An overview of the

Sewage Treatment Plant (STP) at PWC

Inputs from PHL Management and an independent Consultant

Documented by Satish Tavag

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Hope

Some questions about the STP still remain. Since I have faced difficulty in getting answers to my remaining questions, I am publishing this document in its current form; I cannot expect all our wonderful flat owners at PWC to wait forever, to get even working idea of the STP at PWC. In future, if and when I receive more information (perhaps after the formation of an Association at PWC), there will be an opportunity to update this document and increase its accuracy.

S1. Preface

This document describes the Sewage Treatment Plant (STP) setup at Provident Welworthcity and its operation. PHL Management provided inputs, walked me around the STP explaining the setup and operation to the extent they are aware of. Inputs were largely verbal in nature. I would like to acknowledge the various people working at the PWC maintenance office in this regard. One of them even took me around on his scooter to show me around the 18 bore wells on PWC premises, using up his fuel. I am not naming any of them here at their requests. If at any time, I am provided with any information to enhance the accuracy of the information provided in this document I would be glad to do so.

There were quite a few aspects of the STP setup, principle and operations that those working at the PWC maintenance office were not aware and / or sure of. I got such aspects clarified by a professional consultant.

Quite a few questions still remain in my mind about the STP set up and operations, as well about accuracy of the Horse powers of the different pumps used. However, I cannot delay the availability to all PWC owners of information about the STP.

S2. Acronyms

CT – Collection Tank (Also referred to as the Bar Screen Chamber)

BSC – Bar Screen Chamber

PAT – Pre Aeration tank

SHT – Sludge Holding Tank

MAT – Main Aeration Tank

DCT - DeCanter Tank

PSF – Pressure Sand Filter

RWP – Rain Water Pit

SCB – Staircase to Basement

PR – Plant Room

FFP – Filter Feed Pump

KLD - Kilo litres of water per day.

SLP – Sludge Pump

SUP – Submerged pump in CT

ABL – Air Blower

DRP – Drainage pump

FPFP – Filter Press Feed Pump

S3. Storage tanks used in the STP at PWC.

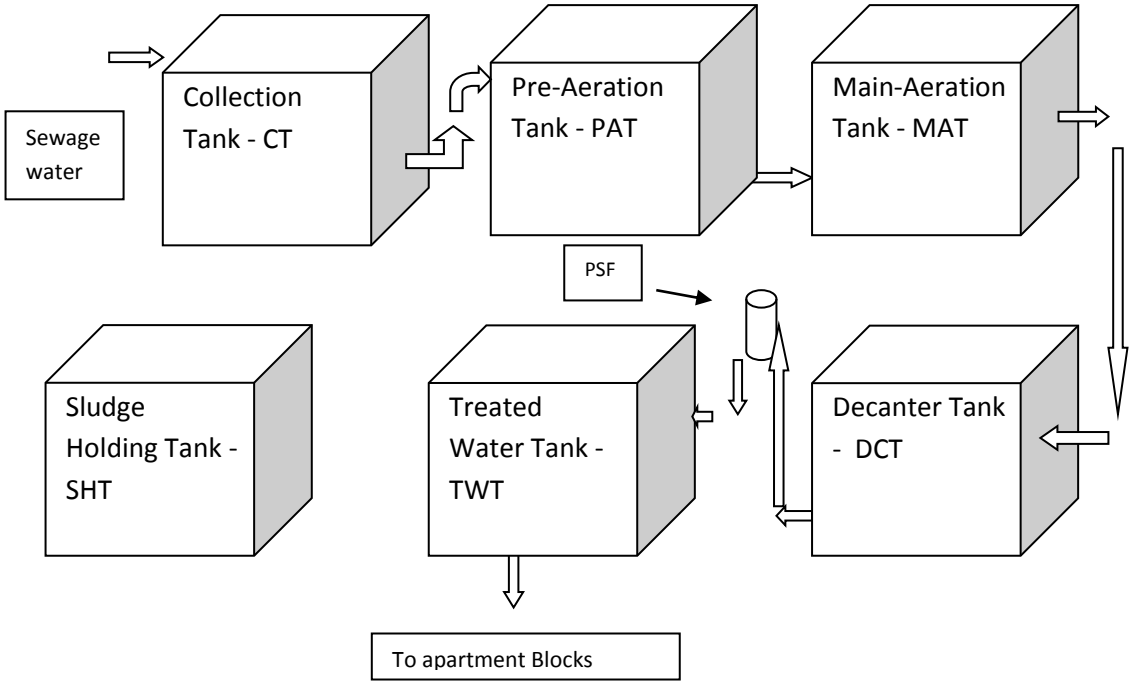


Fig 1 – Various Underground Tanks used in the STP

The STP has one each of the CT, DCT, TWT, DCT. However there are three PAT – MAT pairs, namely PAT-1 and MAT-1, PAT-2 and MAT-2 and PAT-3 and MAT-3. AT this time (May 2015) with only about 500 families residing at PWC, only one pair (PAT-1 and MAT-2) is being used. The other two pairs, currently not in use (along with their associated air blowers) will be deployed when more water needs to be treated due to a larger number of flat owners moving into their flats.

The following may be noted:

P1. The CT has six submerged pumps, used to pump water from the CT into the PAT.

P2. There are no submerged pumps in the PAT. Only air diffusers are present at the floor of the PAT. Air is pumped into PAT through these diffusers by air blowers stationed in the PR.

P3. Air diffusers are present at the floor of the MAT. Air is pumped into MAT through these diffusers by air blowers stationed in the PR. There is one pump submerged in MAT-1, called the Sludge Pump (SP). No submerged SPs are present in MAT-2 and MAT-3.

P4. The FFP used to pump water out of the DCT into the PSF is installed in the PR.

P5. There are a total of 6 air blowers in the PR, two assigned to blow air into the CT, PAT-1 MAT-1 pair, of capacity 40 HP. The second set of two blowers is assigned to the PAT-2 MAT-2 pair. The third set of two blowers is assigned to the PAT-3 MAT-3 pair. The second and third sets of blowers are of lower horse power.

Each of the PAT-1 MAT-1, PAT-2 MAT-2, and PAT-3 MAT-3 pairs has a capacity of handling 700 KLD of water.

Please refer to appendix E for a list of pumps installed and their current status as of May 2015.

S4. Sewage Water Treatment Overview

P1. Sewage water from all apartments collects in the CT. Paper, plastic, Napkins are screened out. Air diffusers on the CT floor blow air upward into the water so that solid mixes with the liquid and does not precipitate out.

P2. When water level reaches about a height of 3 feet from the floor of the CT, the submerged pumps automatically get activated. These pumps pull water out of the CT and pour the same into PAT at the level of ceiling of the PAT. The level of the water in the PAT steadily increases.

P3. Water is swirled by air pressure (diffusers) in PAT at its floor level. The pressure at which air is pumped into PAT has to be greater than that in CT. This is because the body of water in the PAT is significantly greater than in the CT. This also ensures that water and the solid matter mix very well.

P4. Water from the PAT flows into the MAT, through holes in the common wall. These holes are close to the floors of the PAT and the MAT. Thus water levels in the PAT as well as the MAT go up at the same pace and are almost at the same level in both tanks at any time.

P5.Water is swirled by air diffusers in the MAT too for the same reason as it is done in the PAT.

P6. When the water level in the PAT rises to a preset level, detected by a float that acts as a level sensor, the air blower shuts off, thus stopping the swirling movement.

P7. At this time, the air blowing into the MAT also shuts off, thus stopping the swirling movement.

P8. Now the water in the MAT is allowed to stand still for about 40 minutes so that the solid matter settles at the bottom. Clearer water stays at the top.

P9. During these 40 minutes, chlorine dosing takes place in the DCT. Approximately, one litre of chlorine liquid is used for 10,000 litres of water.

P10. At the end of 40 minutes, valves at either end of a pipe connecting the MAT to DCT open up automatically. The clear water from the MAT flows through this pipe into the DCT for the next 20 minutes. Chlorine dosing continues during these 20 minutes.

P11. At the end of these 20 minutes, the MAT and DCT valves close automatically, as commanded by the float sensor in the MAT. In these 20 minutes about 1.25 lakh litres of water flows in to the DCT. The DCT has the capacity to hold 5 such instalments of water.

P12. A float sensor in the DCT senses the level of water in the DCT and automatically starts the Filter Feed Pump (FFP). This pump draws water out of the DCT and feeds it into a Pressure Sand Filter (PSF) metal chamber through an inlet at the top. The PSF has 5 layers of sand, decreasing in granularity down the PSF. The water filtered through the layers of sand flows out at the bottom of the PSF through into the TWT. Please refer to appendix C.

P12. The TWT now contains clear water that can be used in our toilet flush tanks and for gardening purposes.

S5. Sewage Water Treatment Details

S5.1 Waste water collection and screening

Waste water, from the kitchen, bathroom and toilet from every flat, flows through underground paths into the Collection tank (CT), as shown in the figure below. The top of the CT is at ground level. An inconspicuous shed like concrete structure, above ground level, provides direct access to the CT. The CT itself is 15 feet deep. About 5 feet below the ground level, inside the collection tank is a platform for workers to stand upon.

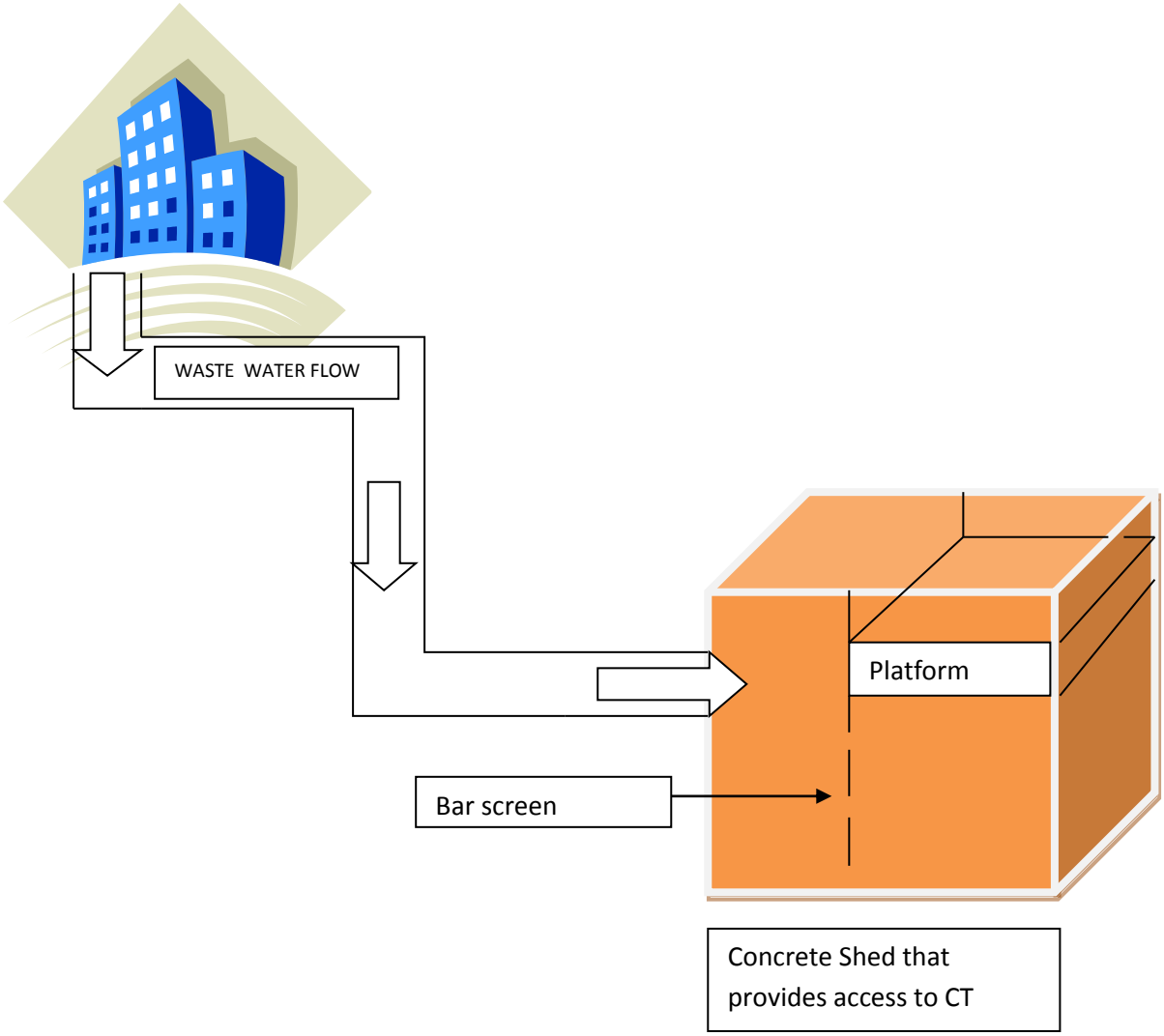


Figure 2 : Waste water collection from all flats

The waste water could carry along with it paper, plastic pieces, used napkins and the natural faeces from the toilets in all flats. Any paper, plastic, diapers, cotton wipes, bottle tops, rags, used napkins etc are blocked by the vertical bar screen in the Collection tank. The faeces will pass through the bar screen. STP workers, using a garden rake (see appendix A), remove the blocked plastic, paper, napkins etc out of the collection tank on to the ground. Once in 15 days, these objects are carried away outside PWC premises by tempos and tempo workers who provide such transportation services to agencies such as BBMP etc.

S5. 2 Primary Treatment - Mixing in Collection Tank

Figure 2 shows the Collection tank in its expanded form. Note that the bar screen is to the left of the tank in this figure. The waste water with the faeces slurry flows into Partition A through the Bar Screen on the left. Partitions are imaginary, just to show the placement of the Main and Standby pumps submerged pumps (SUP 1 through SUP 6). SUP 1 through SUP 6 are used to pump the sewage water mix out from the CT into PAT – 1. Air Blower 1 pumps air at high pressure into air diffusers placed on the floor of the CT, as well as into PAT – 1 and MAT -1. These diffusers diffuse air at high pressure into the CT inducing a swirling movement of sewage water. This swirling movement prevents the solid matter from separating from the rest of the water. Ct water level is usually low.

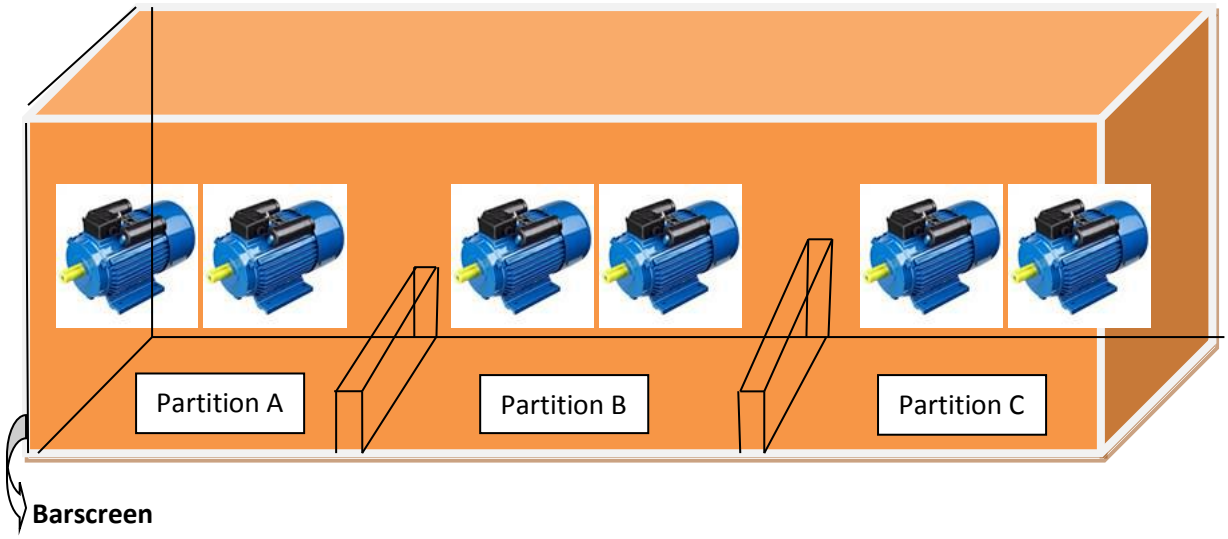
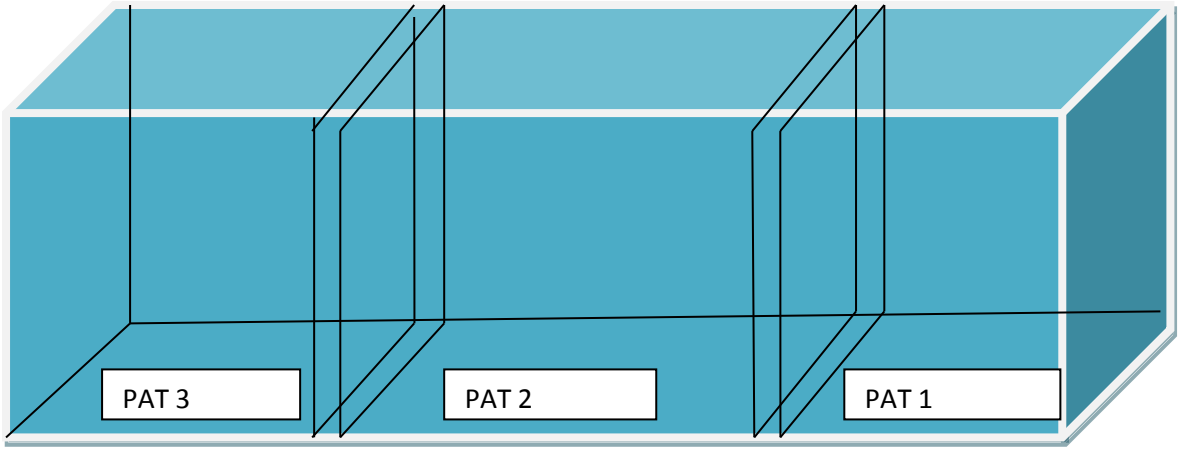


Figure 3 (above) Collection tanks and submerged pumps

Figure 4 (below) Pre-aeration tank with partitions



S5.3 Pre-aeration chamber and process

The PAT (figure 3) now contains water mixed with solid matter. The wastewater is pre-aerated by air pumped through perforated pipes at the bottom of the tanks (appendix B). As the air jets are positioned such that the water is swirling as it moves down the tanks, the suspended solids are prevented from settling down. The air also provides dissolved oxygen for the bacteria to use later in the process, but the wastewater is not retained in these tanks long enough for bacterial action to occur here.

The illustration in appendix B gives an idea of what the air diffusers, positioned at the tank floors look like.

At PWC, the pre-aeration tanks, PAT – 1, PAT – 2 and PAT – 3 collectively are of the same size as the CT.

S5.4 Main aeration

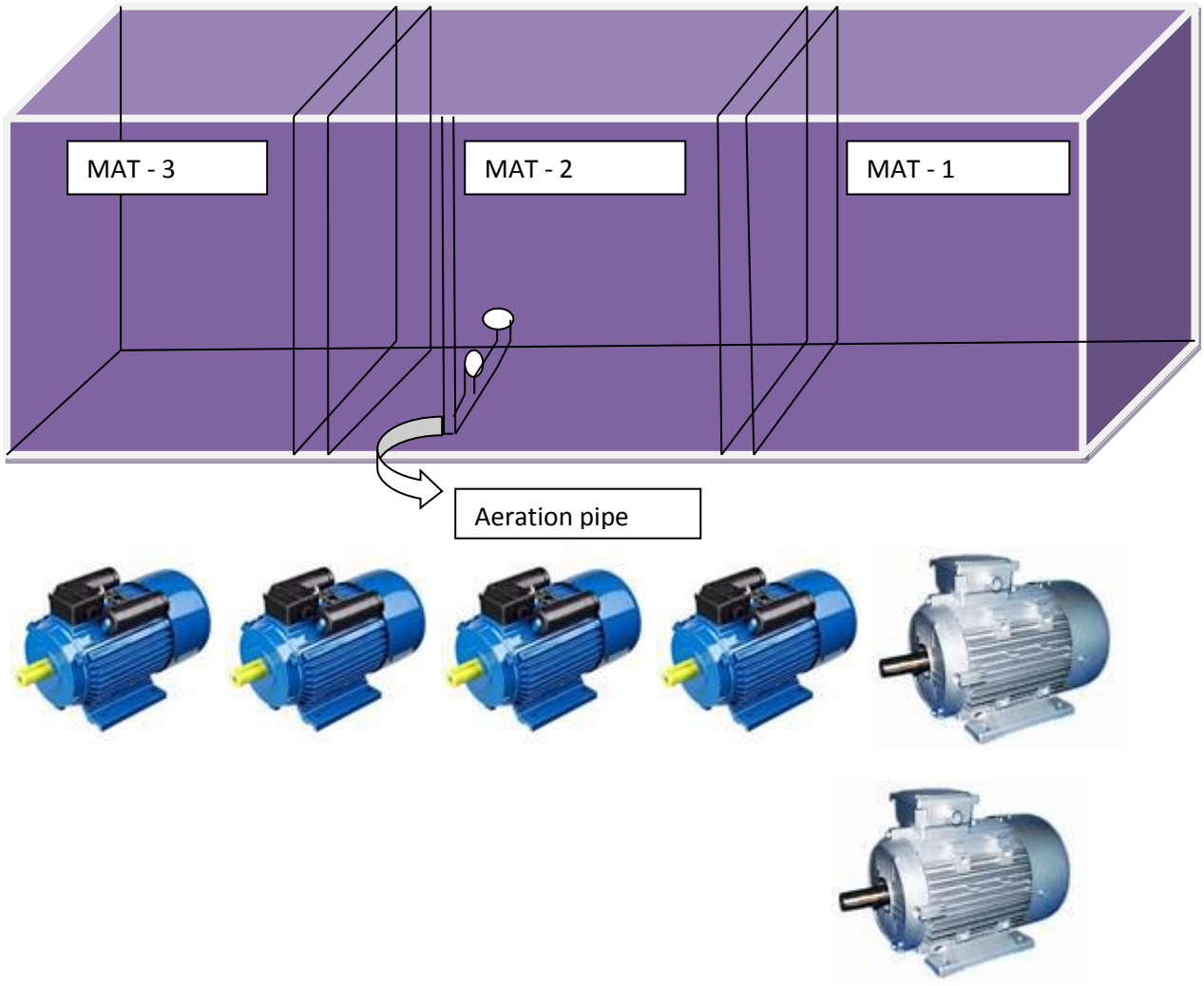


Figure 4 (above) Main-aeration tank with partitions with Air Blowers

The MAT is significantly bigger than the PAT. This is because water is allowed to stand here for about 40 minutes so that the broken down solid matter in this larger mass of water settles down. During this period, some water may still be pumped into the PAT, but it will not disturb the sedimentation of the solid matter in the MAT.

At PWC, two electrical blowers (**slave** blowers – ABL 3, ABL 4, ABL 5 and ABL 6) are assigned to aerate each of the partitions PAT - 2, PAT - 3, MAT - 2 and MAT - 3. The blowers (ABL 3 and ABL 4) assigned to partitions MAT - 2 also blow into partitions PAT – 2. The blowers (ABL 5 and ABL 6) assigned to partitions MAT - 3 also blow into partitions PAT – 3. Two blowers (**master** blowers ABL 1 and ABL 2), significantly stronger than the above blowers are assigned to blow air into MAT - 1 of the main aeration tank and partition PAT - 1 of the pre-aeration tank and the entire CT. The air thus blown in at the bottom of these partitions through actuators / diffusers ensures swirling motion of the water in the partitions.

MAT -1 and PAT -1 as of May 2015 fill up on a daily basis. When the level of water is about 4 feet below the ground (or the top surface of the underground tank) air blowing automatically stops for 40 minutes, so that the suspended solids settle down at the bottom. After 40 minutes the water in the MAT partitions, above the precipitated solid, is almost clear.

Over a period of time however, the sludge collects at the bottom of the MAT. This is then pumped out using motors into a separate tank called the sludge holding tank (SHT) using Sludge Pumps (SLP). A filter press mechanism then squeezes the water out of this sludge and forms it into what are called sludge cakes. This is used as fertilizer.

S5.5 Decantering

During the 40 minutes that the solid matter precipitates in the MAT, chlorine dosing (12% Sodium Hypochlorite - NaOCl) steadily takes place in the DCT. At the end of the 40 minutes, the water from the MAT is let into the underground decanter tank (DCT) at through a pipe (controlled by valves at either end) that connects the MAT and the DCT. These valves are opened automatically through electrical controls (PLC). As a backup option, these valves can also be opened mechanically, by hand. Based on the setting of the float sensors that sense water levels, water transfer takes place for about 20 minutes. During these 20 minutes, automatic chlorine dosing continues. Approximately one litre of chlorine is used to dose 10,000 litres of water.

S5.6 Pressure Sand filtering

Motors (FFP) are used to draw water out of the DCT into vertical metal chambers containing sand (Pressure Sand Filter – PSF) to act as a filter to stop any solid particles from passing through into a downstream Treated Water Tank (TWT). The PSF is installed in the PR. Water is pumped into the PSF from the top. The PSF has 5 layers of sand, decreasing in granularity down the PSF. The water filtered through the layers of sand flows out at the bottom of the PSF through into the. The TWT now contains fairly clear water.

S6 Treated Water Supply to flats

Water pipes carry water from the TWT to each of the apartment blocks (A thru J). At each of these blocks, narrower pipes carry water to each apartment in the block, from the ground floor upward to floor 7.

Three pumps, named Phase Pumps (PHP – 1, PHP – 2 and PHP – 3) are dedicated to maintain pressure on the water (in the pipes mentioned above) to be supplied to Phase 1 flats. At lower loads, only one of these pumps is switched on. As more flush tanks need to fill up and /or significant amounts of water is used in gardening, the 2 and / or the third pump could also start operating. These pumps push water into a vertical cylinder which is used as a pressure balancer.

The Phase pumps and this final stage of filtering were not designed / installed by Brookfield technologies. These were installed by JMC.

Whenever a toilet is flushed, the pressure thus maintained will fill the emptied flush tanks again. This water is supplied only to the flush tanks of the toilet WCs, and is not pumped to any overhead tanks on roof tops. The pipes that supply water to the flats run vertically through the plumbing shaft. At each floor of a tower, this supply is tapped to provide water to flats on that floor. As this main supply pipe continues to run vertically up the tower, its diameter gradually gets reduced by means of reducers to help maintain water pressure to flats at higher floors.

Three pumps (PHP – 4, PHP –5 and PHP –6) are dedicated to maintain pressure on the water (in the pipes mentioned above) to be supplied to Phase 2 flats. At any time, only one of these pumps is switched on.

Three pumps (PHP – 7, PHP – 8 and PHP – 9) are dedicated to maintain pressure on the water (in the pipes mentioned above) to be supplied to Phase 2 flats. At any time, only one of these pumps is switched on.

The water from the TWT is used to water the gardens all over the PWC campus through water outlets provided at the stilt floors and gardens. Residents use this water to wash their two and four wheelers too.

S7 Maintenance of the STP

Certain operations have to be carried out to maintain the STP in operating condition. These are listed below.

S7.1 Sludge Extraction and Disposal

About 2 litres of water from the MAT (when the air blower is on) is drawn into a graduated jar and allowed to settle for an hour. The graduations are in MLSS units. MLSS stands for Multi Liquor Suspended Solids. MLSS is measured in mg / litre.

At the end of an hour, note the MLSS. If under 250 mg/L, no action needs to be taken. However, for values above 250 mg/L and certainly not above 400 mg/L, sludge from the MAT has to be drawn out. This is done by running the Sludge Pump (SLP) which sucks out the sludge form the bottom of the MAT into the Sludge Holding Tank (SHT). Please note that the SLP is set to not turn on so long as air blowers ABL-1 or ABL-2 is on.

When the SHT fills up sufficiently, the Filter Press Feed Pump (FPFP) can be used to draw small quantities of sludge from the SHT into the Filter Sludge Press (FSP) machine. This machine squeezes the water out of the sludge and presses the sludge into cakes that can be dried and used as fertilizers for plants and gardens.

However, it looks like at PWC, the FSP has not been used at all. The sludge pump does not seem to have been used for a while. Sludge from MAT was extracted a year ago and transported out through tankers to distant locations.

If MLSS is too high, bulking of solids can take place and the treatment system can get overloaded. The dissolved oxygen content can drop and reduce the settleability of the sludge. Excessive aeration may then be required that will waste electricity.

If the MLSS is too low, the treatment process may not remove sufficient organic water from the waste water.

At PWC, it doesn't look like any MLSS test is being done.

S7.2 Backwashing

Over a period of time, in the PSF, some solid particles could collect during the filtering process. When this happens, water is pumped into the PSF from the bottom so that it flows through the sand upwards. This is called **backwashing**. This upward motion of the water dislodges the solid matter collected at the top of the sand. This solid matter (mixed with water) is pulled out from a tube at the top of the PSF and pumped back to the collection tank.

It looks like backwashing has not been done for a while. The pressure reading of water into the PSF is very high, whereas that of the water exiting the PSF is very low. This indicates very poor efficiency of the filtering process.

S7.3 Flooding due to rain

Due to rain, the STP area gets flooded very quickly making the area slushy and causing water flow along with mud into the different tanks. In the past, I am told, water from the tanks overflowed on to the ground in the STP area. This caused a lot of problems to the residents. Since then a drain has been constructed around the STP underground tanks so that any overflow water flows into the surrounding drains – these are like a moat for the STP area.

The standby pump (DRP-2) originally installed in the PR to drain water out of the drainage sump in the PR has been disconnected and is being used to pump the overflow water from the drain surrounding the STP area (which I have referred to as a moat above) into the CT.

S7.4 Sludge in the CT

Solid matter collected in the CT has to be periodically removed. This solid matter is reportedly preventing reinstallation of repaired SUPs in the CT. The CT needs to be cleared of this solid matter.

I have not been told of any provision made to remove this solid matter from the CT.

S8 Current usage of the STP plant

Currently Partitions PAT 2, PAT 3, MAT 2 and MAT 3 are not in use. However, when the number of residents increases, it will be necessary to deploy these Partitions also, to handle the increased inflow of water.

S9 Daily Operations

Operators have to log the daily activities carried out in the STP along with observations. This assumes great importance since some automatic events have ceased to function. Some of these are given below:

D1. Date

D2. Removal of gross items caught at Bar Screen

D3. Air blowers turn on and turn off times

D4. FFP turn on and turn off times.

D5. Decanter inflow start and stop time

D6. PSF backwash time – recommended almost on a daily basis

D7. MLSS test daily when ABL is running.

D8. Flow meters readings

S10 Concerns as of May 2015.

P1. Of the six pumps submerged in the CT, 2 are disconnected. Only 4 are operational. Pipes leading up from SUP-3 and SUP-4 to the top of the CT are currently disconnected; therefore SUP-3 and SUP-4 are currently not operational.

P2. For some reason, water from the CT is transferred into PAT – 1 through an external path by submerged pump SUP-6 and not through the path provided underground from CT to PAT -1. I heard

two different reasons for this arrangement. One is that there significant solid matter on the CT floor. The other is that the pump is very heavy.

P3. Air Blower 1 (main) has been non-functional for at least a couple of months. Air Blower 2 (standby) is being used. If Air Blower 2 also becomes non-functional, the entire STP could come to a halt rapidly. A possible way out of this could be to put PAT – 2 and MAT – 2 into use quickly and isolate PAT -1 and MAT – 1 until at least one of Air-Blower 1 or Air Blower 2 is repaired. However, air diffusion will not happen in the CT only Air Blower 1 and Air Blower 2 are connected to the diffusers submerged in the CT.

P4. The PSF has to be backwashed on a daily basis. This is not happening. Due to this fact, the PSF is clogged with solid matter from the DCT. Therefore water from the DCT is not getting filtered prior to flowing into the TWT. The valves perhaps are positioned so that the DCT water flows directly into the TWT. This could be the reason we find dirty water in the flush tanks in the apartment toilets from time to time. This is a cause for great concern.

P5. The sequence of operations, involving float sensors, air blowers, pumps, water transfers etc is pre-programmed into a PLC (Programmable Logic Control). However, many of the sub-systems / components are not functional in the automatic mode – and are being operated manually. Since operators are not present at the STP at all times, switching pumps on or off is not being done on a timely basis, posing risks to the pumps, comprising the quality of the STP water output and a possibility of the PR getting flooded.

P6. On May 8, 2015 when I visited the PR at around 12:30 PM, the underground drainage tank in the PR was full, and water had overflowed onto the floor of the PR. I am not sure how long the water was stagnating here; any flooding or stagnation poses a risk to the plant room. We asked the electrician who happened into the PR to switch the DRP on to pump out the stagnant water into the CT. The drainage and the DRP were programmed for automatic operation; however, the automation is currently non-functional.

P7. Sludge has not been so far filter pressed into cakes. There is no reliable information on any MLSS test, sludge extracting, and filter press or sludge transportation.

P8. It looks like some sedimentation has taken place in the CT, preventing normal placement of repaired SUPs into the CT. How should this be cleaned?

P9. Pressure of air flowing through the diffusers into the PAT and MAT needs to be higher than that in the CT. At present it seems to be the opposite.

P10. Due to inadequate mixing in the Pat and MAT, one can see a greasy layer floating at the surface of water in the MAT. This will pass on to the Decanter tank and into the PSF. Some of this will pass into the TWT tank too.

P11. A few valves have been removed; wire connections were seen uncovered and at least one metal sleeve used in valve connection was found lying around.

P12. Chlorine dosing is happening manually.

P13. Logs of daily observations and operations are not sincerely and procedurally maintained.

S11 Recommendation as of May 2015.

It is important to have a consultant (preferably Brookefield Technologies) to be brought in, at least on a consulting basis to set STP infrastructure, equipment and operations as soon as possible. STP operators need to understand the importance of adhering to laid down operations and laid down procedures.

Even as I am getting ready to publish this document to PWC owners, owners are complaining of dirty water in their toilet flush tanks.

Appendix A: Garden Tools

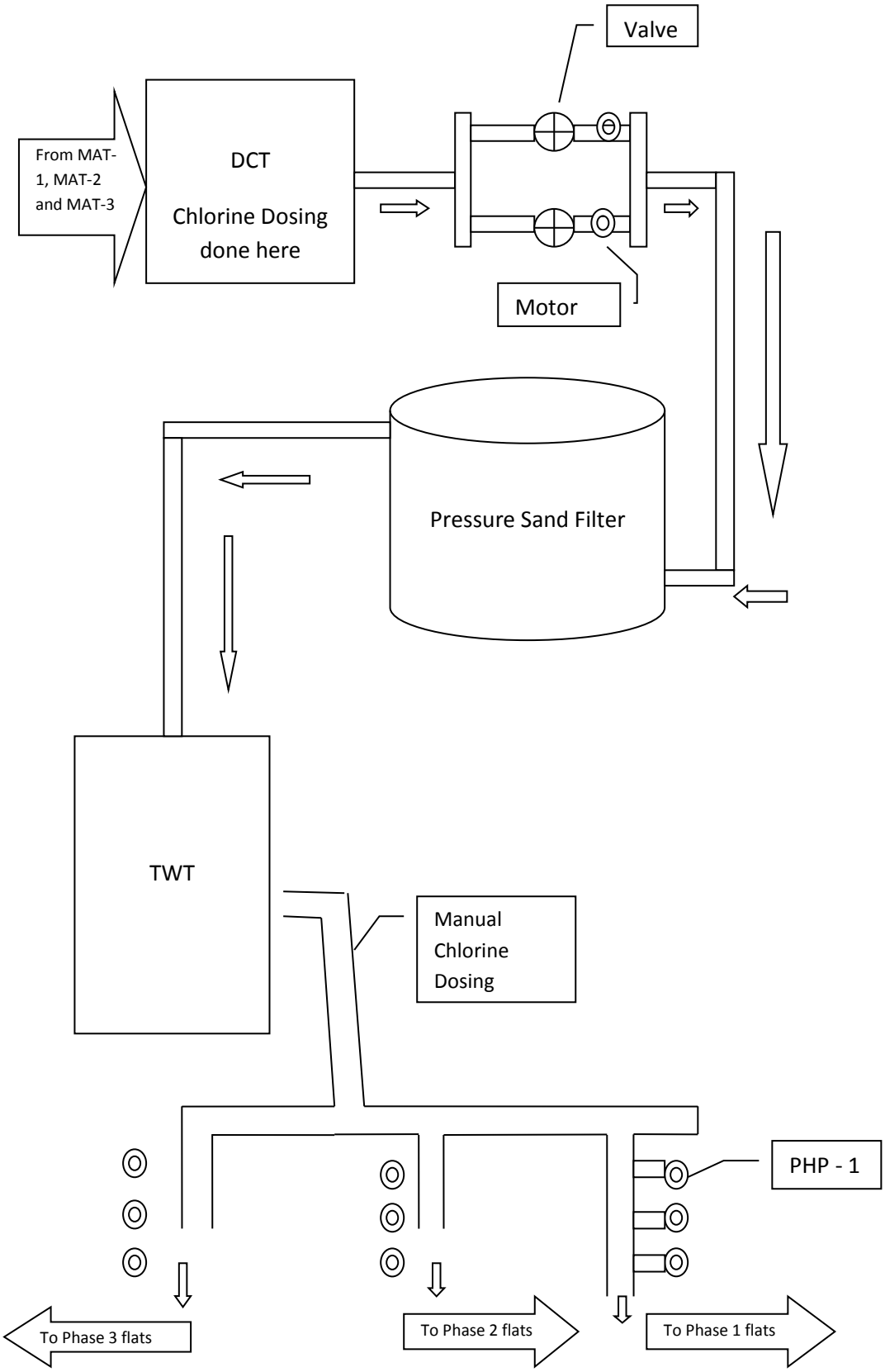
Appendix B Air Diffusers

Sample Tube Diffusers at the bottom of a Sewage Treatment Tank

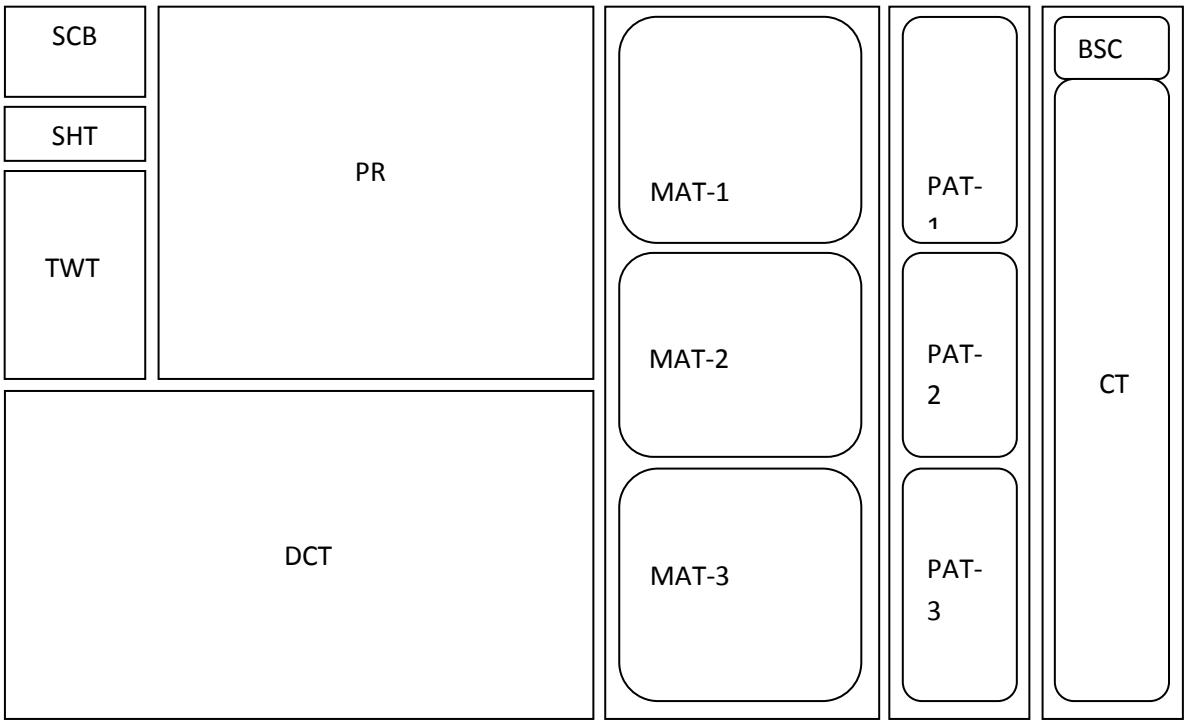
You may look at the following link if interested.

http://www.sheffy6marketing.com/index.php?page=test-child-page

Appendix C Process from MAT to Apartments



Appendix D STP layout at PWC



Dimensions (not accurate)

SCB	4.2 metres ↑ by 6.0 metres →
SHT	3.0 metres ↑ by 6.0 metres →
TWT	10 metres ↑ by 6.0 metres →
PR	10 metres ↑ by 9.8 metres →
DCT	11.0 metres ↑ by 15.5 metres →
PR	17.8 metres ↑ by 09.8 metres →
MAT – 1, MAT - 2, MAT – 3	09.5 metres ↑ by 13.0 metres →
PAT – 1, PAT – 2, PAT – 3	09.5 metres ↑ by 03.5 metres →
CT + BSC	28.5 metres ↑ by 03.5 metres →

Appendix E Pumps used at PWC STP

Pump	Horse Power	Purpose installed	Where installed	Main or Standby	Working condition as on May 2015
ABL - 1	40HP	To blow air into CT, PAT-1 and MAT-1.	PR	Main	Not working
ABL - 2	40HP	To blow air into CT, PAT-1 and MAT-1.	PR	Standby	Operational
ABL - 3	30 HP	To blow air into PAT-2 and MAT-2.	PR	Main	Not used, not verified
ABL - 4	30 HP	To blow air into PAT-2 and MAT-2.	PR	Standby	Not used, not verified
ABL - 5	30 HP	To blow air into PAT-3 and MAT-3.	PR	Main	Not used, not verified
ABL - 6	30 HP	To blow air into PAT-3 and MAT-3.	PR	Standby	Not used, not verified
FFP - 1	2 HP	Pump water from DCT to PSF	PR	Main	Working
FFP - 2	2 HP	Pump water from DCT to PSF	PR	Standby	Repaired recently, wires exposed.
SUP - 1	2 HP	To pump water from CT into PAT-1, PAT-2 and PAT-3.	CT	Main	Operational
SUP - 2	2 HP	To pump water from CT into PAT-1, PAT-2 and PAT-3.	CT	Standby	Operational
SUP - 3	2 HP	To pump water from CT into PAT-1, PAT-2 and PAT-3.	CT	Main	Not operational
SUP - 4	2 HP	To pump water from CT into PAT-1, PAT-2 and PAT-3.	CT	Standby	Not operational
SUP - 5	2 HP	To pump water from CT into PAT-1, PAT-2 and PAT-3.	CT	Main	Operational
SUP - 6	2 HP	To pump water from CT into PAT-1, PAT-2 and PAT-3.	CT	Standby	Operating through external path

Pump	Horse Power	Purpose installed	Where installed	Main or Standby	Working condition as on May 2015
SLP -1	2 HP	To extract sludge from the MAT -1	MAT - 1	Main	Not known because sludge not extracted for quite sometime
SLP -2	2 HP	To extract sludge from the MAT - 2	PR	Main	Not verified
SLP -3	2 HP	To extract sludge from the MAT - 3	PR	Main	Not verified
DRP - 1	1 HP	To pump water from the drainage tank in the PR into the CT.	PR	Main	Working in manual mode
DRP - 2	1 HP	To pump water from the drainage tank in the PR into the CT.	PR	Standby	Removed. Now used for pumping overflow water from drain surrounding STP tanks into CT
PHP - 1	2 HP	To pump water to Phase -1 apartments	PR	Main	Not verified
PHP - 2	2 HP	To pump water to Phase -1 apartments	PR	Standby 1	Not verified
PHP - 3	2 HP	To pump water to Phase -1 apartments	PR	Standby 2	Not verified
PHP - 4	2 HP	To pump water to Phase -2 apartments	PR	Main	Not verified
PHP - 5	2 HP	To pump water to Phase -2 apartments	PR	Standby 1	Not verified
PHP - 6	2 HP	To pump water to Phase -2 apartments	PR	Standby 2	Not verified
PHP - 7	2 HP	To pump water to Phase -3 apartments	PR	Main	Not verified
PHP - 8	2 HP	To pump water to Phase -3 apartments	PR	Standby 1	Not verified
PHP - 9	2 HP	To pump water to Phase -3 apartments	PR	Standby 2	Not verified
FPFP - 1	1.5 HP	To pump sludge from SHP into Filter Press	PR	Main	Not verified
FPFP - 2	1.5 HP	To pump sludge from SHP into Filter Press	PR	Standby	Not verified