

Ogden Water Ltd.

**Saladworks
Leicester**

Trade Effluent Treatment Plant Discussion Document

14th December 2019

Introduction

Saladworks and Blueberry Foods manufacture of a range of food products at their site in Leicester. As a result, trade effluent is generated which is discharged to Severn Trent drains.

This quotation is for a turnkey solution to treat the trade effluent to allow compliance to be achieved. There is one caveat – soluble COD and the COD load consent – this is covered in more detail later on in the quotation.

Our plans for meeting compliance in the most cost-effective manner utilises data supplied by Saladworks, along with experience from other food manufacturing plants such as Bakkavor, Samworth Brothers, Premier Foods, United Biscuits, Unilever, Nestle etc.

Reference sites:

Hitchen Foods, Bakkavor
Paul Barton, 07921 212 764
Design = 900m³ per day, discharge to United Utilities

Manton Wood, Samworth Brothers
Tom Cooper, 07860 876 146
Design = 350m³ per day, discharge to Severn Trent

EM Recycling and various projects
Tim Haigh, 07583 105 879

Project cost = £860,000 including 5% contingency

Trade Effluent Data

A full sampling programme was carried out in May 2019 by EMS Ltd.

The data is a little spurious in places with many samples outside the time frame for accurate testing.

There are also some outlying results that don't seem to correlate with the others in the series, see page 11, solids, for the worst example.

There are also no soluble COD results in the report, so we requested a dozen random samples to be sent to our own laboratory to assess this vital information. This showed a residual soluble COD of between 900 and 2,800 mg/l.

In addition, and in summary, **these** are the parameters that will be utilised to design the plant:

Effluent	Volume / m3/ day	FOG / mg/l	TSS / mg/l	sCOD / mg/l	Temp. / oC
Saladworks, Low care	158.7	909	1030	3670	57
Saladworks, High care	348.8	3110	972	5350	50
Blueberry, Low care	125.1	1650	988	9570	45
Blueberry, High care	177.2	1900	1350	7180	61
Final	813.0	1400	980	4940	71

There are serious issues with many of these values in the table above and the consent to discharge – see next page

Consent levels

Temperature = 43 degrees C

pH = 6 to 10

sCOD = 6000 mg/l or 1,800 kg per day = 3,000 mg/l at the maximum volume of 600m³ (with instant flow maximum of 20 l/s)

TSS = 2000 mg/l

NVM = 350 mg/l

P = 25 mg/l

S = 10 mg/l

Free of physically separable oil, dispersed, emulsified or soluble oil – technically this could mean 0 mg/l and is impossible to achieve without biological treatment and reverse osmosis, so therefore excluded from any performance guarantees

The same is true of soluble COD – biological treatment is included in the options section.

An increase in the maximum volume is required – this could see a reduction in the levels of contaminants permitted.

An outright refusal would mean water must be recycled on site, or water usage capped to 600m³/day trade effluent discharge.

Design Brief

Severn Trent (ST) Requirements – Section 8 of the consent

The ST consent document specifies that an approved composite sampler and flow meter should be included in the effluent system, along with records of volumes and levels of contamination.

Composite sampler, ST approved.

Refrigerated, four bottle collection, flow proportional and true 24-hour running period, midnight to midnight, auto start-stop, overflow release, bottle recycle facility, fully programmable = £9,770



Siemens electromagnetic flow meter with calibration pipework/ valve arrangement and output to sampler, maximum discharge rate = 20 l/s = £4,920



Example - Gerald McDonald, Basildon

Also includes flash mixer pH correction tank



Laboratory equipment for analysis for pH, total suspended solids and Settled
COD = £5,180

Training = FOC

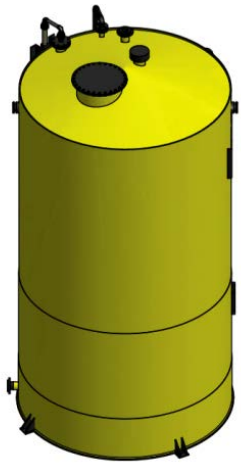


Examples below, clockwise from top right:

Spectrophotometer for solids and COD measurement
COD digestion block
100 COD vials



General

Chemical storage tanks and a safety shower and eyewash station will be required:

		
Chemical storage tank	Alkali specific eyewash	Safety shower

10,000 litres, single skin, caustic, acid and coagulant, with laser level indicator and tanker fill points = £31,600

Polymer is prepared through an activation unit with laser level probe, automatic water solenoid valve and neat polymer pump to ensure the correct concentration is always made = £8,600

Polymer will be delivered in 25kg blue or black drums which can be poured into a more transparent 50 litres storage vessel = £290

Safety shower = £4,280

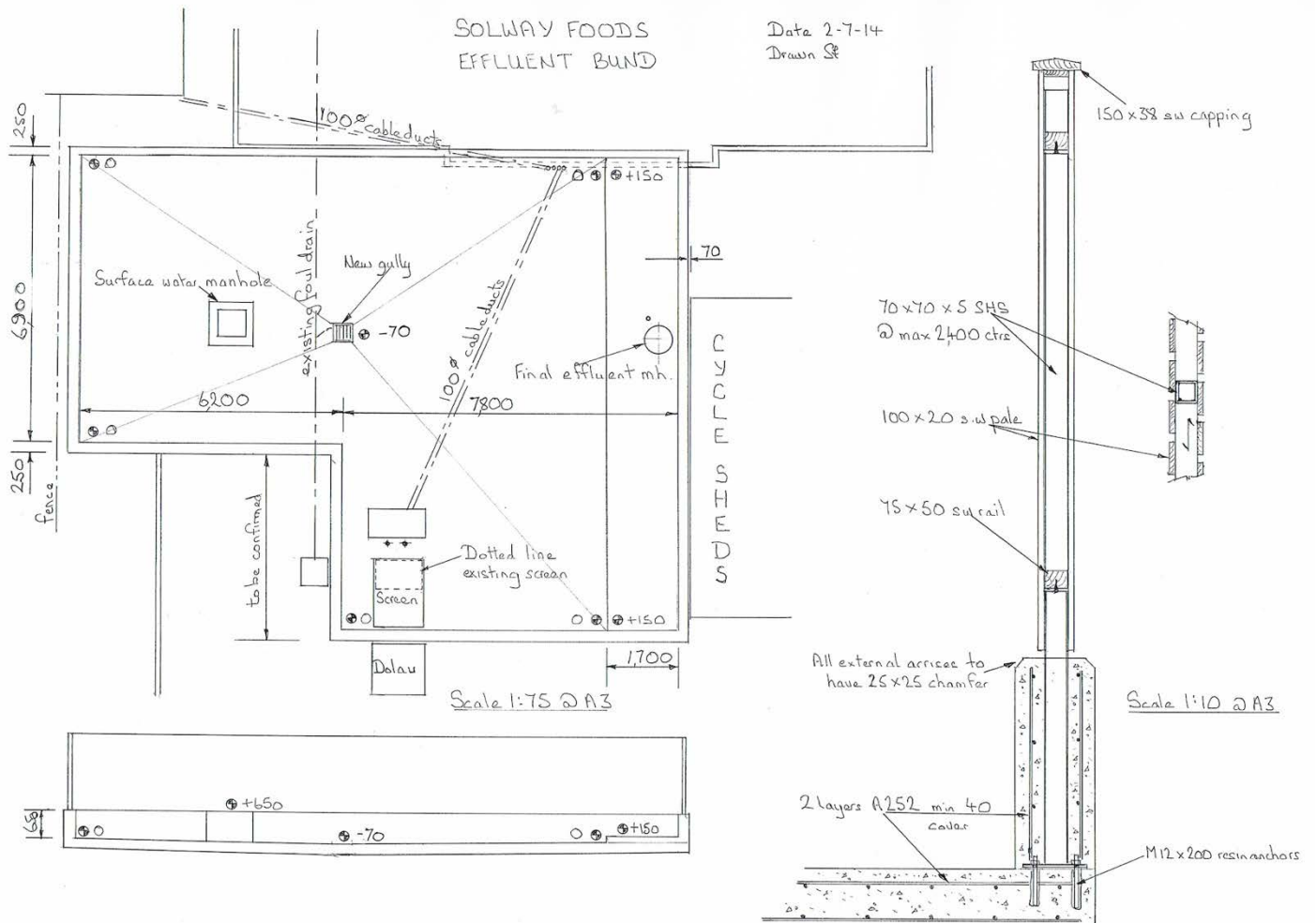
Alkali specific eye wash and appropriate signage = £1,060

Manufacturer training = £495

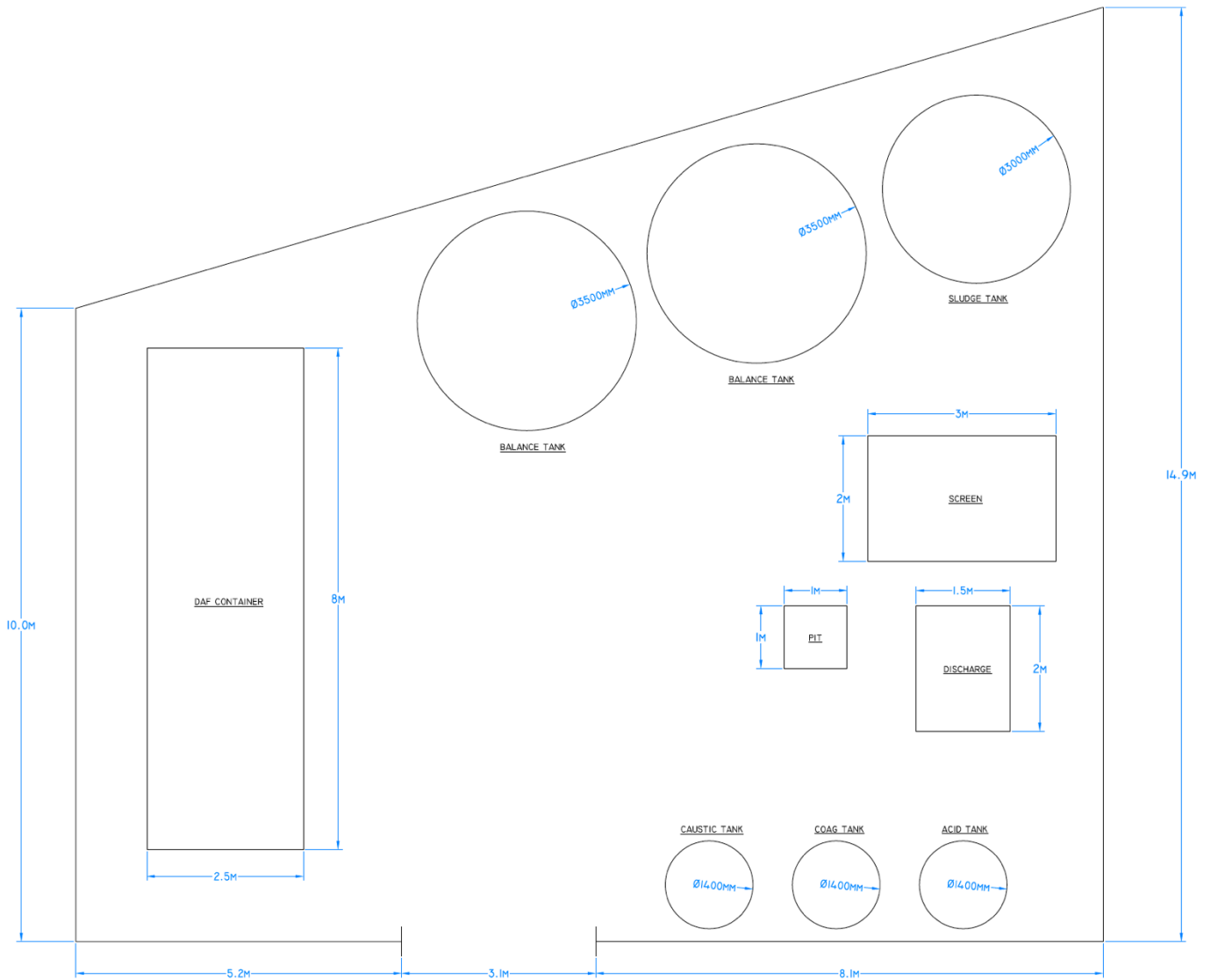
The area set aside for the trade effluent treatment plant area will require a concrete plinth with appropriate “enveloping” or drainage channels to allow spillages and rainwater to be collected in a small sump. This water will be pumped into the balance tank for treatment – one cannot be sure if the water is rainwater or contaminated, so cannot be discharged without treatment.

The bund must be capable of holding a capacity of liquid at least 110% of the largest vessel.

Example – Manton Wood



Example – New York Bakery

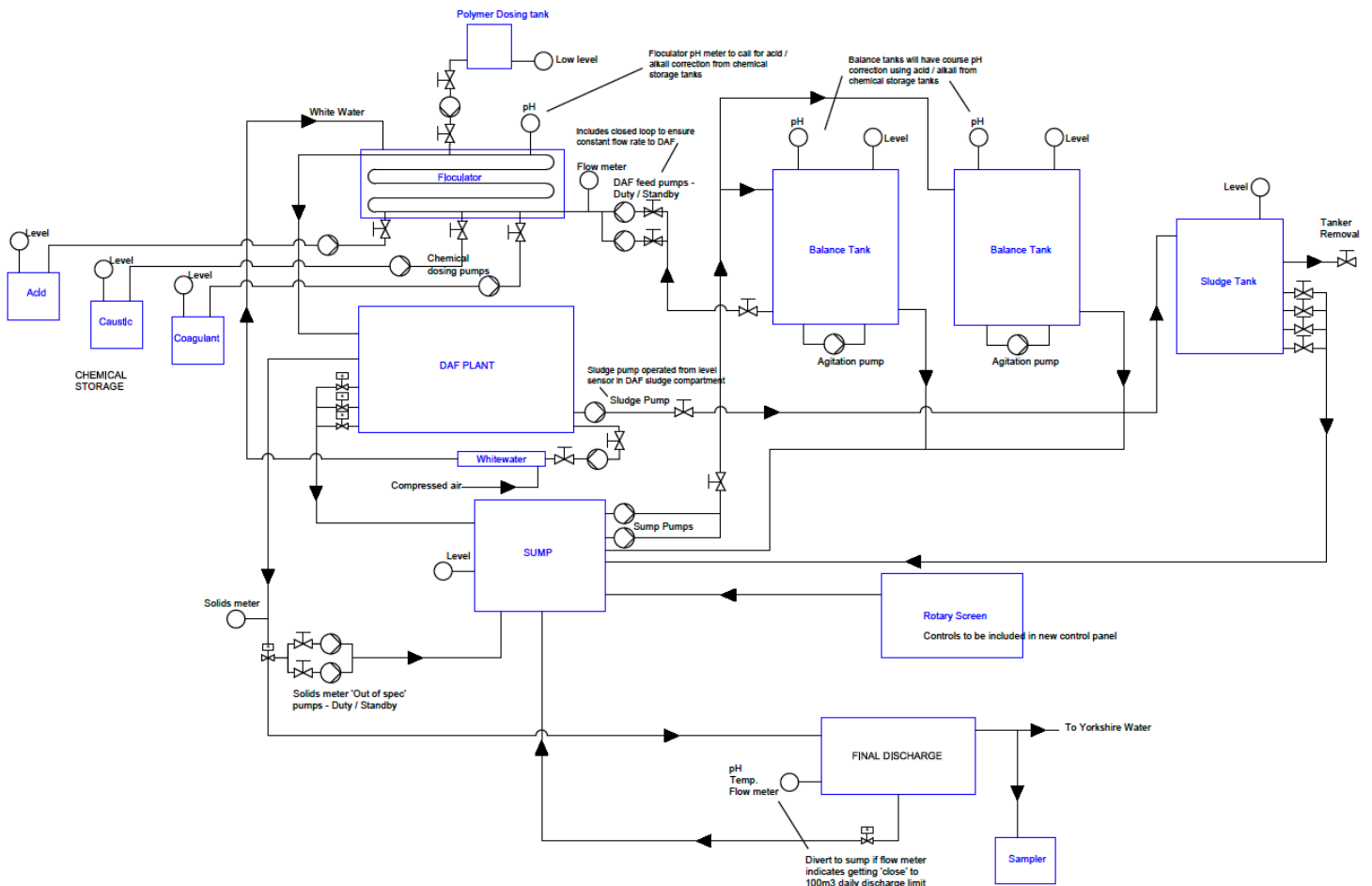


Based on experience at other sites, we have include a sum of £150,000 for the civil works.

Example P&ID (New York Bakery Dec 2019)

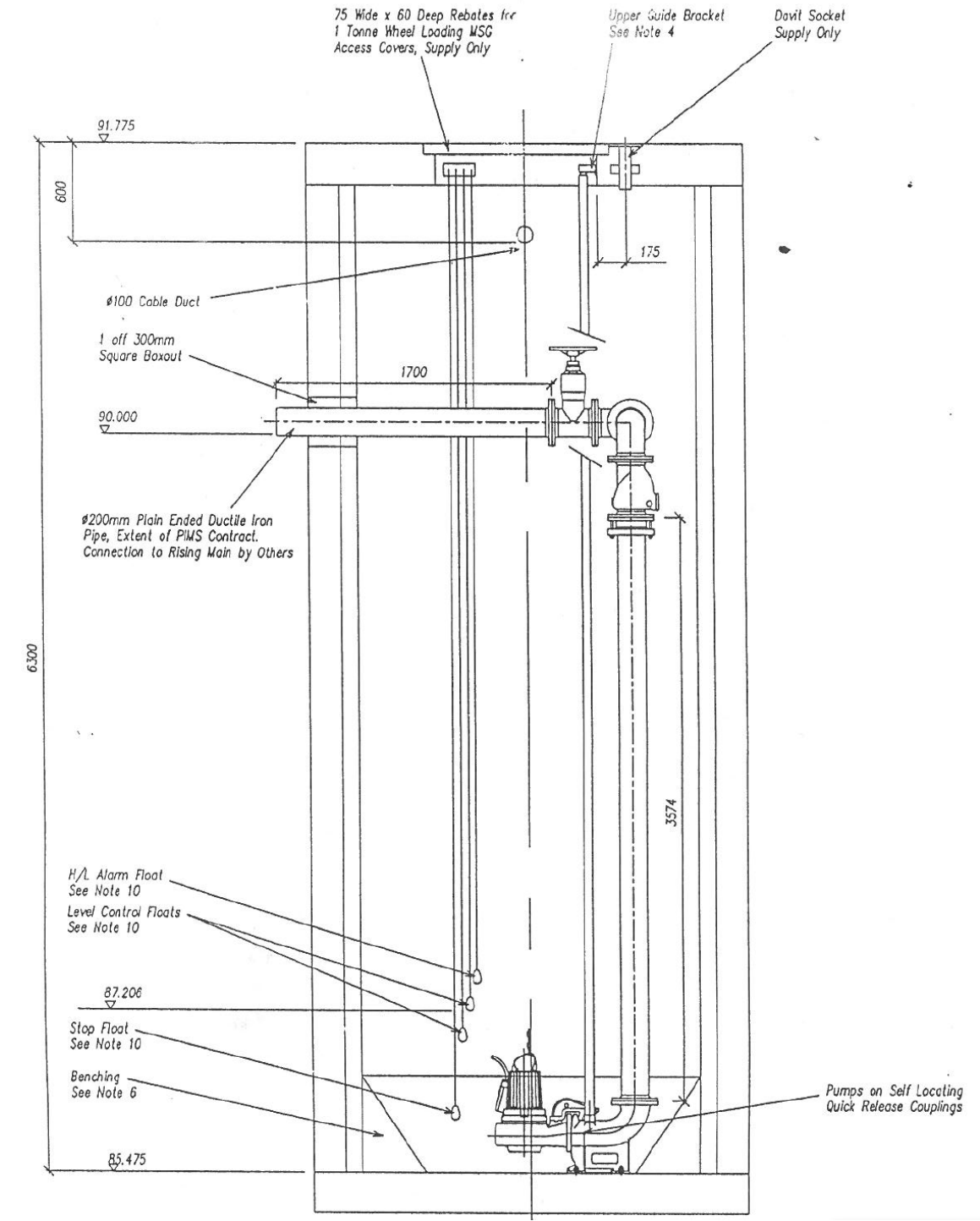
This is an example of our philosophy for a trade effluent treatment plant based around five keystones:

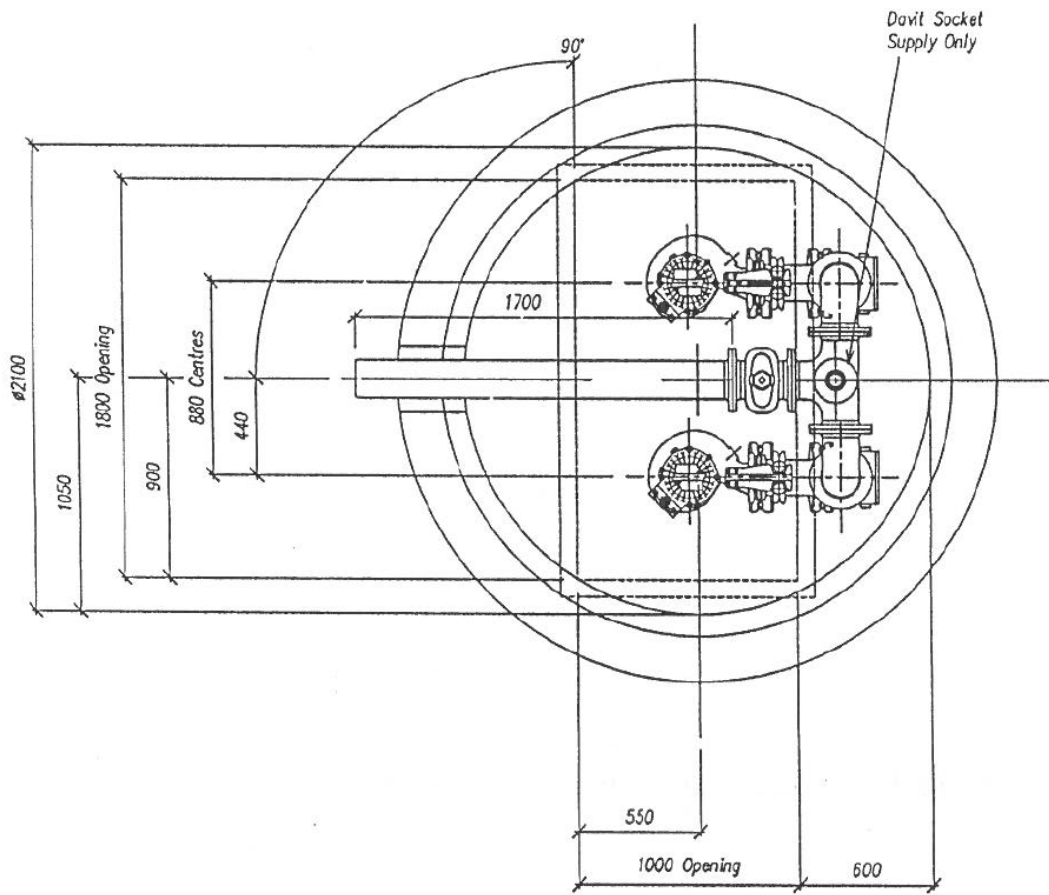
- Filtration
- Balancing
- Chemistry
- DAF
- Sludge storage



Reception pit and Screen

There are two reception pits and pumping systems:

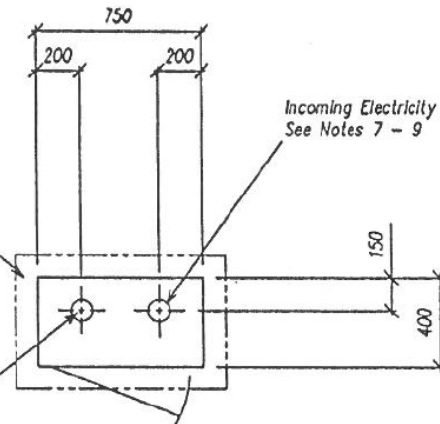




KIOSK AND PLINTH DETAIL

Kiosk 1250 high

Plinth to be 100mm Larger All Round. Plinth must be Level, True and Free from any Irregularities. Top to be 150mm Minimum Above Ground Level.



Ø100mm Continuous Cable Duct on Direct Line to Wet Well, Complete With Draw Ropes, by Others

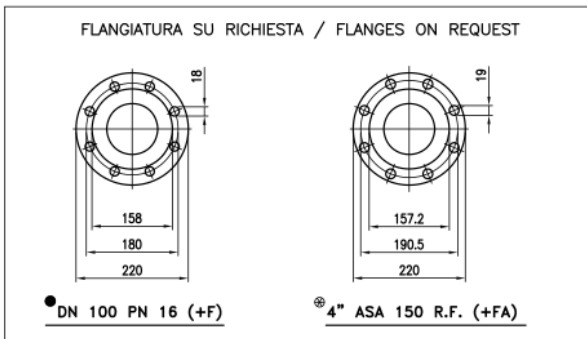
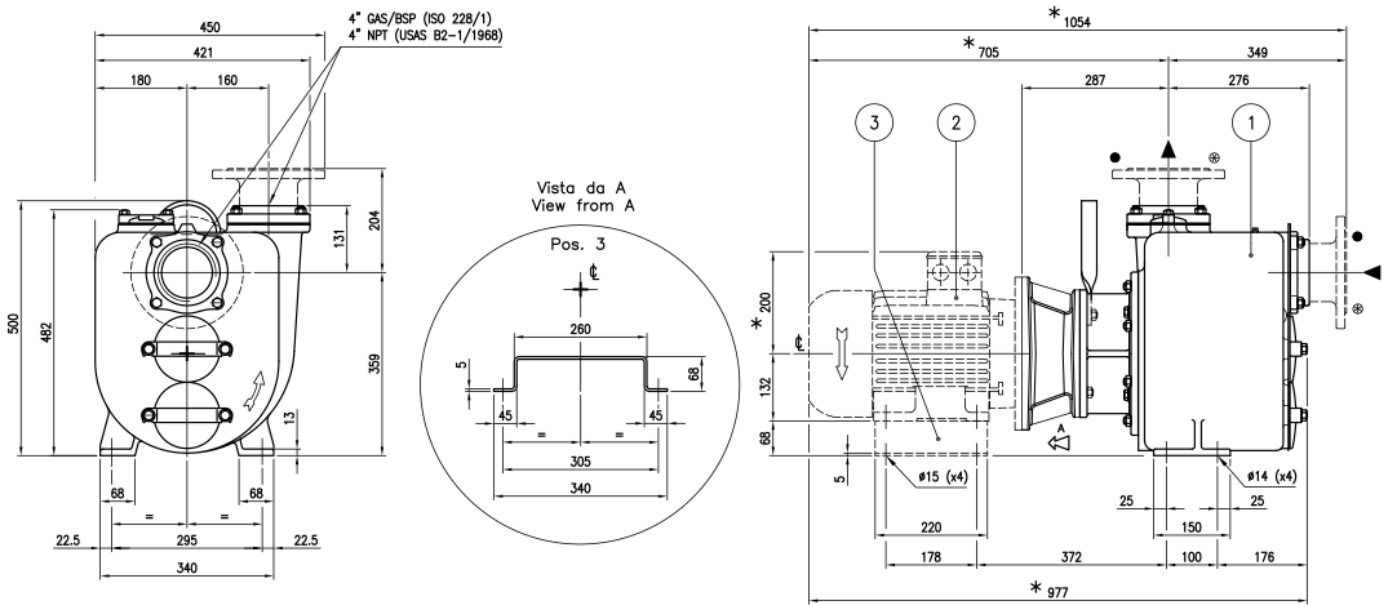
It is assumed that these pumping stations are in good working order and will be utilised to transfer TE to the treatment compound.

If they are to be replaced, we would install duty/standby above ground stainless steel self-priming pumps to lift TE from the reception sumps at a rate of 100m³/hr, based on head < 15m = £53,300 total for four pumps

Two 6" trenches will be required per pit with ducts that will allow the insertion and removal of 3" semi-rigid pipework, in case of emergency. Once the trenches are covered, there will be minimal opportunity to dig down to expose the trenches.

Two smaller ducts will also be required per pit for power and signal cables.

Typical pump dimensions:



- * Dimensione indicativa: può variare in funzione della marca del motore utilizzato
- * Approximate dimension: it may change according to the motor make

3	PIEDE MOTORE/MOTOR BRACKET	VARISCO	260x220x68 sp.5	DIS. B80.0021
2	MOTORE ELETTRICO/A.C. MOTOR		IM B35 (IEC 60034)/132M	50 Hz/7,5 kW/4p
1	POMPA/PUMP	VARISCO	J 4-250	
POS	DESCRIZIONE/DESCRIPTION	FORNITORE/SUPPLIER	TIPO/TYPE	NOTE/NOTES
		Tipo / Type JP(E) 4-250 - - - ETO		Dis.n. / Dwg No. B3/18.000.J.20
Sost./Repl.N		Sost.Dal/Repl.from		Approv.
Codice / Code				Ver.
				Dis. 03.12.2008 R.Crocco



The controls will be included in the new control panel, with local isolators for the pumps.

Float balls or laser level will be used to control the reception sump pumps. There will also be independent duty/ standby float balls for high level alarm.
Hardware costs based on float balls = £1,400

A high-level alarm from the balance tank will inhibit the reception sump pumps.

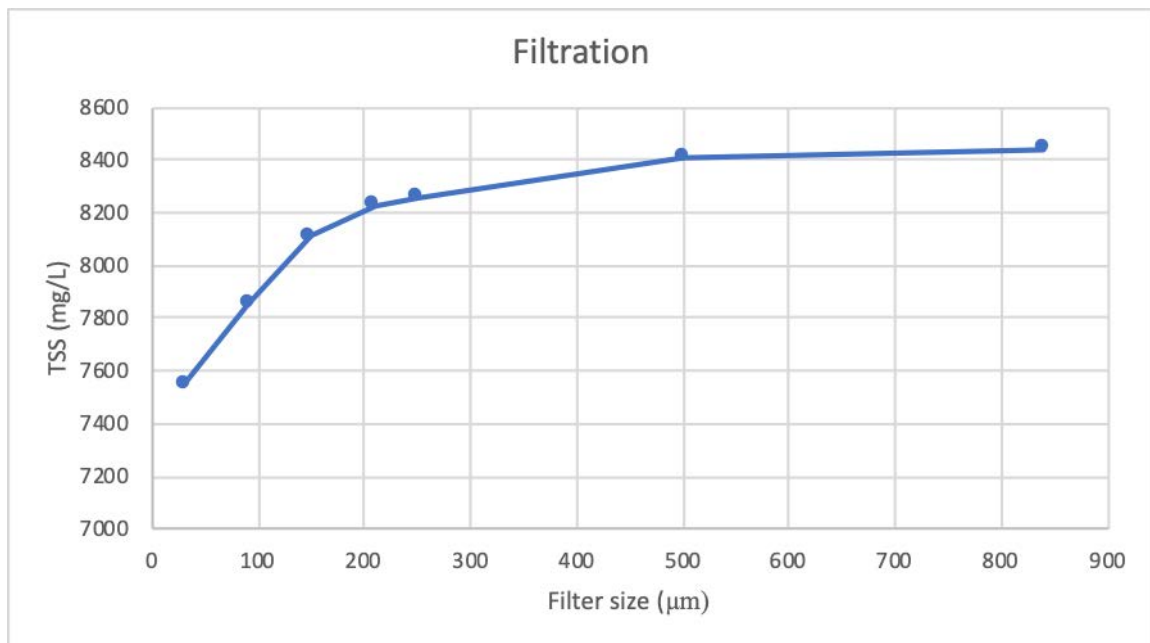
Screen

A screen is utilised to remove any gross debris from the trade effluent. This has several benefits:

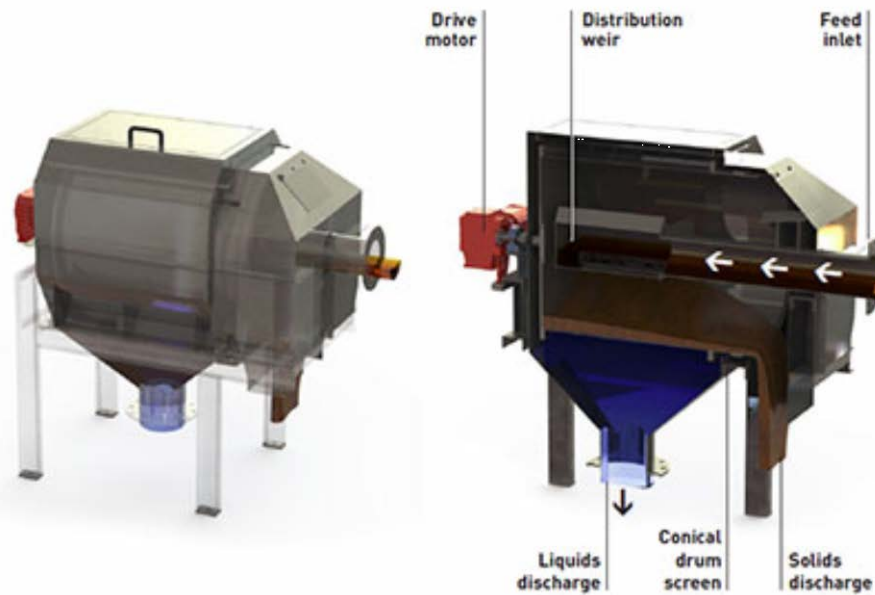
- Allows the use of less expensive, less specialised pumps downstream as there are no large solids to worry about, potentially blocking impellers etc.
- Removes “food” from the water that enters the pH correction tank and holding pits – any organic matter can release dissolved contaminants into water, thus making pH correction more difficult. By removing as many solids as possible, the trade effluent becomes easier to treat.
- Reduces the chemical requirements and therefore reducing running costs – pH correction chemicals are dosed according to pH.

Without any particle size analysis, it is difficult to size the screen.

This is the usual chart we prepare so in this example, it can be observed that a 1mm aperture size is recommended – the graph suggests there is no value in using anything smaller.



Our preference would be a rotary drum screen:



Prices vary considerably according to mesh size; all prices are based on at least 100m³/hr as per the reception sump pumps:

Model	Mesh size	Cost / £
2	2mm	23,000
3	1mm	32,000
4S	0.5mm	42,000
6TF	0.25mm	54,000

We believe a clear return on investment will be achieved with the finest mesh size in terms of reduced chemical and sludge costs, as well as reduced maintenance costs by stripping gross solids out at early as possible in the process.

The filtered water will fall into a break tank of ~2000 litres – this allows the screen to be mounted at ground level = £4,640

Duty/ standby centrifugal pumps, as per the reception sump for commonality, will transfer the TE to the balance tanks. Due to the pH levels being observed, the pumps would need to be 100% stainless steel = £26,700

A laser level device will be used to control the pumps with duty/standby independent float balls for the high-level alarm = £1,420

This device is not affected by temperature, condensation, foaming or thick sludge material in the water like other technologies, e.g. ultrasonic.



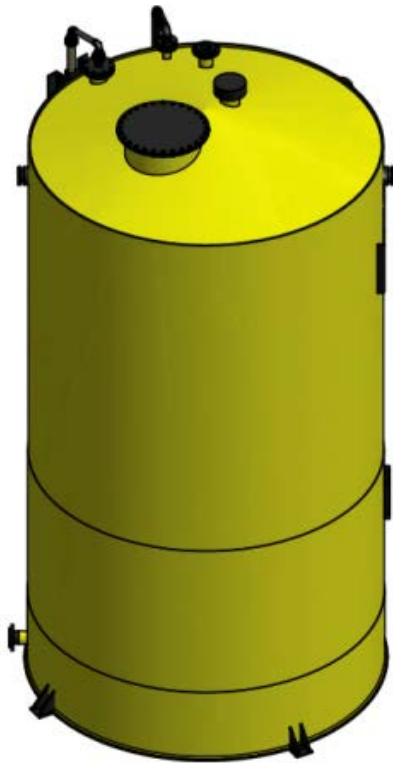
The solids from the RDS can be deposited into a skip. This should be located inside the bund in case of spillage or outside the bund if there is a drain back inside the bund.

Balance tank

The textbook size for a balance tank is 24 hours production, to allow all the peaks and troughs in terms of volumes, contaminants, production and cleaning waters all to be combined into one homogenous feed to the Dissolved Air Flootation (DAF) plant.

However, there is no space for an ~800m³ vessel. Therefore, we would suggest 2 off 50m³ vessels with two stainless steel mixing pumps capable of 50m³/hr, and coarse pH correction to trim the pH from the extremes, e.g. instead of 2 to 12, the balance tank pH will be maintained at 6 to 9.

Laser level probes will be mounted on top of the tanks, along with top entry manways. No ladders or top access structures are to be included.



The balance tank will be agitated and aerated - It is essential that the effluent is homogenous for feeding to the DAF plant to maximise performance and minimise treatment costs. The aeration also prevents undesirable bacteriological reactions and septic/ anaerobic conditions. Carbon scrubbers will be included.

There will be a tanker pull off point on the balance tanks in case effluent ever needs to be taken off site in this manner.

The tanks will be fitted with a connection for a 6" low level connector pipe and single valve isolation option.

Tanks with level control, two off = £71,720

Pumps, two off = £13,450

pH correction with acid and caustic dosing pumps, one off system = £4,380

Example - Hitchen Foods, Bakkavor



DAF plant

A PID loop will be required in the control panel for duty/ standby mild steel 50m³/hr DAF feed pumps to ensure a preset flow can be transferred to the DAF plant.

Pumps, 2 off = £8,590

Flow meter = £3,470

The TE will then pass through a polypropylene pipe mixer for the addition of chemicals, as required = £4,800



Example layout

Coagulant – to prepare the solids for flocculation

Acid/ base for pH correction – to ensure the optimum pH for flocculation and within the pH consent limit for discharge to Severn Trent

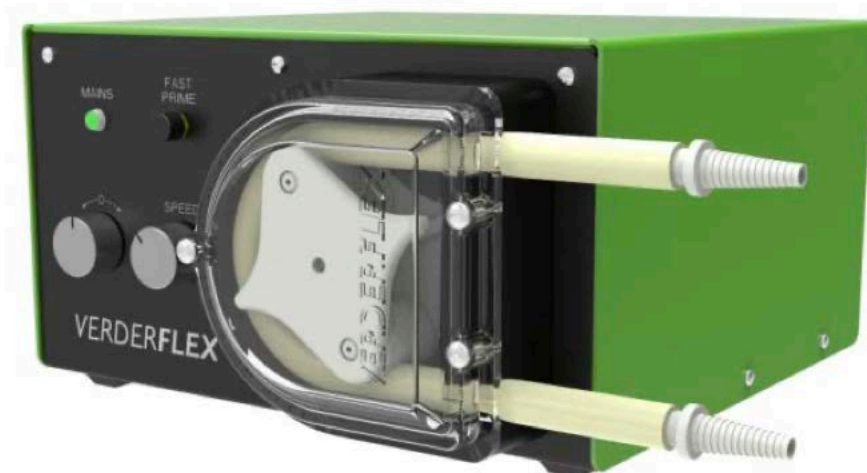
Polymer – to bring the solids together into a “cotton wool” structure – this allows the maximum possibility for air being trapped underneath and lifting the solids, fats, oils and greases to the surface

Antifoam – may be required if there are high detergent residues

Advanced, fully automatic, on/off, 4-20mA/ 0-10V control, min/max flow rates, 5-year guarantee, polymer, coagulant, acid and caustic = £19,920



Basic antifoam dosing pump = £1,580

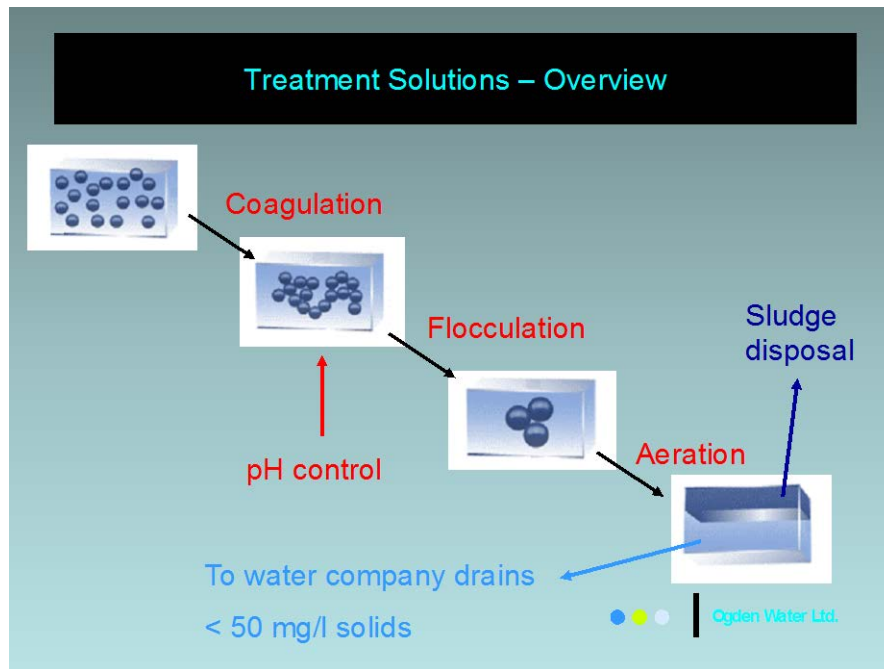




Perfect coagulation and flocculation using, left, aluminium based and right, vegetable based, coagulants

There will be a Hach pH control system with 4-20mA outputs to the dosing pumps, to ensure the correct pH level is reached at all times = £5,480

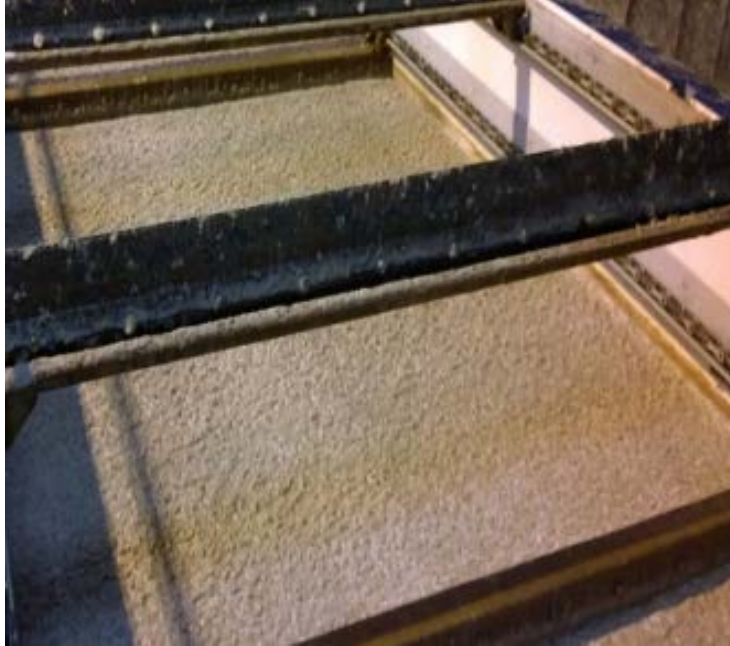
Upon entering the 100kg DAF*, the bubbles generated by a duty only whitewater/ aeration system will rush to the surface, taking up to 95% solids to the surface of the DAF at the same time = £134,500



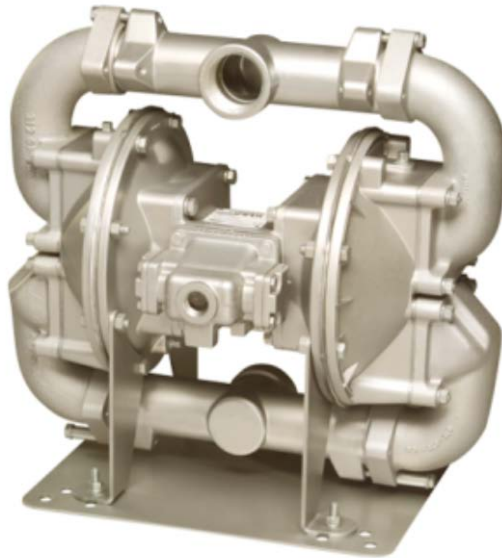
*a 100kg DAF will remove 2,000 mg/l of insoluble material per hour at a flow rate of 50m³/hr

The aeration pumps do not require compressed air, however, there are a number of pneumatic valves etc. that will require a compressor and associated components = £1,970

Any insoluble contaminants that have risen to the surface of the DAF will be scraped into the sludge compartment where a programmable level sensor will stop and start the duty/standby air operated sludge pump = £5,920



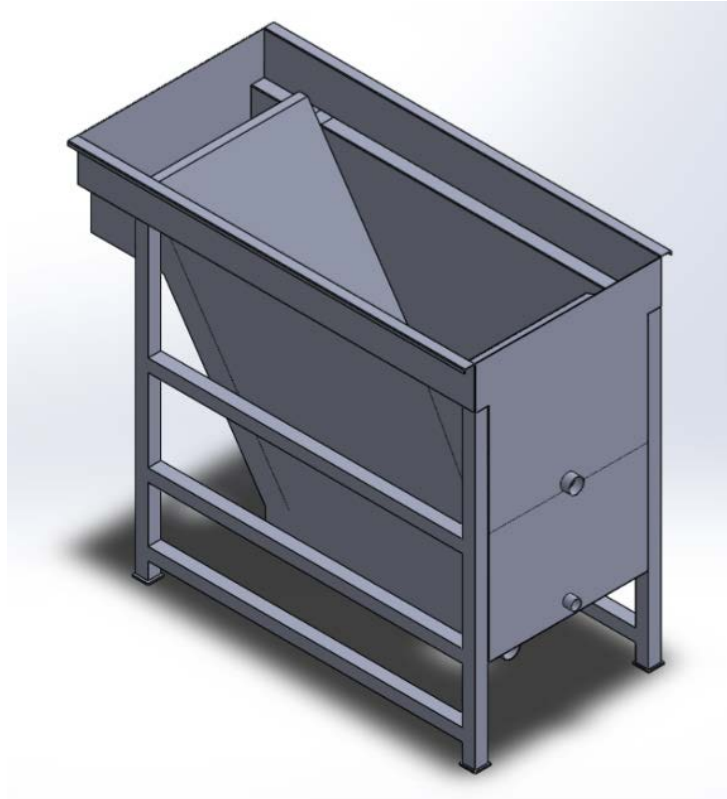
Example – porridge like consistency - Ahlstrom

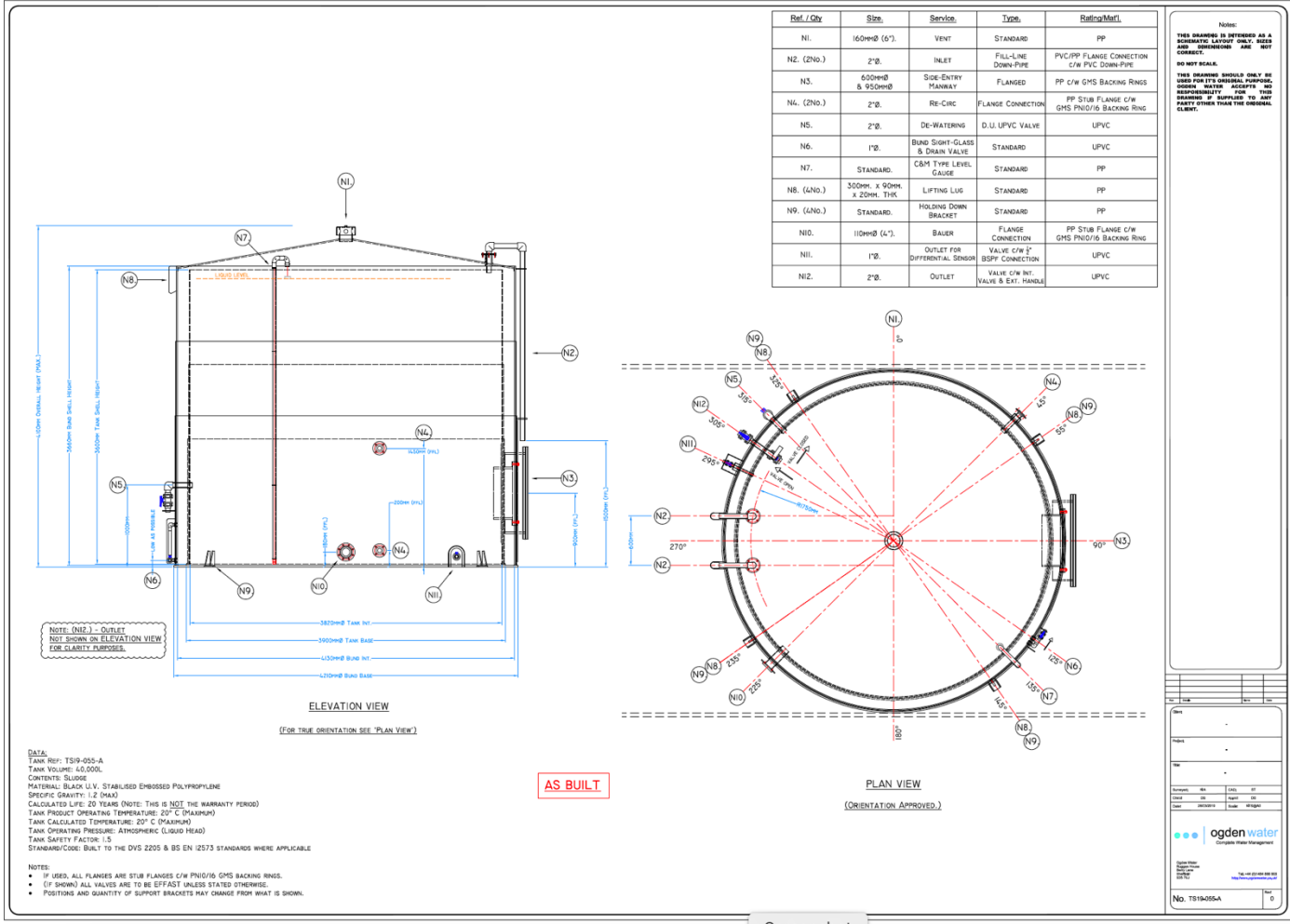


Sludge pump

A Hach in-line solids meter will be added after the DAF to allow automatic chemical dosing changes as well as providing an alarm system in case the performance drops away from ideal = £9,200

The conical base of the DAF allows any dense debris/ grit/ sand to be removed – an automatic air operated valve will allow these components to be deposited in the same sludge break tank, before being pumped to a 30m³ sludge tank, complete with slow mixer, dewatering valves and carbon scrubber = £44,400





Example sludge tank

Other

Control panel = £39,000

There will be output options for the subsequent connection of SCADA/ BMS etc, at extra cost.

This is based on the control panel at Manton Wood, see reference on page 1, plus 40% for the increased size of inverters, HMI, control parameters etc.

Delivery, HIAB/ crane, positioning etc. = £8,000

Service contract:

A service engineer will attend site once per month = £580

An example report is attached.

As you can see, this is an in-depth analysis of the plant and includes continuous monitoring of performance and chemistry.

Installation = 10% of project total

Commissioning = 2% of project total

Options

Modular biological plant, 300kg per day = £180,000

For the removal of 3,000 mg/l on 900m³ = 2,700kg per day

Eight plants = £1.5m, all are modular and would be ~20ft shipping container in size

Reverse Osmosis plant, 900m³/day infeed = £190,000

Spares

There is a high degree of duty/standby included in the scope. However, the following are not available as duty/standby and so we recommend boxed spares on site:

Balance tank mixer pump = DAF Feed pump = £6,725
pH controller, probe and dosing pump, balance tank = £3,400
pH controller and probe, pipe mixer = £5,480
Chemical dosing pump, pipe mixer = £4,980
Antifoam pump = £1,580
Scraper bars, chains, rubbers, motor, gearbox etc = £8,760

Note – the items below are neither duty/standby nor sensibly kept on site as boxed spares:

Screen
DAF
Sludge tank

Failure of any of these items could result in production being halted and/or significant tanker costs.

Trade Effluent Charges – Severn Trent

Trade effluent charges are calculated using the MOGDEN formula:

MOGDEN formula – trade effluent charges

$$C = R + [(V + B_v)] + B (O_t / O_s) + S (S_t / S_s)$$

- C = charge / p/m³ (**VOLUME**)
- R = reception/ conveyance cost (“sewer maintenance”)
- V = Primary treatment cost (“volumetric”)
- B_v = charge related to bio treatment disposal
- B = Oxidation treatment cost (“biological”)
- O_t = **sCOD** effluent O_s = COD ST average
- S = Sludge treatment cost
- S_t = **TSS** effluent S_s = TSS ST average

Reducing any of these 3 parameters reduces trade effluent charges



Example:

TSS / mg/l	sCOD / mg/l	Cost per annum* / £
2,000	5,000	1,003,000
200	2,500	502,000
200	1,000	307,000

*based on 900m³ per day, 350 days per year

Estimated chemical usage = £3,000 to 5,000 per week

There is a tremendous payback opportunity on this project, even more so for water recycling:

Based on a £2m additional investment, the return would be less than 2 years.

Broad Scope of Supply

Reception sump pumps, duty/standby, 100m³/hr each
Inlet screen – size to be confirmed
Two 50m³ balance tanks with roof and mixer
One balance tank mixer with pH correction
Flow meter to DAF and to Severn Trent
Sludge tank with roof
Sludge tank slow mixer
DAF plant, 100kg per hour
10m³ chemical storage tanks, single skin as located in an overall bund
Duty/ standby sludge pump
pH control system for DAF feed
Acid, caustic, polymer, coagulant and antifoam dosing pumps
Polymer activation system
Control panel
Sampler
Laboratory equipment

Exclusions

Any items not listed in the Design Brief/ Scope of Supply
Air, Water and Power requirements
Civil and building work
M&E work
Installation

Conclusion and Performance Details

Ogden Water are able to offer a waste water treatment plant that can ensure discharge compliance with correct operation and maintenance as per instruction manuals and training provided and the use of Ogden Water chemicals.

The following items are not guaranteed – see Page 3 for full details, summarised below:

Temperature of discharge – no equipment supplied is actively designed to reduce the temperature of the waste water, however, with consent of 43 degrees C, we believe there will be no problems.

Soluble contaminants e.g. COD – this is basically dissolved sugar – no equipment is being supplied to digest soluble COD – this requires biological treatment.

Sulphide and Phosphorus - no equipment supplied is actively designed to reduce the levels of these two parameters in the waste water, however, ww believe there will be no problems.

Service contract – monthly visits at £580 including travel and accommodation as required. All equipment carries a 24-month manufacturers warranty assuming use of Ogden Water chemicals and service.

I trust the report is of interest to you and look forward to hearing from you.

Yours sincerely



David Shepherd

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