BAKKAVÖR	Effluent Plant	

Task: Maintaining the Waste Water (Effluent) Treatment Plant

Description: The function of the effluent treatment plant is to reduce the pollution load in the incoming wastewater to render it acceptable for disposal into the water course.

Work Areas: Waste Water (Effluent) Treatment Plant

Essential Safety Information

	
Lone Working Allowed when wearing Skyguard	Know and Follow the Chemical Spillage Procedure

Personal Protective Equipment

				
Wear Bump Cap at All Times in the Yard	Wear Steel Toe Caps at All Times in the Yard	Wear High Visibility Clothing at All Times in the Yard	Wear Glasses when Handling Chemicals	Wear Gloves when Handling Chemicals

Key Hazards / Risks (From Risk Assessment)	Key Risk Control Measures (From Risk Assessment)
Environmental Pollution	Escalate issues according to the emergency procedure.
Corrosive & Irritant Chemicals	Work safely and wear personal protective equipment as indicated by the safe system of work.
Working at Height & Lone Working	Lone working allowed when wearing Skyguard

The Law
The Water Industries Act 1991 and the Water Resources Act 1991 provide the legislative framework for the prevention and control of water pollution. • It is an offence to "cause or knowingly permit poisonous, noxious or polluting matter or any solid waste matter to enter controlled waters or foul drains without the appropriate discharge consent with the EA or Sewerage Undertaker" • Site must ensure that the conditions of their discharge consent are adhered to at all times and set parameters are not breached • The company must have systems to prevent water pollution • All polluting matter arising from any emergency situations such as accidents or spillages must be contained on site and not allowed to reach the surrounding ground.

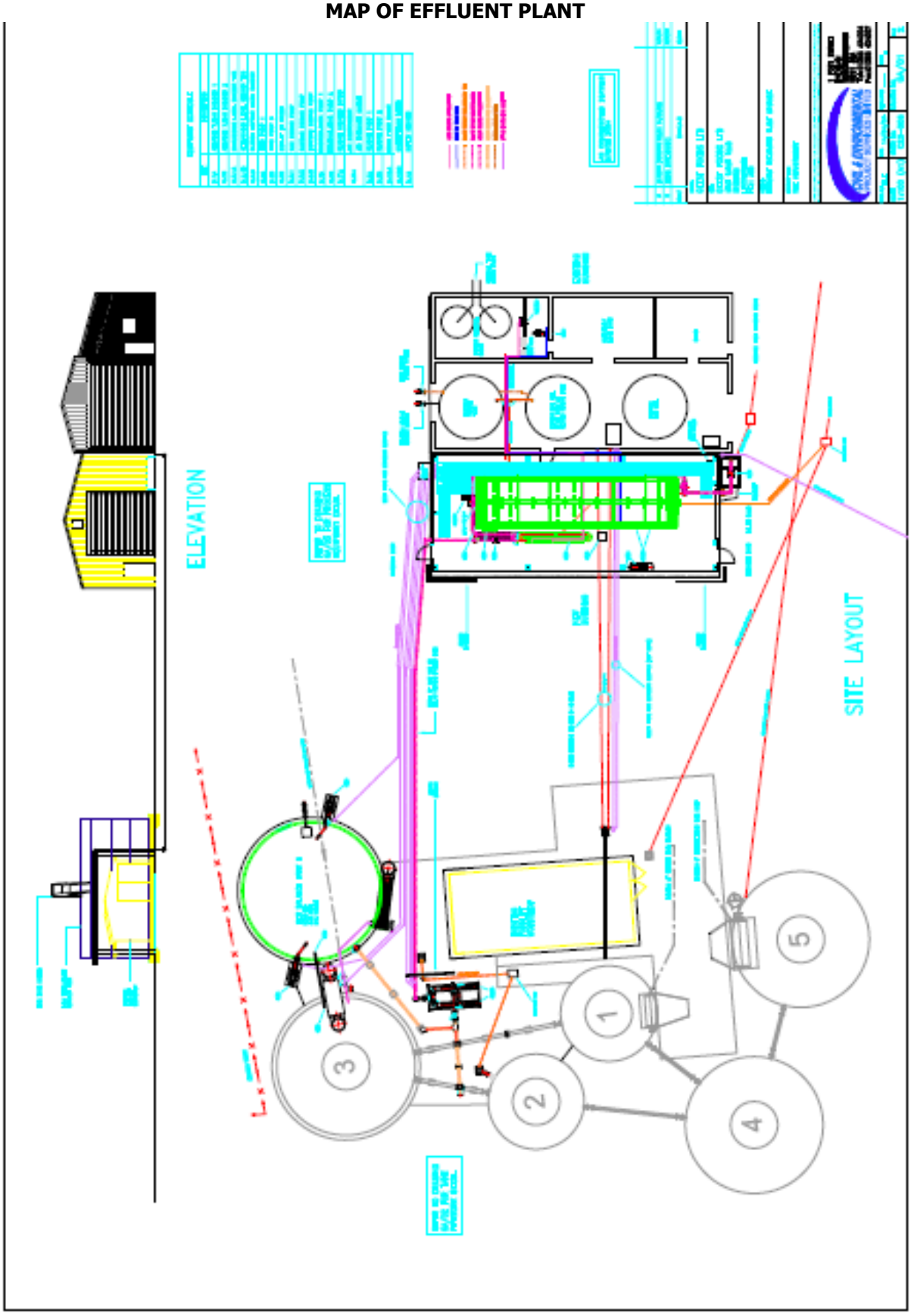
RISKS ASSOCIATED WITH FAILURE OF EQUIPMENT

- Failure of the duty/standby pumps in the pumping sumps will result in flooding of the area and the potential pollution of the receiving water.
- Failure of the dissolved air flotation cell feed pumps will result in the balancing tank overflowing and the potential pollution of the receiving water.
- Failure of the aerators in the balancing tanks will reduce the oxidation process and the effluent quality.

DISCHARGE CONSENT CONTROLS.

- Daily wastewater samples are taken throughout the plant and the resultant analytical results are communicated to the company.
- The plant operators carry out daily checks to confirm the plant condition and identify malfunctions.
- Anglian Water take 1 or 2 samples per week to determine composite sample

MAP OF EFFLUENT PLANT



OVERVIEW

Effluent from the 4 separate factory units is pumped to the Effluent Treatment Plant area.

It is screened and stored in a total of 6 interconnected above ground holding tanks prior to treatment in the Dissolved Air Flotation (DAF) Effluent Treatment Plant.

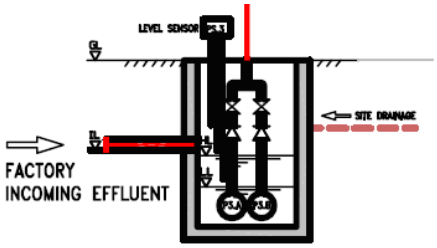
The DAF Plant uses chemical treatment followed by air flotation to obtain a separation of waste sludge from the treated effluent.

The waste sludge is stored in sludge holding tanks and taken off-site via road tanker.

The treated effluent discharges to an outfall drain that connects to the main Anglian Water sewer for further treatment

How the Effluent Plant Works

Crude wastewater pumps – where the raw effluent (waste water) from the factory (no toilet water) comes into the system. There is a main pump and a backup pump here. They are set as duty standby; only 1 pump can run at a time.



Run-down Screens – Filter out the gross debris; anything larger than 1mm.

There's a metal plate that controls the flow of incoming waste water, which is not removable, so, only the front of the screens are cleaned. The solids are placed in a **skip**

Raw Effluent is screened at high level via these run-down screens, and then collected and stored in one of the above ground **Balance Tanks.** The Tanks contents are mixed via **Aerators/Mixers** in order to provide a suitable homogenised effluent for the treatment stage.

All the 6 Tanks are inter-connected; therefore, mixed and aerated effluent from different balance tanks is combined prior to treatment.

Ultrasonic level control sensors, fitted on Tank 3 and Tank 6 operate one of the 2 variable speed progressing cavity **DAF Feed Pumps** that controls the feed rate of Effluent into the treatment plant.

In the **Treatment Building**, a Dissolved Air Flotation (DAF) process is used to treat the incoming effluent in order to obtain a final effluent that will meet the Anglian Water trade effluent consent. Effluent for sampling and PH measurement is diverted into the **inlet flow sampling tank** located on the DAF platform. The inlet flow meter is used to control the DAF Feed pumps to a pre-set flowrate; it has a display for instantaneous flow and totalized flow.

DAF Plant

Waste water arrives into the DAF plant and goes through a **flow meter** that measures the flow rate and logs the total volume that goes past. This information is useful for calculating chemicals and the amount of activated sludge (live micro-organisms) that are required.

In the DAF plant the waste water is chemically treated in three different ways in the coil pipe **flocculator**.

Waste water arrives to the effluent system full of dissolved fats and solid particles. These fats and particles are very small and finely dispersed throughout the water. They are too small to separate out of the waste water naturally (by gravity) or by a physical filter therefore chemical treatment is required.

How the Effluent Plant Works

The first stage in the DAF process takes place in this pipe floculator, which is used to add and mix chemicals in order to obtain basic solids/liquids separation ahead of the main flocculation tank. The pipe floculator comprises of a serpentine pipe arrangement, along which there are located a number of standard dosing **chemical injection points** and sample valves. A 3 stage chemical dosing system is used, comprising acid primary coagulant (PAC), neutralisation and final polymer.

First, a coagulant, PAC, is added to **crack out the fats** and oils. The polluted matter is than destabilised and fine "floc" particles are formed.

PAC is stored in a **Tank in a confined area**; it is automatically dosed into the effluent through the **dosing pumps** which are controlled by the main panel PLC.

Caustic Soda is than added to balance the PH of the waste water after cracking out. Pac makes the waste water slightly acidic and the pH must be corrected to a neutral of approximately 7 which will help the next stage work correctly.

Caustic is stored in a **Tank in a confined area**, it is automatically dosed into the effluent through the **dosing pump**s which are controlled by the main panel PLC.

Because the "floc" particles are not ideal for separation and in order to obtain a more stable "floc" a secondary polymer flocculant needs to be added. The particles of solids and oils/fats must stick together so they can be removed from the water by means of scrappers. These particles in the waste water will than stick to the polymer causing a **loosely clumped mass of fine particles, Flocs**.

The **Flopam (polymer) is mixed with potable water in the Polyblend machine chamber** forming an emulsion prior of being injected automatically into the final injection stage along the pipe Flocculator. The pipe flocculator provides the correct mixing and the pipe length controls the reaction time required prior to the flotation stage.

The neat polymer, Flopam, is supplied in an **IBC tank and stored in the sludge room on an elevated platform; 2 containers are than manually refilled which will than supply the Polyblend**; the Polyblend is controlled by the main panel PLC.

Flopam is non-toxic but it is extremely slippery if spilled, shouldn't be rinsed or washed away with water, paper towels, sand or cloths should be used to clean up the spill and these should be disposed appropriately.

How the Effluent Plant Works

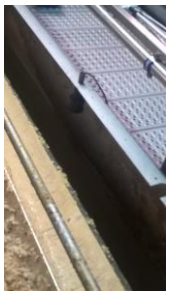
Effluent from the pipe flocculator chemical pre-treatment stage enters the inlet end of the main flotation tank; this flocculated effluent is combined with an air-water **(whitewater)** mixture injected via a series of ball-valves located along the base and sides of the inlet end of the tank. The microscopic air bubbles in the whitewater entrain the particle matter in the flocculated effluent to provide a rapid upwards separation and form a surface sludge blanket.

The **whitewater** system uses effluent from the outlet end of the main flotation tank, which is recycled by 2 **recirculation pumps** back through the injection valves at the inlet end of the tank. The air-water mixture is generated using air pressurised by one of the **2 air compressors** and injected on the suction side of the recirculation pump which then becomes dissolved into the recycled effluent. The **injection valves** on the tank are used to maintain a working pressure within the recycle pipework loop so that the optimum microscopic bubble size is generated for flotation.



The flotation sludge is removed via **sludge scrapers**, which skim the floating sludge into a **sludge hopper** located at the inlet end of the DAF tank. The scraper operation is controlled via an adjustable cycle timer in the main control panel and can also be manually adjusted on the scraper drive.

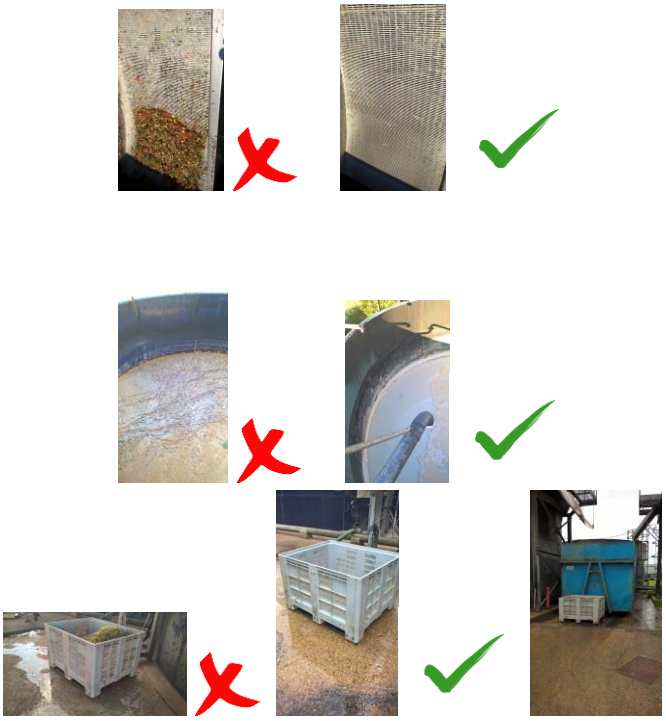
The sludge removed from the flotation tank and collected in the sludge hopper is than level controlled by a ultrasonic sensor which will operate the **sludge pumps** and these will transfer sludge into the **sludge storage tanks** located on the sludge room prior to removal by a road tanker off-site.

The **treated effluent overflows** at the outlet end of the main flotation tank via a **weir** before entering below ground pipework into the final flowmeter chamber located outside of the treatment building.

Operator Duties

- Rundown screens must be checked manually cleaned daily using a squeegee and/or a brush; and pressure washed monthly or when required.
- There is a metal plate which controls the flow of incoming waste water, this plate is not removable so only the front of the screens are cleaned.
- The solids should be placed in a skip for off-site disposal.
- Area around the skip must be cleaned and washed daily and pressure washed weekly or when necessary
- Tank levels must be visually checked daily as well as the aerators and the state of sludge forming in the tanks.
- Plastic bin must emptied daily and area around it also cleaned daily and pressure washed weekly or when necessary
- Check the DAF feed pumps daily if they are running properly and keep area around them tidy and clean.
- Check and clean ultrasonic sensors on Tank 3 and Tank 6 weekly



- Check if level of balancing tanks on control panel in the DAF plant, corresponds to the actual level previously and visually checked
- Check on the control panel if all pumps, scrappers and compressors are working

- Check the DAF cell to ensure the flocs are forming; they should be solid enough that they can be floated and scraped off easily but soft enough that they can be pumped without blocking the pipes.
- If flocs are not forming correctly adjust the chemical dosing on the control panel, chemical range between 400 and 500 on PAC, all the others adjust automatically
- Check the quality of the treated water on the outlet weir, chemical adjustment might be needed.

- Check inlet and outlet samplers daily.
- Take inlet and outlet samples daily to the lab; Lagoon, warehouse and Eden interceptor weekly samples to the lab.
- Clean inlet and outlet samplers weekly or if necessary, including pipes and sample containers.

How to clean inlet/outlet samplers; see procedure BKSEP02

Operator Duties

- Take readings on outlet meter, PAC and caustic daily
- Inspect and clean pH inlet and outlet probes twice daily with Hydrochloric Acid wearing the right PPE

How to clean pH probes; see procedure BKSEP03

Inspect and clean DAF cell tank, parts, chain, scrappers, ultrasonic level controller daily to prevent build-up of debris.

- Empty sludge hopper completely daily, inspect and wash to avoid excessive build-up of fat and to avoid blockage on the pipes; make sure both sludge pumps are working freely.
- Clean the injection valves/nozzles on the DAF cell weekly.

How to clean injection valves/nozzles on the DAF; see procedure BKSEP04

- Inspect and wash sludge tanks daily or when necessary.
- Inspect and bleed air compressors daily
- Inspect Polyblend (polymer machine/mixer) daily.
- Refill Flopam (polymer) drums weekly, clean filter and bleed system on Polyblend weekly

How to refill Polyblend, clean filter and bleed system; see procedure BKSEP05

- Service the Polyblend monthly, which includes complete strip down, clean chamber, clean nozzle, clean parts, check bearings and change if necessary, check drive belt and pulleys, clean filter and machine in general

How to service the Polyblend; see procedure BKSEP06

- Inspect chemical pumps daily, if they are working properly or if there is any air locks on pipes or any blockage.
- Maintain the area tidy and clean regularly
- Do the H&S checks and record readings
  - ✓ Emergency Shower weekly
  - ✓ Chemical PPE weekly
  - ✓ Fridge temperature Daily
- Monitor chemical usage and order chemicals when necessary
- Fill in relevant paperwork

Operator Duties	
➢ On average day the Effluent plant operates when balance tanks reach 40% capacity and stops when it drops to 30%. Around every 6-10 weeks one of the 6 balance tanks is emptied and cleaned out by Contractors (White's Environmental) to prevent a build-up of sludge. ✓ A Confine Space Risk Assessment is completed during this operation as White's employees may enter the tank and jet wash it.	
➢ Daff cell is fully inspected yearly; it has to be completely emptied in order to check its overall condition including parts that are submersed such as injection valves / nozzles / channels ✓ A Confined Space Risk Assessment is completed during this operation as White's may enter the DAF tank and jet washes it.	

Emergency Procedure…	
	SUPPORT CONTACTS: Glen Farrow.Tele.01775 722327 (24 hour contact). Chris Griffin. Mobile 07912 300151 Kevin Hargrave. Mobile 07595 276102 Andy Thompson. (Electrical). Mobile 07834 754244 Allan Williams. Mobile 07834 754243 Paul Kitchen(MD).Mobile 07834 754242 Chemicals. Griff Crouch. Mobile 07787 564967 Sykes pump hire.Tele.0800 211611. (A/C NO.42206677) Mechanical. John Mason. Mobile 07711019196 Hereward Pumps. Steve Robinson. Mobile 07710483316 Whites Tankers.Tele.01572 767177