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UTILIZATION OF TREATED WATER FOR MAINTANCE & SERVICES IN INDUSTRIAL RESEARCH & DEVELOPMENT CENTER

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Abstract: Water scarcity is one of the major problems in the world and millions of people have no access to freshwater. Untreated wastewater is widely used for agriculture in many countries. This is one of the world-leading serious environmental and public health concerns. Instead of using untreated wastewater, treated wastewater has been found more applicable and ecofriendly option. Moreover, environmental toxicity due to solid waste exposures is also one of the leading health concerns. Therefore, intending to combat the problems associated with the use of untreated wastewater, we propose in this review a multidisciplinary approach to handle wastewater as a potential resource for use in agriculture. We propose a model showing the efficient methods for wastewater treatment and the utilization of solid wastes in fertilizers. The study also points out the associated health concern for farmers, who are working in wastewater-irrigated fields along with the harmful effects of untreated wastewater. The consumption of crop irrigated by wastewater has leading health implications also discussed in this review paper. This review further reveals that our current understanding of the wastewater treatment and use in agriculture with addressing advancements in treatment methods has great future possibilities.

Index Terms **- STP , WTP , FL , TREE REPLANTATION.**

1. STP

SEWAGE TREATMENT PLANT

The STP proposed for this facility is a modular MBR Type wastewater treatment plant designed and developed for treatment as well as reclamation and reuse of treated sewage for non-potable purposes. The system uses the most advanced and efficient technology of MBR combining activated sludge process treatment with submerged membrane filtration. The membranes with a pore size of around 0.1 – 0.06 micron separate all the solids in the process giving away the solids free clear water. This system is the most compact one among all other systems eliminating the secondary treatment of clarification and tertiary treatment of Pressure Sand Filtration and Activated Carbon Filtration.

In the MBR type sewage treatment system, the activated sludge formed in the bioreactor is at remarkably high levels of MLSS. The excess sludge to be removed is more concentrated thus lowering the disposal cost. The MBR Type system proposed is a simple and reliable system, tolerant to organic and hydraulic fluctuations producing steady high quality with minimal technician attendance.

The proposed system will be provided with a high degree of automation and will become completely autonomous. There is also a provision of a hard-real time system in the form of Programmable Logic Controller which operates the system strictly according to the process designed. So, we have a high reliability, better control over the process and the facility of process fault diagnosis. The PLC will be linked to an HMI Unit which displays the whole process on the screen.

STP TREATMENT PROCESS

The sewage generated from the facility will be passed through a screen chamber provided with a set of coarse screen and bar screen for separation of solids.

The sewage free from the large solids will be treated for removal of oil and grease in a tank. The oil and grease being lighter will float on the surface of the tank from there it can be skimmed manually.

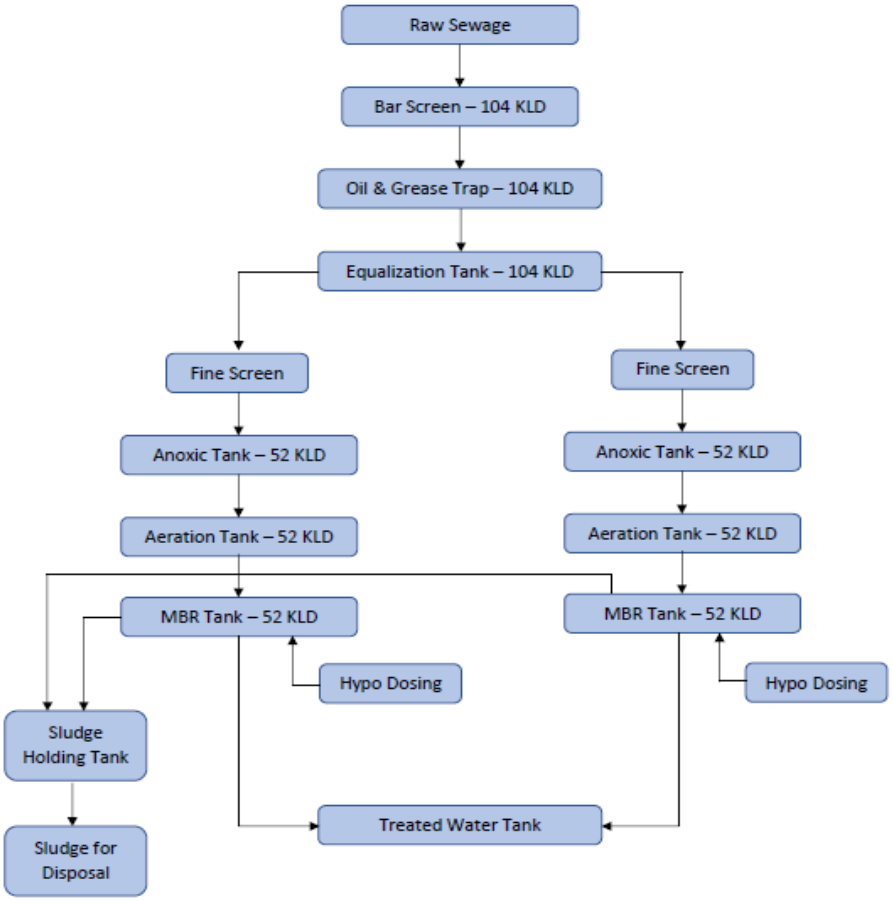
The sewage free from oil and grease will be collected in a tank which will be termed as Equalization tank for holding and homogenizing the sewage.

The membrane bio reactor unit consists of anoxic and aeration tank. The screened sewage from equalization tank is pumped to anoxic tank for removal of nitrogenous compounds contributing to the Total Nitrogen

The sewage from the anoxic tank enters the aerobic tank for removal of carbonaceous compounds contributing to BOD & COD. The membrane modules are immersed inside the aerobic tanks where organic contents in the sewage will be biologically degraded by activated sludge.

The MLSS (Mixed Liquor Suspended Solid) concentration in the MBR system is higher as compared to conventional activated sludge systems, thus the retention time required will be much less than the conventional system. Through recirculation of MLSS from aerobic tank to anoxic tank, nitrate content is removed.

The membranes also separate suspended solids from liquid through the filtration process. As the pore size of the membrane is ≤ 0.1 µn, not only suspended solids but also the bacteria such as coliform bacteria are also removed. The excess sludge drained will be collected in the sludge holding tank from where it will be carried out to sludge dewatering system.



4 APPENDIX B – WATER BALANCE CHART

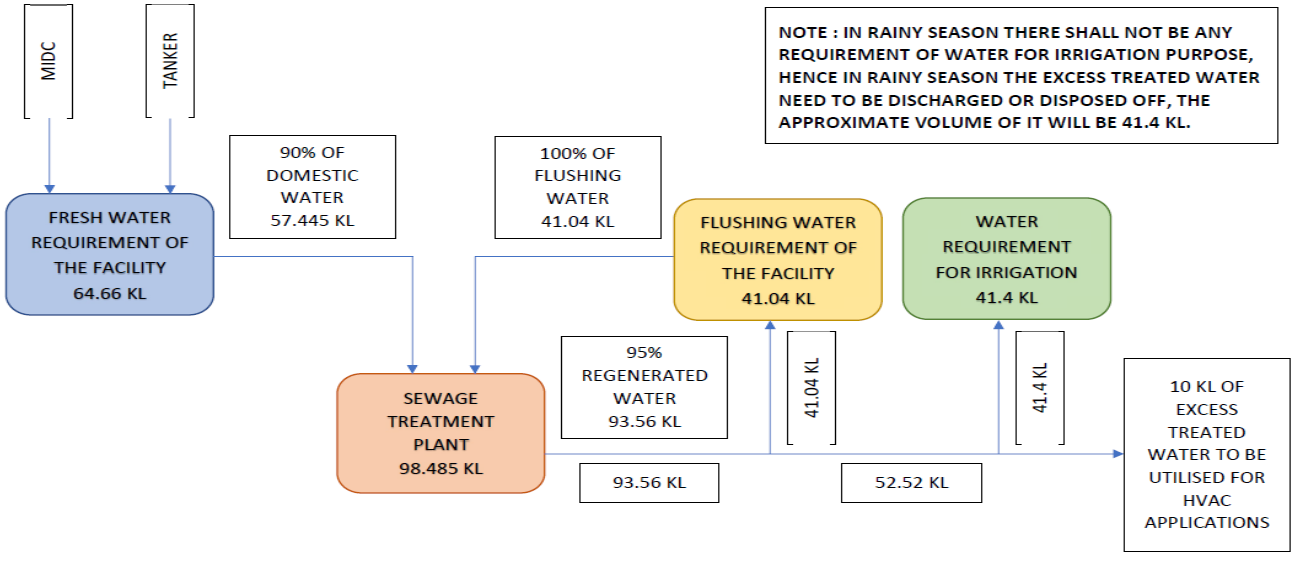


Table 1 Table Type Styles

Rainfall Assessment study

- The Peak Rainfall Intensities for the project location are calculated based on the PERSIANN – CCS - CDR (Precipitati Estimation from Remotely sensed Information using Artificial Neural Networks – Cloud Classification System - Climate Da Record). Developed by the Center for Hydrometeorology and remote Sensing (CHRS) at the university of California for t scientific community. The PERSIANN – CCS – CDR provides precipitation estimates at 0.04° spatial and 3 – hourly tempo resolutions for the specified time period over the global domain.

Serial No.	Storm Return Period (Years)	Time of Surface Flow (min)	Peak Rainfall Intensity From IDF Curve (mm / Hr)	Annual Chances of Storm Event Occurance at Corresponding Rainfall Intensity
1	2 - Years	15 min	96.379	**50 %**
2	5 - Years	15 min	146.430	**20 %**
3	10 - Years	15 min	179.568	**10 %**
4	25 - Years	15 min	221.439	**4 %**
5	50 - Years	15 min	252.500	**2 %**
6	75 - Years	15 min	270.555	**1.34 %**
7	100 - Years	15 min	283.333	**1 %**

- The storm water conveyance system shall be designed considering the peak rainfall intensities and the volumet calculations for Rainwater harvesting will be referred from the Hydrogeological Assessment done by the Hydrolc consultant.

Analysis:

- As per the surface runoff calculations we will be having the excessive surface runoff (excluding the retention volume of Rainwater Harvesting System), which needs to be taken care off.
- Currently there is no connection to Authority drain where excessive water can be connected.
- To minimize the volume of excess runoff the retention volume of the Rainwater harvesting system can be increased by increasing the dimensions of the Rainwater harvesting pits. But, As per Hydrogeology survey done by consultant the water table in this area cannot hold this surface runoff water.

The exercise has been done in two stages :-

1. Calculation of the Storm water with respect to maximum rainfall in the last 100 years. This helps us to arrive at the optimum plinth level for the Lower Ground Floor – Calculation sheet attached.

2. Raising the levels on the overall Masterplan so that the developed level is above the North side road (telco road) and accordingly the LGF finished level also increases – Masterplan and Statement attached.

3. Cut-Fill calculations have been done for the proposed scheme. We do not anticipate any upward revision with respect to the Land Grading. There is no cost impact as the cut-fill is almost balancing.

We can discuss this in detail in the next week to explain our assumptions and proposals.
We would also await feedback from the team with their observations / suggestions.

1. Please find attached the PCMC MIDC Layout. As per the attached plan except the East Side Road rest all area falls under MIDC. Also requesting you to download the Storm Water Analysis Report.

2. The storm water analysis report has been prepared to derive the peak rain fall intensity & associated volume of rainwater for various return periods. We have done the analysis for 2 year, 5 Year, 10 Year, 50 Year, 75 Year & 100 Year return period. We have also mentioned the probability of occurrence of peak rain fall for the given return period.

3. As per as CPHEEO (Central Public Health And Environment Engineering Organization – Govt. of India) Manual for Storm Water drainage design, Clause 4.4.1.4 suggests a Storm Return Period of 5 Years for Business Buildings. The Peak rain fall for 5 year return period considering 15 mins run off is 146mm/hrs which can be considered for design. However we request to advise us what return period we should consider for storm water design.

4. We have also included the 100-year flood catchment area for the nearest river. Our Plot is far away from this flood line.

5. Now as far as IGBC or LEED recommendations are concerned based upon the Credit points we are looking for; we are doing the Rain Water Percolation pits to meet the requirement.

6. Over and above if there is no discharge point on site, we have to have a big storage pond. The sizing of this pond depends upon the rainwater return period. We do not suggest to have such a big storage pond. We suggest to do the Rain Water Harvesting to the extent of getting Green Certification. And rest of water should be allowed to be connected to external storm water network.

7. If the discharge /overflow is not connected to external line, in case of heavy rain fall / cloud burst there could be flooding inside the campus.
8. We request to go through the attached report and look for the over flow connection to external line. And also advise on the Return period to be considered for the design.

9. Requires modification of current operations both for direct reuse and treat-and-reuse.

Pond at Southwest Side

Hydrology Report

During this visit the following studies were carried out in the field:

• Entire stretch of the proposed area and small sections exposed were observed to understand geological conditions.

• Observations were made in the entire area to infer the role of local geological, geo-morphological and climatological factors leading to weathering of the rock.

• Dowsing and Electrical Resistivity Surveys were conducted to infer subsurface geological conditions in general and thickness / depth of different layers in particular besides geotechnical strata classification for estimating the extent and thickness of different layers.

Scope of the work:
1. Attempt geo-technical strata classification by using resistivity method
2. To delineate the areas suitable for rainwater harvesting
3. To find out the groundwater table
4. Percolation test on site with test bore

The results of the electrical resistivity surveys along with the strata classification and aquifer conditions are included in this report. In order to understand the hydrogeological conditions of the area, investigations were carried out in January 2022 at Proposed R &D Center site at Pimpri, Pune. The outcome of the investigations is discussed in the present report.

(A) HYDROGEOLOGICAL:

(i) Topography:

The site has a continuous gradual slope from North to South And discharges into a nala connecting to Pawana River. The site is in the catchment of Pawana River which is located towards Southwest of the site at an aerial distance of approximately 1900 M from site boundary.

(ii) Geology:

The area under investigation forms the part of the volcanic sequence of basaltic rocks belonging to the Deccan Volcanic activity, which is one of the largest known geological formations in India, covering over 80 percent area of the state of Maharashtra. The flows exposed in the area are compound type and has limited thickness of 4 to 6 meters. The site is rocky and has average stativity. The upper flow is mantled by a soil horizon which is followed by weathered basalt (Murum). The soil of the district is underlain by partially decomposed basaltic rock locally known as “Murum” which overlies parent rock.

(iii)Hydrogeology:

The entire district is underlying by Deccan trap basaltic lava flow of Upper Cretaceous to Lower Eocene age. The shallow alluvial formation of recent age also occurs as narrow stretch along the major rivers flowing in the district however, they have limited areal extension. Deccan trap occurs as basaltic lava flows which are normally horizontal and deposited over wide stretch and give rise to tabular type of topography also known as plateau. Thus, major water bearing formations are alluvium and weathered fractured jointed basalt. Major part covered by Diveghat Chikhali Formation.

The Basaltic rocks due to poor storage and transmission capability get fully saturated during monsoon and de-saturated early in summer. These aquifers also drain naturally due to high ground water gradient formed by sloping and undulating topography.

(B) GEOPHYSICAL:

In order to study the overall sub-surface geological conditions of the area, Geophysical investigations (Electrical Resistivity Surveys) were carried out. This was to understand the overall spread of sub-surface geological formations in the entire area. From the Electrical Resistivity Surveys, Electrical Resistivity Method (IS: 1892-1979 Appendix B clause 3.3 B-2):

Methodology:

By applying this method, the resistance to the flow of an electric current through the subsurface materials is measured at intervals on the ground surface. The resistivity is usually defined as the resistance between opposite phases of a unit cube of the material.
In studying the lateral as well as vertical variations, various electrode configurations are adopted and the array is moved as a whole along a traverse line. The first type of measurement is called as ‘Vertical Electrical Sounding’ (VES) and the second one is ‘Horizontal Profiling’ (HP). In the present work both VES and HP were conducted at 20 different locations at the site. The L sections generated on the basis of values of electrical resistivity for the site have been used to depict 2-D subsurface images of the strata that are also included in this report.

Results and data processing:

In the area to understand the shallow subsurface geological and aquifer conditions extending up to 70-90 meters depth, vertical electrical soundings were conducted at Twenty different locations. Using IPI2 WINDOW based software the data obtained from field was processed. As discussed above the sounding points with typical curves at selected sites give point information, which was further utilized to build comprehensive picture of subsurface geological situation depth-wise by preparing 2-D geo-electrical sections.
The geo electrical cross-sections passing through various points have been presented in the above figures. It is to be noted that these are apparent resistivity L sections, which broadly match the true resistivity of formations. The values of true resistivity have been computed and thickness, depth and true resistivity have been presented in appendix. Using IPI2 software, the values of true resistivity of strata (ρ), its thickness (h) and depth (d) have been obtained after modeling of data and are depicted in table form besides each curve.

Runoff Assessment:

Sr No	Ground Cover	Area in sq.m	Average Daily Intensity (m/day)	Runoff coefficient	Runoff (cum/ day)	Annual potential for RWH (Cum)
A	Before Development					
	Plot Area	39840.0	0.018	0.6	430.27	21441.89
B	After Development					
1	Softscape area	3033.0	0.018	0.1	5.46	272.06
2	Terrace Area	16361.0	0.018	0.95	279.77	13942.03
3	Other hardscape/ driveway/ services	20446.0	0.018	0.95	349.63	17423.06
Total B	Total	39840.0			634.86	31637.15
B-A	Increase in the runoff due to development				204.59	10195.26

SUMMARY:

It is impossible to exactly predict the annual recharge/ harvesting taking place due to large variance in intensities, concentration and spread out of the monsoon and rain-spells. Exact quantification of recharge will vary from year to year.

1. Since the site has significant aquifer upto 6 to 14 m, 33 to 38 m BGL and 63 – 64 m BGL; recharge bores are recommended upto 60 m deph

2. As per average daily rainfall in the area which is 18 mm/day, the system can accommodate 100 % of the differential runoff after development. As well as 2 days complete site runoff after development thereby causing zero discharge upto 36 mm/ d rainfall intensity.

3. The system can accommodate almost 17 minutes increased runoff at max rainfall intensity in the form of recharge structures.

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