Asset Management
Asset Standard
Odour Management Plan

Crossness STW

CROSS1ZZ

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0 Document Control & Procedures

0.1 Contents

Figures and Tables:

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For further information/advice, please e-mail: am.standards@thameswater.co.uk.

Owner Review Requirements

Document to be reviewed when any changes are made to the site or processes.

Local Review Requirements

Site Manager should be informed when handwritten amendments are made to this document.

Revision No	Reason for Revision	Prepared by	Approved by	Date
1		[redacted]		
2				May 2007
3				
4				
5				
6	TTQI updates			August 2014
7	Conversion and validation of OMP into new Standard format			October 2014

8	Updated alongside AD permit application	[redacted]		June 2021
8.1	Update for STC permit application following EA feedback			July 2022
8.2	Resubmission of IED AD permit application	[redacted]	[redacted]	November 2023

0.4 Sign Off

Area Operations Manager	[redacted]	Date: November 2023
Site Manager THP	[redacted]	Date: November 2023
Site Manager STW	[redacted]	Date: November 2023

0.5 Glossary of Terms

TERM	DESCRIPTION
AD	Anaerobic Digestion
CHP	Combined Heat and Power
CVGC	Constant Velocity Grit Channels
CSM	Customer and Stakeholder Manager
DEFRA	Department for Environment, Food and Rural Affairs
DRP	Disaster Recovery Plan
EA	Environment Agency
EHO	Environmental Health Officer
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2016
FST	Final Settlement Tank
GBT	Gravity Belt Thickener
H4	Environment Agency - How to comply with your permit – H4 Odour Management, March 2011
HL	High Level
ICA	Instrumentation Control & Automation
IED	Industrial Emissions Directive
OCU	Odour Control Unit
OHC	Out of Hours Coordinator
OMC	Operational Management Centre
OMP	Odour Management Plan

TERM	DESCRIPTION
PC	Process Controller
PFT	Picket Fence Thickener
PPM	Planned Preventive Maintenance
PST	Primary Settlement Tank
PTW	Preliminary Treatment Works
RAS	Return Activated Sludge
Receptors	Sensitive receptors are any fixed buildings or installations where odour annoyance may occur, such as residential homes, schools, hospital, offices, shops or garden centres. Open areas such as playgrounds and public footpaths should also be listed where these are known to have been affected by odour.
RSPS	Raw Sludge Pumping Station
SAS	Surplus Activated Sludge
SAP	Thames Water's enterprise resource and planning system
SCADA	Supervisory Control And Data Acquisition
SOM	Site Operating Manual
SOS	Southern Outfall Sewer
SPG	Sludge Powered Generator
SPS	Sewage Pumping Station
STC	Sludge Treatment Centre
STW	Sewage Treatment Works
TCM	Technically Competent Manager
THP	Thermal Hydrolysis Plant
TM	Team Manager
TW	Thames Water
UWWTD	Urban Wastewater Treatment Directive
WOCC	Waste Operations Control Centre

1 Introduction

This Odour Management Plan (OMP) forms part of Crossness STW Best Operating Practice and is a constituent part of the Environmental Management System (EMS). A key related document is the Site Operating Manual (SOM) – this document can be found as a hard copy in the Crossness STW administration building and on Thames Water's database SharePoint, within the EMS pages.

The purpose of this OMP is to define how the potential and actual sources of odour from Crossness STW are identified, and how, as far as is reasonably practicable, they are controlled and recorded. It is primarily a management guide; detailed procedures are contained within the SOM referred to above.

Changes to OMP procedures are captured in the SOM as part of the periodic reviews of this document.

The effectiveness of the odour control measures will be reviewed at least annually, or sooner, if any of the following occur:

- If the site in question acquires any other permitted activity with the potential to increase the risk of odour off site.
- When significant changes are made to the site which may affect odour, e.g. capital spend.
- As a result of a change in pattern of odour complaints, increase in public concern and as soon as possible after a significant incident.
- When the site management changes.
- If there is a material change in relevant regulations or guidance.
- If there is an odour release incident.
- If a contingency measure is triggered.

This OMP is an operational document that has been developed following a review of the potential risk areas for odour release. It details operational and control measures appropriate to the reduction or elimination of the impact of odours from wastewater treatment works. It provides detail to allow operators and maintenance staff to understand the operational procedures for both normal and abnormal conditions.

This OMP was updated in 2022 to incorporate appropriate odour control measures for activities that will be newly regulated under an Environmental Permit issued under the Environmental Permitting (England and Wales) Regulations 2016 (EPR), following the principles transposed through the Industrial Emissions Directive. This follows the reinterpretation of the Industrial Emissions Directive in exclusion of UWWTD activities - meaning that anaerobic digestion (AD) on a Sewage Treatment works now needs an Environmental Permit.

A permit for the SPG is still present but the incinerator poses no odour risk since it is permanently non-operational and has been subject to clean and make safe activities.

The Odour Management plan has been structured to distinguish between the two regulatory regimes, which are fully described in the Site Information chapter. The wastewater treatment process is covered by the Urban Wastewater Treatment Directive (UWWTD). The Environmental Permit for the Sludge Treatment Centre (STC) covers various process including but not limited to, the anaerobic digestion (AD) process, thermal hydrolysis plant, combustion of biogas in the CHP plant and the storage of resulting sludge. This OMP responds to odour risks from both UWWTD and the Sludge Treatment Centre (STC) permitted processes.

This OMP is stored electronically on SharePoint within the EMS page. A hard copy is kept on site within the Site Operating Manual.

1.1 Relevant Guidance

The following guidance has been used to inform the contents of the OMP where it relates to activities regulated under EPR through the Sludge Treatment Centre Permit. This guidance does not apply to UWWTD activities:

- Environment Agency - How to comply with your permit – H4 Odour Management', March 2011 (H4)
- Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council (Waste Treatment BAT Conclusions)

Where this Odour Management Plan relates to STW activities regulated under the UWWTD this OMP may still draw upon elements of best practice taken from H4 but this should not be inferred as H4 being applicable to these activities.

The OMP format used is in line with that adopted for other Thames Water sites.

2 Site Information

2.1 Location and Receptors

Site Address:

Crossness STW
Belvedere Road
Abbey Wood
London
SE2 9AQ
What3Words:///fell.bottom.late
EPR Permit number for STC to be included when issued
EPR Permit number for SPG: EPR/UP3737PQ – **Non-operational**

Crossness STW is a large works that serves a major part of South London. It is located on the tidal reach of the River Thames close to Abbey Wood and Thamesmead in the London Borough of Bexley. The works serves the population of the London Boroughs of Richmond-Upon-Thames, Wandsworth, Merton, Lambeth, Southwark, Lewisham, Greenwich and parts of Sutton, Bexley and Bromley. This catchment area covers approximately 240km^2 and serves a population equivalent of 2.1 million people.

The Crossness STW catchment extends south of the River Thames and encompasses Putney in the West, Thamesmead in the East and Bromley to the South. There are 3no. major sewers that transfer flows to the works. Two of the sewers serve the low-lying ground close to the river and are named SOS (Southern Outfall Sewer) 1&2 and the third the HL (High Level) serves the high level ground in the south of the area. The three sewers combine at the inlet to Crossness STW. There are pumping stations on the route that provide a combination of storm relief (pumping to river) and transfer. Greenwich SPS (Sewage Pumping Station) is a major transfer and storm pumping station that is controlled from the Crossness STW control room.

The sewage treatment works has been extended to treat increased volumes to meet new EA discharge consent limits. This project has delivered additional fine screens, grit removal plant, primary settlement tanks, diffused aeration and final settlement tanks which will handle 38% of the site flows.

In 1998 a Sludge Powered Generator (SPG) plant was added to the site, which burned the sludge and used the heat to generate electricity for the site. In 2018, the SPG was decommissioned and is no longer in use.

Receptors

The nearest receptors are given in Table 2.1 below and have been marked on site location map in Figure A, Appendix 4:

Table 2.1 - Location of potentially sensitive odour Receptors.

Receptor Number	Receptor Address	Receptor type	Approximate distance to the nearest site boundary (m)	Direction from the site.	Receptor Sensitivity
1	Eastern Way (A2016)	Passing traffic	Adjacent	South	Low
2	BLT Motorcycle Training	Commercial	Adjacent	West	Medium
3	Sports Club Thamesmead	Recreational	80	West	High
4	Ridgeway – park and garden	Open Space	Adjacent	West	Low
5	Crossness Nature Reserve	Open Space	Adjacent	East	Low
6	Riverside Resource Recovery Ltd T/A Cory Riverside Energy	Industrial	300	East	Medium
7	Iron Mountain, Asda & Lidl Belvedere Regional Distribution Centres, Ocado CFC4 Erith and other surrounding warehouses, distribution centres and storage facilities (either side of Crabtree Manorway N)	Industrial	500 - 1700	East / Southeast	Medium
8	Area surrounding Crabtree Manorway S	Industrial	1150 – 1600	Southeast	Medium
9	Area surrounding Hailey Road	Industrial / Retail	430 - 810	Southeast	High
10	Area surrounding Clydesdale Way	Hotel / Residential / Retail / Pub	710 - 970	Southeast	High
11	Residential area surrounding North Road	Residential	800	Southeast	High

12	Belvedere train station	Transport	1100	Southeast	Medium
13	Area surrounding Mitchell Close	Community Centre / School / Church/ Sikh Temple	1400	Southeast	High
14	Belvedere	Residential	1000 - 2000	South / Southeast	High
15	Frank's Park	Open Space	1500	Southeast	Low
16	Erith Fire Station	Fire Station	1900	Southeast	Medium
17	Belvedere Beach Playground	Recreational	1750	South	High
18	Asda Belvedere Superstore and area surrounding Picardy Street	Retail	1100	Southeast	High
19	Cornerstone School	School	1100	South	High
20	Lesnes Abbey Woods	Open Space	1300 - 2000	South	Low
21	Area surrounding Waldrist Way	Commercial / Industrial	330 - 630	South	Medium
22	Area surrounding Centurion Way	Commercial / Industrial	800	South	Medium
23	Harris Garrard Academy & Yarnton Way Nursery	Schools	680	South	High
24	Residential area surrounding Middle Way	Residential	1200	South	High
25	Abbey Way Play Area	Open Space	1050	Southwest	Low
26	Residential area surrounding Overton Road	Residential	1300	Southwest	High
27	Southmere Park & Southmere Lake	Open Space	500	Southwest	Low
28	Residential area surrounding Hartslock Drive	Residential	750	Southwest	High

29	Willow Bank Primary School	School	1000	Southwest	High
30	Abbey Wood	Residential	1700	Southwest	High
31	Boxgrove Primary School	School	1700	Southwest	High
32	Abbey Wood train station	Transport	1750	Southwest	Medium
33	Birchmere Business Park	Commercial	2000	Southwest	Medium
34	Woolwich Polytechnic School for Boys	School	1700	West	High
35	Thamesmead	Residential	300 - 2000	West	High
36	Thamesmere Leisure Centre	Recreational	1700	West	High
37	Cannon Retail Park	Retail	2000	West	High
38	Jubilee Primary School	School	770	West	High
39	Crossway Park	Open Space	500	West	High
40	Birchmere Community Hub	Recreational	1100	Southwest	High
41	Thamesmead Ecology Study Area	Open Space	600	West	Low
42	Thames Path	Footpath	Adjacent	North / Northwest / Northeast / East	Low
43	Residential area surrounding Summerton Way / Fairway Drive	Residential	300	West	High
44	A A Guest Rooms	Guest House	525	West	High
45	Oil Storage Depot	Industrial	760	North	Medium
46	Industrial area surrounding Choats Road	Industrial	1400	North	Medium
47	Dagenham Dock train station	Transport	1900	North	Medium

48	Ford Dagenham - Quality Department / Dagenham Engine Plant / Dagenham Diesel Centre (DDC) etc	Industrial / Commercial	800 - 1800	North	Medium
49	Area surrounding Marsh Way	Industrial	1500 - 2000	Northeast	Medium
50	Area surrounding Ferry Lane	Industrial / Commercial	2000	East	Medium
51	A13	Passing traffic	1950	North	Low
52	Riverside School	School	1900	Northwest	High
53	Area surrounding Fielders Crescent	Residential	1900	Northwest	High
54	SRC Barking Depot	Industrial	1300	Northwest	Medium
55	Area surrounding Church Manorway	Industrial	1750 - 2000	Southeast	Medium
56	Bullman Marine – Container Supplier	Industrial	1900	Northwest	Medium
57	National Grid Substation - Barking	Industrial	1900	Northwest	Mediu

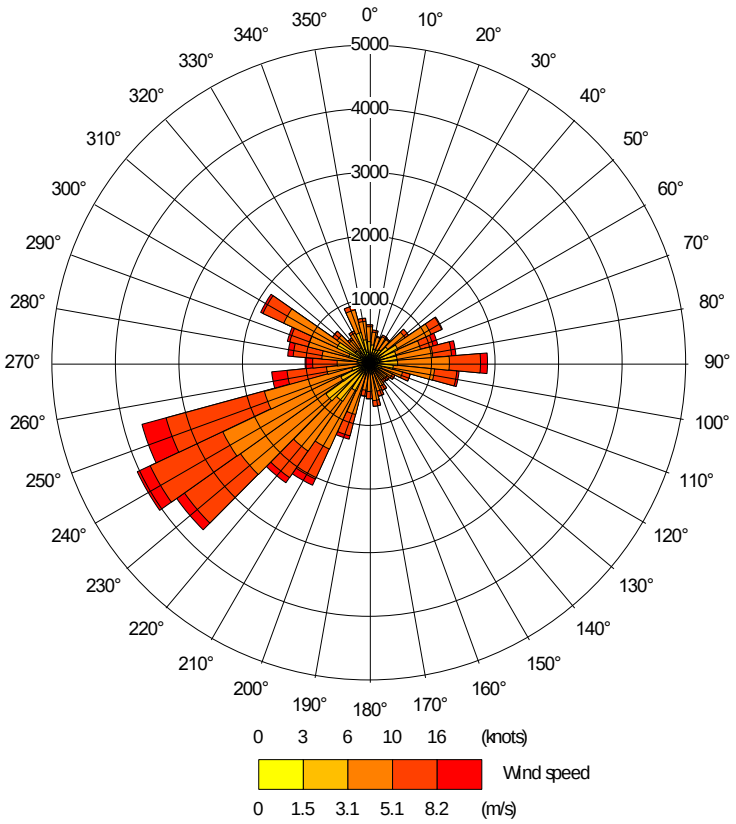
2.2 Off-Site Sources of Odour

There is an Energy from Waste facility adjacent directly east of Crossness STW with the potential to generate odour. Furthermore, there is a waste facility south east of Crossness STW that may also have the potential to generate odour.

2.3 Wind Rose and Weather Monitoring

London/City Airport meteorological station (approximate location NGR E 543189 N 180444) is located approximately 6.2 km west of the site and is considered the closest most representative meteorological monitoring station to the site. Data is recorded at the meteorological station in hourly measurements and the figure below presents the relationship between the frequency and speed of wind from compass point directions for the combined years 2016 – 2020. The figure illustrates the predominant wind direction to be southwesterly, which means receptors northeast of the site would have the highest probability of experiencing potential increases in odour emissions.

Figure 2.3.1 London City Airport Meteorological Station 2016-2020



There is an on-site weather station at Crossness which monitors rainfall, wind direction and wind speed (see section 4.5). Weather on site can be reviewed if complaints are received or during periods of abnormal operations. The internal 'Weather' SharePoint site provides adverse weather information, and the UK Met Office website can also be used.

2.4 Site Layout and Treatment Processes

Details of the site layout and treatment processes are given in the following sections of the Site Operating Manual and are therefore only given summary attention in this OMP:

Section	Description
1	Governance & Control
2	Location, key layout plans and diagrams. Site services, including power, water, drainage, SCADA and ICA. Consent details, process overview, chemical and waste handling.
3	Detailed description of each treatment process, including sludge and odour control.

4	Maintenance
5	Plant control, monitoring, and logging.

Process Description

2.4.1 UWWTD activities

The sewage that arrives at Crossness is mainly domestic, the remainder being made up of rainwater run-off and a small proportion of industrial effluent. Sewage flows to Crossness STW through three 3.5m diameter sewers, 2no. low-level sewers and s 1no. high-level sewer, delivering 700,000m^3 per day on average. During storm conditions, a much greater volume flows to Crossness. The extra storm flow is either fed by gravity and/or pumped into 4no. storm tanks, which hold excess sewage until the flow returns to normal.

The effluent stream passes through 8no.coarse rake screens and 10no. fine screens, utilising screening to 6mm. Screenings are processed through 8no. skip compactors and the screened sewage enters 2no. three-lane grit removal plant, before being fed to 24no. rectangular scraped Primary Sedimentation Tanks (PSTs). The fine screens and grit removal plant are known as the PTW. The preliminary treatment works is covered to minimise odour, the grit clarification plant is housed in a building with odour control and PSTs 17 – 24 and the associated Sludge PS and Distribution Chamber are covered to minimise Odour.

The settled sewage passes to 16no. activated sludge tanks with surface aeration, and 6no. diffused air activated sludge tanks and the mixed liquor passes to 44no. Final Settlement Tanks (FSTs) before final effluent enters a common culvert and then to the outfall.

2.4.2 Sludge Treatment Centre Permit Activities

The STC treats both indigenous sludges and imported sludges. Indigenous sludge is generated from the incoming flow to the STW, which is screened, passes to the Primary Settlement Tanks and through the aerobic treatment process under the UWWTD. Indigenous sludges derived from the main flow are then subject to sludge thickening processes and thickened sludge is transferred to either a Primary Sludge Blending Tank or SAS Blending Tank, which are connected to an Odour Control Unit. Liquors from Primary Sludge and SAS thickening processes are returned via Liquor Return Pumping Stations to the head of the works for treatment via the urban waste water treatment route.

Additional Sludge Buffer Tanks are available to be used for the storage of sludge as required if sludge cannot be processed by the Thermal Hydrolysis Plant (THP). Imports of sludge from other works are delivered by tankers to import points and pumped to the Sludge Buffer Tanks. Imported sludges are pumped to the Sludge Blending Tanks where they combine with indigenous sludge. All such imports are subject to appropriate waste pre-acceptance and acceptance checks, prior to import. Similarly, sludge imports may also be discharged into the THP High Energy Blending Tank.

The STC comprises of an offloading point for permitted imported wastes close to the works inlet of the STW. Wastes are imported via tanker to the Works Inlet for treatment through the aerobic treatment process via the UWWTD at the site. All imports will be assessed using the Thames Water standard waste pre-acceptance checks to ensure that they are appropriate for treatment via the

UWWTD. Once pre-approved as suitable for treatment via the UWWTD route, the waste carriers are approved. Wastes will be subject to appropriate waste acceptance checks in accordance with Thames Water procedures. Incoming vehicles are directed to the offloading point, which is an impermeable surfaced area, equipped with sealed drainage and kerbing to reduce the risk of spillages. Incoming tankers park in the offloading area, and hook up to the offloading point, using the site supplied flexible hose pipes to prevent misconnection issues. The offloading then proceeds, with the inlet point discharging via a dedicated pipeline into the incoming flow to the site.

Sludge from the two Blending Tanks is pumped to the THP High Energy Blending Tank and further pumped to THP Blended Sludge Tanks and to Pre THP Dewatering Feed Tanks via Sludge Screens. Sludge is then dewatered in Pre THP Dewatering Plant and pumped to the THP Feed Silo. Tanks between the two Sludge Blending Tanks and THP Feed Silo are odour abated as required via Odour Control Units (OCUs). Sludge from the THP Feed Silo is subject to pre-treatment within a Thermal Hydrolysis Plant (THP) Process, with the application of temperature and pressure, used to enhance the digestion of the sludge, in an enclosed and odour abated system. Liquor from all the Pre THP Dewatering Plant is returned via Liquor Return Pumping Stations to the Works Inlet for treatment via the urban waste water treatment route. From the THP, sludge is cooled and transferred to one of the eight anaerobic Primary Digester Tanks at the site. The Primary Digester Tanks are of concrete construction with a Biogas Storage Holder in the headspace of each Primary Digester Tank.

Following treatment over an appropriate number of days within the Primary Digester Tanks, digested sludge is transferred to two enclosed, Digested Sludge Buffer Tanks. From these Digested Sludge Buffer Tanks, sludge is dewatered by Digested Sludge Dewatering Plant the dewatered sludge then falls to the Cake Barn below. The Cake Barn, which is fully enclosed and subject to air extraction, stores the cake prior to removal from the site under the Sludge Use in Agriculture Regulations 1989 (SUiAR), and in accordance with the Biosolids Assurance Scheme (BAS). Liquor from the Digested Sludge Dewatering Plant is returned via Liquor Return Pumping Stations to the Works Inlet for treatment via the urban waste water treatment route. The Digested Sludge Buffer Tanks and Digested Sludge Dewatering Plant are odour abated via an OCU.

Biogas from the Primary Digester Tanks is captured and stored within roof mounted double Membrane Biogas Storage Holders in the headspace of each Primary Digester Tank. Individual biogas lines from each Biogas Storage Holder join a common line transferring the biogas for use on site within the CHP engines, boilers, or emergency flare. The biogas lines are fitted with foam trap pots and condensate pots which captures entrained foam and moisture for discharge to the site drainage system. The Biogas Storage Holders are fitted with Pressure and Vacuum Release Valves (PVRVs) as a safety precaution in the event of over pressurising the system.

Biogas is combusted within one of three CHP engines on site, generating electricity for use within the site, and heat is used within the THP boilers.

In the event that additional heating is required for the THP, this is provided by the two onsite boilers. In the event there is excess biogas, i.e. more than the CHP engines or boilers can utilise, or in the event that the CHP engines or boilers are unavailable, there are two ground mounted emergency flares. These are utilised under 10% of the year or less than 876 hours per year.

This OMP includes the import of treated sludge cake from other works, for temporary storage within the site Cake Barn. All such imports will be subject to appropriate waste pre-acceptance and acceptance checks, prior to import, including confirming that the incoming cake complies with the requirements of both SUiAR and BAS.

Imported treated sludge cake is offloaded into an area within the cake barn, so as to be stored separately to indigenous sludge cake. The waste stream is the same as that arising from the

treatment of sludge within the Crossness STC with the same characteristics, composition and eventual end use – application to land. As such, the infrastructure which is acceptable for use for site cake is appropriate for the imported material. Cake is stored on an impermeable engineered surface within the cake barn, for the shortest time practicable, the duration depending on factors such as prevailing weather and availability of the landbank.

The STW includes a number of Emergency Standby Generators and other combustion assets that are already permitted.

3 Site Management Responsibilities and Procedures

3.1 Site Roles

Figure 3.1 - Site Roles

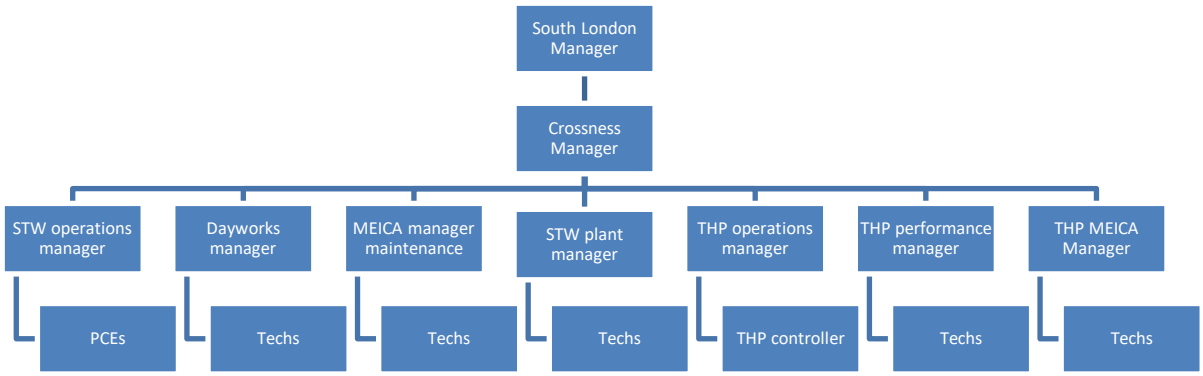


Table 3.1 - Tasks and Responsibilities

Role	Tasks and Responsibilities
Area Operations Manager	Responsible for the overall performance of the STW and catchments areas.
Performance Manager	Responsible for overall performance of the STW and THP and will be responsible for • odour control and management at the site • day to day implementation of the OMP • dealing with customer complaints • assessing the scope of, and updating, the OMP as it is implemented. • Ensuring Thames Water staff undergo appropriate training
Team Managers	Responsible for day-to-day operation of the site (STW, and THP).

Role	Tasks and Responsibilities
Technically Competent Manager	Hold the required WAMITAB qualification to support the activities on site under EPR, ensuring permit conditions are complied with.
Shift Leaders / Operators	Day to day duties include maintaining and operating process equipment.
Technician 1	Day to day duties include maintaining and operating process equipment.
Process Controllers	Monitoring and recording of site data and operating process plant.
Compliance and optimisation manager	Responsible for process investigations and technical assistance
Process Compliance Coordinator	Reports to Process Optimisation Manager. Process monitoring, improvement and troubleshooting.
Customer and Stakeholder Manager (CSM)	Responsible for managing liaison with all external customers and stakeholders in liaison with customer centre, escalation team, local govt. liaison team etc.
Duty Manager	The duty manager is centrally based (off-site) and is responsible for event management across the business.
Customer Centre	Responsible for receiving all customer calls, logging them and passing them to the appropriate operational departments.

The site is manned 24 hours per day and 7 days per week.

3.2 Key Contacts

Thames Water Website – www.thameswater.co.uk

Role	Name	Email address	Phone Number
Operations Area Manager	[redacted]	[redacted]	[redacted]
Site Manager STW	[redacted]	[redacted]	[redacted]
Site Manager THP	[redacted]	[redacted]	[redacted]
Technically Competent Manager	[redacted]	[redacted]	[redacted]
Customer Centre	Crossness STW	customer.feedback@thameswater.co.uk	0800 316 9800

3.3 Operator Training

Staff working on site undergo a site induction that is carried out by the Performance Manager. The site induction includes direction to the presence and location of the various operational procedures which include the SOM and the OMP.

All Technicians/Operators undergo a specific programme of training which covers management of activities on site. In addition, the THP Technicians undertake external BOAS training to be either BOAS O (operator) or BOAS M (manager)

All training records are currently held on Learning on Tap where they are accessible by the site Performance Manager and individual members of staff.

Personnel will be briefed via the Team Meetings on a frequency required to keep everyone updated on odour management issues and activities.

4 Odour Critical Plant Operation, Monitoring and Management Procedures

Odour prevention and reduction is achieved at Crossness through at least an annual review, or sooner as mentioned in Section 1, of the Odour Risk Assessment, Odour Improvement Plan and Odour Management Plan. In combination with the maintenance and monitoring carried out on site mentioned in sections 4 and 5.

Through our Odour Management Plans and maintenance procedures, the primary focus is on effective process control to minimise the risk of off-site odour nuisance. Similarly, our site-based frontline Wastewater Treatment Operations team are focussed on effectively managing the on-site process.

4.1 Odour Sources, Critical Issues and History

Crossness STW had two formally recorded odour complaints in 2022 , 0 in 2021, 1 in 2020, 2 in 2019 and 1 in 2018.

An Odour Risk Assessment is included as Appendix 1.

An Odour Improvement Plan is included as Appendix 2.

Critical Odour Issues, Emergency Response and Mitigation Measures are summarised in Tables 4.3 to 4.7.

4.2 Identification of Odour Critical Plant

4.2.1 Odour Risk Assessment

An Odour Risk Assessment has been carried out for the site and was updated in July 2022. A copy is included in Appendix 1.

The Odour Risk Assessment is not a ‘one-off’ exercise but an on-going process. The Odour Risk Assessment should be reviewed whenever the site undergoes an operational or capital change which could significantly affect odour.

It is constructed in the following manner:

- Each part of the treatment process is considered under different operating modes – e.g. normal, failure, abnormal: system overload, summer conditions, maintenance etc.
- The nearest customers to the particular odour source are identified.
- The likely frequency and duration of occurrence for each eventuality is identified.
- A score is assigned to the severity (0 – 5) of odour under each operating mode.
- A score is assigned to the probability (0 – 5) of causing an odour nuisance for each operating mode.
- Multiplying the severity of odour and probability of causing an odour nuisance generates a ‘Current Odour Emission Risk’ score. Between 0 (zero risk) and 25 (maximum risk), this is used to decide where mitigation should be applied in the short term, and determine where in the longer term enhanced improvement measures are required. Where improvements are identified as necessary (i.e., where suitable mitigation measures are not already in place), entries are made onto the Odour Improvement Plan.

- The need for operational mitigation, enhanced measures and customer communication is stated and brief details given.

Items scored in the Odour Risk Assessment with a risk score greater than 10, are classified as Odour Critical Plant, and where existing operational mitigation measures are not sufficiently robust, will have Improvement Plans generated to address the odour issues. The Odour Improvement Plan for Crossness STW is included in Appendix 2.

4.2.2 Potential Odour Sources

The following list of potential UWWTD odour sources been identified during the risk assessment:

- Works inlet
- Cess reception area
- Screenings Skips/Wheelie Bins
- Storm tanks
- Screens and screenings handling system
- Main Inlet
- Grit Removal Plant and Grit Conditioning Building
- Flow & Distribution to Primary Settlement Tanks
- Primary Settlement Tanks
- Fats, oil & grease Scum Removal System
- Primary Raw Desludge Pumping
- Activated Sludge Plant Lanes & Zones
- Final Settlement Tanks
- Scum removal system
- RAS/SAS chambers and pumping
- SAS buffer tank
- Final effluent
- Odour control units

The following list of potential Sludge Treatment Centre odour sources been identified during the risk assessment:

- Cess reception area
- Sludge import
- Picket fence thickeners (PFTs)
- Gravity Belt Thickeners
- Aquabelts
- Sludge (SAS) Blending Tank
- Sludge (Primary) Blending Tanks
- THP High Energy Blending Tank
- Liquor Return
- Sludge buffer tanks
- Primary Digesters and gas bag holders.
- THP & associated tanks
- Cake Barn (including cake import)
- Standby Generators
- digested sludge buffer tanks
- Dewatering presses
- CHP engines
- Boilers
- Waste /gas Burner – Flare stack gas

- Odour control units

4.2.3 Odour Critical Plant

The following list of odour critical plant has been identified during the Odour Risk Assessment:-

- Primary Settlement Tanks
- Fats, Oil & Grease Scum Removal System
- Primary Raw Desludge Pumping
- Sludge (Primary) blending tank
- Odour control units
- Waste gas burner – flare stack

4.2.4 Waste Storage for Sludge Treatment Centre Permit

Waste is not stored on site prior to treatment through the UWWTD or AD process. A list of the main tanks relating to the sludge treatment process and their associated volumes and retention times is shown below.

Table 4.0 Sludge Treatment Centre Permit Tank Inventory

Tank Purpose	Number	Operational Volume (m^3)	Material	Average retention time (where applicable) Days
Picket Fence Thickeners	6	1,856	Steel	1.04
Primary Sludge Blending Tank	1	3,655	Concrete	1.81
SAS Blending Tank	1	3,655	Concrete	1.81
Sludge Buffer Tanks	12	4,000	Concrete	Not a part of normal operation
THP High Energy Blending Tank	1	30	Steel	0.14
THP Blended Sludge Tanks	2	235	Steel	0.1
Pre-THP Dewatering Feed Tanks	2	183	Steel	0.1
THP Feed Silo	2	85	Steel	0.1
THP Process	1			
Pulper Tank (THP Process)	1	34	Steel	<1 continuous process
Reactor Tank (THP Process)	4	13	Steel	
Flash Tank (THP Process)	1	42	Steel	
Primary Digester Tanks	8	3,330	Concrete	19.00
Digested Sludge Buffer Tanks	2	250	Steel	0.2
Polymer Tank (for primary sludge dewatering)	1	10 tonnes	Steel	NA
Polymer Tank (for SAS dewatering)	1	10 tonnes	Steel	NA

Polymer Silo (for THP)	1	30	Steel	NA
Polymer Silo (for digested sludge)	1	30	Steel	NA
Main diesel storage tanks	2	350	Steel	NA
Diesel storage day tanks (for MTU and Paxman Engines)	6	3.5	Steel	NA
Powerhouse dump tanks	2	10.5	Steel	NA
Webster House Boilers	2	16	Steel	NA
Powerhouse Emergency Lighting Generator	1	0.5	Steel	NA
SPG Standby Engine	1	0.4	Steel	NA

An inventory of potential odorous materials relating to the Sludge Treatment Centre Permit is shown in Table 4.1 below. Air Emission Points are listed, and the locations shown on the site plan in Figure C of Appendix 4.

Table 4.1 Odorous materials for Sludge Treatment Centre Permit

Odorous and potentially odorous material (any solid, liquid or gas)	Location of odorous materials on site	Maximum quantity on site at any given day	Maximum time held on site (hours or days)	EWC Codes	Type of emission	Odour potential High Risk / Medium Risk / Low Risk
Cake (including cake imports)	Cake Barn	3000 tonnes	70 days	19 06 06	Point Source (air extraction system)	Low
Biogas	Gas holders on top of primary digesters; PRV;Whessoe valve release; See air emission plan	6440m^3	Continuous operation	-	Point source	Low
Liquor	Site drainage. Liquor return Pumping Stations	Liquor is continuously pumped to the head of works	Continuous pumping of liquors from underground pipework.	16 10 02	Diffuse Point Source (See OCU entry)	Low
Sludge Import	Sludge Buffer	Refer to Table 4.0	Retention times for each	19 08 05	Point Source (see OCU	Medium/High

Odorous and potentially odorous material (any solid, liquid or gas)	Location of odorous materials on site	Maximum quantity on site at any given day	Maximum time held on site (hours or days)	EWC Codes	Type of emission	Odour potential High Risk / Medium Risk / Low Risk
	Tanks; THP High Energy Blending Tank	Site Tank Inventory	stage of the process are detailed in Table 4.0		entry/pfd)/Diffuse	
Primary Sludge	PFTs, , primary sludge thickening plant	Refer to Table 4.0 Site Tank Inventory	Retention times for each stage of the process are detailed in Table 4.0	19 08 05	Point source (see OCU entry)	Medium/High
Surplus Activated Sludge	SAS blending tank SAS thickening plant	Refer to Table 4.0 Site Tank Inventory	Retention times for each stage of the process are detailed in Table 4.0	19 08 05	Point Source (see OCU entry) Diffuse	Medium/High
Sludge Screenings	2 near the THP.	2 Skips	1 week once full.	19 08 01	Diffuse	Low
Odour Control Units	For OCUs see detailed consideration in section 5	Variable throughput	Continuous operation	NA	Point source	Low/Medium

Table 4.2 Odorous raw materials for Sludge Treatment Centre Permit

Raw Material	Odorous	Storage	Mitigation	Odour Risk
1)Flopam FO4698XXR 2)Flopam FO4698XXR	Not odorous	1)10 tonnes 2)10 tonnes 3)5,000L in /ibc on bunds	Fully contained	Low

3)Flopam EM 640 HIB 4)Flopam FO 4650VHM 5)Flopam FO4698XXR		4)24 tonnes stored in bunded silo 5)24 tonnes stored in bunded silo and 4 tonnes of 25Kg bags stored within building		
Flofoam 681 F	Not odorous	3.5 tonnes stored in IBCs on portable bunds	Fully contained	Low
Ferric chloride 40% ICL 40% solution	Mild Odour	25m3 stored in bunded silo	Fully contained	Low
Biogas	N/A	NA	Fully contained	Low
Diesel	Petroleum	724,000L stored within a number of double skinned fuel tanks	Fully contained	Low
Texaco HDAX 6500 LFG gas engine oil SAE 40	Solvent	7,500L stored in bunded oil tanks or bunded IBCs	Fully contained	Low
Glycol coolant Texaco Delo XLC antifreeze/coolant premixed 40/60	Solvent	3,000L stored in bunded IBCs	Fully contained	Low
Sodium bisulphite Nalco 77211	Sulphurous	300L in bunded tanks	Fully contained	Low
Sodium hydroxide (205) Nalco 77224	Not odorous	300L in bunded tanks	Fully contained	Low
Phosphate polymer Nalco Nexgaurd 22310	Not odorous	300 L in bunded tanks	Fully contained	Low
Salt Zoutman Softsel pluss	Not odorous	1 tonne in bags	stored within a building	Low
Sodium hydroxide 25% Brenntag	Not odorous	1,500 L bunded tanks	Fully contained	Low
hydrogen peroxide 35% Brenntagg	not odorous	1,500 L bunded tanks	Fully contained	Low
Phosphoric acid 75% Brenntag	not odorous	10 x 25L drums stored on portable bund	Fully contained	Low
Spraid Blue	Soapy	10 x 25L drums stored on portable bund	Fully contained	Low

Low odour raw materials are chosen for use, as far as practicable.

4.3 Odour Control Measures

The SOM referred to above complies with Thames Water's Asset Standards – Operating Standards. It states the operational procedures to be followed in order to maintain and operate plant to agreed

company standards. These standards include, where appropriate, procedures for ensuring that generation of odour is kept to a minimum. Refer to risk assessment in Appendix 1 where these measures are summarised as 'Normal Mitigations'.

Daily site and sludge rounds are carried out to check each part of the process is operating correctly. These are detailed in Appendix 8 and 9.

4.3.1 Odour Control Units

STC OCU's:

Odour control unit for PFT Supernatant Well (Liquor Return Pumping Station 2) (OCU 1) A26

- Comprises a Bio-trickling filter, duty/standby fans and two carbon filters.

Odour control unit for the Picket Fence Thickeners (OCU 5) A28

- The PFTs (Picket Fence Thickeners) also known on site as Consolidation tanks are covered and the atmosphere passes through an odour control unit. The unit is a biofilter . Air is drawn from the PFTs by a bank of 3no. blowers that operate 2 duty/standby and passes up through the base of the odour control unit. Potable water is circulated through the unit by 2no. pumps that operate duty/standby. Make up water is continually fed to the system and wastewater is drawn from the base through an overflow and fed to the works drain. The H2S (Hydrogen Sulphide) level is measured on the inlet and outlet of the OCU. The unit is operated and monitored from SCADA.

Odour control unit for Sludge Blending Tanks (Primary and SAS)(OCU8) A29

- The OCU for sludge blending tanks 3 & 4 is a 2 stage biofilter design.

Odour control unit for the Primary Sludge Buffer Tanks (UWWTD), THP related tanks, Digested Sludge Buffer Tanks, and Sludge Dewatering Presses, Return Liquor pumping station 3 (OCU 10) A31

- The OCU uses a wet biofilter system followed by two carbon media filters.

Odour Control Unit for Gravity Belt Thickeners (OCU 4) A27

The OCU comprises of a biofilter and a carbon filter with 2 fans (duty/stand by)

Odour control unit for Sludge buffer Tanks (OCU 9) A30 - *not all sludge buffer tanks are odour abated.*

- The OCU for the sludge buffer tanks is a 2 stage biofilter design.

Please note, two new OCUs (OCU 11 &12) A34 and A35 are being installed which will serve new Liquor Pumping Station 1 and Liquor Pumping Station 2 respectively. These are proposed to be 2-stage Biofilter and Dry Scrubbing systems.

On site there is also an air ventilation system which takes air from the cake barn A33

UWWTD OCUs:
Odour control unit for the Preliminary Treatment Works (OCU 2)

- The OCU for the new preliminary treatment works consists of a biofilter and 4 carbon filters.

Odour control units for the Primary Treatment Works

- Odour Control Unit (OCU 6) for Primary Settlement Tanks 1 - 8, raw sludge wet well consists of 2no. carbon filters.
- Odour Control Unit (OCU 7) for Primary Settlement Tanks 9 - 16, and raw sludge wet well consists of 2no. carbon filters.
- Odour control unit (OCU 3 for Primary Settlement Tanks 17 – 24, Raw Sludge PS and Distribution Chamber 1 consists of a biofilter followed by 2no. carbon polish filters.

4.3.2 Site Specific Measures

By the nature of the sewage treatment process and the materials involved, odour will be generated from certain parts of the operation. This section of the plan details the arrangements required to minimise odour emissions from process equipment, and therefore the site as a whole.

1. The plant will be operated according to the procedures laid down in the Asset Standard / Maintenance Task Specifications / Site Operating Manual (SOM).
2. At all times, the site will be monitored and managed with the minimisation of odour releases as a key activity.
3. All inspection hatches shall be kept closed except as required for essential inspection or maintenance or in the event of an emergency.
4. The condition of the site shall be audited, at least monthly by Team Leader to ensure standards are maintained (see Section 4.4.1).
5. All odour abatement plant shall be subject to olfactory performance tests (as per BSEN13725) on an annual basis. Records of such test shall be held for 24 months

In addition to the information in the tables, the Operations team also undertake daily and weekly checks of each part of the process to ensure it is operating correctly. These checks are summarised in Appendix 8 and 9.

H4 has been used to guide the preparation of this OMP where it relates to activities regulated under the Sludge Treatment Centre Permit. As this guidance does not apply to UWWTD activities, where reference to H4 is made within this document this should not be inferred as H4 being applicable to UWWTD activities. Specific tasks and measures taken in intermittent, abnormal, and emergency events associated with the control of odours at Crossness STW are summarised in the tables below:

Tables 4.3-4.7 - Summary of Critical Odour Issues, Emergency Response and Mitigation Measures

The purpose of Table 4.3-4.7 shall be to identify site specific emergency response procedures and mitigation measures relating to site odour generation and release. They include:

- Generic odour issues and mitigation measures relating to site-specific process stages; and,
- Additional site-specific odour issues and mitigation measures associated with process stages identified under the site Odour Risk Assessment.

Table 4.3: Summary of routine odour mitigation tasks for assets under UWWTD

Odour source	Odour and offensiveness L/M/H	Specific odour management tasks	Responsibility	Monitoring	Monitoring Frequency	Trigger for action	Remedial action and timescale
Site Housekeeping for urban waste-water treatment assets	General / L	1) The site shall be kept clean and tidy. 2) All employees shall ensure that any areas of work are left clean and tidy after process or maintenance activities under their control are complete. 3) All contractors shall be briefed to ensure that any areas of work are left clean and tidy after activities under their control are complete.	All site personnel	Visual Inspection	Daily	Waste/Spillage identified	Clean up as soon as possible and within 24 hours
Skips/Wheelie Bins, Linked tasks in appendix 8 section 2.5	Screenings and Waste / L	1) Any skips which are not in use shall be covered. 2) Wheelie bin lids shall be kept closed except during normal filling operations 3) Skips and wheelie bins shall not be overfilled 4) Skips and wheelie bins will be collected on a routine basis 5) Full skips and wheelie bins shall not be stored on site longer than necessary; the Waste Skip Contractor shall be contacted to arrange collection. 6) The skips are routinely inspected by operational staff 7) The wheelies bin are routinely collected	Site Tech 1s / Contractors	Visual Inspection	Daily / As required	Skips over two thirds full prioritised for emptying first due to potential for increased odour	Ensure full skips are removed within a week by Biffa, covers to be used in the event of delays in collection
Storm tanks , Linked tasks in appendix 8 section 2.6	Raw Sludge / L	1) The Storm Water Tanks shall be operated in accordance with the SOM. 2) The Storm Water Tanks are fitted with an automatic cleaning system, checked during the site rounds, in appendix 8	Site Tech 1s	Visual Inspection	Daily	Storm conditions have ceased and site flows have returned to DWF levels	Storm tanks to be returned at the earliest opportunity once storm conditions have ceased.
Screens and screenings , Linked tasks in appendix 8	Screenings / L	1) Regular inspections of screens as per site rounds in appendix 8 2) Emergency overflow skips should be emptied once	Site Tech 1s	Visual Inspection	Daily	Screen breakdowns identified promptly	Screens are cleaned and maintained according to site

section 2.3 and 2.4handling system		emergency situation has been resolved. 3) Any screening breakdown will be repaired.					procedures Attention to blocked screens is immediate/asap on detection since will have significant impact on subsequent process. Timescales of remedial tasks such as repairs to screen brushes would be 2 to 8 hours; full replacement over 6 weeks duration. Screens replaced according to wear but within every 7 years typical.
Main Inlet	Dilute Sewage / L	1) Odour controlled and covered, including the fine screens.	N/A	Continuous	Continuous	Any visible damage to covers	Damaged covers to be replaced but potential for delays due to supply chains and material availability
Grit Removal Plant and Grit Conditioning Building , Linked tasks in	Grit and screenings M/L	1) Grit Building, Conveyors, and Constant Velocity Grit Channels are odour controlled and covered 2) Do not allow storage of grit that would exceed one grit collection lorry capacity. This is approximately equivalent to three full drying bays.	Site Tech 1s	Visual Inspection	Daily	Skips over two thirds full are always prioritised for emptying given	Removal of grit removal skips follows approach for screenings (although odour

appendix 8 section 2.5		3) Only grit should be stored in the existing works grit clarification area. 4) Grit drying bays shall be operated as per SOM. 5) The Grit Dewatering plant area shall be kept clean.				potential for odour.	potential can be proportionally less). Proactive interventions are also made earlier in the process, such as removal of grit build up in the inlet channels; attention to blockages in the wash water system; rag removal from mechanical equipment are regular tasks completed as per site procedures.
Flow & Distribution to Primary Settlement Tanks	Crude Sewage /L	1) Pipe located underground.	N/A	N/A	N/A	Above ground leakage detected	Major projects would be consulted to locate and rectify leaks
Primary Settlement Tanks , Linked tasks in appendix 8 section 3	Crude Sewage /L	1) All 24 PSTs are odour controlled. 2) Sludge blanket depth will be monitored twice per week & recorded as per the SOM. Depth in any operational tank shall be minimised at all times. 3) PSTs 1-16: tanks with over 1 ft of sludge shall be given priority in the de-sludging cycle and/or maintenance activity. The dried solids content of the sludge will be sampled and recorded. If the solids percentage trend increases to 2% or more, action shall be	Shift operatives	Visual Inspection	Daily	Elevated sludge blankets in PST's prioritised and desludging and refreshing of the tanks undertaken	If scraper operation impaired remedial action is manually desludge the tank by the Shift Operative within 2 working days. Attention to

		taken with the de-sludging cycle to prevent blanket formation. 4) PSTs 17 -24 are covered. 5) All hatches shall be kept closed at all times except for process monitoring or maintenance activities or in the event of emergency. The condition of the flaps will be audited by the Operational Team and recorded as part of the sludge blanket depth checks. 6) Any PST that requires draining should be desludged as far as possible, emptied in a controlled manner back to the head of the works and flushed to clear residual sludge.					scraper fail alarm will be addressed within 1 working day and if cannot be resolved a job raised on SAP for M/E to try and resolve in 1 working day. Tanks may require cleaning or emptying which may take up to 3 months to complete. Funding to support scaffolding and cleaning may be required.
Primary Raw Desludge Pumping	Raw Sludge / L	1) Odour Controlled and Underground.	N/A	Continuous	Continuous	Above ground leakage detected	Major projects would be consulted to locate and rectify leaks
Activated Sludge Plant Lanes & Zones , Linked tasks in appendix 8 section 4.1	Earthy / L	1) Closed pipe between each pair of PSTs and its associated pair of aeration lanes.	N/A	N/A	N/A	Above ground leakage detected	Major projects would be consulted to locate and rectify leaks

Flow and distribution to secondary settlement	Earthy / L	1) Closed pipe between each pair of aeration lanes and its associated four FSTs.	N/A	N/A	N/A	Above ground leakage detected	Major projects would be consulted to locate and rectify leaks
Scum removal System	Earthy L		Site techs	Visual inspection	Daily	Any failures or defects identified by site operatives	
RAS Pump House	Sludge / L	1) Personnel doors & windows into the RAS Pump House building shall be kept closed at all times unless required for operational or maintenance works or in event of an emergency. 2) The area shall form part of the monthly site audit by plant management (see Section 4.4.1) 3) The building shall be measured for H_2S levels at least once per month.	Site Tech 1s	Visual Inspection	Daily	Failure of windows and doors. Elevated H2S levels	Work orders to be raised to Building services provider to undertake repairs. Investigation of odour source and work order raised for any repairs to be undertaken within 2 days
OCUs	Hydrogen Sulphide//L	1) H2S monitoring 2) Monthly performance checks by specialist Framework agreed contractors. 3) Weekly maintenance checks as per Site Rounds in appendix 8.	Site Tech 1s / Contractors	SCADA	Weekly / Monthly	Any failures or defects identified by site operatives or contractors	Work order raised within 1 day and repairs undertaken. Larger repairs may require additional funding which could take up to 3 months to resolve depending on the scale of the repair

Cess Reception , Linked tasks in appendix 8 section 2.1	Concentrated sewage / L	1) The cess off-loading point can be accessed 24/7 only by tanker drivers with fobs issued by Commercial Waste Team. 2) All delivery drivers report to site security on arrival. 3) At the end of off-loading, the delivery driver shall make every effort to empty the residual hose contents into the system. 4) After disconnection, the delivery driver shall wash down the Cess Import area. 5) The area is monitoring by CCTV so that it may be checked to ensure the area has been left in a satisfactory condition. 6) Tech 1s check area is clean and tidy, as per site and sludge rounds in Appendix 8 and 9. 7)If the area is left in an unsatisfactory condition, the Commercial Waste Team are notified by the site management team. 8)Tankers discharge through closed couple connections	Commercial Waste Team Site Tech 1s Performance Manager	Visual Inspection	Daily	Waste/Spillage identified	Clean up as soon as possible and within 24 hours
SAS bufferTank Linked tasks in appendix 9 section 3	Earthy/L	Daily checks as per site and sludge rounds in Appendix 8 and 9. Level monitoring via SCADA.	Site Tech 1s	Visual inspection SCADA	Daily	Waste/Spillage identified	Clean up as soon as possible and within 24 hours. If tank is damaged repair to be carried out if possible, if not tank to be removed from service until repair is rectified.

Table 4.4: Summary of routine odour mitigation tasks for assets under Sludge Treatment Centre Permit

Odour source	Odour and offensiveness L/M/H	Specific odour management tasks	Responsibility	Monitoring	Monitoring Frequency	Trigger for action	remedial action and timescale	odour risk id measures fail
Site Housekeeping for Sludge Treatment Centre assets	General / L	1) There will be no admixture of sludge cake with straw or other bulking material on site except in enclosed & odour-controlled structures or in the event of an emergency. 2) All trailers shall be covered except during filling operations. 3) All spilt material will be cleaned up as soon as possible. 4) All centrate shall be passed to site drains via enclosed pipework/gullies.	Site Tech 1s	Visual Inspection	Daily			Low
Cess Reception Linked tasks in appendix 8 section 2.1	Concentrated sewage / L	1) The cess off-loading point can be accessed 24/7 only by tanker drivers with fobs issued by Commercial Waste Team. 2) All delivery drivers report to site security on arrival. 3) At the end of off-loading, the delivery driver shall make every effort to empty the residual hose contents into the system. 4) After disconnection, the delivery driver shall wash down the Cess Import area. 5) The area is monitoring by CCTV so that it may be checked to ensure the area has been left in a satisfactory condition. 6) Tech 1s check area is clean and tidy, as per site and sludge rounds in Appendix 8 and 9. 7)If the area is left in an unsatisfactory condition, the Commercial Waste Team are notified by the site management team.	Commercial Waste Team Site Tech 1s Performance Manager	Visual Inspection	Daily	Waste/Spillage identified	Clean up as soon as possible and within 24 hours	Low

		8)Tankers discharge through closed couple connections						
Sludge imports	Raw Sludge L	Ensure tankers coupled correctly. Site rounds	Site Tech 1s	Visual inspection	Daily	Spillage	Clean up as soon as possible and within 24 hours	Low
Sludge Buffer Tanks	Earthy / M	Daily checks as per site and sludge rounds in Appendix 8 and 9. Level monitoring via SCADA.	Site Tech 1s	Visual inspection SCADA	Daily	Waste/Spillage identified	Clean up as soon as possible and within 24 hours. If tank is damaged repair to be carried out if possible, if not tank to be removed from service until repair is rectified.	Medium
PFTs Linked tasks in appendix 8 section 8.1	Raw Sludge / L	1) All roof panels, covers, launder channel flaps, etc. shall be kept closed at all times except for process monitoring or maintenance activities or in the event of an emergency. 2) Odour Controlled – monthly contractor service. 3) The area shall form part of the site management audit plan. 4) The input and output H_2S readings shall be measured weekly and recorded on the Weekly Odour Management Check Sheet (see Section 4.4.1) 5) The plant shall be checked at least once per week to ensure that the equipment (including standby units) is operational and valves are correctly aligned.	Site Tech 1s	Visual Inspection	Continuous / monthly	Tripping of PFT or associated pumps	Timescales to correction will vary according to precise issue identified. Immediate response from tech 1 to reset PFT or pump. If unable to reset then work order raised for	Medium

		6) The plant shall be maintained as per the SAP PPM schedule.					maintenance within 1 day to investigate and attempt to repair. If unable to repair tank would be taken out of service.	
Gravity Belt Thickeners Linked tasks in appendix 8 section 8.3	Earthy / L	1) Enclosed in a building, Ensure all doors and windows are kept closed at all times, save as required for access purposes or in an emergency. 2) Ensure checks detailed in generic sludge rounds in appendix 9 are carried out to ensure correct plant operation. 3) Abated by odour control unit.	Site Tech 1s	Visual Inspection	Daily	Intermittent running from fouling to belt seizure.	Timescales to correction will vary according to precise issue identified. Immediate response from tech 1 to reset belt and washdown. Washdown of belt and refitting in 5 working days for new belts. Critical spares are supplied by framework contractor, and they would expect to get belt back running within 10 working days. In the	Low

							event of both SA belts failing co-settling in the PSTs would take place after consultation with Process Scientist and raw sludge timers increased to address the additional sludge make.	
Aquabelts Linked tasks in appendix 8 section 8.3	Earthy / L	1) Doors & windows into the Aquabelt buildings shall be kept closed at all times unless required for operational or maintenance access or in the event of an emergency. 2) Part of the monthly site audit by plant management (see Section 4.4.1). 3) The building shall be measured for H2S levels at least once per month. The results shall be recorded and held in the Odour Management procedures support file held the Site Managers Office.	Site Tech 1s	Visual Inspection	Daily	Intermittent running from fouling to belt seizure.	Timescales to correction will vary according to precise issue identified. Immediate response from tech 1 to reset belt and washdown. Washdown of belt and refitting in 5 working days for new belts. Critical spares are supplied by framework contractor, and they would	Low

							expect to get belt back running within 10 working days. In the event of both SA belts failing co-settling in the PSTs would take place after consultation with Process Scientist and raw sludge timers increased to address the additional sludge make.	
Sludge blending Tank (SAS) Linked tasks in appendix 9 section 3	Earthy / L	1) Ensured covered and hatches closed. 2) Odour Controlled. 3) The input and output H_2S readings shall be measured weekly and recorded on the Weekly Odour Management Check Sheet (see Section 4.4.1) 4) The plant shall be checked at least once per week to ensure that the equipment (including standby units) is operational and valves are correctly aligned. 5) The plant shall be maintained as per the SAP PPM schedule.	Site Tech 1s	Visual Inspection	Daily	Leaking supply pipework	Stem leak and clean immediately	Low
Sludge blending Tank (Primary) Linked tasks	Raw sludge / L	1) Ensured covered and hatches closed. 2) Odour Controlled. 3) The input and output H_2S readings shall be measured weekly and recorded on the Weekly Odour Management Check Sheet (see Section 4.4.1)	Site Tech 1s	Visual Inspection	Daily	Leaking supply pipework	Stem leak and clean immediately	Medium

in appendix 9 section 3		4) The plant shall be checked at least once per week to ensure that the equipment (including standby units) is operational and valves are correctly aligned. 5) The plant shall be maintained as per the SAP PPM schedule.						
THP High Energy Mixing Tank	Raw sludge / L	1) Ensured covered and hatches closed. 2) Odour Controlled. 3) The input and output H_2S readings shall be measured weekly and recorded on the Weekly Odour Management Check Sheet (see Section 4.4.1) 4) The plant shall be checked at least once per week to ensure that the equipment (including standby units) is operational and valves are correctly aligned. 5) The plant shall be maintained as per the SAP PPM schedule.	Site Tech 1s	Visual Inspection	Daily	Leaking supply pipework	Stem leak and clean immediately-discharge to bunded drain if overflows	Medium
Liquor Return	Sulphur	1) Contained in pipework below ground.	N/A	N/A	N/A	Above ground leakage detected	Major projects would be consulted to locate and rectify leaks	Low
Digested Sludge Buffer Tanks Linked tasks in appendix 9 section 3	digested sludge / M	1) Ensured covered and hatches closed. 2) OCU controlled	Site Tech 1s	Visual Inspection	Daily	Leaking supply pipework	Stem leak and clean immediately-discharge to bunded drain if overflows	Medium
THP	Raw sludge / L	1) Odour Controlled	N/A	Continuous	Continuous	Leaking supply pipework	Stem leak and clean immediately-discharge to	Low

							bunded drain if overflows	
Standby Generators	Diesel / L	1) Enclosed, ensure hatches closed.	Site Tech 1s	Visual Inspection	Daily	Identified spillages of diesel/oil	Clean up as soon as possible and within 24 hours	Low
Sludge Dewatering Presses Linked tasks in appendix 9 section 9	Digested sludge(L)	1)Operated inside odour controlled cake barn.	Site Tech 1s	Visual Inspection	Daily	Odour extraction failure	Repair & reset or engage specialist services	Low
Primary Digesters and gas bag holders. Linked tasks in appendix 9 section 6	Biogas (L)	Regular checks are made on the primary digester whessoe valves and other pressure relief devices. 12 monthly contractor service with report provided.	Site Tech 1s Contractors	Visual Inspection / SCADA	Daily	Loss of containment; visible on SCADA	Remove digester from service (stop feeding) until fault repaired	Low
CHP Engines & Boilers Linked tasks in appendix 9 section 9	Combusted Biogas / L	CHP engines and boilers are subject to regular maintenance to maintain maximum use of outlets. Daily checks.	Site Tech 1s	Visual Inspection	Daily	Slam shut activation	Call in specialist to repair	Low
Waste Gas Burner - Flare stack gas Linked tasks in appendix 9 section 8	Combusted Biogas / L	The flare stack is maintained under a service contract with the supplier with a report provided.	Contractor	Service	Annually	Failure to ignite	Engage specialist contractor	High

Cake Barrn (including cake imports) Linked tasks in appendix 9 section 16 and 17	Cake / L	1) Stored in cake barn which is connected to OCU. 2) No storage or stockpiling of sludge cake on site except in enclosed & odour-controlled structures or in the event of an emergency 3)Cake in storage forms a crust after a day or two reducing risk of odour. No additional turning or handling during cake storage. Barn provides wind barrier Imports subject to pre-acceptance checks.	Site Tech 1s TW Biorecycling	Visual Inspection	As required	Odour extraction failure. Constant alarm. estimate 90% full	Repair & reset or engage specialist services. Extra vehicles needed to reduce stock.	
Odour Control Units Linked tasks in appendix 8 section 9	Hydrogen Sulphide	1) H2S monitoring 2) Monthly performance checks by specialist Framework agreed contractors. 3) Weekly maintenance checks as per Site Rounds in Appendix 8	Site Tech 1s Contractors	Visual Inspection SCADA	Weekly / Monthly	H2S alarms activation	Investigate & repair or call specialist if required.	High

Table 4.5: Intermittent (Int), abnormal (Ab), and emergency (E) events for assets under UWWTD

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab//E events	Odour risk after mitigation
Skips/Wheelie Bins	Collection frequency is insufficient / process generates extra material.	Int	Waste Skip Contractor shall be contacted to arrange additional collections.	Ab/ skips will be covered until collection is made by the skip contractor	Medium
Screenings	Breakdown of screen Maintenance	Ab P	Repair screen Complete promoptly		Low
Spillages	Areas where spills can occur at; Storm Tank Screenings Skips, Low level sewer Screenings Skips, FFT screens when skip is disconnected	Ab	1) All spillages of odorous materials will be cleaned up as soon as practicable 2) In the event of a spillage, the Process Controller will assess the spill using the category level overview matrix (see Appendix 7c). 3) If the spillage is Category 3, or considered to present an offsite odour nuisance potential, the PC will make a note in the Spill Record Sheet, Environmental Management System - Forms (sharepoint.com), and follow the spillage procedures in section 4.3.3		Low
Storm tanks	Amajets failure	Ab	Repair Amajets as per SOM / Empty storm tanks at next storm event		Medium
	Failure of return system	Ab	Control system in manual		Low
	Breakdown of screen	Ab	Repair, see SOM for details		Low

	Long storage period in skip	Ab	Contact contractors	skips will be covered until collection is made by the skip contractor	Low
Main Inlet	Breakdown of IPS Pumps	Ab	Repair, see SOM for details	Failure of a storm or dry weather pump would require utilisation of rolling critical spares.. Limited odour risk from pump failure. Potential discharge at Greenwich PS	Low
Grit Removal Plant and Grit Conditioning Building	Breakdown of CVGC, Conveyor, Screenings compactor, Grit classifier, Grit Channel and Tram, Grit Screens.	Ab	Allowable redundancy in installation. Clean / routine maintenance / repair		Low
	Grit left more than two weeks in drying bay	Ab	Contact contractors		Low
	Faulty grit classifer or no skips	Ab	Allowable redundancy in installation. Clean /routuine maintenance/ repair		Low
Primary Settlement Tanks	OCU failure	Ab	Hatches can be opened for ventilation if required. OCU repair		Medium
	Scraper bridge breakdown	Int	Refresh tank and chase repair, see SOM for details	**Ab:** operational response from couplings and motor issues within 2 weeks turnaround	High
	Tank drained down for maintenance	Ab	Refresh tank and chase repair, see SOM for details		Medium
	Scum bridge breakdown Fats, Oil & Grease Scum Removal System leading to scum sitting on the surface	Ab	Refresh tank and chase repair, see SOM for details		High

	Through scum flap remains open	Ab	Manually shut flap		Low
Primary Raw Desludge Pumping	OCU failure	Ab	Repair / Call specialist contractor if required		High
	Pump failure	Ab	Use stand by pump / Fit new pump	Monitor to avoid failures	Low
Activated Sludge Plant Lanes & Zones	Spinner / Mixer failure Lane drained down	Ab P	Stop flow into tanks / Repair the spinners		Low Low
Secondary Settlement	High sludge blanket level on FSTs	Ab	Bottom draining of tank / Restrict flow to the tank		Low
	Bridge breakdown on FSTs	Ab	Drain tank for repair if required		Low
	Breakdown of scum Removal System	Ab	Repair / Manual scum removal	Monitor to avoid failures	Low
	Scum build up blocking scum removal system	Int	Manual scum removal		Low
	Pump failure on RAS Chambers & Pumping	Ab	Use standby pump	Monitor to avoid failures	Low
	Solids in final effluent from FSTs.	Ab	Bottom draining of tank / Restrict flow to the tank. Consider EA contact if consent level breeched.		Low
SAS Buffer Tank	Spillage	ab	Clean up ASAP		Low
OCUs	Unit Failure	Ab	Contact specialist contractor / Maintenance repair	Consider use of temporary odour suppressant sprays	High
	Maintenance	P			Medium

Table 4.6: Intermittent (Int), abnormal (Ab), and emergency (E) events for assets under Sludge Treatment Centre Permit

Incidents and emergencies	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab//E events	Odour risk after mitigation
Spillages	Spills May occur at; Cess Reception, PFTs, Belt Thickeners, Sludge blending Tank No.3, sludge blending Tank No.4, Sludge Storage Tanks, sludge imports	Int	1) All spillages of odorous materials will be cleaned up as soon as practicable 2) In the event of a spillage, the Process Controller will assess the spill using the category level overview matrix (see Appendix 7c). 3) If the spillage is Category 3, or considered to present an offsite odour nuisance potential, the PC will make a note in the Spill Record Sheet, Environmental Management System - Forms (sharepoint.com), and follow the spillage procedures in section 4.3.3		Low
PFTs	Breakdown of PFTs / PFT pumps	Ab	Drain tank and chase repair / use standby pump		Low
	Failure of OCU	Ab	Repair OCU / contact contractors	Consider temporary odour suppressant sprays	Medium
Gravity Belt Thickeners	Plant failure / Maintenance	Ab	Wash off belts and empty feed hopper		Low
Sludge (SAS) blending tank	Failure of OCU	Ab	Repair OCU / contact contractors	Consider temporary odour suppressant sprays	Medium
Sludge (primary) blending Tank	Failure of OCU	Ab	Repair OCU / contact contractors	Consider temporary odour suppressant sprays	medium
	Failure of tank	Ab	Drain tank, chase repair and divert sludge to open tank		Medium

	Breakdown of sludge transfer pumps	Int	Maintenance repair, see SOM		Low
THP High Energy Mixing Tank	Failure of OCU	Ab	Repair OCU / contact contractors	Consider temporary odour suppressant sprays	Medium
	Blockages due to rag build up	Ab	Drain and isolate tank / Unblock, clean up and divert sludge to Blending Tank 4		Medium
Relevant to all sludge storage tanks	Loss of sludge processing capacity	Ab	Excess liquid sludge shall be stored in the buffer storage tanks. Should these be filled to capacity, follow the Thames Water's Event Management procedure		Low
	Sludge processing plant failure	Ab	Potential loss in sludge processing capacity should be identified. Once the emergency is over, the tanks used will be emptied and cleaned as soon as practicable as per the procedure in the Asset Standards.		Low
sludge bufferTanks	Failure of OCU	Ab	Repair OCU / contact contractors	Consider temporary odour suppressant sprays	Low
	Hatches left open	Ab	Close hatches		Low
	Hot weather	R	Increase on site odour checks		Medium
THP	Failure of OCU	Ab	Repair OCU / contact contractors	Consider temporary odour suppressant sprays	Medium
Cake Barn Including cake imports Cake Barn	Disposal routes for sludge cake are not available	Ab	TW Biorecycling overseeing the off-site sludge cake disposal shall arrange for sludge to be stored appropriately at another Thames Water site. If this is not possible then landfill shall be considered. Policy on Crossness STW to store liquid sludge. Ensure to minimise double handling of solid materials and any potential issues with sludge cake liquors leaching to ground.		Low

	Sludge processing plant failure	Ab	If timescale for restoration requires the need to implement the Emergency Protocol, in appendix 5, the necessary resources shall be brought in to cover the shortfall in processing capacity. Once the emergency is over, the stockpile will be removed, and ground remediation carried out as quickly as possible as per the procedures in the Emergency Protocol		Medium
Wate Gas burner – flare stack	Failure allowing gas to escape from digesters	Ab	Gas monitoring system in place. Automatic shutdown of the process and stop digester feeding if PRVs are activated for a sustained period of time. Regular service contract. Investigate and rectify. Contractors contacted by phone to organise repair.	**Int/Ab:** Impaired availability of engine/boilers. **E:** failure of CHP engine &/or ground flare. If repair not possible, response would be recourse to a standby boiler/engine/flare to limit whessoe/PRV releases. Lead in time of c. 4 to 6 weeks. Potential for odour to be present from released biogas.	High
OCUs	H2S Exceedance	Ab	Any exceedance of the agreed hydrogen sulphide emissions from bioscrubbers and biofilters shall be reported on the next working day to the London Borough of Bexley and within 30 days thereafter proposals shall be submitted to the Borough for remedial measures.		medium
	Unit Failure	Ab	Contact specialist contractor / Maintenance repair	Consider temporary odour suppressant sprays	Medium/high

Table 4.7: General Intermittent (Int), abnormal (Ab), and emergency (E) events

Process Stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Incidents and emergencies				**For all entries TWUL's incident management response process would be followed including use of Site Incident (SIC) cards.**	
Flooding	Flooding causing process or equipment problems.	E	There is a flood plan in place as part of the emergency response plan, which can be found on SharePoint		Medium
Fire	Failure of OCUs or damage to assets.	E	Follow Incident Management Arrangements. Diversion of inter-site sludge and cess imports to alternative works. Consider use of temporary odour suppression. Raise any repairs needed on SAP and/or raise a risk via APS to ensure repairs are carried out as soon as possible.		Medium
Severe Weather	Transport of sludge to land inhibited.	E	Up to 70 days storage on site. Follow Biorecycling Team procedures and consider transport to other Thames Water sites.		Low
Illness/absence of key staff	Accumulation of sludge/loss of odour control etc.	E	Task allocation is independent of individual staff.		Low
Power cuts	Loss of power to fan leading to loss of odour control	E	Within Thames Water's incident response planning, arrangements are already in place with a supplier for		Low

			temporary generators. This agreement has a Service Level Agreement for provision within 24 hours.		

4.3.3 Spillages

Spillages will be cleared as soon as practicable. The person discovering the spillage will inform site management, who will utilise resources as required to clear it.

Spill response guidance is also available in the Pollution Prevention Essential Standard at Environmental Management System - Pollution Prevention (sharepoint.com).

4.4 Routine Monitoring

4.4.1 Performance Checks and Testing

- As per Blackfriars Crown Court (2005): weekly tests of all odour abatement plant, including biofilters and bioscrubbers must be carried out. The resolution of the H_2S meter should be at least 1ppb.
- As per Blackfriars Crown Court (2005): olfactometry performance tests must be carried out on all odour abatement plant, including biofilters and bioscrubbers annually as a minimum. Such tests shall consist of at least 3 samples of inlet and outlet air analysed to the BSEN13725 standards.
- Refer to the Crossness STW Odour Management Weekly Check Sheets in Appendix 7 for performance checks carried out.

4.4.2 General Monitoring

Overall plant performance is assessed daily as part of the generic Site and Sludge inspections rounds, which apply to Thames Water large STW sites, and have been included in appendices 8 and 9, respectively.

The objective of these are to ensure that treatment processes, including odour control, are checked for effective operation. Any of the checks that result in performance of the process outside of the limits defined in the SOM or a fault being detected will require an Operator to change the process to bring the plant back into acceptable limits or the fault needs to be logged and reported for follow up maintenance/repair.

Where remedial actions are identified from any source these are listed in Tables 4.3 & 4.4 with expected durations accompanying rectification. The timescales given are indicative or illustrative but are informed directly by operational experience. Repairs requiring capital funding will take longer as they are directly informed by complexity and will be bespoke to the issue(s) identified.

Various process parameters are monitored using a combination of online instruments (to measure flows, temperatures, pressures, levels); samples that are taken to our UKCAS accredited laboratories, or run through sampling tests at the on-site laboratories (%DS, pH, alkalinity, ammonia).

The online instruments all have signals that are taken back to the site SCADA system and these ‘alarm’ if the readings are outside pre-set trigger points. Similarly, laboratory analysis samples will have expected ranges, which if outside of these, a notification is sent to the site process controllers.

In all instances that parameters are out of 'range', the operational teams will carry out an investigation to understand the cause and initiate corrective actions. If the reasons are not obvious, the process optimisation team is contacted to evaluate further.

In addition, a range of digester process parameters are subject to routine monitoring or checking to ensure that the digestion process is operating optimally so that the required sewage cake output quality is achieved.

- pH: At a THP digestion site such as Crossness the processes is maintained around pH 8 but within the range 7.5-8.6 (this is % dry solids and digester load dependant) for healthy operation.
- alkalinity: Levels dependant on feedstock characteristics (primary sludge: surplus activated sludge (SAS) ratio). Advanced digestion (THP) typically, 5,000 - 10,000mg/litre (target range from 6,000-8,000 mg/litre) but is dependent on % dry solids and digester load.
- temperature: minimum target of 40°C for advanced digestion. This is maintained within the range 36-45°C for THP AD.
- HRT (hydraulic retention time): minimum target is 15-days, there is no upper limit. Retention times shall not be less than 12-days during plant outages to keep the product pathogen kill efficiency control.
- OLR (organic loading rate): see table below - this is dependent on the primary/SAS ratio. Crossness fits into the fourth row of the table.
- Dry solids feed: see table below, Crossness has a target of 10%DS, but this can vary between 8-14%DS and impacts the HRT.

Type of Digestion	0%- 35% SAS[x]	36%- 45% SAS	46%- 50% SAS	51%- 55% SAS	>55% SAS	Max Feed %DS
MAD* in Conventional Digestion	3	2.5	2	1.75	n/a	6
MAD after Pre-pasteurisation	4.5	4	3.5	3	n/a	7
MAD after Acid Hydrolysis	4.5	4	3.5	3	n/a	7
MAD after Thermal Hydrolysis	7	6.5	6	5.5	5.5	14

* mesophilic anaerobic digestion

[x] surplus activated sludge, arising from the UWWTD treatment route.

- VFA (volatile fatty acid) concentration: There is no specific range for VFAs as it depends on the feedstock. It is used as an indicator of digester health rather than a process control. The production of organic acids depends on the volume of solids fed to the digester. The typical range for VFAs in a primary digester is between 50 and 800 mg/L. When VFA concentrations climb above 1000 mg/L, the digester could be overloaded or experiencing other problems.
- Ammonia - Ammonia concentrations of 50 to 1000 mg/L are beneficial, but ammonia levels of 1500 to 3000 mg/L (pH greater than 7.4) could be inhibitory but not always. An ammonia concentration higher than 3000 mg/L for prolonged period is toxic.
- VFA to Alkalinity ratio: Very important parameter to monitor for digestion process. The VFA to alkalinity ratio of below 0.4 is good and above this threshold value means diminishing alkalinity and low pH i.e. sour digester content. As long as this ratio is maintained higher VFA, and alkalinity digester content can be acceptable, and the digestion process is deemed healthy. Anaerobic digestion process is always controlled based on holistic parameters based but not based on single parameter.

Sniff Testing

Sniff testing has been incorporated into our Odour Improvement Plan (Appendix 2). This is to allow time to ensure that the most effective sniff testing can be carried out using personnel not sensitised to smells on site.

The procedure will be undertaken in response to complaints or if a risk of odour nuisance at sensitive receptors is expected and/or has been substantiated.
• Sniff testing will be carried out at by someone not routinely based at site, who are less sensitised to odour produced on site.
• Assessing potential odour sources within the Urban Waste Water Treatment (UWWT) and Sludge Treatment Centre (STC) processes and attempt to trace the odour to its source.
• The procedure and recording form which will be used can be found in appendix 10 of the OMP

Details of routine monitoring tasks are included in the Site Operating Manual.

4.5 Record Keeping

All records are stored on the company SharePoint system, SAP or SCADA.

- OCUs
    - As per Blackfriars Crown Court (2005): records of the weekly tests on all odour abatement plant, including biofilters and bioscrubbers should be kept for at least 24 months – recorded on the Weekly Odour Management Check Sheet.
    - As per Blackfriars Crown Court (2005): records of the annual olfactometry performance tests of all odour abatement plant, including biofilters and bioscrubbers should be kept for at least 24 months – recorded on the Weekly Odour Management Check Sheet.
    - Contractor service reports are emailed monthly.
- Weather Data Records
    - Rainfall, wind direction and speed are recorded using an automated weather station in the STW Control Room
        - The weather data from the station is held electronically on SCADA.
        - The monthly summary report will be printed and shall be held in the Odour Management procedures support file. At least 1 year's data will be held on file.
    - Rainfall is also recorded manually with a rainfall gauge between the Powerhouse and RAS Pumping Station
        - The rainfall data card (METFORM 7137) will be photocopied before it is mailed to the Environment Agency.
        - The data shall be held in the Odour Management procedures support file. At least 1 year's data will be held on file.
- PSTs
    - The records dip for the PSTs will be retained for at least 24 months.
- Monthly Odour Management System audits
    - Audit records shall be held in the Odour Management procedures support file. They shall be held for a minimum of 24 months.
- H_2S measurement instrument calibration records
    - Records of H_2S measurement instrument calibration will be held for 24 months.

- Records of operational performance and plant availability are maintained and kept on SharePoint for a minimum of 24 months.

4.6 Emergency Response and Incident Response Procedures

Emergencies such as fire, flood and severe weather are managed by Thames Water's Incident Management and Business Resilience team. The processes employed can be found on Thames Water's SharePoint site and are entitled: 'Security and Emergency Risk Management'. This is a company confidential document and therefore, is not included in the Appendices of this document.

Disaster recovery arrangements are held in the site Disaster Recovery Plan, which is a separate procedure. Given the potential combinations & permutations of circumstance that may constitute an emergency it is not practical to include specific responses within these procedures.

Hazard reporting and accidents are all recorded on the Health and Safety software database SpheraCloud (https://sphera.com) and monitored by Thames Water's Health, Safety & Environment team.

In the event of power failure, the site will run on island mode for process critical plant, this doesn't include odour control units and some leakage of odour may occur from below covers until power is restored.

Absence of key staff does not affect the running of Crossness STW, as Tech 1s from other sites can be called upon to cover, if required.

Tables 4.3 to 4.7 respond to the identification of relevant triggers and actions to minimize odour. OCU monitoring is also included. Monitoring of odour release to atmosphere for wider sludge treatment assets is constrained by sludge containment (say versus an open composting operation), the lack of a confined emission point and the episodic nature of odour release and exposure.

Irrespective of such constraints, our Operations Team and odour contractor have recommended consideration of the following techniques either proactively (so accompanying planned or reactive works with known odour risk) and in an investigative capacity attached to an incident:

(a) Targeted use of 'Jerome' hydrogen sulphide analysers
(b) Targeted use of sniff tests ('calibrated nose')
(c)H2S measurements of stored materials where septicity is either present, or the material is at risk of septicity from continued storage especially in the open air, for example, prior to de-watering where measurements of sulphide & dissolved O2 would inform a condition assessment. Quantities and storage times precipitating a need for such assessments. This recommendation is being raised with the Area Process Scientist.
(d) Inclusion of temporary odour suppressants/misting agents and continued access to process critical spares (odour minimisation by early intervention).
(e) Further expansion of odour risk within site incident planning (this is already referenced in Tables 4.5, 4.6 & 4.7 under relevant Intermittent; Abnormal Operation & Emergency scenarios)
(f) For PSTs, asset condition (wear/damage) would consider odour risks where assets are taken offline
g)Telemetry/alarming of whessoe valve releases – there is an existing phased project within TWUL to enhance this at our sludge locations .

5 Maintenance and Inspection of Plant and Processes

5.1 Routine Maintenance

5.1.1 General Requirements

Site staff has a schedule to ensure routine maintenance for key mechanical items. In addition, a dedicated maintenance team provide additional support for more specialised equipment, e.g. regular calibration of Dissolved Oxygen probes.

In addition to the routine operational tasks, planned preventative and defect maintenance of plant is carried out. Plant which may have an impact on odour release is assigned an appropriate criticality rating to ensure effective performance is maintained. Plant assessed to be odour critical is listed in Section 4.2.3 above.

All maintenance is captured on the corporate system SAP, which generates work requests for the various activities for the treatment process assets. Maintenance procedures are detailed in the SOM.

5.1.2 OCU selection and performance validation

OCU 1 – PFT supernatant Well (Liquor return pumping station 2)(STC) A26

The nominal design basis for the system is summarised below.

Parameter	Units	Value
Supernatant well volume	m^3	14
Supernatant well air changes per hour	-	2
Supernatant well air flowrate	Am^3/hr	28
Dilution air flowrate	Am^3/hr	112
Total air flowrate to OCU	Am^3/hr	140
Design inlet temperature	°C	20
Design inlet humidity	%RH	70

Supernatant well outlet H_2S concentration – (ave)	ppm	1,500
Supernatant well outlet H_2S concentration – (max)	ppm	5,000
Bio-trickling filter inlet H_2S concentration - (ave)	ppm	300
Bio-trickling filter inlet H_2S concentration - (max)	ppm	1000
Carbon filter inlet H_2S concentration – (ave)	ppm	6
Carbon filter inlet H_2S concentration – (max)	ppm	20
Carbon filter outlet H_2S concentration from ICF – (ave)	ppm	<1
VOC's @ MW 56 (max) at supernatant well outlet	ppm	60
VOC's @ MW 56 (max) into bio-trickling filter	ppm	12
VOC's @ MW 56 (max) into carbon filter	ppm	9.6
Mercaptans (max) at supernatant well outlet	ppm	40
Mercaptans (max) into bio-trickling filter	ppm	8
Mercaptans (max) into carbon filter	ppm	0.4
DMS & DMDS (max) at supernatant well outlet	ppm	20
DMS & DMDS (max) into bio-trickling filter	ppm	4
DMS & DMDS (max) into carbon filter	ppm	0.2
VOC's @ MW 56 (ave) at supernatant well outlet	ppm	45
VOC's @ MW 56 (ave) into bio-trickling filter	ppm	9
VOC's @ MW 56 (ave) into carbon filter	ppm	7.2
Mercaptans (ave) at supernatant well outlet	ppm	20
Mercaptans (ave) into bio-trickling filter	ppm	4
Mercaptans (ave) into carbon filter	ppm	0.2
DMS & DMDS (ave) at supernatant well outlet	ppm	10
DMS & DMDS (ave) into bio-trickling filter	ppm	2
DMS & DMDS (ave) into carbon filter	ppm	0.1

For continuous operational monitoring, system incorporates:

- Visible of fans on SCADA for loss of extraction from odorous sources

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

OCU 2 – Preliminary Treatment Works: (UWWTD)

Original manufacturer	Anua
Design air flow rate	27,356 m3/hr
Design H2S inlet load	15 ppm (max) 3 ppm (average)
Design removal efficiency	98%
Duty standby extraction	Present
Design inlet temperature	23.5°C

Design values back calculated by ERG

For continuous operational monitoring, system incorporates:

- Visible of fans on SCADA for loss of extraction from odorous sources

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

OCU 3 - Primary Settlement Tanks 17 – 24, Raw Sludge PS and Distribution Chamber (UWWTD)

For continuous operational monitoring, system incorporates:

- Visible of fans on SCADA for loss of extraction from odorous sources

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

OCU 4 - GBT Building (STC) A27

Extraction Points	Design H_2S Concentration (ppm)		Ductwork Diameter mm	Design Flow Volume m^3/h
	Ave	Max		
5 x Gravity Belt thickeners	40	190	Ø110	650
Total Airflow				*650 m^3/h*

Design inlet temp – 5-40

Removal efficiency – 99%

The OSIL odour control unit details are:

LavaRok® dimensions:	1.8 m Diameter x 3.15 overall height
LavaRok® media volume:	5.4 m^3 of LavaRok® media
Retention time:	30 seconds for deign airflow 650 m^3/h.
CuCarb® dimensions:	1.26 m Diameter x 1.4 m high
CuCarb® media volume:	0.63 m^3 of CuCarb® media
Retention time:	3.5 seconds for normal airflow of 650 m^3/h.

For continuous operational monitoring, system incorporates:

- Odour improvement plan has identified task to get OCU 4 on SCADA

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

OCU 5 - Picket Fence Thickeners (STC) A28

Original manufacturer	Forbes
Design air flow rate	1199 m3/hr
Design H2S inlet load	45 ppm (max) 16 ppm (average)
Design removal efficiency	98%
Duty standby extraction	Present
Design inlet temperature	25°C

Design values back calculated by ERG

For continuous operational monitoring, system incorporates:

- Visible of fans on SCADA for loss of extraction from odorous sources

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

OCU 6 - Primary Settlement Tanks 1 – 8 (UWWTD)

For continuous operational monitoring, system incorporates:

- Visible of fans on SCADA for loss of extraction from odorous sources

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

OCU 7 – Primary Settlement Tanks 9-16 (UWWTD)

For continuous operational monitoring, system incorporates:

- Visible of fans on SCADA for loss of extraction from odorous sources

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

OCU 8 – Sludge Blending tanks (STC) A29

First stage bioscrubber

Original manufacturer	Hibernia
Design air flow rate	526 m3/hr
Design H2S inlet load	750 ppm (max) 401 ppm (average)
Design removal efficiency	90%
Duty standby extraction	Present
Design inlet temperature	27°C

Second stage biofilter

Original manufacturer	Hibernia
Design air flow rate	526 m3/hr
Design H2S inlet load	70 ppm (max) 31 ppm (average)
Media type	Lava rok
Design removal efficiency	98%
Duty standby extraction	Present
Design inlet temperature	27°C

Design values back calculated by ERG

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

OCU 9 – Sludge Buffer Tanks (STC) A30

First stage bioscrubber

Original manufacturer	BNM
Design air flow rate	2545 m3/hr
Design H2S inlet load	500 ppm (max) 140 ppm (average)
Design removal efficiency	98%
Duty standby extraction	Present
Design inlet temperature	20°C

Second stage biofilter

Original manufacturer	BNM
Design air flow rate	2545 m3/hr
Design H2S inlet load	3 ppm (max) 3 ppm (average)
Design inlet temperature	20°C

Design values back calculated by ERG

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged

System integrity checked during daily site rounds

OCU 10 – Primary Sludge Buffer Tanks (UWWTD), THP related tanks, Digested Sludge Buffer Tanks and Sludge Dewatering Presses (STC) A31

First stage bioscrubber

Original manufacturer	Anua
Design air flow rate	6000 m3/hr
Design H2S inlet load	70 ppm (max) 46 ppm (average)
Design removal efficiency	98%
Design inlet temperature	27°C

Second stage carbon filter

Original manufacturer	Anua
Design air flow rate	3,000 m3/hr
Design H2S inlet load	1 ppm (max) 1 ppm (average)
Design inlet temperature	20°C

Design values back calculated by ERG

For continuous operational monitoring, system incorporates:

- Visible of fans on SCADA for loss of extraction from odorous sources
-
- Water Valve open/shut

For periodic monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged.

Please note, 2 new OCUs are being built to serve Liquor return pumping stations 1 and 2, OCU 11 and 12. Air Emission points A34 and A35. These are proposed to be be a 2 stage biofilter and dry scrubber design.

5.1.3 Maintenance of Odour Control Units

Operation and maintenance of OCUs is delivered in accordance with the Company's Asset Standards and Equipment Maintenance Standards. This is either delivered in house by Operations or outsourced to contractors. Refer to the Odour Control Unit Asset Standard and Site Operating Manual for more information. The scope of this table includes anticipated monitoring requirements of emissions to air from the OCU outlets; TWUL's own site round checks as they pertain to OCUs; followed by a further five key performance indicators reflecting discussion with our specialist OCU inspection contractor as of greatest relevance to Crossness.

Table 5.1 Maintenance and Monitoring of Odour Control Units

Parameter	Monitoring Method	Action if red flag identified and Expected timescales	Frequency	Biofilter	Carbon	Chemical scrubber
Performance monitoring						
Gas inlet temperature (5-40C)	Temperature probe	Investigate any anomalies relating to temperature, such as individual process checks	Monthly	X	X	X
Gas outlet temperature (5-40C)	Temperature probe	Investigate any anomalies relating to temperature, such as individual process checks				
Gas inlet flow rate or velocity (6m/sec)	Calibrated velocity meter	Investigate any anomalies relating to flow rates; velocities and pressure drop across the system by measuring the inlet and outlet pressure. Check fan functionality; presence of obstructions; bring forward contractor service. If fan replacement needed c. 2* months minimum typical duration depending on severity of issue/condition of back up fan (*time of order to mobilisation; assumes second duty fan runs; timescale includes time to install replacement and fabrication). If solely an electrical issue, recourse to TWUL ICA Technician mostly likely within a week. Other root causes are usually blocked media; duct and failure of non-return dampers around fan sets.	Monthly	X	X	X
Gas outlet flow rate or velocity (6m/sec)	Calibrated velocity meter					
Gas inlet humidity (Post biofilter humidification > 90% Carbon units <70%)	Hygrometer	Check any preheaters fitted to system before carbon, or check irrigation is working on biofilter.	Monthly	X	X	-
Back pressure (to assess media thatching or media compaction) Typically systems work around 0.5 kPA	Calibrated digital pressure meters	Values above threshold would be 'RAG' banded in the OCU contractor inspection reports. If pressure gauges are over-pressurised to the extent fouling is or has occurred to be treated as high priority. Check for blockages, poor FFE quality/check if media is of a type susceptible to biodegradation.	Monthly	X	X	X

pH of discharge irrigation water (2-3pH)	pH paper	Less than 2 increase irrigation.	Monthly	X	-	-
pH of scrubber liquor (9.2 pH)	Calibrated pH probe (calibrated with standard solutions)	Recalibrate pH probe and check dosing and chemical availability	Continuous	-	-	X
Redox potential of scrubber liquor (700-730 mV)	Calibrated redox probe (calibrated with standard solutions)	Recalibrate redox probe and check dosing and chemical availability	Continuous	-	-	X
Gas inlet/outlet concentrations for hydrogen sulphide (50ppb used for media change out)	Drager Tubes/CEN TS 13649 for sampling NIOSH 6013 for analysis OR US EPA M11*	Check functionality of odour control unit. If repair or replacement media required raise a job on SAP or APS risk and arrange for contractor repair. Timescale Bespoke to root cause/see later entries. Arrange re-test post remedial work. Major repairs up to 6 months depending on complexity	Monthly/ 6 monthly	X	X	X
Gas inlet/outlet concentrations for ammonia (20mg/m3)	EN ISO 21877 OR CEN TS 1369 for sampling NIOSH 6016 for analysis*	Check functionality of odour control unit. If repair or replacement media required raise a job on SAP or APS risk and arrange for contractor repair. Timescale Bespoke to root cause/see later entries. Arrange re-test post remedial work. Major repairs up to 6 months depending on complexity	6 monthly	X	X	X
Gas inlet/outlet concentrations VOCs and RSH	RSH – Drager tubes VOC – PID as isobutylene		Quarterly	x	x	x
Maintenance checks and inspections						
Check integrity of tank covers for damage and ensure access hatches are closed		Close hatches ASAP	Daily	X	X	X
Check building & door integrity for damage or leakage; doors closed (if required)		Closed doors ASAP	Daily	X	X	X
Check damper positions on ductwork are in the correct positions		Correct positioning	Daily	X	X	X

Check irrigation and humidification systems are functioning	Turn on systems or investigate malfunction.	Daily	X	-	-
Check for free discharge of effluent from drain	Investigate blockage	Daily	X	-	-
Check irrigation water supply is working at required rate	Visual check on flow gauge, investigate if required.	Monthly[1]	X	-	-
Check condensate removal points for free flow of liquid	Visual check	Daily/Monthly[1]	X	X	X
Check OCU condition for signs of damage or leaks	Call specialist contractor if identified	Daily / Monthly[1]	X	X	X
Check general ductwork for signs of damage or leaks	Condition of ductwork would be 'RAG' banded in the OCU contractor inspection reports. If broken, then odours not being conveyed to OCU and can be indicated by low inlet load. Worst case the ductwork is disconnected ('sucking air') such that odour removal is not taking place.	Daily / Monthly[1]	X	X	X
Check spray pattern from irrigation nozzles and clean nozzles as required	Adjust spray pattern, clean the strainer and unblock nozzles or replace as deemed necessary. Timescale durations of c. 2 weeks where just irrigation required.	Daily / Monthly[1]	X	-	X
Check flexi joints between fans and ductwork for leaks	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	X	X
Check fans for excessive vibration or noise, belt tension and bearing temperature	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	X	X
Check irrigation water pH	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale	Monthly	X	-	-

	durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)				
Check irrigation pumps condition and operation	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	-	
Check chemical reagent levels and supply	Order when required. Ensure no low-level alarms.	Weekly	-	-	X
Check chemical dosing and blow down pump condition and operation	If outside pH levels, investigate. Initiates blow down to correct level.	Daily/Monthly	-	-	X
Check blow down rate is within correct range	If outside pH levels, investigate. Initiates blow down to correct level.	Monthly	-	-	X
Check ph and Redox probes are working and in calibration	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	-	-	X
Check recirculating liquor strainer and replace if necessary	Flows recorded on SCADA	Monthly	-	-	X
Check water softener is working correctly (if installed)	Water hardener test papers used to check water quality.	Monthly	-	-	X
Check dampers are operational and in good condition	Swap over duty fan to stand by fan and record flow volumes to identify issue.	Monthly	X	X	X
Inspect electrical control panel and check for faults and alarms	Visual inspection by monhtly contractor and investigation any alarm conditions.	Monthly	X	X	X
Simulate duty / standby fan and pump changeover	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	X	X

Check H_2S meter is functioning and calibrated (if installed)	Check calibration is still in date during monthly contractor inspection.	Monthly	X	X	X

*Only relevant to OCUs covered by STC permit.

Monthly tasks carried out by specialist contractors, daily caried out by site ops.
Condition of the media in the OCU is monitored by performance checks and by additional testing as required.

OCUs at Crossness are covered by a service and maintenance contract. They are inspected on a monthly basis and reports are sent to the team manager. Figure 5.1 below highlights the scope of work required from our OCU Maintenance Contractors through their monthly visits. Monitoring during the visits is as follows:

- Monthly – flow (m^3/h), differential pressure(kPa) and hydrogen sulphide(ppm) at both the inlet and outlet. Where applicable, monitoring may also include fan hours run and removal efficiency of hydrogen sulphide.
- Quarterly – VOC(ppm) and mercaptans(ppm) at the inlet and outlet.

>50ppb hydrogen sulphide will be used as a threshold value for media change out. More detailed maintenance procedures are located in the SOM.

The OCUs are specifically designed to minimise the release of odour, bioaerosols and microorganisms.

Optimum flow rates; trigger levels; odorous components/concentrations in the gas stream and associated physical properties are all important to OCU function and are described below:

(i)Optimum flow rate through the system to allow for effective treatment.

A '**Maximum velocity in duct work'**; rather than volume; is the key design aspect informing effective treatment for new/existing OCUs. Not exceeding 10m/second in a piece of ductwork will avoid noise break out; the industry benchmark for new plant being 8m/second. Given velocity is directly related to the volume; the specification is +/- 20% to reflect

instrumentation variation; and therefore all OCUs are checked to see ***if they can meet 6m/second*** with escalation in monthly contractor inspection reports where this value is not reached. This is a good indicator of functionality, appropriate sizing, and system health.

ii) The trigger levels/ranges for action if processes monitoring parameters are breached/ outside optimal parameters.

All OCUs, irrespective of media type, *will stipulate a minimum of 30 seconds* ***retention time***, for a biofilter to achieve a minimum of 95% removal efficiency. A minimum of 2-3 seconds retention time for Carbon filters and 2 seconds for chemical scrubbers.

H2S readings are reported in the monthly service reports which inform odour equivalents (OEs). The accepted OEs for H2S at 0.5 part per million is equivalent to 1,000 odour units. A "red action" would be raised for any value 3 parts per million on the discharge from a biofilter (before the carbon filter). and 0.5 parts per million off the subsequent carbon filter/dry scrubber. Where a biofilter or carbon filter is alone the red action would be raised for 0.5 ppm detected, regardless of it's removal efficiency. There is a relationship between increases in discharge efficiency from the biofilter since if this rises it will start to exhaust the carbon filter defining the red action. Contextual knowledge must inform any triggers for action; rather than focusing on a single value

Trigger levels are more difficult to identify for other parameters, such as mercaptans and ammonia since the design assumptions for OCUs are informed by H2S removal. Removal for these parameters is therefore limited. For Total VOCs, *in respect to methane rather than small chain VOCs*, there is no removal.

From a qualitative value, from visual inspections, 'red flags;' would include if irrigation pipework to the biofilter is broken (no water entry to media); neither extraction fan running; broken ductwork leading to the OCU sucking in atmospheric air.

On identification of such red flags, such that the effective function of the OCU is at risk of being compromised, the following actions would be taken:

(i) For significant issues relating to any aspect of 'condition monitoring' - including effective function of the biofilters - impacting upon parameter reductions at the inlet/out; differential pressures or irrigation volumes – the Performance Manager would urgently contact Head of Maintenance at ERG to book in reactive maintenance attention. Timescales would be of highest priority but response times/duration dependent on the issue identified

(ii) For issues relating to housekeeping (leaks) or issues relating to OCU power supply (electrics) – for example, impacting either fan operation - these would be referred to a TWUL Electrician for assessment and either rectified by the area operational team or escalated to an external contractor where repairs are more complex. Timescale for expectation of resolution would typically be within 24 hours.

For either (i) and (ii) if any significant pollution risk (odour) was identified the Performance Manager would contact TWUL's incident help desk. A supporting risk would be recorded in APS (risk assessment software) to support funding where a need for remedial works was identified.

iii) Odorous components in the gas stream and concentrations of emissions

The monthly contractor inspections of each OCU provide data for H2S; VOC; Mercaptans (RsH). The sampling methodology being Drager (gas analysis) tube for c. 30 seconds to 2 minutes duration.

To achieve an appropriate level of surveillance on OCU performance, outside of the contractor monthly inspections, there is additional oversight from the Operations Management Team through:

- Visibility using local SCADA control panels for THP OCU , which records fan status

- Daily site rounds by Thames Water technicians. These are Psion based checks using SAP Plus for escalations including, for example, internal MANDAT tickets or identifying a need for contractor support. The tasks in the daily checks mirror the numbered tasks in the contractor 'Monthly Health Checks'. See Figure 5.1 and section 9 in Appendix 8 in the OMP. There is connectivity between the site rounds and SCADA, for example, if excessive noise is recorded this could relate to an operational fault in THP OCU fan, and in turn, is visualised on the local SCADA screens.

iv) Physical properties of the air stream at point of control i.e., humidity, optimum temp, pH for effective odour control

For **humidity**, *the gas is humidified before being received by a CIF or biofilter,* so this parameter has less relevance. Biofilters post humidification standard being > 90%. Carbon units and dry scrubbers humidity standard should be set at <70%.

For **temperature**, this is fairly constant throughout the year as this is informed by the need to achieve fairly constant temperatures in the digestion process. A range of 20 to 40^{o}C being standard.

pH will be slightly variable depending on the H2S that is there from the condensing air stream contributing to SO2 formation. This tends not to be an issue at the biofilter itself since the active component of the biofilter will in itself produce SO2 as a waste product from converting the H2S.

pH off a bio-scrubber is checked on the quarterly inspections since it might suggest an issue with the active component of the biofilter being impacted by the accumulation of its waste product thereby making the lower part of the bed inactive. A pH of 2 to 3 would be expected as a theoretical upper limit to liquor discharged from the biofilter but recorded values are significantly less; pH 4 to 5 being typical (reflecting the logarithmic scale). Note if efficiency of the process is being impacted; pH would also be part of the investigative checks (i.e., more than quarterly).

pH of a wet scrubber will be slightly variable depending on the H2S that is there from the condensing air stream contributing to SO2 formation. pH of the system will be monitored continuously online, with the desired value 9.2

ORP of a wet scrubber is monitored continuously with the desired value being 700-730 mV

Figure 5.1 – Monthly OCU Health Checks

Monthly Health Checks

Biofilter

Please enter any comments you may have in the yellow comments boxes

Number	Task	Comments
1	Examine ductwork for any signs of damage or leaks and check condensate drains are free flowing	
2	Visually inspect the Odour control system will be made and any defects or deterioration of the housings will be reported.	
3	Check the airflow through the system and any anomalies investigated.	
4	Measure the pressure drop across the system by measuring the inlet and outlet pressure. Record any abnormalities	
5	Measure the contaminate levels (primarily H2S) at the inlet and at the stack	
6	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	
7	Examine the irrigation system to ensure correct operation including spray pattern, clean the strainer and unblock nozzles or replace as deemed necessary.	
8	Take a sample of the drainage water and measure the pH value and compare to target pH value (this is not pH 7 for modern biotech)	
9	Check all hatches and doors for integrity and ensure they are closed	

Chemical Scrubber

Please enter any comments you may have in the yellow comments boxes

Number	Task	Comments
1	Examine ductwork for any signs of damage or leaks and check condensate drains are free flowing	
2	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	
3	Visually inspect the Odour control system will be made and any defects or deterioration of the housings will be reported.	
4	Check the airflow through the system and any anomalies investigated.	
5	Measure the pressure drop across the system by measuring the inlet and outlet pressure. Record any abnormalities	
6	Measure the contaminate levels (primarily H2S) at the inlet and at the stack	
7	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	
8	Examine the recirculation pumps and distribution pipework to ensure correct operation, clean the strainer and check trough / distributor	
9	Carry out a functional check of the dosing system ensuring target pH and Redox are achieved, and validate the probe calibration using a handheld unit	
10	Calibrate if necessary	
11	Visually check the seals of all hatches note any leaks.	
12	Visually check the wet scrubber housing, note any significant deterioration	
13	Scrubber dosing cabinet - Check chemical dosing pumps for leaks	
14	Scrubber dosing cabinet - Check that dosing rates are correct	
15	Scrubber dosing cabinet - Check all valves, instruments and pipe-work for leaks	
16	Scrubber dosing cabinet - Check inside of cabinet for chemical residue and dirt and wash if necessary	
17	Scrubber dosing cabinet - After wash down check catch-pot high level alarm is working before draining	

Carbon Adsorber

Please enter any comments you may have in the yellow comments boxes

Number	Task	Comments
1	Examine ductwork for any signs of damage or leaks and check trapped condensate drains are free flowing. If a manual drain valve is provided, operate the valve until the flow of condensate ceases and leave valve in closed position.	
2	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	
3	Visually inspect the Odour control system will be made and any defects or deterioration of the housings will be reported.	
4	Check the airflow through the system and any anomalies investigated.	
5	Measure the pressure drop across the system by measuring the inlet and outlet pressure. Record any abnormalities. Read off Delta-P gauge if fitted or using a portable manometer	
6	Measure the contaminate levels (primarily H2S) at the inlet and at the stack	
7	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	

5.2 Fault Reporting

Faults identified during routine inspections are reported to the Team Manager or Process Controller who assesses criticality before entering the task into the job scheduling system on SAP for allocation to an appropriate person and to a timescale appropriate to the criticality.

5.3 Emergency Repairs

24-hour maintenance cover is available at the discretion of the Process Controller, Team Manager or Duty Manager, with planned follow up. Less urgent repairs are assessed for criticality and dealt with during normal working hours.

6 Customer Communications

6.1 Customer Odour Complaints Process

Customer contacts regarding Crossness STW will be made via the Customer Services Centre, Operations will investigate and take appropriate action. Complaints may also be received from the local council and Environment Agency.

Customers / residents are encouraged to communicate with local Thames Water Operations via the Customer Centre to report if they are noticing odour from Crossness STW, to ensure that all contacts are recorded and actioned. Customers have 3 main options to report complaints to Thames Water:

1. Thames Water Website – "Report A Problem" at https://www.thameswater.co.uk/contact-us/report-a-problem/report-a-problem-online
2. Email - customer.feedback@thameswater.co.uk with the subject 'Crossness Sewage Treatment Works'
3. Telephone - Customer Services 0800 316 9800

Out of Hours Procedure: customer centre to contact the duty PC who will contact the duty Crossness OHC to initiate the investigation.

Crossness STW Management will process any contacts made with Thames Water regarding odour at Crossness STW within 2 working days of receipt of the contact.

If the customer / resident would prefer to contact the Environmental Services of the London Borough of Bexley, their contact details are as follows:

London Borough of Bexley - Environmental Services
Telephone: 020 8303 7777 (Out Of Hours) or 020 83037171

Complaints received on site

- If a complaint is received locally, they will be redirected to the customer centre so the complaint can be accurately captured.

Complaints received via Customer Services Centre:

- Complaint information is logged electronically by the Customer Services Centre.
- An action is raised to Waste Operations Control Centre (WOCC) who contact the CSM by telephone and email the complaint information to both the CSM and Performance Manager
- The Performance Manager and CSM will review the complaint and take action to investigate (see section 6.3)
- The CSM is responsible for contacting the customer and updating them on the outcome of the investigation.

- Any problems are noted and remedial work actioned. An update of action taken and feedback given to the customer is emailed to the WOCC by the CSM.
- The WOCC update the electronic complaint report and it is closed down.

Complaints received via email or post:

- Complaint information is logged electronically by Customer Relations and allocated a Case Manager.
- The complaint is emailed to the CSM who reviews the complaint and investigates with the Performance Manager (see section 6.3).
- Actions taken are emailed back to the Case Manager who updates the electronic system and updates the Customer.

Complaints received via Customer Centre out of normal working hours

- For a large number of calls, or serious concerns, the Out of Hours Coordinator will be contacted to respond.
- For all other calls Crossness STW site management will investigate and respond the next working day.

In the event of a pattern and/or regular customer complaints relating to odour, an Odour Improvement Plan would be produced or modifications would be made to the Odour Management Plan to address these concerns (or possibly both).

6.2 Customer Communication Plan

The Customer Communication Plan in Appendix 3 identifies how and when contact will be made with customers and stakeholders in relation to stable, abnormal and emergency site operation.

6.3 Investigating a complaint

Upon receiving a complaint the Wastewater Control Centre have 24 working hours to respond to the customer with an update. Within these 24 hours, the Customer & Stakeholder Manager will contact to the performance manager who will carry out an investigation to determine whether the odour source is coming from the Thames Water site. If the odour is decided to be from the Thames Water site, then the root cause is investigated.

Should the source of the odour be confirmed as coming from the Thames Water Operations then the performance manager will review all activities currently taking place on site, including any maintenance, cleaning, and non-standard activities to identify the root cause, and ensure appropriate mitigation measures are in place.

If the performance manager cannot identify the source of the odour, but complaints persist, the Customer & Stakeholder Manager will ensure the customer who made the complaint is contacted, and obtain further details. These details include their proximity to the site location, the time of occurrence and for how long. If odour problems continue to persist, Thames Water may even ask the customer to keep a detailed odour diary to ensure their issue can be fully addressed.

The root cause investigation may include site walkaround checks, which look for irregularities such as spillages / open doors and hatches, ensuring appropriate measures as detailed in table 4.3-6 are in place.

When the root cause of the odour is found, the customer will be updated with an explanation and provided with a timescale for its resolution. Furthermore, the situation is assessed for hazards to determine any possibility of health risk to the local community.

To ensure any limitations regarding everyday staff becoming desensitised to the odour, if site odour complaints persist with no result in locating its source, personnel who do not spend prolonged time on a single site, such as the Area Operations Manager, will participate in the walkaround checks.

6.4 Notification of Operations with Potential to Cause an Odour Problem

Where operations may impact on local residents, notification will be made to the Customer Centre who will log the details on their Bulletin Board. This will be used to provide information directly to customers who call with queries. Letter drops may also be used.

The Customer Stakeholder manager will be contacted directly if there are risks of odour generation (e.g. digester cleaning, tank cleaning or process issues).

The Environment Agency will be notified in accordance with the notification condition in the STC permit.

If notified by the Environment Agency that the activities are giving rise to pollution outside the site due to odour, Thames Water shall investigate and carry out a review of the OMP and appropriate measures if deemed necessary.

Appendices

Appendix 1. Odour Risk Assessment

Crossness%20STW%
20SERV%20Odour%2

Appendix 2. Odour Improvement Plan

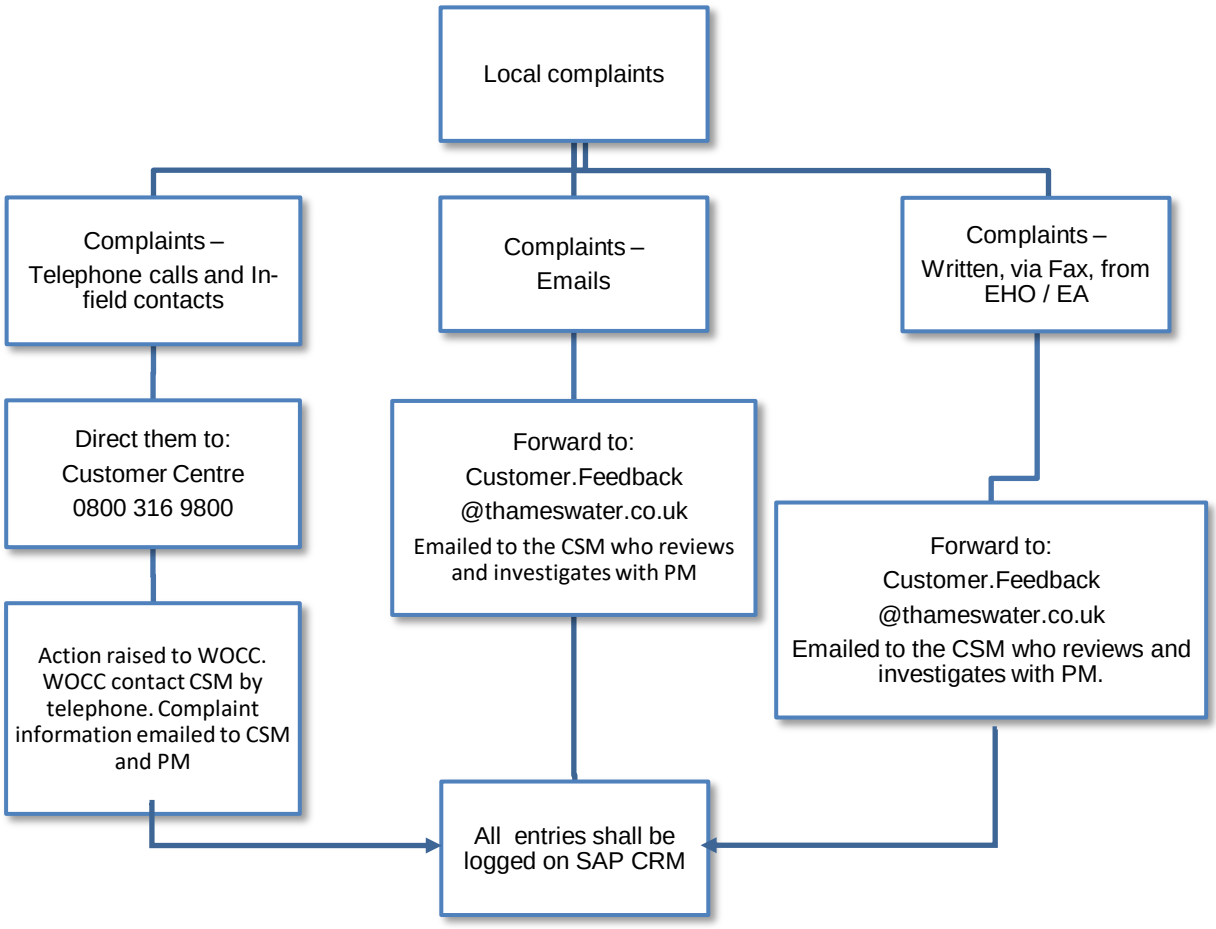
Odour Improvement Plan Crossness STW

Review Date		Nov-23				
Process Stage	**Owner**	**Plan**	**Action**	**Expected difficulties**	**Measures to mitigate**	**Timeframe**
THP OCU's	Dean Horsley	Refurbishment of OCUs	Refurbishment of THP blending tank OCU and buffer tank OCU 160891 and 160892 Funding achieved for repairs on THP OCU (fan replacement and other refurbishment work) 130486 - awaiting attendance to site to undertake work	achieving funding	Continue to operate current OCUs with associated checks and maintenance until refurbishment commences.	AMP8
Storm tanks	Maintenance Projects	Storm Tank Clean	Full storm tank clean		drain the tanks back as soon after storm as practicable –investigating ways of cleaning the tanks following the full cleans	Dec-23
GBT OCU	Leigh Hughes	GBT OCU	GBT OCU is currently local, PO has been raised to get this on SCADA		monthly health checks and site rounds	Dec-23
OCU	Dean Horsley & Leigh Hughes	Action recommendations laid out by monthly health checks	Action recommendations laid out by monthly health checks	Funding		Ongoing
Sniff testing	Odour Specialist	Implement sniff testing procedure	Procedure written for sniff testing, in order to achieve effective sniff testing personnel needs to be identified to carry out the procedure who are not acclimatised to smells on site.	Resource	Site Round, Monthly health checks	6 months from permit issues

Appendix 3. Customer Communications Plan

Complaints Process

All locally received complaints are re-directed to the Customer Centre. Please see below for details.



IMPORTANT NOTE:	
Any communications received from the local Member of Parliament or senior council officers need to be forwarded to the Local/Regional Government Liaison person:	
Name: Telephone:	[redacted]

Communications

Level 1	Stable operations: Compliant with Operational Asset Standards.			
Communications Approach	Standard regular proactive contact with key stakeholders.			
Stakeholders External	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Local council(s) Environmental Health Department	As required	Telephone / email / meeting	Update on operational activity on site	Performance Manager and Customer & Stakeholder Manager
Environment Agency	As required	Telephone / email / meeting	Update on operational activity on site	Performance Manager and Customer & Stakeholder Manager
Local residents associations (if applicable)	As required	Telephone / email / meeting	Update on operational activity on site	Performance Manager and Customer & Stakeholder Manager
Stakeholders Internal	**Frequency of Contact**	**Method & Level of Contact**	**Aim of Contact**	**TW Contact/Level**
Press Office	As required	Report sent out by operations to the business	Update the business on operational activity on site	Duty Manager
Customer Centre (Swindon)	As required	Report sent out by operations to the business	Update the business on operational activity on site	Duty Manager

Level 2	Unstable operations: • Non-compliant with Operational Asset Standards on one or more sub-processes leading to increased odour risk.			
Communications Approach	As Level 1 plus: • Briefing Contact Centre agents / Briefing statement with Q&A prepared for the press office (to use reactively). • Monthly discussions with the EHO. • Commence proactive communications with other stakeholders.			
Stakeholders External	**Frequency of Contact**	**Method & Level of Contact**	**Aim of Contact**	**TW Contact/Level**
Local council(s) Environmental Health Department	Immediately then monthly	Telephone / email / meeting	Report unstable operation with action plan	Performance Manager and Customer & Stakeholder Manager
Environment Agency	Potential for notification procedure	As required as per notification procedure	As required as per notification procedure	Pollution Desk Performance Manager
Local residents associations (if applicable)	Immediately then monthly	Telephone / email / meeting	Report unstable operation with action plan	Performance Manager and Customer & Stakeholder Manager
Stakeholders Internal	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Press Office	Immediately then as required	Q&A prepared for press office by Operations	To enable the press office to deal with queries from the press (reactive only).	Duty Manager
Customer Centre (Swindon)	Immediately then as required	Telephone / email	To enable the Customer Centre to deal with queries from the customers (reactive only).	Duty Manager
Other areas/stakeholders outside Crossness STW potentially impacted				
Stakeholder	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Local businesses	As required	Telephone / email / meeting	Report unstable operation with action plan	Area Operations/Site Manager

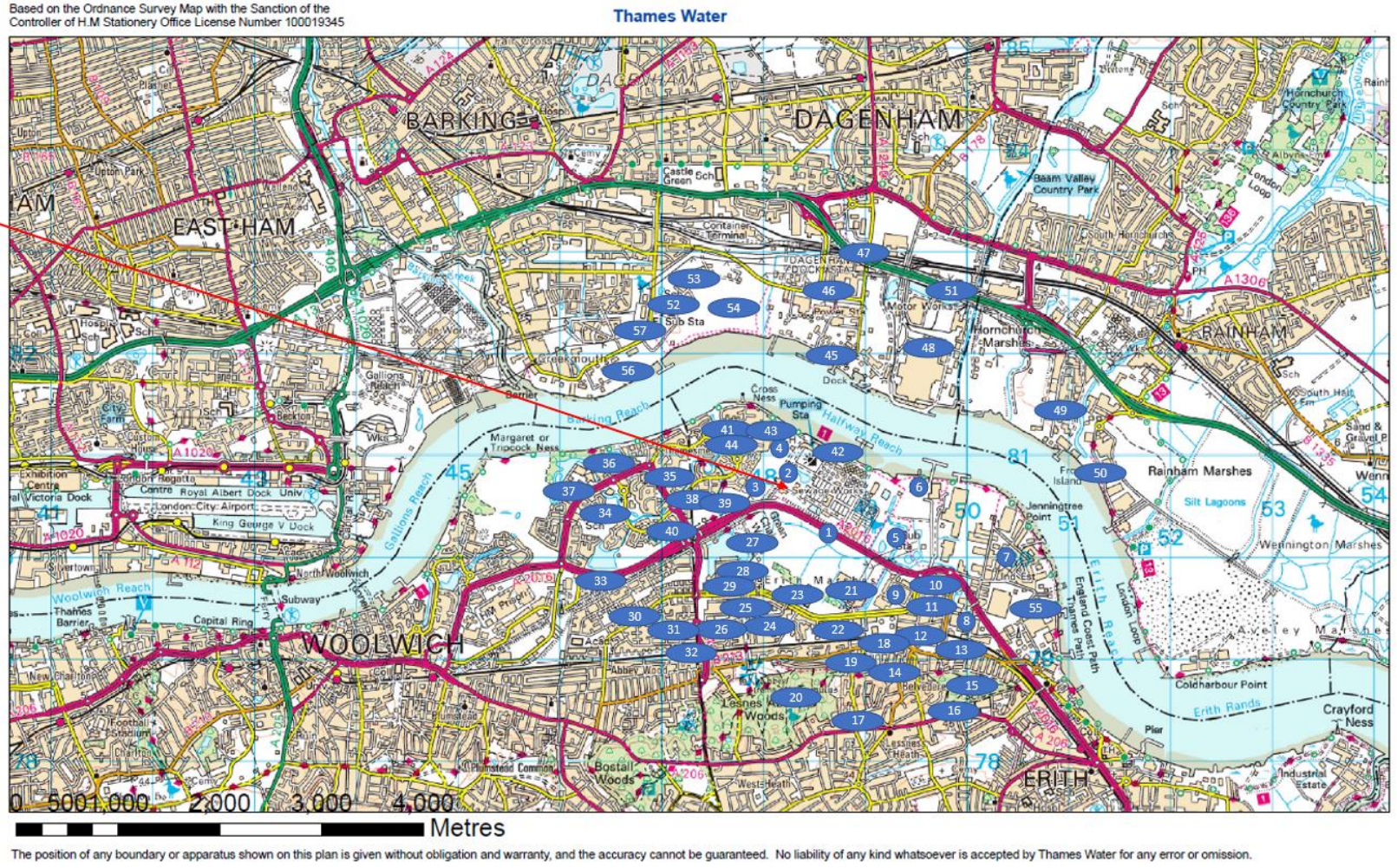
Level 3	Emergency • Temporary or transient activities not deemed to be compliant with Operational Asset Standards. High risk of odour emitting plant.			
Communications Approach	As level 2 plus: • Odour event set up internally (including OOH's cover from OMC (Kemble Court)). • Weekly discussions with EHO. • Monthly Stakeholder meetings, (internal and external – include MPs, Councillors, schools, businesses etc.). • Press release may be required.			
Stakeholder External	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Local council(s) Environmental Health Department	Immediately then weekly	Telephone / email / meeting	Report emergency event with action plan and update with progress	Level 5/4 Manager
Environment Agency	Immediately then weekly as required as per notification procedure	Telephone / email / meeting as required as per notification procedure	Report emergency event with action plan and update with progress as required as per notification procedure	Level 5 Manager (Operations Manager) / Pollution Desk
Local residents associations (if applicable)	Immediately then weekly	Telephone / email / meeting	Report emergency event with action plan and update with progress	Level 5/4 Manager
Councillors / MPs for local areas	Immediately then weekly	Telephone / email / meeting	Report emergency event with action plan and update with progress	Level 5/4 Manager
Stakeholders Internal	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Press Office	Immediately then daily	Q&A and press release prepared by press office	To enable the press office to deal with reactive queries from the press and prepare a media strategy if required.	Duty Manager
Customer Centre (Swindon)	Immediately then daily	Telephone / email	To enable the Customer Centre to deal with queries from customers (reactive only)	Duty Manager
Other areas/stakeholders outside Crossness STW potentially impacted				
Stakeholder	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**

Local businesses	As required	Telephone / email / meeting	Report emergency event with action plan and update with progress	Level 5/4 Manager

Appendix 4. Site Drawings

Figure A - Site Location Map

Crossness STW



The position of any boundary or apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. No liability of any kind whatsoever is accepted by Thames Water for any error or omission.

Figure B – Site Plan

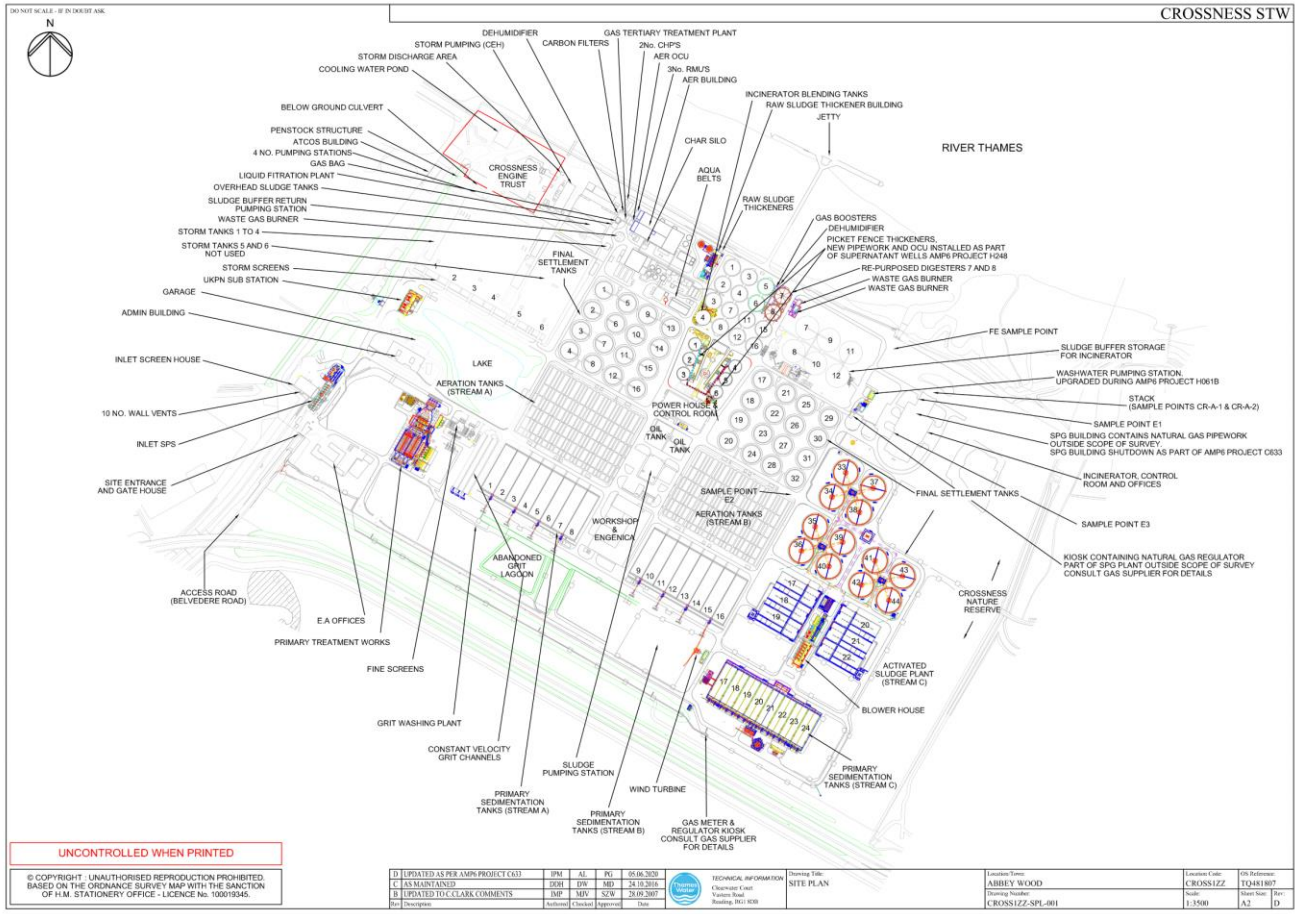


Figure C – Area Permitted under Sludge Treatment Centre Permit

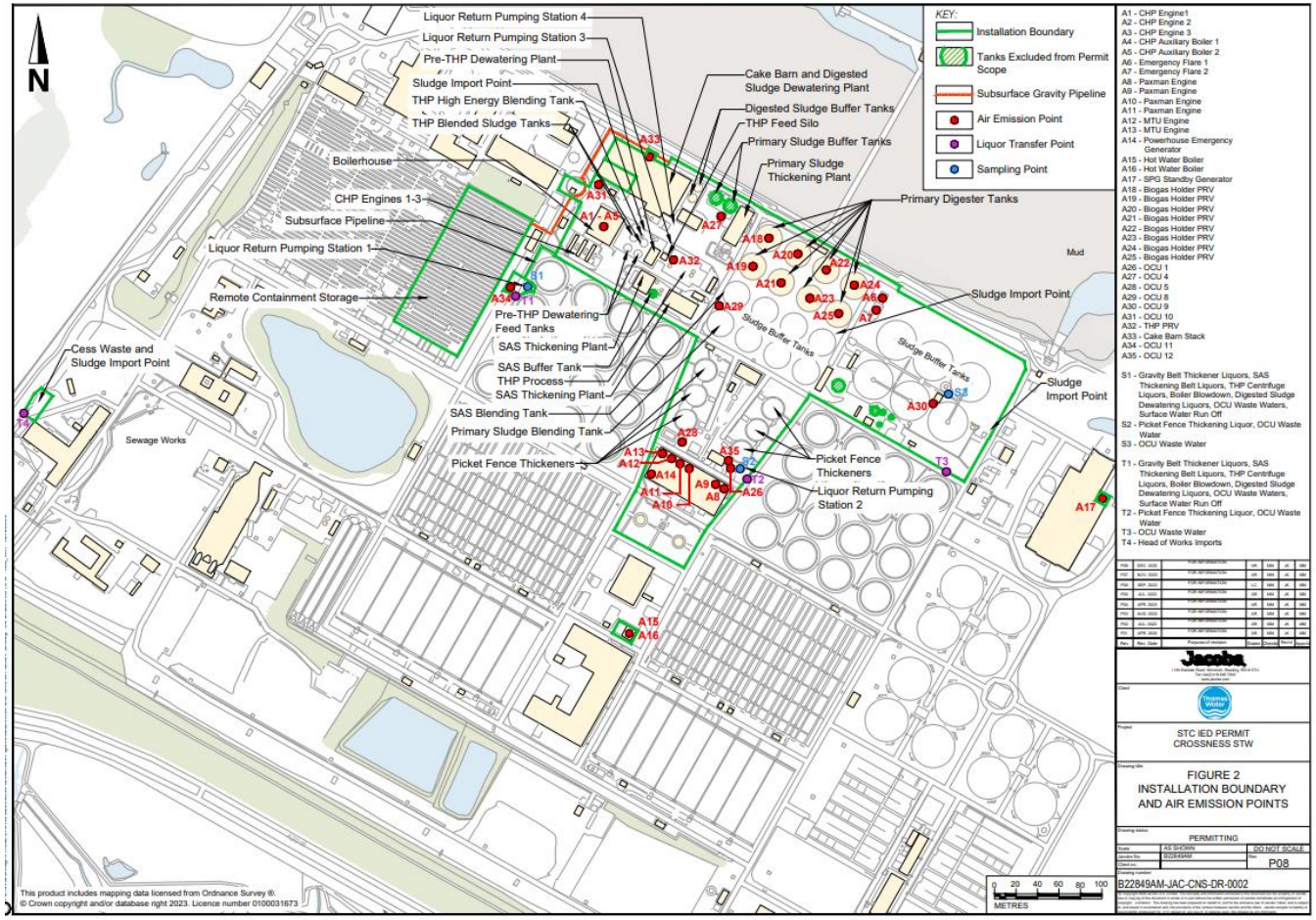


Figure D1 - Process Block Diagram for full site

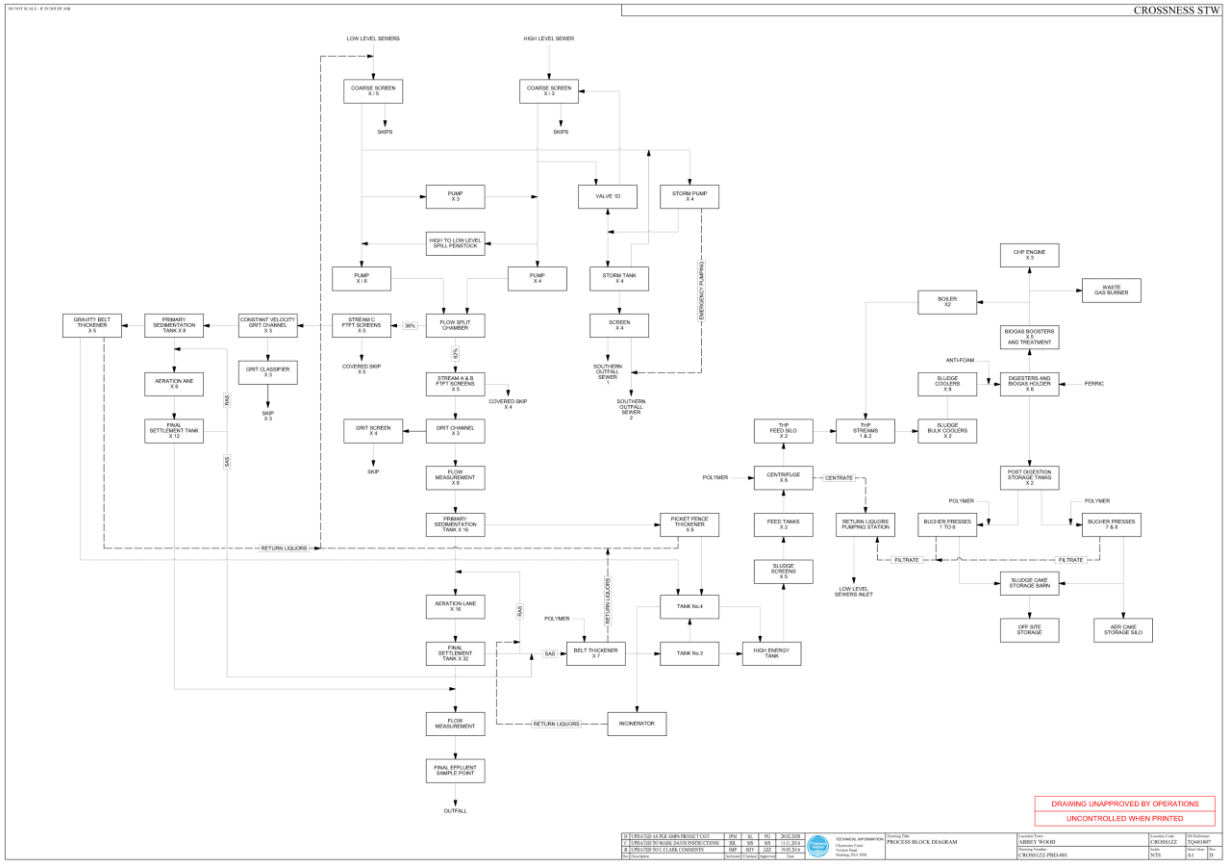
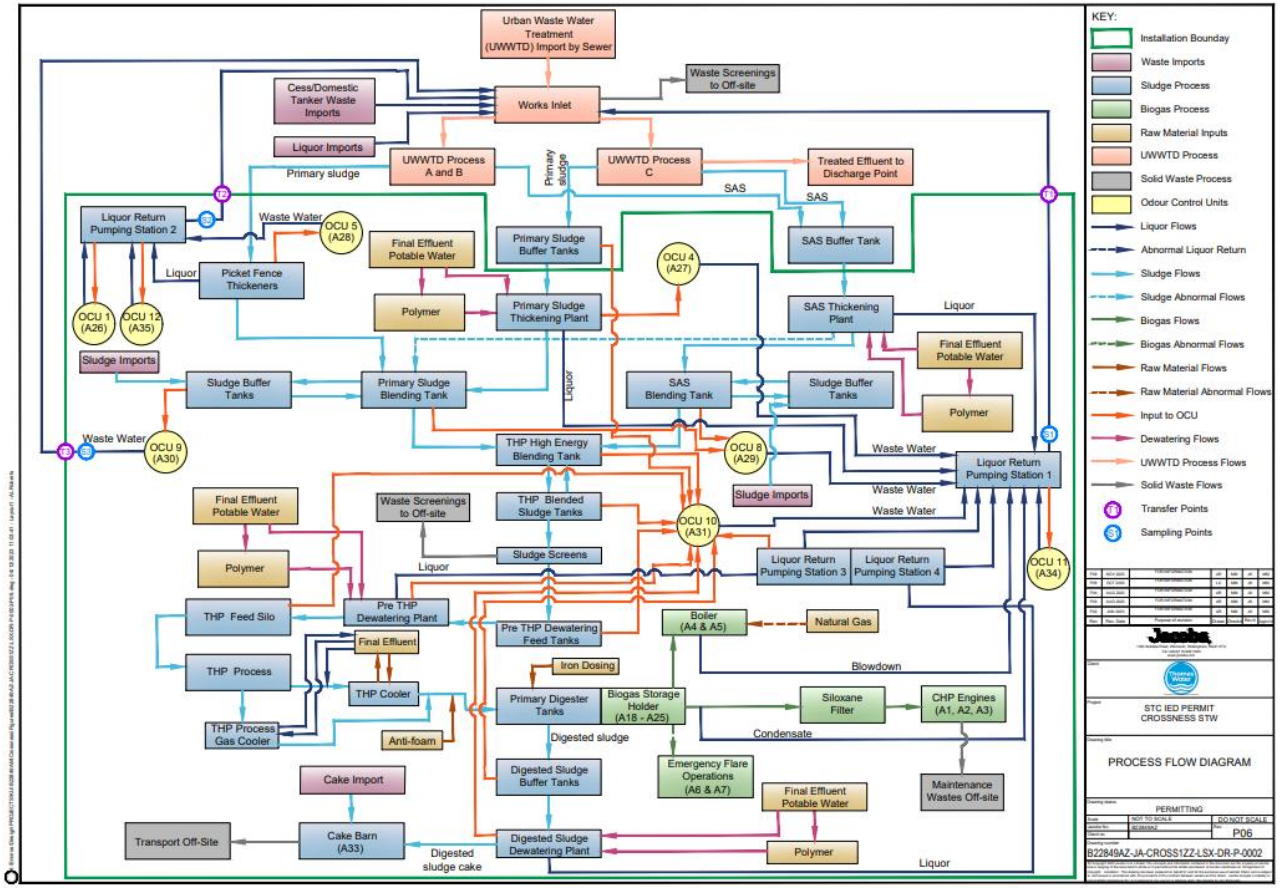


Figure D2 - Process Block Diagram for permitted assets



Appendix 5. Emergency Protocol – Storage/Stockpiling Sludge Cake on Site

A5.1 Definition of Emergency for the Purposes of this Protocol

A5.1.1 Further to the general definition of an emergency contained in the Odour Management Plan (section 4.3.1.2), a circumstance constituting an emergency for purposes of this Protocol is any condition resulting in loss of off-site disposal capacity, such that once all covered and uncovered liquid sludge storage is full to capacity, the quantity of dewatered sludge cake removed from site on any particular day, is less than the quantity of sludge produced on that day.

A5.1.2 Conditions meeting the criteria in A5.1.1 (above), would include:

a. Restrictions in the quantity of sludge removed from site due to limitations in the normal disposal route caused by adverse disposal conditions at the disposal site - e.g. wet weather conditions making access to fields difficult.
b. A lack of suitable and / or available disposal options - e.g. during an outbreak of foot and mouth disease.
c. Other reasons beyond the control of TWUL that prevent sludge being removed from site - e.g. transport issues.

A5.1.3 Examples cited above are indicative of reasons for implementation of this Protocol, but are neither necessarily exclusive nor exhaustive.

A5.2 Procedural Steps for storing/stockpiling dewatered sludge cake on-site

A5.2.1 If at any time it is deemed probable that sludge cake storage on-site will be required, the THP cake storage building will be used for this purpose.

A5.2.2 In the event of the uncovered sludge storage tanks being filled to capacity, full cake production will be resumed. As necessary, additional sludge processing equipment will be hired in to provide additional dewatering capacity. At this point there will be no remaining liquid sludge storage available on site, and the Emergency Protocol will be fully implemented.

A5.2.3 Initially sludge cake will be stored in covered lorry trailer units in order to minimise double handling of the sludge. The trailer units will be removed from site as soon as a suitable outlet becomes available. However, suitable parking for loaded trailer units is limited, and only approximately 30 units (approx. 1,000 tonnes of dewatered sludge cake) can be accommodated in this way.

A5.2.4 When trailer storage is full, sludge will be stored/stockpiled in the THP cake storage building. Once this is full a designated bunded area(s) will have to be defined. As each section of the bunded area is filled, it will be treated and covered as required to minimise odour emissions from the stockpile. The treatment will use the most effective product(s) and method(s) available at the time of implementing this protocol.

A5.2.5 Odour reduction / masking sprays will be set up at strategic points around the circumference of the area containing the sludge stockpile to minimise as much as possible, the effect of any odour emissions.

A5.2.6 The sludge cake is to be loaded into lorries and removed from site at the earliest opportunity once disposal routes are available again.

A5.2.7 When all of the sludge cake stockpile has been cleared, the bunded area will be re-instated.

A5.3 Other Information

A5.3.1 The London Borough of Bexley will be verbally notified at the earliest opportunity when storage or stockpiling of dewatered sludge cake commences or may be required.

A5.3.2 If potentially,

a. more than 1,000 tonnes of dewatered sludge cake is to be stored/stockpiled on site and/or
b. dewatered sludge cake is likely to be stored or stockpiled for a period exceeding 14 days,

then the London Borough of Bexley will be formally notified in writing of this fact at the earliest opportunity. This notification will include the following details:

- The date that the storing or stockpiling of dewatered sludge cake commenced, (or will commence).
- The estimated duration of sludge cake storage / stockpiling.
- The reason why sludge cake storage / stockpiling on-site is being used.
- The total quantity of dewatered sludge cake likely to be stored on site.
- How the situation causing sludge cake to be stored / stockpiled on site will be resolved.
- The measures to be implemented to minimise odour emissions from any storage or stockpiling

A5.3.3 As soon as this Protocol is enacted, the following steps will be taken:

- A Bulletin Board will be prepared for the Customer Centre, in order to allow local stakeholders to be updated of the current situation when they contact the Customer Centre.
- If this Protocol is likely to be in place for more than two days, the External Affairs Office will be contacted as to the best way to keep local stakeholders informed.

A5.3.4 Details of appropriate disaster recovery arrangements to be applied in the case of fire, flooding or other emergency eventuality at the Works are to be found in the Crossness 'Disaster Recovery Plan', copies of which can be located on the East London DRP shared area, with hard copies in the Control Rooms.

A5.3.5 The competent department will, at this time, be nominated as TW Biorecycling.

A5.4 Additional Plant Required

A5.4.1 In the event of this Protocol being enacted, it is likely (in the event of an item of sludge processing plant failure), that a selection of the following equipment is required:

- In the event of all emergency liquid sludge storage being full, except when the incineration plant is fully operational, it may be necessary to hire in additional plant. When the incineration and THP plant is fully operational, it is expected that the existing dewatering equipment is more than adequate to deal with the expected throughput.
- It will be necessary to hire “inflatable” water-filled bunds with covers, or to prepare suitable bunded areas with earth walls for the storage / stockpiling of the dewatered sludge cake.
- If sludge cake is stored or stockpiled on site, odour masking spray / misting equipment will be hired and deployed around the stockpile area to minimise the effect of odour emissions.

A5.4.2 Depending on the nature of the emergency other equipment may be required. This will be discussed with the London Borough of Bexley and be brought in as required.

Appendix 6. Skip/Wheelie Bin Locations

The current skip and wheelie bin locations are located in the following areas of the site. Where appropriate skip sizes, types, quantities and/or references numbers have been included.

A6.1 Skips

Location	Size	Quantity
Inlet Works (Screen House)	26.8m^3	2
Existing works - Preliminary Works (Fine Screens)	26.8m^3	4 – Closed packers
New works - Preliminary Works (Fine Screens)	26.8m^3	5 – Closed packers
New works - Preliminary Works (Grit Dewatering)	15.3m^3	3
Raw Sludge Screen East	15.3m^3	1
Raw Sludge Screen West	15.3m^3	1
Storm Tanks	15.3m^3	4
THP	15.3m^3	2

A6.2 Wheelie Bins

Location	Quantity
Power House	1
Aquabelt Building	1
Digester 12	1
Jetty	3
Main Admin	3
Day Works Office	2
Maintenance Building	1

A6.3 Contractor Skips

In addition to the skips used by Thames Water, the site tenants and contractors may also use skips to dispose of waste materials. Although these skips are unlikely to generate odours, contractors and tenants will be instructed to ensure their skips are covered if possible to help reduce odour potential and maintain site house keeping standards.

Appendix 7. Forms & Other Paperwork

The following forms and other paperwork supporting this manual are attached below. This list will be reviewed annually to make sure that it is up to date.

Appendix 7a. Odour Management Audit Form - Logsheet OMP1

Appendix 7b. Weekly Odour Management Check Sheet - Logsheet OMP2

Additional forms:

1. Folder: operations/fowwprocess/opssoutheast/crossnessstw/processperformancedata/forms
    a. Form S4 Crossness STW PST Report Sheet
2. Office: meteorological office
    a. Rainfall data card (METFORM 7137)

Appendix 7a. Crossness STW Odour Management Audit Form - Logsheet OMP1

Logsheet OMP1

Date:_____

	Y/N?
Are the Odour Scrubbers/Bio-filters operating satisfactorily:	
Consolidation Tanks (PFTs)?	
Sludge Blending Tanks?	
Sludge Buffer Storage Tanks?	
Picket Fence Thickeners?	
New Preliminary Treatment Works?	
Primary Treatment Works?	
Are all odour related SAP PPM tickets complete for previous month?	
Have weekly management checks been completed?	
Is the weather file data up to date?	
Are all building doors and windows closed as per procedures (STW & THP / Cake Barn)?	
Were all non-operational skips covered as per procedures (inc contractors/tenants)?	
Are planned odour briefings complete?	
Are all remedial actions complete or on schedule?	
Were any odours noted during audit? (if yes detail in comments below)	

Average PST Sludge Depth (ft) for 1-24 for last month		**Average PST %ds for 1-16 for last month**	

Comments (inc SAP Job No's raised, service provider order no, etc):

Print Name:_____ **Sign:**_____ **Date:**_____

Appendix 7b. Crossness STW Odour Management Weekly Check Sheet - Logsheet OMP2

Logsheet OMP2

1. Odour Scrubbers

Unit	H_2S In (ppm)	H_2S Out (ppm)	Plant OK?	Comments (including SAP PPM Job No's raised)
PFTs				
Blending Tanks				
Buffer Tanks				
THP				
PTW				
PSTs 1- 8				
PSTs 9- 16				
PSTs 17-24				

2. Site boundary and building monitoring Log Sheet

Location	H_2S(ppm)	Location	H_2S(ppm)	Location	H_2S(ppm)	Location	H_2S(ppm)	Location	H_2S(ppm)
N1		S1		W1		E1		RAS pump house	
N2		S2		W2		E2		Aquabelt building 1-4	
N3		S3		W3		E3		Aquabelt building 5-7	
N4				W4		E4		Raw sludge GBT	
N5									

3. Skips/Wheelie Bins

Skip Area	OK?	Skip Area	OK?	Bin Area	OK?	Bin Area	OK?
Inlet Works (Screen House)		Raw Sludge Screen East		Power House		Main Admin	
Existing works - Preliminary Works (Fine Screens)		Raw Sludge Screen West		Aquabelt Building		Day Works Office	
New works - Preliminary Works (Fine Screens)		Storm Tanks		Digester 12		Maintenance Building	
New works - Preliminary Works (Grit Dewatering)		THP		Jetty		Power House	

4. Building & Plant Checks

Area	OK?	Area	OK?	Area	OK?	PST's	
Inlet works building		Aquabelt Buildings		THP		Sludge Depth PSTs 1-8 (ft)	
RAS pump house		Raw sludge gravity belt thickeners (GBTs)		Digesters		Sludge Depth PSTs 9-16 (ft)	
PFTs		Storm pump station				Sludge Depth PSTs 17-24 (ft)	

5. General Comments (including any odours noted & SAP PPM Job No's raised):

If any odour control unit H_2S removal rate drops below 95% increase monitoring frequency to daily.
Are all previous remedial actions completed or on schedule?

Print Name:_____ **Sign:**_____ **Date:**_____

Appendix 8. Generic site round checks

ID	Instruction	Daily	Weekly
1	**Final Effluent**		
a)	Check the effluent quality at the sample point. Sample (ammonia, phosphorus, temperature & turbidity) in accordance with SOM. Record in site log book & via Direct Text.	**X**	
b)	Check final effluent sampling point is accessible. Highlight to manager if need to clean inline monitor, channel/chamber.	**X**	
c)	Check storm sampling point is accessible. Highlight to manager if need to clean inline monitor, channel/chamber.	**X**	
d)	Visual check on point of discharge to the watercourse if accessible. Check operability of outfall flap valve if fitted.	**X**	
e)	Check storm discharge point, if shared & if accessible.	**X**	
f)	Compensation water pumps. Check and clear ultrasonic head of cobwebs etc.	**X**	
g)	Check data and operation of inline monitor. Check inline monitor installation for damage, take appropriate action where required.	**X**	
h)	Remove and clean inline monitor probe.		**X**
i)	Check flow meter & flume is clear of debris. Take appropriate action.	**X**	
2	**Preliminary Treatment**	Daily	Weekly
a)	Check Crude sewage appearance. Does it look normal for the site?	**X**	
2.1	**Cess Waste Reception Point**		
a)	Note any suspicious activity or discharges as required	**X**	
b)	Check logger system is operating correctly	**X**	
c)	Check all pipework is in good condition	**X**	
d)	Where a macerator is fitted, check operation and oil reservoir	**X**	
e)	Where a manual stone trap is fitted, clear of accumulated material	**X**	
f)	Check grit bins are available and stocked with grit for winter	**X**	
g)	Carry out general housekeeping, remove litter, clear debris, washdown any spillages, empty bins	**X**	
h)	Ensure all signage is in good condition, clean and legible	**X**	
i)	Check washdown equipment is operating correctly	**X**	

ID	Instruction	Daily	Weekly
2.2	**Inlet / storm pumping station**	Daily	Weekly
a)	Check Ammeter reading, Too high could indicate a blockage. Too low could indicate an air lock or impeller damage. Where reading is unusual ensure appropriate action is taken.	**X**	
b)	Check the well level is within the normal operating limits taking into account the flow conditions at the time (such as storm conditions & peak flow to site). If level is too low or high, this could indicate control issues or pumping issues.	**X**	
c)	Check condition of the wet well. Does it have more than the usual scum or debris floating on top that will indicate the need for a wet well clean?	**X**	
d)	Check fault light(s) are not on, take appropriate action as required.	**X**	
e)	Check flow rate (where meter is fitted); is it within the normal operating range?	**X**	
f)	Inspect buildings, kiosks and control/switchgear panels for general condition, damage and that they are securely locked. Clean and tidy the interior of the buildings and/or Kiosks. Remove rubbish from site or if large volume arrange for collection.	**x**	
g)	Listen for undue pump noise and check for undue vibration by safely touching the lifting chain or guide rail.	**X**	
h)	Check non-return valve is operating correctly Non return valves prevent water from flowing back through the pump when it is not in operation. If a weighted arm is fitted is it at the usual angle? If it is low and chattering it could indicate the pump is blocked.	**X**	
i)	Check operation of the ultrasonic level control. Is it reading correctly? Compare the well level with the normal readout from the display. Check hard wired control floats, clean as required. Are floats weighed down with rag or debris preventing them from lifting if the water level rises?	**X**	
j)	Check pumps, pipelines and couplings for leaks where possible.		**X**
k)	Start the cleaning cycle manually where required.	**X**	
l)	Pumps - Log hours run		**X**
m)	Pumps - Log kWhrs		**X**
2.3	**Screen(s) / macerator(s)**	Daily	Weekly
a)	Check inlet channel level is normal taking into account the flow conditions at the time (such as storm conditions & peak flow to site).	**X**	

ID	Instruction	Daily	Weekly
b)	Check screen operation and check for screenings carryover. Check for blockages and blinding (hairpinning) on screen panels and remove where necessary. Check for rag rolling or rag balls upstream of the screen and remove where necessary. Check for any grit build up in front of screen	**X**	
c)	Inspect debris disposal mechanism for correct operation and verify screenings are being removed. Check & clean any obstructions impeding the operation of screen mechanisms.	**X**	
d)	Check screens bypass is available and clean	**X**	
e)	Clean area around screen. Check & clean screen panels of any obstructions.		x
f)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action to replace them if needed. Inspect grease pots and fill them when level is below the standard. Use grease nipples to lubricate required parts of screen.	**X**	
g)	Visually check unit and its associated equipment for the following: Safety & security with all panels locked & guards secure and in good condition. Excessive noise or vibration Overheating External damage, leaks, missing fixings Where applicable, ensure main and brush drives turn and that brushes are spinning	**X**	
h)	Check operation of wash water system for screens Ensure wash water pressure of spray bar is correct. Check the inline filter is present, clean and feeding the spray bars (where applicable). Check the spray bar pattern and clean the spray bar nozzles as required.	**X**	
i)	Check & clean accumulation of screenings and fat from debris disposal mechanism Check & clean launder chutes and channels for accumulation of grit, sand, rag, fat,	**X**	
j)	Check the lip, labyrinth or other seals between the screen and the channel wall are making an effective seal.	**X**	
k)	Visual check on the screenings removal brushes for blinding and wear. Clean the brushes as required. Ensure the brushes are in correct contact with the screen and that screenings are being removed.	**X**	
l)	Check and clean instrumentation probes, floats and ultrasonic heads (where applicable).	**X**	
2.4	**Screenings handling**	Daily	Weekly

ID	Instruction	Daily	Weekly
a)	Check control system and amps on panel for normal levels / operation, take appropriate action as required. Jumping amps indicates a blockage.	**X**	
b)	Where installed, visual check for normal operation of macerator. Look for visible blockages/build up on unit, high flows in front of macerator. Listen for unusual noise. Take appropriate action as required.	**X**	
c)	Where installed, check and empty stone trap.	**X**	
d)	Clean area around screenings handling units and skips.		**X**
e)	Check operation of wash water system for screenings handling. Check the inline wash water filter is present, clean and feeding the spray bars (where applicable Ensure wash water pressure of spray bar is correct. Check the inline filter is present, clean and feeding the spray bars (where applicable). Check the spray bar pattern and clean the spray bar nozzles as required.	**X**	
f)	Check screenings product quality and quantity, Check level of screenings in skip and change skip when full.	**X**	
g)	Check operation of auto drain.		**x**
h)	Where installed check operation of the trough desludge system. Check for grit build-up in trough - hose out where required.		**x**
i)	Visual check on condition and operation of brushes (ensure trough is being cleaned). If blinding occurs regularly have wear on screw brushes checked.		**x**
j)	Check screw conveyor and brushes for wear and central running.		**x**
k)	Clean and check mesh for blinding and hairpinning.		**x**
2.5	**Grit removal**	Daily	Weekly
a)	Check mechanical plant is operating correctly. Check equipment– Compressor, Rake, Detritor & Pista grit.	**X**	
b)	Check manually de-gritted constant velocity channels for build-up of grit, take appropriate action as required.	**X**	
c)	Check inflow and outflow for normal rate of flow and correct distribution.	**X**	
d)	Check volume, dryness and quality of grit produced.	**X**	
e)	Remove rag from the areas around baffles and mechanical equipment	**X**	
f)	Log manual de-gritting operations where required.	**X**	
g)	Log abnormal grit volumes.	**X**	

ID	Instruction	Daily	Weekly
h)	Clean grit channel as required. Check grit build up in inlet channels and clean out if necessary.		X
i)	Check operation of wash water system and check the inline filter is present, clean and feeding the spray bars (where applicable)	X	
j)	Check aerated grit channels for air flow and bubble pattern (where applicable).	X	
2.5	Skips	Daily	Weekly
a)	Check skip capacity is adequate, and inform contractor when skip is full.	X	
b)	Rake skip where required.	X	
c)	Remove excess water if there is a facility to do so.	X	
d)	Ensure only prescribed material is in the skip. Remove any materials not prescribed.	X	
2.6	**Storm separation and treatment**	Daily	Weekly
a)	Check Flow To Full Treatment penstock is set at correct level.	X	
b)	Check storm return system is operational, manually return storm contents where required.	X	
c)	Check storm tanks cleaning system, check level sensors, check tanks are clean and empty outside of storm conditions.	X	
d)	Check and clear storm screens where required. (automatic clearance and manual clearance linked to safe system of work)	X	
e)	Check screens bypass is available and clean	X	
f)	Check and clear/replace any outlet screening sacks		X
g)	Check separation weirs and clean where required.		X
h)	During storm check that the flow to treatment is normal. (Treating Flow To Full Treatment)		X
i)	Log abnormal flows. Log storm discharge flows. Log storm flows in dry weather conditions.		X
j)	Log storm events.		X
k)	Remove any debris in the system.		X
l)	Storm LTA – Visually check area is clean and operating within site parameters. Remove any debris.		X
m)	Storm LTA – Check for short circuiting during operation. Inspect banks for leakage		X
2.7	**Flow measurement**	Daily	Weekly

ID	Instruction	Daily	Weekly
a)	Check site is within flow permit (treating Flow To Full Treatment before going to storm). Check that flow is going through site as expected.	X	
b)	Check flow meter and flume and clean where required	X	
c)	MCERTS – Log & record flow meter readings	X	
d)	Check EDM (Event Duration Monitor) sensor is clean and weir is free of debris	X	
3	Primary Treatment- Primary Settlement Tanks	Daily	Weekly
a)	Check and log sludge level by dipping tanks (Mon/Wed/Fri)	X	
b)	Check bridge/scraper operation	X	
c)	Check de-sludge pump(s) and timer for normal operation	X	
d)	Check scum boards for breaks or carry under	X	
e)	Check scum trap for normal operation and clean/hose out	X	
f)	Check settled sewage quality (visual check only)	X	
g)	Check stilling chamber for rag, clear as necessary	X	
4	Secondary Treatment		
4.1	Secondary Treatment – Activated Sludge	Daily	Weekly
a)	Check air filters indicators for normal readings. Check blower control panel. Check the blowers for normal operation. Check there are no illuminated fault lights.	X	
b)	Check and record dissolved oxygen (D.O) readings, where probes are installed.	X	
c)	Sample, measure and record Mixed Liquor Suspended Solids (MLSS) /RASS concentration and sludge settleability (Stirred Specific Volume Index) (SSVI), (Monday/Wednesday/Friday)	X	
d)	Vent condensate from air lines		X
e)	Check SAS pump(s) are operating correctly	X	
f)	Check and record sludge return from the final settlement tanks (RAS rate)	X	
g)	Check D.O probe and / or timers are carrying out the correct control functions. Aeration control function.	X	
h)	Check flow distribution to aeration lanes if more than one lane present	X	
i)	Log changes to RAS rate, Log flows (where meters are fitted), Log KWh, Log SAS Rate.	X	
j)	Check and record bubble pattern and size of the bubbles	X	
k)	Check mixers for rotation in anoxic (un-aerated) zones	X	

ID	Instruction	Daily	Weekly
l)	Check recycle pumps are running, as required (Biological Nutrient Removal -BNR plants)		X
m)	Check redox monitor is operating correctly (BNR plants)		X
n)	Check VFA / liquor return (BNR plants)		X
o)	Check and record rate and frequency of SAS removal	X	
p)	Withdraw the D/O probe from the tank and remove clean		X
4.2	**Secondary Treatment – Biological Filters**	Daily	Weekly
a)	Visually check for correct flow distribution across the filter (radial distribution)	X	
b)	Keep filter surface clear of all debris and any significant moss or weed growth. Deal with ponding as appropriate.	X	
c)	Where recirculation is installed, check for normal operation at the correct flow rate	X	
d)	Check all air vents and under drains are clear and not flooded	X	
e)	Clear distribution arm orifices and or weir plates of debris	X	
f)	Remove end caps and rod/flush arms - clear debris from open channel arms	X	
g)	Check for appropriate flow distribution between filters to suit filter size	X	
h)	Check operation of distributor arms (uniform speed of rotation)	X	
i)	Check for leakage at the centre column seals and end caps. Short circuiting etc.	X	
j)	Check rotation timer. Check alignment of rotation alarm sensor and target plate	X	
5	**Secondary Settlement – Humus Tanks / Final Settlement Tanks**	Daily	Weekly
a)	Check correct operation of desludging pump(s) or valve(s)	X	
b)	Check scraper/bridge operation where installed	X	
c)	Check and log blanket level with portable blanket meter where detectors not fitted. (Monday, Wednesday, Friday)	X	
d)	Check tank surface for buildup of floating debris. Visually check effluent quality over the weir for solids carry over	X	
e)	Check RAS pump(s) are operating correctly (FSTs only)	X	
f)	Check Bellmouth and de-rag where required	X	
g)	Check effectiveness of weir brushes, chains, “other systems” where fitted	X	
h)	Check scum boards for breaks or carry under	X	

ID	Instruction	Daily	Weekly
i)	Check scum removal system for correct operation, clear any fouling where necessary	X	
j)	Check flow of recirculation bleed back/constant draw off where used	X	
k)	Check operation of fixed blanket detectors and alarms		X
l)	Check operation of Mallard pump by test running in hand, where installed		X
m)	Clear overflow weirs and launder channels of any build-up that will affect the tanks or effluent performance	X	
6	**Chemical Dosing**	Daily	Weekly
a)	Check that chemical is discharging, rather than dosing pump running dry (any nozzles blocked?)	X	
b)	Check chemical storage tank level - reorder as required. Log level in storage tank, Log discharge rate.		2 days a week
c)	Check for excessive vibration in the dosing pump		2 days a week
d)	Check the level in the internal bund and empty as required. Report any abnormalities.		2 days a week
e)	Visual check for leaks on tanks and visible chemical lines		2 days a week
f)	Check the trace heating system		2 days a week
g)	Check external storage tank bund for rainwater and/or chemical. Empty as appropriate.		X
7	**Tertiary Treatment**		
7.1	**Low Head Sand Filter**	Daily	Weekly
a)	Check smooth movement of bridge, unusual sounds and vibrations, and abnormal flow patterns	X	
b)	Check water level in each filter, compare with other units and relate to flow rate, and last backwash	X	
c)	Check unit isn't in bypass	X	
d)	Check for evidence of chemical leaks	X	
e)	Check cleanliness of carriage & filter area	X	
f)	Check sodium hypochlorite level in the bridge tanks where fitted and fill from bulk tank	X	
g)	Check sodium hypochlorite bulk tank level	X	
h)	Check the amount of sand in the wash water	X	
i)	Check the colour of the backwash water	X	
j)	Check the correct amount of hypochlorite is being dosed	X	

ID	Instruction	Daily	Weekly
k)	Check water level in each filter, compare with other units and relate to flow rate, and last backwash	X	
l)	Log backwash timer settings and head loss	X	
m)	Log flows and flow rate, where meters are fitted	X	
n)	Clean the level sensor head		X
o)	Log clarity of feed (compare with final effluent)	X	
7.2	**Disc Filter**	Daily	Weekly
a)	Log backwash pressure	X	
b)	Check frequency of backwash is within correct range		X
c)	Check bypass is not working during normal operations	X	
d)	Check depth in and out of the drum for normal operation	X	
e)	Check drum is rotating in correct mode and sounds normal	X	
f)	Check all ancillaries are operating normally	X	
g)	Log flows and flow rate where meters are fitted	X	
h)	Sample and record turbidity on feed (compare with final effluent)	X	
i)	Inspect inside filter for large pieces of debris		X
j)	Check for accumulation of weed in backwash trough		X
k)	Check and clean backwash water strainer.		X
l)	Check for soundness of mesh panels by lifting inspection panels		X
m)	Check wash water pressure and nozzles for normal operation		X
8	**Raw Sludge Holding & Thickening**		
8.1	**Sludge Holding Tanks**	Daily	Weekly
a)	Check mixing regime is correct	X	
b)	Log levels in tank(s)	X	
c)	Decant liquors	X	
d)	Check tank(s) for ragging and blockages and clear or remove (where safe access is possible)	X	
e)	Check that holes on sludge cage(s) are clear where fitted, Clean sludge cage(s) dewatering holes (where safe access is possible)	X	
f)	Log tanker movements and compare with schedule	X	
g)	Ensure any crust build up does not interfere with any control equipment/alarm floats	X	
8.2	**Picket Fence Thickener**	Daily	Weekly
a)	Check fence is rotating & “stop, look, listen,” for mechanical issues.	X	

ID	Instruction	Daily	Weekly
b)	Check weir overflow quality and the surface of the unit. Clear any buildup of debris	**X**	
c)	Log blanket measurements / pump timers	**X**	
d)	Sample from discharge pump (run manually if necessary) and assess product quality. Sample, analyse and record % dry solids entering the PFT. Sample, analyse and record % dry solids out (Monday, Wednesday, Friday)	**X**	
e)	Check control system is operating normally	**X**	
f)	Log any changes to settings or duty	**X**	
g)	Log sludge flows in (where meters fitted) and out	**X**	
h)	Visually assess the dry solids & flow entering the PFT	**X**	
i)	Log hours run meters	**X**	
j)	Remove buildup of debris on the rake	**X**	
8.3	**Belt Thickeners**	Daily	Weekly
a)	Check for good floc formation. Check sludge on the top belt and assess the conditioning of the sludge. Check belt drainage and filtrate quality	**X**	
b)	Check product quality & quantity. Check condition of hopper	**X**	
c)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	**X**	
d)	Sample, analyse & record % Dry Solids on feed and sludge/cake (Monday, Wednesday, Friday)	**X**	
e)	Check sludge feed rate and log	**X**	
f)	Check poly dosing system. Log polymer usage, note each bag change/delivery. Make adjustments to optimise	**X**	
g)	Ensure wash water pressure is available at a minimum of 6 bar	**X**	
h)	Clean belt steering paddles and check they are functioning correctly	**X**	
i)	Clean hopper level probes and check they are functioning correctly	**X**	
j)	Wash Station - Check formation of spraying fans, rotate internal brush to clean spray nozzles. (Minimum twice daily)	**X**	
k)	Visual Check - Hydraulic Power Pack - Check oil level and top up using clean equipment and fresh oil as required, maintain as close to full level as possible. Oil level must not be allowed to fall below 3/4 as this will cause serious damage	**X**	
l)	Jet wash clean the belt filter.	**X**	
m)	Use low pressure water hose to clean complete machine, frame, rollers and hoppers.	**X**	
n)	Check condition of Belt Filter for blinding / blockages / good filtration	**X**	

ID	Instruction	Daily	Weekly
o)	High pressure steam clean the belt from underside.		**X**
p)	High pressure steam clean complete machine, frame rollers and hoppers avoiding all electrical and instrumentation equipment		**X**
q)	Check condition of Belt Filter for wear i.e. Creasing / condition of seam to avoid failure / breakage and damage to other components		**X**
8.4	**Drum Thickeners**	Daily	Weekly
a)	Check for good floc formation. Check sludge feed rate. Check product thickness (visually). Check filtrate quality	**X**	
b)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	**X**	
c)	Sample for % dry solids analysis and record (Monday, Wednesday, Friday)	**X**	
d)	Check spray bar nozzles to ensure they are clear and spraying correctly. Check spray bar wash water pressure	**X**	
e)	Clean probes in discharge hopper, hose down and carry out cleaning duties	**X**	
f)	Log polyelectrolyte used – each drum/bag change	**X**	
g)	Log sludge inlet flow meter, monitor throughput	**X**	
h)	Check & clean flocculator tanks		**X**
i)	Check appearance of mesh, adjust cleaning and cleaning pause intervals if necessary.	**X**	
j)	Clean dry solids monitors sensors		**X**
k)	Clean foot valves on washwater suction lines		**X**
l)	Clean mechanical filter on washwater booster set		**X**
m)	Clean washwater booster secondary screen in channel		**X**
n)	Jet/remove fat deposits from thickened sludge discharge pipework		**X**
o)	Log hours run		**X**
9	**Odour Control**	**Daily**	**Weekly**
	Tasks for all Odour Control Units		
a)	Check covers, hatches and doors are closed	**X**	
b)	Confirm duty fan running and standby fan availability	**X**	
c)	Check damper position to ensure they have not been tampered with	**X**	
d)	Check ductwork for any signs of damage or leaks	**X**	
	Specific tasks for Biofilter OCU		
e)	Check the spray pattern from the irrigation nozzles and clean nozzles where required. (If possible)	**X**	

ID	Instruction	Daily	Weekly
f)	Check for free discharge of effluent water to drain	**X**	
g)	Check for free discharge on any condensate removal points	**X**	
	Specific tasks for Chemical Scrubber OCU		
h)	Check water softener availability, check salt reservoir level, and top up if required.	**X**	
i)	Check stocks in bulk chemical tanks and reorder if required – tanker delivery	**X**	
j)	Check that the Redox and pH are within the agreed range – on dosing skid	**X**	
k)	Check duty and standby dosing pumps are available for each bulk chemical	**X**	
l)	Check the duty scrubber liquor recirculation pump is running and the standby is available in auto	**X**	
m)	Check that there is free drainage of scrubber blow-down liquor to drain	**X**	
n)	Check differential pressure gauges are within design range (if fitted)	**X**	
o)	General check for leaks in the scrubber liquor recirculation and dosing system – raise follow on work if any defects are identified	**X**	
	Specific tasks for Carbon OCU		
p)	Examine ductwork for any signs of damage or leaks and check trapped condensate drains are free flowing. If a manual drain valve is provided, operate the valve until the flow of condensate ceases and leave valve in closed position.	**X**	
q)	Check differential pressure gauge for over-pressure (if provided) – indicates media fouling	**X**	
10	**On Site Pumping**	Daily	Weekly
a)	Pumping System(s) (Drainage, Interstage, Washwater, Recirculation, Return Liquors etc.) operating correctly?	**X**	
b)	Check Ammeter reading - too high could indicate a blockage. Too low could indicate an air lock or impeller damage.	**X**	
c)	Check the well level is within the normal operating limits - taking into account the flow conditions at the time. If level is too low or high, this could indicate control issues or pumping issues.		
d)	Check condition of the wet well- does it have more than the usual scum or debris floating on top that will indicate the need for a wet well clean?		
e)	Check fault light(s) are not on	**X**	
f)	Check flow rate (where meter is fitted); is it within the normal operating range?	**X**	

ID	Instruction	Daily	Weekly
g)	Check for undue pump noise and vibration by safely touching the lifting chain or guide rail.	**X**	
h)	Check non-return valve. Non return valves prevent water from flowing back through the pump when it is not in operation. If a weighted arm is fitted, is it at the usual angle? If it is low and chattering it could indicate the pump is blocked	**X**	
i)	Check operation of the ultrasonic level gauge. Is it reading correctly? Compare the well level with the normal readout from the display.	**X**	
j)	Check pumps, pipelines and couplings for leaks. Check for visible leaks.	**X**	
k)	Start the cleaning cycle manually where required	**X**	
l)	Pumps - Log hours run	**X**	
m)	Pumps - Log kWhrs	**X**	
n)	Check hard wired control floats - are floats weighed down with rag or debris preventing them from lifting if the water level rises.	**X**	
o)	**Washwater Pumping** - Check the pipe line pressure from a gauge (where installed) on the pressure vessel or the pipe line manifold. Possible indication of strainer blockage	**X**	
p)	**Washwater Pumping** - Check operation of surge vessels (where installed).	**X**	
q)	**Washwater Pumping** - Check the strainers. If necessary, put automatic strainers in manual clean and inspect the manual strainers where local conditions allow.	**X**	
r)	**Washwater Pumping** - Check automatic filters are operating correctly	**X**	
11	**Distribution Chambers**	Daily	Weekly
a)	Inspect all weirs and brush clean. Remove any debris, scum, algal growth, blanket weed, grit, etc. from the chamber. Check flow split is correct.	**X**	
b)	Ensure any rag is removed, especially from around the penstocks, gate valves and their spindles. Ensure none of this passes over the weir.	**X**	
c)	Check that all valve, penstock and weir operating positions are correctly set.	**X**	
d)	Check chamber for any visible leaks	**X**	

Appendix 9. Generic sludge round checks

	Instruction	Daily	Weekly
1	**Liquid Sludge Import Facilities**	Daily	Weekly
a)	Check sludge logger device is fully operational	**X**	
b)	Check that the pattern of imports is in line with site requirements/agreement with tanker operators.	**X**	
c)	Check general area is clean and tidy	**X**	
d)	Check reception tank for rag/grit build up		**X**
2	**Sludge Screen**	Daily	Weekly
a)	Check sludge screen operation	**X**	
b)	Check screened sludge quality	**X**	
c)	Check / clean moisture sensor	**X**	
d)	Visually check unit and its associated equipment for the following: Safety & security with all panels locked & guards secure and in good condition. Excessive noise or vibration Overheating External damage, leaks, missing fixings	**X**	
e)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action to replace them if needed. Inspect grease pots and fill them when level is below the standard. Use grease nipples to lubricate required parts of screen.	**X**	
f)	Carry out checks on cold weather operation systems before frost sets in	**X**	
g)	Check screenings quality & quantity		**X**
h)	Check general area is clean and tidy		**X**
i)	Check washwater is operating correctly during period of sludge discharge Ensure wash water pressure of spray bar is correct. Check the inline filter is present, clean and feeding the spray bars (where applicable). Check the spray bar pattern and clean the spray bar nozzles as required.		**X**
j)	Clean steel probes on rotamat screen		**X**

	Instruction	Daily	Weekly
3	**Sludge Buffer & Blending Tanks** "Sludge Blending Tank" refers to a tank, into which more than one type of sludge is fed, requiring mixing: normally immediately prior to sludge digestion or dewatering. It may on some sites be referred to as a sludge holding tank or digester feed tank.	Daily	Weekly
a)	Check that mixer is operating correctly. Mixers are normally inhibited if the sludge level falls below a set level to protect the impellor, pump or blower.	**X**	
b)	Check for signs of stratification or poor mixing and rectify where necessary	**X**	
c)	Check pH and if less than 5 attempt to reduce septicity and freshen sludge	**X**	
d)	Check for ragging and blockages and clear or remove (where safe access is possible)	**X**	
e)	Check amps on mixer motor		**X**
f)	Check tank control system		**X**
4	**Sludge Treatment Inter Process Pumping**	Daily	Weekly
a)	Check Ammeter reading, Too high could indicate a blockage. Too low could indicate an air lock or impeller damage. Where reading is unusual ensure appropriate action is taken.	**X**	
b)	Check flow rate (where meter is fitted); Is it within the normal operating range?	**X**	
c)	Check the well level is within the normal operating limits taking into account the flow conditions at the time. If level is too low or high, this could indicate control issues or pumping issues.	**X**	
d)	Check operation of the ultrasonic level gauge. Is it reading correctly? Compare the well level with the normal readout from the display.	**X**	
e)	Listen for undue pump noise and check for undue vibration by safely touching the lifting chain or guide rail.	**X**	
f)	Check pumps, pipelines and couplings for visible leaks	**X**	
g)	Check non-return valve is operating correctly Non return valves prevent water from flowing back through the pump when it is not in operation.	**X**	

	Instruction	Daily	Weekly
	If a weighted arm is fitted is it at the usual angle? If it is low and chattering it could indicate the pump is blocked.		
5	**Pasteurisation**	Daily	Weekly
a)	Check batch rates according to sludge levels	**X**	
b)	Check digester temperatures in relation to pasteurisation plant	**X**	
c)	Check hmi panel	**X**	
d)	Check operation of biotherm reactor aeration blower package.	**X**	
e)	Check heat exchanger performance	**X**	
f)	Check digested sludge buffer tanks	**X**	
g)	Check blended sludge buffer tanks	**X**	
h)	Check operation of biotherm reactor mixer	**X**	
i)	Check operation of heat exchanger mixer	**X**	
j)	Check operation of scum cutter	**X**	
k)	Check pump and valve operation	**X**	
l)	Log and record flows, pressures and temperatures	**X**	
m)	Check % ds of feed sludge to pasteurisation plant (Monday, Wednesday, Friday)	**X**	
n)	Check, remove and clean temperature probe		**X**
6	**Primary Sludge Digestion**	Daily	Weekly
a)	Check sludge discharge to limpet chambers, where installed. Clear any blockages	**X**	
b)	Check digester feed system is working Clear any blockages	**X**	
c)	Check digester heating system is working & temperatures are within HACCP range.	**X**	
d)	Check digester mixing system is operating correctly	**X**	
e)	Log digester temperatures (HACCP) Log inlet and outlet temperatures of each boiler Log inlet and outlet temperatures of sludge and water in heat exchangers	**X**	
f)	Log sludge feed volumes into each digester and establish the retention time (HACCP)	**X**	
g)	Check operation of sludge and water recirculation pumps	**X**	

	Instruction	Daily	Weekly
	Check pumps, pipelines and couplings for leaks where possible.		
h)	Monitor water supply where glycol is not used to heat exchanges that are exposed to elements, Ensure water is drained when heat exchanges are not in use.	**X**	
i)	Log use of secondary fuel within boilers.	**X**	
j)	Sample sludge into and out of digester. Analyse and record % dry solids. (Monday, Wednesday, Friday.) Analyse and record % volatile matter. (3 times a week Monday – Thursday)	**X**	
k)	Check digesters for foaming on the top.		**X**
l)	Remove grit from base of digester if facility is provided. **Do not** leave grit removal operation unattended and ensure valve is fully closed before leaving task.		**X**
m)	Sample, measure and record pH of digested sludge		**X**
7	**Secondary Sludge Digestion**	Daily	Weekly
a)	Check mixing system, for short-circuiting or separation, Mix before transfer to the next process, where facilities exist	**X**	
b)	Decant supernatant liquor when required	**X**	
c)	Log status of each tank	**X**	
d)	Record number of day's storage	**X**	
8	**Biogas Handling, Storage, & Utilisation.**	Daily	Weekly
a)	Check all condensate traps manually and drain or top up if necessary. This check is required **twice daily** in prolonged periods of warm weather. Check automatic u-tubes visually, to ensure that there are no gas leaks or freezing Check automatic drain traps working correctly. Use manual drains if automatic drains not working, report defects	**X**	
b)	Check glycol pressure relief valve and ensure liquid level visible in sight glass	**X**	
c)	Check pressure/vacuum relief (whessoe) valves are not passing biogas. Listen for gas passing, note any unusual smell, visual check of valve.	**X**	
d)	Check for genuine operation of flare stack / waste gas burner, e.g. chp is at full power and there is excessive gas make	**X**	

	Instruction	Daily	Weekly
e)	Check and record dehumidifier temperature	**X**	
f)	Log gas volumes: produced, flared, to chp, to boilers	**X**	
g)	Sample, monitor & record methane composition of biogas	**X**	
h)	Manually check gas isolation valve handle operation by closing & opening valve.		**X**
9	**CHP & Biogas Power Management**	Daily	Weekly
a)	Check automatic drain traps working correctly. Use manual drains if automatic drains not working, report defects	**X**	
b)	Check for genuine operation of flare stack / waste gas burner, e.g. CHP is at full power and there is excessive gas make	**X**	
c)	Check glycol pressure relief valve and ensure liquid level visible in sight glass	**X**	
d)	Check & log hours run	**X**	
e)	Check & log kwh exported (where relevant)	**X**	
f)	Check & log kwh generated	**X**	
g)	Check & log kwh used on site	**X**	
h)	Check & log use of secondary fuel	**X**	
i)	Check & log gas used	**X**	
j)	Check & log heat liberated from engine, heat dumped, heat liberated from boilers	**X**	
k)	Check & log engine temperatures and pressures, by exception	**X**	
l)	Check & log gas stream for methane composition		**X**
m)	Check automatic u-tubes to ensure that there are no gas leaks or freezing		**X**
n)	Check pressure/vacuum relief (whessoe) valves are not passing biogas. Listen for gas passing, note any unusual smell, visual check of valve.	**X**	
10	**Liquor Treatment**	Daily	Weekly
a)	Check return liquors and return rate	**X**	
11	**Chemical Dosing**	Daily	Weekly
a)	Check that chemical is discharging, not just dosing pump running (any nozzles blocked?)	**X**	
b)	Check chemical storage tank level - reorder as required	**X**	

	Instruction	Daily	Weekly
c)	Check for excessive vibration in the dosing pump	**X**	
d)	Check the level in the internal bund and empty as required	**X**	
e)	Check for leaks on visible chemical lines	**X**	
f)	Check the trace heating system	**X**	
g)	Check external storage tank bund for rainwater and/or chemical. Empty as appropriate.		**X**
h)	Check the correct amount of chemical is being delivered for the conditions		**X**
i)	Check storage tank can take delivery before delivering		**X**
12	**Sludge Dewatering – Belt Press**	Daily	Weekly
a)	Check poly dosing system, Log polymer usage, note each bag change/delivery, Make adjustments to optimize	**X**	**-**
b)	Check sludge feed rate and log	**X**	
c)	Check sludge on the top belt and assess the conditioning of the sludge, Check belt drainage and filtrate quality	**X**	
d)	Check product quality & quantity, Check condition of stockpile	**X**	
e)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	**X**	
f)	Ensure wash water pressure is available at a minimum of 6 bar	**X**	
g)	Clean belt steering paddles and check they are functioning correctly	**X**	
h)	Clean hopper level probes and check they are functioning correctly	**X**	
i)	Wash station - check formation of spraying fans, rotate internal brush to clean spray nozzles. (minimum twice daily)	**X**	
j)	Visual Check - Hydraulic power pack - check oil level top up using clean equipment and fresh oil as required, maintain as close to full level as possible. Oil level must not be allowed to fall below 3/4 as this will cause serious damage	**X**	
k)	Jet wash clean the belt filter.	**X**	
l)	Use low pressure water hose to clean complete machine, frame, rollers and hoppers.	**X**	
m)	Check condition of belt filter for blinding / blockages / good filtration	**X**	

	Instruction	Daily	Weekly
n)	Steering flaps - check condition and correct operation for activation of the hydraulic steering mechanism and check for wear and replace as required	**X**	
o)	Sample, analyse & record % dry solids on feed and cake, (Monday, Wednesday, Friday)	**X**	
p)	High pressure steam clean the belt from underside.		**X**
q)	High pressure steam clean complete machine, frame rollers and hoppers avoiding all electrical and instrumentation equipment		**X**
r)	Check condition of belt filter for wear i.e. Creasing / condition of seam to avoid failure / breakage and damage to other components		**X**
13	**Sludge Dewatering – Centrifuge**	Daily	Weekly
a)	Check condition of stockpile, Check quality of product	**X**	
b)	Check kwh, amps and hours run	**X**	
c)	Check poly dosing system	**X**	
d)	Check quality of centrate	**X**	
e)	Check sludge feed rate, Check quality of product in feed	**X**	
f)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	**X**	
g)	Log hours run	**X**	
h)	Log kwh hours run	**X**	
i)	Log polymer usage, note each bag change/delivery	**X**	
j)	Log sludge flow rate	**X**	
k)	Log volume of cake produced	**X**	
l)	Make adjustments to get optimum throughput, product quality and poly dosing	**X**	
m)	Sample, analyse & record % dry solids on feed and cake (Monday, Wednesday, Friday)	**X**	
14	**Poly Make Up, Storage, & Dosing – Liquid**	Daily	Weekly
a)	Poly make up storage & dosing – liquid - check supply of polymer held in IBC; Top up, replace, order as appropriate	**X**	
b)	Liquid - check dosing pumps & settings	**X**	
c)	Liquid - check dilution water is available	**X**	

	Instruction	Daily	Weekly
d)	Liquid - clean up any spillages of liquid	**X**	
e)	Liquid - log usage of polymer i.e. IBCs level	**X**	
f)	Liquid - log settings of dosing pumps	**X**	
g)	Liquid - log type of polymer	**X**	
h)	Liquid - check polymer flowmeter pressure – if above 3 bar clean filter and mixer		**X**
i)	Liquid - check made up solution appears ok	**X**	
j)	Liquid - check bunded area for spillages	**X**	
15	**Poly Make Up, Storage, & Dosing – Powder**	Daily	Weekly
a)	Dry powder - check dosing pumps & settings	**X**	
b)	Dry powder - check supply of polymer held in silo; Top up, replace, order as appropriate	**X**	
c)	Dry powder - check bunded area for spillages	**X**	
d)	Dry powder - check dilution water	**X**	
e)	Dry powder - check dry room / silo is heated, dry and doors are closed	**X**	
f)	Dry powder - check made up solution appears ok	**X**	
g)	Dry powder - check polymer is dry and flowing, look at screw drive and discharge to wetted head – “JETWET”	**X**	
h)	Dry powder - clean up any spillages	**X**	
i)	Dry powder - log settings of dosing pumps	**X**	
j)	Dry powder - log type of polymer, check using correct polymer.	**X**	
k)	Dry powder - log usage of polymer i.e. bags used	**X**	
l)	Dry powder - check polymer flowmeter pressure – if above 3 bar clean filter and mixer		**X**
16	**Sludge Cake Transfer**	Daily	Weekly
a)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	**X**	
b)	Check conveyor rollers & keep clear	**X**	
c)	Check drive bearings for wear & operation	**X**	
d)	Check electric trip wire emergency stop wire	**X**	
e)	Keep general area clean. Clear up any spillages	**X**	

	Instruction	Daily	Weekly
f)	Check belt condition	**X**	
17	**Sludge Cake Storage**	Daily	Weekly
a)	Ensure silo not filled above 70% capacity. Inform Bio-recycling of any changes to sludge production.	**X**	
b)	Keep general area clean to minimise odour	**X**	
c)	Log & record each storage pad bay activity and status if applicable	**X**	
d)	Check wheel wash is operational	**X**	

Appendix 10 Sniff Testing Procedure

Odour sniff testing protocol:

Purpose

Sniff testing is conducted to assist in managing odours to prevent or minimise the risk of adverse odour impact offsite.

Frequency

The procedure is to be undertaken in response to complaints or if a risk of odour nuisance at sensitive receptors is expected and/or has been substantiated.

Pre-requisites for the assessor

The assessment is undertaken by a member of staff trained in the procedure. The assessment in response to complaints will be carried out by someone not based on site. The member of staff will normally be office based rather than operations based. This means that their senses are less likely to become affected by any site odours.

Assessors must comply with the following:

- They should not consume strongly flavoured food or drink (this includes coffee) at least half an hour before conducting the assessment.
- They should not smoke at least half an hour before conducting the assessment.
- They should not consume confectionary or soft drinks must be avoided for the duration of the assessment.
- Scented toiletries including perfume, deodorant or aftershave should not be applied less than an hour before conducting the assessment.
- If the assessment requires travelling between locations in a vehicle, this vehicle must not contain deodorises / air fresheners.
- If the assessor has a cold, sore throat, or sinus trouble they should not conduct the assessment.

Prior to the commencement of the inspection, the operator shall check the weather data including the wind direction, wind speed, temperature and rainfall.

Odour complaint investigation

Where possible, odour complaints will be actively investigated by an assessor. Timely receipt of a complaint is essential if such investigations are to have any value.

At each location the following procedure is undertaken:

a. The assessor will stand facing the wind and breathe deeply, for a period of 3-5 minutes.

b. The following information is recorded using the odour monitoring form.

    i. Time, wind speed and direction, temperature, precipitation.

    ii. The type of any odour(s) detected.

    iii. The intensity of any odours detected on a scale of 0 to 6.

    iv. The persistence of the any odours detected i.e. constant or intermittent.

    v. The likely source of any odours detected (e.g. a specified onsite IED source, a specified non IED sources, offsite odour source, etc).

    vi. Any abnormal conditions on site that may account for the odour e.g. broken duct, open door, unusual operation, spillage etc.

The pre-requisites for assessors and monitoring approach are as defined in the sniff testing procedure with the following exceptions:

- The first assessment should be conducted at the complainant's location.
- If site odours are detected, the assessor shall move back towards the site, assessing potential odour sources within the Urban Waste Water Treatment (UWWT) and Sludge Treatment Centre (STC) processes and attempt to trace the odour to its source.
- On site operations shall also be reviewed to identify any abnormal site operations or activities that could be responsible for elevated odour levels.
- The sensitivity of the offsite location to odours should be recorded as a comment.

The findings of the investigation should be reported back to the Thames Customer Services Centre so that feed-back can be provided to the complainant.

Odour monitoring form

Date: _____ Assessor name: _____

Time	Location	Receptor sensitivity (off site locations only)	Wind speed & direction	Temperature (degrees)	Rainfall (y/n)	Odours detected (description)	Intensity (0 – 6)	Persistence (intermittent / constant)	Perceived source	Other comments

Intensity			**Receptor Sensitivity**
1 Very faint odour	3 Distinct odour	5 Very strong odour	Low (e.g. footpath, road)
2 Faint odour	4 Strong odour	6 Extremely strong odour	Medium (e.g. industrial or commercial workplace)
			High (e.g. housing, pub/hotel etc.)

---- End of OMP ----