EVALUATION OF UNIVERSITI TEKNOLOGI PETRONAS SEWAGE TREATMENT PLANT PERFORMANCE AND ITS DESIGN

by

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14507

Dissertation report in partial fulfillment of the requirements for the Bachelor of Engineering (Hons)

(Civil)

MAY 2015

Universiti Teknologi PETRONAS

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the
Civil and Environmental Engineering Department
Universiti Teknologi PETRONAS
In partial fulfilment of the requirement for the
BACHELOR OF ENGINEERING (Hons)
CIVIL ENGINEERING

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TRONOH, PERAK
MAY 2015

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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(AIZUDDIN KAMARUSZAMAN)

ABSTRACT

This report is a study for evaluation the performance of each treatment process in Universiti Teknologi PETRONAS Sewage Treatment Plant. University Technology PETRONAS Sewage Treatment Plant (UTP's STP) is a treatment plant that used an Extended Aeration Activated Sludge (EEAS). The sewage treatment plant is capable treat effluent to a standard A which is 20 mg/Ll of BOD and 50 mg/L of suspended solids. A hydraulic loading off 225 L/pe/d and an organic loading off 55 g/pe/d and sludge storage of 40 days at 4% of solid were considered for design. The design basis flow rate for this plant is about 5,175.00 m3/d or 23,000 population equivalent. This sewage treatment plant consists of inlet chamber, grit and grease chamber, distribution chamber, anoxic zone, aeration tank, clarifier and chlorination tank. At the beginning stage, the problems are identified on the various parameters such like biochemical oxygen demand (BOD) and total suspended solids (TSS). Samples from UTP's STP will be taken frequently to analyze the wastewater in the laboratory. At the end, this project will help the properties management and maintenance department (PMMD) a better operating system of the STP and also provide a recommendation of upgrading.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

In Malaysia, there are standards established to control the quality of the effluent discharged into the streams. Two types of standards set by Environmental Quality Act 1974; Standard A and Standard B (refer Table 1). Standard A is for sewage treatment plant (STP) effluent discharged upstream of a water supply intake while Standard B is for STP effluent discharged downstream of a water supply intake. To ensure that effluent discharged meet the standard set, the effluent of STP are sampled and tested at regular intervals in laboratory.

Oxidation pond was the old sewage treatment that had been used by Universiti Teknologi PETRONAS (UTP). This oxidation pond is low maintenance cost since its does not requires much mechanical equipment. Yet the disadvantages by applied this system are it will result in odor if there is less sunlight and requires large area of land. BOD removal also in low efficiency because it is depends on the availability of algae in the effluent (Porges and Mackenthun,). UTP oxidation pond was supposed to treat incoming influent to the complying standard A. Below showed the flow picture for UTP oxidation Pond.

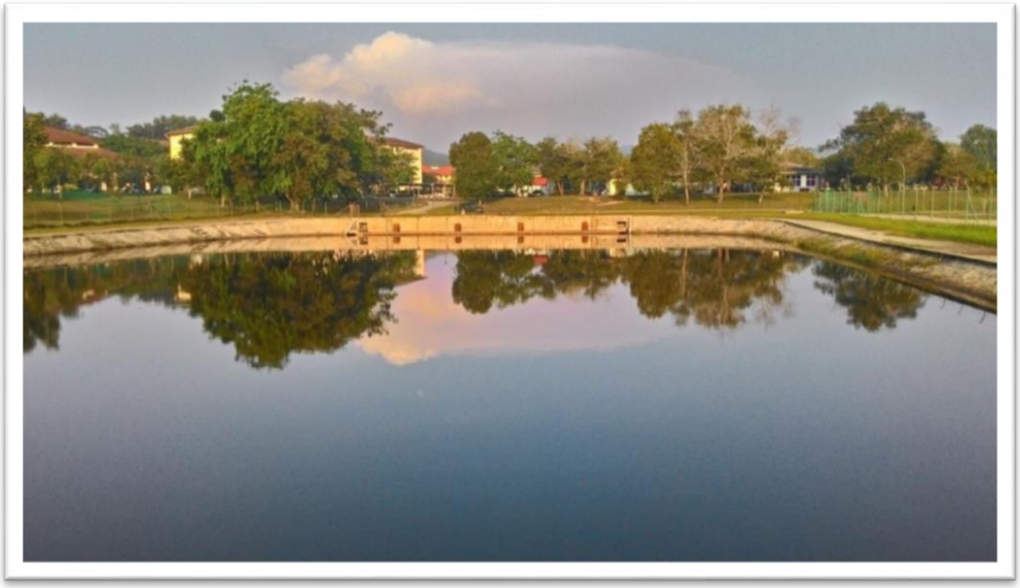


Figure 1 : UTP's Oxidation Pond

In 2002, Universiti Teknologi PETRONAS (UTP) are using combination of mechanical equipment like primary screen, pump station, grit and grease chamber, distribution chamber, anoxic tank, aeration tank and clarifier tank to make UTP Sewage Treatment Plant (STP). The treatment called Extended Aeration Activated Sludge System. This system is capable of processing Biochemical Oxygen Demand Day 5 ($BOD_{5)}$ to meet the standard A (20 mg/L BOD_5 and 50 mg/L Total Suspended Solids). UTP sewage Treatment Plant is located at the upstream of a water supply intake. Therefore, the plant has to meet standard A set by Environmental Quality Act 1974.

Pakar Management Technology Sdn Bhd originally designed the plant based on the hydraulic loading of 225 L/pe/d and organic loading of 55 L/pe/d. The design basis of the flow rate for this plant is about 5,175 m^3/d and 23,000 population equivalent (PE). However, only the phase one of the design that could cater 11,500 PE was built. In the phase one of the STP there are two aeration tanks and two clarifier tanks. Only one aeration tank is operating currently with two of the clarifier. Additional information, UTP STP was rectified once in 2007.

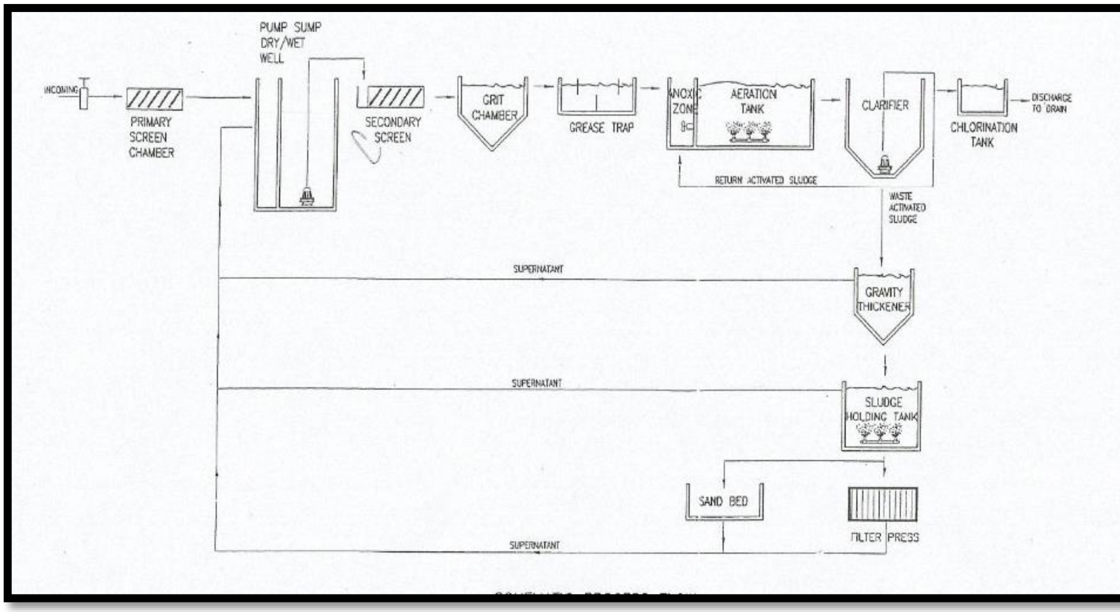


Figure 2 : Schematic process flow ot UTP STP

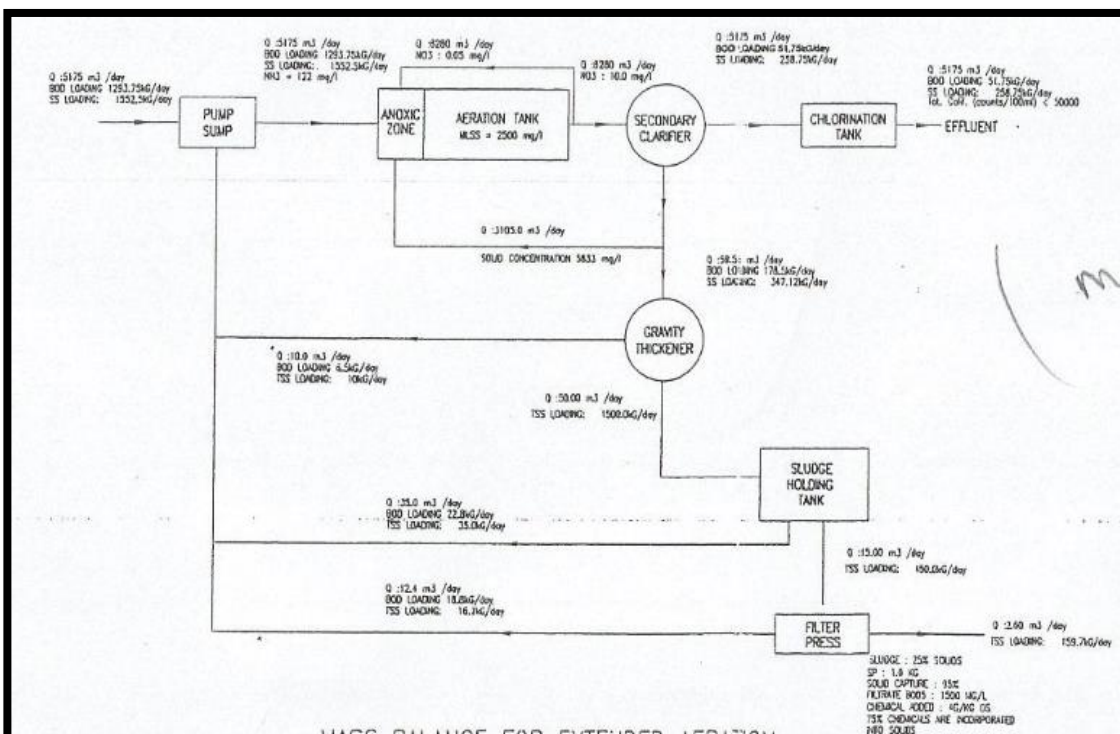


Figure 3 : Mass balance of UTP STP

Besides these two STP, UTP have another 3 STP in the campus. Two STP at Block B and Block C are not functioning. The STP is not operating due to very low flow rate coming from those blocks. The other STP is located at Duyung Block, Village 6. It use the Hi-Kleen system. Hi-Kleen is designed to cater small population. In this case, the Hi-Kleen is to cater about 250 PE of Village 6 residents. The operation of Hi- Kleen is exactly the same as extended aeration activated sludge system. It has screen chamber, aeration tank with air diffuser and secondary clarifier. At Duyung Hi-Kleen, at the flow of sewage is design to flow by gravity.

Figure 4 : Screen Chamber of Duyung's STP

Figure 5 : Biological treatment of Duyung's STP beneath the soil

Apparently, the contractor in charge for the operation and maintaining the sewage treatment plant is Tabah Enterprise and also to analyze the quality of the effluent discharge. The company will collect the sample of effluent from main STP of UTP by weekly basis and test the sample at qualified laboratory in Ipoh, Perak. The result then sends to the Department of Environment (DOE) of Perak. By referring to DOE requirement, a particular STP that caters more than 5000 PE is obligated to send the sample report by weekly. Since UTP is an institutional area, our STP has not required to be tested in term of Nitrogen and Phosphorus limits. The parameters that need to send are total suspended solids, BOD_5, COD and oil and grease.

Parameter	Unit	Standards	
		A	B
Temperature	C	40	40
pH Value	-	6.0-9.0	5.5-9.0
BOD5 at 20C	mg/l	20	50
COD	mg/l	50	100
Suspended Solids	mg/l	50	100
Mercury	mg/l	0.005	0.05
Cadmium	mg/l	0.01	0.02
Chromium, Hexavalent	mg/l	0.05	0.05
Arsenic	mg/l	0.05	0.10
Cyanide	mg/l	0.05	0.10
Lead	mg/l	0.10	0.5
Chromium, Trivalent	mg/l	0.20	1.0
Copper	mg/l	0.20	1.0
Manganese	mg/l	0.20	1.0
Nickel	mg/l	0.20	1.0
Tin	mg/l	0.20	1.0
Zinc	mg/l	1.0	1.0
Boron	mg/l	1.0	4.0
Iron (Fe)	mg/l	1.0	5.0
Phenol	mg/l	0.001	1.0
Free Chlorine	mg/l	1.0	2.0
Sulphide	mg/l	0.50	0.5
Oil and Grease	mg/l	Not Detectable	10.0

Table 1 : Effluent Discharge Standard in Malaysia (Source: IWK, 2015)

Parameter	Standard A (mg/L)	Standard B (mg/L)
Temperature (Celcius)	40	40
pH Value	6.0 - 9.0	5.5 - 9.0
Biological Oxygen Demand	20	50
Chemical Oxygen Demand	50	100
Suspended Solids	50	100
Ammoniacal Nitrogen	15	25

Table 2 : Effluent Discharge Limits for ammonia (Source: IWK, 2015)

1.2 PROBLEM STATEMENT

The operation of the sewage treatment plant has been years conducted by the contract company. Even, the effluent results are always meeting the standard but the operational of the plant could be enhanced. The manual set up for the operator is determined by observation estimation only.

The bar screening is being handle manually. Daily checking is to determine either the screen bar need to be cleaned or not. Second process is equalization tank. Here, the operator will check the condition of the pump sets, nuts and bolts. Then the sewage will pumped to secondary bar screening and grit trap chamber.

The grease trap chamber condition is doubtful. The consequent of not functioning grease trap causes the broken of recycle activated sludge (RAS) pump. The technician found those oil and lady sanitary pads are the reasons of the malfunction of the RAS pump. This indicates the problem is begun at the grease trap chamber.

Other than that, the operation of anoxic tank is taken for granted. The mixers in the tank are usually not be switched on by the operator. The water flow in the tank also experience short circuit. By theoretically, the anoxic tank needs to be fed with Alkalinity but our STP is failed to do so. The recycle pump is running with unknown flow rate. Thus, some improvements need to be done.

After anoxic tank, the sewage will go through aeration tank. The air diffusers in tank are just replaced. Two blowers are currently functioning well. The blowers operated automatically and alternately for every 2 hours. At the end of the aeration tank, there are two recycle pumps. These pumps will recycle sewage to the anoxic tank. It’s also operated automatically and alternately for every hour. Somehow, the flow rate of the pump for every pumping is unknown by the operator.

Moreover, the clarifiers are functioning in decent condition but the monitoring of RAS pumps are not proper. The RAS pump is opened manually during office hours. The operator usually opens the RAS when there is a lot of sludge floating in the clarifier. While after the office hour the RAS will run automatically every hour. Again the flow rate of the RAS is undefined. It was found out the process of wasting sludge is even improper. The operators only waste the sludge once a month.

In a nut shell, UTP STP size might be adequate to cater both organic and hydraulic load as it was design for higher population equivalent. This indicates the problems with UTP STP are mostly regarding the operational system. There is no operation manual for the operators.

1.3 OBJECTIVES

i. To evaluate the design of UTP sewage treatment plant using the present population equivalent.
ii. To evaluate the performance of each treatment units in the UTP sewage treatment plant.
iii. To develop the operation and maintenance of UTP sewage treatment plant to meet the required standards.

1.4 SCOPE OF STUDY

Universiti Teknologi PETRONAS (UTP) Sewage Treatment Plant (STP) is apparently experiencing the problems of improper maintaining operation. Thus, this study is to investigate the waste water characteristic such as Biochemical Oxygen Demand (BOD), Total Organic Carbon (TOC), Total Suspended Solids (TSS), Mixed Liquor Volatile Suspended Solids (MLVSS), Ammonia (NH_3), Nitrate (NO_3) and Phosphorus (P). Besides, I had also studied about the process of each treatment units and the challenges that usually happen.

CHAPTER 2

LITERATURE REVIEW

Biological processing is the ultimate way to remove organic matter from the wastewater. Decomposition, colloidal removal and dissolved organic substances from the solution are done by mixing the microbial culture. The activated sludge is supplied with sufficient oxygen to maintain an aerobic condition. Wastewater contains the biological food, inoculums of microorganism and growth nutrients (Grady Jr, Daigger, Love, & Filipe, 2012).

There are a few types of activated sludge systems that are commonly used. Package plants, oxidation ditch, deep shaft and lagoons are some type of activated sludge system. A package plant is often chosen to serve small communities or industrial plants. Hybrid treatment process is used to treat the income sewage (Fletcher, 2007). Package plants are designed and fabricated with dimensions that allow for their transportation to the job site in public highways. Length varies with capacity with larger plants being fabricated in pieces and welded on site. Steel is preferred over synthetic materials for its durability.

In some areas, where more land is available, oxidation ditches is another type of activated sludge to use. Sewage is treated in large round or oval ditches with one or more horizontal aerators typically called brush or disc aerators which drive the mixed liquor around the ditch and provide aeration. Oxidation ditches are installed commonly as 'fit & forget' technology, with typical design parameters of a hydraulic retention time of 24 – 48 hours, and a sludge age of 12 – 20 days. This compares with nitrifying activated sludge plants having a retention time of 8 hours, and a sludge age of 8 – 12 days (Hartley, 2008).

Deep shaft is a high technology of activated sludge system. According to Mazumder (2002) the land that is short in sewage may be treated by injection of oxygen into a pressured return sludge stream which is injected into the base of a deep columnar tank buried in the ground. Such shafts may be up to 100 meters deep and are filled with sewage liquor. As the sewage rises the oxygen forced into solution by the pressure at the base of the shaft breaks out as molecular oxygen providing a highly efficient source of oxygen for the activated sludge biota. The rising oxygen and injected return sludge provide the physical mechanism for mixing of the sewage and sludge. Mixed sludge and sewage is decanted at the surface and separated into supernatant and sludge components. The efficiency of deep shaft treatment can be high.

The most famous system during the 90's is aerated basin or lagoons. Most biological oxidation processes for treating industrial wastewaters have in common the use of oxygen (or air) and microbial action. Surface-aerated basins achieve 80 to 90% removal of BOD with retention times of 1 to 10 days. The basins may range in depth from 1.5 to 5.0 meters and utilize motor-driven aerators floating on the surface of the wastewater. In an aerated basin system, the aerators provide two functions. The transfer air into the basins required by the biological oxidation reactions, and the mixer is required for dispersing the air and for contacting the reactants (Grady Jr, 2012).

Other system of active sludge is extended aeration which is used in UTP. The wastewater in extended aeration commonly contains sufficient concentrations of Carbon, Nitrogen, Phosphorus and trace nutrients to allow the growth of microbial culture. The ratio of BOD to Nitrogen to Phosphorus of 100/5/1 should be adequate to support the aerobic treatment (Mook et al., 2012). Nevertheless, it is depend on the type of system and mode of operation. If the wastewater contains a huge volume of nutrient-deficient waste, additional Nitrogen as Anhydrous Ammonia (NH_3) or Ammonium Nitrate (NH_4NO_3) and Phosphate as Phosphoric Acid (H_3PO_4) are required.

In order to remove organic matter from municipal wastewaters, biological processing would be the most efficient way. These living systems rely upon mixed microbial cultures to decompose and remove colloidal and dissolved organic substances from the solution. The treatment chamber that holding the microorganism provides controlled the environment. For example, activated sludge is supplied with sufficient oxygen to maintain an aerobic condition. Wastewater contains the inoculums of microorganism, biological food and growth nutrients (Hammer, 2001).

To start the activated sludge in a mechanical or diffused air system, the aerators and feeding the wastewater need to be turned on. Initially a high rate of recirculation from the bottom of the final clarifier is necessary to retain sufficient biological culture. The most important factors affecting biological growth are oxygen supply, temperature, pH, and nutrients availability, presence of toxins and sunlight; in the case of photosynthetic plants. Bacteria are classified according to their optimum temperature range for growth. Mesophilic bacteria grow in a temperature of 10 to 40°C with an optimum of 37°C. Aeration tanks and trickling filters generally operate in the lower half of this range with wastewater temperatures of 20 to 25°C in warm climates. If cold well water serves as a water supply, wastewater temperature can be lower than 20°C (Hammer, 2001).

Diffused and mechanical aeration basin must supply sufficient air to maintain dissolved oxygen for the biota to use in metabolizing the waste organics. The rate of microbial activity is independent of the dissolved oxygen concentration above a minimum critical value below which the rate is reduced by the limitation of oxygen required for respiration. The exact minimum depends on the type of activated sludge process and the characteristics of the wastewater being treated (Gao, 2004).

Hydrogen ion concentrations have a direct influence on biological treatment system which operates best in a neutral environment. The general range of operation of aeration systems is between pH 6.5 and 8.5. Above this range microbial activity is inhibited and below pH6.5 fungi are favored over bacteria in the competition for metabolizing the waste organics. Normally the bicarbonate buffer capacity of a wastewater is sufficient to prevent acidity and reduced pH, while carbon dioxide production by the microorganisms tends to control the alkalinity of high pH wastewaters (Hammer, 2001).

In an activated sludge process, waste organics serve as food for the bacteria and the small population of fungi that might be present. Some of the bacteria die and lyse, releasing their contents which are resynthesized by other bacteria. Control of the microbial populations is crucial for efficient aerobic treatment. If wastewater were simply aerated, the liquid detention times would be intolerably long requiring time period of about five days at 29°C for 70 percent reduction. However, extraction of organic matter is possible within a few hours of aeration provided that a large number of microorganisms are mixed with wastewater. This is achieved by settling the microorganisms out of solution in a final clarifier and returning them to the aeration tank metabolize additional waste organics (Gao, 2004).

Activated sludge system treatment of nitrogenous matter or phosphate involves additional steps where the mixed liquor is left in anoxic condition (meaning that there is no residual dissolved oxygen). For the single sludge system, the denitrification process is controlled by the rate of nitrate recycle in the mixed liquor to the first anoxic zone. The primary operation that controls the performance of the separate stage system is the rate of alkalinity addition. Single sludge system does not require the use of external chemical, while the separate system stage involves the storage and handling of alkalinity.

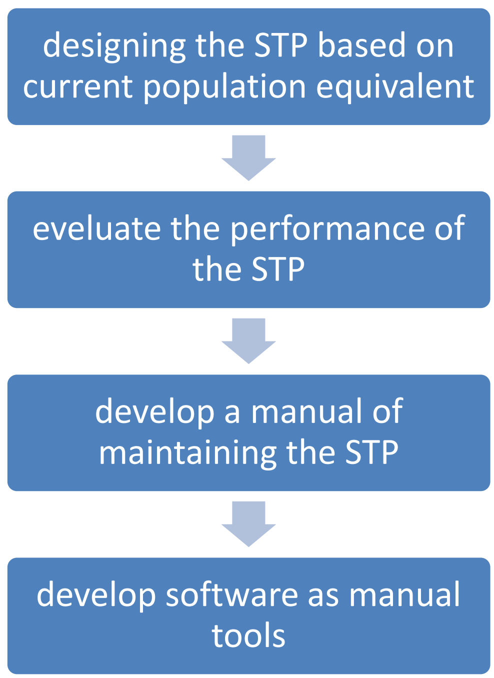
Nitrification is the oxidation of ammonium ion to nitrite ion (Lacasa, Cañizares, Sáez, Fernández, & Rodrigo, 2011). In aeration tank the bacteria obtain energy during the oxidation of ammonium ions and release nitrite ions. Nitrification is the biological conversation of ammonium to nitrate nitrogen under two step of process. Ammonia and ammonium are converted by the bacteria known as Nitrosomonas to nitrite. Then, Nitrite is converted to nitrate by the bacteria called Nitrobacter. As the reactions to the nitrate form are rapidly happen, the nitrite level at any time are usually low (Lacasa et al., 2011).

Lastly, proper sampling techniques are vital for accurate testing in evaluation studies. A composite sample is a mixture of individual proportion according to the wastewater flow pattern. A representative sample is then integrated by mixture together portions of individual samples relative to flow rates at sampling times. Weekdays sample will be collected over 24-hour period. Integrated samples during the period of peak flow usually 8 to 12 hours depending on influent variations allow determination of maximum loading on treatment units.

CHAPTER 3

METHODOLOGY

This project required a few works to be done before the objective could be achieved. The flow chart below, explain in the simplest way of completing this project.



3.1 PRECAST DESIGN

The design will be done based on Metcalf & Eddy, Wastewater Engineering, Treatment and Reuse, 2014, Fifth Edition, McGraw Hill. The result is attached in appendices.

3.2 THE MEASUREMENT OF PARAMETERS

The method to collect the sample use is composite sampling. The samples will be taken 24 hours in weekday and weekend at the influent and effluent of the treatment plant. All the samples will be tested for all the parameters discussed.

The primary parameter to be tested is biochemical oxygen demand (BOD). The amount of oxygen needed for the bacteria for degrade the organic matter in the wastewater can be determined by this test. Sufficient aerated distilled water need to prepared by aerate it for at least 24 hours. The sample of BOD then placed in the BOD bottle. The bottle is then filled with saturated oxygen distilled water and nutrients required for biological growth. Common volume of BOD bottle is 300mL. Prepared 3 BOD bottle for each sample for achieve more accurate result. The initial dissolved oxygen (DO) of the sample then measured and recorded before it is incubated for 5 days at 20°C. At day 5, DO is measured again. BOD then calculated by using below formula:

$$BOD = \frac{(intial\ DO - Final\ DO) - Blank\ Correction}{Volume\ of\ the\ sample/300ml}$$

Total suspended solids (TSS) test is to determine the weight of suspended solids existed in samples. Aluminum foils for the filtration paper is weighted and recorded. Then, 50ml of influent sample and 200 ml of effluent sample for a particular hour are filtered by using the filter unit. Three samples are used for every hour to get a precise result. The aluminum foils and filter paper then dried in the oven for 20 minutes. The weights are recorded.

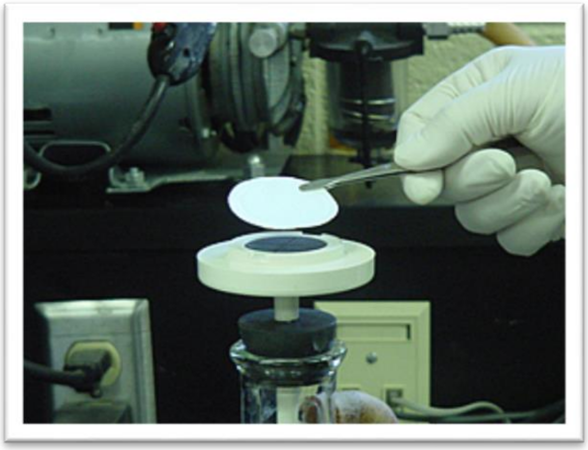


Figure 6 : Filter Unit

The processes are repeated for every other hour of sample. The result is recorded in form of table, refer table 2. TSS then is calculated by using this formula:

$$TSS = \frac{B - A}{volume\ of\ sample}$$

- A = Initial weight of aluminum foil + filter paper
- B = Final weight of aluminum foil + filter paper + residue

Mixed Liquor Volatile Suspended Solid (MLVSS) is to be determined for aeration tank, anoxic tank and clarifier. First, the sample needs to undergo dilution. Then, the method and procedure is the same as in TSS with the volume of sample used 50mL. But with addition of last step of dried the sample in furnace for an hour in 550°C. Be caution that in MLVSS experiment, the type of filter used are differences to sustain the heat of 550°C. The table and the formula are shown below.

$$MLVSS = \frac{B - A}{volume\ of\ sample} \times dilution\ factor$$

- A = Initial weight of aluminum foil + filter paper
- B = Final weight of aluminum foil + filter paper + residue

In order to determine the amount of Ammonia in the wastewater is by using the Nessler Method. The instruction is referred from the HACH Water Analysis handbook. The sample is transferred into a cuvette with the additional of mineral stabilizer solution. A spectrophotometer is used to read the concentration of ammonia of the sample. The spectrophotometer must first being zerolize by using the blank sample.

Next, the analysis for Nitrate is based on the cadmium reduction Method. Again this method is using the Water Analysis handbook on method 8039 as reference. The sample is poured into the cuvette with Nitra Ver5 with direct shake for 1 minute before it to be reacted for 5 minutes. A zerolized spectrophotometer is used again to read the concentration Nitrite that converted from Nitrate during the reaction with cadmium particles.

Last perimeter to be measure is total Phosphorus. The analysis of Phosphorus is based on Method 8190 from the Water Analysis handbooks, which is the PhosVer3 with Acid Persulfate digestion Method. The sample must be diluted so that a valid measurement can be obtain. This is due to the workable range only falls within a few mg/L. Phosphates present in the sample must be converted to a reactive orthophosphate by heating the sample with acid persulfate.

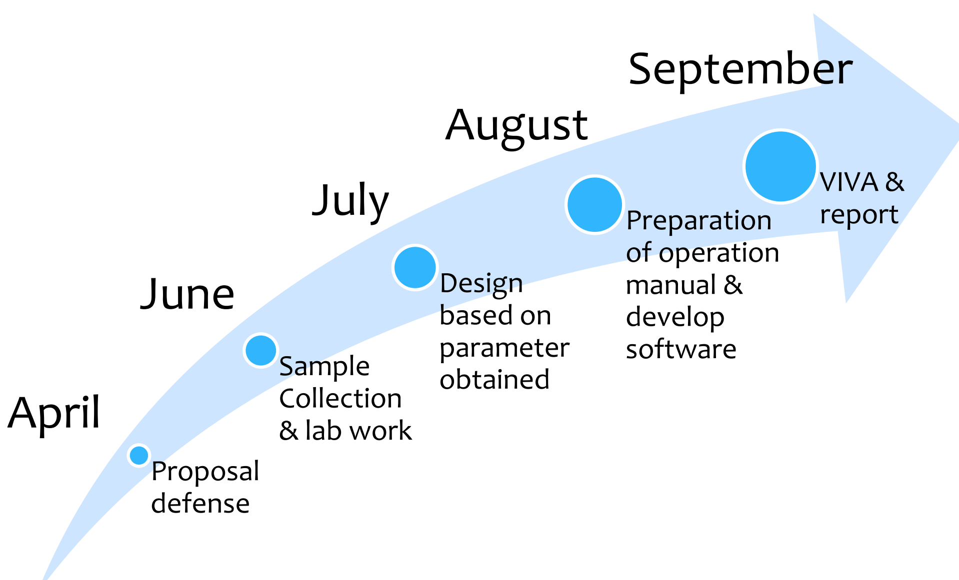
3.3 OPERATION MANUAL

The manual will be prepared after the designing work is been done based on results of perimeters. After a thorough calculation work, the result of design will be compared to the precast design. Analysis will be done based of the size and biological requirement. For example, biological requirement in anoxic tank is the carbon source. The requirement and supplied carbon source are to be analyzed. Aeration unit, clarifier unit and grease trap unit will undergo the same method but difference problem to be analyzed.

3.4 GANT CHART

Activities	April 2015	May 2015	June 2015	July 2015	Aug 2015	Sept 2015
Proposal submission						
Pre-design						
Sample collection and experiment						
Design						
Preparation of Manual						
Develop software						
Writing report						

3.5 KEY MILESTONE



CHAPTER 4

RESULT AND DISCUSSION

4.1 POPULATION EQUIVALENT

Population equivalent (PE) is not a measure of population in a particular area. PE is the number of persons required to contribute an equivalent quantity of wastewater related to the quantity of flow and strength of Biochemical Oxygen Demand, commonly expressed in terms of BOD5. The average daily design flow is based on the assumption that a person generates 225 liters of wastewater contain 55 gram per liter organic load per day. For this design of sewerage systems, Malaysian Standard Code of Practice. For MS1228:1991 is used.

Type of Establishment	**Population Equivalent**
School / Educational Institutions : **- Day schools / Institutions** **- Fully residential** **- Partial residential**	 **0.2 per student** **1 per student** **0.2 per non-residential student** **1 per residential student**

The optimum population in UTP is 8000 students and 800 stuffs in a particular semester. In determining the current PE of UTP, base of the MS1228, a student is equal to 1 PE however the stuff could be assumed as non-resident person. Thus, staff is equal to 0.2 PE.

$$UTP'S\ PE = (8000\ \times 1) + (800\ \times 0.2) = 8160\ PE$$

4.2 PRECAST DESIGN

The initial design base on the Malaysia standard parameter will be done. This will give a prediction of the current feasibility of UTP sewage treatment plant. Most of the parameter will be taken from the department of environment of Malaysia. The parameters of activated sludge processes are form Table 8-19 (Metcalf & Eddy, 2014).

Component	Concentration, mg/L[a]
COD	508
sCOD	177
BOD	200
TSS	195
VSS	150
TKN	35
NH_4-N	20
NO_3-N	0
Total phosphorus	5.6
Alkalinity	200 (as $CaCO_3$)

Table 3 : Typical domestic wastewater characterization parameters and typical values (Table 8-1 from Metcalf & Eddy, 2014)

Coefficient	Unit	COD oxidation[a]	NH_4 oxidation[b]	NO_2 oxidation[b]
μ_{max}	g VSS/g VSS·d	6.0	0.90	1.0
K_s, K_{NH_4}, K_{NO_2}	mg/L	8.0	0.50	0.20
Y	g VSS/g substrate oxidized	0.45	0.15	0.05
b	g VSS/g VSS·d	0.12	0.17	0.17
f_d	unitless	0.15	0.15	0.15
K_{o_2}	mg/L	0.20	0.50	0.90
θ Value				
μ_{max}	unitless	1.07	1.072	1.063
b	unitless	1.04	1.029	1.029
K_s, K_{NH4}, K_{NO2}	unitless	1.0	1.0	1.0

Table 4 : Activated sludge design kinetic coefficients for BOD removal and nitrification (Table 8-14 from Metcalf & Eddy, 2014)

Hydraulic loading = 8160 × 225 L/d = 1,836,000L/d = 1,836 m^3/d × 1d/ 24hr = 76.5 m^3/hr

Organic loading = 55g / 225 L = 0.2444 g/L = 244.4 mg/L or g/m^3

Wastewater Characteristic

Constituent	Concentration	
BOD	**225**	**g/m3**
sBOD	**113**	**g/m3**
COD	**508**	**g/m3**
sCOD	**177**	**g/m3**
rbCOD	**129**	**g/m3**
TSS	**195**	**g/m3**
VSS	**150**	**g/m3**
TKN	**35**	**g/m3**
NH4-N	**20**	**g/m3**
TP	**6**	**g/m3**
Alkalinity	**200**	**g/m3**
bCOD/BOD ratio	**1.6**	**g/m3**

Q	**1836**	**m3/d**
Y	**0.4**	**gVSS/gbCOD**
So	**360**	**bCOD/m3**
Ks	**20**	**g/m3**
SRT	**20**	**Day**
fd	**0.15**	
Xtss	**3000**	**g/m3**

N	**0.5**	**g/m3**
DO	**2**	**g/m3**
Ko	**0.5**	**g/m3**
Yn	**0.15**	**gVSS/gNH4-N**

T	**28**	**ºC**

BOD REMOVAL

Develop the wastewater characteristics needed for design

a. bCOD

bCOD = 1.6(BOD)

360 g/m3

b. nbCOD

nbCOD = COD - bCOD

148 g/m3

c. sCOD effluent

sCODe = sCOD - 1.6sBOD

-3.8 g/m3

d. nbVSS

bpCOD/pCOD = (1.6(BOD-sBOD)/(COD-sCOD))

0.54

nbVSS = (1 - bpCOD/pCOD)VSS

68.79 g/m3

e. iTSS

iTSS = TSS - VSS

45 g/m3

Design suspended growth system for BOD removal only

a. S

μm,t = μmθ^(T-20)

10.31 g/g.d

kd,t = k20θ^(T-20)

0.1642 g/g.d

S = (Ks(1+(kd)SRT)) / (SRT(μm-kd)-1)

0.4244 g bCOD/m3

b. Pxvss

Pxvss = (QY(So-S) / (1+(kd)SRT) + ((fd)(kd)QY(So-S0)SRT) / (1+(kd)SRT)

91.9992242 kg VSS/d

Determine the mass of VSS and TSS in the aeration basin

a. Px,vss

218.3005 kg/d

Px,tss

183.8775814 kg/d

b. MLVSS

4366.009862 kg

MLSS

3677.551629 kg

Select design MLSS and determine the aeration tank volume and detention time

a. V = MLSS*10^3/Xtss

1225.851 m3

b. detention time

T=V/Q

16.02419 h

c. MLVSS

Fraction VSS

1.187206

MLVSS

3561.617 g/m3

Determine F/M and BOD volumetric loading

a. F/M= QSo/XV

0.094617 kg/kg.d

b. BOD Loading

0.336991 kg/m3.d

Determine the observed yield on TSS and VSS

a. Observed yield based on TSS

bCOD removed = Q(So-S)

660180.748 **kg/day**

Yobs ,tss

0.00044564 **g TSS/g BOD**

b. Observed yield based on VSS

Yobs,vss

0.00053 **g VSS/ g BOD**

BOD REMOVAL AND NITRIFICATION

Determine the specific growth rate, µn

a. µn,m at T=28c

1.288639635 **g/g.d**

b. Kn at T=28

1.118558466 **g/m3**

c. kdn at T=28

0.109485524 **g/g.d**

d. µn = ((µnm*N)/(Kn+N))((DO)/(Ko+DO))-kdn

0.208980484 **g/g.d**

Determine the theoretical and design SRT

a. Theoretical SRT = 1/μn

4.78513581 d

b. Design SRT = FS*theoretical SRT

FS = TKN peak / TKN average

1.5

Design SRT

7.17770372 d

Determine biomass production

a. S

0.606759346 g bCOD/m3

Assume NOx=0.8TKN

28 g/m3

b.
Px,bio

146.8779834 kg VSS/d

Determine the amount of nitrogen oxidized to nitrate

a. NOx = TKN - Ne - 0.12Px,bio / Q

24.9001318 g/m3

Determine the concentration and mass of VSS and TSS

Mass=Px(SRT)

a.

i. Px,vxx

	273.17925	**kg/d**
	273179.25	**g/d**

ii. Px,tss

	381.7189	**kg/d**
	381718.9	**g/d**

b.

i. MLVSS

	1960.7997	**kg**
	1960799.7	**g**

ii. XtssV=Px,tssSRT

	2739.8651	**kg**
	2739865.1	**g**

Determine the aeration tank volume and detention time

a. Volume

V

	913.2884	**m3**
	913288.4	**L**

b. Detention time

T=V/Q

	11.93841	**h**

c.

MLVSS

	2146.967	**g/m3**

Determine F/M and BOD volumetric loading

a. F/M

0.210679 g/g.d

b. BOD loading

Lorg = Qso/V

0.452322 kg/m3.d

Determine observed yield

bCOD removed = Q(So-S)

659845.9898 kg/d

a. Observed yield based on TSS

Yobs,tss

0.00093 gTSS/gBOD

b. Observed yield based on VSS

Yobs,vss

0.001098872 gVSS/gBOD

ANOXIC TANK

Design Condition		
Nitrification in RAS	6	g/m3
RAS Ratio	0.6	

Determine the active biomass concentration

Xb = ((Q*SRT)/V)((Y(So-S))/(1+(kd)SRT))

953.6719069 g/m3

Determine the IR ratio

IR = Nox/Ne - 1 - R

2.550021968

Determine the amount of NO3-N fed

Flowrate to anoxic tank = IR Q + RQ

5783.440333 m3/d

NOx feed

34700.64 g/d

Determine the anoxic volume

Assume detention time

1.2 h

T

0.05 d

Vnox = T * Q

91.8 m3

Determine the F/Mb ratio

4.71860392 g/g.d

Determine the SDNR

rbCOD = rbCOD/bCOD

0.358333

Figure 8-23 (metcalf)

SDNR

0.38 g/g.d

Temperature Correctiom

SDNR28

0.466619 g/g.d

Determine the amount of NOx remove

Nor = Vnox*SDR*MLVSS

40851.13746 g/d

Ratio **1.177244428**

accepable

SDNR(MLSS)=0.25(Xb/Xt)

0.079472659 g/g.d

CLARIFIER

Determine R
assumed Xr=8000g/m3
R=X/Xr-X
0.6

Determine the size of clarifier
assumed average flow rate=24 m3/m2.d
Area=Q/average flow rate for the clarifier = 76.5 m2

The results from precast design are as follow:

TREATMENT UNIT	SIZE	
	VOLUME (m3)	AREA(m2)
AERATION	913.3	-
ANOXIC	91.8	-
CLARIFIER	-	76.5

Table 5 : Precast dimension of UTP STP

The actual dimension from original design (drawing attach at the appendices):

TREATMENT UNIT	SIZE	
	VOLUME (m3)	AREA(m2)
AERATION	972	-
ANOXIC	54	-
CLARIFIER	-	145.27

Table 6 : Actual dimension of UTP STP

The precast design shows that the existing aeration tank and clarifier are adequate to cater current organic loading and hydraulic loading. However, two clarifiers are apparently operating. This show that the problem is actually comes from improper operation system. In anoxic unit, UTP STP needs bigger size of tank. Insufficient size of anoxic tank might be the cause of two clarifiers in operation. Denitrification happens in the clarifier due to insufficient size of anoxic tank. To see actual drawing of treatment units, refer Appendix page 115.

4.3 BIOCHEMICAL OXYGEN DEMAND (BOD)

There are twelve experiments were conducted on biochemical oxygen demand (BOD). Six experiments are for influent and another six for effluent. While three of the influent and effluent were sampled during weekday and another were on the weekend.

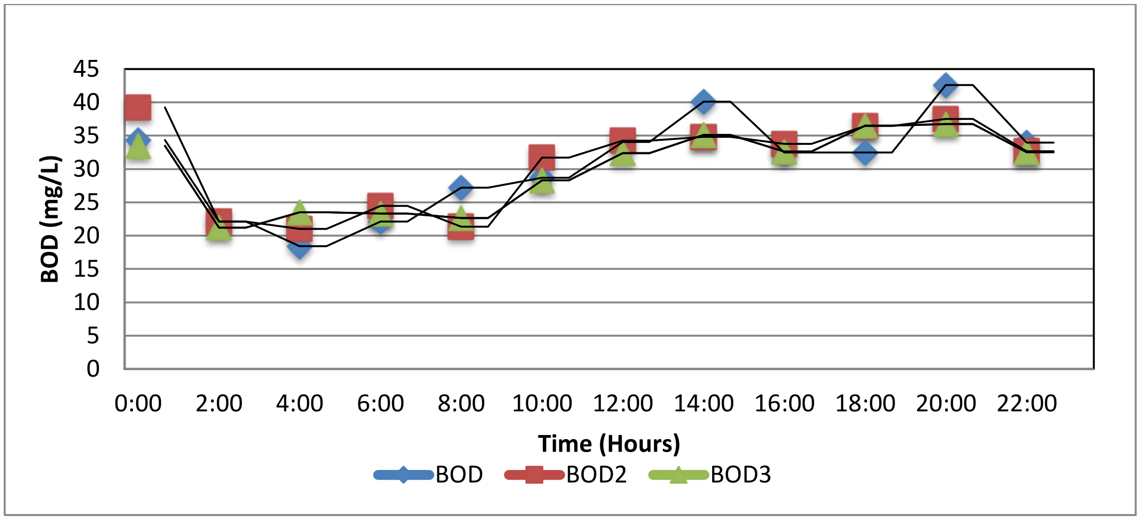


Figure 7 : BOD Weekend (Influent)

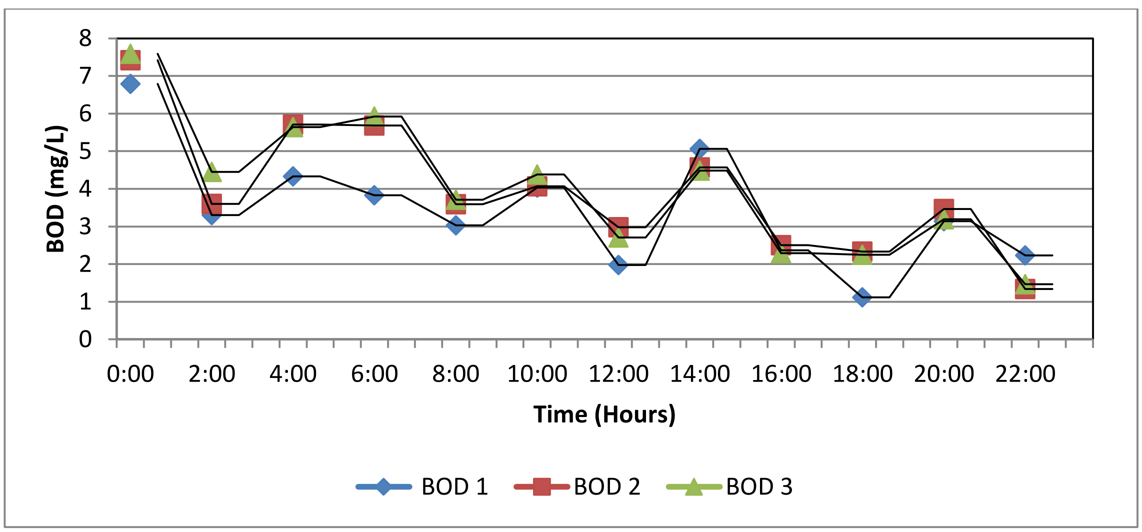


Figure 8 : BOD Weekend (Effluent)

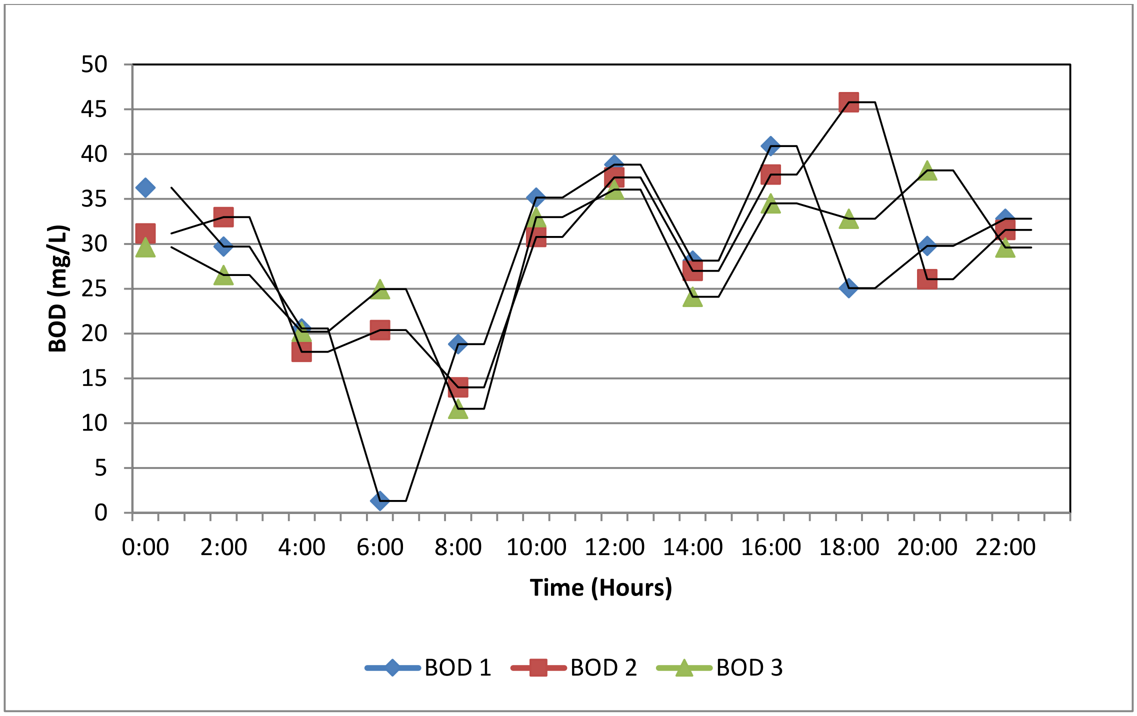


Figure 9 : BOD Weekday (Influent)

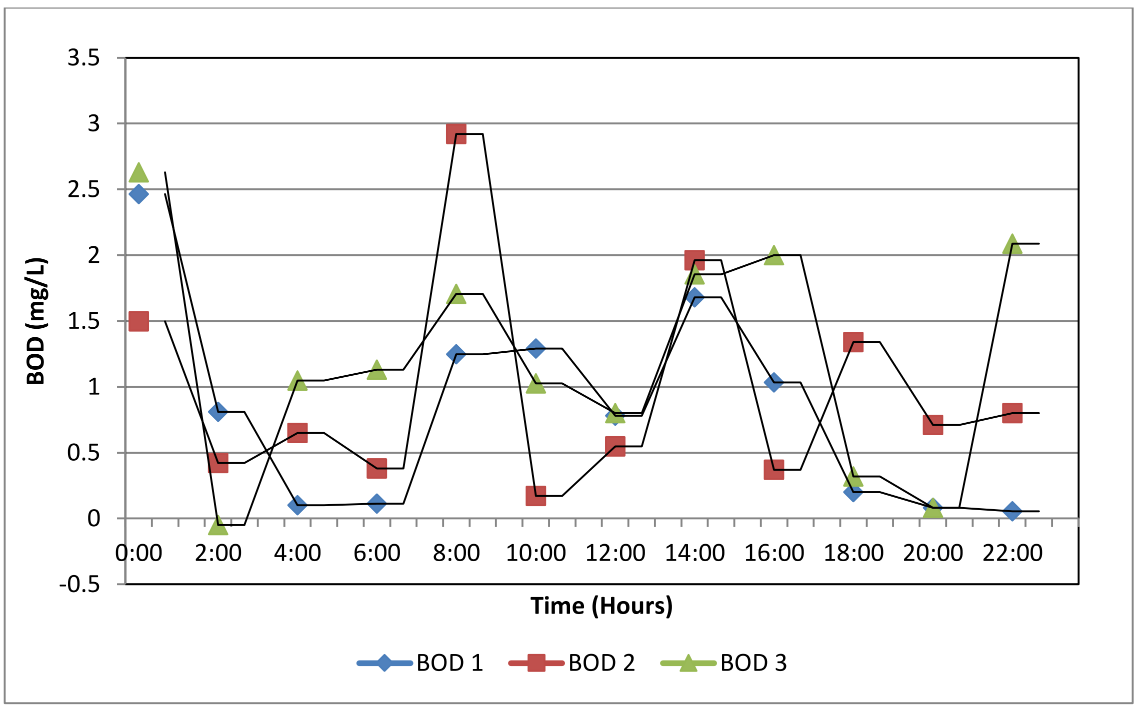


Figure 10 : BOD Weekday (Effluent)

Table 7 : BOD for a single particular experiment

	Influent (mg/L)		Effluent (mg/L)	
	Avg weekly	Avg all	Avg weekly	Avg all
Weekend 1	30.72	29.55	3.81	3.306667
Weekend 2	30.78		4.17	
Weekend 3	29.87		4.24	
Weekday 1	28.11		2.46	
Weekday 2	29.39		2.92	
Weekday 3	28.43		2.24	

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to Appendix page 72 -85.

4.4 TOTAL SUSPENDED SOLID

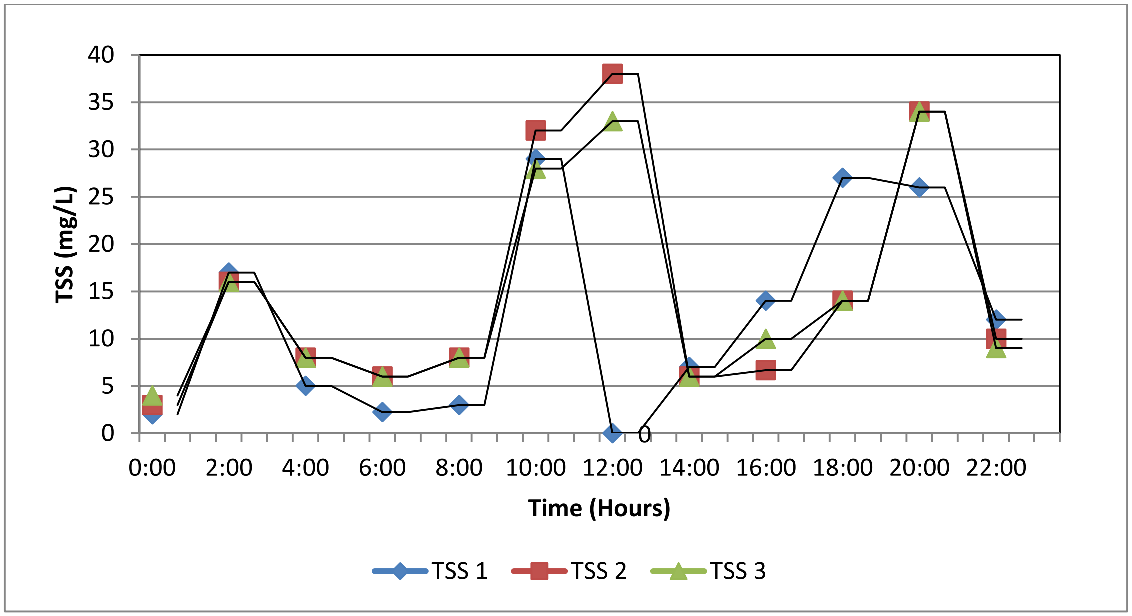


Figure 11 : Total Suspended Solid Weekend (Influent)

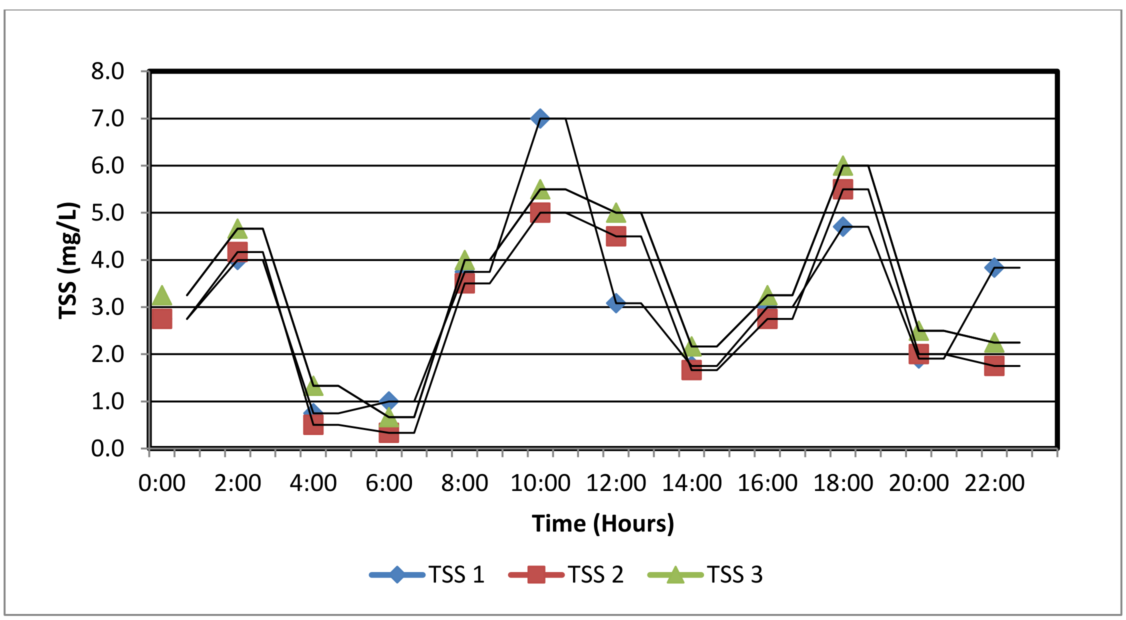


Figure 12 : Total Suspended Solid Weekend (Effluent)

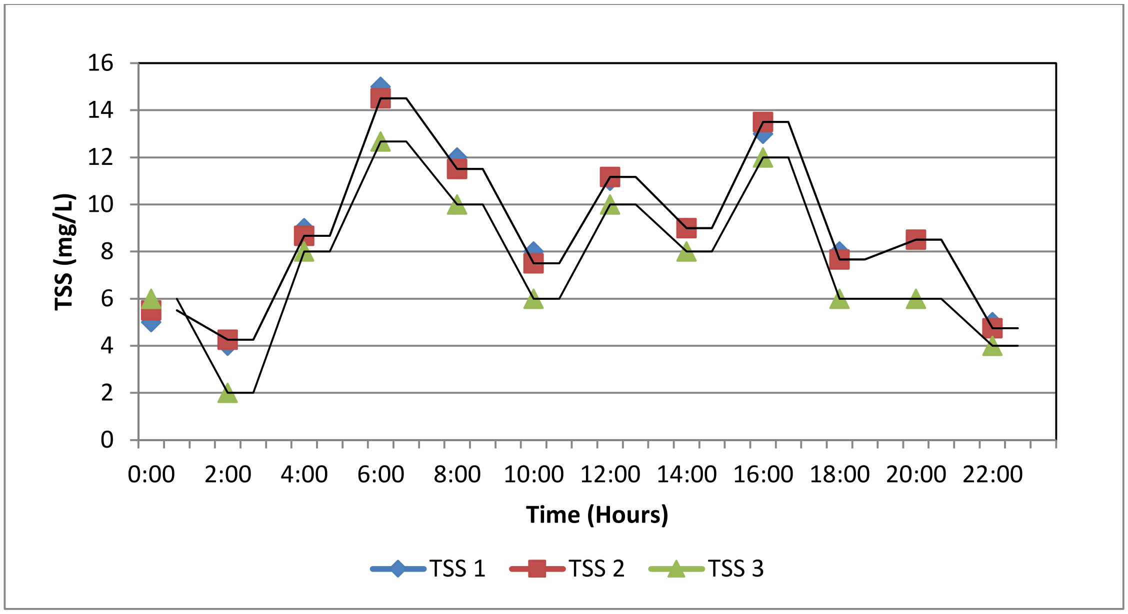


Figure 13 : Total Suspended Solid Weekday (Influent)

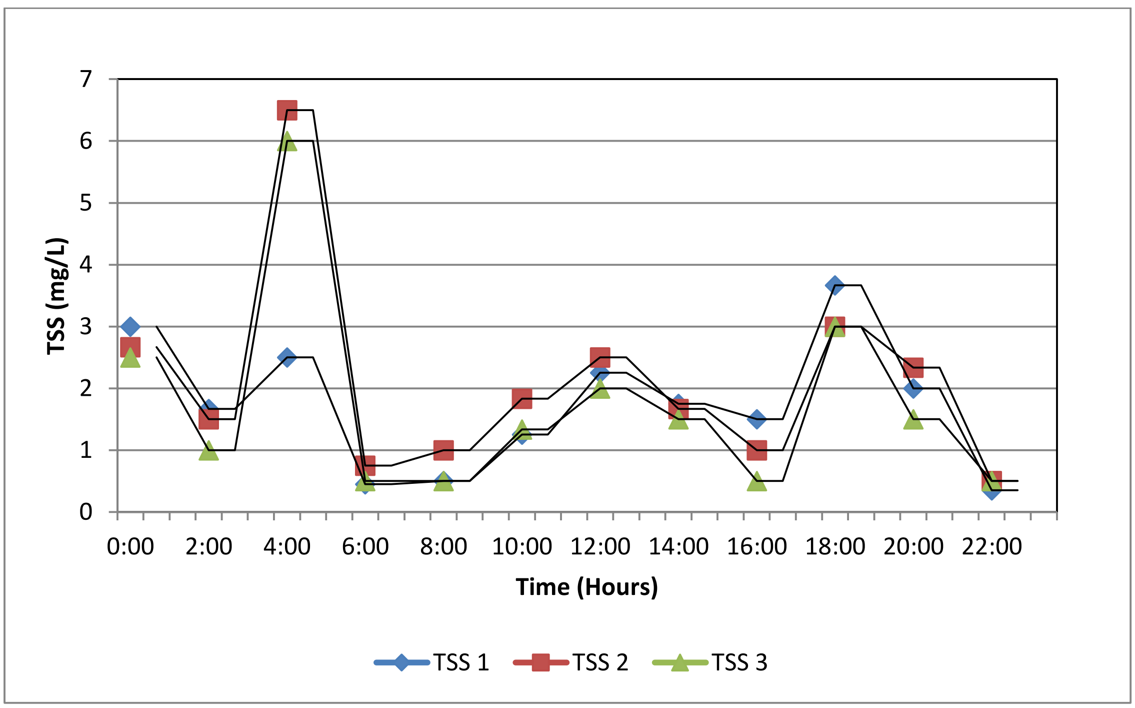


Figure 14 : Total Suspended Solid Weekday (Effluent)

Table 8 : TSS Summary

	Influent (mg/L)		Effluent (mg/L)	
	Avg weekly	Avg all	Avg weekly	Avg all
Weekend 1	12.02	11.21	3.1	2.50
Weekend 2	15.14		2.9	
Weekend 3	14.67		3.4	
Weekday 1	8.96		1.74	
Weekday 2	8.88		2.1	
Weekday 3	7.56		1.74	

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to appendix page 97-108.

4.5 NITRATE

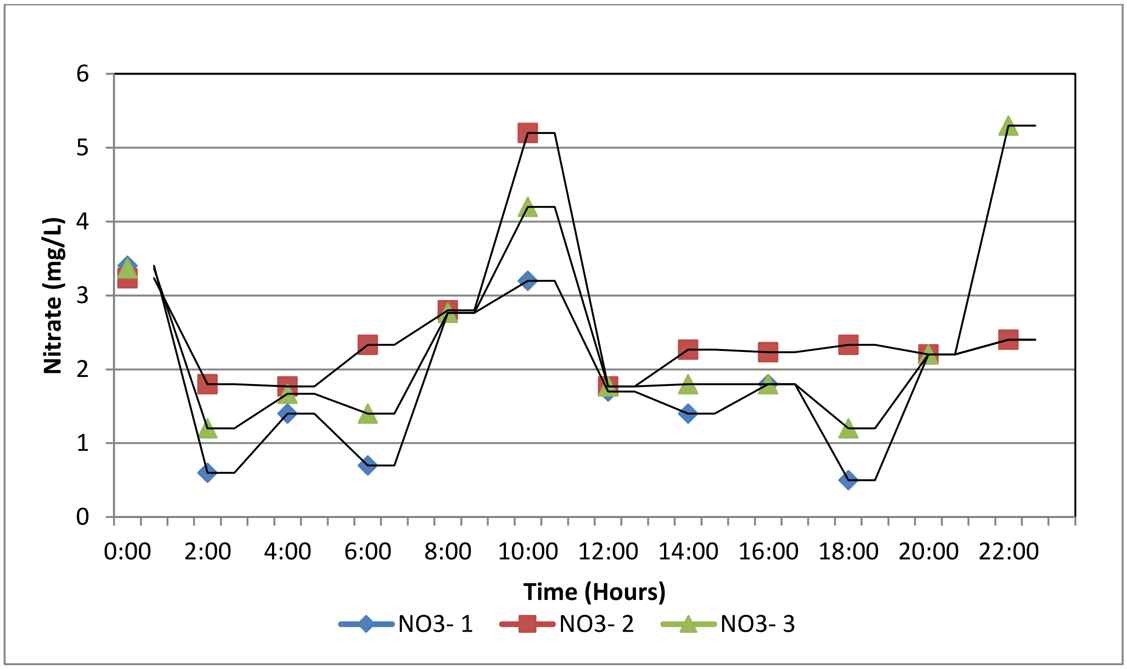


Figure 15: Nitrate Weekend (Influent)

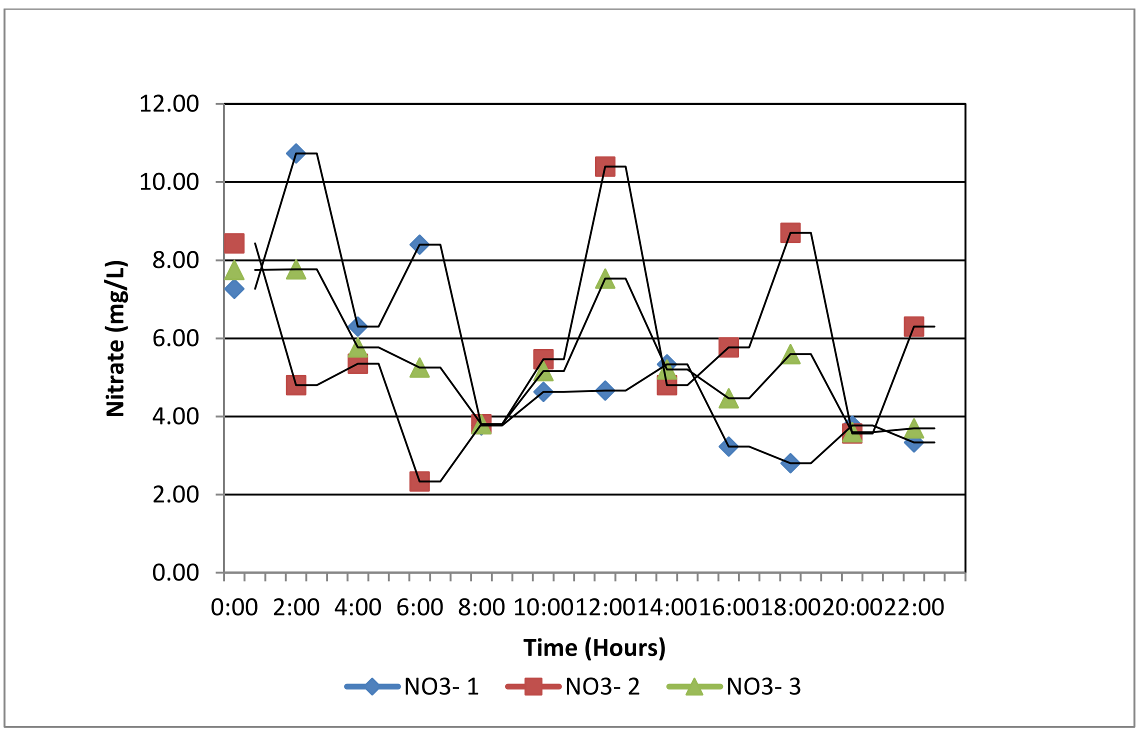


Figure 16 : Nitrate Weekend (Effluent)

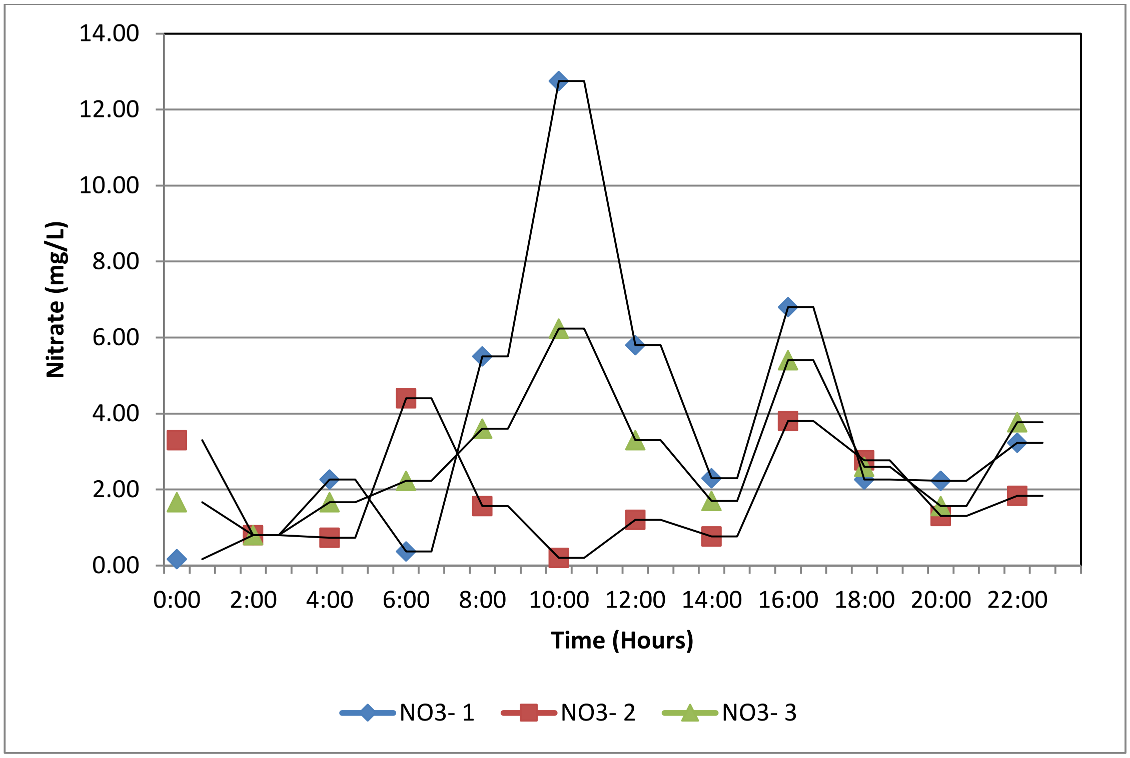


Figure 17 : Nitrate Weekday (Influent)

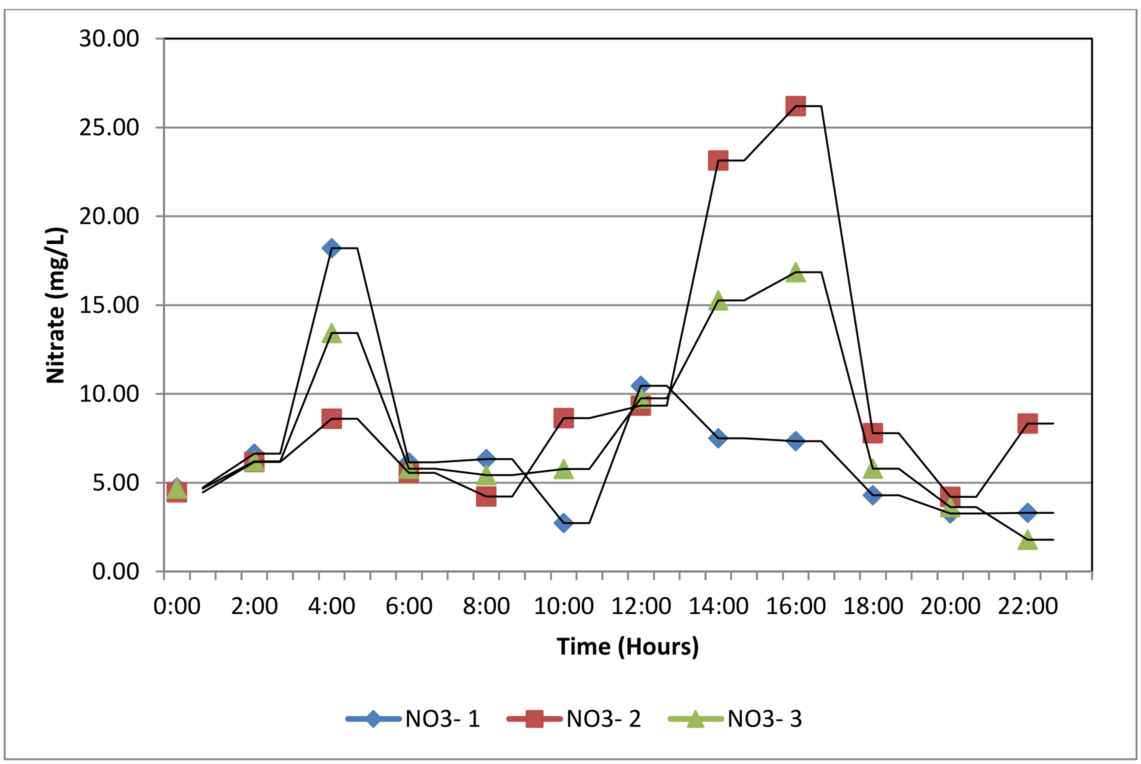


Figure 18 : Nitrate Weekday (Effluent)

Table 9 : Nitrate Summary

	Influent (mg/L)		Effluent (mg/L)	
	Avg weekly	Avg all	Avg weekly	Avg all
Weekend 1	1.84	2.54	5.35	6.83
Weekend 2	2.53		5.81	
Weekend 3	2.39		5.47	
Weekday 1	3.71		6.75	
Weekday 2	1.89		9.72	
Weekday 3	2.88		7.87	

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to appendix page 86 -97.

4.6 AMMONIA

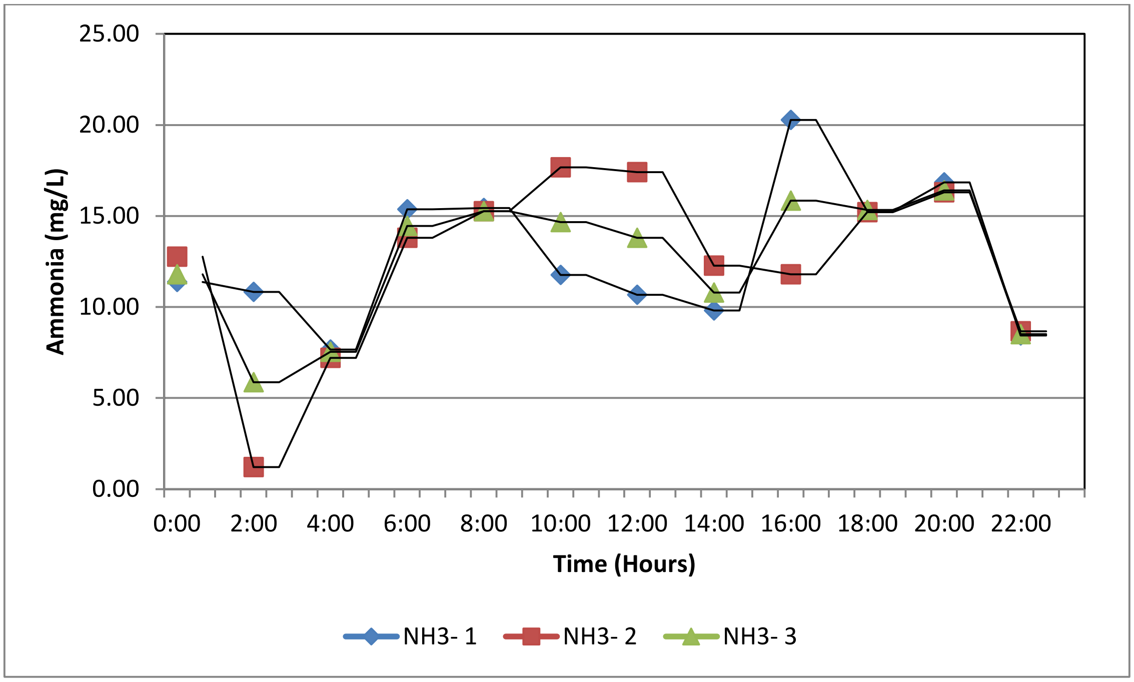


Figure 19 : Ammonia Weekend (Influent)

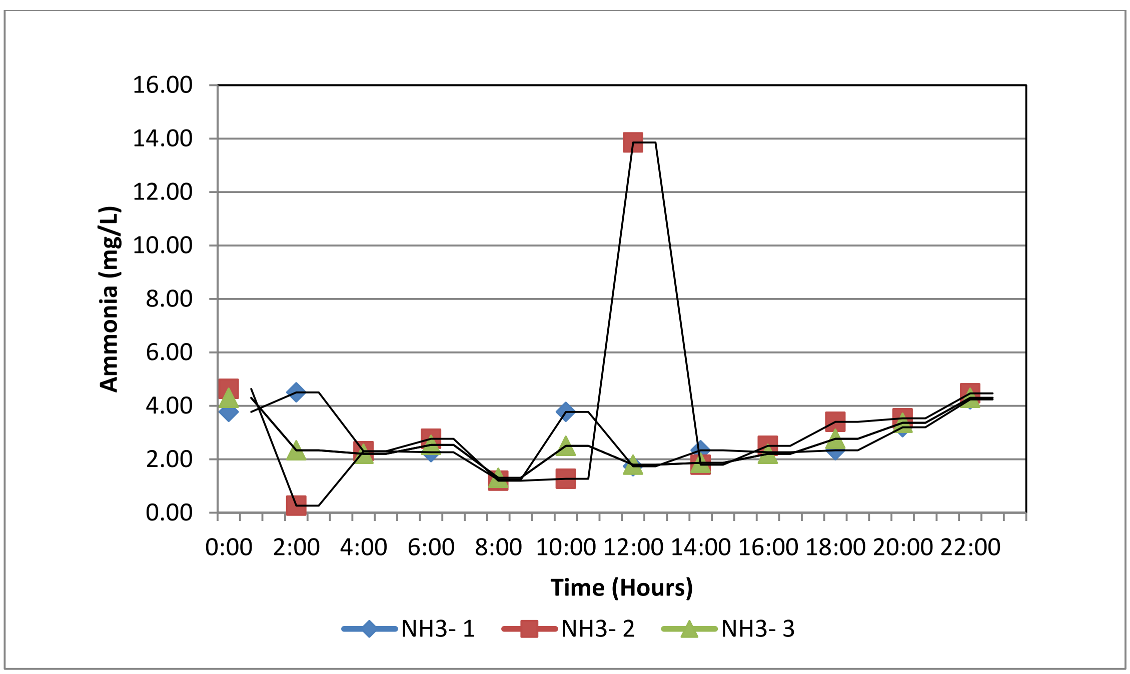


Figure 20 : Ammonia Weekend (Effluent)

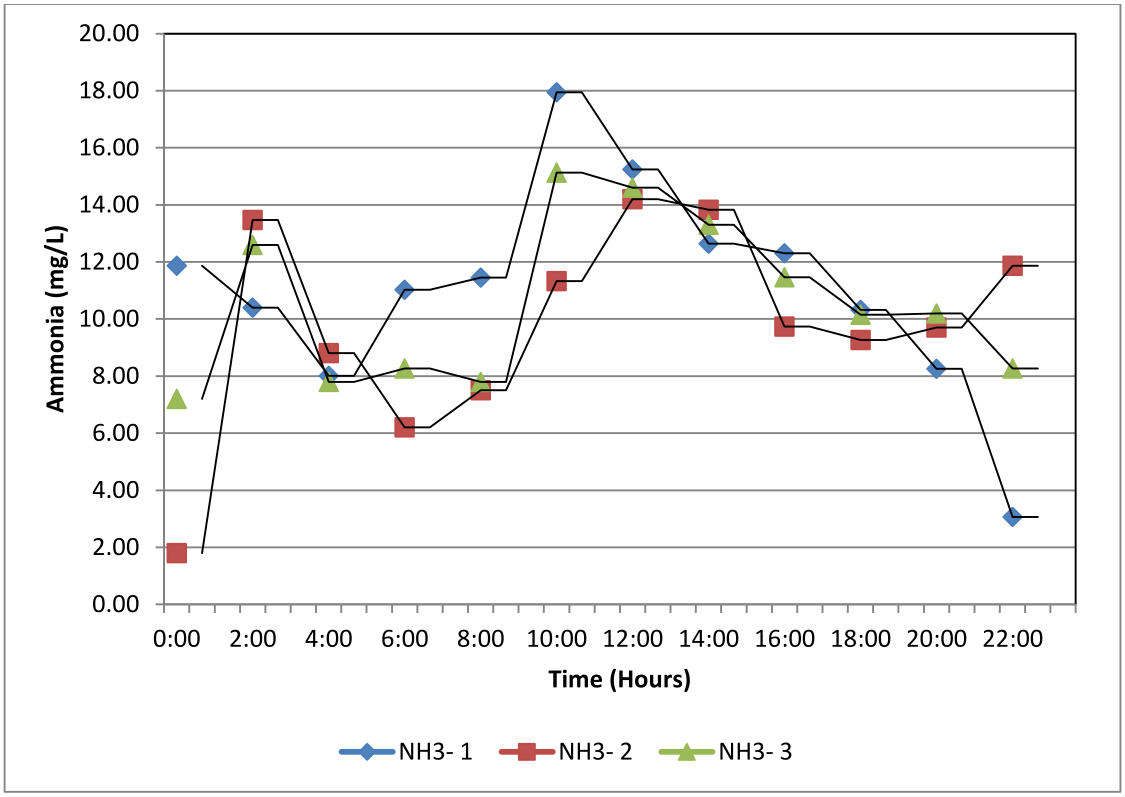


Figure 21 : Ammonia Weekday (Influent)

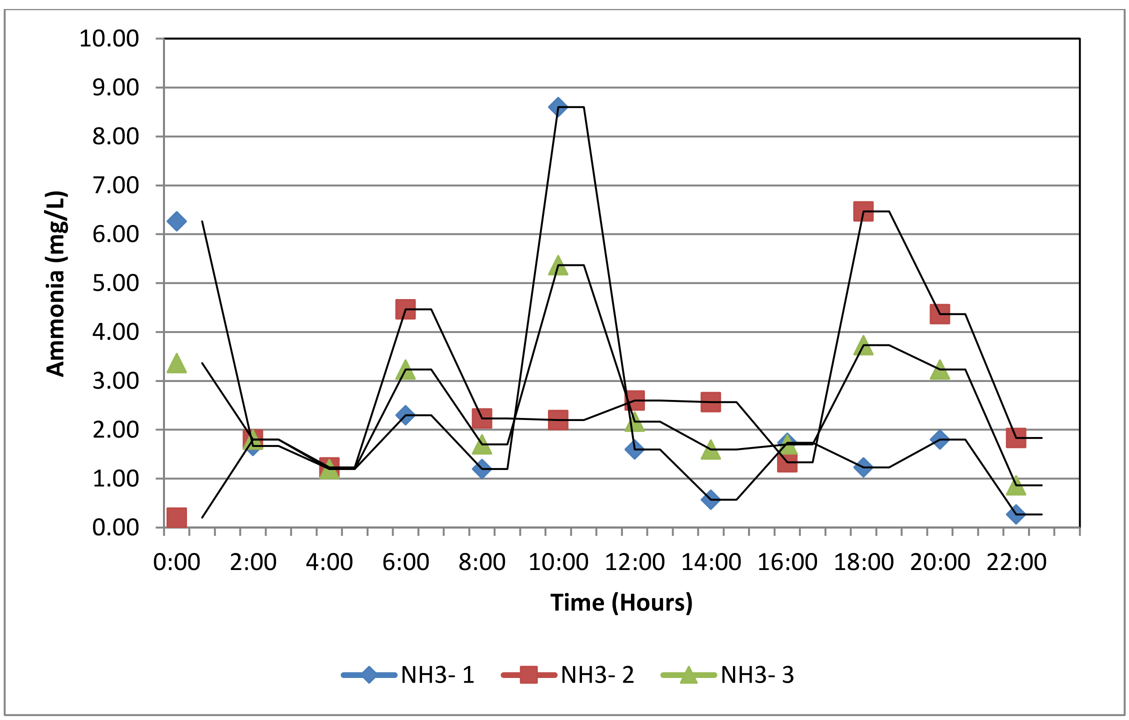


Figure 22 : Ammonia Weekday (Effluent)

Table 10 : Ammonia Summary

	Influent (mg/L)		Effluent (mg/L)	
	Avg weekly	Avg all	Avg weekly	Avg all
Weekend 1	12.81	11.54	2.83	2.74
Weekend 2	12.46		3.5	
Weekend 3	12.52		2.62	
Weekday 1	11.04		2.37	
Weekday 2	9.81		2.61	
Weekday 3	10.57		2.5	

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to appendix page 86 -97.

4.7 PHOSPHORUS

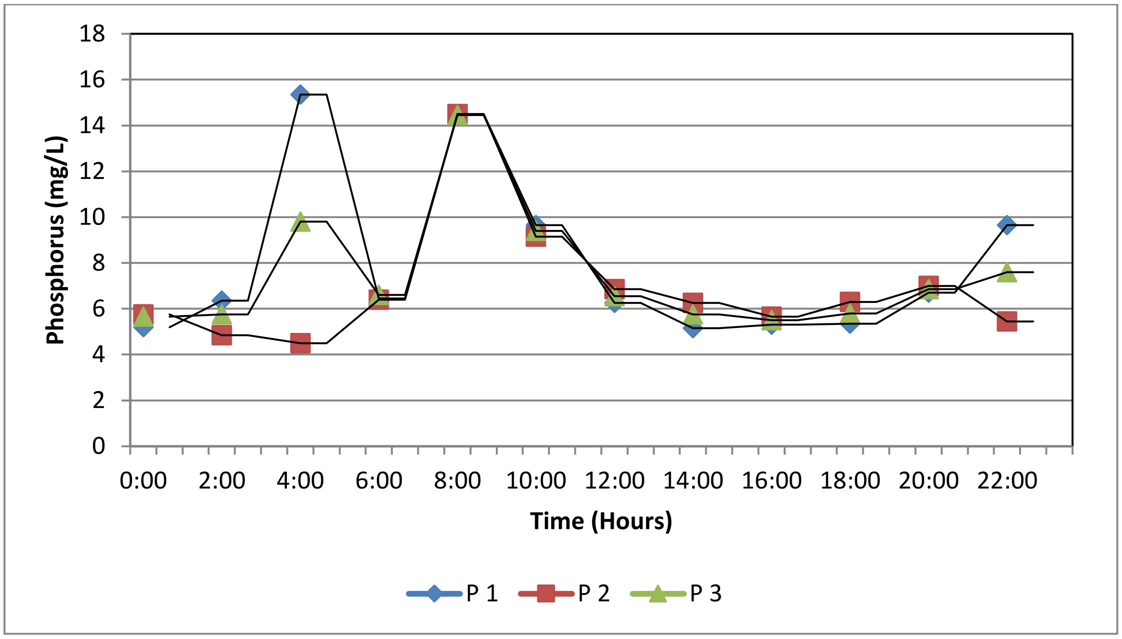


Figure 23 : Phosphorus Weekend (Influent)

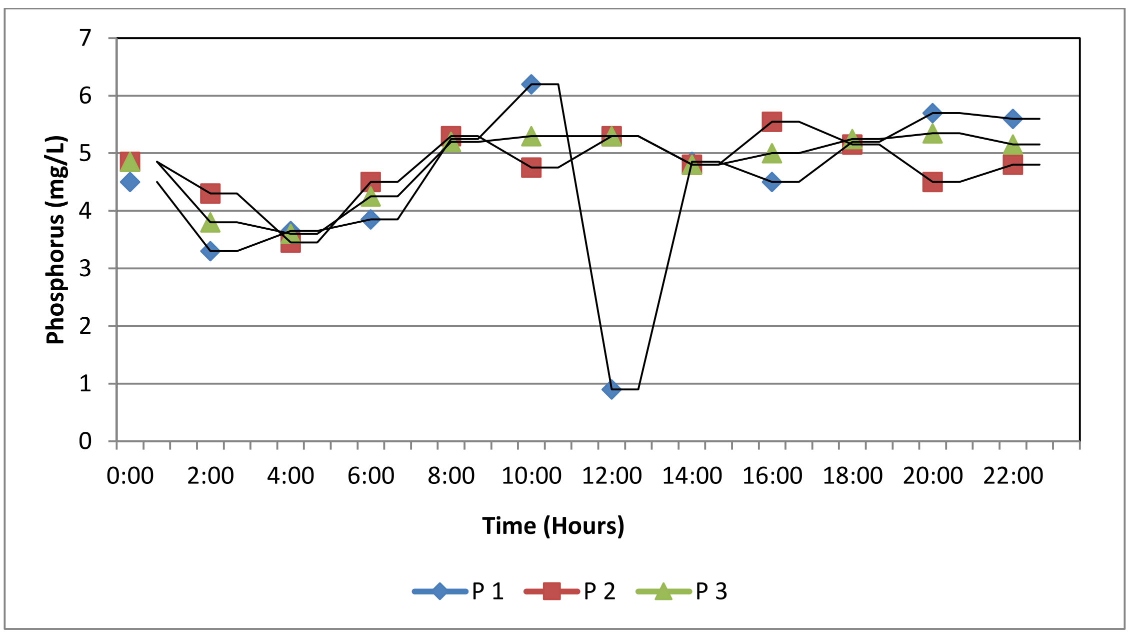


Figure 24 : Phosphorus Weekend (Effluent)

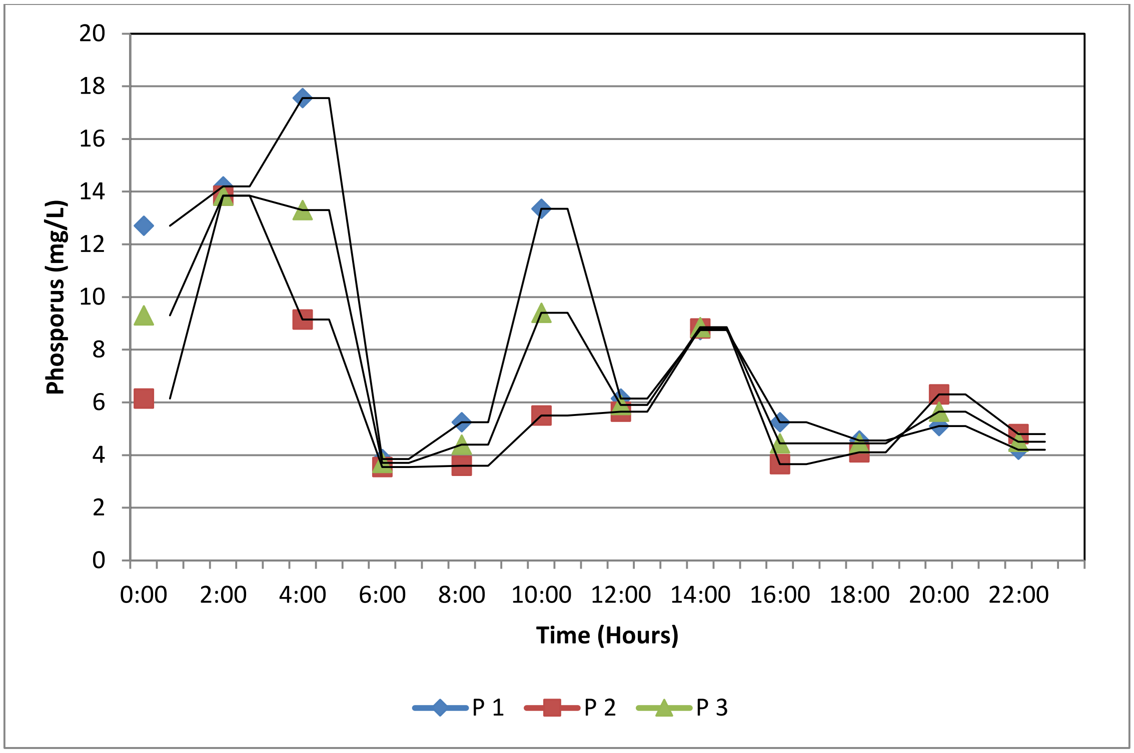


Figure 25 : Phosphorus Weekday (Effluent)

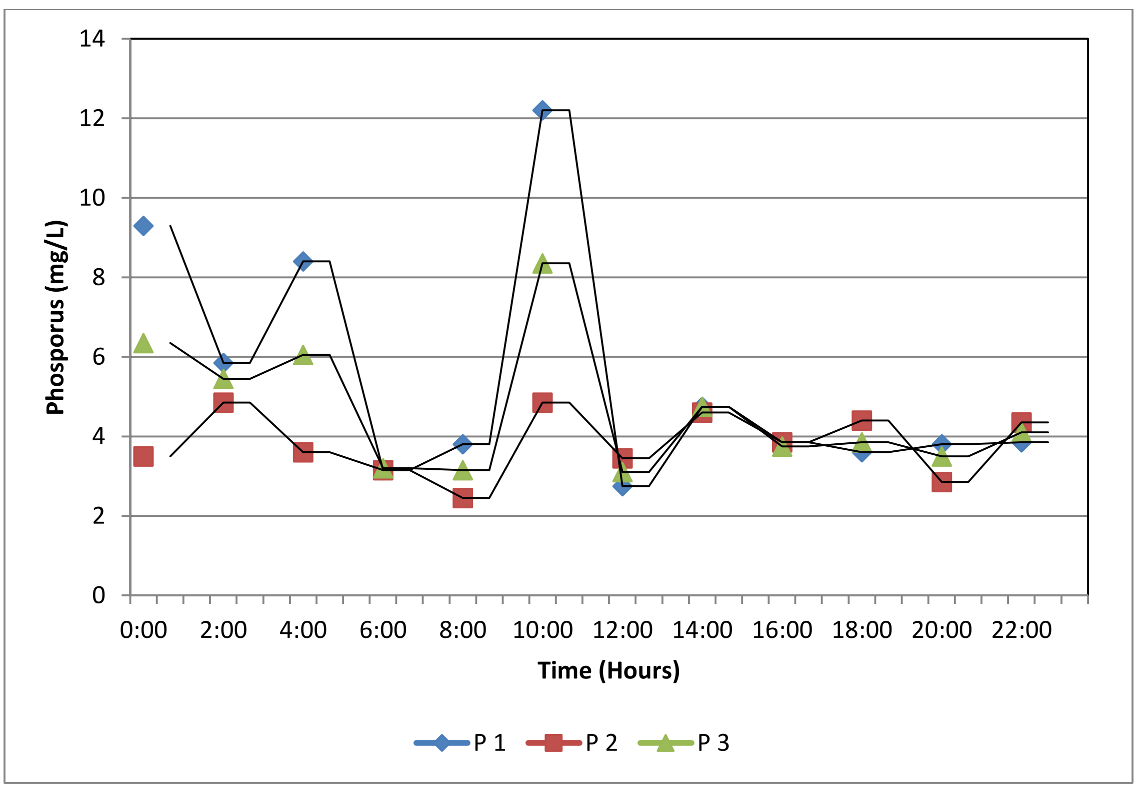


Figure 26 : Phosphorus Weekday (Effluent)

Table 11 : Phosphorus Summary

	Influent (mg/L)		Effluent (mg/L)	
	Avg weekly	Avg all	Avg weekly	Avg all
Weekend 1	7.99	7.39	4.46	4.66
Weekend 2	6.89		4.77	
Weekend 3	7.48		4.82	
Weekday 1	8.41		5.44	
Weekday 2	6.26		3.83	
Weekday 3	7.31		4.63	

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to appendix page 86 -97.

4.8 ANOXIC TREATMENT UNIT

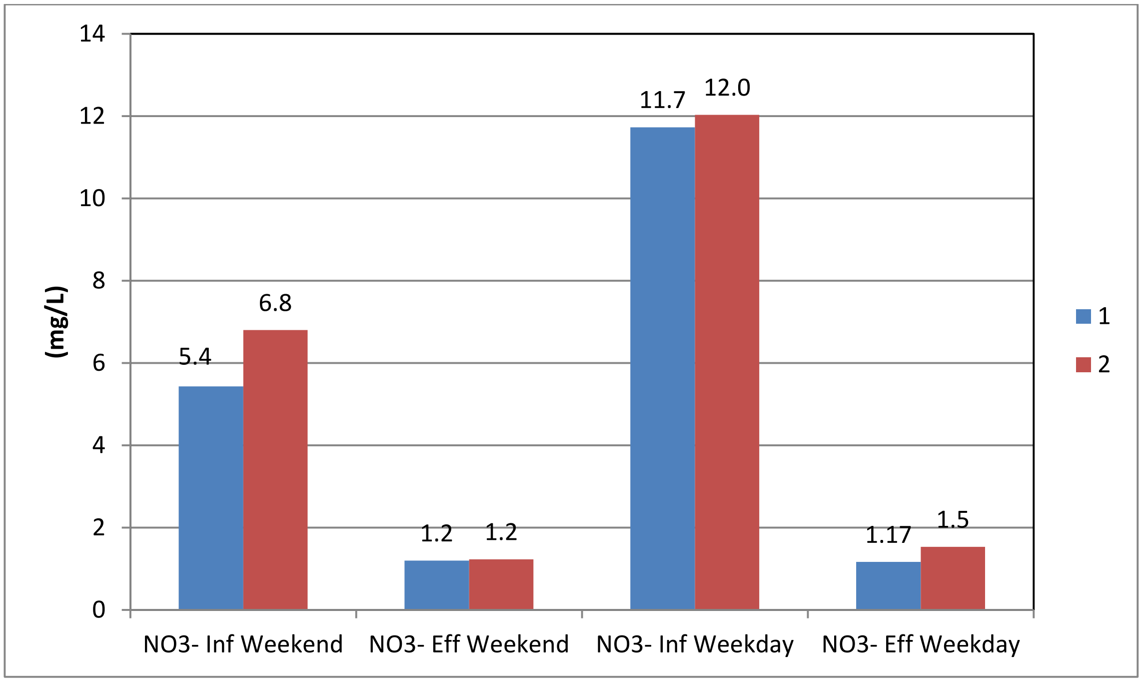


Figure 27 : Nitrate in Anoxic tank

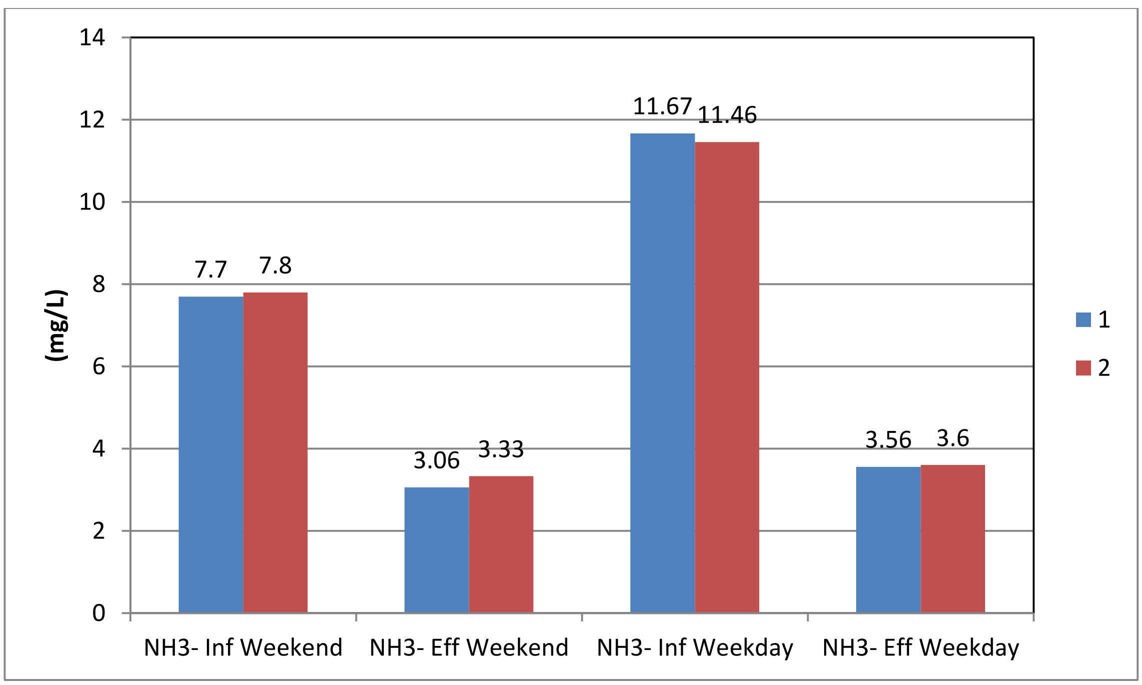


Figure 28 : Ammonia in Anoxic Tank

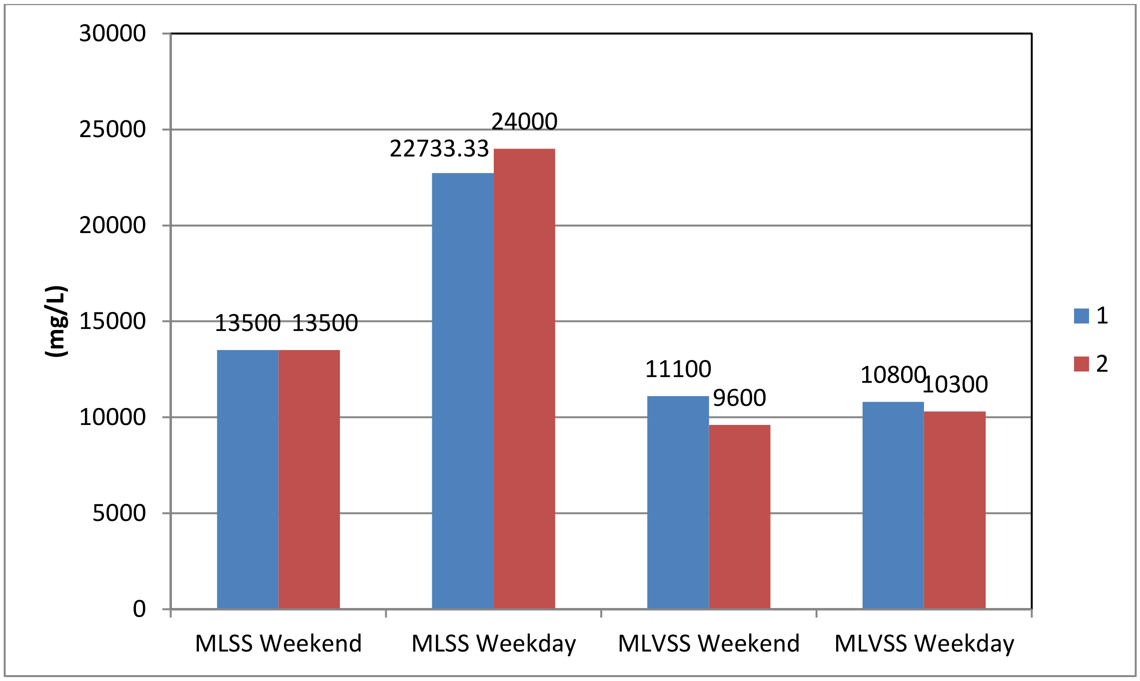


Figure 29 : MLSS & MLVSS in Anoxic tank

Table 12 : Anoxic Treatment Unit Summary (i)

	Nitrate (mg/L)				Ammonia (mg/L)			
	Influent	Avg	Effluent	Avg	Influent	Avg	Effluent	Avg
Weekend 1	5.4	8.975	1.2	1.25425	7.7	9.6575	3.06	3.3875
Weekend 2	6.8		1.2		7.8		3.33	
Weekday 1	11.7		1.117		11.67		3.56	
Weekday 2	12		1.5		11.46		3.6	

Table 13 : Anoxic Treatment Unit Summary (ii)

	MLSS (mg/L)		MLVSS (mg/L)	
	Weekly	Avg	Weekly	Avg
Weekend 1	13500	18433.25	11100	10450
Weekend 2	13500		9600	
Weekday 1	22733		10800	
Weekday 2	24000		10300	

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to appendix page 109 -110.

From Table 12, we could see the reduction of Nitrate and Ammonia in Anoxic tank. Those directly indicate the efficiency of the Anoxic tank in removing Nitrate and Ammonia. Thus, it shows that the anoxic treatment in Universiti Teknologi PETRONAS sewage treatment plant is functioning in decent condition.

4.9 AERATION AND CLARIFIER TREATMENT UNIT

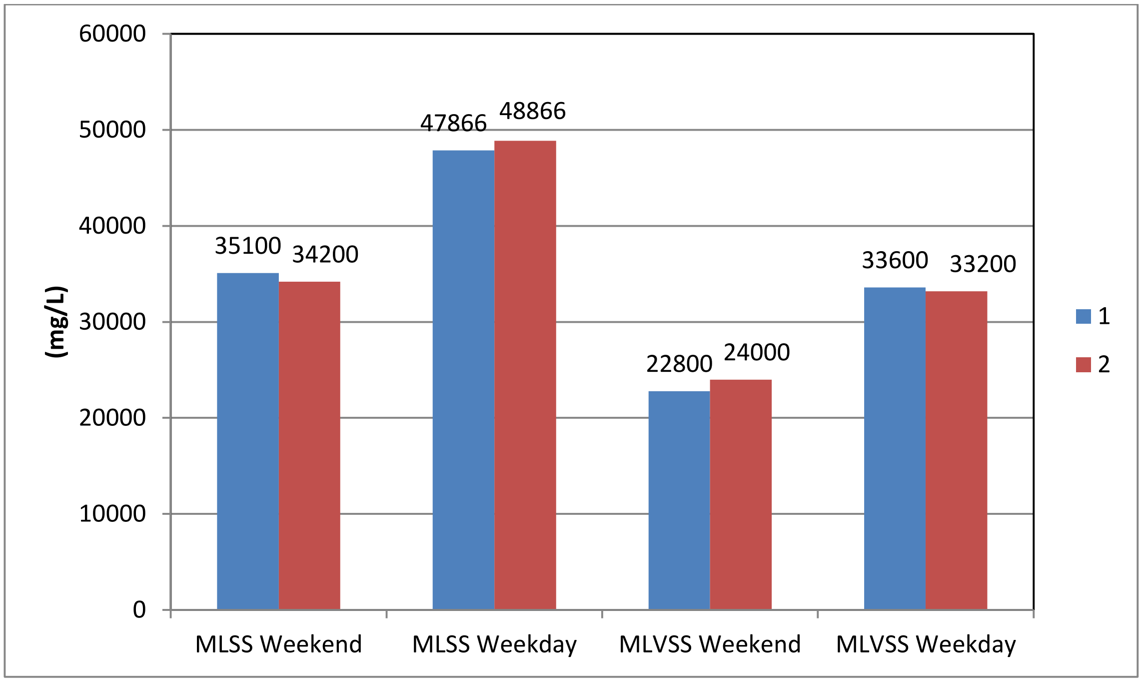


Figure 30 : MLSS & MLVSS of Aeration Tank

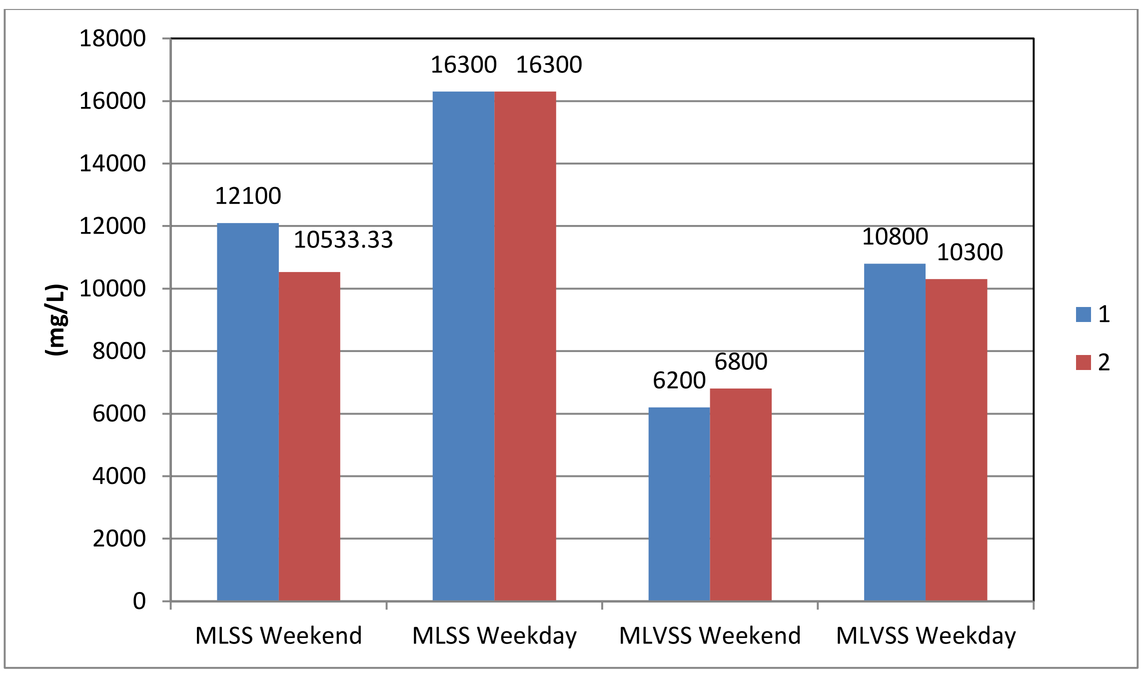


Figure 31 : MLSS & MLVSS in Clarifier

Table 14 : Aeration & Clarifier Treatment Unit Summary

	Aeration Tank				Clarifier Tank			
	MLSS (mg/L)	Avg (mg/L)	MLVSS (mg/L)	Avg (mg/L)	MLSS (mg/L)	Avg (mg/L)	MLVSS (mg/L)	Avg (mg/L)
Weekend 1	35100	41508.5	22800	23000	12100	13808.25	6200	8525
Weekend 2	34200		2400		10533		6800	
Weekday 1	47867		33600		16300		10800	
Weekday 2	48867		33200		16300		10300	

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to appendix page 109 – 110.

4.10 TOTAL ORGANIC CARBON (TOC)

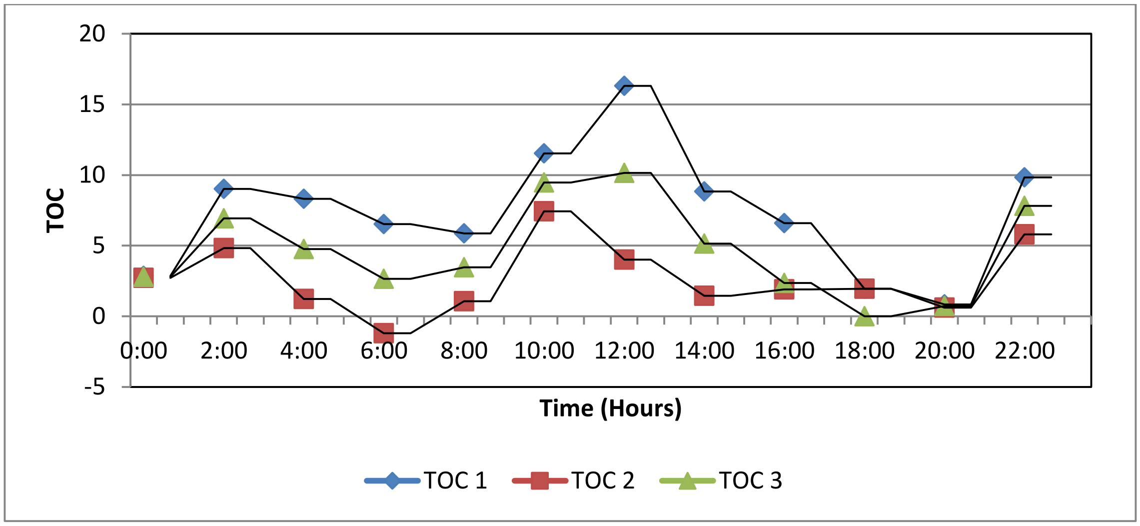


Figure 32 : TOC Weekend (Influent)

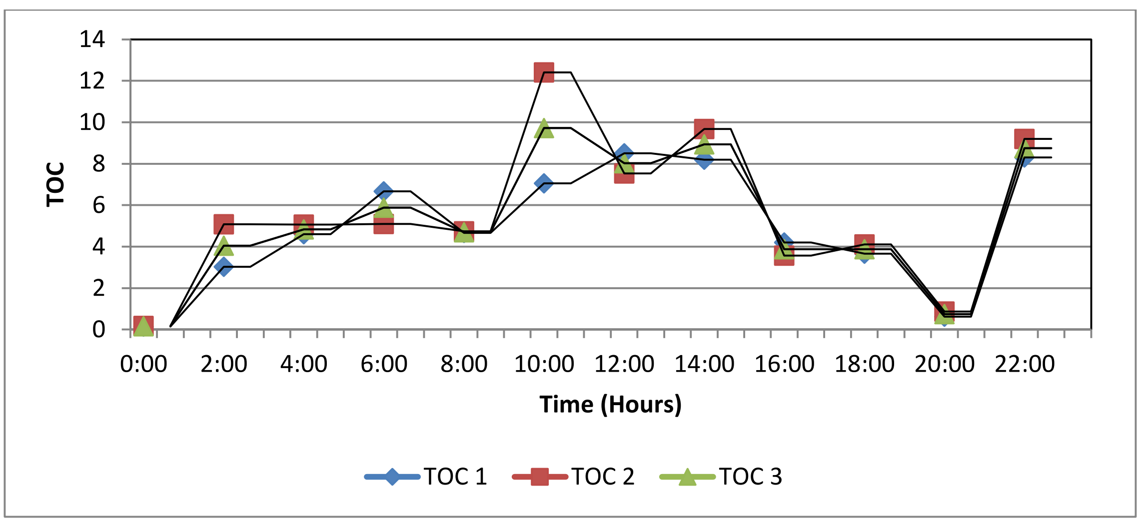


Figure 33 : TOC Weekday (Effluent)

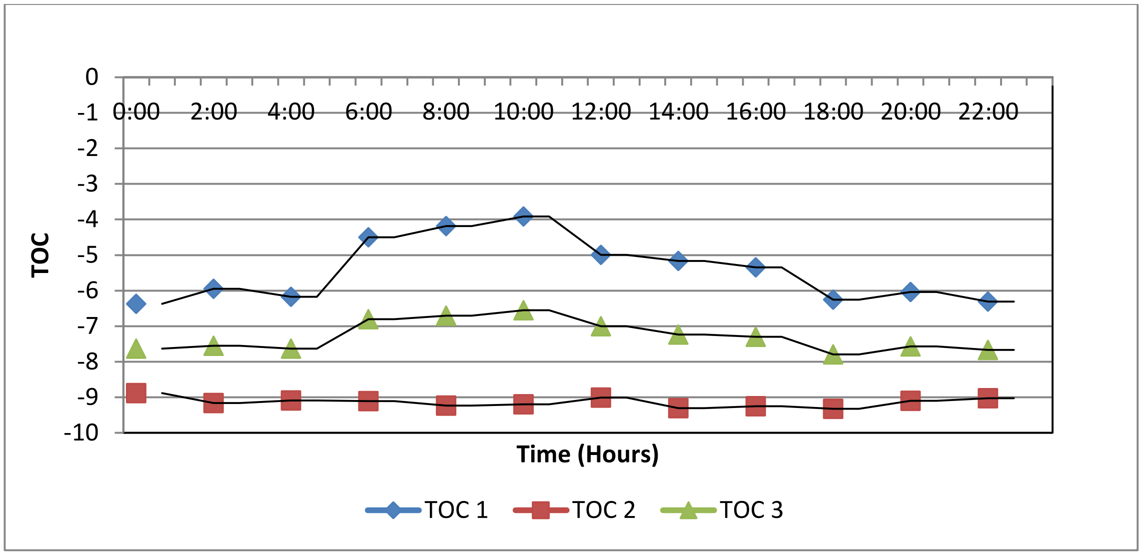


Figure 34 : TOC Weekend (Influent)

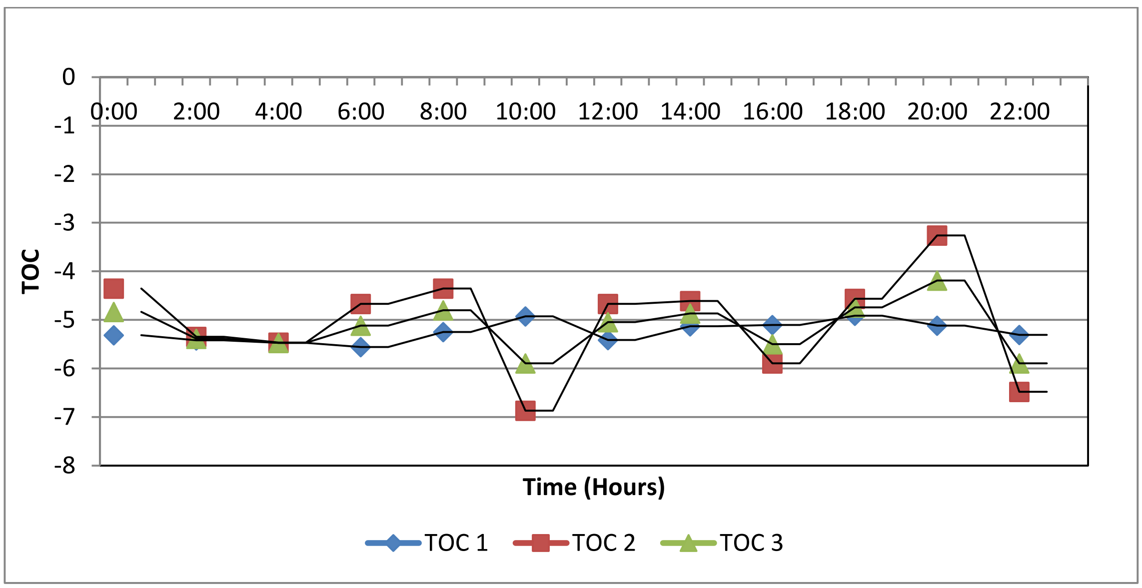


Figure 35 : TOC Weekday (Effluent)

Table 15 : TOC Summary

	Influent (mg/L)		Effluent (mg/L)	
	Avg weekly	Avg all	Avg weekly	Avg all
Weekend 1	7.37	5.16	-5.43	-6.21
Weekend 2	3		-9.14	
Weekend 3	4.69		-7.29	
Weekday 1	4.97		-5.24	
Weekday 2	5.62		-5.04	
Weekday 3	5.3		-5.14	

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to appendix page 111 -113.

4.11 Oil and Grease Treatment Unit

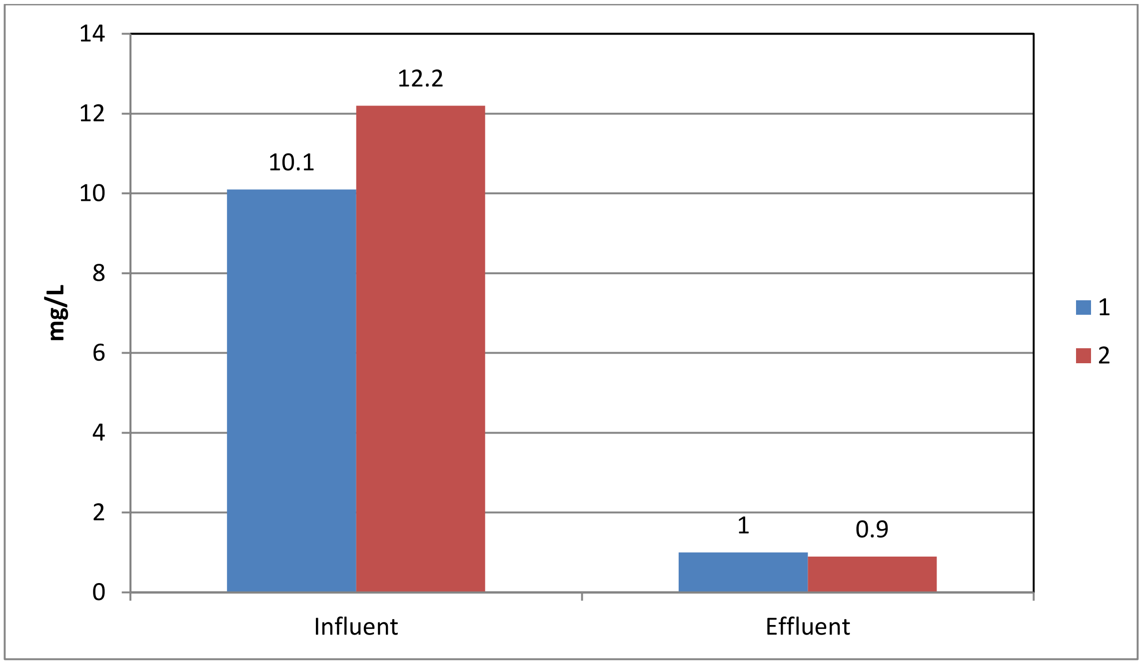


Figure 36 : Oil & Grease Weekend

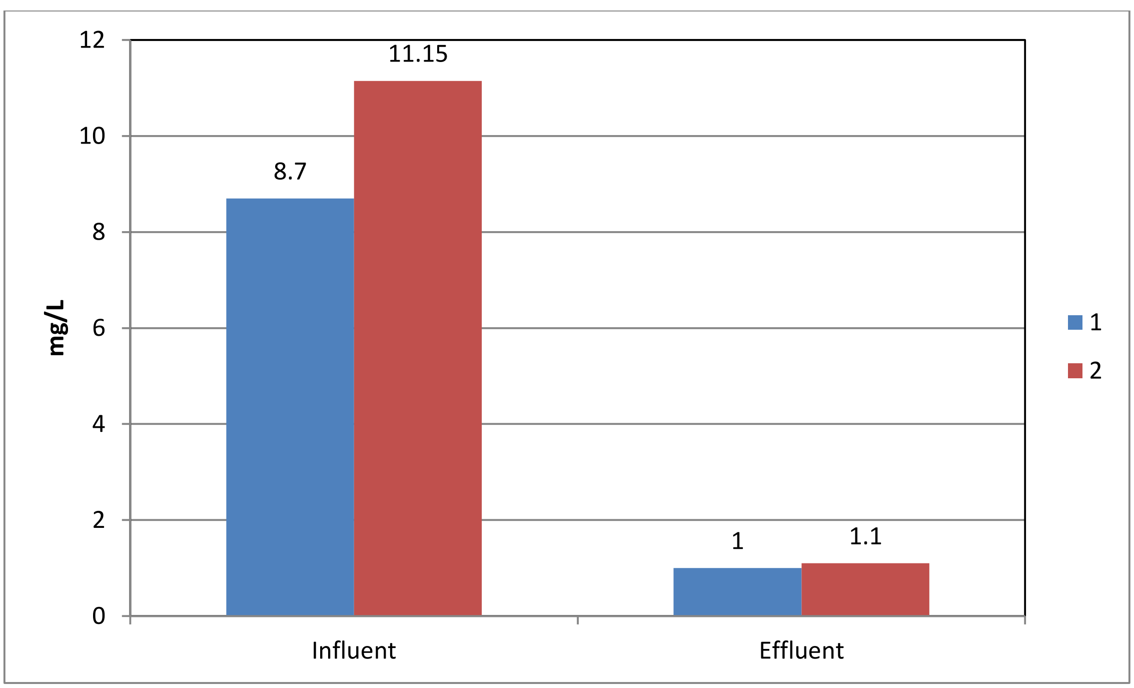


Figure 37 : Oil & Grease Weekday

Table 16 : Oil & Grease Treatment Unit Summary

<table>
<tr><td rowspan="2"></td><td colspan="4">Oil & Grease (mg/L)</td></tr>
<tr><td>Influent</td><td>Avg</td><td>Effluent</td><td>Avg</td></tr>
<tr><td>Weekend 1</td><td>10.1</td><td rowspan="4">10.55</td><td>1</td><td rowspan="4">1</td></tr>
<tr><td>Weekend 2</td><td>12.2</td><td>0.9</td></tr>
<tr><td>Weekday 1</td><td>8.75</td><td>1</td></tr>
<tr><td>Weekday 2</td><td>11.15</td><td>1.1</td></tr>
</table>

The table shows the average value obtain from the experiments. The average values are tabulated to design the operation manual. To see the raw data, refer to appendix page 113 -114.

In the beginning of the project, the grease trap chamber was suspected not efficient. However, the data show that oil and grease treatment unit is functioning in decent condition.

4.12 DESIGN STAGE

Flowrate, Q = 1,836 m^3/d

Detention Time, Ʈ = 18 hours

Table 17 : Waste Water Characteristic base on the Experiments

BOD	30 mg/L
bCOD (1.6BOD)	48 mg/L
TKN	14 mg/L
TP	8 mg/L
Sludge Age	30 days
Alkalinity	122 mg/L
MLSS	41500 mg/L
MLVSS	23000 mg/L
SVI	23

$$\text{SVI} = \frac{Settled\ Volume\ of\ Sludge\ in\ 30\ minutes\ (\frac{mL}{L})}{MLSS\ (\frac{mg}{L})} \times \frac{1000mg}{g}$$

Table 18 : Kinetic Coefficients at 28oC

μ_m	10.31 g VSS/g VSS.day
K_s	20 g COD/m^3
Y	0.4 g VSS/g COD
k_d	0.16 g VSS/g VSS.day
f_d	0.15 g/g
Y_n	0.15 g VSS/g NH_4-N
k_{dn}	0.08 g VSS/g VSS.day

$$S_e = \frac{K_s(1+k_d\vartheta_c)}{\vartheta_c(\mu_m - k_d) - 1}$$

$$= \frac{20(1+(0.16)(30))}{30(10.31-0.16)-1}$$ = 0.4 mg COD/L

$$P_{x,vss} = \frac{Q\,Y\,(S_o - S_e)}{1 + k_d\ \vartheta_c} + \frac{(f_d)(k_d)\,Q\,Y\,(S_o - S_e)\,\vartheta_c}{1 + k_d\ \vartheta_c} + \frac{Q\,Y_n\,(NO_x)}{1 + k_{dn}\ \vartheta_c}$$

$$= (\frac{1836\,(0.4)\,(48-0.4)}{1+(0.16)(30)} + \frac{(0.15)(0.16)(1836)\,0.4\,(48-0.4)\,30}{1+(0.16)(30)} + \frac{(1836)0.15\,(0.8)(14)}{1+(0.08)(30)})\quad \frac{1kg}{1000g}$$

= 6.03 + 4.34 + 0.91 = 11.28 kg VSS/day

$P_{x,TSS}$ = 11.28/0.85 = 13.27 kg/day

Aeration Tank

$$V = \frac{P_{X,TSS}\ \vartheta_C}{X_{TSS}} = \frac{13.27(30)}{(3000/0.85)} = 0.12m^3$$

R_o = $Q\,(S_o - S) - 1.42\,P_{x,vss}$ + 4.33 Q (NO_x)

= 1836 m^3/d (48 – 0.4) g/m^3 (1 kg/10^3 g) – 1.42 (11.28 kg/d) +

(4.33 g O_2/g N) (1836 m^3/d) (0.8 x 14 g/m^3) (1 kg/10^3g)

= 87.39 kg/d – 16.01 kg/d + 89.04 kg/d = 160.42 kg/d = 6.68 kg/h O_2

Anoxic Treatment Unit

Alkalinity to be added

= Res Alk (70~80 g/m^3 as $CaCO_3$) - Inf. Alk +

Alk. Used for nitrification (7.14 g $CaCO_3$/ g NH_4-N)(NO_x)

= 80 g/m^3 – 122 g/m^3 + 7.14 (.8 x 14 g/m^3)

= 37.97 g/m^3 as $CaCO^3$

= 1836 m^3/d (37.97g/m^3) (1kg/10^3g)

= 69.71 kg/d as $CaCO_3$

= (69.71 kg/day $CaCO_3$) (84 g $NaHCO_3$/eq) / (50 g $CaCO_3$/equivalent)

= 117.11 kg/d $NaHCO_3$

Nitrogen required by biomass = $0.12P_{x,bio}/Q$

= (0.12 g N/g VSS) (11.28 kg VSS/d) (10^3 g/kg) / 1836 (m^3/d) = 0.74mg/L

TKN = 14 mg/L. Hence, no additional nitrogen need to be added.

Phosphorus required by biomass = $0.02P_{x,bio}/Q$

= (0.02 g N/g VSS) (11.28 kg VSS/d) (10^3 g/kg) / 1836 (m^3/d) = 0.12mg/L

Total P = 8 mg/L. Hence, no additional nitrogen need to be added.

Return Activated Sludge

X_r = 10^6/SVI mg/L = 1000000/23 = 43,478 mg/L x 3105 m^3/d =135,000 kg/d

Biomass concentration X_{vss} = 13,808 (0.85) = 16,245 mg/L

Sludge waste flowrate,

Q_w = $V\ X_{MLVSS} / \theta_C\ X_{vss}$

Q_w = (972)(23000)/(30)(16,245)

Q_w = 45.87 m^3/d

4.13 DISCUSSION

4.13.1 RESULT OF ACTUAL DESIGN

Table 19 : Comparison of Daily Operation

Unit	Process	Propose Design	Present
Anoxic	Nitrogen	Nil	Nil
	Phosphorus	Nil	Nil
Aeration	Required Oxygen	6.68 kg/h O_2	30 kg/h O_2
	RAS	135,000 kg/d	18,112 kg/d
	Alkalinity	117.11 kg/d $NaHCO_3$	414 kg/d $NaHCO_3$
Clarifier	Waste Sludge	45.87 m^3/d	Occasionally, based on the Aeration Tank colour of foams.

Base on the Table 19, some of operating system needs to be changed but some are fine. By changing the operating, UTP STP could operate effectively and reduce it operating cost.

Cost reduction is due to less number of clarifier operating and maintenance of clarifier. As mention in the problem statement, two clarifiers are operating because of excess floating sludge. Floating sludge could be due to filament growth of denitrification happen inside the clarifier.

Both possibilities are related to insufficient anoxic treatment and improper sludge wasting. As proven in Table 19, current sludge wasting process is definitely not systematic. Others, the amount of recycle activated sludge is not sufficient.

In the first stage of precast design, it was found that Anoxic Tank in the biological treatment is not sufficient. In order to increase the size of Anoxic Tank, huge rectifications need to be done and costly. Thus, the size of the Anoxic can be remained if the detention time is increased. Therefore, set of baffles are recommended to be installed.

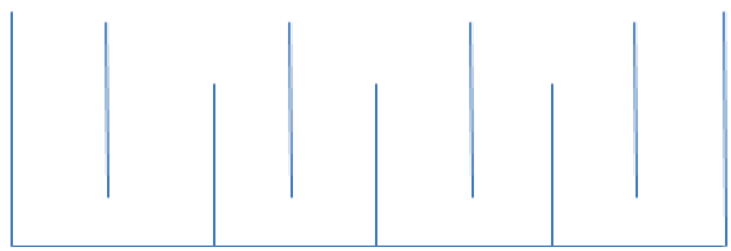


Figure 38 : Example of the side view of the baffle

4.13.2 UNIVERSITI TEKNOLOGI PETRONAS SEWAGE TREATMENT PLANT OPERATION MANUAL

Treatment unit	**Operation**	**Modification**
Oil & Grease	Maintain operation	
Anoxic	24 hours mixing	Install baffle
Aeration - Oxygen supply - Alkalinity - Return Activated Sludge	 7 kg/h O_2 118 kg/d NaHCO3 135,000 kg/d	 Maintain Blower Maintain Operation Apparently, 18,112 kg/d. Increase the pump flow rate
Clarifier - Waste Sludge	 46 m3/d	 Use 1 clarifier

Others non biological operation shall be remain as usual.

CHAPTER 5

CONCLUSION

Based on the study, background research and literature review that have been carried out, the project seems to be relevant and feasible to be executed within the time frame and the scope of study.

The first objective was achieved and it is proven that UTP STP could support the present population equivalent. However, the challenge is to operate the STP efficiently and optimizing the treatment unit.

Second objective was the key to the success of this project. Even, it has to take longer period than expected; the data collected were enough to proceed for the next objective. A very long and helpful data had been recorded in this project. The experiment could be more accurate with more manpower.

As has been discus in the Chapter 4, new operation manual just need to convert into electrical and mechanical reading. The changing of operation will involve difference setting of ohmmeter, timer and etc in the operation room. This process need to be done together an electrical expert from PMMD in order to make it success.

Lastly, a lot of improvement room of improvement that can be done during this project. More people working for the lab work shall lead to reduce of time consumption and accurate data. Well calibrate machine and sampling tools can be consider in the betterment of next project.

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APPENDICES

Figure 39: STP at Block A

Figure 40 : STP at Block B

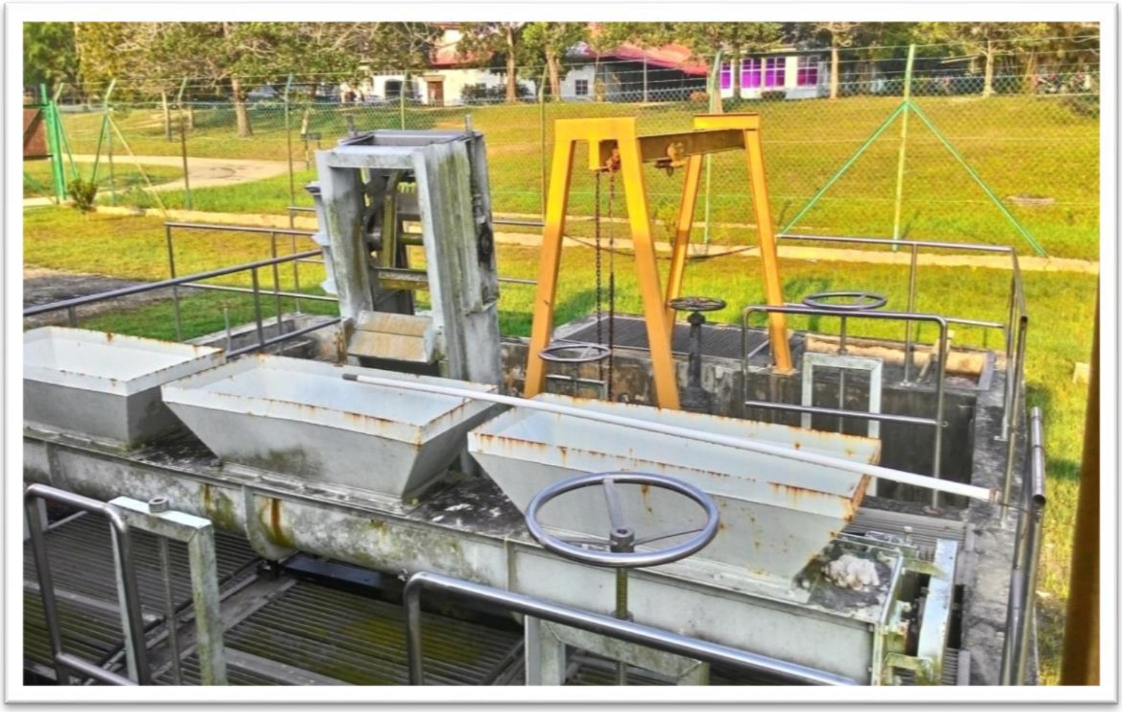

Figure 41: Bar Screen (Main UTP STP)

Figure 42 : Grease Chamber (Main UTP STP)

Figure 43 : Anoxic tank (Main UTP STP)

Figure 44 : Aeration tank (Main UTP STP)

Figure 45: Clarifier 1 (Main UTP STP)

Figure 46 : Clarifier 2 (Main UTP STP)

Figure 47 : Operator do some checking on the suizes

	Bottle	A=Initial DO(mg/L)	B=Final DO(mg/L)	C=Blank Correction	A-B-C	Sample Volume	BOD (mg/L)	BOD AVG (mg/L)
influent								
effluent								

Table 20 : BOD Tabulation Result

Sample	A	B	Volume of Sample	TSS	TSS AVG (mg/L)
Influent					
Effluent					

Table 21: Data tabulation of TSS

Sample	Dilution factor	A	B	Volume of Sample	MLVSS	MLVSS AVG (mg/L)
Aeration tank						
Anoxic tank						
Clarifier						

Table 22 : MLVSS data tabulation

Sample	Ammonia (mg/L)	Nitrate (mg/L)	Phosphorus (mg/L)
Influent			
Effluent			

Table 23 : Ammonia, Nitrate & Phosphorus data

Experiments Result

BOD weekend (21st June 2015)

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			7.98	2.07	5.79	34.02	
			8.02	2.41	5.49	32.94	
0:00	Inf 1	50	7.86	1.96	5.78	34.68	34.35
			7.9	4.06	3.72	22.32	
			7.86	4.34	3.4	20.4	
2:00	Inf 2	50	6.54	2.77	3.65	21.9	22.11
			8	4.74	3.14	18.84	
			7.84	4.71	3.01	18.06	
4:00	Inf 3	50	8.04	5.14	2.78	16.68	18.45
			7.84	3.23	4.49	26.94	
			7.8	4.27	3.41	20.46	
6:00	Inf 4	50	7.8	4.52	3.16	18.96	22.12
			7.88	4.67	3.09	18.54	
			7.9	3.29	4.49	26.94	
8:00	Inf 5	50	7.76	3.07	4.57	27.42	27.18
			7.73	3.14	4.47	26.82	
			7.68	2.81	4.75	28.5	
10:00	Inf 6	50	7.76	2.82	4.82	28.92	28.71
			7.56	2.78	4.66	27.96	
			7.61	0.79	6.7	40.2	
12:00	Inf 7	50	7.54	1.25	6.17	37.02	34.08
			7.77	1.51	6.14	36.84	
			7.66	0.81	6.73	40.38	
14:00	Inf8	50	7.63	0.87	6.64	39.84	40.11
			7.81	2.22	5.47	32.82	
			7.89	2.42	5.35	32.1	
16:00	Inf 9	50	7.76	1.88	5.76	34.56	32.46
			7.98	2.26	5.6	33.6	
			8	2.52	5.36	32.16	
18:00	Inf 10	50	7.97	2.39	5.46	32.76	32.46
			7.96	0.69	7.15	42.9	
			8	0.73	7.15	42.9	
20:00	Inf 11	50	7.98	0.85	7.01	42.06	42.62
22:00	Inf 12	50	7.65	1.21	6.32	37.92	33.96

			7.69	1.91	5.66	33.96	
			7.67	1.89	5.66	33.96	
			8.14	8.03	0.11		
			8.18	8.05	0.13		
	Blank	0	8.21	8.09	0.12		0.12

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			8.04	4.53	3.39	6.54	
			8.02	4.47	3.43	6.86	
0:00	Eff 1	150	8.02	4.42	3.48	6.96	6.786667
			8.61	6.77	1.72	3.44	
			8.67	7.555	0.995	1.99	
2:00	Eff 2	150	8.54	6.84	1.58	3.16	3.3
			8.07	5.79	2.16	4.32	
			8.01	5.13	2.76	5.52	
4:00	Eff 3	150	8.11	5.82	2.17	4.34	4.33
			8.07	6.13	1.82	3.64	
			8.15	6.1	1.93	3.86	
6:00	Eff 4	150	8.14	6.02	2	4	3.833333
			8.18	6.55	1.51	3.02	
			8.16	6.56	1.48	2.96	
8:00	Eff 5	150	8.13	6.46	1.55	3.1	3.026667
			8.13	5.9	2.11	4.22	
			8.12	5.97	2.03	4.06	
10:00	Eff 6	150	8.06	6.03	1.91	3.82	4.033333
			8.14	6.84	1.18	2.36	
			8.14	7	1.02	2.04	
12:00	Eff 7	150	8.08	7	0.96	1.92	1.98
			8.17	5.97	2.08	4.16	
			8.12	5.52	2.48	4.96	
14:00	Eff 8	150	8.11	5.41	2.58	5.16	5.06
			8.53	7.3	1.11	2.22	
			8.52	7.13	1.27	2.54	
16:00	Eff 9	150	8.46	7.17	1.17	2.34	2.366667
			7.94	7.33	0.49	0.98	
			8.01	7.34	0.55	1.1	
18:00	Eff 10	150	8.61	7.85	0.64	1.28	1.12
20:00	Eff 11	150	8.43	6.76	1.55	3.1	3.14

			8.48	6.77	1.59	3.18	
			8.42	7.37	0.93	1.86	
			8.54	7.29	1.13	2.26	
			8.46	7.1	1.24	2.48	
22:00	Eff 12	150	8.43	7.21	1.1	2.2	2.23

BOD weekday (24th June 2015)

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			7.88	1.59	6.18	36.4	
			7.82	1.07	6.64	39.84	
0:00	Inf 1	50	7.86	1.73	6.02	36.12	36.26
			7.9	2.91	4.88	29.28	
			7.86	2.46	5.29	31.74	
2:00	Inf 2	50	7.78	2.65	5.02	30.12	29.7
			7.84	4.38	3.35	20.1	
			8.04	4.43	3.5	21	
4:00	Inf 3	50	8.02	3.82	4.09	24.54	20.55
			7.76	7.43	0.22	1.32	
			7.8	7.47	0.22	1.32	
6:00	Inf 4	50	7.82	7.32	0.39	2.34	1.32
			7.76	4.38	3.27	19.62	
			7.78	4.67	3	18	
8:00	Inf 5	50	7.7	4.76	2.83	16.98	18.81
			7.68	1.88	5.69	34.14	
			7.79	2.36	5.32	31.92	
10:00	Inf 6	50	7.72	1.58	6.03	36.18	35.16
			7.54	1.33	6.1	36.6	
			7.58	0.98	6.49	38.94	
12:00	Inf 7	50	7.61	1.04	6.46	38.76	38.85
			7.67	3.26	4.3	25.8	
			7.64	2.79	4.74	28.44	
14:00	Inf8	50	7.65	2.9	4.64	27.84	28.14
			7.79	0.85	6.83	40.98	
			7.8	1.02	6.67	40.02	
16:00	Inf 9	50	7.76	0.69	6.96	41.76	40.92
			7.8	3.02	4.67	28.02	
18:00	Inf 10	50	7.78	3.55	4.12	24.72	25.05

			7.97	3.63	4.23	25.38	
20:00	Inf 11	50	7.89	2.41	5.37	32.22	29.76
			7.9	2.73	5.06	30.36	
			7.88	2.91	4.86	29.16	
22:00	Inf 12	50	7.7	2.06	5.53	33.18	32.82
			7.72	1.97	5.64	33.84	
			7.74	2.22	5.41	32.46	
	Blank	0	8.46	8.31	0.15		0.11
			8.19	8.1	0.09		
			8.21	8.11	0.1		

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
0:00	Eff 1	150	8.23	7.25	0.87	1.513333	2.464444
			8.28	6.42	1.75	3.5	
			8.34	7.04	1.19	2.38	
2:00	Eff 2	150	8.76	8.21	0.44	0.88	0.81
			8.67	8.3	0.26	0.52	
			8.66	8.18	0.37	0.74	
4:00	Eff 3	150	8.1	8.07	-0.08	-0.16	0.1
			8.14	8.03	-5.7E-16	-1.1E-15	
			8.11	7.95	0.05	0.1	
6:00	Eff 4	150	8.19	8.02	0.06	0.12	0.113333
			8.17	8.01	0.05	0.1	
			8.19	8.02	0.06	0.12	
8:00	Eff 5	150	8.18	7.39	0.68	1.36	1.246667
			8.2	7.41	0.68	1.36	
			8.19	7.57	0.51	1.02	
10:00	Eff 6	150	8.14	6.91	1.12	2.24	1.29
			8.16	7.33	0.72	1.44	
			8.06	7.38	0.57	1.14	
12:00	Eff 7	150	8.14	7.63	0.4	0.8	0.78
			8.18	7.71	0.36	0.72	
			8	7.48	0.41	0.82	
14:00	Eff 8	150	8.19	7.35	0.73	1.46	1.68
			8.15	7.23	0.81	1.62	
			8.18	7.2	0.87	1.74	
16:00	Eff 9	150	8.5	7.87	0.52	1.04	1.033333
			8.54	7.84	0.59	1.18	

			8.46	7.91	0.44	0.88	
			7.94	7.72	0.11	0.22	
			8	7.8	0.09	0.18	
18:00	Eff 10	150	8.61	8.47	0.03	0.06	0.2
			8.56	8.42	0.03	0.06	
			8.5	8.34	0.05	0.1	
20:00	Eff 11	150	8.54	8.43	-5.7E-16	-1.1E-15	0.08
			8.65	8.51	0.03	0.06	
			8.45	8.31	0.03	0.06	
22:00	Eff 12	150	8.43	8.3	0.02	0.04	0.053333

BOD weekend (28th June 2015)

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			8.69	1.93	6.65	39.24	
			8.76	2.09	6.56	39.36	
0:00	Inf 1	50	8.85	2.22	6.52	39.12	39.24
			8.68	4.22	4.35	26.1	
			8.71	4.89	3.71	22.26	
2:00	Inf 2	50	8.66	4.89	3.66	21.96	22.11
			8.13	4.37	3.65	21.9	
			8.18	4.57	3.5	21	
4:00	Inf 3	50	8.26	4.8	3.35	20.1	21
			8.13	3.83	4.19	25.14	
			8.18	4.11	3.96	23.76	
6:00	Inf 4	50	8.06	4.3	3.65	21.9	24.45
			8.14	4.12	3.91	23.46	
			8.28	4.68	3.49	20.94	
8:00	Inf 5	50	8.33	4.6	3.62	21.72	21.33
			8.11	2.68	5.32	31.92	
			8.04	3.23	4.7	28.2	
10:00	Inf 6	50	8.17	2.81	5.25	31.5	31.71
			8.01	2.33	5.57	33.42	
			8.04	2.09	5.84	35.04	
12:00	Inf 7	50	8.05	2.64	5.3	31.8	34.23
			7.94	2.05	5.78	34.68	
			7.93	1.99	5.83	34.98	
14:00	Inf8	50	7.96	2.62	5.23	31.38	34.83

			7.97	2.2	5.66	33.96	
			8.04	2.79	5.14	30.84	
16:00	Inf 9	50	8.07	2.36	5.6	33.6	33.78
			8.29	2.13	6.05	36.3	
			8.34	2.18	6.05	36.3	
18:00	Inf 10	50	8.36	2.11	6.14	36.84	36.48
			8.33	1.97	6.25	37.5	
			8.32	2.12	6.09	36.54	
20:00	Inf 11	50	8.43	1.9	6.42	38.52	37.52
			8.39	2.5	5.42	32.52	
			8.41	2.64	5.3	31.8	
22:00	Inf 12	50	8.35	2.29	5.59	33.54	32.67
			8.39	8.2	0.19		
			8.32	8.22	0.1		
	Blank	0	8.37	8.25	0.12		0.11

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			8.32	4.39	3.82	7.42	
			8.41	4.48	3.82	7.64	
0:00	Eff 1	150	8.41	4.59	3.71	7.42	7.42
			8.53	6.08	2.34	4.68	
			8.66	6.65	1.9	3.8	
2:00	Eff 2	150	8.65	6.84	1.7	3.4	3.6
			8.68	5.77	2.8	5.6	
			8.72	5.69	2.92	5.84	
4:00	Eff 3	150	8.72	5.77	2.84	5.68	5.706667
			8.69	5.68	2.9	5.8	
			8.72	5.69	2.92	5.84	
6:00	Eff 4	150	8.69	5.88	2.7	5.4	5.68
			8.64	6.73	1.8	3.6	
			8.63	6.73	1.79	3.58	
8:00	Eff 5	150	8.04	6.71	1.22	2.44	3.59
			7.88	5.74	2.03	4.06	
			7.93	5.38	2.44	4.88	
10:00	Eff 6	150	7.98	5.83	2.04	4.08	4.07
			8.29	6.6	1.58	3.16	
			8.23	6.63	1.49	2.98	
12:00	Eff 7	150	8.27	6.76	1.4	2.8	2.98

			8.18	5.71	2.36	4.72	
			8.22	5.88	2.23	4.46	
14:00	Eff 8	150	8.31	5.86	2.34	4.68	4.57
			8.21	6.87	1.23	2.46	
			8.29	6.91	1.27	2.54	
16:00	Eff 9	150	8.32	6.96	1.25	2.5	2.5
			8.24	6.94	1.19	2.38	
			8.26	7.01	1.14	2.28	
18:00	Eff 10	150	8.3	6.61	1.58	3.16	2.33
			8.16	6.62	1.43	2.86	
			8.26	6.51	1.64	3.28	
20:00	Eff 11	150	8.26	6.33	1.82	3.64	3.46
			8.19	7.4	0.68	1.36	
			8.25	7.48	0.66	1.32	
22:00	Eff 12	150	8.23	7.32	0.8	1.6	1.34

BOD weekday (1st July 2015)

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			7.75	2.27	5.34	31.23	
			7.92	2.35	5.43	32.58	
0:00	Inf 1	50	7.92	2.6	5.18	31.08	31.155
			7.66	2.05	5.47	32.82	
			7.69	2.03	5.52	33.12	
2:00	Inf 2	50	7.68	2.97	4.57	27.42	32.97
			7.64	4.41	3.09	18.54	
			7.63	4.49	3	18	
4:00	Inf 3	50	7.6	4.58	2.88	17.28	17.94
			7.7	4.15	3.41	20.46	
			7.7	4.18	3.38	20.28	
6:00	Inf 4	50	7.56	4.47	2.95	17.7	20.37
			7.87	5.48	2.25	13.5	
			7.87	3.36	4.37	26.22	
8:00	Inf 5	50	7.92	5.37	2.41	14.46	13.98
			7.76	2.51	5.11	30.66	
			7.59	2.48	4.97	29.82	
10:00	Inf 6	50	7.74	2.3	5.3	31.8	30.76
12:00	Inf 7	50	7.11	0.69	6.28	37.68	37.41

			7.13	0.8	6.19	37.14	
			7.17	1.02	6.01	36.06	
			7.55	2.93	4.48	26.88	
			7.64	2.99	4.51	27.06	
14:00	Inf8	50	7.65	3.32	4.19	25.14	26.97
			7.71	1.11	6.46	38.76	
			7.78	1.38	6.26	37.56	
16:00	Inf 9	50	7.84	1.56	6.14	36.84	37.72
			7.85	2.6	5.11	30.66	
			7.93	2.8	4.99	29.94	
18:00	Inf 10	50	7.85	2.54	5.17	31.02	45.81
			7.57	2.94	4.49	26.94	
			7.64	3.31	4.19	25.14	
20:00	Inf 11	50	7.7	2.59	4.97	29.82	26.04
			7.55	2.13	5.28	31.68	
			7.34	2.07	5.13	30.78	
22:00	Inf 12	50	7.48	2.1	5.24	31.44	31.56
			8.23	8.17	0.06		
			8.14	8	0.14		
	Blank	0	8.15	8.02	0.13		0.14

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			8.23	7.38	0.71	1.15	
			8.28	7.2	0.94	1.88	
0:00	Eff 1	150	8.34	7.47	0.73	1.46	1.496667
			8.76	8.4	0.22	0.44	
			8.67	8.33	0.2	0.4	
2:00	Eff 2	150	8.66	8.08	0.44	0.88	0.42
			8.1	7.96	-3.3E-16	-6.7E-16	
			8.14	7.51	0.49	0.98	
4:00	Eff 3	150	8.11	7.81	0.16	0.32	0.65
			8.19	7.9	0.15	0.3	
			8.17	7.8	0.23	0.46	
6:00	Eff 4	150	8.19	8.06	-0.01	-0.02	0.38
			8.18	7.8	0.24	0.48	
			8.2	6.6	1.46	2.92	
8:00	Eff 5	150	8.19	8.03	0.02	0.04	2.92
10:00	Eff 6	150	8.14	7.9	0.1	0.2	0.17

			8.16	7.95	0.07	0.14	
			8.06	7.98	-0.06	-0.12	
			8.14	7.73	0.27	0.54	
			8.18	7.76	0.28	0.56	
12:00	Eff 7	150	8	7.59	0.27	0.54	0.546667
			8.19	7.01	1.04	2.08	
			8.15	7.09	0.92	1.84	
14:00	Eff 8	150	8.18	7.7	0.34	0.68	1.96
			8.5	8.13	0.23	0.46	
			8.54	7.95	0.45	0.9	
16:00	Eff 9	150	8.46	8.18	0.14	0.28	0.37
			7.94	8.09	-0.29	-0.58	
			8	8.06	-0.2	-0.4	
18:00	Eff 10	150	8.61	7.8	0.67	1.34	1.34
			8.56	8.06	0.36	0.72	
			8.5	8.07	0.29	0.58	
20:00	Eff 11	150	8.54	8.05	0.35	0.7	0.71
			8.65	7.89	0.62	1.24	
			8.45	7.9	0.41	0.82	
22:00	Eff 12	150	8.43	7.9	0.39	0.78	0.8

BOD weekend (5th July 2015)

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			8.18	2.5	5.55	32.5	
			8.19	2.46	5.6	33.6	
0:00	Inf 1	50	8.2	2.51	5.56	33.36	33.48
			8.45	4.34	3.98	23.88	
			8.47	4.76	3.58	21.48	
2:00	Inf 2	50	8.41	4.79	3.49	20.94	21.21
			8.65	4.61	3.91	23.46	
			8.59	4.53	3.93	23.58	
4:00	Inf 3	50	8.52	4.63	3.76	22.56	23.52
			8.66	3.2	5.33	31.98	
			8.55	4.56	3.86	23.16	
6:00	Inf 4	50	8.66	4.62	3.91	23.46	23.31
			8.46	4.55	3.78	22.68	
8:00	Inf 5	50	8.36	4.46	3.77	22.62	22.65

			8.43	4.43	3.87	23.22	
			8.21	3.34	4.74	28.44	
			8.19	3.33	4.73	28.38	
10:00	Inf 6	50	8.14	3.33	4.68	28.08	28.3
			8.02	2.5	5.39	32.34	
			7.99	2.43	5.43	32.58	
12:00	Inf 7	50	8.07	2.57	5.37	32.22	32.38
			8.06	2.06	5.87	35.22	
			8.11	2.14	5.84	35.04	
14:00	Inf8	50	8.03	2.36	5.54	33.24	35.13
			8.04	2.34	5.57	33.42	
			8.25	2.68	5.44	32.64	
16:00	Inf 9	50	8.4	2.84	5.43	32.58	32.61
			8.21	2.01	6.07	36.42	
			8.24	2.04	6.07	36.42	
18:00	Inf 10	50	8.25	2	6.12	36.72	36.52
			8.16	1.88	6.15	36.9	
			8.1	1.86	6.11	36.66	
20:00	Inf 11	50	8.13	1.88	6.12	36.72	36.76
			8.1	2.65	5.32	31.92	
			8.2	2.68	5.39	32.34	
22:00	Inf 12	50	8.25	2.67	5.45	32.7	32.52
			8.1	8	0.1		
			8.18	8.01	0.17		
	Blank	0	8.16	8.03	0.13		0.13

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			8.37	4.41	3.83	7.393333	
			8.38	4.46	3.79	7.58	
0:00	Eff 1	150	8.42	4.49	3.8	7.6	7.59
			8.53	6.23	2.17	4.34	
			8.6	6.25	2.22	4.44	
2:00	Eff 2	150	8.59	6.18	2.28	4.56	4.446667
			8.64	5.73	2.78	5.56	
			8.7	5.77	2.8	5.6	
4:00	Eff 3	150	8.68	5.67	2.88	5.76	5.64
			8.74	5.65	2.96	5.92	
6:00	Eff 4	150	8.69	5.65	2.91	5.82	5.92

			8.77	5.68	2.96	5.92	
			8.67	6.69	1.85	3.7	
			8.64	6.65	1.86	3.72	
8:00	Eff 5	150	8.4	6.67	1.6	3.2	3.71
			7.92	5.57	2.22	4.44	
			7.89	5.62	2.14	4.28	
10:00	Eff 6	150	7.93	5.59	2.21	4.42	4.38
			8.1	6.61	1.36	2.72	
			8.07	6.59	1.35	2.7	
12:00	Eff 7	150	8.11	6.63	1.35	2.7	2.706667
			8.12	5.78	2.21	4.42	
			8.22	5.84	2.25	4.5	
14:00	Eff 8	150	8.16	5.76	2.27	4.54	4.486667
			8.18	6.94	1.11	2.22	
			8.24	6.94	1.17	2.34	
16:00	Eff 9	150	8.28	6.99	1.16	2.32	2.293333
			8.3	7.04	1.13	2.26	
			8.26	7.06	1.07	2.14	
18:00	Eff 10	150	8.3	7	1.17	2.34	2.246667
			8.18	6.58	1.47	2.94	
			8.24	6.51	1.6	3.2	
20:00	Eff 11	150	8.2	6.48	1.59	3.18	3.19
			8.27	7.44	0.7	1.4	
			8.27	7.36	0.78	1.56	
22:00	Eff 12	150	8.25	7.4	0.72	1.44	1.466667

BOD weekday (8thJuly 2015)

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			7.44	2.35	4.91	28.41	
			7.44	2.3	4.96	29.76	
0:00	Inf 1	50	7.47	2.37	4.92	29.52	29.64
			7.33	2.8	4.35	26.1	
			7.29	2.66	4.45	26.7	
2:00	Inf 2	50	7.26	2.62	4.46	26.76	26.52
			7.39	3.9	3.31	19.86	
			7.34	3.73	3.43	20.58	
4:00	Inf 3	50	7.35	3.15	4.02	24.12	20.22

			7.81	3.48	4.15	24.9	
			7.81	3.46	4.17	25.02	
6:00	Inf 4	50	7.8	3.3	4.32	25.92	24.96
			7.92	5.81	1.93	11.58	
			7.91	5.73	2	12	
8:00	Inf 5	50	7.92	5.8	1.94	11.64	11.61
			7.79	2.12	5.49	32.94	
			7.78	2.1	5.5	33	
10:00	Inf 6	50	7.75	2.4	5.17	31.02	32.97
			7.79	1.67	5.94	35.64	
			7.83	1.99	5.66	33.96	
12:00	Inf 7	50	7.85	1.59	6.08	36.48	36.06
			7.48	3.26	4.04	24.24	
			7.55	3.35	4.02	24.12	
14:00	Inf8	50	7.5	3.33	3.99	23.94	24.10
			7.5	1.58	5.74	34.44	
			7.43	1.62	5.63	33.78	
16:00	Inf 9	50	7.5	1.55	5.77	34.62	34.53
			7.96	2.32	5.46	32.76	
			7.94	2.26	5.5	33	
18:00	Inf 10	50	7.83	2.21	5.44	32.64	32.8
			7.61	1.03	6.4	38.4	
			7.56	1.06	6.32	37.92	
20:00	Inf 11	50	7.57	1.01	6.38	38.28	38.2
			7.3	2.2	4.92	29.52	
			7.32	2.24	4.9	29.4	
22:00	Inf 12	50	7.36	2.21	4.97	29.82	29.58
			8.37	8.11	0.26		
			8.35	8.18	0.17		
	Blank	0	8.38	8.2	0.18		0.18

Sample time	Sample Number	Sample Volume	Intial DO (mg/L)	Final DO (mg/L)	DOi - Dof - Blank Correction (mg/L)	BOD (mg/L)	Avg. BOD (mg/L)
			8.59	7.16	1.25	2.15	
			8.57	7.14	1.25	2.5	
0:00	Eff 1	150	8.59	7.03	1.38	2.76	2.63
			8.45	8.29	-0.02	-0.04	
			8.4	8.33	-0.11	-0.22	
2:00	Eff 2	150	8.44	8.29	-0.03	-0.06	-0.05

			8.1	7.43	0.49	0.98	
			8.14	7.41	0.55	1.1	
4:00	Eff 3	150	8.11	7.4	0.53	1.06	1.046667
			8.18	7.42	0.58	1.16	
			8.17	7.44	0.55	1.1	
6:00	Eff 4	150	8.18	8.42	-0.42	-0.84	1.13
			8.24	7.19	0.87	1.74	
			8.22	7.25	0.79	1.58	
8:00	Eff 5	150	8.24	7.16	0.9	1.8	1.706667
			8.11	7.41	0.52	1.04	
			8.14	7.48	0.48	0.96	
10:00	Eff 6	150	8.13	7.41	0.54	1.08	1.026667
			8.23	7.68	0.37	0.74	
			8.21	7.63	0.4	0.8	
12:00	Eff 7	150	8.25	7.64	0.43	0.86	0.8
			8.19	7.03	0.98	1.96	
			8.17	7.13	0.86	1.72	
14:00	Eff 8	150	8.19	7.07	0.94	1.88	1.853333
			8.33	7.85	0.3	0.6	
			8.35	7.84	0.33	0.66	
16:00	Eff 9	150	8.32	7.74	1	2	2
			8.18	7.77	0.23	0.46	
			8.16	7.89	0.09	0.18	
18:00	Eff 10	150	8.13	7.97	-0.02	-0.04	0.32
			8.55	8.33	0.04	0.08	
			8.58	8.36	0.04	0.08	
20:00	Eff 11	150	8.56	8.36	0.02	0.04	0.08
			8.6	7.35	1.07	2.14	
			8.65	7.4	1.07	2.14	
22:00	Eff 12	150	8.59	7.42	0.99	1.98	2.086667

Weekend(21st June 2015)

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3-(mg/L)	Avg. Phosphorus, PO3-(mg/L)
		3.6		11.2		5.3	
		3.2		11.4		5.1	
0:00	Inf 1	3.4	3.4	11.5	11.37		5.2
2:00	Inf 2	0.8	0.6	11	10.83	6.2	6.35

		0.4		10.7		6.5	
		0.6		10.8			
		1.3		7.5		15.4	
		1.5		7.7		15.3	
4:00	Inf 3	1.4	1.4	7.8	7.67		15.35
		0.6		15.3		6.5	
		0.8		15.2		6.4	
6:00	Inf 4	0.7	0.7	15.6	15.37		6.45
		2.6		15.6		14.4	
		2.9		15.4		14.6	
8:00	Inf 5	2.8	2.77	15.3	15.43		14.5
		3.3		11.9		9.8	
		-1.6		11.6		9.5	
10:00	Inf 6	3.1	3.2	11.8	11.77		9.65
		1.6		10.7		6.2	
		1.7		10.8		6.3	
12:00	Inf 7	1.8	1.7	10.5	10.67		6.25
		1.6		-6.3		5.2	
		1.2		9.7		5.1	
14:00	Inf8	1.4	1.4	9.9	9.80		5.15
		1.9		20.1		5.2	
		1.8		20.3		5.4	
16:00	Inf 9	1.7	1.8	20.4	20.27		5.3
		0.5		15.4		5.4	
		0.4		15.3		5.3	
18:00	Inf 10	0.6	0.5	15.1	15.27		5.35
		2.3		16.8		6.8	
		2.1		16.9		6.6	
20:00	Inf 11	2.2	2.2	-4.3	16.85		6.7
		2.6		8.4		9.7	
		2.5		8.3		9.6	
22:00	Inf 12	2.1	2.4	8.6	8.43		9.65

Sample time	Sample Number	Nitrate, NO3-(mg/L)	Avg. Nitrate, NO3-(mg/L)	Ammonia, NH3-(mg/L)	Avg. Ammonia, NH3-(mg/L)	Phosphorus, PO3-(mg/L)	Avg. Phosphorus, PO3-(mg/L)
		7.3		3.6		4.4	
		7.4		3.9		4.6	
0:00	eff 1	7.1	7.27	3.8	3.77		4.5
		10.7		4.4		3.2	
		10.9		-2.7		3.4	
2:00	eff 2	10.6	10.73	4.6	4.50		3.3
		6.4		2.3		3.7	
		-2.6		2.2		3.6	
4:00	eff 3	6.2	6.30	2.4	2.30		3.65
		8.3		2.1		3.8	
		8.5		2.3		3.9	
6:00	eff 4	8.4	8.40	2.4	2.27		3.85
		3.8		1.3		5.4	
		3.9		1.1		5.1	
8:00	eff 5	3.6	3.77	1.3	1.23		5.25
		4.6		3.8		6.1	
		4.5		3.9		6.3	
10:00	eff 6	4.8	4.63	3.6	3.77		6.2
		4.7		1.6		-3.6	
		4.5		1.7		5.4	
12:00	eff 7	4.8	4.67	1.9	1.73		0.9
		5.3		2.2		4.8	
		5.5		2.3		4.9	
14:00	eff 8	5.2	5.33	2.5	2.33		4.85
		3.2		2.1		4.6	
		3.1		2.4		4.4	
16:00	eff 9	3.4	3.23	2.3	2.27		4.5
		2.8		2.1		5.3	
		2.9		2.5		5.1	
18:00	eff 10	2.7	2.80	2.4	2.33		5.2
		3.8		3.2		5.8	
		3.6		3.3		5.6	
20:00	eff 11	3.9	3.77	3.1	3.20		5.7
		3.1		4.2		5.5	
		3.5		4.1		5.7	
22:00	eff 12	3.4	3.33	4.4	4.23		5.6

Weekday (24th June 2015)

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		0.1		12.8		12.6	
		0.2		12.4		12.8	
0:00	Inf 1	0.2	0.17	12.9	11.87		12.7
		0.7		11.7		14.3	
		0.9		11.5		14.1	
2:00	Inf 2	0.8	0.80	11.9	10.40		14.2
		2.4		6.2		17.8	
		2.3		6.8		17.3	
4:00	Inf 3	2.1	2.27	6.3	8.01		17.55
		0.5		10.6		3.8	
		0.4		-5.9		3.9	
6:00	Inf 4	0.2	0.37	10.4	11.02		3.85
		5.3		8.3		5.1	
		5.7		8.1		5.4	
8:00	Inf 5	5.5	5.50	8.4	11.45		5.25
		12.8		19.2		13.5	
		12.7		19.4		13.2	
10:00	Inf 6	-6.7	12.75	19.2	17.95		13.35
		5.7		16.7		6.2	
		5.8		16.4		6.1	
12:00	Inf 7	5.9	5.80	16.5	15.25		6.15
		2.6		12.9		8.7	
		2.1		12.7		8.8	
14:00	Inf8	2.2	2.30	12.6	12.64		8.75
		6.8		13.5		5.1	
		6.7		13.1		5.4	
16:00	Inf 9	6.9	6.80	13.4	12.31		5.25
		2.1		11.3		4.7	
		2.4		11.4		4.4	
18:00	Inf 10	2.3	2.27	11.2	10.32		4.55
		2.2		10.8		-1.6	
		2.4		10.9		5.1	
20:00	Inf 11	2.1	2.23	10.6	8.26		5.1
22:00	Inf 12	3.2	3.23	4.5	3.07	4.1	4.2

		3.1		4.7		4.3	
		3.4		4.4			

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		4.7		6.2		9.4	
		4.9		6.5		9.2	
0:00	eff 1	4.6	4.73	6.1	6.27		9.3
		6.8		1.5		5.9	
		6.4		1.8		5.8	
2:00	eff 2	6.7	6.63	1.7	1.67		5.85
		18.1		1.3		-3.2	
		18.3		1.1		8.4	
4:00	eff 3	18.2	18.20	1.2	1.20		8.4
		-2.5		2.3		3.2	
		6.1		2.2		3.1	
6:00	eff 4	6.2	6.15	2.4	2.30		3.15
		6.5		1.1		3.9	
		6.2		1.2		3.7	
8:00	eff 5	6.3	6.33	1.3	1.20		3.8
		2.7		8.6		-5.2	
		2.9		8.7		12.2	
10:00	eff 6	2.6	2.73	8.5	8.60		12.2
		10.5		1.6		2.8	
		10.6		1.8		2.7	
12:00	eff 7	10.3	10.47	1.4	1.60		2.75
		7.6		0.7		4.7	
		7.5		0.6		4.8	
14:00	eff 8	7.4	7.50	0.4	0.57		4.75
		7.3		1.9		3.9	
		-4.6		1.6		3.8	
16:00	eff 9	7.4	7.35	1.7	1.73		3.85
		4.2		1.4		3.7	
		4.4		1.1		3.5	
18:00	eff 10	4.3	4.30	1.2	1.23		3.6
		3.5		1.7		3.7	
		3.1		1.8		3.9	
20:00	eff 11	3.2	3.27	1.9	1.80		3.8
22:00	eff 12	3.3	3.30	0.3	0.27	3.8	3.85

		3.2		0.1		3.9	
		3.4		0.4			

Weekend(28th June 2015)

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		3.4		12.6		5.7	
		3.1		12.9		5.8	
0:00	Inf 1	3.2	3.23	12.8	12.77		5.75
		1.8		1.1		4.8	
		1.9		1.2		4.9	
2:00	Inf 2	1.7	1.80	1.3	1.20		4.85
		1.9		7.1		4.6	
		1.8		7.3		4.4	
4:00	Inf 3	1.6	1.77	7.2	7.20		4.5
		2.1		13.7		6.3	
		2.4		13.8		6.5	
6:00	Inf 4	2.5	2.33	13.9	13.80		6.4
		2.8		15.3		14.6	
		2.9		15.4		14.4	
8:00	Inf 5	2.7	2.80	15.1	15.27		14.5
		5.1		17.5		9.2	
		-0.7		17.8		9.1	
10:00	Inf 6	5.3	5.20	17.7	17.67		9.15
		1.9		17.3		6.9	
		1.8		17.4		6.8	
12:00	Inf 7	1.6	1.77	17.5	17.40		6.85
		2.4		12.3		6.3	
		2.3		12.1		6.2	
14:00	Inf8	2.1	2.27	12.4	12.27		6.25
		2.1		11.8		5.7	
		2.4		11.7		5.6	
16:00	Inf 9	2.2	2.23	11.9	11.80		5.65
		2.4		15.2		6.4	
		2.5		15.3		6.2	
18:00	Inf 10	2.1	2.33	15.1	15.20		6.3
		2.3		16.3		7	
20:00	Inf 11	2.1	2.20	16.4	16.30	-3.1	7

		2.2		16.2			
		2.5		8.9		5.5	
		2.3		8.6		5.4	
22:00	Inf 12	2.4	2.40	8.5	8.67		5.45

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		8.6		4.4		4.8	
		8.4		4.8		4.9	
0:00	eff 1	8.3	8.43	4.7	4.63		4.85
		4.8		0.1		4.4	
		4.9		0.4		4.2	
2:00	eff 2	4.7	4.80	0.3	0.27		4.3
		5.3		2.4		3.6	
		5.4		2.3		3.3	
4:00	eff 3	-1.2	5.35	2.2	2.30		3.45
		2.4		2.9		4.6	
		2.1		2.6		4.4	
6:00	eff 4	2.5	2.33	2.8	2.77		4.5
		3.8		1.3		5.4	
		3.9		1.1		5.2	
8:00	eff 5	3.7	3.80	1.2	1.20		5.3
		5.3		1.3		4.9	
		5.5		1.4		4.6	
10:00	eff 6	5.6	5.47	1.1	1.27		4.75
		10.3		-5.3		5.4	
		10.5		13.8		5.2	
12:00	eff 7	-4.7	10.40	13.9	13.85		5.3
		4.8		1.9		4.9	
		4.7		1.7		4.7	
14:00	eff 8	4.9	4.80	1.8	1.80		4.8
		5.9		2.6		5.6	
		5.8		2.5		5.5	
16:00	eff 9	5.6	5.77	2.4	2.50		5.55
		8.6		3.4		5.1	
		8.8		3.5		5.2	
18:00	eff 10	8.7	8.70	3.3	3.40		5.15
		3.7		3.4		4.6	
20:00	eff 11	3.4	3.57	3.7	3.53	4.4	4.5

		3.6		3.5			
		6.2		4.4		4.7	
		-1.4		4.6		4.9	
22:00	eff 12	6.4	6.30	4.4	4.47		4.8

Weekday (1st July 2015)

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		3.4		1.7		6.2	
		-0.1		1.9		6.1	
0:00	Inf 1	3.2	3.30	1.8	1.80		6.15
		0.8		13.6		13.9	
		0.9		13.3		13.8	
2:00	Inf 2	0.7	0.80	13.5	13.47		13.85
		0.7		8.8		9.1	
		0.6		8.9		9.2	
4:00	Inf 3	0.9	0.73	8.7	8.80		9.15
		4.3		6.1		3.7	
		4.4		6.3		3.4	
6:00	Inf 4	4.5	4.40	6.2	6.20		3.55
		1.6		7.4		3.7	
		1.7		7.6		3.5	
8:00	Inf 5	1.4	1.57	-1.6	7.50		3.6
		0.2		11.5		5.4	
		0.1		11.4		5.6	
10:00	Inf 6	0.3	0.20	11.1	11.33		5.5
		1.2		14.3		5.6	
		1.1		14.1		5.7	
12:00	Inf 7	1.3	1.20	14.2	14.20		5.65
		0.8		13.8		8.9	
		0.7		13.9		8.7	
14:00	Inf8	0.8	0.77	13.8	13.83		8.8
		3.7		9.8		3.6	
		3.9		9.9		3.7	
16:00	Inf 9	3.8	3.80	9.5	9.73		3.65
		2.9		9.1		-0.3	
		2.8		9.4		4.1	
18:00	Inf 10	2.6	2.77	9.3	9.27		4.1

		1.2		9.6		6.4	
		1.3		9.8		6.2	
20:00	Inf 11	1.4	1.30	9.7	9.70		6.3
		1.9		11.9		4.9	
		1.8		11.8		4.7	
22:00	Inf 12	1.8	1.83	11.9	11.87		4.8

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		4.5		0.2		3.6	
		4.6		0.1		3.4	
0:00	eff 1	4.3	4.47	0.3	0.20		3.5
		6.1		1.7		4.8	
		6.1		1.8		4.9	
2:00	eff 2	6.3	6.17	1.9	1.80		4.85
		8.7		1.2		3.7	
		-1.7		1.4		3.5	
4:00	eff 3	8.5	8.60	1.1	1.23		3.6
		5.4		4.3		3.1	
		5.6		4.5		3.2	
6:00	eff 4	5.7	5.57	4.6	4.47		3.15
		4.2		2.1		2.3	
		4.1		2.2		2.6	
8:00	eff 5	4.4	4.23	2.4	2.23		2.45
		8.6		2.3		4.8	
		8.5		2.1		4.9	
10:00	eff 6	8.8	8.63	2.2	2.20		4.85
		9.4		2.6		3.6	
		9.2		2.7		3.3	
12:00	eff 7	9.4	9.33	2.5	2.60		3.45
		23.1		2.4		4.5	
		-2.4		2.6		4.7	
14:00	eff 8	23.2	23.15	2.7	2.57		4.6
		26.1		1.3		3.9	
		26.2		1.2		3.8	
16:00	eff 9	26.3	26.20	1.5	1.33		3.85
		7.9		6.6		4.3	
		7.7		6.5		4.5	
18:00	eff 10	7.8	7.80	6.3	6.47		4.4

		4.3		4.6		2.9	
		4.1		4.2		2.8	
20:00	eff 11	4.2	4.20	4.3	4.37		2.85
		8.5		1.8		4.5	
		8.2		1.9		4.2	
22:00	eff 12	8.3	8.33	1.8	1.83		4.35

Weekend(5th july 2015)

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		3.5		11.7		5.7	
		3.2		11.8		5.6	
0:00	Inf 1	3.4	3.37	11.9	11.80		5.65
		1.3		5.9		5.8	
		1.2		5.8		5.7	
2:00	Inf 2	1.1	1.20	5.9	5.87		5.75
		1.7		7.5		9.9	
		1.8		7.7		9.7	
4:00	Inf 3	1.5	1.67	7.4	7.53		9.8
		1.5		14.3		6.7	
		1.3		14.6		6.5	
6:00	Inf 4	1.4	1.40	-1.9	14.45		6.6
		2.9		15.4		14.3	
		2.8		15.3		14.6	
8:00	Inf 5	2.6	2.77	15.1	15.27		14.45
		4.3		14.8		9.5	
		4.1		14.7		9.3	
10:00	Inf 6	4.2	4.20	14.5	14.67		9.4
		1.8		13.9		6.5	
		1.9		13.7		6.6	
12:00	Inf 7	1.6	1.77	13.8	13.80		6.55
		1.8		10.7		5.8	
		1.7		10.8		5.7	
14:00	Inf8	1.9	1.80	10.9	10.80		5.75
		1.7		15.8		5.6	
		1.8		15.9		5.4	
16:00	Inf 9	1.9	1.80	-3.6	15.85		5.5
18:00	Inf 10	1.1	1.20	15.3	15.33	5.9	5.8

		1.3		15.4		5.7	
		1.2		15.3			
		2.2		16.2		6.8	
		2.3		16.4		6.9	
20:00	Inf 11	2.1	2.20	16.6	16.40		6.85
		5.5		8.6		7.5	
		5.2		8.4		7.7	
22:00	Inf 12	5.2	5.30	8.5	8.50		7.6

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		-1.3		4.2		4.9	
		7.7		4.2		4.8	
0:00	eff 1	7.8	7.75	4.5	4.30		4.85
		7.9		2.3		3.9	
		7.6		2.5		3.7	
2:00	eff 2	7.8	7.77	2.2	2.33		3.8
		5.8		2.1		3.7	
		5.6		2.2		3.5	
4:00	eff 3	5.9	5.77	2.3	2.20		3.6
		-2.5		2.3		4.3	
		5.2		2.7		4.2	
6:00	eff 4	5.3	5.25	2.6	2.53		4.25
		3.7		1.2		5.1	
		3.9		1.4		5.3	
8:00	eff 5	3.8	3.80	1.3	1.30		5.2
		5.1		2.5		5.4	
		5.3		2.3		5.2	
10:00	eff 6	5.1	5.17	2.7	2.50		5.3
		7.7		1.8		5.4	
		7.4		1.7		5.2	
12:00	eff 7	7.5	7.53	1.9	1.80		5.3
		5.1		1.9		4.7	
		5.3		1.8		4.9	
14:00	eff 8	5.2	5.20	1.9	1.87		4.8
		4.6		2.2		-2.1	
		4.3		2.1		5	
16:00	eff 9	4.5	4.47	2.3	2.20		5
18:00	eff 10	5.3	5.60	2.9	2.77	5.3	5.25

		5.8		2.6		5.2	
		5.7		2.8			
		3.7		3.2		5.4	
		3.5		3.5		5.3	
20:00	eff 11	3.6	3.60	3.4	3.37		5.35
		3.8		4.3		5.1	
		3.6		4.4		5.2	
22:00	eff 12	-0.9	3.70	4.2	4.30		5.15

Weekday (8th July 2015)

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		1.7		7.3		9.4	
		1.5		7.2		9.2	
0:00	Inf 1	1.8	1.67	7.1	7.20		9.3
		0.9		12.8		13.9	
		0.8		12.6		13.8	
2:00	Inf 2	0.7	0.80	12.4	12.60		13.85
		1.9		7.9		13.5	
		1.5		7.7		13.1	
4:00	Inf 3	1.6	1.67	7.8	7.80		13.3
		2.4		8.3		3.6	
		2.1		8.1		3.8	
6:00	Inf 4	2.2	2.23	8.4	8.27		3.7
		3.5		7.9		4.5	
		3.6		-2.4		4.3	
8:00	Inf 5	3.7	3.60	7.7	7.80		4.4
		6.2		15.1		9.5	
		6.1		15.2		9.3	
10:00	Inf 6	6.4	6.23	15.1	15.13		9.4
		3.6		15.5		5.9	
		3.1		13.2		5.9	
12:00	Inf 7	3.2	3.30	15.1	14.60		5.9
		1.8		13.3		8.9	
		1.6		13.1		8.8	
14:00	Inf8	1.7	1.70	13.5	13.30		8.85
		5.3		11.4		4.6	
16:00	Inf 9	5.5	5.40	11.3	11.47	4.3	4.45

		5.4		11.7			
		2.7		10.2		4.6	
		2.5		10.1		4.3	
18:00	Inf 10	2.6	2.60	-1.7	10.15		4.45
		1.7		10.2		5.7	
		1.6		10.1		5.6	
20:00	Inf 11	1.4	1.57	10.3	10.20		5.65
		3.9		8.1		4.4	
		3.6		8.3		4.6	
22:00	Inf 12	3.8	3.77	8.4	8.27		4.5

Sample time	Sample Number	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Ammonia, NH3- (mg/L)	Avg. Ammonia, NH3- (mg/L)	Phosphorus, PO3- (mg/L)	Avg. Phosphorus, PO3- (mg/L)
		4.8		3.4		6.3	
		4.5		3.5		6.4	
0:00	eff 1	4.7	4.67	3.2	3.37		6.35
		6.3		1.7		5.6	
		6.1		1.9		5.3	
2:00	eff 2	6.2	6.20	1.8	1.80		5.45
		13.3		1.2		6.1	
		13.5		1.3		6	
4:00	eff 3	13.5	13.43	1.1	1.20		6.05
		5.7		3.2		3.2	
		5.9		3.4		-1.1	
6:00	eff 4	5.8	5.80	3.1	3.23		3.2
		5.3		1.5		3.2	
		5.6		1.7		3.1	
8:00	eff 5	5.4	5.43	1.9	1.70		3.15
		5.6		5.1		8.5	
		5.8		5.4		8.2	
10:00	eff 6	5.9	5.77	5.6	5.37		8.35
		-1.2		2.1		3.1	
		9.8		2.3		3.1	
12:00	eff 7	9.7	9.75	2.1	2.17		3.1
		15.1		1.4		4.9	
		15.3		1.8		4.6	
14:00	eff 8	15.4	15.27	1.6	1.60		4.75
		16.9		1.7		3.9	
16:00	eff 9	16.8	16.85	1.9	1.70	3.6	3.75

		-2.5		1.5			
		5.9		3.9		3.9	
		5.7		3.6		3.8	
18:00	eff 10	5.8	5.80	3.7	3.73		3.85
		3.5		3.2		3.7	
		3.8		3.4		3.3	
20:00	eff 11	3.6	3.63	3.1	3.23		3.5
		1.9		0.8		4.1	
		1.7		0.9		4.1	
22:00	eff 12	1.8	1.80	0.9	0.87		4.1

TSS weekend (21st June 2015)

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1074.8	1074.9	2	
			1070.8	1071	4	
0:00	Inf 1	50	1071.7	1071.8	2	2
			1070	1070.8	16	
			1076.8	1077.7	18	
2:00	Inf 2	50	1077	1077.6	12	17
			1083.3	1083.8	10	
			1079.7	1080	6	
4:00	Inf 3	50	1075	1075.2	4	5
			1075	1075.05	1	
			10776.8	10776.93	2.5	
6:00	Inf 4	50	1075.8	1075.9	2	2.25
			1081.9	1082.1	4	
			1084.8	1084.9	2	
8:00	Inf 5	50	1073.1	1075	38	3
			1080.6	1082.3	34	
			1072.9	1074.1	24	
10:00	Inf 6	50	1077.9	1078.4	10	29
			1082.8	1089.1	126	
			1083.2	1084.6	28	
12:00	Inf 7	50	1076.7	1079.6	58	0
			1078.8	1079	4	
			1068.7	1069	6	
14:00	Inf8	50	1081.3	1081.7	8	7
16:00	Inf 9	50	1080.4	1081.1	14	14

			10798	10800.2	44	
			1077.8	1078.5	14	
			1073.4	1074.8	28	
			1065.6	1065.7	2	
18:00	Inf 10	50	1073.9	1075.2	26	27
			1076.8	1078	24	
			1089.1	1090.5	28	
20:00	Inf 11	50	1081.3	1082.1	16	26
			1070.7	1071.7	20	
			1076.4	1077.1	14	
22:00	Inf 12	50	1086.9	1087.4	10	12

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1078.9	1079.2	1.5	
			1078.6	1079.1	2.5	
0:00	Eff 1	200	1064.7	1064.9	1	2.7
			1073.8	1074.8	5	
			1080.9	1082.4	7.5	
2:00	Eff 2	200	1075.6	1076.2	3	4.0
			1075.2	1075.3	0.5	
			1077	1077.2	1	
4:00	Eff 3	200	1068.9	1068.9	0	0.7
			1077.7	1077.9	1	
			1076.7	1076.82	0.6	
6:00	Eff 4	200	1076.9	1077.1	1	1.0
			1079.6	1080.6	5	
			1077	1077.1	0.5	
8:00	Eff 5	200	1077.2	1077.3	0.5	3.8
			1078.4	1079.8	7	
			1079.6	1081.7	10.5	
10:00	Eff 6	200	1080	1081.4	7	7.0
			1076.2	1077	4	
			1078.7	1079.3	3	
12:00	Eff 7	200	1079.8	1080.5	3.5	3.1
			1078.9	1079	0.5	
			1074	1074.1	0.5	
14:00	Eff 8	200	1079.8	1080.1	1.5	1.7
16:00	Eff 9	200	1083.5	1083.7	1	3.0

			1078.9	1083.5	23	
			1083.5	1084.5	5	
			1088	1089.5	7.5	
			1082.8	1084.2	7	
18:00	Eff 10	200	1088.3	1089.1	4	4.7
			1083.9	1084.08	0.9	
			1077.2	1077.34	0.7	
20:00	Eff 11	200	1088.8	1089	1	1.9
			1077.3	1078.9	8	
			1088.7	1088.9	1	
22:00	Eff 12	200	1080.2	1080.9	3.5	3.8

TSS weekday (24th June 2015)

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1074.5	1074.7	4.00	
			1070.8	1070.9	2.00	
0:00	Inf 1	50	1071.9	1072.2	6.00	5
			1069.8	1070	4.00	
			1077.2	1077.4	4.00	
2:00	Inf 2	50	1077	1077.8	16.00	4
			1083.5	1083.7	4.00	
			1079.6	1080.1	10.00	
4:00	Inf 3	50	1074.7	1075.1	8.00	9
			1073.9	1074.6	14.00	
			1077.1	1077.5	8.00	
6:00	Inf 4	50	1075.5	1075.9	8.00	15
			1081.7	1082.3	12.00	
			1084.3	1084.9	12.00	
8:00	Inf 5	50	1072.6	1073.1	10.00	12
			1080.8	1081.2	8.00	
			1072.3	1072.6	6.00	
10:00	Inf 6	50	1077.8	1078.2	8.00	8
			1082.6	1083.2	12.00	
			1083.4	1083.8	8.00	
12:00	Inf 7	50	1076.8	1077.3	10.00	11
			1078.6	1078.6	0.00	
			1068.7	1069.5	16.00	
14:00	Inf8	50	1081.7	1081.8	2.00	9

			1080.2	1080.9	14.00	
			1079.9	1081.6	34.00	
16:00	Inf 9	50	1077.9	1078.5	12.00	13
			1073.7	1074.1	8.00	
			1065.2	1065.3	2.00	
18:00	Inf 10	50	1073.6	1074	8.00	8
			1076.6	1076.975	7.50	
			1089.3	1090.05	15.00	
20:00	Inf 11	50	1080.7	1081.175	9.50	8.5
			1069.9	1070.1	4.00	
			1076.6	1076.9	6.00	
22:00	Inf 12	50	1086.8	1087.4	12.00	5

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1078.8	1080.6	9	
			1078.9	1079.3	2	
0:00	Eff 1	200	1064.6	1065.4	4	3
			1073.7	1073.8	0.5	
			1080.6	1081.3	3.5	
2:00	Eff 2	200	1075.4	1075.6	1	1.666667
			1075.6	1076	2	
			1077.2	1077.8	3	
4:00	Eff 3	200	1068.7	1071.6	14.5	2.5
			1077.5	1077.8	1.5	
			1076.3	1076.4	0.5	
6:00	Eff 4	200	1076.6	1076.68	0.4	0.45
			1079.8	1079.9	0.5	
			1076.9	1077.1	1	
8:00	Eff 5	200	1076.8	1076.9	0.5	0.5
			1078.6	1078.7	0.5	
			1079.8	1080.1	1.5	
10:00	Eff 6	200	1088.5	1088.7	1	1.25
			1075.8	1076.1	1.5	
			1078.7	1079.2	2.5	
12:00	Eff 7	200	1080.2	1080.6	2	2.25
			1078.6	1079	2	
			1073.5	1073.7	1	
14:00	Eff 8	200	1080	1080.3	1.5	1.75

			1083.2	1083.4	1	
			1078.8	1079.4	3	
16:00	Eff 9	200	1082.3	1082.4	0.5	1.5
			1088.1	1088.8	3.5	
			1082.4	1083.9	7.5	
18:00	Eff 10	200	1088.5	1088.5	0	3.666667
			1083.3	1083.7	2	
			1076.9	1077.3	2	
20:00	Eff 11	200	1089.1	1091.5	12	2
			1076.6	1076.66	0.3	
			1089.9	1089.98	0.4	
22:00	Eff 12	200	1080.4	1080.64	1.2	0.35

TSS weekend (28th June 2015)

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1080.7	1080.9	4	
			1073.7	1073.8	2	
0:00	Inf 1	50	1072.2	1072.4	4	3
			1073.5	1074.6	22	
			1082.4	1083.2	16	
2:00	Inf 2	50	1076.7	1077.5	16	16
			1080.1	1080.5	8	
			1074.7	1075.2	10	
4:00	Inf 3	50	1073.5	1073.9	8	8
			1072.6	1072.9	6	
			1080.1	1080.4	6	
6:00	Inf 4	50	1077.8	1078.1	6	6
			1076.6	1077	8	
			1084.5	1084.9	8	
8:00	Inf 5	50	1075.7	1076.1	8	8
			1075.9	1077.5	32	
			1069.1	1070.2	22	
10:00	Inf 6	50	1073	1074.6	32	32
			1083.4	1085.3	38	
			1075.7	1077.6	38	
12:00	Inf 7	50	1074.6	1075.7	22	38
			1078.8	1079.1	6	
14:00	Inf8	50	1076.5	1076.8	6	6

			1079	1079.2	4	
			1079.9	1080.2	6	
			1080.2	1080.7	10	
16:00	Inf 9	50	1075.7	1075.9	4	6.666667
			1071.5	1072.2	14	
			1068.2	1068.8	12	
18:00	Inf 10	50	1064.7	1065.4	14	14
			1072.4	1074.1	34	
			1076.6	1077.8	24	
20:00	Inf 11	50	1071.4	1073.1	34	34
			1072.4	1072.8	8	
			1072.3	1072.8	10	
22:00	Inf 12	50	1068	1068.5	10	10

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1073.4	1073.8	2	
			1069.9	1070.6	3.5	
0:00	Eff 1	200	1069.6	1069.5	-0.5	2.7
			1064.6	1065.4	4	
			1074.6	1075.5	4.5	
2:00	Eff 2	200	1077.7	1078.5	4	4.2
			1071.2	1071.3	0.5	
			1075.7	1076	1.5	
4:00	Eff 3	200	1070.1	1070.2	0.5	0.5
			1065.6	1065.7	0.5	
			1076.6	1076.7	0.5	
6:00	Eff 4	200	1079.1	1072.3	-34	0.3
			1072.3	1073	3.5	
			1074.5	1075.3	4	
8:00	Eff 5	200	1064.6	1065.2	3	3.5
			1074.7	1075.7	5	
			1079.1	1080.1	5	
10:00	Eff 6	200	1080.1	1082	9.5	5.0
			1068	1068	0	
			1078.1	1078.9	4	
12:00	Eff 7	200	1066	1067	5	4.5
			1074.6	1075	2	
14:00	Eff 8	200	1067.7	1068	1.5	1.7

			1071.2	1071.5	1.5	
			1080.2	1080.4	1	
			1081.3	1081.9	3	
16:00	Eff 9	200	1062.5	1063	2.5	2.8
			1077.8	1079	6	
			1076.7	1078.2	7.5	
18:00	Eff 10	200	1073.6	1074.6	5	5.5
			1068.9	1069.3	2	
			1070.2	1070.1	-0.5	
20:00	Eff 11	200	1082.4	1082.8	2	2.0
			1067.8	1067.7	-0.5	
			1073.5	1073.8	1.5	
22:00	Eff 12	200	1082.4	1082.8	2	1.7

TSS weekday (1st July 2015)

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1074.7	1075.1	8	
			1071	1071.25	5	
0:00	Inf 1	50	1071.8	1072.1	6	5.5
			1069.9	1070.1	4	
			1077.3	1077.525	4.5	
2:00	Inf 2	50	1077.4	1077.55	3	4.25
			1083.3	1083.75	9	
			1079.4	1079.825	8.5	
4:00	Inf 3	50	1074.6	1075.025	8.5	8.666667
			1074.2	1074.95	15	
			1077.4	1078.1	14	
6:00	Inf 4	50	1076.2	1076.1	-2	14.5
			1081.9	1082.5	12	
			1084.6	1085.3	14	
8:00	Inf 5	50	1072.9	1073.45	11	11.5
			1081.1	1081.5	8	
			1077.8	1078.15	7	
10:00	Inf 6	50	1077.8	1078	4	7.5
			1082.9	1083.45	11	
			1083.6	1084.175	11.5	
12:00	Inf 7	50	1077.3	1077.85	11	11.16667
14:00	Inf8	50	1079.1	1079.55	9	9

			1068.9	1069.35	9	
			1082.1	1082.55	9	
			1080.5	1081.15	13	
			1080.3	1080.925	12.5	
16:00	Inf 9	50	1077.9	1078.6	14	13.5
			1074.6	1075	8	
			1065.4	1065.75	7	
18:00	Inf 10	50	1074.5	1074.9	8	7.666667
			1077.1	1077.5	8	
			1089.1	1089.55	9	
20:00	Inf 11	50	1080.3	1081.05	15	8.5
			1070.3	1070.55	5	
			1076.7	1076.8	2	
22:00	Inf 12	50	1086.5	1086.725	4.5	4.75

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1078.9	1079.5	3	
			1078.9	1079.3	2	
0:00	Eff 1	200	1064.8	1065.4	3	2.666667
			1073.5	1073.9	2	
			1080.1	1080.3	1	
2:00	Eff 2	200	1075.9	1076.2	1.5	1.5
			1075.8	1076.6	4	
			1077.7	1078.9	6	
4:00	Eff 3	200	1068.9	1070.3	7	6.5
			1077.1	1077.3	1	
			1076.3	1076.4	0.5	
6:00	Eff 4	200	1077	1076.9	-0.5	0.75
			1079.8	1080	1	
			1078	1078.2	1	
8:00	Eff 5	200	1077.4	1077.6	1	1
			1079	1079.4	2	
			1079.3	1079.6	1.5	
10:00	Eff 6	200	1088.1	1088.5	2	1.833333
			1076.7	1076.1	-3	
			1079.1	1079.5	2	
12:00	Eff 7	200	1080.6	1081.2	3	2.5
14:00	Eff 8	200	1078.7	1079.1	2	1.666667

			1073.6	1074	2	
			1080.2	1080.4	1	
			1083.4	1083.6	1	
			1078.7	1078.9	1	
16:00	Eff 9	200	1082.5	1083.3	4	1
			1088.3	1088.9	3	
			1082.5	1082.9	2	
18:00	Eff 10	200	1088.8	1089.6	4	3
			1083.1	1083.5	2	
			1077.3	1077.9	3	
20:00	Eff 11	200	1089.9	1090.3	2	2.333333
			1076.2	1076.4	1	
			1090.8	1090.9	0.5	
22:00	Eff 12	200	1080.2	1080.3	0.5	0.5

TSS weekend (5th July 2015)

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1074.8	1075	4	
			1070.8	1071	4	
0:00	Inf 1	50	1071.6	1071.5	-2	4
			1070.7	1070.5	-4	
			1076.9	1077.7	16	
2:00	Inf 2	50	1077	1077.8	16	16
			1083.4	1083.8	8	
			1079.3	1079.7	8	
4:00	Inf 3	50	1074.8	1075.2	8	8
			1075.2	1075.05	-3	
			1077.8	1077.7	-2	
6:00	Inf 4	50	1075.9	1076.2	6	6
			1081.7	1082.1	8	
			1084.5	1084.9	8	
8:00	Inf 5	50	1073.5	1074	10	8
			1080.8	1082.3	30	
			1073.1	1074.4	26	
10:00	Inf 6	50	1078	1078.4	8	28
			1082.7	1083.1	8	
			1083.1	1084.6	30	
12:00	Inf 7	50	1076.9	1078.7	36	33

			1078.9	1079.2	6	
			1068.6	1068.9	6	
14:00	Inf8	50	1081.5	1081.7	4	6
			1080.7	1081	6	
			1079.7	1080.2	10	
16:00	Inf 9	50	1077.9	1078.1	4	10
			1073.9	1074.6	14	
			1065.1	1065.7	12	
18:00	Inf 10	50	1074.5	1075.2	14	14
			1077.2	1078.8	32	
			1088.7	1090.5	36	
20:00	Inf 11	50	1081.5	1082.1	12	34
			1071.3	1071.7	8	
			1077.2	1077.1	-2	
22:00	Inf 12	50	1086.6	1087.1	10	9

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1078.7	1079.2	2.5	
			1078.3	1079.1	4	
0:00	Eff 1	200	1065	1064.9	-0.5	3.2
			1073.7	1074.6	4.5	
			1080.6	1081.6	5	
2:00	Eff 2	200	1075.4	1076.3	4.5	4.7
			1075.2	1075.4	1	
			1068	1068.4	2	
4:00	Eff 3	200	1068.9	1069.1	1	1.3
			1077.8	1078	1	
			1076.7	1076.9	1	
6:00	Eff 4	200	1076.9	1070	-34.5	0.7
			1079.6	1080.4	4	
			1076.8	1077.7	4.5	
8:00	Eff 5	200	1077.2	1077.9	3.5	4.0
			1078.6	1079.7	5.5	
			1078.1	1079.2	5.5	
10:00	Eff 6	200	1080	1082	10	5.5
			1076.4	1076.4	0	
			1078.6	1079.5	4.5	
12:00	Eff 7	200	1080.8	1081.9	5.5	5.0

			1078.7	1079.2	2.5	
			1074.2	1074.6	2	
14:00	Eff 8	200	1078.9	1079.3	2	2.2
			1083.5	1083.8	1.5	
			1078.6	1079.3	3.5	
16:00	Eff 9	200	1083.7	1084.3	3	3.2
			1088.3	1089.6	6.5	
			1082.3	1083.9	8	
18:00	Eff 10	200	1088.5	1089.6	5.5	6.0
			1083.7	1084.2	2.5	
			1077.6	1077.5	-0.5	
20:00	Eff 11	200	1090.1	1090.6	2.5	2.5
			1077.5	1077.4	-0.5	
			1088.9	1089.3	2	
22:00	Eff 12	200	1079.5	1080	2.5	2.2

TSS weekday (8th July 2015)

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1090.7	1090.9	4	
			1094	1094.2	4	
0:00	Inf 1	50	1090.4	1090.6	4	6
			1093.3	1093.4	2	
			1098.4	1098.6	4	
2:00	Inf 2	50	1075.6	1075.7	2	2
			1100.5	1100.9	8	
			1106.1	1106.5	8	
4:00	Inf 3	50	1083.5	1083.9	8	8
			1091.8	1092.5	14	
			1101.8	1102.4	12	
6:00	Inf 4	50	1104.8	1105.4	12	12.66667
			1105.4	1105.9	10	
			1113.1	1113.6	10	
8:00	Inf 5	50	1103.9	1104.4	10	10
			1106.4	1106.7	6	
			1102.4	1102.7	6	
10:00	Inf 6	50	1102.3	1102.6	6	6
			1102.8	1103.3	10	
12:00	Inf 7	50	1110.9	1111.4	10	10

			1100.8	1101.3	10	
			1100	1100.4	8	
			1098	1098.4	8	
14:00	Inf8	50	1105.4	1105.8	8	8
			1081.9	1082.5	12	
			1081.7	1082.3	12	
16:00	Inf 9	50	1078.3	1078.9	12	12
			1083.7	1084	6	
			1088.7	1089	6	
18:00	Inf 10	50	1085.4	1085.7	6	6
			1088.1	1088.4	6	
			1083.3	1083.7	8	
20:00	Inf 11	50	1084.6	1084.9	6	6
			1077.8	1078	4	
			1070.7	1070.9	4	
22:00	Inf 12	50	1064.5	1064.7	4	4

Sample time	Sample Number	Sample Volume	Intial weight (mg)	Final weight (mg)	TSS (mg/L)	Avg. TSS (mg/L)
			1087.9	1088.4	2.5	
			1087.4	1087.7	1.5	
0:00	Eff 1	200	1081	1081.5	2.5	2.5
			1065.8	1066.1	1.5	
			1075.8	1075.9	0.5	
2:00	Eff 2	200	1090.5	1090.7	1	1
			1085	1085.7	3.5	
			1086.6	1087.7	5.5	
4:00	Eff 3	200	1078.3	1079.6	6.5	6
			1078.1	1078.2	0.5	
			1089.1	1089.1	0	
6:00	Eff 4	200	1084.4	1084.3	-0.5	0.5
			1071.5	1071.6	0.5	
			1084.3	1084.4	0.5	
8:00	Eff 5	200	1083.6	1083.7	0.5	0.5
			1084.6	1084.9	1.5	
			1078.5	1078.7	1	
10:00	Eff 6	200	1188.2	1188.5	1.5	1.333333
			1189.2	1188.6	-3	
12:00	Eff 7	200	1188	1188.3	1.5	2

			1178.3	1178.8	2.5	
			1190	1190.3	1.5	
			1194.8	1195.1	1.5	
14:00	Eff 8	200	1189.5	1189.6	0.5	1.5
			1197.1	1197.2	0.5	
			1193.1	1193.2	0.5	
16:00	Eff 9	200	1187.8	1188.5	3.5	0.5
			1177.8	1178.3	2.5	
			1181.8	1182.1	1.5	
18:00	Eff 10	200	1183.3	1184	3.5	3
			1186.4	1186.7	1.5	
			1190	1190.5	2.5	
20:00	Eff 11	200	1191.5	1191.8	1.5	1.5
			1197.8	1197.9	0.5	
			1194.8	1194.8	0	
22:00	Eff 12	200	1189.3	1189.3	0	0.5

Anoxic Treatment Unit

NH3-
Weekend I

Inf		Eff	
Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)
7.8		3	
7.7		3.1	
7.6	7.7	3.1	3.066667

NH3-
Weekend II

Inf		Eff	
Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)
7.7		3.3	
7.8		3.3	
7.9	7.8	3.4	3.333333

NH3-
Weekday I

Inf		Eff	
Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)
11.3		3.5	
12		3.6	
11.7	11.66667	3.6	3.566667

NH3-
Weekday II

Inf		Eff	
Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)	Nitrate, NO3- (mg/L)	Avg. Nitrate, NO3- (mg/L)
11.5		3.5	
11.6		3.6	
11.3	11.46667	3.7	3.6

MLSS & MLVSS weekend I

Sample Name	Sample Volume	Intial weight (mg)	Final weight (mg)	MLSS (mg/L)	Avg. MLSS(mg/L)	Final weight after 550oC	MLVSS (mg/L)	Avg. MLVSS(mg/L)
anoxic tank (1:100)	50	1045.4	1055.4	20000	13500	1049.2	12400	11100
		1042.7	1048.8	12200		1046.2	5200	
		1044.7	1052.1	14800		1047.2	9800	
aeration tank (1:100)	50	1050.9	1056.1	10400	12100	1053.6	5000	6200
		1043.9	1049.9	12000		1046.7	6400	
		1041.7	1047.8	12200		1044.2	7200	
clarifier (1:100)	50	1045.4	1063	35200	35100	1051.6	22800	22800
		1039.7	1058.8	38200		1046.8	24000	
		1044.7	1062.2	35000		1050.8	22800	

MLSS & MLVSS weekend II

Sample Name	Sample Volume	Intial weight (mg)	Final weight (mg)	MLSS (mg/L)	Avg. MLSS(mg/L)	Final weight after 550oC	MLVSS (mg/L)	Avg. MLVSS(mg/L)
anoxic tank (1:100)	50	1045.8	1052.4	13200	13500	1049.3	6200	9600
		1043.4	1049.6	12400		1044.7	9800	
		1045.4	1052.3	13800		1047.6	9400	
aeration tank (1:100)	50	1051	1056.4	10800	10533.33	1053.2	6400	6800
		1044.2	1049.5	10600		1046.1	6800	
		1042.5	1047.6	10200		1044	7200	
clarifier (1:100)	50	1046.3	1063.3	34000	34200	1051.5	23600	24000
		1040.3	1059.1	37600		1045.9	26400	
		1045.3	1062.5	34400		1050.3	24400	

MLSS & MLVSS weekday I

Sample Name	Sample Volume	Intial weight (mg)	Final weight (mg)	MLSS (mg/L)	Avg. MLSS(mg/L)	Final weight after 550oC	MLVSS (mg/L)	Avg. MLVSS(mg/L)
anoxic tank (1:100)	50	1044.3	1056.2	23800	22733.33	1046.5	19400	19333.3
		1041.8	1053.2	22800		1043.5	19400	
		1044.5	1055.3	21600		1045.7	19200	
aeration tank (1:100)	50	1049.8	1057.8	16000	16300	1052.4	10800	10800
		1043.4	1052.6	18400		1045.7	13800	
		1041	1049.3	16600		1043.9	10800	
clarifier	50	1044.3	1067.3	46000	47866.67	1051.1	32400	33600

(1:100)		1039.3	1063.4	48200		1046	34800	
		1045	1069.7	49400		1049.6	40200	

MLSS & MLVSS weekday II

Sample Name	Sample Volume	Intial weight (mg)	Final weight (mg)	MLSS (mg/L)	Avg. MLSS(mg/L)	Final weight after 550oC	MLVSS (mg/L)	Avg. MLVSS(mg/L)
anoxic tank (1:100)	50	1046.3	1058.3	24000	24000	1048.7	19200	19100
		1044.5	1056.4	23800		1046.9	19000	
		1042.1	1054.2	24200		1044.65	19100	
aeration tank (1:100)	50	1050.5	1058.4	15800	16300	1053.3	10200	10300
		1045.9	1054.1	16400		1046.3	15600	
		1043.2	1051.3	16200		1046.1	10400	
clarifier (1:100)	50	1046.7	1071.2	49000	48866.67	1054.6	33200	33200
		1043.5	1067.8	48600		1051.25	33100	
		1046.2	1070.7	49000		1054.05	33300	

TOC

Sample time	Sample Number	weekend I	weekend II	weekend III	weekdayI	weekday II	weekday III
0:00	Inf 1	2.851	2.719	2.785	0.1479	0.1659	0.1569
2:00	Inf 2	9.026	4.83	6.928	3.021	5.083	4.052
4:00	Inf 3	8.303	1.224	4.7635	4.605	5.064	4.8345
6:00	Inf 4	6.522	-1.206	2.658	6.669	5.093	5.881
8:00	Inf 5	5.861	1.058	3.4595	4.654	4.738	4.696
10:00	Inf 6	11.52	7.437	9.4785	7.054	12.4	9.727

12:00	Inf 7	16.32	3.997	10.1585	8.501	7.537	8.019
14:00	Inf8	8.843	1.456	5.1495	8.195	9.673	8.934
16:00	Inf 9	6.59	1.893	2.3485	4.204	3.56	3.882
18:00	Inf 10	1.948	1.937	0.0055	3.657	4.108	3.8825
20:00	Inf 11	0.8252	0.6141	0.71965	0.6221	0.874	0.74805
22:00	Inf 12	9.839	5.804	7.8215	8.302	9.204	8.753

Sample time	Sample Number	weekend I	weekend II	weekend III	weekdayI	weekday II	weekday III
0:00	Eff 1	-6.373	-8.887	-7.63	-5.312	-4.356	-4.834
2:00	Eff 2	-5.945	-9.165	-7.555	-5.423	-5.346	-5.3845
4:00	Eff 3	-6.174	-9.093	-7.6335	-5.475	-5.467	-5.471
6:00	Eff 4	-4.5	-9.11	-6.805	-5.56	-4.67	-5.115
8:00	Eff 5	-4.181	-9.235	-6.708	-5.251	-4.35	-4.8005
10:00	Eff 6	-3.914	-9.195	-6.5545	-4.924	-6.87	-5.897
12:00	Eff 7	-4.991	-9.013	-7.002	-5.415	-4.67	-5.0425

14:00	Eff 8	-5.168	-9.309	-7.2385	-5.127	-4.61	-4.8685
16:00	Eff 9	-5.343	-9.249	-7.296	-5.106	-5.893	-5.4995
18:00	Eff 10	-6.253	-9.327	-7.79	-4.91	-4.567	-4.7385
20:00	Eff 11	-6.042	-9.1	-7.571	-5.12	-3.26	-4.19
22:00	Eff 12	-6.308	-9.026	-7.667	-5.305	-6.478	-5.8915

Oil & Grease of Grease trap

Weekend I

Inf		Eff	
O&G	Avg. O&G	O&G	Avg. O&G
9		-0.4	
10.2		-0.5	
11.1	10.1	1	1

Weekend II

Inf		Eff	
O&G	Avg. O&G	O&G	Avg. O&G
15		0.5	
13.3		-2.2	
11.1	12.2	1.3	0.9

Weekday I

Inf		Eff	
O&G	Avg. O&G	O&G	Avg. O&G
8.7		1	
8.8		1	
10.2	8.75	-0.3	1

Weekday II

Inf		Eff	
O&G	Avg. O&G	O&G	Avg. O&G
10.3		1.2	
4.5		1	
12	11.15	-0.6	1.1

UTP STP DESIGN DRAWING