



## PROCESS INVESTIGATION REPORT EXAMPLE

Produced by MVC Solutions Ltd

Client : **MVC Solutions Ltd**  
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## Executive Summary

In August 2020, MVC Solutions Ltd conducted a seven-day Flow and Load (F&L) study at the King's Bay Factory in East Surry. As a leading food manufacturing company with a range of confectionery products, the expansion of line 77 would allow recipes to be rotated cyclically every 24hrs to match demand.

The main significant findings from the site visit are listed below and include:

Maximum FOG values stated in the client's report in Appendix A5-3 were based on assumptions taken from the factory production figures. Appendix A5-2 provides spot sample data from 2017, which states readings that were typically disregarded due to a scrapped batch being sent to drain. Three of these data points were omitted for this reason and the highest which was included in the calculation of the average FOG level was 680mg/L. Data points for 28 composite samples were also provided and these gave an average of 109.6mg/L and a maximum of 328mg/L.

High temperatures up to 58oC were measured in the holding tank, significantly higher than those stated in the client's 2017 report (Max 36oC). The average 24hour temperature collected by the study ranged between 41.4 and 43.6oC.

Fat, Oil and Grease (FOG) levels (average 243kg/d with a maximum of 978kg/d) were higher than those stipulated in the client's report (60 - 91kg/d). The F&L study found FOG loading rates above the clients stated maximum of 91kg/day for 4 consecutive days during the survey period.

Maximum COD readings during the F&L study were significantly lower than those stated in the client's report (2260 vs 7100mg/l). The maximum COD value was noted on the same day as the maximum FOG value.

The clients report stated average pH concentrations of 7.7. The survey recorded average pH levels of 7.3. Maximum & minimum pH ranges varied from 5.2 to 11.9, but stayed within the range detailed by the client, namely 2.35 - 12.85.

Ammonia and Nitrogen levels during the study were generally below 1mg/l.

Sufficient alkalinity is present in the system for nitrification if biological treatment is to be considered, but if stronger ammonia levels were encountered, additional alkalinity correction would need to be considered. Average Alkalinity Loading Rates over the study were 120 kg/day. The Maximum and Minimum Alkalinity loading rates were 256 & 41kg/day.

Maximum flow at 611m<sup>3</sup>/d was close to that stated in the client's report (628m<sup>3</sup>/d). Average daily flow readings were higher (442 vs 250-390m<sup>3</sup>/d) and the minimum recorded flow during the survey was 240m<sup>3</sup>/d.

Flows measured by the Mars flow meter were up to 790m<sup>3</sup>/d which is higher than the maximum stated in the client's 2017 report.

Total Suspended Solids averaged 337mg/l, close to the average stated in the clients report of 327mg/l.

Flow measured by the temporary flow meter were around 20% lower than the on-site King's Bay flow meter. Despite issues with the temporary flow meter battery, high quality data was recorded.

The on-site King's Bay flow readings were previously being under-read by a factor of 10 which explains some of the discrepancy between the onsite magflow and impeller flow meters. All flow was diverted directly to sewer (not through the works) for the duration of the survey.

Small 'fat balls' were found in the effluent entering the holding tank, indicating they may be initially forming upstream of the transfer tank. These balls were significantly smaller than the balls observed in the balance tank.

The inlet screen periodically blinds and overflows. This happened once during the survey period, but it is understood that it happens quite regularly. Screenings entering the bund are pumped directly into the holding tank. This means that solids can bypass the screen and enter the transfer tank, potentially causing blockages and pump failures.

## Introduction

Kings Bay Ltd is a leading food manufacturing company with a production facility at San Pele Rd, Kingsgate, East Surry. A range of foodstuffs are manufactured at this facility, including many household confectionery products. Operational recipes are produced 24hrs a day and rotated cyclically to match the demand.

Effluents from the various production lines are characteristically different in nature and require screening and buffering before being processed by the treatment plant. The outside 1mm Screen sends flow into the holding tank and additional effluent lines enter the holding tank directly from the boiler house (bypassing the screen). Boiler house effluent can contain cleaning products and high ranges in temperature, typically at an average of 42C+.

MVC Solutions conducted a seven-day Flow and Load Study to investigate the factory effluent. Calculations produced by the Flow and Load study (F&L) aided in confirming both the current loading rates to the treatment plant and also helped to determine the requirement for future expansion of the production facility (via the incorporation of Line 77).

As well as the F&L study, additional temperature monitoring was conducted within the Holding Tank via the use of a Solist Temperature Probe. Regular SPOT pH readings were also recorded at the Holding Tank, enabling a pH profile between the hours of 8am - 5pm.

The MVC Solutions F&L investigation also looked at possible reasons for the pump failures and pipe blockages, resulting in a temporary shutdown of the treatment facility.

The clients report had detailed expected effluent flow ranges of between 250 - 390 m<sup>3</sup>/day with peak flow rates of 628 m<sup>3</sup>/day. The MVC Solutions F&L study confirmed these flows are roughly accurate, recording an average daily flow rate of 442 m<sup>3</sup>/day with peak recorded flow rates of up to 600 m<sup>3</sup>/day during the study.

The client's 2017 report stated that the 'Factory Effluent could be as high as 7000 mg/l of COD, with an average COD of 1140 mg/l'. The clients report also indicated that TSS must be no higher than 1406 mg/l with an average of 318 mg/l.

FOG detailed in the client's report should be between 60 - 91 kg/day.

Average pH readings recorded by the client are detailed as 7.6, with times when the pH could fluctuate between 2.35 – 12.85.

## Existing System

### *Treatment Process Overview*

The process flow is as follows:

- Food grade effluent is pumped from the clients Food Production Factory to the outdoor 1mm Screen, located next to the Effluent House.
- Screened effluent is sent (via gravity feed) to the Holding Tank for collection buffering and mixing. Additional lines from the Effluent House feed the Holding Tank increasing the temperature within to a maximum of 58°C and an average temperature of 34°C.
- The site drainage pump sump also connects to the Holding Tank, where spilled effluent is mixed freely with the content of the Holding Tank.
- Once the level in the Holding Tank has increased to 80%, the level switch, initiates the duty/standby Siemens Pumps, sending flows from the holding tank to the treatment plant, approximately 805 metres.
- Each Siemens Pump is capable of 60-92 m<sup>3</sup>/hr (ref pump curve) and typically runs for a maximum of 15 minutes twice/three times per hour.
- On arrival at the treatment plant, flows are first captured in the Transfer Tank which has a retention time of 30 minutes at an average flow rate of 68 m<sup>3</sup>/h.
- Two duty/standby Sepex pumps forward the effluent from the Transfer Tank and into the Balance Tank which has a storage capacity of 125 m<sup>3</sup> or a retention time of 2.1 hours at 68m<sup>3</sup>/h.
- After passing into the Balance Tank, flows are automatically processed by the treatment plant on level, effectively removing COD, TSS and FOG from the process stream. Once the effluent is treated, flows are discharged to sewer for further treatment via the water authority.

### ***Onsite problems and proposed solutions***

Blockages of the 1mm Inlet Screen have led to effluent spills and occasional bund flooding events. The client is aware of these issues and has proposed the adoption of a new inlet screen to coincide with the factory expansion of line 77.

Elements of equipment deterioration through daily use were observed during the Flow & Load study. The 1mm Screen experienced frequent blockages requiring high pressure cleaning and the area around the holding tank was prone to occasional flooding.

An agreed bench test to investigate the chemical removal method (via Eco Cat Bio-Organic Catalyst) was initiated on the 11.07.2020. The project team decided to eliminate any additional costs by re-examining the current loading rates (in kg/day) to the Treatment Plant and therefore gaining a better understand of the variations in Holding Tank effluent concentrations.



## Flow Monitor

During the MVC Solutions Flow and Load Study (F&L), the pipe mounted Katronic Flow Meter (logger) was located approximately 2 meters from the Siemens pumps on a straight length of pipework with limited possibility of backflow or turbulence. Noise and signal loss levels were established as 'good' throughout the study period and the Flow Logger had regular battery changes and downloads to minimise any data loss.



Flows from the Effluent Holding Tank to the treatment plant are not continuous, but intermittent pumped flows, starting and stopping several times per hour depending on the level in the Holding Tank. The Siemens Pump Curve readings provided typical pumped flow rates between 60-92 m<sup>3</sup>/hr.

Above is an image of the Flow Logger recording an instantaneous flow reading of 65.3 m<sup>3</sup>/hr, which corresponded well with expected values based on the design pump curve. The average overall recorded flow during the F&L Study was 18.4 m<sup>3</sup>/hr or 442 m<sup>3</sup>/day, with a peak flow rate of 600 m<sup>3</sup>/day.

### Note

Due to battery issues some gaps in the data appear. In these circumstances the hourly average is used as a prediction of the daily total in m<sup>3</sup>/day.



## Autosampler 24hr Comp

The 24hr composite autosampler was located on the access platform adjacent to the 1mm Screen. A sample hose was positioned approximately 30cm from the bottom of the Holding Tank and secured to the handrail with cable ties. Access to the platform was restricted by black & yellow security tape to prevent any unauthorised personnel climbing onto the platform.

24hr Comp Autosampler      Temperature Monitor



The composite carousel of the autosampler enabled 48 samples to be taken in 30-minute intervals to produce a 24hr composite sample. Collection of the 24hr composite sample was completed routinely every morning at 8am. Samples were sent daily to the Laboratory for Accredited Analysis.

## Temperature Probe

The temperature probe was also positioned inside the Holding Tank at a depth approximately 30cm from the bottom of the Tank. Secured to the access platform handrail with black & yellow security tape prevented access to any unauthorised personnel, the probe recorded readings of both temperature and level every 2x minutes.

## pH Spot Samples

As an additional study, pH spot samples were recorded daily from 8am to 5pm (ref appendix 1a). The pH spot sample study lasted for 4 days and provided insight into workday pH levels and cleaning cycles. Samples were collected hourly from the Holding Tank between 8am through to 17:00 pm. The results show a Maximum pH of 7.3, a Minimum pH of 6.7 and an Average pH reading of 6.9. The pH readings are within the normal range of expected concentrations; however the 24hr accredited pH samples show more variance, indicating possible cleaning cycles or recipe changes.

## Effluent Characteristics

### Typical Screened Effluent

The photograph below shows a typical post 1mm Screen Effluent sample, collected over a 24-hour period. The opaque colour and thin film of oil and scum on the surface of the bottle are typical of the general samples recorded onsite.

### Unusual Screen Effluent

On Saturday afternoon 08.08.2020 at 14:15pm, an unusual RED effluent entered the Inlet Screen. The observed Spot sample is orange in colour with sediment forming at the bottom of the bottle.

Inlet Screen



Spot Sample



24hr Sample (tainted orange)



The unusual orange effluent was visible on the screen for approximately two hours and was sufficient to taint the 24hr composite sample.

## Inlet Screen (1mm)

The banded area of the inlet screen is prone to flooding if the 1mm Screen becomes blinded with grease and oil. Effluent that would normally go through the Inlet Screen and into the Holding Tank flows instead into the skip (containing food screenings) and overflows into the bund, taking with it rice & oil. On this occasion the bund sump pump had failed and had to be replaced.

The screenings are then pumped directly into the Holding Tank. By this mechanism, solids which would normally be screened can pass into the Balance Tank and through to the rest of the MVC Process Plant.

## Results

The following 1-6 tables and charts 1-15 detail the site Flows, the Loading Data and Spot samples results, recorded during the 07.08.2020 to 14.08.2020 study period.

Table 1.

Max Min and Average Effluent Flow readings during the study period in m3/day

DATE	Client FLOW Flow m3/d	MVC FLOW Flow m3/d
07.08.2020	500	240
08.08.2020	490	240
09.08.2020	510	408
10.08.2020	450	456
11.08.2020	670	576
12.08.2020	780	600
13.08.2020	620	576
14.08.2020		
<b>Max</b>	<b>780</b>	<b>600</b>
<b>Min</b>	<b>450</b>	<b>240</b>
<b>Average</b>	<b>574</b>	<b>442</b>

Chart 1.

Max, Min, and Average Effluent Flow readings during the study period in m3/day

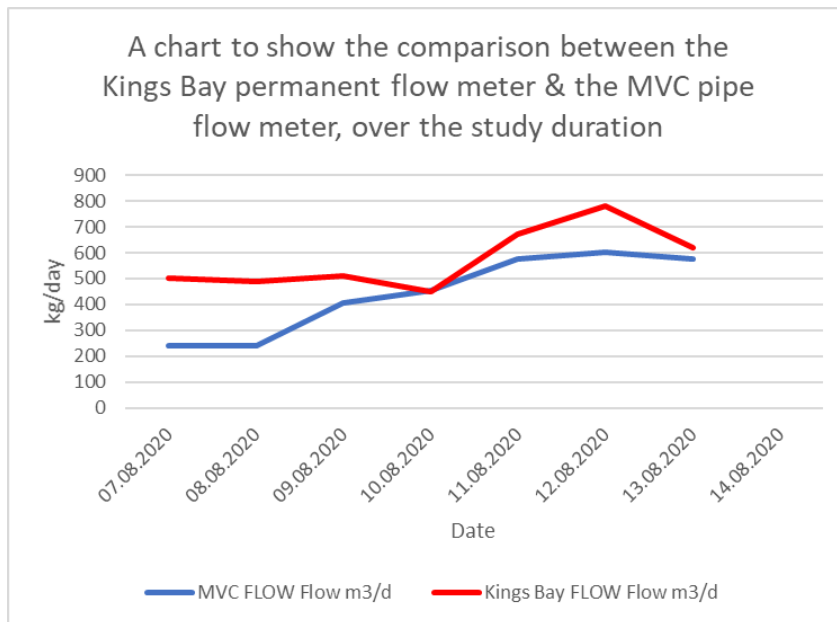


Chart 2.

Inlet effluent flow readings recorded during the study period in m3/day

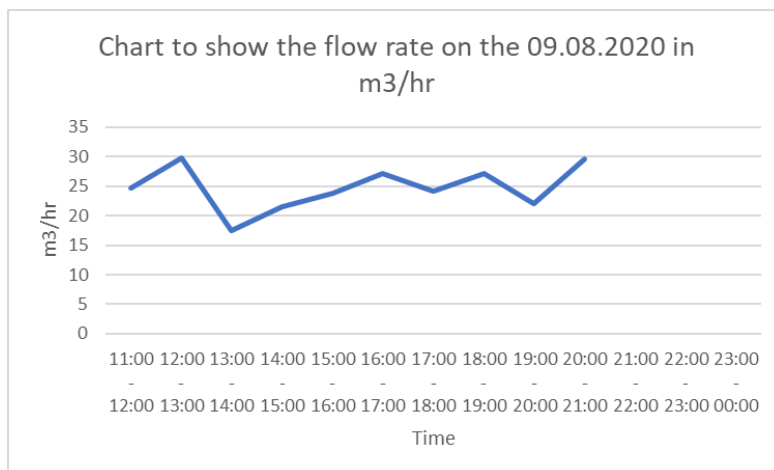


Chart 3.

Inlet effluent flow readings recorded during the study period in m3/day

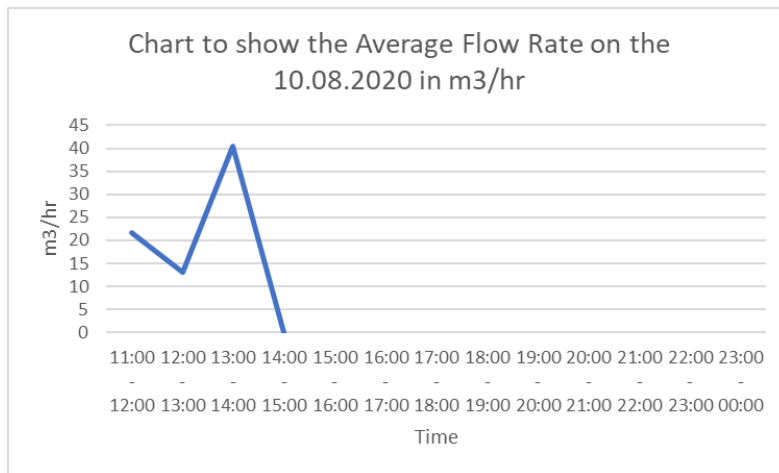


Chart 4.

Inlet effluent flow readings recorded during the study period in m<sup>3</sup>/day

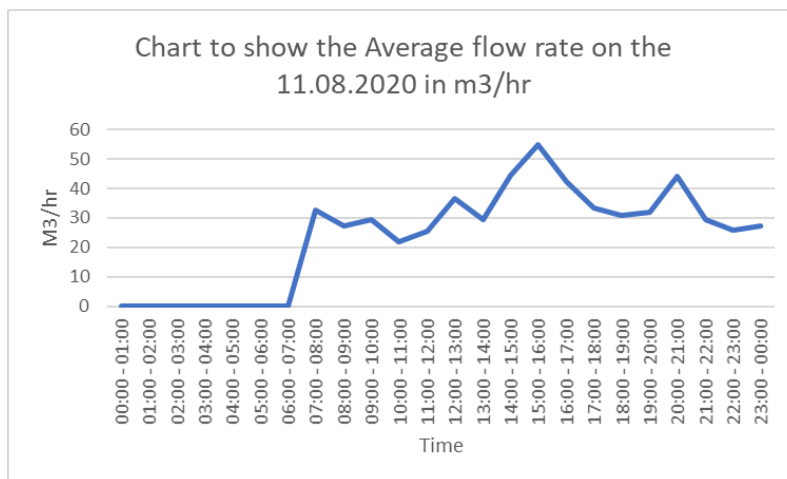


Chart 5.

Inlet effluent flow readings recorded during the study period in m<sup>3</sup>/day

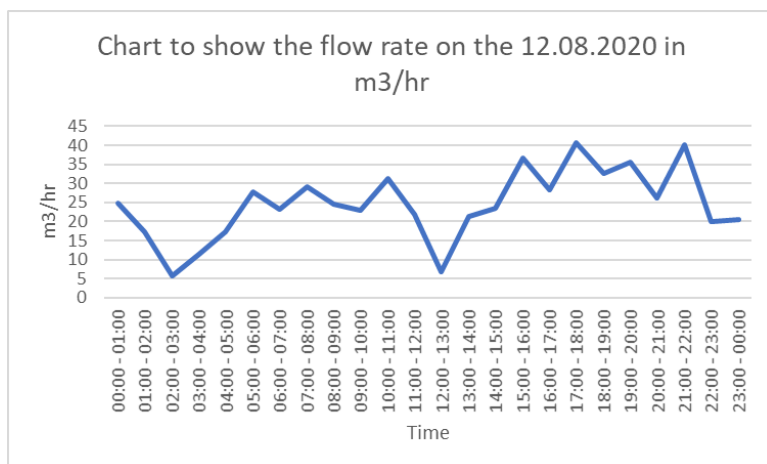


Chart 6.

Inlet effluent flow readings recorded during the study period in m<sup>3</sup>/day

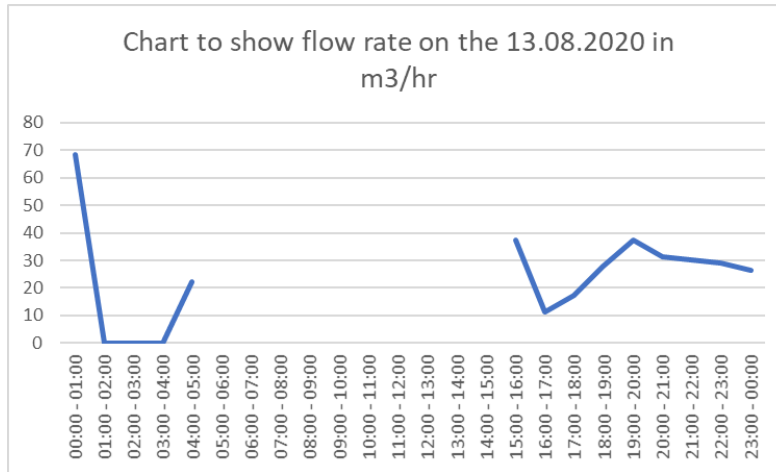


Table 2.

Max, Min & Average pH levels during the study period 07.08.2020 - 14.08.2020

DATE	pH
07.08.2020	6.5
08.08.2020	7.1
09.08.2020	11.6
10.08.2020	7.1
11.08.2020	6.1
12.08.2020	5.6
13.08.2020	6.9
14.08.2020	6
<b>Max</b>	<b>11.6</b>
<b>Min</b>	<b>5.6</b>
<b>Average</b>	<b>7.1</b>

Chart 7.

Max, Min & Average pH levels during the study period (07.08.2020 - 14.08.2020)

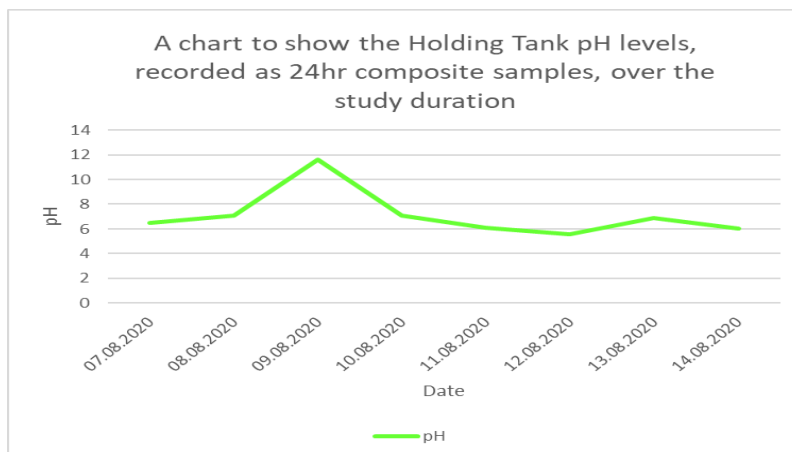


Table 3.

Max, Min & Average Temperature readings over the 24hr study period (07.08.2020 - 14.08.2020)

Date	Average Temperature C	Maximum Temperature C	Minimum Temperature C
10.08.2020	42.0	58.0	30
11.08.2020	43.6	58.0	29
12.08.2020	41.8	53.0	28
13.08.2020	42.4	57.0	24

Chart 8.

Max, min & Average Temperature (C) readings over the study period (07.08.2020 to 14.08.2020)

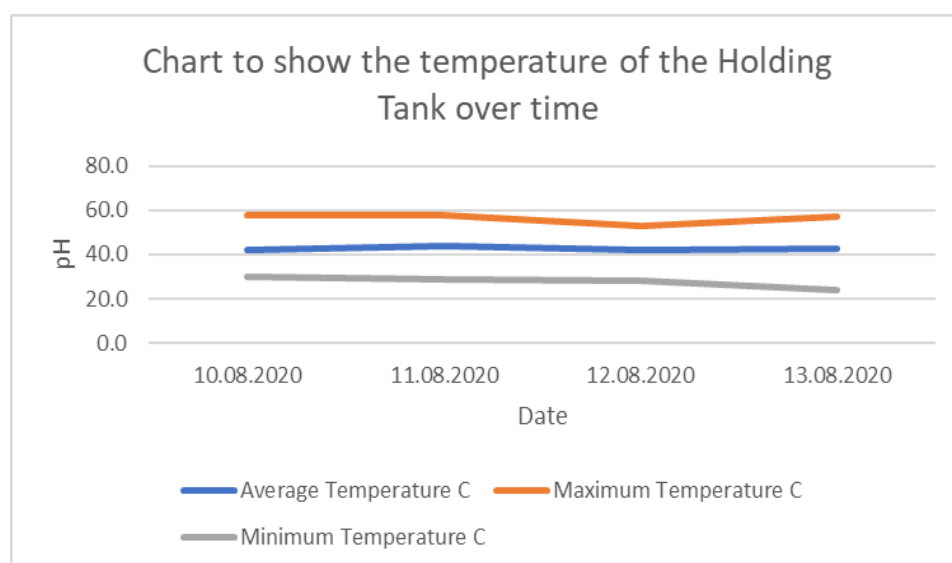


Table 4.

Table to show the Max, Min & Average Effluent Concentrations in the Holding Tank, measured in mg/l during the 24hr study period 07.08.2020 - 14.08.2020

MVC FLOW		HOLDING TANK - 24HR COMPOSITE SAMPLES (mg/l)												
DATE	Flow m <sup>3</sup> /d	BOD	BOD-F	COD	COD - F	TSS	NH4	TOTAL N	pH	ALK	P	SO4	CL	O&G
07.08.2020	240	522	286	942	458	238	2.11		6.5	180.0	1.4	34.6	135.0	267.0
08.08.2020	240	136	50	247	118	85	0.41		7.1	167.0	1.9	49.5	561.0	40.7
09.08.2020	500	699	353	1350	567	600	1.99		11.6	602.0	2.2	61.3	412.0	283.0
10.08.2020	456	234	110	333	202	111	0.53		8.0	232.0	3.3	48.0	309.0	73.8
11.08.2020	576	1140	393	1100	517	604	0.5		7.0	255.0	5.5	52.0	386.0	692.0
12.08.2020	700	1590	437	2160	222	624	0.41		5.6	173.0	3.0	4.0	380.0	1630.0
13.08.2020	576	710	350	973	463	302	0.41		6.9	208.0	5.0	5.0	340.0	171.0
14.08.2020				1090	534	186	1.06		6.0	236.0	3.0	7.0	345.0	174.0
Max	700	1590	437	2160	567	624	2		11.6	602	6	61	561	1630
Min	240	136	50	247	118	85	0		5.6	167	1	4	135	41
Average	470	719	283	1024	385	344	1		7.3	257	3	33	359	416

Table 5.

Table to show the Max, Min, Average Loading Rates in Kg/day over the 24hr study period (07.08.2020 – 14.08.2020)



						HOLDING TANK LOADINGS kg/Day								
DATE	BOD	BOD -F	COD	COD - F	TSS	NH4	TOTAL N	pH	ALK	P	SO4	CL	O&G	
07.08.2020	125	69	226	110	57	1	0		43	0	8	32	64	
08.08.2020	33	12	59	28	20	0	0		40	0	12	135	10	
09.08.2020	231	144	551	231	245	1	0		246	0	25	168	115	
10.08.2020	116	50	204	92	62	0	0		104	0	22	141	34	
11.08.2020	657	226	634	298	348	0	0		147	3	30	222	399	
12.08.2020	954	262	1296	358	374	0	0		104	0	0	0	978	
13.08.2020	409	202	560	267	174	0	0		120	0	0	0	98	
14.08.2020														
Max	954	262	1296	358	374	1	0		246	3	30	222	978	
Min	33	12	59	28	20	0	0		40	0	0	0	10	
Average	361	138	504	198	183	0	0		115	0	14	100	243	

Chart 9.

Chart to show the Max, Min, Average BOD & COD loading rates in kg/day over the 24hr study period 07.08.2020 - 14.08.2020

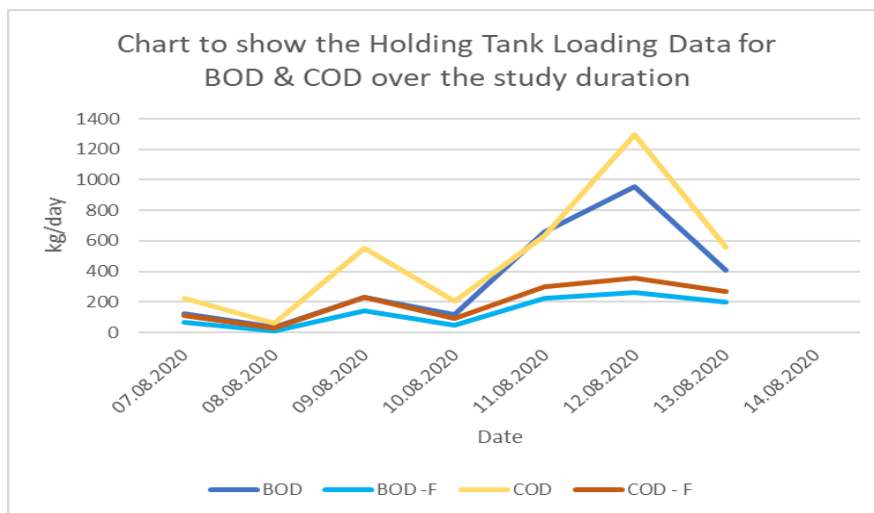


Chart 10.

Chart to show the Max, Min & Average Ammonia/Total N loading rates over the study period 07.08.2020 – 14.08.2020 and measured in kg/day

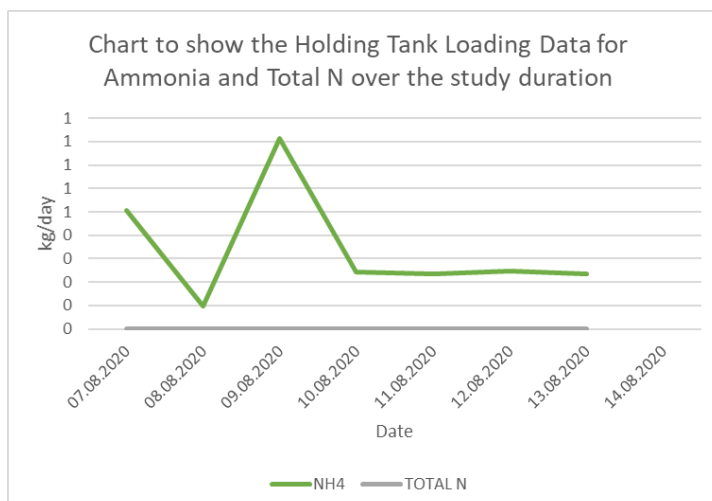


Chart 11.

Chart to show the Max, Min & Average TSS & Alkalinity loading rates over the study period 07.08.2020 - 14.08.2020 and measured in kg/day

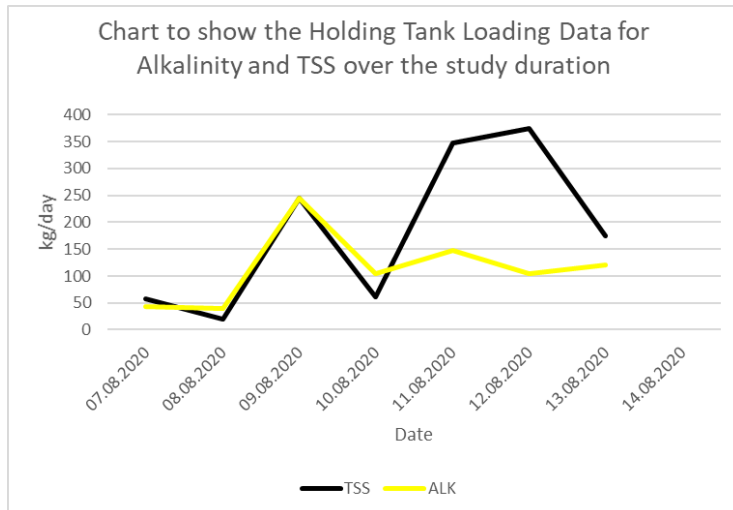


Chart 12.

Chart to show the Max, Min & Average Cl, SO4 and P loading rates over the study period 07.08.2020 - 14.08.2020 and measured in kg/day

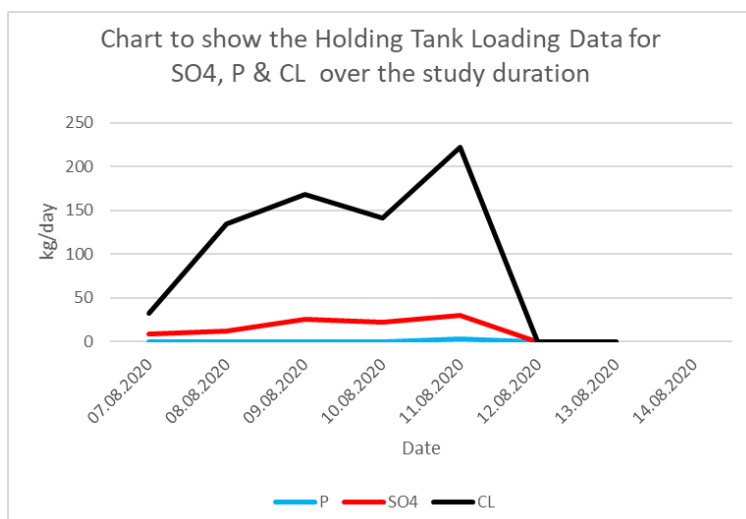
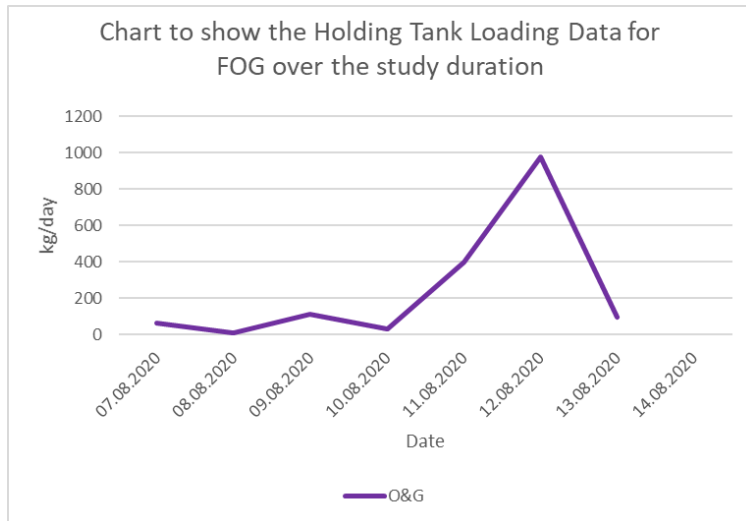


Chart 13.

Chart to show the Max, Min & Average FOG loading rates over the study period 07.08.2020 - 14.08.2020 and measured in kg/day



## Summary of Results

The results of the study period 07.08.2020 to 14.08.2020 show the following ranges within the Kings Bay Holding Tank:

- Results are based on typical factory production outputs and encompass both flow and load readings recorded as 24-hour composite samples.
- The Average Daily Flow equated to **442 m<sup>3</sup>/day**
- Maximum and Minimum Daily Flows were 600 & 240 m<sup>3</sup>/day
- The Average Temperature in the Holding Tank was **42.4C**
- Maximum and Minimum Temperatures in the Holding Tank were 58C & 24C
- The Average pH levels in the Holding Tank were pH **7.1**
- Maximum and Minimum pH readings in the Holding Tank were 11.6 & 5.6
- The Average BOD loading rate from the Holding Tank was **361 kg/day**
- Maximum and Minimum BOD loading rates from the Holding Tank were 954 & 33 kg/day
- The Average COD loading rate from the Holding Tank was **504 kg/day**
- Maximum and Minimum COD loading rates from the Holding Tank were 1296 & 59 kg/day
- Average TSS loading rate from the Holding Tank was **183 kg/day**
- Maximum and Minimum TSS loading rates from the Holding Tank were 374 & 20 kg/day
- Average FOG Loading Rate from the Holding Tank was **243 kg/day**
- The Maximum and Minimum FOG loading rates from the Holding Tank were 978 & 10 kg/day
- Average Alkalinity Load from the Holding Tank was **115 kg/day**
- The Maximum and Minimum Alkalinity loading rates from the Holding Tank were 246 & 40 kg/day

## Conclusion

The Flow and Load Study, together with the temperature, pH and Fat Ball investigation have highlighted many interesting features detailed in the body of this report.

The 1mm Screen is due for refurbished and the sump pump must be in operation to prevent both the bund flooding and non-screened effluent entering the Nijhuis DAF Plant.

Average flow rates entering the Nijhuis Treatment Plant from the Mars factory during the Flow & Load study were 442 m<sup>3</sup>/day. These flow rates are marginally higher than those stipulated in the Mars RFQ Report (250-390 m<sup>3</sup>/day), but within the design standard which stated the of peak flow rates at 107-628 m<sup>3</sup>/day. The maximum flow rate recorded during the Flow & Load Study was 600 m<sup>3</sup>/day, with a minimum flow rate of 240 m<sup>3</sup>/day.

Flows measured by the Mars flow meter were up to 780m<sup>3</sup>/d which is higher than the maximum stated in the RFQ. Flow measured by the temporary flow meter is around 20% lower than the on-site Mars flow meter. Despite issues with the temporary flow meter battery, high quality data was obtained, and the data is reliable.

The on-site Mars flow readings were previously being under-read by a factor of 10 which explains some of the discrepancy between the Nijhuis meters. This should be further investigated considering the new flow information.

High temperatures up to 58°C were measured in the holding tank.

High FOG – this averaged 243kg/d with a maximum of 978kg/d, vs a range stipulated in the RFQ of 60 – 91kg/d.

pH is within specified RFQ limits, although pH of composite samples varied significantly between 5.6 and 11.6.

Average COD readings stated by the RFQ and recorded in the Flow and Load study are remarkably similar, being 504 & 624mg/l respectively. Maximum COD readings during the F&L study were significantly lower than those stated in the RFQ (1039 vs 7000 mg/l).

The RFQ report stated average pH concentrations of 7.6, the F&L recorded average pH levels of 7.1. Maximum & minimum pH ranges varied from 5.6 to 11.6, but stayed within the range detailed by the RFQ (2.35 – 12.85)

Ammonia and Nitrogen levels during the study were all below 1mg/l

Sufficient alkalinity is present in the system for nitrification if biological treatment is to be considered, but if stronger Ammonia levels were encountered, additional alkalinity correction would need to be considered.

Average Alkalinity Loading Rates over the study were 115 kg/day

The Maximum and Minimum Alkalinity loading rates were 246 & 40 kg/day

Small 'fat balls' were found in the effluent entering the holding tank, indicating they may be initially forming upstream of the ETP.

Inlet screen periodically blinds and overflows. This leads to screenings entering the bund, from where they are pumped directly into the holding tank. This means that solids can bypass the screen and enter the ETP.

## APPENDIX 1: SPOT pH Data

Table 6

Table to show the Max, Min & Average onsite SPOT pH reading taken over the study period 07.08.2020 – 14.08.2020

	Mars Inlet Screen pH			
Day	Date	Time	pH	Temp
Monday	10.08.2020	08:00	7	33
	10.08.2020	09:00	7.1	33
	10.08.2020	10:00	6.8	36
	10.08.2020	11:00	6.9	32
	10.08.2020	12:00	6.7	36
	10.08.2020	13:00	6.8	39
	10.08.2020	14:00	6.8	41
	10.08.2020	15:00	6.7	49
	10.08.2020	16:00	6.8	36
	10.08.2020	17:00	6.7	37
Max			7.1	49.0
Min			6.7	32.0
Average			6.8	38.3

Table 7

Table to show the Max, Min & Average onsite SPOT pH reading taken over the study period 07.08.2020 – 14.08.2020

	Mars Inlet Screen pH			
Day	Date	Time	pH	temp
Tuesday	11.08.2020	08:00	7.3	36
	11.08.2020	09:00	7.3	36
	11.08.2020	10:00	6.8	41
	11.08.2020	11:00	6.8	39
	11.08.2020	12:00	6.8	36
	11.08.2020	13:00	7.2	49
	11.08.2020	14:00	6.2	36
	11.08.2020	15:00	7.2	33
	11.08.2020	16:00	7.1	33
	11.08.2020	17:00	7.1	33
Max			7.3	49.0
Min			6.2	33.0
Average			6.9	37.2



Table 8

Table to show the Max, Min & Average onsite SPOT pH reading taken over the study period 07.08.2020 – 14.08.2020

Mars Inlet Screen pH			
Day	Date	Time	pH
Wednesday	12.08.2020	08:00	6.8
	12.08.2020	09:00	6.7
	12.08.2020	10:00	6.7
	12.08.2020	11:00	7.1
	12.08.2020	12:00	7.1
	12.08.2020	13:00	6.9
	12.08.2020	14:00	5.9
	12.08.2020	15:00	6.8
	12.08.2020	16:00	6.9
	12.08.2020	17:00	6.7
Max			7.1
Min			5.9
Average			6.8

Table 9

Table to show the Max, Min & Average onsite SPOT pH reading taken over the study period 07.08.2020 – 14.08.2020

Mars Inlet Screen pH			
Day	Date	Time	pH
Thursday	13.08.2020	08:00	6.8
	13.08.2020	09:00	6.8
	13.08.2020	10:00	6.9
	13.08.2020	11:00	6.9
	13.08.2020	12:00	6.9
	13.08.2020	13:00	7
	13.08.2020	14:00	7
	13.08.2020	15:00	6.8
	13.08.2020	16:00	6.8
	13.08.2020	17:00	7
Max			7.0
Min			6.8
Average			6.9

Chart 14

Chart to show the Max, Min & Average onsite SPOT pH reading taken over the study period 07.08.2020 – 14.08.2020

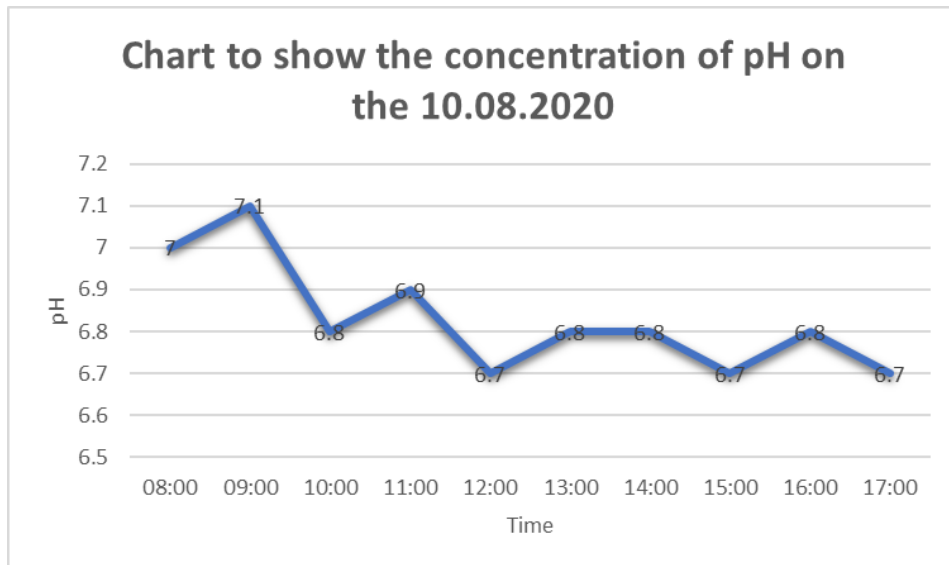
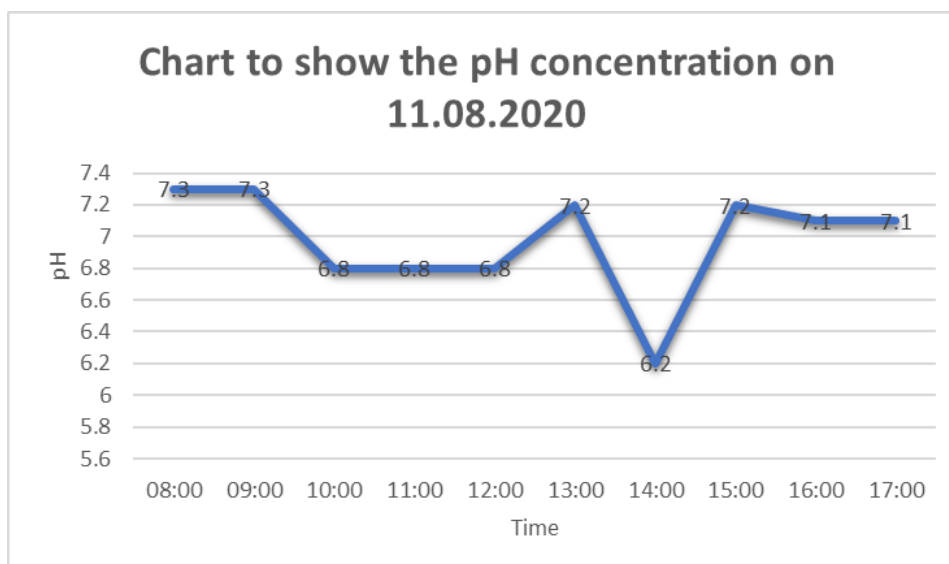


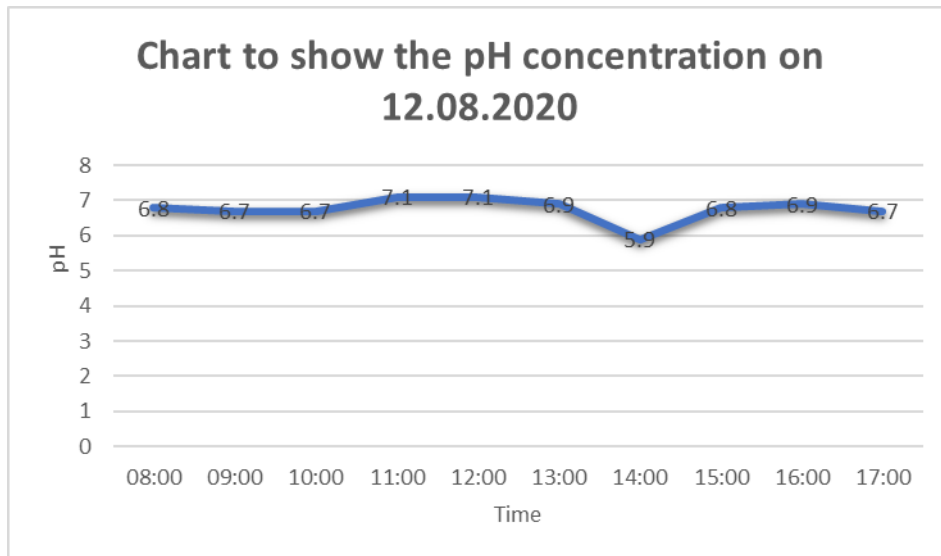
Chart 15

Chart to show the Max, Min & Average onsite SPOT pH reading taken over the study period 07.08.2020 – 14.08.2020



### Chart 16

Chart to show the Max, Min & Average onsite SPOT pH reading taken over the study period 07.08.2020 – 14.08.2020



### Chart 17

Chart to show the Max, Min & Average onsite SPOT pH reading taken over the study period 07.08.2020 – 14.08.2020

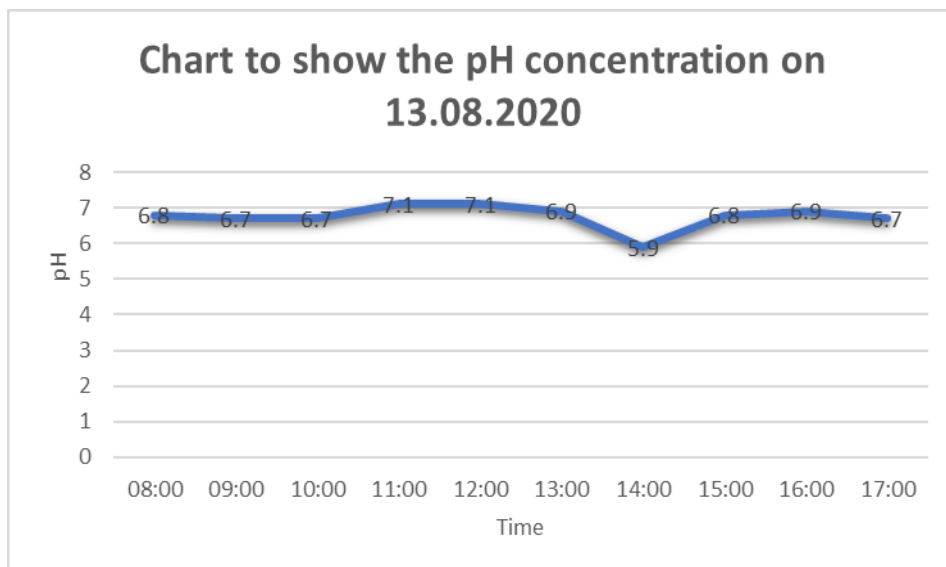


Chart 18

Chart to show the Holding Tank Temperature levels taken over the study period 07.08.2020 – 14.08.2020

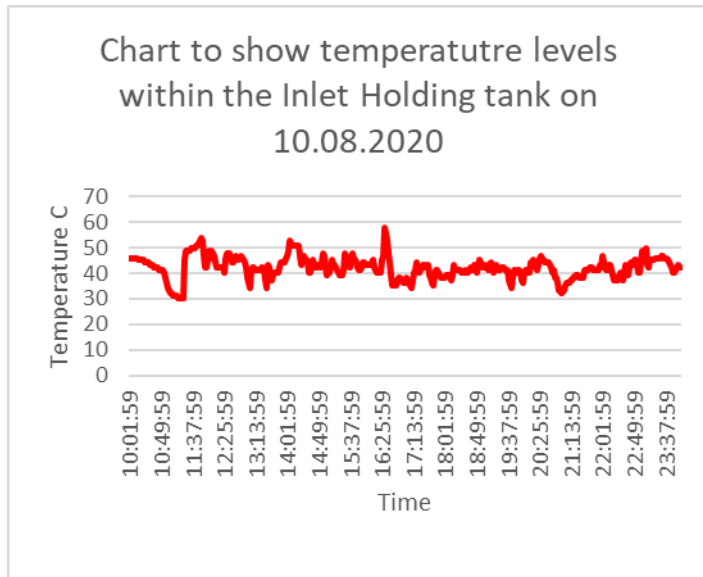


Chart 19

Chart to show the Holding Tank Temperature levels taken over the study period 07.08.2020 – 14.08.2020

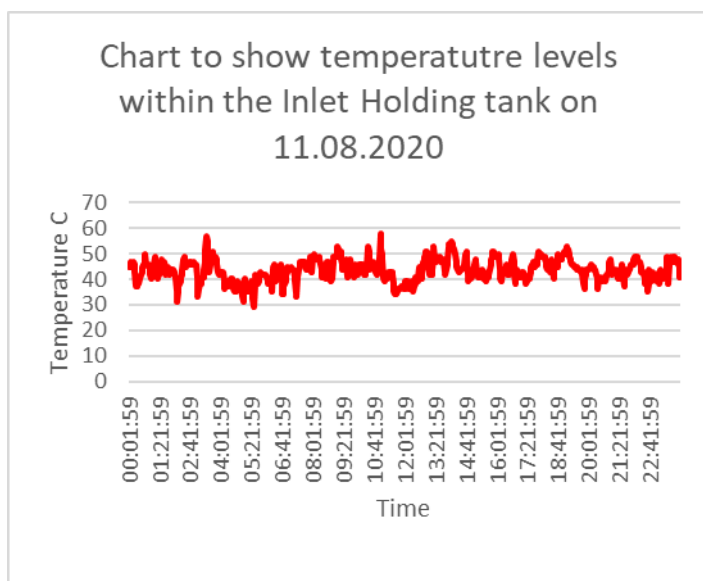


Chart 20

Chart to show the Holding Tank Temperature levels taken over the study period 07.08.2020 – 14.08.2020

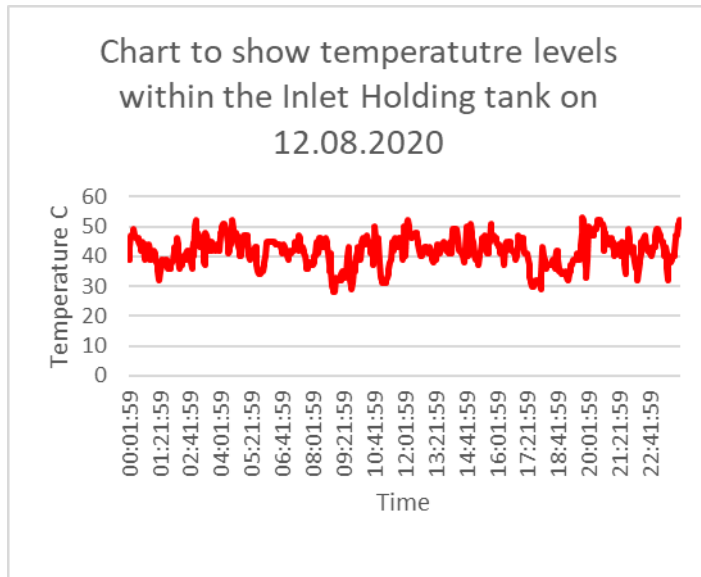


Chart 21

Chart to show the Holding Tank Temperature levels taken over the study period 07.08.2020 – 14.08.2020

