Severn Trent Water Limited
Worksop Sludge Treatment Facility

Permit number EPR/LB3309KJ.

Severn Trent Water Limited

Roundhill Sewage Treatment Works
Gibbet Lane
Kinver
Stourbridge
DY7 6PX

Raw Materials, Water and Waste Residue Management Plan

Document Reference: Residue Management plan						
Revision	**Purpose**	**Originated**	**Checked**	**Reviewed**	**Authorised**	**Date**
1	Permit application	J Chapman	K Daily	SITE	J Chapman	Jun 22

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Executive Summary

In accordance with the consolidated IED Environmental Permit for Roundhill and associated written management systems, this is the site management plan covering use of raw materials, water and residues. Severn Trent Water Limited is required to review and record at least every 4 years whether there are suitable alternative materials that could reduce environmental impact or opportunities to improve the efficiency of raw material and water use and to carry out a waste production review.

The prime function of the sludge treatment facility at Roundhill Sewage Treatment Plant is to capture the energy potential from the treatment of sewage sludges. The plant is run 24/7 due to the continuous supply of sewage received at the treatment works either from the surrounding catchment, or via tanker discharge.

Environmental Management System and Technical Competence

The Severn Trent Water Environmental Management System (EMS) is certified to ISO14001:2015 standard. All permitted IED installations are within the certification scope.

Severn Trent Water is committed to continual environmental improvements, including materials management, water resources and waste management. This commitment is delivered through better control of processes, capital investments, and environmental training.

Under the EMS, a risk assessment has been carried out to evaluate environmental aspects and impacts of the Company's operations. Energy production activities, including use of materials and water as well as waste production have been evaluated. These activities have been considered as having both positive and negative impact. All negative impacts were considered to have a medium impact with appropriate mitigating measures in place without further recommendations (refer to EMS Aspects & Impact Register see Guidance tab).

The permitted activities are undertaken by technically competent persons, within the scope of Severn Trent Water's Competence Management System. This is certified to the EU Skills CMS Standard and UKAS accreditation.

Process Responsibility

The Operational Manager for the site has overall responsibility for reviewing the processes on the site that use raw materials, raw water and create residue wastes. This document is reviewed 4-yearly, but in reality the review process is ongoing as part of the regular performance monitoring for the site.

There are many drivers for reducing use of raw materials, and creation of wastes within our processes, including environmental, financial, and resourcing, so it is in our best interests to undertake these reviews regularly, and to include representatives across the full chain of specialist teams involved in the decisions. For example, from initial procurement processes, and contractor management, through to operations, alarms, and the regular maintenance of the installation. These all work together to ensure that the processes utilise the minimum amount of raw materials/water (such as overdosing of chemicals), and that wastes are minimised (such as worn parts or broken machinery).

Raw Materials and Water Management

There are a limited number of raw materials used in the process. All materials used at the installation are subject to storage and handling procedures. There are no dusty or potentially wind conveyed materials used on the installation.

The use of raw materials is carefully monitored and benchmarked for cost reasons, and in many cases the correct quantity has to be precisely used for proper processing to take place, so there are controls in place through monitoring and optimisation of the process.

Regular maintenance of the installation ensures that there are minimal energy losses from worn parts, thereby maintaining its inherent efficiency.

Biogas

The principal fuel used in the installation is biogas resulting from the anaerobic digestion of sludge from the sewage treatment works. There is no alternative fuel used in the gas engine as the biogas utilisation is the primary reason for the installation's existence. Biogas is stored in floating roof gas holders which form part of the primary digesters within the installation boundary.

The heat produced by the CHP engine allows the digestion process to be optimised in order to maximise biogas production. Overall this allows a greater efficiency in converting sludge to biogas and power. Key to maximising the energy production of the site is the consistent and predictable production of biogas from the digestion process and the minimisation of the use of electrical power in doing so.

The generation and use of power and heat from a renewable biogas source represents a positive impact with respect to global warming potential.

Fuel Oil

Ultra Low Sulphur light fuel oil is also used in the installation as a standby fuel for the boiler plant only. The boilers operate if there is a temperature deficit to provide supplementary heat to the digestion plant; this only happens occasionally in practice.

Lubrication oil

Lubrication oil used on site in the CHP engine, with the volume dictated by the operational requirements. Severn Trent Water monitors the use of oil to increase its efficiency and reduce quantities required. The monitoring is carried out through a monthly oil analysis programme, which assesses the condition of the oil. The oil is changed if the quality is below pre-defined standards. This minimises consumption of oil as it will only be replaced when necessary. Once determined to

be below standard, the oil is changed and the replaced oil is sent for recycling off-site.

CHP engine oil is monitored for contaminants, which indicate oil performance and general engine condition.

In addition, oil is used in the transformers; this is sampled every two years and only changed if the sample shows any deterioration. Transformer oil does not contain PCBs.

Water

Water used on the installation is mains water, for three purposes:

- General use;
- Make up of polymer; and the
- Heating loop and boiler system.

Water within the heating loop and boiler systems are treated with dosing chemicals under the management of a specialist subcontractor. It is in closed loop system which only requires minimal top up and inhibitor chemicals addition. This is to decrease water hardness that can cause scale build up within the heat exchangers. The system is inspected for leaks, particularly where excess water has to be added to top up the system.

Water is also used within the polymer make up system, which is an automatic system that only uses the necessary volumes of water per cycle.

Mains water is provided by Severn Trent Water, and water usage is metered at site. Savings have been identified and implemented, for example, where water is used for washing down purposes within the site, for example if a spillage of sludge occurs, this water is final effluent from the works.

Waste Water Streams

Waste water transfers from the operational areas of the site back to the works inlet for treatment prior to final discharge take place via the sites drainage system. Where such transfers leave the permitted area for the digestion process, these are marked on the site plan.

Waste water arises from a number of sources within the works. These include:

- Surface water drainage (predominately rainfall related);
- Dewatering of Surplus Activated Sludge in belt thickeners
- Dewatering of digested sewage sludge by centrifuges;
- Biogas condensate from moisture traps on biogas lines;
- Boiler blowdown; and

- Washing / cleaning of surfaces.

Waste Water Streams

Please see Figure 1

The drainage system at the works includes both process waters and surface water drainage within the same system, in order to reduce the risk of spillages being diverted directly to the adjacent water body. Instead, all water in the drainage system is captured and returned to the works inlet for processing within the UWWTD stream at the site. Where drainage leaves the permit boundary, it may include waste waters from within areas of the site which sit outside of the permit boundary, due to the design and configuration of the drainage system within the works. These are all collected in the same system and prevented from directly discharging to any watercourse.

To reduce the risk from smaller, accidental spills we have separate controls in place. Tankers offload within impermeable areas and standard spill procedures are in place. Chemicals are stored within impermeable areas and within bunds. Containment assessments are being undertaken to show where further improvements are required on site.

Drainage plans are available on site to show any leading to the treatment works, and any which may lead to controlled waters. The drainage plan is dated 2011, and although shows drains returning to the inlet of the treatment works, there are a small number that need confirming, and so a CCTV survey will be undertaken. At present, no direct monitoring of site drainage is carried out where it leaves the permit boundary, with regards to chemical composition; loading; volume or variability. Centrate returns are assessed periodically with regard to ammonia loading in particular, as this can impact on the operation of the works. All process returns within the drainage system originate within the incoming sludge derived from the main works flow. As such, the loading originates within the works and does not need confirmatory checking.

Drainage leaves the permit boundary at one points, labelled as T1 on the site layout plan.

Emission point reference and location	Source	Parameter	Quantity	Unit
T1	Centrate from sludge dewatering; Surface water drainage;	-	-	-

	Cake pad drainage; Boiler blowdown; Biogas condensate			

The following substances may be present at elevated concentrations in the drainage leaving the permitted area:

- BOD;
- COD
- Suspended Solids
- Ammonia
- pH

We are currently shadow sampling twice monthly for Ammonia, Soluble BOD, Total BOD, Orthophosphates and Suspended Solids in return liquors to the inlet. We are getting costings to get additional sampling to align to the returns sample determinates, this will then be added to the twice monthly shadow sampling, if we see any data that is abnormal we will carry out root cause investigations with the process support teams to understand what has changed on site and ensure that we can reduce the risk to the inlet. If we pick up any anomalies in the sample data we can instruct the STW catchment team to increase catchment sampling to ascertain the root cause.

We have refrained from adding PFOS and PFOA from the sample regime due to the fact the samples take 2 weeks to get the results which means we would not be able to react in a sufficient timescale to find a root cause.

However, although monitoring has been commenced as detailed above, there is insufficient data at present relating to concentrations, loadings or variability data. The site drainage system was designed to take all potentially contaminated waste waters back to the works inlet, and as such, features a large number of points where elements of the drainage system leave the proposed environmental permit boundary.

There is no separation between ‘clean’ sources of returned water, such as surface water run off, from process related waste waters. The drainage system is equipped with a number of oil interceptors to capture any spilled petrochemicals to prevent them entering the works inlet.

The centrate from the dewatering plant on site is the biggest source of waste water within the permitted area.

Water Usage

Water usage is not metered at the site. The water usage per annum for 2021 to date is 32,623m^3.

Biogas

Biogas production is not subject to direct measurement, due to the difficulty of measuring volumes with or without moisture content. Instead biogas production is monitored by CHP engine output over time. Flare use is monitored and recorded and an allowance made for gas based on flare capacity.

Waste Gases

Waste gases are generated in a limited number of locations within the site, primarily the air emission points associated with the biogas handling, storage and utilisation system.

Biogas comprises a mixture of approximately 40% carbon dioxide and 60% methane; with low levels of other volatile organic compounds and Hydrogen Sulphide and entrained moisture. Moisture is removed using moisture traps within the biogas handling system, so both the exact composition and volume of biogas handled at the site vary dependent upon the precise location where sampling occurs.

This contains four main potential sources:

- Pressure relief valves on floating roof gas holders;
- Boiler emissions;
- CHP stack; and
- Emergency flare stack.

There are potentially low volumes of waste gases not captured from open topped secondary digesters at the site and from cake storage.

Pressure relief valves, if operated, will release raw biogas.

CHP stack, boilers and flare stacs combust biogas, so will release primarily CO_2, and NOx with low volumes of SO_2 volatile organic compounds (VOCs) and CO.

The CHP is subject to routine maintenance and annual air emission monitoring. The flare stack is not monitored unless its operational hours exceed 10% of the year.

There are also low volume emissions from the odour control units on site, although the full composition of these is not analysed.

Emission point reference and location	Source	Parameter	Concentration	Units
A1		NOx	500	mg/m^3

	CHP engine (biogas only)	SO2	350	mg/m^3
		CO	1400	mg/m^3
A2a	Auxiliary Boiler 1 (fueled on biogas)	NOx	200	mg/m^3
		SO2	100	mg/m^3
		CO	No limit set	mg/m^3
	Auxiliary Boiler 1 (fueled on natural gas)	NOx	100	mg/m^3
		SO2	100	mg/m^3
		CO	No limit set	mg/m^3
A2b	Auxiliary Boiler 2 (fueled on biogas)	NOx	200	mg/m^3
		SO2	100	mg/m^3
		CO	No limit set	mg/m^3
A3	Emergency Flare	NOx	150	mg/m^3
A4	Digester storage tanks pressure relief valve	No limit set	-	-
A5	Digester storage tanks pressure relief valve	No limit set	-	-
A6	Odour control unit on import screens	No limit set	-	-
A7	Odour control unit on picket fence thickeners	No limit set	-	-

These release points are shown on the site plan.

Inventory

Biogas production is monitored at the site, based upon the electrical output of the CHP engine in kWh, based around a standard consumption of biogas per kWh, from the manufacturers specification for the CHP engine. An allowance can then be added for flare use, which is minimal at sites. This will give a volume of produced biogas following the removal of gross moisture within the handling system.

As the production is dependent upon sewage inputs and flows, the volume produced in any month varies.

In 2020, the site produced approximately 2,532,306 Nm^3 of biogas

Other Raw Materials

The site has two odour control units (OCUs) located within the installation boundary.

Both units are Peacemaker units, with lavarock media in them. This media is not subject to any routine replacement. As part of their annual service, the media is checked for quality and only in the unlikely event it has degraded, it is replaced.

Table 1 below lists all the raw materials used on site.

Table 1: Raw Material List

Roundhill				
Description of raw material and composition	**Maximum storage amount (tonnes or as stated)**	**Annual throughput (tonnes per annum or as stated)**	**Description of the use of the raw material including any main hazards (include safety data sheets**	**Storage**
Anti-foam: KemFoamX 2500 Burst 5400	8000l (8 IBCs)	6 litres per day maximum during winter months; Minimal/as required in summer months.	Added to primary digesters to reduce foaming, as required	Standard plastic IBCs, stored on bunded pallet trays
Polymer: Flopam 64	Polymer liquid: 2,000 litres (2 IBCs) Polymer powder: 22,000 litres	Polymer liquid: 50 litres per day (<20,000 litres) Polymer powder: <22,000 litres	Flocculant added to digested sludge to aid centrifugation and dewatering	Liquid - Standard plastic IBCs, stored on bunded pallet trays Powder - Delivered by bulk tanker and stored in powder silo
Diesel	2 x 4,600 litre tanks	<10,000 litres	Back-up fuel for use within boilers	Delivered by tanker and stored in oil storage regulations compliant tanks
Lubricating oils	5,000 litres	<5,000 litres	Equipment lubricant	Delivered in metal drums and stored on bunded pallet trays
Waste oil	5,000 litres	As required	Waste oil from the CHP.	Not stored on site
Lime	Biolime As required*	As required	*Temporary treatment of caked sludge, only in use when digesters are out of service; managed by subcontractor (not stored on site)	Not stored on site, delivered in drums when required

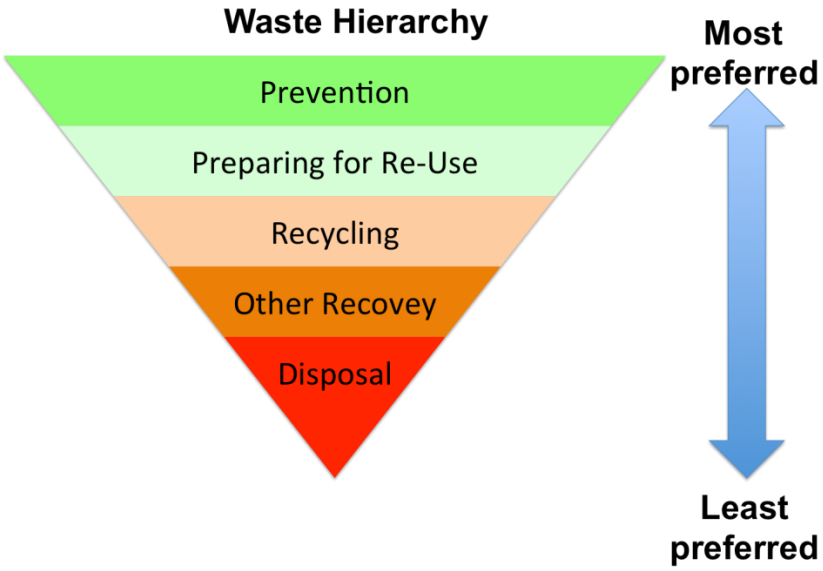
Residue Management

This document records the measures we take to:

- Minimize the generation of residues arising from the treatment of waste
- Optimise the waste hierarchy
- Ensure the proper disposal of residues.

A residue is defined as the solid waste generated by the permitted waste treatment activity. With that definition, this document does not focus on the general wastes created from activities outside the scope of the permit, for example office buildings even if they are collocated on the same site, or on gaseous emissions from the processes. Nor does it include the solid sewage cake produced by dewatering digested sewage sludge, which is removed from site, following checks to determine its quality and adherence to appropriate requirements, and spread to land in accordance with the Sludge Use in Agriculture Regulations 1989 and the Biosolids Assurance Scheme (BAS).

The Waste Hierarchy demonstrates the most preferred options for waste management, and Severn Trent Water commits to achieving waste targets by utilizing its approach.



There are only a limited number of residue streams that require off-site disposal, treatment or recycling because this sludge treatment facility is collocated with Severn Trent Water's sewage treatment works (see Table 2).

The residues are stored within designated areas as described within the Waste Management Standard Operating Procedures.

Oil filters and some contaminated maintenance wastes are considered hazardous and are therefore segregated from non-hazardous wastes for disposal in line with legislation.

Where waste is required to be sent offsite, it is sent to a suitably permitted facility for disposal / treatment by approved third party waste management contractors.

All waste contractors used will be registered with the Environment Agency / Natural Resources Wales and have a current Waste Carriers Licence. Our waste contractors will supply us with a Waste Transfer Note (WTN) and/or Waste Consignment Note (WCN) - dependant on what type of waste is being removed from site. All waste documentation for the installation is retained for the appropriate length of time at the site (two years for WTN and three years for WCN)

The residues produced by the permitted processes including management in line with the waste hierarchy and areas for potential improvement and future review are detailed in Table 2 below:

Table 2: Residue List

Residue Type	Current Measures	In line with Waste Hierarchy	Potential Improvements
Waste lube oil	The quality of the oil is monitored so as to minimise its replacement. Any waste oil is recycled. Waste oil is stored in a tank within a bunded area inside the installation boundary. Off site recovery at appropriately licensed facility	Recycled	No improvement opportunities foreseen. Current route considered to be BAT
Waste transformer oil	The quality of the oil is monitored so as to minimise its replacement. Any waste oil is recovered. Off site recovery at appropriately licensed facility (by specialist contractor)	Recovery	No improvement opportunities foreseen. Current route considered to be BAT
Waste coolant	Glycol coolant is monitored and replaced as required to protect the CHP engine. Any waste coolant is recovered.	Recovery	No improvement opportunities foreseen. Current route considered to be BAT

	Off site recovery at appropriately licensed facility (by specialist contractor)		
Biogas condensate	Condensate is removed from the biogas lines using moisture traps Released to site drainage and returned to works inlet for processing within the UWWTD stream	Disposal following treatment	No improvement opportunities foreseen. Current route considered to be BAT
General engineering waste (e.g. oily rags, oil filters, air filters)	Stored within appropriate segregated containers in the waste storage area. Disposed of (as hazardous waste) by specialist contractor	Disposal	No improvement opportunities foreseen. Current route considered to be BAT
Contaminated PPE	Stored within appropriate segregated containers in the waste storage area. Disposed of (as hazardous waste) by specialist contractor	Disposal	No improvement opportunities foreseen. Current route considered to be BAT
Spill kit materials	Minimisation of spillages through regular maintenance, pollution prevention infrastructure, and staff training on Standard Operational Procedures. Spill kits used for hazardous materials (oil or fuel) will be managed as hazardous waste. Spillages of liquids will be contained and treated on site where possible.	Disposal	No improvement opportunities foreseen. Current route considered to be BAT
Fluorescent tubes	Stored within appropriate segregated containers in the waste storage area. Removed from site (as hazardous waste) by specialist contractor for offsite recycling	Recycling	No improvement opportunities foreseen. Current route considered to be BAT
Scrap Metal	Stored within appropriate segregated skip.	Recycled	No improvement opportunities foreseen. Current route considered to be BAT

	Off site recovery at appropriately licensed facility		
Empty chemical containers	Use of chemical is minimised in the processes by performance monitoring, which results in decreasing the amount of waste containers produced. Returned to producer for reuse where possible, or removed from site by specialist sub-contractor.	Reuse	Bulk chemicals currently delivered by tanker to reduce use of individual containers No improvement opportunities foreseen. Current route considered to be BAT
Grit and screenings from digester cleansing	As much grit and screenings as possible are screened out during earlier processes (outside the scope of this permit) to minimise that entering anaerobic digestion process. Grit and screenings removed from digesters are screened to segregate the waste streams. Grit can be recycled. As screenings originate from non-segregated sources, there are currently no alternatives to landfill.	Grit: Recycled Screenings: Landfill	No improvement opportunities foreseen. Current route considered to be BAT Screenings fate reviewed on a periodic basis to identify alternative routes for this waste stream

Energy Review

Site Energy Management Plan reviews are carried out at all of our permitted sites at frequent intervals.

Sites with CHP engines have a KPI target for generation of electricity from biogas, and excess electricity is exported from the site where possible.

Flare use is monitored to ensure that the use of flaring to control biogas volume is minimised and where appropriate, additional CHP resource is deployed to a site where excess flaring occurs. Where possible, other green energy sources are deployed at works. The onsite generation and use of power and heat from a renewable biogas source represents a positive impact with respect to global warming potential and reduces imports of energy from the grid.

All capital projects consider whole life costs, including energy usage for schemes, and design concepts such as gravity transfers are implemented where possible over pumping. Where possible, low energy lighting is specified and all pumps and motors are appropriately sized for their location. Pumps which may be impacted by rags and solid material are checked and cleaned in accordance with the sites preventative maintenance program, which is developed from a combination of manufacturers recommendations and operational experience of issues with specific pumps within the site network.

Insulating materials are applied to transfer pipelines for hot water and digesters to reduce heat losses which reduces energy consumption.

Summary and recommendations

Raw Materials and Water Usage Review

Currently, there are no additional techniques or raw material alternatives known, which could be implemented on site to reduce environmental impact or improve the efficiency of raw materials or water usage.

Where raw, potable, water can be replaced with lower grade water on site, for example for washing down small spillages, this has already been implemented.

Residue Production Review

Due to the small number and type of residue streams, there was very little scope for further reduction of those generated on site. All current waste disposal/recovery routes are considered to be BAT and utilise application of the Waste Hierarchy.