

An inline H_2S monitor has been installed at the inlet of Whitlingham WRC to monitor the effectiveness of the chemical dosing in the catchment. This will be recorded on Anglian Water's telemetry system but until that happens we will record the H2S level at the inlet daily on the Routine Activities ticksheet.

Odour control units on site are monitored by on-site staff, which includes record keeping. The units are maintained in accordance with the manufacturers guidance (details of which are in the Common Information Section Appendix 2: pg17)

3.4 Containment and Abatement

As of March 2017 there are no outstanding investment proposals for the WRC. The six-monthly odour survey will be used to quantify any future investment needed.

3.5 Contingency and Emergency Planning

Breakdowns

In the event of a breakdown the responsible person creates a job which is then raised via Anglian Water's Operational Management Centre (OMC). The response time for remedying breakdowns is dependant upon the criticality of the plant, response codes are:

- A0 Within 1 hour.
- A1 Within 4 hours.
- A2 Within 1 day.
- A3 Next day.
- A4 Next 2 days.

The majority of critical plant at Whitlingham is allocated a response code of A1. Jobs are allocated by the OMC via an electronic scheduling tool, 'Click'. This identifies an appropriately qualified person who is able to respond within the timescales determined by the response code.

The site holds many spares for key equipment and framework arrangements are in place for critical plant including lead times for delivery to site. In addition, maintenance contracts are in place with many suppliers and include the requirement for them to store spares on Anglian Water's behalf.

Flood, Fire and Extreme weather

Hot and dry weather is likely to increase odour emissions by increasing evaporation rates, reducing dispersion when wind is low and increasing the residence times in the sewers leading to increased septicity and odour emissions. Heavy rain after dry weather generates a first flush of odorous sewage likely to cause odour at the inlet works as well as overflowing to the storm tanks where raw sewage can be stored for some time. It is therefore essential that the inlet works and storm tanks are managed closely to avoid odour nuisance during changing or extreme weather conditions.

Problematic rising mains have been identified and chemical dosing installed to mitigate the effect of septicity during hot and dry weather conditions. The storm flows which accumulate in the storm tanks will be

returned to the inlet works for treatment in the WwTW as soon as flows permit and the storm tanks will be cleaned after emptying to ensure odour emissions are minimised.

Freezing can stop the operation of valves, pumps and other equipment leading to sludge build-up in the process. Trace heating is installed on critical plant to ensure continued operation through the winter months. Snow fall or frozen roads can also limit access to the site limiting chemical deliveries. Access roads to site are gritted to ensure continued access during cold weather. A snow plough attachment is available on site for use on site plant to clear snowfall.

A fire contingency plan is complete for the site, detailing what is to be done and how to recover from this event.

Power Failure

The site at Whitlingham is equipped with a duel electricity supply. 2 backup generators are on site to cover critical aeration plant and main site in case of a major power failure.

In the event that it is required, Anglian Water also has a contract in place for hiring mobile generators on short notice.

Abnormal Operation/Construction

Any planned construction of a certain size on site will meet the requirements of CDM Regulations 2007. Such new works will require a Pre-Construction Site Management Plan which will be developed to cover the construction and commissioning period of proposed works. The strategy/plan will be continually reviewed in line with site conditions to ensure that the process capabilities of the works will not be compromised. Under the agreed delivery model, construction and commissioning gateway governance shall be completed and approved by key stakeholders, which includes the Treatment Manager. The document covers management of environmental impacts of the construction, including how odour is to be managed and minimised while work on site is on-going.

In the event that an activity is assessed as a medium or high risk of odour nuisance the activity shall be undertaken under an impact plan. Impact Plans are used by AWS to manage non routine activities that have the potential to impact on works compliance, health & safety and customers. The plan is designed to ensure appropriate controls, mitigation and communication procedures have been identified and are followed appropriate to the task. Such examples where odour risk is identified and an impact plan is required, mitigation actions may include:-

- Revised construction sequence and commissioning activities that shall reduce/remove odour generation
- Revised commissioning sequence
- Utilisation of existing odour control equipment, possible extension via temp measures to accommodate additional areas
- Provision of temporary odour reduction plant
- Enabling new odour management plant earlier within construction programme
- Provision of sufficient temporary spray systems to mask odour.

The Regulators will be made aware of any event which may lead to a risk or temporary increase in odour, the mitigation measures put in place and time scales for the work to be undertaken.

4 Monitoring Procedures

4.1 Monitoring of Odours

Consultants are used to undertake odour monitoring surveys of the site in conjunction with the STC. The conclusions from these surveys will be used by the Treatment Manager to assess the effectiveness of current control measures and, where necessary, amend these or implement additional measures.

Routine monitoring twice per week by sniff testing will be undertaken by office based staff who are not regularly exposed to site operations, in areas around the site and close to potential receptors as identified in the Odour Risk Assessment, for example at the top of Whitlingham Lane. Records of this weekly monitoring will be maintained in the site diary. Results will be available to the Treatment Manager and Process Optimiser. If an odour is detected on site, sources will be investigated to determine the source. If the source can be identified, actions will be taken to stop odour generation or stop the activity responsible. If the activity cannot be stopped immediately for operational reasons, the Regulators will be informed, with a timescale to affect a permanent solution.

A record will also be maintained of any known off-site activities that may have an impact on odour, such as agricultural practices.

A weather station has been installed on site by Skyview Systems Ltd. at a suitable location to minimise interference from tanks and buildings (the corner of the administration building closest to the STW inlet). The station will continuously log:

- Atmospheric pressure.
- Temperature.
- Humidity.
- Wind speed and direction.
- Rainfall.

Wind direction will be considered (onsite wind socks) before any non routine work likely to cause odour is carried out. The weather station data will also be used to investigate odour complaints or to determine the source of odours during weekly sniff testing by site staff.

The weather station has been calibrated by the supplier and a yearly visit is performed for re-calibration.

4.2 Monitoring of Performance

The inline H_2S monitor will is used to continuously monitor the effectiveness of the chemical dosing in the Catchment.

5 Complaint Management

5.1 Dealing with Complaints and Reporting

Anglian Water will advise the EA of any abnormal operation or maintenance work which is likely to result in increased odour emissions. Emissions and the potential for odour nuisance will be minimised through positive odour control measures and planning of maintenance activities.

Odour complaints are generally received by one of two ways:

- from BDC/SNC or customers through the OMC.
- from BDC/SNC, customers, the EA or EHO directly to the Site Manager.

Any complaints received from either members of the public or from regulators (Environment Agency, Environmental Health) will be investigated promptly and appropriate remedial action taken. Site staff will carry out a sniff test to try and identify the odour and its source following the site odour complaint investigation form . If the complainant has contacted AW via the contact centre, a Customer Liaison Manager will contact them to inform them of the outcome of investigations and actions taken. If the complainant contacts the Treatment Manager directly, the TM will reply with the relevant information.

Complaints from the EA/EHO are sent directly to the Site Manager. The site manager will ensure all relevant managers are aware of the complaint and the true cause of the odour nuisance is identified. Details of the compliant and actions taken will be recorded in the site diary.

5.2 Record Keeping

All complaints made directly to Anglian Water will be copied to the Correspondence Team. It is their responsibility to log complaints and actions onto the SAP database.

The AWS SAP database holds records of all complaints received directly by the company and allows a history of actions taken. A root cause analysis will be undertaken by the Customer Liaison Manager on a regular basis and outcomes compared to actions being undertaken on the site or in the local sewerage network.

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5.3 Community Engagement

The STW and STC are treated holistically and full details of community engagement can be found in the Common Information Section (pg6)

6 Odour Risk Assessment

See Appendix 1.

7 Summary of Odour Works Undertaken

During months ending August 2011, over £5million was invested on site to improve odour mitigation. Works have included:

- Odour Masking sprays have been installed and are operating 24/7 at the inlet of the works
- Sewer vent pipes have been capped at the inlet of the works.
- The construction of a SHARON liquor treatment facility has allow the cessation of liming liquid sludges which has historically been a significant source of odour and complaints on site.

A full septicity study was undertaken in the Norwich Catchment. This resulted in septicity chemical dosing at 16 pumping stations.

Appendix 1. Odour Risk Assessment

Section	Potential Odour Source	Current control measures	Future proposals	Date
WRC	Sewerage Network Odour Control There is a low risk of odour from incoming sewage from Trowse, Thorpe Business Park, Thorpe Bungalow Lane and Bramerton TPSs. There is a high risk of odour from Brundall (Baybridge) TPS and Sprowston (Blue Boar) TPS due to the long (5000m) rising mains involved.	Septicity removal by chemical dosing at 6 TPS's. Only Trowse TPS not currently dosed.	Inline H_2S monitor to measure efficacy of dosing.	Spring 2012
WRC	Preliminary Treatment. Inlet channel has odour masking prior to screening Storm Tanks. Potential for odour generation when emptied, and deposited sludge is exposed.	Checking operation of suppressant Current tank cleaning method very labour intensive. Tanks are cleaned as soon as flows subside.	Potential to Install automatic storm tank cleaning system.	
WRC	Primary Treatment. The surface of the primary tanks represents a source of odour. This odour has been identified by the EHO of Broadland DC as being identical to that affecting Thorpe/Dussindale. Primary Tank De-	Daily desludging (manual)	Potential to Install auto desludging to spread the times of desludging throughout the 24hr period	

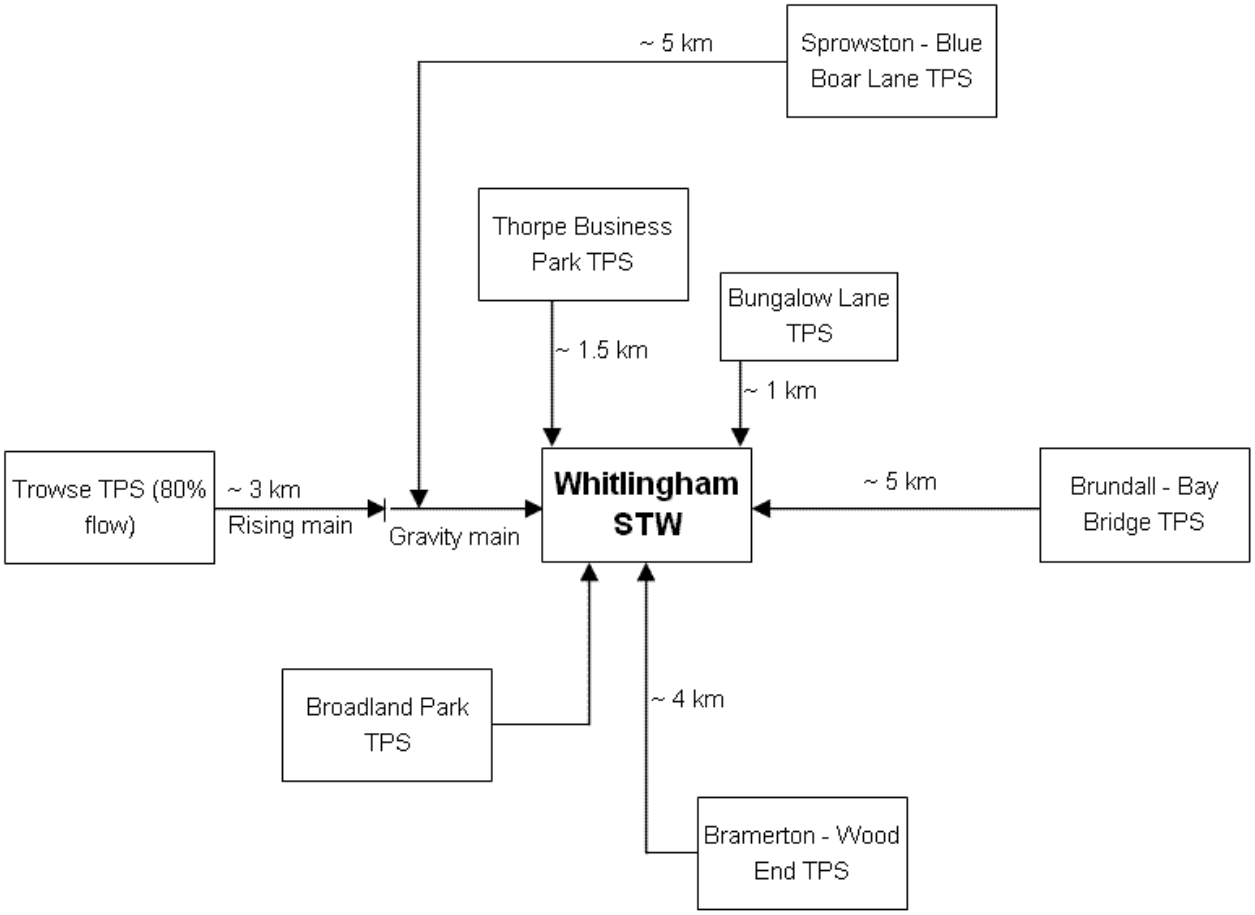
	sludge Chambers: intermittent odour source, but very localised. Medium risk.			
WRC	Activated Sludge (Biological) Treatment: low risk.	None		
WRC	Clarification: low risk.	None		
WRC	Surplus Activated Sludge: low risk	None		

Appendix 2: Whitlingham Dosed Pumping Stations list

Stations ending in SM are terminal pumping stations, stations ending in SP are inline pumping stations (an inline pumping station pumps to a terminal station before being pumped on to the WRC).

BRUNDALL-BAY BRIDGE TPS	BDBASM
BRAMERTON MAIN-WOODS END TPS	BMTWSM
NORWICH-LONGWATER BUS PK SP	COSISP
EASTON-AG COLLEGE PS	EASCSP
FRETTENHAM-BECK FM SP	FREBSP
HONINGHAM-HALL DRIVE SP	HONHSP
LITTLE PLUMSTEAD-OLD STW SM	LPLUSM
NORWICH-HEARTSEASE SP	NRWHSP
ROCKLAND MAIN-LOW RD SP	ROCLSP
SPIXWORTH-RUSSELL AVE SP	SPIRSP
SPROWSTON-BLUE BOAR LANE SM	SPRBSM
SRUMPSHAW-OLD STW SP	STRUSP
SURLINGHAM MN-BEERLICKS LOK SP	SURBSP
SOUTH WALSHAM-SCHOOL ROAD SP	SWLSSP
THORPE-BUNGALOW LANE TPS	THRPSM
THORPE ST ANDREW-YARMOUTH RD	THYRSM

Appendix 3: Terminal Pumping Stations Schematic



ANGLIAN WATER SERVICES LTD.

Whitlingham Sludge Treatment Centre

Odour Management Plan

This document must be reviewed at intervals not exceeding 12 months

Revision	Authors	Date of Issue	Comments
1.0	J Van de Moortel & A Paskins Mott MacDonald		
2.0	Pete Holland	17 Dec 2011	Update following EA review
3.0	P Holland / A Ebbage	24/4/12	
4.0	P Holland / A Ebbage / T Blackmore	15/06/12	
5.0	P Holland / A Ebbage	26/7/12	
6.0	P Holland / A Ebbage	29/7/13	Update
7.0	P Holland / A Ebbage	04/07/2014	Update/Review

8.0	P Holland/ A Ebbage / T Blackmore	12/11/14	Update - Cake
9.0	A. Pope	18/05/2015	Review
10.0	A. Pope	25/03/2017	Update
11.0	A. Pope	10/05/2018	update
12.0	S Spencer	16/03/21	Review

Note: This document is one part of a four part document and should not be issued separately. The sub Odour Management Plans should always be read in conjunction with the Odour Management Strategy and the General Information Section

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1 Overview

1.1 Introduction

Whitlingham Sludge Treatment Centre (STC) is regulated by means of an Environmental Permit. The permitted activity is of a type that requires the production of an Odour Management Plan (OMP).

The purpose of an OMP is to ensure that the permitted activities operate in a manner that prevents, or minimises, the risk of pollution from odour, it details operational and control measures appropriate to management and control of odour at the site.

The permitted activity of sludge treatment takes place within the boundary of an operational Water Recycling Centre (WRC). This WRC also has the benefit of an OMP produced in line with Defra's Code of Practice on odour nuisance from sewage treatment works and current EA guidance.

1.2 Sludge Treatment Processes

The sludge treatment process was upgraded in 2009 with a new biological hydrolysis process (CAMBI) upstream of the anaerobic digesters. The benefits of this process are:

- A higher conversion rate of volatile matter.
- Pasteurisation of the sludge cake.
- A reduction in sludge cake quantities produced.
- Renewable energy generation from the enhanced production of biogas.
- Mothballing lime stabilisation process.
- Reduced fuel consumption and carbon emissions from transport.
- Agricultural recycling.

The current treatment processes are described as follows:

Imported Sludge: Whitlingham STW is designated as a sludge treatment centre, and imports sludge from other works in the local area for treatment (See Appendix 4 in this document) in addition to treating the sludge produced by the on site plant (i.e., the indigenous sludge). Imported sludge brought in by tankers discharges into an imported sludge tank, and then gravitates to a 6 mm screen, the purpose of which is to

remove any rag or plastics. The screened sludge is then stored in 2 No. odour controlled rectangular storage tanks prior to processing.

From 2016 sludge is also imported as dewatered 'cake' (circa 25% dry solids) – this will be watered down on site and added in to the treatment process. The advantage of importing cake rather than just liquid sludge is the same tonnage of dry solids equates to a significantly less number of cake lorries than it would as liquid tankers.

Cambi Thermal Hydrolysis Process: Sludge is pumped to strainpresses and then to centrifuges that thicken it prior to thermal hydrolysis which will kill any pathogens. The thermal hydrolysis process is a potential source of odour. The sludge then goes through digesters and is further thickened into treated sludge cake. The treated sludge cake is then suitable for application to agricultural land. Intermittent odours due to sludge discharges from tankers and also odour from sludge storage can be experienced. This is all now under odour control since January 2011.

Centrifuges: The centrate produced from the centrifugation of the sludges is a potential source of odours. See section 2 of the action plan for controls implemented. The centrifugation of the sludges is contained within a building and the cake produced is stored on the small concrete pad closest to the STC (measuring circa 6000m^2) which has an odour suppressant spray system should this be needed (this system is not routinely used now, it was originally installed when limed cake was stored here).

Additional Sludge Treatment Process: There is on-site a liming process which is not currently being used but will remain on-site to be used as emergency contingency equipment if needed. The process for this equipment being used consists of (i) addition of a small dose of lime slurry to condition the sludge and fix the phosphate in the sludge: (ii) dewatering in 2 No. belt presses: (iii) dosing of the resulting sludge cake

with a high dose (up to 20% on dry solids) of powdered quicklime to raise the pH of the sludge and thereby kill pathogens. The limed sludge cake is then suitable for application to agricultural land. Sludge liquors from the dewatering operation are returned to the inlet works for further treatment. The limed cake is stored on a concrete pad adjacent to the lime plant pending removal to agricultural land.

SAS: from the clarifiers is pumped to three aquabelt sludge thickeners. These units thicken the sludge by separating the solid and liquid fractions. The thickened sludge is proportioned between the imported sludge tank (~67%) and the top storage tanks (~33%). Sludge liquors from the thickening operation are returned to the inlet works for further treatment.

Indigenous Sludges: sludge from the primary tanks is pumped to 2 top storage tanks where it is then pumped via 3 strain presses for rag and plastic removal into the CAMBI primary sludge holding tank. This is odour control covered. Primary/SAS is pumped to a contact tank where it is then pumped forward to 3 centrifuges where the sludge is thickened to 18% dry solids. This is then pumped to a holding silo where it is then pumped forward to the CAMBI process.

Sludge Cake Storage Pad: in addition to accepting imported liquid sludges, the Whitlingham site is also a storage site for sludge cake which is not suitable for direct application to agricultural land. These products are stored away from the main site but within the boundary (locally known as the 'large concrete pad', this measures 27000m^2) . These products originate at other Anglian Water Sludge Treatment. These are currently as follows:

- Ipswich (Cliff Quay) STW: storage of digested sludge cake for 3 months to satisfy the requirements of HACCP (the product is stable, this is required for pathogen removal only)
- Cambridge STW: storage of digested sludge cake for 3 months to satisfy the requirements of HACCP (intermittent):

The storage pad is located some 500m to the SW of the works. It has a sealed drainage system, and liquors arising from the pad are returned to the inlet works for further treatment. It is expected in the future that part of the pad will be used for composting sludge cake with green waste. RES/Biosolids manage the cake haulage to and from this pad. Volumes stored on the pad are largely controlled by the farming seasons. When application to land is available, retention times on the pad are limited whereas in Winter when access to land is reduced, this can increase. Biosolids cake naturally dries and forms a crust on top which further reduces any odour emissions.

Due to the Cambi process, the cake produced by Whitlingham STC is at an enhanced compliance level and so storage on site is not required as part of the treatment process. Cake is simply stored until a suitable agricultural outlet is available (this is typically available more in the summer months)

Emission rates from THP cake are as follows:

Stored THP Cake Cotton Valley/Whitlingham - 2.4ouE/m2/s

Disturbed THP Cake during loading Cotton Valley - 4.5ouE/m2/s

Fresh Cake Whitlingham discharging from conveyor on pad - 3.94ouE/m2/s

In contrast below are a series of results collected from limed cake at a non AW site in the north west between the 21st March to the 3rd April 2012 - this data being analogous to the historical situation at Whitlingham. This shows that emissions from limed cake can increase during storage, particularly as the cake dries out in sunlight (that is until the crust forms).

The practice of storing cake and it forming a crust has been carried out for greater than 2.5 years, however we will continue to monitor any complaints for the site and if linked to this practice it will be reviewed and amended

Limed Cake Bays	13.6	54.2	36.6	204.0	102.4	45.1	78.9	14.6

all ouE/m2/s

Sludge Liquor Treatment (SHARON): The SHARON is a process designed to remove biologically the ammonia load from the sludge treatment centre liquors prior to returning to the head of the works. By removing this ammonia load we can maximise the sludge throughput through the CAMBI digestion system thus resulting in cessation of the liming of imported sludge which was highlighted as a major source of odour.

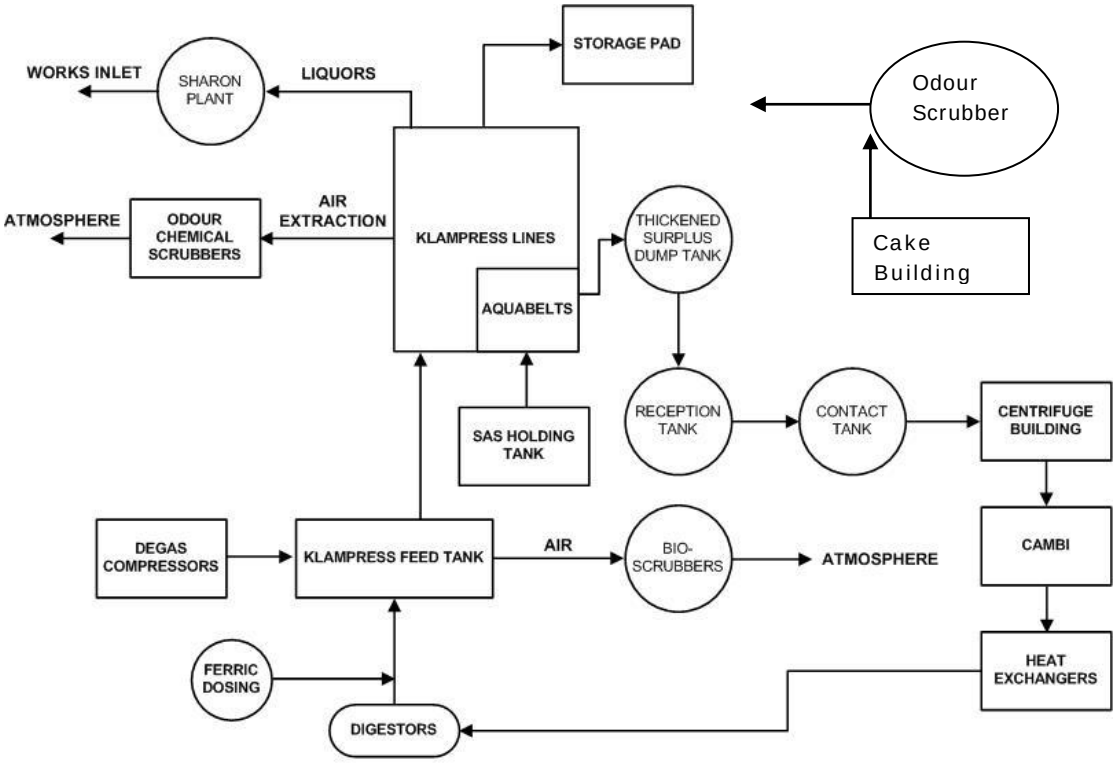
RAW CAKE import building:

The building consists of an airlock style building where sheeted lorries reverse into the building and then the outer doors close, this then allows the internal doors to open and cake be discharged into a below ground hopper. Auger pumps will then transfer this cake into a holding tank and then on into the treatment process. An odour suppressant spray system operates in the building and odours from the below ground hopper are extracted through an odour control unit consisting of lava rock and carbon media to atmosphere at high level.

Odour Control Units: There are now 3 installed odour control units. Units are designed to remove Hydrogen Sulphide and Ammonia. The Sludge Treatment Centre (STC) Odour Control Unit (OCU) is a chemical scrubbing system needed, because wide variations in gas concentrations require a more reactive scrubbing system.

The Biological OCU removes foul odours from underneath a new cover installed over the CAMBI system raw sludge feed tank. Odours extracted from the de-gas tank, top storage tanks, centrifuge cake hoppers and

limpet chambers of both digesters are all passed through to this bio scrubber.



2 Site Management

The management structure including responsibilities and training is included in the Common Information Section.

3 Odour Risk Assessment

All stages in the sludge treatment process have been identified as being potential sources of odour. A number of key receptors were identified along with their location and distance from the permitted activities (these can be seen on the plan in the Common Information Section pg10).

The Odour risk assessment can be found in Appendix 1 of this document.

Inventory of odorous materials on site can be found in Appendix 2

4 Control Measures

4.1 Management of Odorous Materials

Anglian Water's overall strategy for East Anglia will provide 10% spare capacity in enhanced sludge treatment centres. This will allow some flexibility in redirecting sludge imports to ensure sludge is treated in a timely manner and not allowed to build up and become septic.

It is difficult, however, for Works Technicians to refuse imports arriving at the site as there is no clear indication that a particular tanker will present an odour problem until the sludge is discharged. It is therefore critical that sludge imports to Whitlingham are managed such as sludge is collected on a regular and frequent basis from export sites and that the Treatment Manager is made aware of potential operational problems at these sites which could give rise to odorous sludge. In Anglian Water, sludge movements are managed by RTS who prioritise the sites based on consents, operating conditions and storage capacities such that sludge does not build up in any export sites. In the event of a breakdown at the STC, RTS will also redirect sludge to an alternative treatment centre. Auto-desludging based on timers will be installed on the PSTs at Whitlingham WwTW to ensure that indigenous sludge is also processed regularly.

Tanker drivers must record the details of each delivery in the site log. This is then used by the Treatment Manager, along with the records sent from RTS, to keep an accurate track of imports to the works. In addition, sludge levels and throughputs for imported and indigenous sludge are

recorded on the STC SCADA system. Liquid sludge is completely mixed in the import tank.

Good house keeping plays an essential part in reducing odour emissions at the site. Works Technicians perform daily site inspections to ensure there are no spillages from tanks or tanker deliveries and are instructed to clean spillages as soon as possible. Tanker drivers have been instructed to clear their discharge pipes with the tanker still connected so that any remaining odorous gases are contained within the import tank and odour abated. Any sludge/cake spillages during discharge are immediately hosed into the adjacent drain and returned to the WRC. Tanks that have been taken out of service must be kept empty and clean to avoid odour.

Storing sludge on site is essential as it allows a continuous feed to the hydrolysis and digestion process. Disruptions in the feed to the process reduce the performance of the digestion process leading to reduced biogas production and potentially a more odorous digested cake. However, sludge storage has been minimised where possible to reduce odour emissions whilst allowing the smooth operation of the STC. There is no intention to store raw cake on site at Whitlingham, should a breakdown occur within the new cake building loads would be diverted to an alternative treatment centre.

Works Technician shifts are managed by the Operations Management Centre (OMC) to ensure that sickness and holidays are managed centrally across all sites and critical activities are given the highest priority. The shift system implemented at the STC with enhanced digestion allows longer hours for the operators to ensure the smooth operation of the works.

4.2 Reduction of Emissions

In addition to the sludge retention time mentioned above, a considerable factor in odour emissions is turbulence of liquid surfaces due to mixing or pumping into tanks. The mixing in sludge tanks minimises surface turbulence and the post digestion tank is covered and abated.

To reduce the impact of odour, dispersion can also be increased by providing a stack and increasing the air flow velocity. The OCUs have been modelled with varying stack heights up to 15m and air velocities between 15 to 20 m/s. The final design for the OCU was a 15m stack height and 16m/s velocity.

4.3 Containment and Abatement

Based on air changes per hour and odour concentrations from the extracted areas, the OCUs have been sized to provide an appropriate retention time to achieve the outlet stack levels. This is based on odour dispersion studies using AERMOD to meet the guidelines for Most Offensive Odours (1.5 OU_E/m^3 hourly averages on a 98%ile basis) and includes odour emissions from the stacks, and allows stack height, as well as the prevailing meteorological conditions at site. (Additional carbon media has also been provided to ensure media lifetime guarantees are met at average loads.)

The OCUs for the site are now on a rolling investment programme which allows for the financial budgeting of their costly, periodic maintenance. Small OCU (under £2,000) will be managed within the local operational budget but larger units are entered into the OCU register with date of instalment and expected date of refurbishment to ensure adequate funds are made available.

4.4 Contingency and Emergency Planning

The contingency planning process for all Anglian Water STCs has included a risk audit to identify the likelihood of failure on any part of the STC plant. The next step is to amalgamate the risk items from across the company and then critical spares are being sourced and will be held centrally. To date (Dec 2011), the risk analysis has been completed (Appendix 4 of this document) and the amalgamation from all the Anglian Water STCs is underway. As a temporary contingency, critical spares are held on site for the high risk items.

Breakdowns

In the event of a breakdown the responsible person creates a job requisition which is then processed and initiated through Anglian Water's Operational Management Centre (OMC). The response time for remedying breakdowns is dependant upon the criticality of the plant, response codes are:

- A0 Within 1 hour.
- A1 Within 4 hours.
- A2 Within 1 day.
- A3 Next day.
- A4 Next 2 days.

All critical plant at Whitlingham is allocated a response code of A1. Jobs are allocated by the OMC via Anglian Water's electronic scheduling tool, 'Click'. This identifies an appropriately qualified person who is able to respond within the timescales determined by the response code.

The site holds many spares for key equipment and framework arrangements are in place for critical plant including lead times for delivery to site. In addition, maintenance contracts are in place with many suppliers and include the requirement for them to store spares on Anglian Water's behalf.

Other Enhanced STCs also have spare capacity to treat additional sludge should Whitlingham STC not be able to treat imports.

There are some specific aspects of sludge treatment activities which may lead to short or medium term odour issues and therefore require particular attention. For example the annual shutdown requires the opening and inspection of each of the Cambi reactors. To minimise odours during this time, the reactors are thoroughly washed with final effluent whilst still closed before they are opened up to atmosphere.

5 Monitoring Procedures

5.1 Monitoring of Odours

Consultants are engaged to undertake odour monitoring surveys of the permitted activities (summer 2017). The conclusions from these surveys will be used by all site managers to assess the effectiveness of current control measures and, where necessary, amend these or implement additional measures.

Routine monitoring once per week by sniff testing will be undertaken by office based staff who are not regularly exposed to site operations (in reality this is actually done daily when people travel to work and any odours reported through to the EA), in areas around the site and close to potential receptors as identified in the Odour Risk Assessment for example at the top of Whitlingham Lane. Records of this weekly monitoring will be maintained along with similar records from the Wastewater Treatment Works monitoring. An example of the report form can be seen in the Common Information Section pg11 Results will be available to the Treatment Manager and Optimiser. If an elevated odour level is detected on site, sources will be investigated to determine the source. If the source can be identified, actions will be taken to stop odour generation or stop the activity responsible. If the activity cannot be stopped immediately for operational reasons, the Environment Agency will be informed, with a time scale to affect a permanent solution. If odour complaints are being received but the routine sniff testing is not detecting anything we will check for adaptation of the testers by buddying up with employees from other areas of the business.

A record will also be maintained of any known off-site activities that may have an impact on odour, such as agricultural practices.

A weather station has been installed on site by Skyview Systems Ltd. at a suitable location to minimise interference from tanks and buildings (the corner of the administration building closest to the WRC) We believe the changing windrose data demonstrates real-time change and not 'static conditions' caused by buildings on site. This station will continuously log:

- Atmospheric pressure.
- Temperature.
- Humidity.
- Wind speed and direction.
- Rainfall.

Wind direction will be considered before any non routine work likely to cause odour is carried out. If there are problems with the sludge import OCU performance, tanker imports may also be diverted dependant on wind direction. The weather station data will also be used to investigate odour complaints or to determine the source of odours during weekly sniff testing by site staff.

The weather station has been calibrated by the supplier and a yearly visit is performed for re-calibration.

Monthly average windrose data from the Whitlingham weather station for 2014 is contained in separate documents submitted with this plan (titled "Months XX")

5.2 Monitoring of Performance

Performance of OCU's

OCU design parameters are to achieve 99% removal based on:

	Design NH_3 concentration (ppm)	Design H_2S Concentration (ppm)
Chemical Scrubber	100	15-40
Carbon Scrubber	50-100	20-30

Works technicians perform a twice weekly task of taking readings of Hydrogen sulphide (H_2S) to and from OCU's using inline instrumentation. Records are kept of inlet and outlet concentrations in parts per million (see example in Section 7 of the Common Information Section). A decreasing trend in removal efficiency or increasing trend in the outlet gas stream H_2S concentration measurements will indicate the potential need for replacing the media. More accurate readings will then be taken with a Jerome or Zellweger portable hydrogen sulphide monitor (of greater sensitivity) to confirm the results before new media is ordered.

An odour survey was completed of emissions from the digesters and across the STC, this data was used to size the OCUs. Digesters are typically very stable systems and the emissions from them have not been shown to vary significantly.

STC Performance

The performance of the sludge treatment processes can have an impact on the quality of sludge produced and hence the odour emissions from the final product. Furthermore, it is essential to ensure that the STC operates smoothly to guarantee the treatment capacity and avoid sludge build-up in the process.

Monitoring of the digestion process is key to ensuring robustness and maximum efficiency. This includes close monitoring of:

- Digestion temperature
- Sludge coolers after the hydrolysis stage
- Digester feed rate

These readings will be available on the STC SCADA system and monitored daily by Works Technicians. A good indicator of the digestion efficiency is gas production. This will also be monitored closely as part of the energy recovery scheme.

The performance of final dewatering will also affect the final sludge cake. Dewatered cake dry solids concentration will be monitored daily and adjustments made to the poly dosing and dewatering settings by the Works Technicians to maintain optimum dewatering performance.

6 Works Technician Weekly Schedule

Information on the routine tasks carried out by the Works Technicians is included in the Common Information Section pg16

7 Odour Control Unit Maintenance Schedules

Details of maintenance plans of the two main odour control units are included below:

OSIL STC Chemical Scrubber Maintenance Plan

Preventative Maintenance Procedures.	Monitoring Frequency	Expected Value / Actions		
Cleaning and calibration of Ammonia scrubber	Weekly	pH value between 3.5 and 4.7		
pH electrode		after calibration		

Cleaning and calibration of Hydrogen Sulphide	Weekly	pH value between 10 and 11			
scrubber pH electrode		after calibration			
Recirculation water flow - Ammonia scrubber	Weekly	18000 l/hr			
Recirculation water flow - Hydrogen sulphide	Weekly	18000 l/hr			
scrubber					
Ammonia scrubber bleed flow rate	Weekly	100 l/hr			
Hydrogen Sulphide scrubber bleed flow rate	Weekly	100 l/hr			
Sulphuric acid chemical storage tank	Weekly as well as pre and	Check bund. Empty accordingly.			
and bund	post chemical delivery	Check integrity of tanks and pipe-work			
Sodium Hydroxide chemical storage tank	Weekly as well as pre and	Check bund. Empty accordingly.			
and bund	post chemical delivery	Check integrity of tanks and pipe-work			
Preventative Maintenance Procedures.	Monitoring Frequency	Expected Value / Actions			
Safety Shower	Weekly and before each	Check operation			
	chemical delivery				
Safety Shower	Monthly	Operate shower for minimum of five			
		minutes to flush and prevent build up of			
		bacteria.			

Condition of fan drive belts and tension	Monthly	Refer to O&M Section 12 - Manufacturers information.
Water Softener	Daily	Check operation, level of salt and add as required. Note salt consumption is dependant upon the hardness of the incoming water and should be topped up accordingly
Fans	Monthly	Check duty/standby operation
		Monitor current draw: 32 - 35 amps
	Six monthly	Check air flow: 6000m3/hr
Pumps	Monthly	Pressure: 1.0 - 1.2 bar
		Flow: 17 - 20m3/hr
		Current draw: 3.8 - 4.4amps
		Duty/standby operation
Scrubber Differential pressure	Monthly	<500pa

OSIL Biofilter Scrubber Maintenance Plan

Preventative Maintenance Procedures.	Monitoring Frequency	Expected Value/Actions
pH of Bio-Filter sump(s)	Weekly	Between pH 3 and 7.
Back pressure Bio-Filter	Monthly	<500pa
Back pressure Carbon Filter	Monthly	<500pa
Air Flow	6 monthly	9000m3/hr
FE Inlet Flow	Weekly	5000 l/hr

In line strainer for irrigation line	Weekly	Remove, inspect and clean if required.
Inspection of spray nozzles	Every 2 months	If spray pattern reduced or zero, remove
		strainer, clean and replace.
Fans	Monthly	See section 12 - Manufacturers instructions
		Current draw: 35 - 40amps
Differential pressure	Monthly	CuCarb Units: <500pa
		Biofilter: <1250pa

8 Summary of Current and Future Odour Improvement Works

Summary of odour improvement works (this has been £5million)

- Cessation of limed cake
- Sludge import tanks are now covered and extracted via Odour Control Units (OCUs)
- The SHARON plant has been constructed. This has allowed routine liming of sludges to cease and all treatment to be done by the Cambi system.
- Installation of 2 x OCU to extract and treat odours from across the STC is complete. These are two of the biggest odour control units in the company and were specifically oversized to allow for any possible future identified odour sources to be captured too.
- Extraction from centrifuges directly to OCU
- Extraction from Blend Tank to OCU(raw and SAS Sludge)
- Fit new covers on both reception tanks and extract to OCU
- Installation of cake import facility including additional OCU and cake blending tank
  - New section of extraction pipework from Pulper Anti Vacuum valves.
  - Taping up flanges as extra security on key known odorous pipe work.
  - Sealed small gaps around limpet chambers with expanding foam.

Current 2018

- Replacing curtains around Klampresses
-

STC	On Site Odour Control Units STC OSIL chemical scrubber	Manually monitored 2 times	To be put on telemetry if instrumentation trial proves	

	STC OSIL Biofilter scrubber	per week and recorded on site. Manually monitored 2 times per week and recorded on site.	successful To be put on telemetry if instrumentation trial proves successful	
STC	SAS: low risk	None		
STC	Indigenous Sludge Sludge Digesters: completely enclosed. Low risk. Sludge Lagoons: remote site, and quiescent: low risk Sludge Presses (raw and digested): enclosed in a building with forced air ventilation. Storage of Digested Sludge Cake: low risk.	Limpet chambers covered and odour controlled None Now all odour controlled. Cake storage is minimised and controlled by the farming seasons. Cake is transported and applied to land as soon as land banks are available. Suppression sprays are not routinely used but are available if required (following the investigation of any odour complaints).		
STC	Sludge Storage Pad: high risk of odours from stored raw sludge cake and limed sludge cake.	None		

Appendix 2 : Odour Inventory Sheet

Source	Location	Origin	Quantity (m3/d)	Odour Emission Rates	Comments	Contingencies

Indigenous Primary Sludge (liquid)	8 x PST's	PST desludging routine activities	550m3/p/d	High 8 - 160 OUE/m2.s	Odour emissions can increase to over 2000 OUE/m2.s if sludge is septic or agitated.	Desludging is carried out daily (including Sundays) as part of the site routine activities. Visual monitoring for septicity is undertaken by competent technicians (deemed competent by Anglian Water's accredited Licence to Operate Scheme). Should any septicity occur or an increase in sludge held in the PSTs is detected the first stage response would be to increase the length of time that desludging is undertaken. Should further measures be required it is possible to reduce the tankered sludge imports into the site to allow more treatment capacity for the sites indigenous sludges. During the site annual shutdown (pressure vessel inspection legally required yearly), sludges will continue to be removed from the process and will be temporarily stored in tanks in the STC before being treated
Indigenous SAS (liquid)	SAS Buffer tank	RAS/SAS pump station	??	Low 0.1 - 2.8 OUE/m2.s	Odour emissions can increase to 3 OUE/m2.s if the sludge is agitated or septic	Activated sludge levels (MLSS) are monitored regularly as part of the site routine activities to ensure that the correct concentrations of biological activity are present. The activated sludge system is aerated so septicity is very unlikely. Should concentrations of MLSS increase (biological processes are never entirely constant) then it is possible that an increased amount of sludge would have to be surplussed to the STC. This is manually controlled on site. Should this be required it is possible to reduce tankered imports into the STC to ensure that there is capacity for this. During the site annual shutdown (pressure vessel inspection legally required yearly), sludges will continue to be removed from the process and will be temporarily stored in tanks in the STC before being treated
Imported RAW Mixed Liquid Sludge	Sludge import tank	Satellite sites from across the region (designated list is included in this report)	The normal volume is 680m3 per day. The site is capable of treating up to 1000m3/day but not for a prolonged time	High 8 - 160 OUE/m2.s	Odour emissions can increase to 2000 OUE/m2.s if the sludge is septic or agitated	Should there be any operational problems on site, the sites own indigenous sludge will always take priority. Imported sludges are scheduled from across the region based on a prioritisation mechanism. If a treatment centre has to close due to breakdown etc, it is possible to reactively re-schedule these sludges into an alternative treatment centre (Whitlingham is 1 of over 15 Treatment Centres AW Operates). Most AW satellite sites have <2weeks sludge holding capacity and so sludges are generally continuously collected as they are produced, this also reduces septicity from occurring. During the site annual shutdown (pressure vessel inspection legally required annually) no imported sludges will be brought to site.

Imported RAW cake	Cake Reception building	Satellite sites from across the region		Medium 1 to 800 $OU_E/m^2.s$	Odour emissions can increase up to 800 $OU_E/m^2.s$ if the sludge is old or during handling. Need to ensure reliable sludge import/export.	Should any faults occur on the Cake import facility, AW has the ability to divert this cake to alternative treatment centres with Cake import facilities. It would not be the case that a backlog of raw cake is stored on site awaiting treatment
Enhanced Digested liquid sludge	Post digestion tank	Digesters	4078 x 2	Low 2.6 - 13 OUE/m2.s	Odour will reduce with the enhanced digestion process providing stable digestion parameters are maintained (typically temperature and retention). Aeration of this sludge can increase the emission of odours	The digestion process is monitored for stability daily (as part of the site HACCP plan). The digested sludge is contained within a covered and odour extracted tank. Monitoring of the digestor performance is carried out by the Treatment Manager and Optimiser on a continuous basis
Enhanced Digested Sludge Cake	Cake storage pad	Sludge dewatering	100 tonne/d	Low 2.6 - 13 OUE/m2.s	Initial odour potential of 5 but can increase to 13 if stored for 3 days. Will decrease to 2.6 for long term storage.	The digested cake is initially stored on the small concrete pad at Whitlingham STW. This pad is surrounded by an odour masking spray although this is not routinely used, cake is collected and transported to farming land as soon as practicable. Should long term storage be required, cake is moved to the large concrete pad furthest away from odour receptors. In severe weather conditions and when application of the product to land is not possible, this is the storage practice.
Screenings from raw sludges	Imported sludge tank, primary sludges	Indigenous and imported sludges	Typically 3 x rag skips per week, 2 x grit skips	High 20 - 200 OUE/m2.s	Odour emissions from screenings can vary significantly depending on build up of fat and grease (this is not generally deemed to be a significant problem in the Norwich Catchment). Storage of screenings is limited due to very regular collections and removal from site	A plastic strip-curtain is currently being quoted for to surround the grit and screenings skips
Dewatering Liquors	Return liquors well	Dewatering Centrifuges/STC	200m3/p/h	Low 1 - 10 OUE/m2.s	Liquors are pumped to and treated by the SHARON liquor treatment plant straight from the STC.	Although liquors are low in odour the site contingency for any significant long term fault on the SHARON plant is to return the liquors straight to the STW for treatment. The STW is capable of treating all the STC liquors when the CAMBI plant is operating at 50% throughput. Should a failure occur, the volume of imported sludges would be reduced to accommodate the reduction in throughput

Odorous gases from the STC	All sources listed above	All origins listed above	Chemical Scrubber 6000m3/p/h Bio scrubber 9000m3/p/h	inlet 12mg/l Outlet 0 mg/l	The plant and processes on the STC emitting odours are covered and extracted to 2 x Odour Control Units. 1 x Granular Activated Carbon Filter and 1 x Chemical scrubber.	GAC filter: inlet and outlet sampling is undertaken 2 x weekly. The expected removal rate through the GAC filter is >95%. The lifetime of the GAC filter is anticipated at 5 years before a carbon change is required. The routine monitoring will show the percentage removal and so will enable effective monitoring to see if this needs to be done sooner or indeed if it is not required as often. The percentage removal lower limit for acting early is 80%. The carbon replacement will be timed for during the annual shutdown (for the Cambi pressure vessel inspections) during which time the STC will not be running. Chemical Scrubber: The chemical scrubber requires the chemical levels to be maintained for it to continue to be effective. This is monitored continuously on telemetry. The low level re-order alarm is generated when there is 6 days volume remaining in the holding tank. The level of service AW has with the chemical supplier is 3days from order. The chemicals used are readily available from other suppliers should any issues arise with the current vendor.

Appendix 3 Contingency and emergency planning

Liquid Imports

	Units	Risk
Import Tank	1	Low
Transfer Pumps	3	Low
Strain presses	3	Low

Overall LOW risk – should any operational problems occur on site, liquid sludge imports would be diverted to an alternative STC

Cake imports

Import building	1	Low
Transfer Pumps	2	Low
Cake silo / blend tank	1	Low

Overall LOW risk – should any operational problems occur on site, caked sludge imports would be diverted to an alternative STC

Indigenous Raw

	Units	Risk
PSTs	8	Low
Sludge PS	2	Low
Top storage sludge holding tanks	2	Low

Overall LOW risk in terms of storage and transport of sludges. The primary tanks are included in the current odour survey

Sludge pre-thickening Tank

	Units	Risk
CAMBI feed tank	1	Low
Mixers	2	Low
Sludge pumps	3	Low
Odour control unit	1	Low

Overall LOW risk – should any failures occur the contingency remains to hold indigenous sludges within the process and divert imported sludges elsewhere

SAS

	Units	Risk
SAS Pumps	3	Low
Poly Make up	1	Low
SAS Belts	3	Low
Dump tanks	2	Low
Surplus sludge pumps	2	Low
Rotamat Screen	1	Low
Surplus holding Tank	1	Low
Contact tank feed pumps	2	Low

Overall LOW risk – the contingency for breakdowns is to hold sludges within the process. Activated sludge is generally regarded as low odour

Contact Blend Tank

Blend tank	1	Low
Mixers	2	Low
Centrifuge feed pumps	3	Low

Overall LOW risk – odours are extracted to the OCUs on site

Centrifuges

Centrifuges	3	Low
Centrifuge cake pumps	3	Low
Cake Silo	1	Low

Overall Medium Risk – centrifuges contained within a building.

Cambi

	Units	Risk
Cake Silo	1	Low
Cake silo to Pulper tank feed pumps	2	Medium
Pulper to reactor tank feed pumps	2	Medium
Pulper recirc pumps	2	Medium
Digestor feed pumps	3	Medium
CHP (service contract)	1	Low
Waste heat Boiler (service contract)	1	Low
Main Boiler (service contract)	1	Low
Water Make Up Plant (softener) (service contract)	1	Low
Boiler water feed pumps	2	Medium
Diesel tank pumps	2	Low
Actuating valves	10+	Medium
Foul gas unit	1	Medium
Foul gas pumps	2	Medium
Compressors	2	Medium
Gas Holders	1	Low
Gas boosters	2	Low
CAMBI tanks	6	Low

Generally Medium/Low risk – should any failures occur the contingency is to hold indigenous sludges within the treatment process and divert tankered sludges to an alternative treatment centre

Digesters

	Units	Risk
Digesters	2	Low
Digester feed pumps	3	Medium
Digester recirc pumps	3	Medium
Adiabatic unit	2	Medium
Digester gas mixing system	4	Low

Overall LOW risk with odour – the limpet chambers at the top of the digesters are covered and extracted to an OCU

STC Dewatering

	Units	Risk
Klampress feed tank	1	Medium
Klampress feed pumps	4	Medium
Klampress units	4	Medium
Cake conveyer system	5	Medium
Cake storage area	1	Medium
Poly make up	2	Low
Poly feed pumps	4	Low
Main Storage pad for regional non compliant cake	1	Medium

The dewatering plant is located within a building which is abated and extracted to an OCU. Overall this is low risk

SHARON plant (Liquor treatment)

Liquours holding tank	2	Low
Liquors transfer pumps	2	Low
SHARON tank	1	Low
Blowers	3	Low
Caustic dosing unit	1	Low
Glycerol unit	1	Low
Caustic dosing pumps	4	Low
Glycerol dosing pumps	2	Low
Heat exchanger	1	Low

Very low risk, the Sharon plant treats liquors from the STC. Should any problems occur with the SHARON plant the contingency would be to reduce the throughput of the Cambi. The STW is able to treat the Cambi liquors when the plant is running at up to 50% throughput.

Appendix 4 Sites budgeted to import to Whitlingham STC

Site name	Site code	Budgeted Treatment Centre	Distance to Budgeted Treatment Centre (km)	2011-12 Budget volume (m^3)
ACLE - DAMGATE LANE STW	ACLEST	whitlingham	23.0	3,154.63
ALBURGH-CHURCH ROAD STW	ALBUST	Whitlingham	37.0	19.00
ALDBOROUGH - THWAITE FM STW	ALDBST	whitlingham	39.0	700.67
ALDEBURGH STW	ALDEST	whitlingham	61.0	3,817.65
ASHWELLTHORPE STW	ASWTST	whitlingham	19.0	245.38
AYLSHAM STW	AYLSST	whitlingham	30.0	8,300.89
BARFORD - CHAPEL STREET STW	BARFST	whitlingham	23.0	435.09
BARNHAM BROOM STW	BARBST	whitlingham	27.0	938.65
BARSHAM STW	BSHMST	whitlingham	30.0	11.00
BECCLES - MARSH LANE STW	BECCST	whitlingham	29.0	9,465.80
BEDFIELD STW	BDFDST	whitlingham	55.0	166.05
BELAUGH STW	BELAST	whitlingham	22.0	6,306.44
BENHALL STW	BENHST	whitlingham	61.0	4,221.69
BRAMPTON-THE STREET STW (SUFK)	BRAMST	whitlingham	37.0	87.29
BROCKDISH - BUNGAY ROAD STW	BROCST	whitlingham	44.0	245.07
BRUNDISH-CROWN CORNER HSW	BRUCST	whitlingham	58.0	3.33
BUNGAY STW	BUNGST	whitlingham	31.0	6,010.60

BYLAUGH STW	BYLAST	whitlingham	32.0	1,906.80
CAISTER STW	CAIPST	whitlingham	38.0	43,181.63
CANTLEY STW	CANTST	whitlingham	27.0	272.27
CORPUSTY STW	CORPST	whitlingham	35.0	167.76
CROMER STW	RUNMST	whitlingham	47.0	10,507.10
DENHAM-SHINGLE ST HSW	DENSST	whitlingham	47.0	5.67
DICKLEBURGH - RECTORY RD STW	DICKST	whitlingham	32.0	958.60
DITCHINGHAM STW	DITCST	whitlingham	24.0	1,089.39
EARSHAM - BUNGAY RD STW	EARSST	whitlingham	30.0	649.60
ELLINGHAM - BRACES LANE STW	ELLIST	whitlingham	27.0	804.51
EYE-HOXNE RD STW	EYEEST	whitlingham	44.0	7,402.88
FLIXTON-BUCK PLANT STW	FLIXST	whitlingham	34.0	4.67
FORNCETT END STW	FORNST	whitlingham	24.0	1,006.64
FREETHORPE - HALVERGATE RD STW	FREEST	whitlingham	30.0	834.75
FUNDENHALL STW	FUNDST	whitlingham	22.0	27.80
HALESWORTH STW	HALEST	whitlingham	46.0	4,423.68
HARLESTON STW	HARLST	whitlingham	40.0	2,709.39
HEMPNALL-FRITTON RD STW	HEMPST	whitlingham	22.0	1,243.76
HOCKERING-BY A47 STW	HOCKST	whitlingham	24.0	307.05
HOMERSFIELD STW	HOMEST	whitlingham	36.0	55.00
HORNING-KNACKERS WOOD STW	HRNKST	whitlingham	26.0	1,058.06
HOXNE STW	HOXNST	whitlingham	43.0	279.67
ILKETSHALL ST ANDREW STW	ILKAST	whitlingham	35.0	36.67
ILKETSHALL ST LAWRENCE STW	ILKLST	whitlingham	38.0	13.10
ILKETSHALL ST MARGARET STW	ILKMST	whitlingham	37.0	66.12
KENTON-GARNEYS CLS HSW	KENTST	whitlingham	53.0	9.33
KESSINGLAND-MARSH LN STW	KSSSST	whitlingham	43.0	3,636.98
LAXFIELD STW	LAXFST	whitlingham	57.0	4.67
LEISTON-VALLEY RD STW	LEISST	whitlingham	58.0	5,247.38
LONG STRATTON STW	LSTRST	whitlingham	22.0	3,880.10
LUDHAM-WALTON HALL STW	LUDWST	whitlingham	36.0	1,825.86
MENDHAM STW	MENDST	whitlingham	42.0	110.84
MENDLESHAM-STW	MENLST	whitlingham	51.0	554.24
MENDLESHAM-WASH LA HSW	MENWST	whitlingham	53.0	15.60
METFIELD STW	METFST	whitlingham	48.0	168.94
METTINGHAM STW	METTST	whitlingham	29.0	21.33
MONK SOHAM-HSW OAKLANDS	MONKST	whitlingham	54.0	6.67
MUNDESLEY STW	MNDSST	whitlingham	44.0	2,854.15
NORTH WALSHAM STW	NWALST	whitlingham	37.0	6,305.30
NORTHREPPS-FROGS HALL STW	NREPST	whitlingham	46.0	343.94
NORTON SUBCOURSE STW	NORSST	whitlingham	21.0	467.48
OAKLEY-DROSS LN STW	OAKLST	whitlingham	40.0	115.37
PORINGLAND STW	PORIST	whitlingham	12.0	4,413.32
PULHAM ST MARY STW	PSTMST	whitlingham	31.0	1,158.57
RACKHTH-THE SPRINGS WROXRD STW	RACKST	whitlingham	14.0	269.73
REDISHAM-STATION RD STW	REDIST	whitlingham	35.0	37.83

REDLINGFIELD-HSW	REDLST	whitlingham	50.0	4.67
REEDHAM STW	REEDST	whitlingham	25.0	713.09
REEPHAM STW (NORFOLK)	REEPST	whitlingham	31.0	1,702.01
RINGSFIELD-REDISHAM RD STW	RINGST	whitlingham	32.0	78.76
ROUGHTON STW	ROUGST	whitlingham	39.0	707.06
RUMBURGH-ABBEY FARM STW	RUMBST	whitlingham	43.0	61.90
S ELMHAM ST JAMES STW	SESJST	whitlingham	43.0	-
SAXLINGHAM STW	SAXLST	whitlingham	16.0	1,329.50
SHADINGFIELD-HILL FRM HSW	SHADST	whitlingham	34.0	19.14
SHIPMEADOW-LOCKS LANE STW	SHMEST	whitlingham	31.0	101.49
SISLAND STW	SISLST	whitlingham	16.0	4,922.20
SOMERLEYTON-MARSH LA STW	SOLYST	whitlingham	30.0	588.85
SOTHERTON STW	SOTHST	whitlingham	40.0	9.33
SOUTHREPPS-LOWER ST STW	SREPST	whitlingham	46.0	429.63
SOUTHWOLD-COMMON THE STW	SWOLST	whitlingham	49.0	2,915.53
STALHAM STW	STALST	whitlingham	29.0	6,013.85
STOKE ASH-ROMAN WY HSW	STKAST	whitlingham	46.0	27.00
STOKE HOLY CROSS STW	STHXST	whitlingham	13.0	1,306.71
STOVEN-WANGFORD RD STW	STOVST	whitlingham	37.0	53.76
STUSTON-ABBEY CLS HSW	STUSST	whitlingham	40.0	3.33
SWARDESTON-COMMON STW	SWARST	whitlingham	12.0	2,815.51
SYLEHAM-HSW	SYLEST	whitlingham	45.0	6.67
THORNDON-CATBRIDGE STW	TDONST	whitlingham	46.0	699.09
THORPENESS STW	TNESST	whitlingham	61.0	761.39
WANGFORD-STW	WANGST	whitlingham	41.0	312.74
WENHASTON-STW	WENHST	whitlingham	46.0	841.02
WESTHALL-NR MANOR FRM STW	WHALST	whitlingham	41.0	69.96
WESTLETON-OFF B1125 STW	WESNST	whitlingham	51.0	721.97
WEYBREAD-STW	WAYBST	whitlingham	45.0	861.43
WILBY-BARLEY VIEW HSW	WILBST	whitlingham	52.0	8.00
WILLINGHAM-FOX FARM STW	WIFFST	whitlingham	33.0	43.90
WINGFIELD STW	WINFST	whitlingham	48.0	3.33
WITHERSDALE STW	WITDST	whitlingham	46.0	47.14
WOODTON STW	WDTOST	whitlingham	19.0	-
WORLINGHAM - ASHTREE STW	WORAST	whitlingham	29.0	2,075.92
WORLINGWORTH STW	WOWOST	whitlingham	56.0	716.72
WRENTHAM-SOUTHWOLD RD STW	WRENST	whitlingham	41.0	633.65
WYMONDHAM STW	WYMOST	whitlingham	21.0	10,763.44
YOXFORD STW	YOXFST	whitlingham	52.0	663.11

ANGLIAN WATER SERVICES LTD.

Whitlingham Site

Odour Management Plan – Common Information Section

This document must be reviewed at intervals not exceeding 12 months

Revision	Authors	Date of Issue	Comments
1.0	A Paskins	22/11/2011	Draft for comment
1.1	A Paskins	30/11/2011	Inclusion of amendments requested by Pete Holland
2.0	Pete Holland	17 Dec 2011	Updated following EA review
3.0	P Holland / A Ebbage	24/04/12	
4.0	P Holland / A Ebbage	29/7/13	Update
5.0	P Holland / A Ebbage	04/07/2014	Update/Review
6.0	P Holland / A Ebbage / T Blackmore	12/11/14	Update

7.0	A. Pope	18/05/2015	Edit/review
8.0	A. Pope	25/03/2017	Update
9.0	A. Pope	10/05/2018	Edit/ Update
10.0	S Spencer	16/03/21	Review

Note: This document is one part of a four part document and should not be issued separately. The sub Odour Management Plans should always be read in conjunction with the Odour Management Strategy and the General Information Section

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1 Introduction

This section is the fourth part of the Odour Management Plan for Whitlingham and contains information common to the all the previous four sections. When reviewing this section it should be read in conjunction with the Odour Management Strategy and the sub Odour Management Plans for the WRC and STC.

2 Odour Risk Assessment

2.1 Methodology

An odour risk assessment was completed for the site. The purpose of the assessment is to identify potential sources of odour and the receptors, to quantify the risk associated with the odour source and the management controls required to minimise this risk.

The initial risk is based on the probability of a receptor being exposed to the nuisance and the consequences of such exposure (undertaken assuming no management controls are in place). The resultant magnitude of risk then prioritises the areas that need attention and the level of management control required to reduce this risk. Once these management controls are instigated then the residual risk can then be assessed.

A matrix is used to determine the overall risk and uses the following definitions:

Probability

HIGH	Exposure is probable: direct exposure with few/no barriers between hazard and receptor
MEDIUM	Exposure is fairly probable: feasible exposure possible, barriers to exposure less controllable
LOW	Exposure is unlikely: several barriers exist between hazard and receptors to mitigate against exposure
VERY LOW	Exposure is very unlikely: effective multiple barriers in place to mitigate against exposure

Consequence

SEVERE	Sufficient evidence that short or long term exposure may result in serious damage
SIGNIFICANT	Sufficient evidence that exposure to hazard may result in damage that is not severe in nature and is reversible once exposure ceases

MINOR	Damage not apparent though reversible adverse changes may occur
NEGLIGIBLE	No evidence of adverse changes following exposure

The comparison between the probability and consequence provides the following level of risk:

		CONSEQUENCES			
		Negligible	Minor	Significant	Severe
PROBABILITY	High	MEDIUM	MEDIUM	HIGH	HIGH
	Medium	LOW	MEDIUM	MEDIUM	HIGH
	Low	LOW	LOW	MEDIUM	MEDIUM
	Very low	Very Low	LOW	LOW	MEDIUM

3 Complaint Management

3.1 Dealing with Complaints and Reporting

The Treatment Manager will advise the EA and EHO of any abnormal operation or maintenance work which is likely to result in increased odour emissions. Emissions and the potential for odour nuisance will be minimised through positive odour control measures and planning of maintenance activities.

Odour complaints received from South Norfolk Council (SNC), Broadland District Council (BDC), customers, EA and EHO are addressed as below:

- from SNDC, BDC or customers through the OMC.
- from SNDC, BDC customers, the EA or EHO directly to the Site Manager.

Any complaints received from either members of the public or from regulators (Environment Agency, Environmental Health) will be investigated promptly and appropriate remedial action taken. Site staff will carry out a sniff test to try and identify the odour and its source. The complainant will be informed of the outcome of investigations and actions taken by the Customer Liaison Manager.

Complaints from the EA/EHO are sent directly to the Treatment Manager as well as the Collection Manager or directed through the OMC. This ensures all managers are aware of the complaint and the true cause of the odour nuisance is identified. A copy of the complaint and response by the

Site Manager is sent to the Correspondence Team to ensure all complaints are recorded on the Systems Applications and Products in Data Processing (SAP) Database, allowing future analysis of trends and remedial actions required to reduce odour events.

Contacts as per Complaints Management Structure

Position	Name	Phone	Email
Treatment Manager	Andy Pope	-	apope@anglianwater.co.uk
Assistant Treatment Manager	Stuart Chatten		schatten@anglianwater.co.uk
Customer Liaison Manager	Justin Arnold	08457 145145	jarnold@anglianwater.co.uk
Collection Manager	Hugh Crerand	-	hcrerand@anglianwater.co.uk
Regional Treatment Manager	Lisa Bush	-	lbush2@anglianwater.co.uk
OMC (Operations Management Centre)	Duty Manager of the Day	08457 145145	http://anglianwater.custhelp.com/app/ask/session/

3.2 Record Keeping

All complaints received by Anglian Water directly will be copied to the Correspondence Team. It is their responsibility to log complaints and actions in the (SAP) database. A copy of these will also be sent to the Anglian Water Regulatory Team.

The AWS SAP database holds records of all complaints received by the company and actions taken, it also permits the history and an audit of complaints and actions to be examined. A root cause analysis will be undertaken by the Customer Liaison Managers on a monthly basis and outcomes compared to actions being undertaken on the site or in the local sewerage network. Regulators will be invited to attend such meetings.

Complaint records will be available for inspection via the Treatment Manager.

3.3 Community Engagement

Remarkable Group has been working with Anglian Water for some time on community engagement activities. The aim of the initial consultation programme for Whitlingham was:

- To engage directly with residents on the proposals for co-composting.
- To improve understanding among local people, organisations and councillors of the benefits and how issues such as traffic will be managed.
- To ensure residents, organisations and councillors are aware of the economic benefits of the proposal with creating job opportunities with construction and operational phases of work and income derived from the sale of the composted product as fertiliser.
- To make key people aware of the positive environmental impacts of the proposal and how issues such as odour are being addressed.

Community Engagement Programme

Whitlingham WRC/STC has received odour complaints in the past but since the installation of the Cambi process this did increase. Following meetings with the Environment Agency and EHOs a full odour survey was commissioned that led to the investment in the OCUs on the STC. Historically complaints were linked to the storage of limed cake, it was for this reason that the Cambi process was installed to cease the requirement for this.

A planning application for retaining the large concrete pad and developing a co-composting operation was submitted to Norfolk County Council in August 2011. The application has since been approved.

A planning application for a cake import facility is currently underway. The application has since been approved building completed and fully commissioned.

In order to submit, a programme of pre-application consultation was carried out including:

- Stakeholder liaison group meetings
- Public exhibition
- Newsletters
- Posters advertising the public exhibition
- Press release advertising the exhibition and details of the planning application
- A consultation website giving information about the site and planning application

In addition general consultation activities have included:

- Additional newsletters detailing improvements on site
- Exhibition for Thorpe St Andrew residents to tackle concerns over odour
- Open day tours giving local people the opportunity to find out more about the site

Liaison Group

The liaison group meets up as required to discuss any concerns that have been raised.

The group is made up of key local councillors as well as Environmental Health Officers and the Environment Agency.

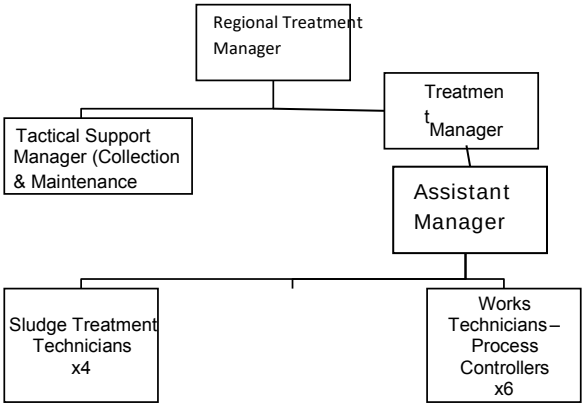
Ongoing

The consultation activity is ongoing for Whitlingham. Newsletters go out on an adhoc basis when there are updates to communicate to residents. Open day tours are arranged once a year to give people the opportunity to meet the team running the site and find out how it operates.

3.0 Management Structure

3.1 Management Structure

Whitlingham WRC is part of Anglian Water's Norwich catchment. The management structure in relation to Whitlingham WRC is shown below:



4 Roles and responsibilities

Whitlingham WwTW is managed by a site based Treatment Manager and a permanent staff of 6 Works Technicians (process controllers) and one Assistant Manager. Works Technicians check the plant daily and inform the Treatment Manager/ Assistant Manager if there is any significant odour emissions above normal values from the wastewater treatment plant.

The Treatment Manager ensures that any odour control records are made available to Broadland District Council/South Norfolk Council and the EA and that potential additional odour issues are identified and every effort made to secure investment in best practicable solutions.

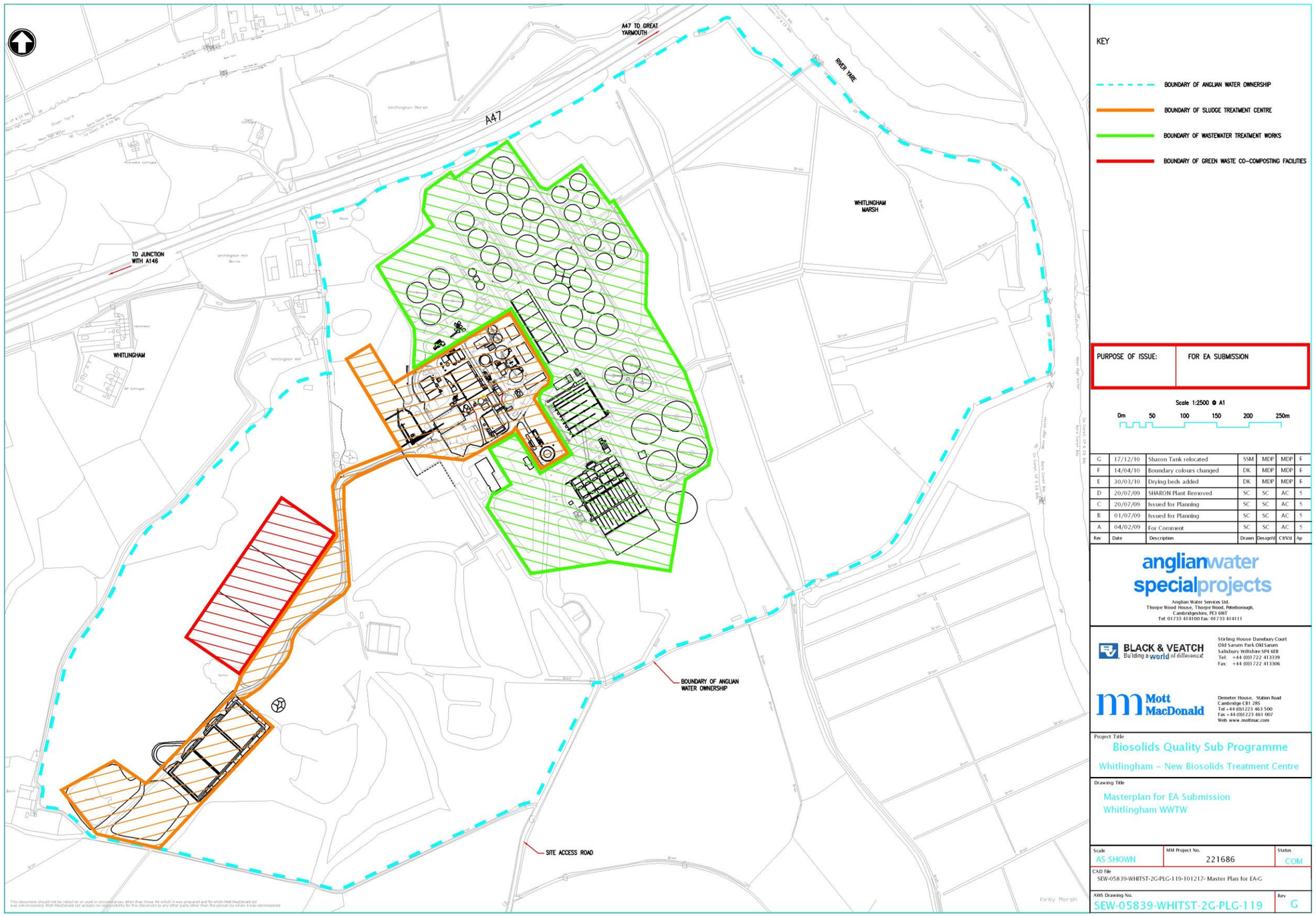
The Treatment Manager will inform BDC and SNC of any short term onsite issues likely to cause odour nuisance to local residents, for example:

- Build up of sludge in the primary tanks resulting from inadequate discharge of primary sludge from the PST's for treatment in the STC.

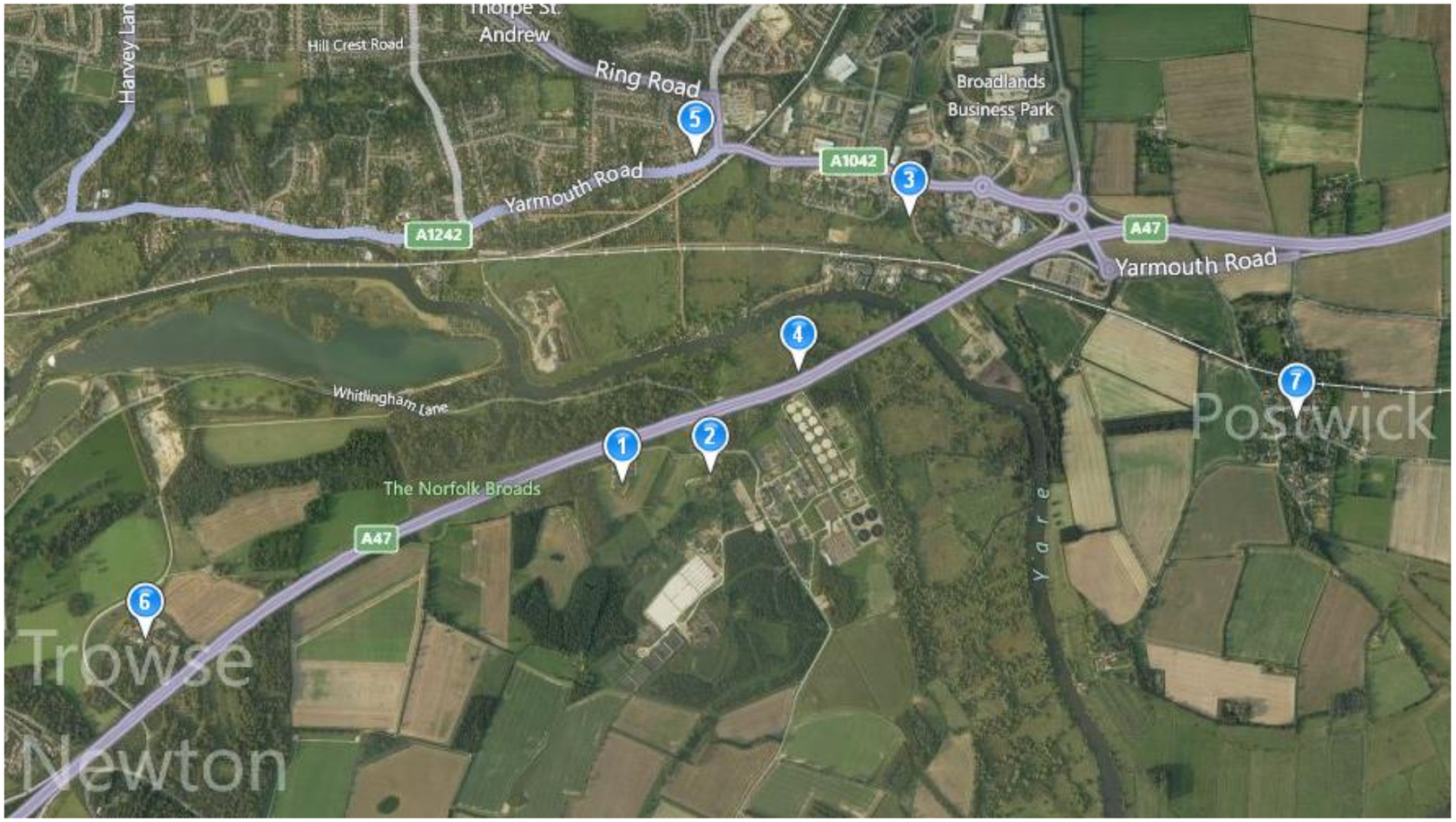
5 Training

All staff have received sufficient training appropriate to their role as summarised in OMP strategy section

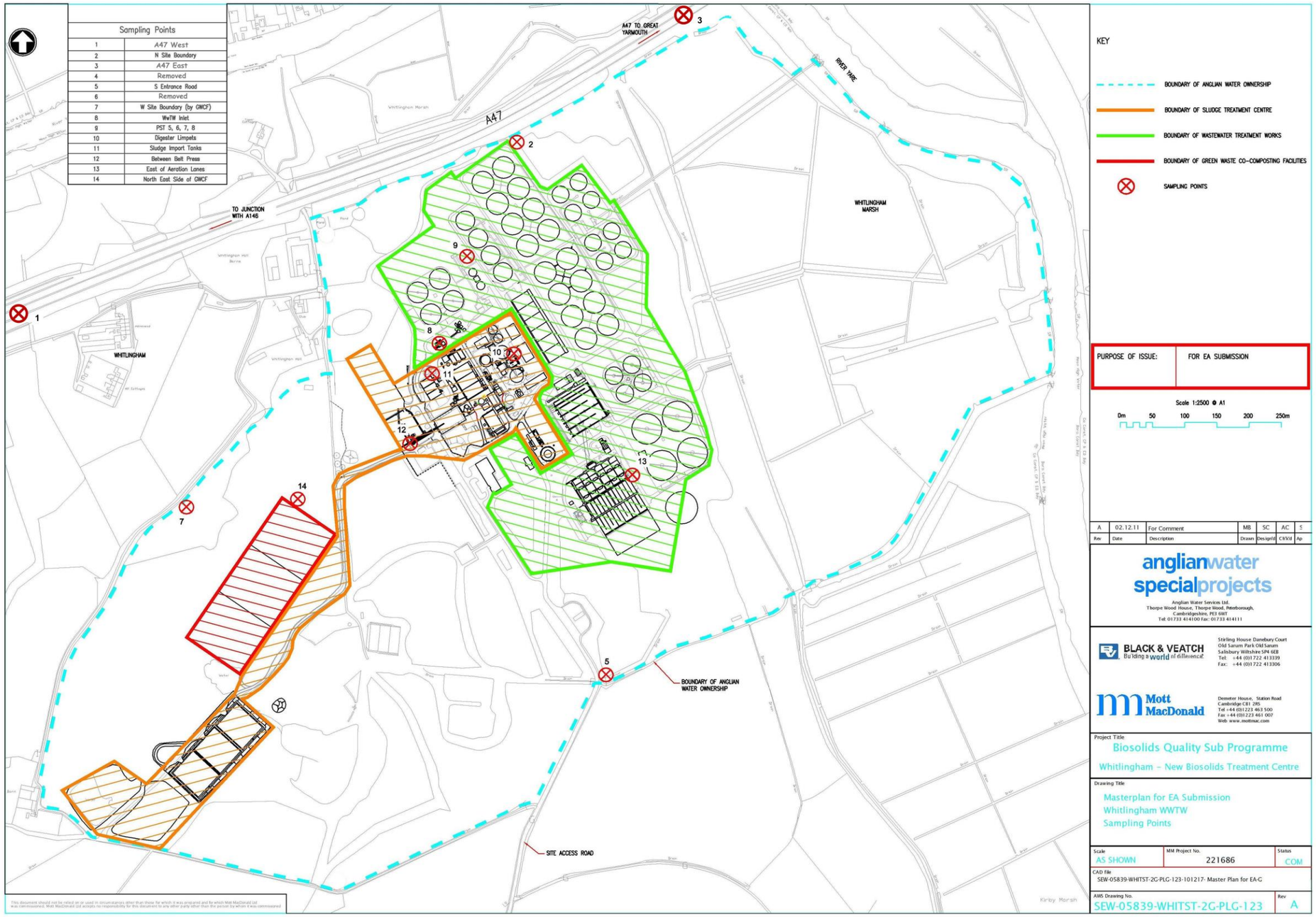
6 Site Layout



Sensitive receptor locations



SNIFF Test Points



7 Odour Monitoring Protocol

7.1 Introduction

Odour monitoring includes:

- Routine, "pro-active", monitoring designed to minimise the potential for odour emissions
- Periodic investigative, "reactive", monitoring in response to reports of increased emissions that may give rise to nuisance at nearby receptors. Typically investigative monitoring will be triggered in response to reports of increased trends in emissions from operations or in response to complaints of odour nuisance received.
- Qualitative emissions of odour to atmosphere by SNIFF testing
- Quantitative assessment of odours emitted from site is undertaken by monitoring hydrogen sulphide as a surrogate measurement for odour. Selected samples may be analysed by olfactometry as required. Other parameters, such as, ammonia, mercaptans or amines may be measured if it is considered that they contribute significantly to the odour emissions

It is recognised that in sewage processes and sludge treatment processes, the major component of untreated odour is frequently hydrogen sulphide, which can be used as a surrogate measurement for odour.

The results of the monitoring exercises allow management decisions, to be taken to modify operational procedures or to delay them, to minimise emissions to atmosphere.

7.2 Baseline Data

Significant amounts of data from existing monitoring regimes are available, for example:

- Continuous monitoring of hydrogen sulphide in the rising main discharge chamber to determine the efficiency of the Nutriox dosing in suppressing septicity in the rising mains ;
- 6 monthly odour surveys have been undertaken on site by a specialist contractor over the last two or three years;
- The results from investigatory monitoring

This data will represent the current situation on the WRC and STC.

The data includes data collected on site, from plant in continuous and intermittent use. It also includes any monitoring data collected outside of the boundary fence and at identified receptor locations.

The existing data will be analysed by AWS to provide typical and extreme values of emissions from plant to indicate the baseline emissions and to assist with populating the inventories within the Odour Management Plans.

The data will be used to select threshold values to be used to initiate actions to minimise odour releases that might cause odour nuisance. However, it is recognised that the selected threshold values may need further adjustment to achieve effective management of odour emissions and to minimise the potential for odour nuisance beyond the boundary fence or at receptors.

Continuing routine monitoring is proposed which will allow trends in the baseline to be monitored over time and the threshold values for action to be adjusted to achieve more effective control over odour emissions.

7.3 Types of Monitoring

SNIFF Testing

This is undertaken in accordance with the methodology specified in *Technical Guidance Note IPPC H4, Integrated Pollution Prevention and Control (IPPC) Horizontal Guidance for Odour Control Part 1 - Regulation and Permitting, April 2011.*.

This testing is subjective, but is a useful, quick, test that can be undertaken to provide a subjective snap-shot of the presence and strength and character of odour either within a site boundary, at the boundary or in the area/community surrounding the site.

This is particularly useful for daily assessments and monitoring by Works Technicians. However, the operator's sensual acuity tends to be desensitized owing to regular exposure to the working environment. To counteract this effect the following actions procedures are in place:

- Office based staff will accompany operational staff on two occasions per week.

All staff associated with the SNIFF testing will be trained in the methodology.

Hydrogen Sulphide Monitoring

Hydrogen sulphide is used as a surrogate measurement for odour, particularly in areas of wastewater treatment and sludge treatment where a relationship can be defined between hydrogen sulphide content and the odour content.

Hydrogen sulphide monitoring is undertaken using a range of methodologies:

- Gas tubes such as Gas Tech/ Draeger or other similar products tubes can be used for spot measurements and to monitor the efficiency of the OCUs. Instrumental loggers such as the Odalogger that can be used to measure spot concentrations or be put in situ to make continuous or semi-continuous measurements of hydrogen sulphide. A fixed logger is proposed for installation in the inlet channel. Measurement range 0 to 100 ±0.5 ppm (v/v). This logger will record data at 15 minutes intervals which is accessible from the AW telemetry system.

AW has purchased a high sensitivity monitor to be used between Whitlingham, Cliff Quay and Kings Lynn. This will be used to monitor environmental hydrogen sulphide concentrations during the six monthly surveys, and, when available, to make spot measurements during investigative monitoring. During 6 monthly survey if 5 mg/l H2s detected this is then investigated further.

All equipment used will be maintained and the calibration checked or undertaken in accordance with the manufacturer's instructions.

Olfactometry

If Olfactometry is undertaken, it will be carried out in accordance with the BS EN 13725.2005. Olfactometry requires the sampling to be programmed in advance and would involve the use of a specialist contractor such as H&M Environmental or Silsoe Odours Ltd.

This involves collecting samples of gas (around 0.25 m^3) and transporting to a laboratory for analysis by olfactometry. The standard method requires a panel of six persons with normal sensitivity to a standard odour (n-butanol).

Because of the limited number of recognised contractors capable of undertaking this work, the methodology and the personnel involved, the cost of undertaking olfactometry can be prohibitive.

Olfactometry will therefore only be considered under special circumstances.

Meteorological Monitoring

Monitoring

There is one weather stations installed at Whitlingham. The weather station was installed by Skyview Systems Ltd in this location to provide the most reliable data. It is around 10m above ground level. Skyview Systems maintain the station and provide access to the output data from their website.

This station continuously logs the following parameters:

- Atmospheric pressure
- Ambient temperature
- Humidity
- Wind speed and direction
- Rainfall

As well as historic weather data, this site provides weather forecast data to allow operators to plan operations in a way to minimise odour conditions.

The weather station has been calibrated by the supplier and a yearly visit is performed for re-calibration.

Specific Meteorological Conditions

Specific meteorological conditions such as unusual wind direction, abnormally hot and dry weather or inversions, can have adverse affects on dispersion of odours from site.

There are no meteorological conditions, such as temperature inversions, known to occur at Whitlingham on a regular basis.

Other

Other monitoring will be undertaken as required including:

- Gas flow measurement
- Other odour determinands (ammonia, mercaptans, amines)
- Record of operational activities - Site diary (especially abnormal activities or maintenance activities that might increase the risk of odour releases)

Gas flow measurement will be used to check that extraction systems are operating at the design flows. Flow measurements will also be undertaken for the same purpose during OCU efficiency tests.

Other odour determinands will only be investigated if the odour and hydrogen sulphide monitoring indicate that another component is contributing to odour nuisance, or when operational activities indicate a need for example, ammonia in relation to the re-introduction of liming of sludge.

7.4 Meteorological Data

Meteorological data has been recorded at Whitlingham since March 2011.

7.5 Routine Monitoring

This section lists the current proposals for routine monitoring at locations around the site.

Monitoring	Site	Locations	Frequency
Routine SNIFF	WRC	As per SNIFF testing diagram	Once weekly
	STC	As above	As above
Hydrogen sulphide	Sewage discharge chamber	STW inlet	Continuous/semi-continuous data logging proposed
	Specified site sampling locations	See sampling locations on site location map	6 monthly
Meteorological data	WwTW	Ontop of the fermentation tank (Data accessed through Skyview Website	Continuous readout with fifteen minute records
	STC	As above	Continuous readout with fifteen minute records
Site diary	Whole site	Operations Records of intermittent activities, abnormal operations, off-site activities and other relevant matters including complaints received and operator observations recorded in works diary/logbook for reference	As and when complaints received and SNIFF tests completed

Records of completion of the routine monitoring will be monitored by the Manager. The records will be kept on site in the site diary and remain available for audit purposes.

7.6 Investigative Monitoring

This will be undertaken in response to:

- Complaints received
- Operator observations of:
    - Measured emissions approaching or exceeding threshold levels
    - Significant changes in emissions likely to result in complaints
    - Poor treatment in the OCUs

This table lists the current generic proposals for investigative monitoring at the site which will be completed using the site odour complaint investigation form.

Monitoring	Site	Locations	Response
SNIFF	Site	As directed by the standard SNIFF test methodology in relation to the likely source of the odour	As soon as personnel are available to undertake the test
Hydrogen sulphide	WRC and STC sites	As directed by works technicians in the light of changes in trends or in response to complaints.	Selective spot sampling or a full site mapping exercise at regular sampling points as required.
	Inlet works	Discharge to inlet works at site following adjustment to Nutriox dosing adjustments	Continuous sampling proposed
	WRC and STC OCU's efficiency testing	As directed to investigate residual life in media of OCU's	Within one day
Other	Site	Monitoring of other components such as ammonia, mercaptans or amines where it is suspected that they specifically may be contributing to emissions eg at the cake import reception and rehydration plant	Sampling and analysis to be organised within one week

7.7 Training

Selected operations staff to receive training in the following:

- SNIFF Testing (Includes selected office/admin workers allocated to undertake the SNIFF)
- Use of gas detector tubes (Operations staff/technicians) involved in relevant operations
- Use of Hydrogen sulphide monitors and loggers (Operations staff)
- Complaint reporting (Management and operations staff)

Additionally specialist contractors used to undertake survey work should be able to demonstrate their expertise and should preferably be accredited in the survey methods proposed.

Appendix 1: OCU Performance Monitoring Record

Works Technicians Routine OCU activity sheet

	Bio-Filter Odour Unit				STC Chemical Odour unit				Cake Building Odour Scrubber			Odour Suppressant Inlet		
Date	Amm In	H2S In	Amm Out	H2S Out	Amm In	H2S In	Amm Out	H2S Out	H2S In	H2S Out	Control	Chemical	Nozzles	Control

Appendix 2 :OCU Maintenance Schedule

Corgin Odour Suppressant Inlet Maintenance Plan

Check	Frequency	Ref.	Action
Check level of concentrate in tank/drum	Daily	Pg.5 item 19	Top up as necessary, take appropriate care, use correct PPE, and check MSDS.
Check system is in daily use. If not, it should be purged	Daily	Pg.4 item12	Purge as required, press purge button on control panel.
Check likelihood of freezing, purge if required.	Daily	Pg.4 item 12	Purge as required, press purge button on control panel. If auto-purge is fitted, confirm frost-stat operates correctly.
Check appearance of filter cartridge within control panel	2 weeks	Pg.3 items 2,4	Change cartridge if discoloured, and change inline filter at the same time. This should be done in any event every 3 months. This is tracked in TM and Optimiser calendar
Legionella check	6-monthly	Pg.7	Contact Corgin to carry out precautionary Legionella test and disinfection service.
Strip down and lubricate nozzles	Annually	Pg. 5 item 21	Access each nozzle position, service by competent person, discuss with Corgin for details.

Corgin Odour Suppressant Cake Pad Maintenance Plan

Check	Frequency	Ref.	Action
Check level of concentrate in tank/drum	Daily	Pg.5 item 19	Top up as necessary, take appropriate care, use correct PPE, and check MSDS.
Check system is in daily use. If not, it should be purged	Daily	Pg.4 item12	Purge as required, press purge button on control panel.
Check likelihood of freezing, purge if required.	Daily	Pg.4 item 12	Purge as required, press purge button on control panel. If auto-purge is fitted, confirm frost-stat operates correctly.
Check appearance of filter cartridge within control panel	2 weeks	Pg.3 items 2,4	Change cartridge if discoloured, and change inline filter at the same time. This should be done in any event every 3 months. This is tracked in TM and Optimiser calendar
Legionella check	6-monthly	Pg.7	Contact Corgin to carry out precautionary Legionella test and disinfection service.
Strip down and lubricate nozzles	Annually	Pg. 5 item 21	Access each nozzle position, service by competent person, discuss with Corgin for details.