

# -:SEWAGE TREATMENT PLANT:-

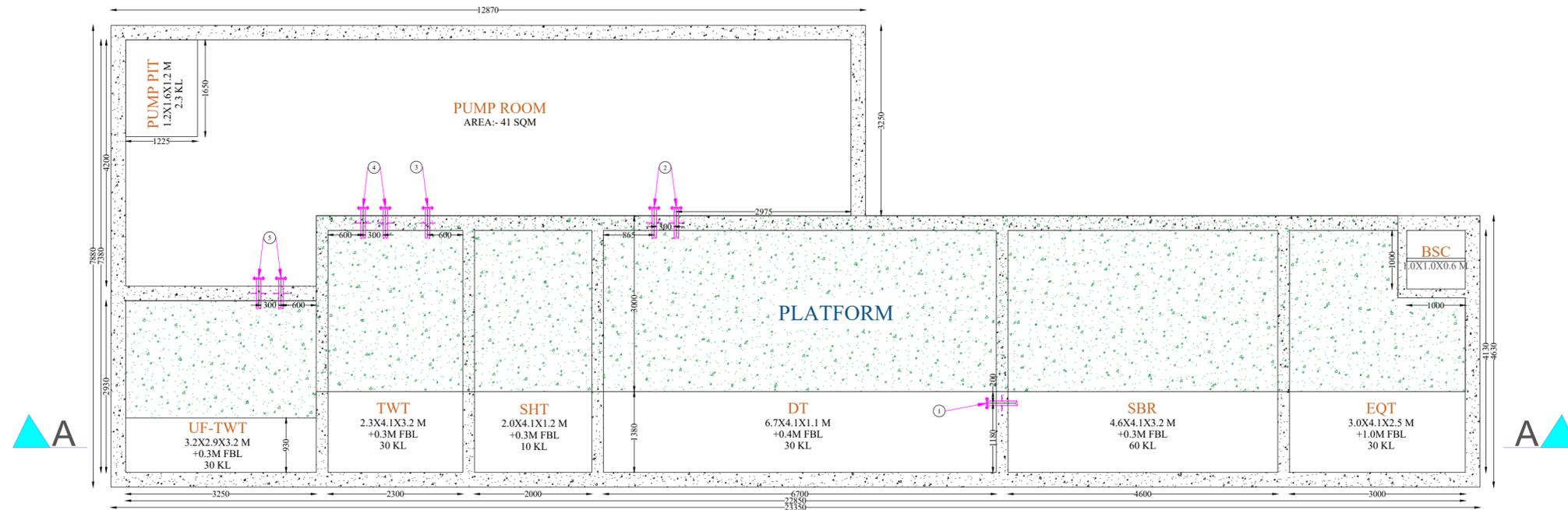
## CAPACITY -60 KLD

### -:PUDDLE FLANGE LEGEND:-

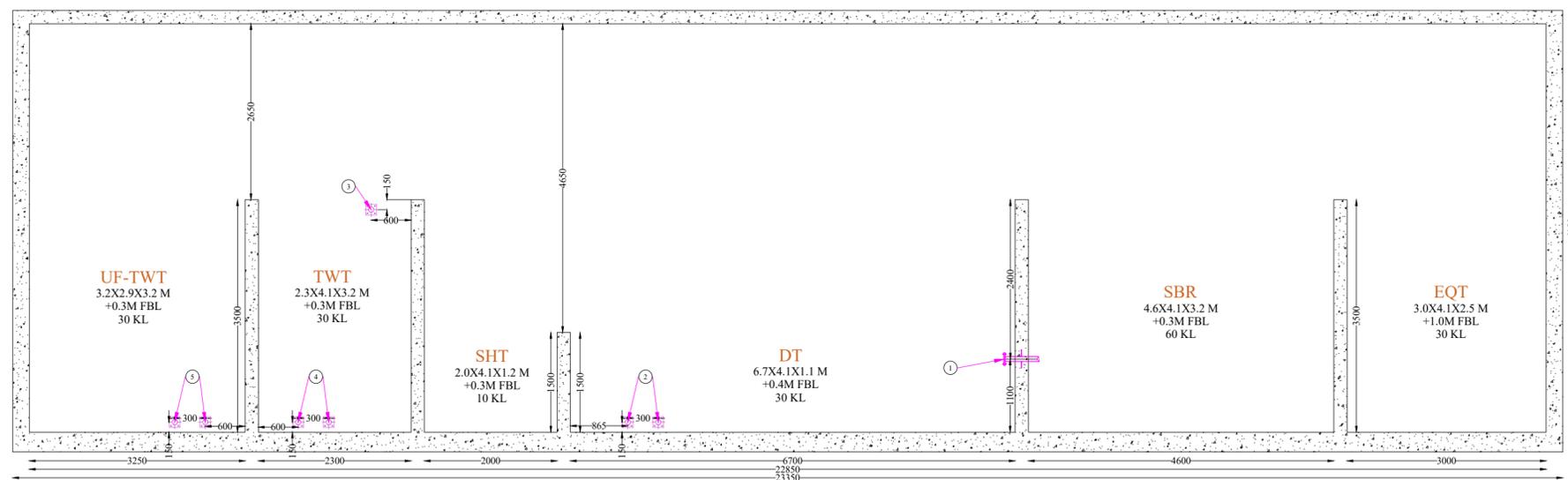
TAG	DESCRIPTION	SIZE	NOS
1	DECANT VALVE-(PUDDLE FLANGE)	Ø100	1
2	FILTER FEED PUMP INLET-(PUDDLE FLANGE)	Ø80	2
3	TREATED WATER INLET (PUDDLE FLANGE)	Ø80	1
4	TREATED WATER OUTLET (PUDDLE FLANGE)	Ø80	2
5	UF-TREATED WATER OUTLET (PUDDLE FLANGE)	Ø80	2

Note:-

ALL THE PUDDLE PIPES ARE SCHEDULE 40



TOP LEVEL PLAN  
SEWAGE TREATMENT PLANT-60 KLD



SECTION-AA"  
SEWAGE TREATMENT PLANT-60 KLD



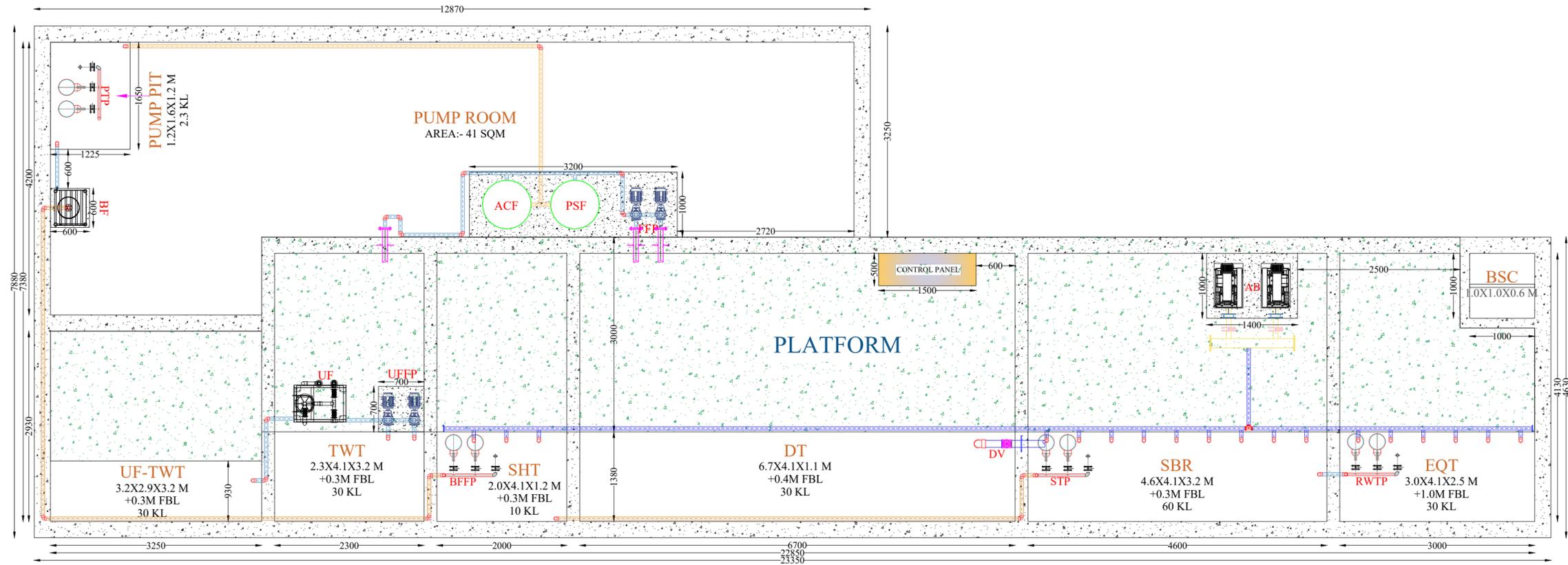
GST.NO:-29AAICV7873R1ZZ

VD TBCH		Plot no 123.VD Building, MTR Food road, Bommasandra ind area, Bangalore -560099				
DWG. SIZE	DRAWN	SYED	CHECKED	B RAKESHA	APPROVED	BASAVARAJU
A3	DATE DRAWN	03-08-2024	REV	00	SCALE	NOT SCALE DRAWING
PROJECT TITLE:			TVS MISSION ROAD-STP-SBR-60 KLD		DRW.NO:-	186
DRAWING TITLE:			STP-SBR-60 KLD-PF-A		OC.NO:-	

THE DOCUMENT IS CONFIDENTIAL AND ITS COPYRIGHTS ARE THE PROPERTY OF VIDYARJUNA AND MUST NOT BE USED OR DISCLOSED OR REPRODUCED EXCEPT AS AUTHORIZED IN WRITING BY VIDYARJUNA.

# -:SEWAGE TREATMENT PLANT:-

## CAPACITY -60 KLD



**TOP LEVEL PLAN**  
**SEWAGE TREATMENT PLANT-60 KLD**



**GST.NO:-29AAICV7873R1ZZ**

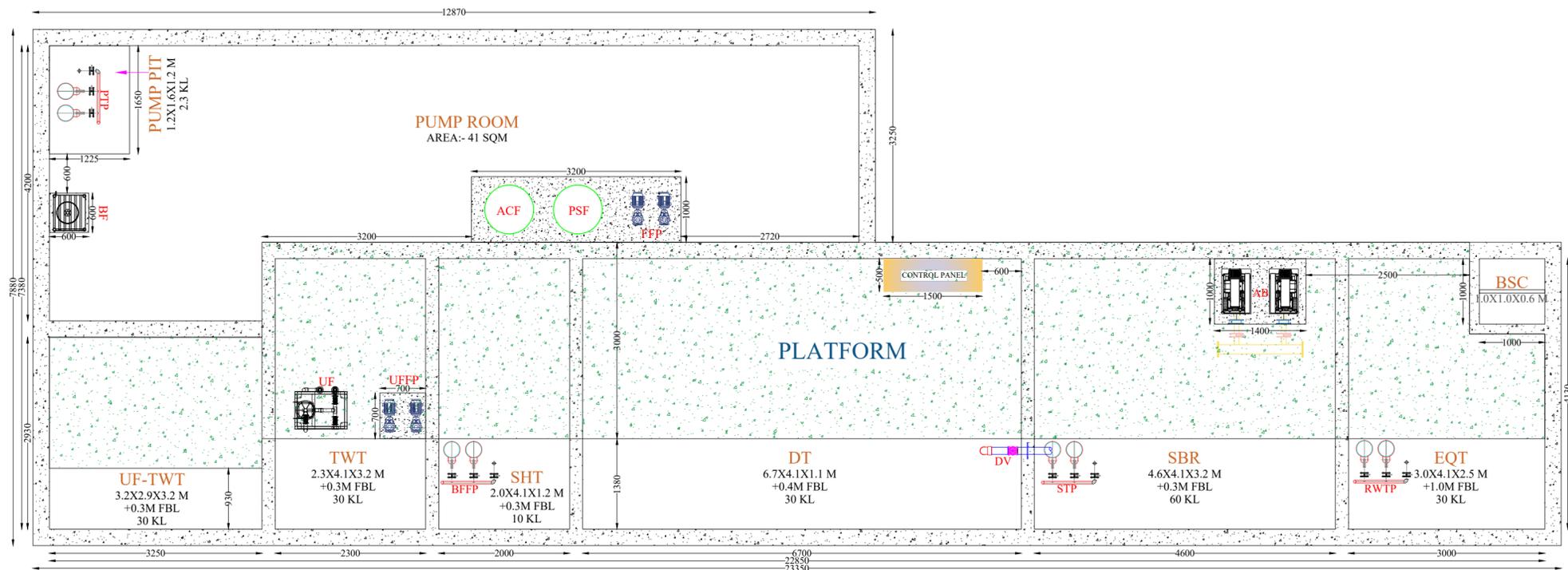
Plot no 123.VD Building, MTR Food road,  
Bommasandra ind area,  
Bangalore -560099

DWG. SIZE	DRAWN	SYED	CHECKED	B RAKESHA	APPROVED	BASAVARAJU
A3	DATE DRAWN	03-08-2024	REV	00	SCALE	NOT SCALE DRAWING
PROJECT TITLE:		TVS MISSION ROAD-STP-SBR-60 KLD		DRW.NO:- 189		
DRAWING TITLE:		STP-SBR-60 KLD-PL-A		OC.NO:-		

THE DOCUMENT IS CONFIDENTIAL AND ITS COPYRIGHTS ARE THE PROPERTY OF VIYADURGA AND MUST NOT BE USED OR DISCLOSED OR REPRODUCED EXCEPT AS AUTHORIZED IN WRITING BY VIYADURGA.

# -:SEWAGE TREATMENT PLANT:-

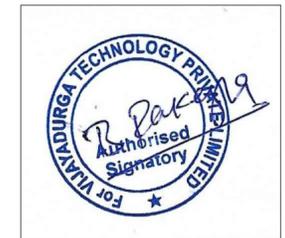
## CAPACITY -60 KLD



**TOP LEVEL PLAN**  
**SEWAGE TREATMENT PLANT-60 KLD**

### -:EQUIPMENTS LEGEND:-

RWTP	RAW WATER TRANSFER PUMP
STP	SLUDGE TRANSFER PUMP
BFFP	BAG FILTER FEED PUMP
DV	DECANT VALVE
AB	AIR BLOWER
FFP	FILTER FEED PUMP
PSF	PRESSURE SAND FILTER
ACF	ACTIVATED CARBON FILTER
UF	ULTRA-FILTRATION
UFFP	ULTRA-FILTRATION FEED PUMP
BF	BAG FILTER
PTP	PIT TRANSFER PUMP



GST.NO:-29AAICV7873R1ZZ



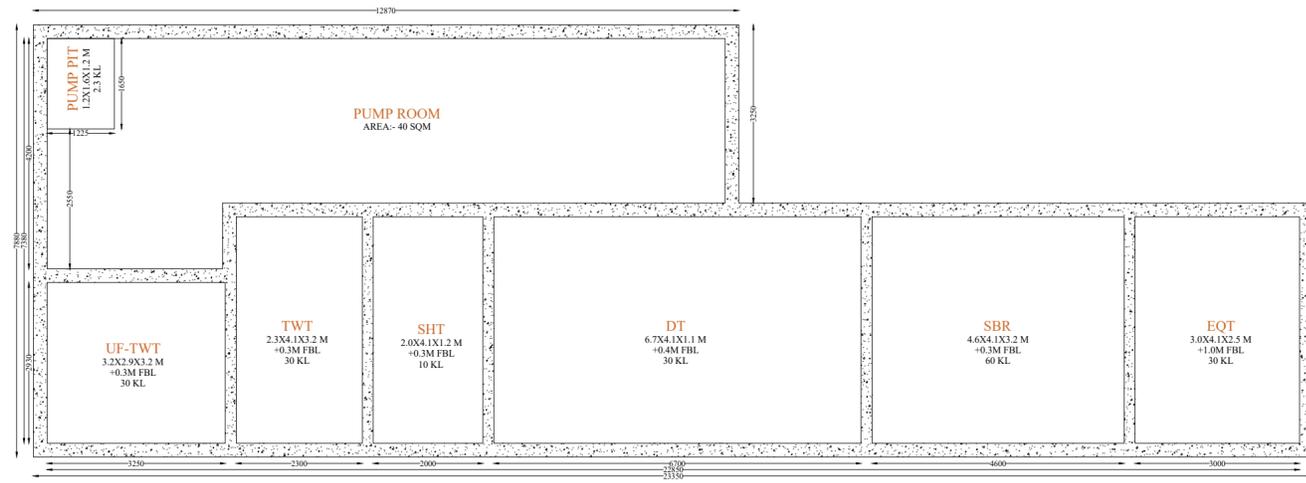
Plot no 123, VD Building, MTR Food road,  
Bommasandra ind area,  
Bangalore -560099

DWG. SIZE	DRAWN	SYED	CHECKED	B RAKESHA	APPROVED	BASAVARAJU
A3	DATE DRAWN	30-07-2024	REV	00	SCALE	NOT SCALE DRAWING
PROJECT TITLE: TVS MISSION ROAD-STP-SBR-60 KLD				DRW.NO:- 186		
DRAWING TITLE: STP-SBR-60 KLD-EQP-A				OC.NO:-		

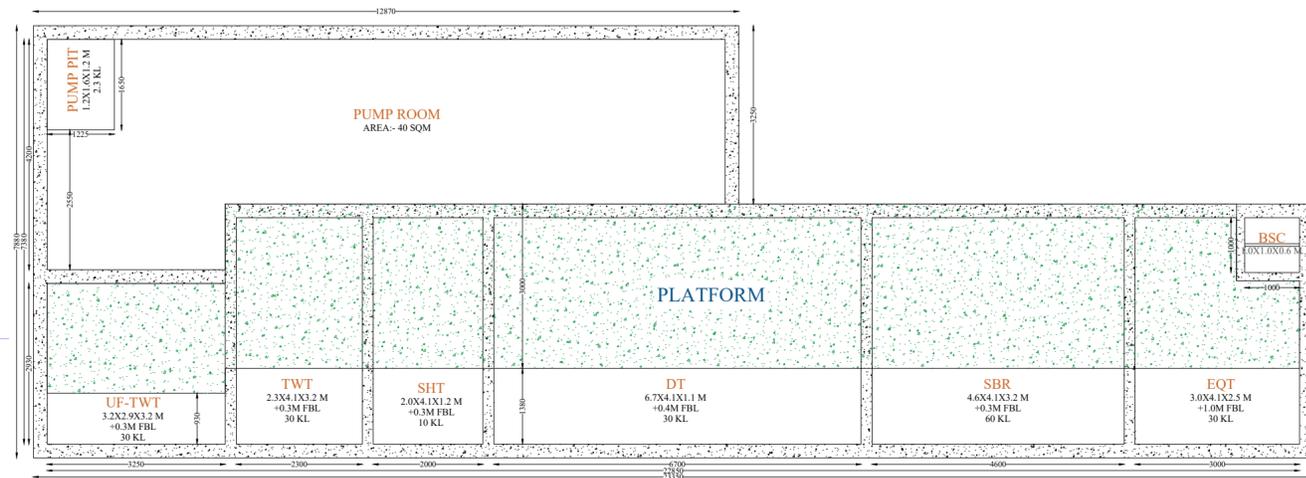
THE DOCUMENT IS CONFIDENTIAL AND ITS COPYRIGHTS ARE THE PROPERTY OF VIJAYADURGA AND MUST NOT BE USED OR DISCLOSED OR REPRODUCED EXCEPT AS AUTHORIZED IN WRITING BY VIJAYADURGA.

# -:SEWAGE TREATMENT PLANT:-

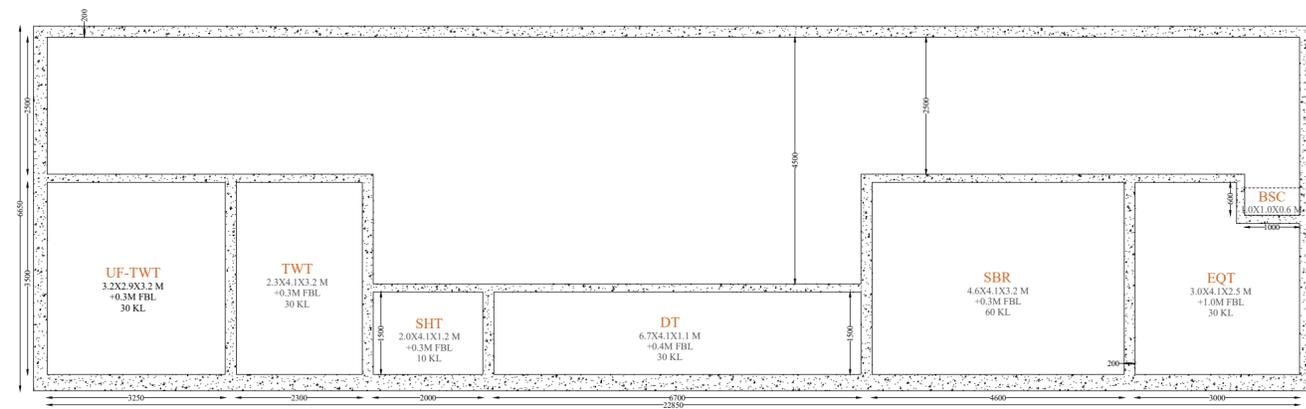
## CAPACITY -60 KLD



BOTTOM LEVEL PLAN  
SEWAGE TREATMENT PLANT-60 KLD



TOP LEVEL PLAN  
SEWAGE TREATMENT PLANT-60 KLD



SECTION-AA"  
SEWAGE TREATMENT PLANT-60 KLD

-:LEGEND:-

BSC	BAR SCREEN CHAMBER
EQT	EQUALIZATIONS TANK
SBR	SEQUENTIAL BATCH REACTOR
DT	DECANT TANK
SHT	SLUDGE HOLDING TANK
TWT	TREATED WATER TANK
UF-TWT	ULTRA FILTRATION TREATED WATER TANK



GST.NO:-29AAICV7873R1ZZ

<b>VD-TECH</b>		Plot no 123,VD Building, MTR Food road, Bommasandra Ind area, Bangalore -560099				
DWG. SIZE	DRAWN	SYED	CHECKED	B RAKESHA	APPROVED	BASAVARAJU
A3	DATE DRAWN	06-06-2024	REV	02	SCALE	NOT SCALE DRAWING
PROJECT TITLE:				DRW.NO:- 166		
DRAWING TITLE:				OC.NO:-		
STP-SBR-60 KLD-P85-C						
THE DOCUMENT IS CONFIDENTIAL AND ITS COPYRIGHTS ARE THE PROPERTY OF VIAYADURGA AND MUST NOT BE USED OR DISCLOSED OR REPRODUCED EXCEPT AS AUTHORIZED IN WRITING BY VIAYADURGA.						

**DESIGN BASIS OF SEWAGE TREATMENT PLANT**

**CAPACITY 60KL/DAY**

**PROCESS: SEWAGE TREATMENT PLANT**

**PROJECT DETAILS**

**TVS MISSION ROAD**



**STP 60 KLD – SEWAGE TREATMENT PLANT**

**1) Design Basis of Effluent treatment plant**

- a) Plant Capacity : 60 KLD
- b) Operation technology : SBR (Sequential batch reactor)
- c) Mode of Operation : Semi automated
- d) Scheme of Treatment : Biological treatment

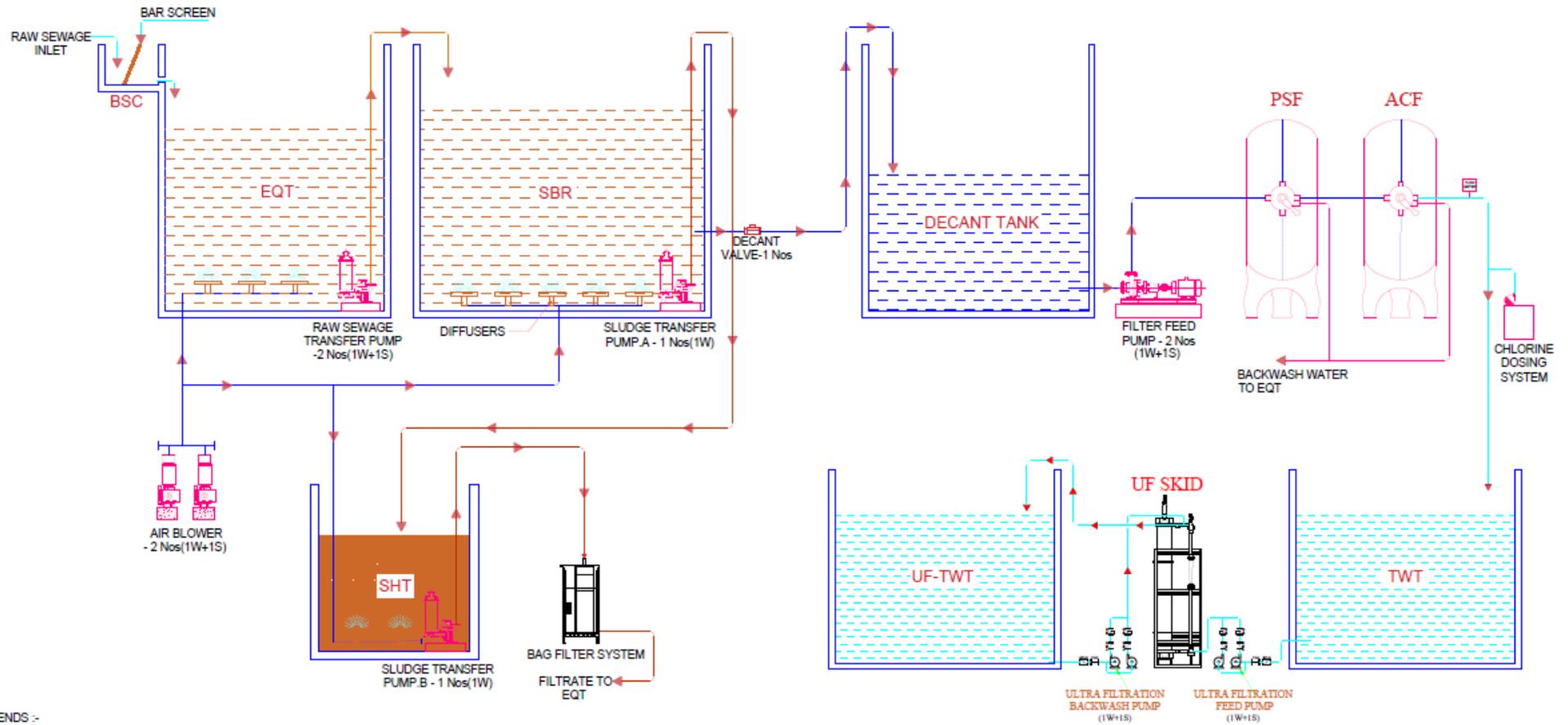
**2) Treated sewage Characteristics**

The treated sewage characteristics are given below:

The following will be the treated water quality as per PCB norms.

Sewage Characteristics	Unit	Inlet	Outlet of Tertiary Treatment
PH		6.5	6.5 – 8.5
BOD,5 days @ 25deg. C, mg/l	PPM	200-250	<10
COD mg/l	PPM	350 -400	<50
Turbidity	NTU	80 – 100	<10
Oil and Grease	PPM	<25 PPM	<10
Suspended Solids	PPM	250	<10
Inlet Temperature	in C	25 – 30	25-30
Colour		Objectionable	Un Objectionable



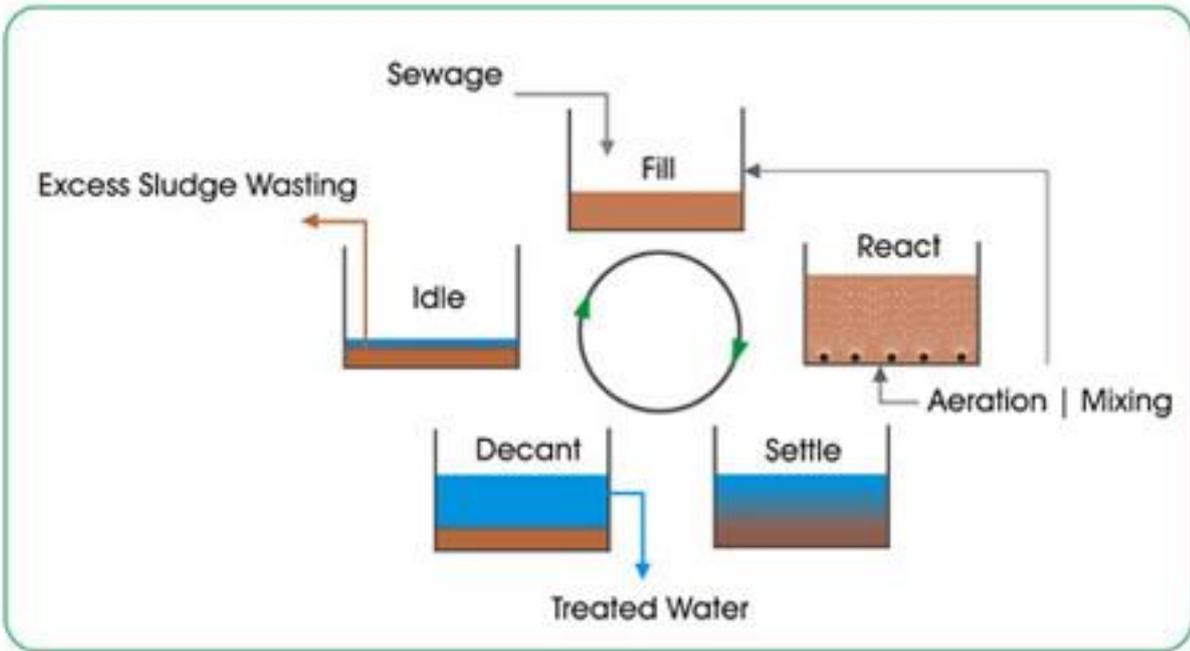


LEGENDS :-



**OPERATION SEQUENCE**

**SBR Operating Principle**



**Bar screen**

Preliminary Treatment process involves removing large rags, sticks and other solids which can choke in the plant pumps heads. The bar screens provided in bar screen chamber will stop all the floating and suspended matter from the influent waste water and they are to be removed manually by raking. The operator should often check for large particles clogged in the bar screen and should be cleaned immediately. The Bar screen chamber not only removes the large solids from the Sewage but will also reduce the load on the subsequent treatment units.

Duty	To remove the floating matter
Number	One
Shape	Rectangular
M.O.C.	SS-304



**Equalization Tank:-**

Usually, Sewage generation is more during peak hours. Visually no Sewage is generated during shift change or lean hours. Any biological system needs constant feed for bacteria to work efficiently. Hence, it is important to put an equalization tank to collect the excess flow during peak hours and feed Sewage in lean hours. A typical equalization tank has a capacity of 6-20 hours of average flow rate. The tank is generally of civil construction by client. Provision of air grid is to be made for thoroughly mixing the sewage to make it of homogenous quality and to keep the suspended matter in suspension and to avoid septic conditions. The well mixed sewage is then pumped into the SBR reactor with the help of pumps.

Duty	To equalize the flow
Number	One
Shape	Square
M.O.C.	RCC

**Sequential Batch Reactor**

The main pollutants in the raw sewage are represented in the form of Bio – chemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). The bacterial ability to synthesize the organic matter to harmless end products like carbon di-oxide and water molecules is utilized to treat the raw sewage.

The bio – reactions are carried out in controlled environment in the bio – reactor. The bio – reactor comprises of a tank, fitted with jet aerators. The bacterial activity needs dissolved oxygen, to synthesize the organic matter. The air is passed at the bottom of the tank, so that complete volume of tank is utilized. Oxygen dissolves in liquid, which can now be used by the aerobic bacteria.

**Aerated Fill**

Mixed liquor is drawn through the manifold, mixed with the influent flow in the motive liquid pump, and discharged, as motive liquid, to the jet aerator. This initiates the feast period. Feast is when the microorganisms have been in contact with the substrate and a large amount of oxygen is provided to facilitate the substrate consumption. Nitrification and de-nitrification occurs at the beginning of this stage. This period ends when the tank is either full or when a maximum time for filling is reached

**React**

During this period aeration continues until complete biodegradation of BOD and nitrogen is achieved. After the substrate is consumed famine stage starts. During this stage some microorganisms will die because of the lack of food and will help reduce the volume of the settling sludge. The length of the aeration period determines the degree of BOD consumption.

**Settle**

Aeration is discontinued at this stage and solids separation takes place leaving clear, treated Sewage above the sludge blanket. During this clarifying period no liquids should enter or leave the tank to avoid turbulence in the supernatant.

**Decant**

This period is characterized by the withdrawal of treated Sewage from approximately two feet below the surface of the mixed liquor by the floating solids excluding decanter. This removal must be done without disturbing the settled sludge.



### Idle

The time in this stage can be used to waste sludge or perform backwashing of the jet aerator. The wasted sludge is pumped to an anaerobic digester to reduce the volume of the sludge to be discarded. The frequency of sludge wasting ranges between once each cycle to once every two to three months depending upon system design.

### Filters (PSF & ACF):

The clarified water collected in Decant tank is passed through pressure sand filter and activated carbon Filter to remove the suspended particles and microorganisms.

Duty	To remove suspended solids, color and odor
Number	One set
Shape	Circular
M.O.C.	MSEP/FRP

### UF Plant:

- ▶ Ultrafiltration (UF) is a water purification process in which water is forced through a semipermeable membrane. Suspended solids and high-molecular-weight solutes remain on one side of the membrane, the retentive side, while water and low-molecular-weight solutes filter through the membrane to the permeate side.
- ▶ Ultrafiltration removes particulate matter from water by forcing it through a membrane. Hence, it not only destroys all bacteria and viruses but also removes their eggs from the water, ensuring pure and safe water.
- ▶ Ultrafiltration (UF) is used to remove essentially all colloidal particles (0.01 to 1.0 microns) from water and some of the largest dissolved contaminants. The pore size in a UF membrane is mainly responsible for determining the type and size of contaminants removed.

### Disinfection:-

The treated Sewage, is then added with chlorine to kill the pathogens / E-Coli coliforms, so that it becomes fit for disposal in the lake / water ways. Chlorine being a very strong oxidizing agent, a small dose of 6 mg / l is enough to achieve desired levels of disinfection. A small residual chlorine (of the order of 0.2 – 0.25 mg / l) also ensures that there is no re-growth of E-coli, till the final disposal point. The treated Sewage, now substantially free from organic contamination, free from coliform bacteria can be safely disposed off in the river, or in other water bodies. This water can also be re-used for gardening / toilet flushing or for other secondary applications after polishing unit (optional).

### EQUIPMENT DESIGN CALCULATION:

#### 1) Raw sewage transfer pump:-

Capacity of Plant = 60 KLD

Filling hours considered for 1 batch water is 2 hours

Required capacity of pump = 1 batch water / 2 hours = 30/2 = 15KL/hr

Hence capacity of pump considered = 15KL/hr @ 10 mtrs head



**2) Air Blower:-**

Inlet BOD considered 300mg/ltrs

Total BOD load = (BOD load in mg/ltr X plant capacity in KLD) / 1000  
 = (300 X 60)/1000 = 18Kg/day

Oxygen required per kg BOD = 2.0kg/kg BOD

Total oxygen required in kg/day = BOD load per day (Kg/day) X oxygen required per kg BOD (Kg)  
 = 18 X 2 = 36kg/day

Air blower capacity for SBR tank in m<sup>3</sup>/hr = (Oxygen load per day) / ( Density of oxygen in kg/m<sup>3</sup> X % of air in atmosphere X diffuser efficiency in % X Aeration hour per day for complete 48KL treatment)  
 = 36/(1.2 X 23% X 15% X 12 hours )  
 = **72m<sup>3</sup>/hour**

Aeration required for Equalization tank and sludge holding tank = Volume of Equalization tank + Volume of Sludge holding tank  
 = 30KL + 10KL

Hence, Aeration required for equalization tank and sludge holding tank = 40m<sup>3</sup>/hr

Combinely Aeration required for Equalization tank, Aeration tank (SBR tank) and Sludge holding tank = 72 + 40 = 112m<sup>3</sup>/hr

**Hence the blower capacity considered is 120m<sup>3</sup>/hr**

**3) Coarse Bubble diffusers (Equalization tank)**

Volume of EQT = 30kl,

So, air required for EQT for equalizing shall be = 30m<sup>3</sup>/hr

Take 4 m<sup>3</sup>/hr – capacity of each diffuser.

i.e No of diffusers required = 30/4 = 7.5Nos

Considered 8 Nos coarse bubble diffusers

**4) Fine Bubble diffusers (SBR tank)**

Air required for SBR tank = 72m<sup>3</sup>/hr,

Take 5 m<sup>3</sup>/hr – capacity of each fine bubble diffuser.

ie., No of diffusers required = 72/5 = 14.4Nos

Considered 14Nos fine bubble diffusers

**5) Filter feed pump:-**

Capacity of Plant = 60 KLD

Time considered for filtering =12Hr

Pump capacity required = 60KL/12hours = 5m<sup>3</sup>/hr

Hence capacity of pump considered = 5m<sup>3</sup>/hr & 30m head



**6) Pressure sand Filter and Activated carbon filter:-**

Filter feed pump flow rate = 5 m<sup>3</sup>/hr.

Filtration velocity considered = 14.0 m<sup>3</sup>/hr/m<sup>2</sup>

Area = Flowrate / velocity = 5/14 = 0.357 m<sup>2</sup>.

A = 0.357m<sup>2</sup>.

$3.14/4 d^2 = 0.357m^2$ .

d = 675 mm.

Hence, Dia of filter considered = 800 mm

Height on straight = 15000 mm.

Size = 800mm Dia x 1500 mm HOS

**7) Dosing pump**

Dosing chemical: Sodium Hypochlorite. (Naocl)

Dosage ppm: 2.0 mg/Lt

Chemical required:  $(2 * 30) / 1000 = 0.06$  ltrs

Chlorine concentration in Naocl: 10 %

Total chlorine required per day =  $0.06/10\% = 0.6$ ltrs = 600ml

Dosing pump considered = 0-6 lph.



**TANK DESIGN CALCULATION:**

**1. Bar Screen**

A manually cleaned vertical bar screen with 60° inclination is proposed. The screenings are removed by a hand rake at regular intervals. The screen is placed at the end of the channel.

MOC	: RCC
Average flow	: 60 m <sup>3</sup> /day
Size of the unit	: 1000mm X1000mm X 600mm

**2. EQUALIZATION TANK**

MOC	: RCC
Average flow	: (60m <sup>3</sup> /day) / 20 hours = 3.0m <sup>3</sup> / hr.
Tank detention time considered	: 10 hours
Tank volume considered	: 30KL

**2. SBR UNIT**

**Design of SBR tank:**

It is Sequential batch reactor method in which treatment will happen in batch wise. Considered total 2 batch a day. Each batch takes 12hours operation which includes above 4 processing stages (Aeration fill + React cycle + Settling time + decanting time).

From 1batch water treatment will be = 60KL/2batch = 30KL

1 batch water is equal to 50% of the total SBR tank volume (Considered only 50% as decanting portion)

Balance 50% of the SBR tank volume will be = 30KL

Total 100% SBR volume = 60KL

Hence SBT tank volume considered = 60KL

MOC	: RCC
-----	-------

**4) DECANT TANK**

Decant tank volume	: 1 batch water outlet from SBR tank
Hence, Decant tank volume	: 30KL
MOC	: RCC



**5. SLUDGE COLLECTION TANK:**

Sludge is a semi-solid slurry that can be produced from waste water treatment by biological/chemical treatment. Mainly sludge dewatering focuses on weight and volume reduction to minimize waste disposal costs, as the name of the method implies, water removal is the principal means to reduce volume before the sludge by-product can be economically disposed of.

Recycling wastewater is another benefit of sludge dewatering. The water extracted from the sludge after dewatering process can be again collected in Equalization tank for recycling.

MOC : RCC  
 Capacity considered : 15% of the plant capacity  
 Tank volume required : 10 KL

**6. Treated water tank**

After disinfection with chlorine the treated water will be stored in the final treated water tank.

MOC : RCC  
 Average flow : (60m<sup>3</sup>/day) / 20 hours = 3.0m<sup>3</sup> / hr  
 Tank volume considered : 50% of total capacity  
 Size of the tank : 30KL

**7. UF Treated water tank**

MOC : RCC  
 Size of the tank : 30KL

**8. SBR (SEQUENTIAL BATCH REACTOR TECHNOLOGY)**

<p><b>BAR SCREEN CHAMBER</b></p>	<p>Preliminary Treatment process involves removing large rags, sticks and other solids which can choke in the plant pumps heads. The bar screens provided in bar screen chamber will stop all the floating and suspended matter from the influent waste water and they are to be removed manually by raking.</p>	<p><b>CHAMBER DETAILS</b>                  MOC: RCC  <b>BAR SCREEN DETAILS</b>                  Screen Spacing: 10mm                  MOC: SS-304                  Qty: 1Nos</p>
<p><b>EQUALIZATION TANK</b></p>	<p>The tank is of civil construction. Provision of air grid is to be made for thoroughly mixing the sewage to make it of homogenous quality and to keep the suspended matter in suspension and to avoid septic conditions. The well mixed sewage is then pumped into the SBR reactor with the help of pumps.</p>	<p><b>TANK DETAILS</b>                  MOC: RCC                  VOLUME: 30KL  <b>PUMP DETAILS</b>                  Sewage handling pump                  Capacity: 15m<sup>3</sup>/hr @ 10mtrs head                  Qty: 2Nos (1W + 1S)  <b>DIFFUSER DETAILS</b>                  Type: Disc type coarse bubble                  MOC: PVC                  Qty: 8Nos</p>
<p><b>SBR TANK</b></p> 	<p>The main pollutants in the raw sewage are represented in the form of Bio – chemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). The bacterial ability to synthesize the organic matter to harmless end products like carbon di-oxide and water molecules is utilized to treat the raw sewage.                  The bio – reactions are carried out in controlled environment in the bio – reactor. The bio – reactor</p>	<p><b>TANK DETAILS</b>                  MOC: RCC                  Volume: 60kl  <b>DIFFUSER DETAILS</b>                  Type: Tubular type fine bubble                  MOC: EPDM                  Qty: 14Nos</p>

	comprises of a tank, fitted with jet aerators. The bacterial activity needs dissolved oxygen, to synthesize the organic matter. The air is passed at the bottom of the tank, so that complete volume of tank is utilized. Oxygen dissolves in liquid, which can now be used by the aerobic bacteria.	
<b>DECANT TANK</b>	Sewage after filling, aeration and settling in the SBR tank, superintend water will be moved to the Decant tank. This semi treated water will be moved for filtration	<b>TANK DETAILS</b> MOC: RCC Volume: 30kl
<b>FILTRATION</b>	The clarified water collected in Decant tank is passed through pressure sand filter and activated carbon Filter to remove the suspended particles and microorganisms.	<b>PRESSURE SAND FILTER</b> Duty: 5m <sup>3</sup> /hr Dimension: 800mm dia x 1500mm HOS Media: Sand, pebble and gravel  <b>ACTIVATED CARBON FILTER</b> Duty: 5m <sup>3</sup> /hr Dimension: 800mm dia x 1500mm HOS Media: Sand, pebble and carbon
<b>TREATED WATER TANK</b>	Water after passing through PSF and ACF filters will have following characteristics as per KSPCB norms and limitation pH: 6.5 – 8 BOD: <10ppm COD: <50ppm TSS: <10ppm Turbidity: <10NTU Ammonical nitrogen: <5ppm Total nitrogen: <10ppm	<b>TANK DETAILS</b> MOC: RCC Volume: 30KL
<b>UF PLANT</b>	Skid mounted UF plant complete automated with necessary feed, backwash pumps and CIP system. following are the characteristics of the UF treated water TSS: <5ppm Turbidity: <5NTU	<b>UF PLANT DETAILS</b> Capacity: 3000LPH Type: Fully automated skid mounted system

