RV Educational Institutions ®
NMKRV College for Women ®

Autonomous Institution Affiliated to Bengaluru University

Recognised by UGC as College with Potential for Excellence. Accredited by NAAC with 'A' Grade

AQAR

2020-21

CRITERIA – VII : Institutional Values and Best Practices

7.1 – Institutional Values and Social Responsibilities

Waste Management

Solid Waste Management

- Leaf Litter-M/s. Soil and Health Solutions

E-Waste Management

- E-WaRDD & Co

Water Recycling System

- ENVIROWISERS Solutions PVT LTD

Go, Change the World

LEAF LITTER

NMKRV COLLEGE FOR WOMEN
#45/1, 22nd Cross, 3rd Block, Jayanagar, Bangalore – 560 011

Ph : 080-26637042 e-mail:nmkrv.college@gmail.com Fax : 080-22440116

Ref :AO/RSST/ 358 /2017-18. Date :03/08/2017.

The Hon. Secretary,
RSST,
Jayanagar,
BANGALORE – 560 011.

RASHTREEYA SIKSHANA SAMITHI TRUST No: 6575 Date: 5.1.18

Dear Sir,

Sub: Request for approval for purchase of Garden Leaf and Flowers Composter –
Ref.: Our letter No.031/17-18 dated 07/04/2017 –
The Hon. Secretary's instructions vide No.426 dated 21/04/2017 not to process the proposal and few suggestions for maintaining cleanliness near canteen, etc.
Fresh quotation received from M/s. Soil and Health Solutions –

******

With reference to the above, we are resubmitting herewith the full set of our earlier proposal, the Hon. Secretary's instructions along with fresh quotation dated 10/07/2017 received from M/s. Soil and Health Solutions quoting Rs.34,000/- for garden leaf and flowers composter, for your kind consideration and necessary instructions in the matter.

In this connection, we understand that Executives from M/s. Soil and Health Solutions have met our Registrar recently, demonstrated the composter to show how it works, etc. Hence, we seek the Hon. Secretary's instructions in the matter.

Thanking you,
Yours faithfully,

PRINCIPAL
N.M.K.R.V. College for Women
3rd Block, Jayanagar, Bangalore-11

Encls: As above.

RASHTREEYA SIKSHANA SAMITHI TRUST No: 6241 Date: 5.1.18

P.T.O.

04/01/18. Ref no: 822/17-18
Request submitted to the Hon. Secretary, RSST, Bangalore, for considering our above request (sent to TRUST office on 03/8/2017 and pending there for approval) now under "AUTONOMY GRANT". Copy of the Hon. Secretary's permission for spending amount under Autonomy grant is furnished on the reverse side of this page.

PRINCIPAL
N.M.K.R.V. College for Women
3rd Block, Jayanagar, Bangalore-11

SOIL HEALTH

#11, Green fields-2, Gubbalala cross, Kanakapura Road, Bangalore-560062
Email : Vasuki.iyengar@gmail.com
GSTIN- 29AAKPI7439M1ZZ Mob:9845690778

QUO# : 93

QUOTATION

Date : 02-02- 2018

Prepared for
NMKRV College for Women.
3rd Block, Jayanagar
Bangalore, Karnataka-560011
GSTIN :N/A

No	Particulars	HSN Code	Qty	Rate	Amount(INR)
01	**Garden Leaf composters:** 5ft Dia X4ft Height includes 6 bioclean blcoks, 1kg neem powder and 1ltr neem powder.	8479	2	13,000	26,000
	GST At 12%				3,120
02	**Cement Blocks**				6,000
	GST At 5%				300
03	**Transportation**				2,000
				Sub Total	**37,420**
				Total Amount Payable	**37,420**

Note: This *Price will be applicable for the 2months from the date of quotation.50% Advance to be paid by the customer at the time of Po .*

A/C Number :50200027552109
Name: Soil and health solutions
Account type: Current
Bank Name : HDFC bank
IFSC Code : HDFC0003635

Cheques payable to "Soil and Heath Solutions"

For SOIL AND HEALTH SOLUTIONS

Soil and health solutions
Vasuki Iyengar- Proprietor

For SOIL AND HEALTH SOLUTIONS

SOIL HEALTH

#11, Green fields-2, Gubbalala cross, Kanakapura Road, Bangalore-560062

Email : Vasuki.iyengar@gmail.com

Mob:9845690778

GSTIN- 29AAKPI7439M1ZZ

Garden leaf composter

- **Includes 6 Bioclean blocks (5kg each)**
- **1 liter Effective Microorganism (EM1) Solution**
- **50 cement blocks to be provided by customer to create a platform .**
- **Installation and Training .**

SOIL HEALTH

#11, Green fields-2, Gubbalala cross, Kanakapura Road, Bangalore-560062

Email : Vasuki.iyengar@gmail.com

GSTIN- 29AAKPI7439M1ZZ

Mob:9845690778

50 cement blocks needs for platform setup

Renovation

SOIL HEALTH

#11, Green fields-2, Gubbalala cross, Kanakapura Road, Bangalore-560062
Email : Vasuki.iyengar@gmail.com
GSTIN- 29AAKPI7439M1ZZ
Mob:9845690778

INV# : 172

INVOICE

Date :14-03-2018

Prepared for
NMKRV
3rd Blocks,Jayanagara
Bangalore-560011
GST :N/A

Sl no	Particulars	HSN Code	Qty	Rate	Amount(INR)
1	**Garden Leaf Composter :** 5ft Dia X 5ft Height, Includes 6bioclean blocks, 1kg Neem powder and 1ltr EM1 Solution.	8479	2	13,000	26,000
	SGST At 6%				1,540
	CGST At 6%				1,540
2	**Cement blocks**				6,000
	SGST At 2.5%				150
	CGST At 2.5%				150
	Transportation				2,000
				Sub Total	**37,380**
				Total Amount Payable	**37,380**

A/C Number 50200027552109
Name: Soil and health solutions
Account type: Current
Bank Name : HDFC bank
IFSC Code : HDFC0003635

Cheques payable to "Soil and Health Solutions"

For SOIL AND HEALTH SOLUTIONS

V——S

Soil and health Solutions
Vasuki Iyengar- Proprietor

19/03/18.
The Hon. Secretary's sanction dated 09/02/18 is enclosed for Rs. 37,420/-. As we have already exceeded ~~[illegible]~~ Autonomy grant amount, we may pay this bill from Management Account.
For orders;

sd/- 19/3/18
PRINCIPAL
N.M.K.R.V. College for Women
3rd Block, Jayanagar, Bangalore-11.
19/3/18.

Work done to our Satisfaction
Payment may be made.
19/03/2018.

Received
[illegible]
2017-18 [illegible]

E-WaRDD & Co

सत्यमेव जयते

INDIA NON JUDICIAL

Government of Karnataka

e-Stamp

Certificate No.	:	IN-KA37672611419169R
Certificate Issued Date	:	12-Nov-2019 01:53 PM
Account Reference	:	NONACC (FI)/ kaksfcl08/ JAYANAGAR4/ KA-BA
Unique Doc. Reference	:	SUBIN-KAKAKSFCL08934156047881S4R
Purchased by	:	HON SECRETARY RASHTREEYA SIKSHANA SAMITHI TRUST
Description of Document	:	Article 12 Bond
Description	:	AGREEMENT
Consideration Price (Rs.)	:	0 (Zero)
First Party	:	HON SECRETARY RASHTREEYA SIKSHANA SAMITHI TRUST
Second Party	:	E WARDD AND CO MYSORE ROAD NAYANDAHALLI BANGALORE
Stamp Duty Paid By	:	HON SECRETARY RASHTREEYA SIKSHANA SAMITHI TRUST
Stamp Duty Amount(Rs.)	:	100 (One Hundred only)

For The Bangalore Suburban Co-operative Ltd. (R) Multipurpose Co-operative Ltd.

Authorised Signatories

Please write or type below this line

Service Agreement for Management of E Waste

This Agreement is entered at Bengaluru on this day 12th November 2019 by and between

(i) **M/s. E-WaRDD & Co**, having its office at #11, Muthachari Industrial Area, Mysore Road, Nayandana Halli, Bengaluru - 560036 and duly represented by its Authorized representative Mr. Asif Pasha, hereinafter referred to as Waste Collecting Agency (which shall, wherever the context so admits, include its legal representatives, successors and assigns) on the one part:

For E-WaRDD & Co.

Proprietor

RASHTREEYA SIKSHANA SAMITHI TRUST BANGALORE

Statutory Alert:
1. The authenticity of this Stamp Certificate should be verified at "www.shcilestamp.com". Any discrepancy in the details on this Certificate and as available on the website renders it invalid.
2. The onus of checking the legitimacy is on the users of the certificate.
3. In case of any discrepancy please inform the Competent Authority.

(ii) Rashtreeya Sikshana Samithi Trust, RV Teachers College Building, Near Ashoka Pillar, Jayanagar 2nd Block, Bengaluru – 560011 hereinafter called as RSST (which shall, wherever the context so admits, include its Institution/Schools under its management indicated in Annexure – 1) (hereinafter collectively referred to as the "Parties" and individually as a party)

WHEREAS there are certain e-waste materials generated by the Institutions of RSST and are required to be disposed of for recycling as per the applicable rules;

WHEREAS Waste Collecting Agency has approached RSST and offered to collect and recycle such e-waste scrap materials in a scientific and environmental procedure manner.

AND WHEREAS Waste Collecting Agency has warranted and represented that it has been obtained all the necessary clearance/permission from the respective authorities in compliance with the applicable statutory rules and regulations for the above said purpose;

AND WHEREAS, RSST have accepted the said offer and both the parties have decided to enter into the Present Agreement incorporating necessary terms and conditions governing the said transaction;

NOW THEREFORE IN CONSIDERATION OF THE MUTUAL COVENANTS AND PEMISES CONTAINED HEREIN, THE PARTIES HERETO ENTER IN TO THIS AGREEMENT AND AGREE THE FOLLOWING:

1. That Waste Collecting Agency agrees to collect E-Waste generated at source i.e RSST being materials included but not limited to scrap PCB, Panels (either it is broken) plastics, wires, metal parts etc.
2. That waste collecting Agency shall collect E-waste from the premises of RSST and its Institutions in a secured manner, using their own transport arrangements, on a quarterly basis or as and when the waste collection request is made by RSST & its Institutions i.e waste generating source.
3. That Waste Collecting agency agrees to pay the fees to RSST, Waste generating source as stated in the following manner for such services of waste collection.

Sl. No	Mixed E waste material	Price in ₹ per piece
1	Desktop with (hdd, ram, mother board, smps).	125
2	Desktop MT	20
3	Monitor CRT	75
4	Monitor LCD	50
5	Keyboard & Mouse	8
6	Laptop	200
7	Wire and cable	20/Kg

RASHTREEYA SIKSHANA SAMITHI TRUST BANGALORE

For WaRDD & Co.

Proprietor

8	UPS Small	100
9	Printer	100

Note: The above rate is including all taxes.

Of waste collected to the generating agency,

4. That Waste Collecting Agency shall issue to the RSST and its Institutions /Waste Generating Source **Form-13** called "The Hazardous waste manifest" after checking the weight of the waste delivered and a copy of the **E-waste pass book** with entry details of e-waste collected.
5. That it is specifically agreed between the parties that once RSST and its Institutions has disposed the E-waste to Waste Collecting Agency, RSST and its Institutions shall not be responsible for waste storage or waste recycle or the manner in which waste is disposed off.
6. That E-waste collecting agency also will issue e-waste disposal certificate once disposal of e-waste collected is disposed.
7. That Waste Collecting Agency, E-WaRDD & Co shall assume all the responsibility of the waste collected, its disposal/ recycling as per the guidelines of KARNATAKA STATE POLLUTION CONTROL BOARD.
8. That it is expressly agreed between the parties that RSST and its Institutions are not required to pay any amount for the waste disposal.
9. That term of the Present Agreement is one year commencing from 12th November 2019 to 31st December 2021 and may be renewed for further periods as mutually agreed upon in writing.
10. This agreement may be terminated by either party hereto by issuing an advance notice of thirty days, in writing, to the other party without assigning any reason thereof.
11. That during the term of the agreement, Waste Collecting Agency will not refuse to take waste from RSST and its Institutions in any case.
12. That E-waste Collecting Agency undertakes to inform RSST, if their license for the hazardous waste managing is canceled by the KARNATAKA STATE POLLUTION CONTROL BOARD due to any reasons whatsoever and in such a case RSST shall be at option to immediately terminate the Agreement without giving any notice.
13. That RSST reserves the right to terminate the agreement without notice in case the e waste is not handled, treated and disposed of at any time during the execution of the contract.
14. That E-waste collecting agency hereby undertakes and warrants that it will handle the entire E-waste materials collected or removed from RSST and its Institutions under its management, in strict accordance with all applicable statutory requirements including the provision of E-waste (Management and Handling) Rules, 2016, in relation to collection, transportation, storage, treatment and disposal of the said e-waste materials for recycling. In the event of any violation of any applicable statutory rules, regulations or order, by or on the part of E-waste collecting Agency or its employees or any other person(s) deputed by E-waste collecting agency in this regard and

For E-WaRDD & Co.

Proprietor

RASHTREEYA SIKSHANA SAMITHI TRUST BANGALORE

involved in the said process, E-WaRDD & Co shall be solely liable thereto including meeting all consequences thereof.

E-Waste collecting agency hereby agrees to indemnify RSST and its Institutions from any and all claims, actions or proceedings that may arise, or result in costs, damages or penalties, in connection with collection, transportation, treatment, storage and disposal of the e-waste materials taken out from RSST and its Institutions by E-waste Collecting Agency for recycling.

15. Neither party hereto shall be responsible to the other for delays or failures in performance resulting from acts beyond its reasonable control and without its fault or negligence. Such delays or failures may be caused by, among other things, riots, rebellions accidental explosions, floods, storms, acts of God and similar occurrences, which are beyond the control of either party.
16. In the event of any dispute or difference arising between the parties hereto relating to or arising out of this agreement, including the Implementation, Execution, Interpretation, Rectification, Validity, Enforceability, Termination or Rescission thereof, Including the rights, Obligations or Liabilities of the Parties hereto, the same will be adjudicated and determined by arbitration. The arbitration shall be conducted by a panel of two arbitrators one each selected party here to and both the arbitrators thus appointed shall appoint the third arbitrator who shall function as the presiding arbitrator. The arbitration shall be conducted at Bangalore in English Language. Any arbitration award shall include attorney's fee for the prevailing party.
17. The courts in the city of Bangalore shall have exclusive jurisdiction to entertain try and determined any dispute.
18. No modification, amendment, supplement to or waiver of this agreement or any of its provisions shall be binding upon the parties hereto unless made in writing and duly signed by both the parties to this agreement.
19. This agreement contains the entire understanding and agreement between the parties hereto and that supersedes all prior understanding and agreements whether oral or written, if any.

Service Provider Agreement for Management of E-Waste

Accepted signed and delivered by
For Rashtreeya Sikshana Samithi Trust

RASHTREEYA SIKSHANA SAMITH TRUST BANGALORE

Authorized Signatory
Date:

For E-WaRDD & Co.
For E-WaRDD & Co.

Proprietor
Authorized Signatory
(Asif Pasha)

ANNEXURE -1

RV Educational Institutions
Under RSST

SL NO	Institution	Contact Nos
1	RSST	080-46746464
2	RV School	080-26768583
3	RV Teachers College	080-26562536
4	RV Teachers Training Institute	080-26565935
5	RV Girls High School	080-26577792
6	RV College of Engineering	080-67178000
7	NMKRV College for Women	080-26637042
8	NMKRV PU College	080-22447132/22458731
9	SSMRV College	080-22453665
10	SSMRV PU College	080-26636909
11	DAPM RV Dental College	080-22445754/22721268
12	RV Public School	080-26569588.
13	RV Institute of Management	080 – 42540300/26547048
14	RV College of Nursing	080-26631466
15	RV College of Physiotherapy	080-26632885
16	RV Skills Center	080-40788574
17	RV PU College	080-26541455
18	RV College of Architecture	080-22717820-21
19	RV Institute of Legal Studies	080-26696263
20	RV Institute of Technology & Management	080-46746464

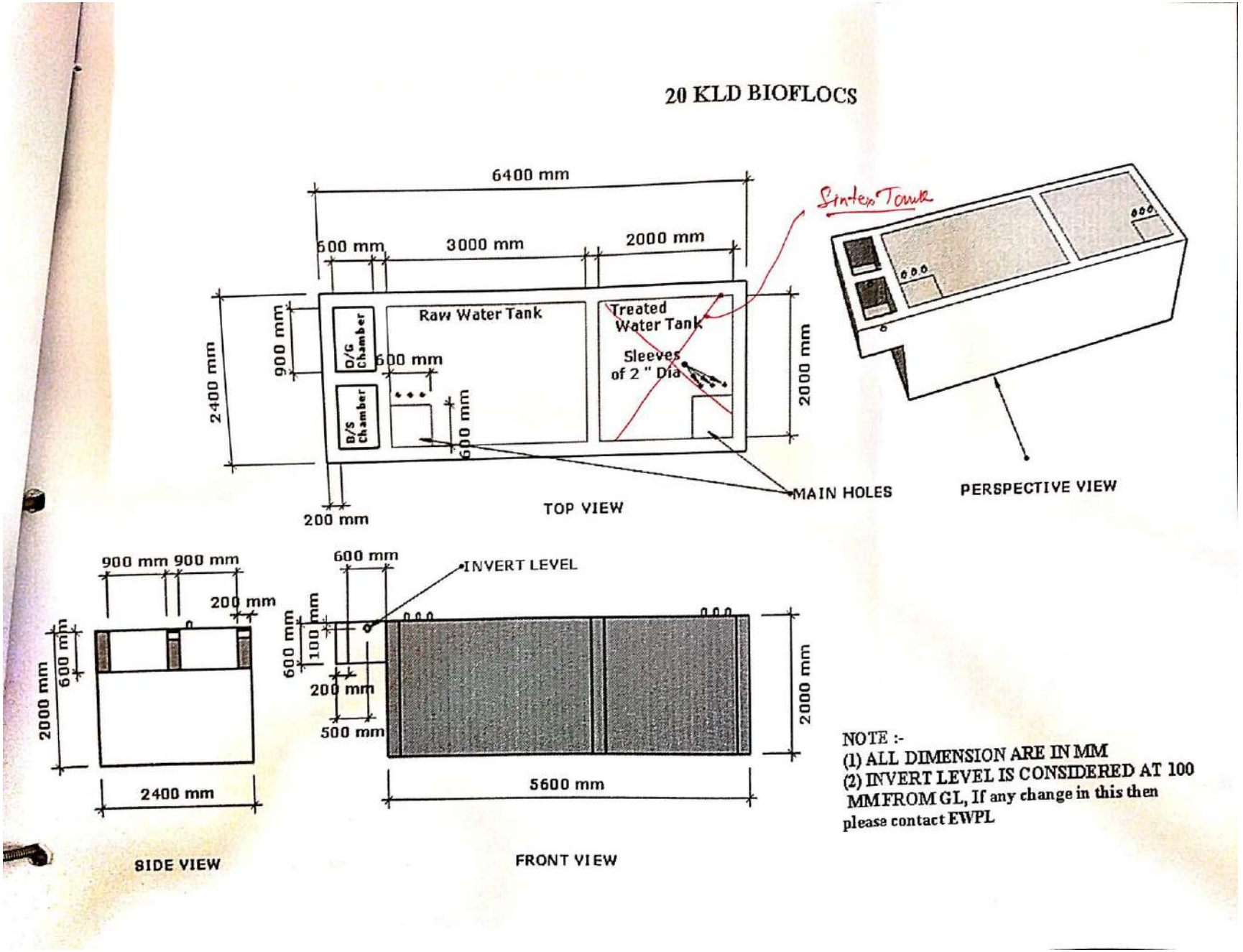
For WaRDD & Co.

Proprietor

RASHTREEYA SIKSHANA SAMITHI TRUST BANGALORE

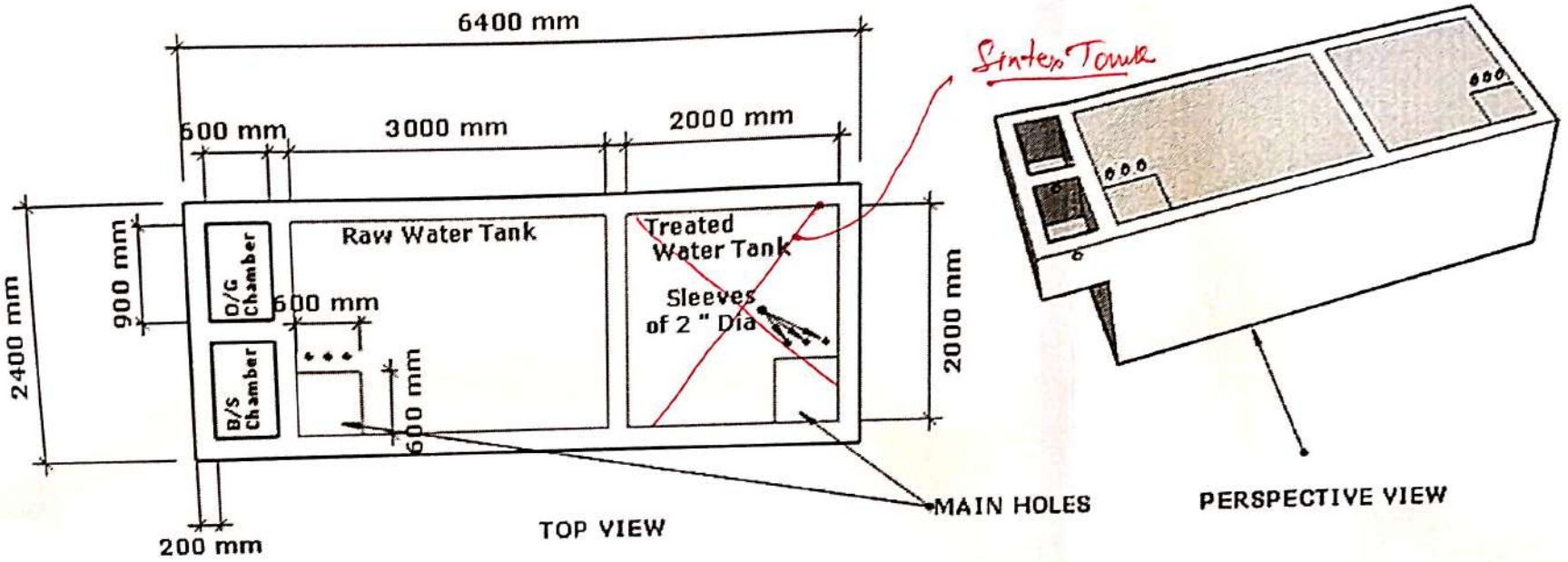
STP PLAN & CONTRACT

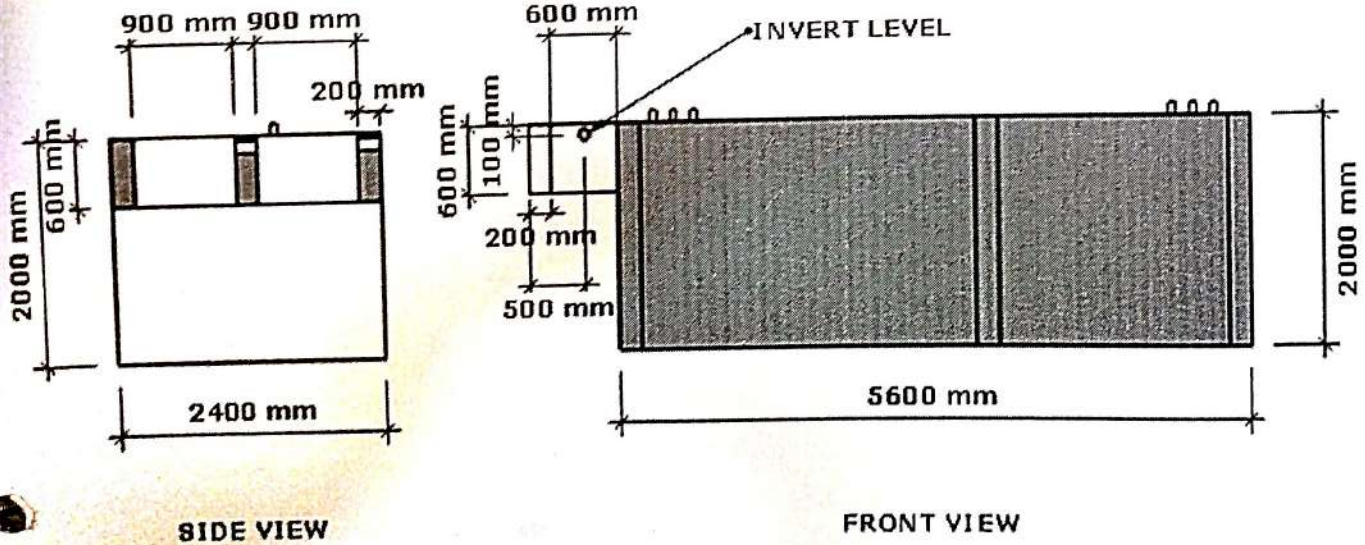
20 KLD BIOFLOCS



NOTE :-
(1) ALL DIMENSION ARE IN MM
(2) INVERT LEVEL IS CONSIDERED AT 100 MM FROM GL, If any change in this then please contact EWPL

20 KLD BIOFLOCS





NOTE :-
(1) ALL DIMENSION ARE IN MM
(2) INVERT LEVEL IS CONSIDERED AT 100 MM FROM GL, If any change in this then please contact EWPL

QUOTE REF: ESPL_STP_NMKRV_01

Date : **31 Oct 2019**

To,

Mr.Vasavachar.V, *Engineering Manager*
R. V. Educational Institutions,
R. V. Teachers College Building, 2nd Block,
Jayanagar, Bengaluru - 560064

Office No : 080 2656 2386
Mobile No : 98451 92013
E-mail: vasavachar@rediffmail.com

Sub: Techno - Commercial proposal for Sewage Treatment Plant (STP) – 20 KLD

Dear Sir,

In reference to your requirement for sewage treatment system and your discussion with eSPL, we are pleased to submit our techno-commercial proposal for STP with 20 KLD capacities. Technical description of the system is explained in further sections.

Introduction

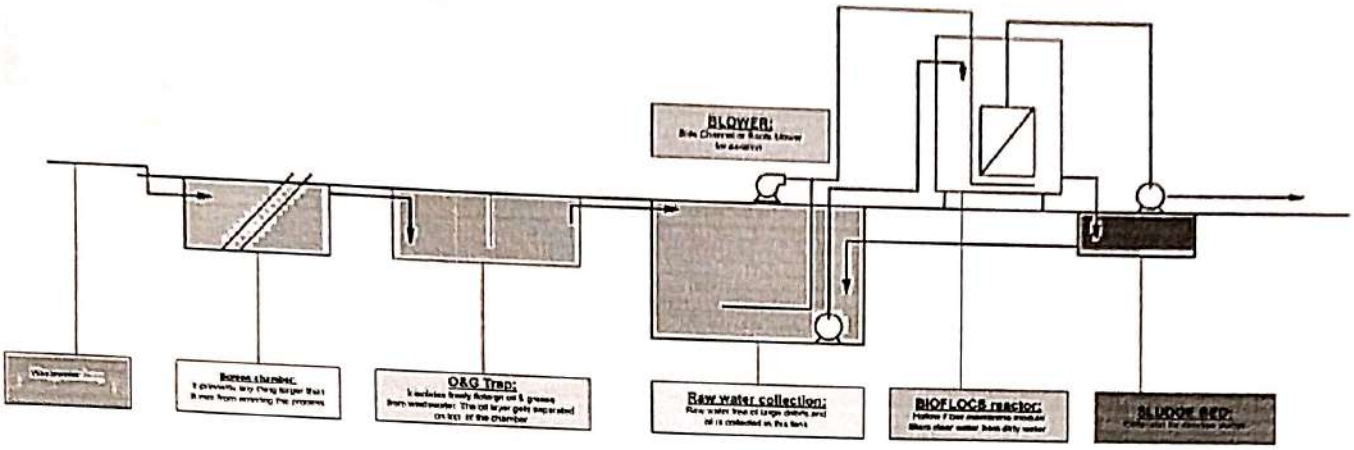
Treatment of Sewage has become a mandatory requirement in today's world of densely populated regions. However, putting up working sewage treatment plants to handle the volumes of sewage generated is challenging. ***Conventional systems require Huge Space, Dedicated Manpower and Constant Maintenance. On top of this getting quality output water is still not assured.***

Now, with advanced technology, ***eSPL proudly presents MBR Systems for sewage treatment***. MBR systems utilize micron filtration combined with microbial degradation to maximize the efficiency. It can handle volumes of sewage in extremely compact spaces. Micron filtration ensures that treated water is clean and even ecoli bacteria are removed. ***MBR Systems are Very Compact, Almost No Manpower is required, Minimal Monitoring, Consistent Output, No Odours, Easy and Quick Installations, Portability, Simple Maintenance and Cost effective.***

Technical Details

Membrane Bio Reactor - MBR is a technology developed to meet stringent treated water quality for sewage and industrial wastewater. **This** is a membrane reactor based design for biological treatment of effluent.

MBR operates on the principle of biological/bacterial treatment combined with micron filtration: Raw untreated wastewater is sent to **MBR** reactor using a pre filter screen to prevent any larger debris, plastics etc. from damaging the membranes. **MBR** module is a bioreactor fitted with necessary components like air diffuser and filtration membrane with a pore size ranging from 0.1 micron to 0.4 micron. Residence time of waste water within the reactor is controlled by drawing rate from the membrane module.



Schematic for STP

Design Parameters

Assumptions:

Nature of waste water	Domestic Sewage
Flow	20 KLD
Operating period	24 hrs

1. The plant is designed to operate at +/- 10 % variation in raw wastewater parameter.
2. No other parameters other than mentioned above is present in the raw waste water which is beyond Pollution Control Norms and hazardous to micro-organisms.
3. Treated water quality will be achieved if the inlet raw water quality is as per the raw water quality mentioned as well as no other pollutant than the mentioned, is present or exceeds the limits or which is hazardous in nature, which otherwise may affect the biological treatment process.

Parameter considerations:

Description	Raw Sewage	Treated Water
pH	6.5 -7.5	6.5 -7.5
COD	≤ 350-400 ppm	≤ 50 ppm
BOD – (3 days @ 27 °C)	≤ 150-200 ppm	≤ 10 ppm
TSS	≤ 200 ppm	≤ 05 ppm
Oil & Grease	≤ 50 ppm	≤ 05 ppm
NH4-N (mg/l)	≤ 200 ppm	≤ 05 ppm
Fecal Coliform (MPN/100ml)	1000-2000	≤ 100
N-Total (mg/l)	≤ 400 ppm	≤ 10 ppm

Note: Above treated water parameters are for disposal of treated water for flushing.

eSPL

Electro Mechanical (eSPL SCOPE) :

No	Equipment description	Qty
1	Bar Screen - (1 Fine & 1 Coarse Screen)	1
2	**Feed pump** - MOC:CI – non clog; Make: Leo/CNP/Equivalent	1W + 1S
3	**Rota meter**	3
4	**MBR module - Equipped with 0.1 – 0.4 micron PVDF Hollow fiber membranes**	1 – Set
5	**Membrane filtration pump** - MOC: SS 304; Make: Leo/CNP/Equivalent	1W + 1S
6	**Back wash pump** - MOC: SS 304; Make: Leo/CNP/Equivalent	1W
7	**Control panel** - With automation and level sensors for automatic controlling of system	1
8	**Blower** - Type: Side channel / Twin lobe roots blower	1W + 1S
9	**Piping (UPVC/CPVC/MSEP GI – as per system requirement)**	1 lot
10	**Automation** - PLC controlled system with level sensors for automatic operation of system	1
11	**Backwash system**	1 – set
12	**MBR Chamber – MOC : MSEP**	1

Note:

- Pump & blower capacities and ratings are as per typical STP setup. If the site demands a different rating of blower, pump, piping, pipe-fitting, electrical or instrumentation then the additional expense would fall under client's scope.
- Hydraulic, electrical and mechanical Battery limit of supplier would be within 5 ft radius of the control panel. Any work of hydraulic, electrical or mechanical nature outside this would be under client's scope.

Civil and Plumbing :

No	Equipment description	Quantity
1	**Raw water storage tank - 10000 L working capacity.**	1
2	**Bar Screen Chamber and Oil and Grease Chamber – 500 L capacity each.**	1
3	**Treated Water – 6000 L working capacity.**	1
4	**Plumbing work between above mentioned tanks**	1
5	**Sludge Drying Bed – as per design**	1

ıer Works (CLIENT SCOPE)

No	Equipment description	Quantity
1	On site piping work till raw water storage tank and after treated line	1
2	Pump room for placing our Electro Mechanical equipment	1
3	Any other civil work required.	
4	Electrical – 3 phase power with neutral, earthing & MCB near location of STP	1
5	Fresh water line – 1/2" at the location of MBR Chamber.	1
6	Proper lighting as per sites requirement.	1

Exclusions from eSPL's scope

- Design & construction of civil tanks & preparation of RCC structural drawings, civil BOQ etc.
- All civil works including grading / leveling of site foundations, pipe and underground cable trenches, grouting, platforms, pipe supports, inserts, puddle pipes, structural supports for air grids & pipes.
- Safe storage of equipment supplied by us, at your site.
- Construction of approach roads with fencing & weather protection shed for Distribution board, blowers, pumps, electrical motors etc., etc.
- Utilities at site. e. g. Water, Chemicals, Electricity etc.
- Supply of all types of lab equipment or its test reports from any 3rd party, during & after commissioning.
- Emergency power supply and plant illumination system.
- All piping, cabling etc. beyond the termination points as mentioned in our offer.
- Fire fighting system including appliances.
- Lightening protection.
- Manpower for operation & maintenance of the plant.
- Initial commissioning consumables, chemicals, lubricants etc.
- NOC / Approval from Pollution Control Board.
- Any other item not specifically mentioned in our scope.

CHAPTER 1

INTRODUCTION

Design and detailed technical proposal along with feasibility study for a 20 KLD Sewage Treatment Plant for **NMKRV College Campus** located at 45/1, 22nd Cross Rd, Jayanagar 3rd Block, Bengaluru, Kamataka 560011.

1.1. Basis for Sewage Treatment Plant

Treatment of Sewage has become a mandatory requirement in today's world to conserve usage of fresh water by utilizing the treated water for gardening, flushing and floor washings etc. Therefore the institution has envisaged installing and running a state-of-the-art MBR - Sewage Treatment Plant for these premises.

1.2. Sewage Generation Basis

Water demand is calculated based on the actual consumption.

Total quantity of water utilized in the premises when it is fully operational is reported to be 25 KLD as per actual observations.

Below conditions have been considered to design the MBR STP

- Water consumed on daily basis is 25000 ltrs/day.
- 80 % of the water consumed will be converted to sewage

Based on above details, sewage generation will be as below:

25000 x 80% = 20,000 ltrs/day

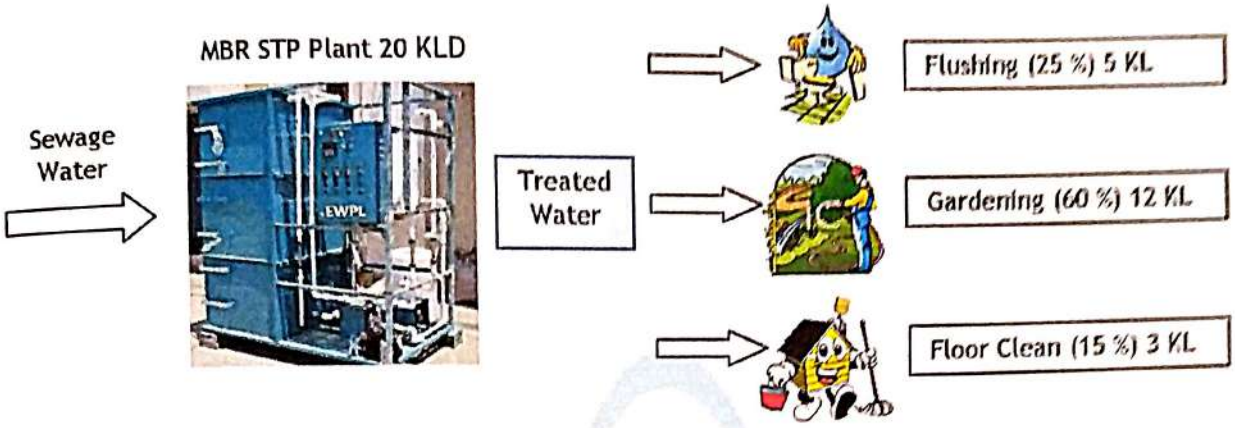
It is proposed to treat the generated sewage in an MBR-STP of 20 KLD capacity.

Detailed design write up of the STP is in the following sections.

1.3. Reuse of Treated Water

The sewage generated during the institution operations will be treated up to the tertiary level in Membrane Bio Reactor Sewage Treatment Plants (STP). The entire (100%) treated sewage from STP of 20 KLD capacity will be recycled / reused for toilet flushing, vehicle washing and landscaping in the site. 100% of treated water is utilized and hence there shall be no discharge of treated water to sewers.

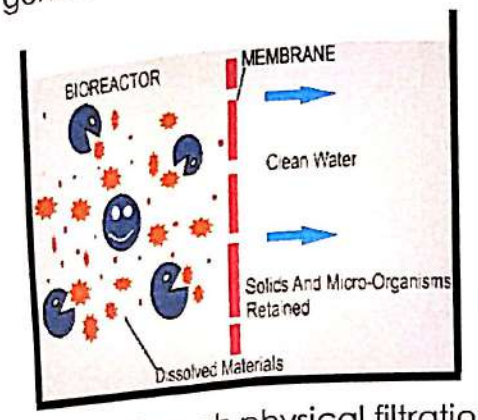
TREATED WATER REUSE SCHEME



CHAPTER 2

MEMBRANE BIO REACTOR SEWAGE TREATMENT PLANT

The Membrane Bio Reactor Process is a continuous process of treating sewage and generating treated water from the system. It incorporates the tried and tested methods of activated sludge process and improvising it to run the system at higher MLSS. This results in extremely efficient digestion process resulting in rapid degradation of sewage.



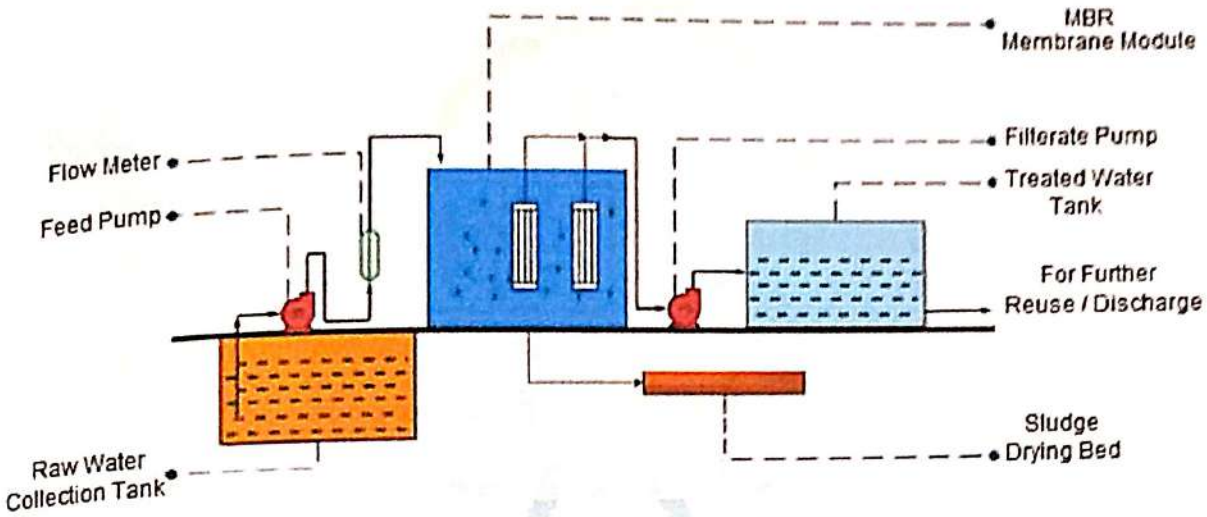
Further improvisation by using Membrane helps to avoid unnecessary tanks while always giving high quality water. Our membranes also disinfect the water during this process through physical filtration at 0.4 microns.

MBR is developed and is used world over to meet stringent treated water quality for sewage and industrial wastewater. MBR is a membrane reactor based design for biological treatment of sewage.

MBR operates on the principle of biological treatment combined with micron filtration.

- Raw untreated wastewater is sent to MBR reactor chamber using a pre filter screen to prevent clogging of the reactor because of larger debris, plastics etc..
- In the reactor chamber, sufficient aeration is provided for bio degradation of sewage as well nitrification.
- MBR module is a bioreactor fitted with necessary components like air diffuser and filtration membrane with a pore size ranging from 0.1 micron to 0.4 micron.
- The immersed MBR module will permeate only treated water leaving all the untreated sewage and pathogens behind.
- Residence time of waste water is controlled by drawing rate from the membranes.
- Treated water is drawn from the reactor using suitable pump.
- As the pore size of the membrane is too small to allow any bacteria or other contaminants to pass through, the treated water at the outlet of the membrane is disinfected and its parameters will be within prescribed limits from KSPCB.

Below is the typical schematic of a MBR STP setup.



Typical Schematic for STP with MBR

Nitrogen is also treated to acceptable levels in the normal operations of an MBR STP.

The typical MBR treatment sequence for nitrification – denitrification systems is as follows:

1. The reactor is continuously filled with raw wastewater that is pumped from collection tank.
2. Aeration is given in the reaction tank to degrade organic content. Also during this aeration, Ammonia Oxidizing Bacteria (AOB) gets sufficient aeration and residence time to nitrify ammonia to nitrates.
3. Overflow from the reaction chamber is designed to fall back into sewage collection tank. This collection tanks acts as anoxic zone where Ammonia Oxidizing Archea (AOA) gets sufficient time to carry out denitrification of nitrates to nitrogen.
4. Dead zones are automatically created inside the reaction chamber leading to partial denitrification inside the reaction chamber also.

Hence ammonical nitrogen and total nitrogen is effectively treated in an MBR System.

Due to the high solid retention time of 60-90 days, efficient digestion is ensured by the prevailing facultative bacteria. This design for maximizing solid retention times and minimizing hydraulic retention time ensure a large reduction in sludge generation. Approximately 5000 liters of liquid sludge is generated per every 30-45 days. This sludge is periodically taken out into drying beds. The dried sludge of approximately 25-50 kgs in every 30-40 days can be utilized as effective manure in the gardens.

Typical components of MBR reaction chamber are as follows:

1. MBR reactor module with 0.4 micron HS PVDF hollow fiber membrane
2. Bio reactor tank
3. Pumps
4. Control and automation system
5. Instrumentation

Client side components will be as follows:

1. Raw water collection tank – with minimum 12 hours of storage
2. Treated water collection tank – with minimum 8-12 hours of
3. 3 Phase power supply with suitable power rating
4. Site leveling and weather proofing as required

CHAPTER 3

DESIGN BASIS

Total water requirement = 25.0 m3 / day.
Assuming Diversity Factor of 0.8 = 20.0 m3 / day.

Therefore, STP will be designed for = 20 m3 / day or 20 KLD

It is proposed to install MBR STP of capacity 20,000 Liters /day, Following is the scheme for treating 20,000 Liters/day capacity sewage. The treated water can be utilized for Toilet Flushing & Gardening. Various treatment units envisaged in this sewage treatment plant are explained below.

3.1 General Characteristics:

3.1.1 Characteristics of Sewage Water:

Sl	Parameter Description	UOM	Raw Sewage	Treated Water Parameters
1	PH Value	No	6.5 to 8.5	6.5 to 8.5
2	Total Suspended Solids (TSS)	mg/Liter	500 to 1000	<20
3	Biological Oxygen Demand (BOD)	mg/Liter	200 to 500	<10
4	Chemical Oxygen Demand (COD)	mg/Liter	500 to 700	<50
5	Total Nitrogen (N)	mg/Liter	70 - 200	<10
6	Ammonia Nitrogen (NH4-N)	mg/Liter	50 - 350	<5
7	Fecal Coliform	MPN/100ml	1000 - 2000	<100

3.2 Operating Basis:

3.2.1 General Operating Conditions of MBR STP

Sl	Parameter	Operating value
1	Incoming raw sewage flow rate (LPH)	1000 – 1100
2	Outgoing raw sewage flow rate (LPH)	1000 – 1100
3	Bioreactor HRT (hours)	4 – 7
4	Bioreactor SRT (days)	15 – 60
5	Design MLSS(mg/Liter)	5000 – 12000
6	Design Air flow rate (cu. m/hour)	30 – 50
7	Treatment water pH	7
8	Total organic loading per day (Kg BOD3 /day)	7.5

3.2.2 Operational Details

Sl	Parameter	Operating value
1	Membrane Flux	12.5 - 15LMH (Liter/sqm/hour)
2	F/M ratio	0.04 – 0.12 g BOD/g MLSS/day
3	Bio Solids yield	0.328 g MLSS/g COD
4	DO	1– 4 ppm

3.3 Design Details

Sl	Process	Importance	Scope of supply
1	Coarse and Fine screen chamber (mesh – 8 mm) Screen chamber – 0.2 m x 0.6 m x 0.8 m	The screen prevents plastic bags, rags and such items from entering collection tank	Screen: ESPL Screen Chamber: Civil work - Client

1. Average flow: 1100 Liter per hour
2. Peak flow: Average flow x 3 = 1100 x 3 = 3300 Liter per hour
3. Assuming an angle of 30 deg of the screen with the horizontal.
   Assuming a bar size of 15 mm x 5mm with opening of 15 mm between the bars.
4. Desired velocity through screen 0.8 m/s
5. Net area of screen = 1.25/3300 x 0.3 = 0.00114
6. Adopting screen with 5 mm thick and 6 mm opening 0.0025 sq m is the gross area of screen
7. Assuming screen at 60 deg with horizontal,
   Gross area of screen is 0.0025/sin 60= 0.0029 sq m = 0.054 x 0.054 m screen size.
8. We suggest bar screen of 0.2 m x 0.4 m to be fitted in screen chamber size of 0.3 m (width) x 0.6 m (height) x 0.8 m (Length) screen chamber.
9. Excess screen area than theoretically needed would prevent flow reduction due to clogging and reduced cleaning frequency.

2	**Oil and Grease trap 0.2 m x 0.6 m x 0.8 m**	**For removal of excess free / floating oil and grease**	**Civil work – Client**

1. For separation of free O&G, separation time of around 10 minutes isdesigned.
2. At peak flow of 3300 LPH, the O&G chamber is to be designed with dimension of 1 x 1 x 1 m, giving effective volume of 1000Liters
3. At average flow with retention would be around 50 minutes.
4. As per design screen chamber would precede O&G trap, so that O&G does not get clogged

3	**Collection tank** **3.0 m(L) x 2.0 m(B) x 2.0 m(D)** **Capacity ~12 m^3**	**Post screening untreated water gets collected in tank. Minimum holding time for the water in this tank must be 12 hours**	**Civil work – Client**

1. Suggested collection tank has capacity to handle at least 12 hours of daily flow. Thus the suggest capacity is 10.0 m^3, also enough to handle peak flow for 3 hours.

4	**Aeration chamber** **2.2 m(L) x 1.5 m(B) x 1.8 m(D)** **Capacity ~6 m3**	**Average residence time for wastewater is set at around 6-7 Hrs.** **This HRT is sufficient for desired treatment.**	**ESPL** **MOC: MSEP**

1. As per the estimate for an average flow of around 1100 LPH and a designed HRT of 4- 6 hours, the volume of aeration chamber comes at round 6000 Liter.
2. HRT of aeration chamber can also be calculated from following equation:

   F/M = (Q x S) / (X x V)

   Where:

   F/M = food of microorganism ratio (estimated from literature on sewage treatment)

   Q = Design flow rate (cu m/day)

   S = Input BOD value (mg/Liter)

   X = MLSS (mg/Liter)

   V = Volume of reactor (cu. M)

   Taking average MLSS of around 8000 and F/M value of 0.1 and input BOD of 300 max; V comes to around 6.25 cu m. We have taken this value close to 6.0 cu m.

5	**MBR membrane module**	**MBR membrane module contains PVDF membrane with an effective pore size of 0.1 micron – 0.4 micron.** **The membrane modules are pre-fitted stack including coarse bubble diffusers for scouring of membranes.**	**ESPL**