Manipal University Jaipur

Water Quality Standards and Guidelines for Water Discharges

Introduction

Manipal University Jaipur is dedicated to the preservation of the environment, ecosystems, wildlife, and the health and welfare of our campus community. The Water Quality Standards and Guidelines for Water Discharges reflect our commitment to implementing responsible water management practices aimed at upholding high water quality standards. It is imperative that all members of our university community comply with these standards to safeguard our environment and promote the well-being of everyone.

General Water Quality Standards

All water discharges resulting from university activities must adhere to local, state, and federal regulations concerning water quality.

Water discharges must not endanger ecosystems, wildlife, or the health and welfare of individuals.

The release of pollutants into natural water bodies, stormwater drains, or wastewater treatment systems is strictly forbidden without the necessary authorization.

Pollutant Control Measures

It is imperative that all university departments and units adopt strategies aimed at reducing the discharge of pollutants into water systems. This encompasses, but is not limited to, the regulation of chemical, biological, and physical contaminants.

Hazardous materials, such as chemicals, oils, and toxic substances, must be stored, handled, and disposed of securely in compliance with applicable regulations.

The university advocates for the utilization of non-toxic, environmentally sustainable alternatives whenever feasible to mitigate the release of pollutants.

Stormwater Management

All campus facilities, construction sites, and open areas are required to implement effective stormwater management systems to safeguard natural water bodies from contamination.

Stormwater runoff must be redirected away from potential sources of pollution and managed appropriately to minimize sedimentation and contamination.

All construction or development initiatives must adhere to erosion and sediment control measures to prevent soil erosion from entering stormwater systems.

Wastewater Treatment

All wastewater produced on campus must be processed in compliance with local wastewater treatment regulations prior to discharge.

The university is committed to investing in and maintaining effective wastewater treatment systems to guarantee the elimination of contaminants and pollutants.

Routine inspections and maintenance of wastewater treatment facilities are crucial to ensure their optimal operation.

Reporting and Record Keeping

Any occurrences of water pollution or failure to comply with these standards must be reported immediately to the university's Directorate of General Services & Administration.

Detailed records of water quality assessments, pollutant control strategies, and wastewater treatment operations must be kept and made accessible for regulatory review.

Training and Education

All staff responsible for managing or handling water discharges are required to receive training in water quality management and adherence to these guidelines.

Ongoing educational initiatives will be implemented to enhance awareness within the university community regarding the significance of water quality preservation and responsible water management.

Manipa University Jaipur will focus on raising awareness about water population amongst stakeholders

Review and Revision

These Water Quality Standards and Guidelines for Water Discharges will undergo an annual review to ensure they remain consistent with changing local, state, and federal regulations and best practices.

Necessary updates will be made to further strengthen water quality protection initiatives on campus.

Version History

Number	Year	Major Revision
Version 3.0	2023	Focus on awareness
Version 2.0	2022	Construction or development projects must follow erosion and sediment control practices to prevent soil erosion into stormwater systems
Version 1.0	2020	Initial Guidelines

Project Completion Report

Project Type: Research Fund Grant/ R21-1877916181

Project title: Harnessing the potential of Polyhydroxyalkanoates (PHA) from *Rhodopseudomonas palustris* as sustainable resource for production of bioplastics

Introduction: Plastics are widely utilized due to their durability and low cost, however, they are mostly generated from non-renewable resources such as natural gas, petroleum, or coal and contain additives such as stabilizers and plasticizers (Filho *et al.*, 2022). These chemicals, which are commonly present in plastics like polyvinyl chloride (PVC), polypropylene (PP), and polyethylene terephthalate (PET), can be toxic, functioning as endocrine disruptors or carcinogens. They can enter the body by skin contact, ingestion, or inhalation, particularly when used in food packaging (Adeniran and Shakantu, 2022; Gaston and Tulve, 2019; Hahladakis et al., 2018; Filho *et al.*, 2021). About 76% of plastic produced globally becomes waste, with 9% recycled, 12% incinerated, and 79% landfilled or released into the environment. This improper disposal harms ecosystems and poses health risks (Geyer, Jambeck and Law, 2017; Sameh S. Ali *et al.*, 2021a; Sameh Samir Ali *et al.*, 2021b). Environmental concerns about plastic waste have driven the shift from petrochemical-based plastics to biobased, biodegradable alternatives, called bioplastics (Reddy, Reddy and Gupta, 2013). Despite their introduction in the 2000s, bioplastics still represent only about 0.5% of the over 400 million tonnes of plastic produced annually (Folino *et al.*, 2020; European Bioplastics, 2023). By 2023, production had reached 2.18 million tonnes, with biodegradable plastics making up roughly 55%. This is expected to rise to 7.43 million tonnes by 2028, driven by increasing demand and advancements in technology (European Bioplastics, 2023). Various types of biobased plastics differ in their raw materials, chemical structures, production methods, and applications, but they offer similar material properties to conventional plastics. One of the most common examples is Polyhydroxyalkanoates (PHA). PHAs are biobased polyesters that are produced as carbon/energy storage materials in microbial cells under stress. These accumulate as intracellular granules without harming the host cell. Their biodegradability and good physical and mechanical qualities make them a viable substitute for conventional petroleum-based plastics (Rajvanshi *et al.*, 2023).

PHAs are produced by various microbial species including *Rhodopseudomonas palustris* (*R. palustris*). *R. palustris* is a versatile purple non-sulfur photosynthetic bacterium popular for its ability to produce bioplastics such as PHAs from diverse carbon and nitrogen sources. It possesses the ability to switch among four metabolic modes, indicating its adaptability to various environments, such as marine sediments and waste lagoons. Along with other bacteria such as *Rhodobacter* and *Rhodospirillum*, it is capable of utilizing various carbon sources for the production of polymers. Other than this, this species possesses potential applications in biotechnology, specifically in hydrogen production, electricity generation, and bioremediation (Brown, Wilkins and Saha, 2022)**.** Despite various attempts to generate industrial PHAs utilizing microorganisms, the costs remain a significant challenge. The high cost of microbial bioplastic synthesis remains a substantial impediment to industry growth. Large-scale PHA manufacturing usually utilizes pure microbial cultures that rely on expensive sugar-based substrates, which raises overall production costs. Furthermore, the process consumes a huge amount of freshwater, reducing availability and increasing expenses (Rajvanshi *et al.*, 2023). Addressing these challenges, the present study has explored the ability of *R. palustris* to use a wide range of substrates in varied conditions for cost-effective PHA production, along with using domestic reverse osmosis (RO) reject water as the major contributor in the production process, hence reducing unsustainable freshwater use. RO reject water is rich in nutrients and free from pathogens, making it an ideal nutrient source for microbial cultivation with minimal alterations. Using this water stream can significantly reduce the costs of expensive nutrient growth media and lessen the reliance on freshwater in cultivation systems (Bhandari and Prajapati, 2022a). This approach enables more cost-effective and large-scale biomass production. This is further helping in repurposing an unmanaged waste stream of RO reject water into a useful and environmentally sustainable process of PHA production.

2. Review of literature:

Based on the literature review, Table 1 summarizes the significance of bioplastic production, highlighting the numerous industries from which waste materials can be derived as substrates. These waste substrates, including agricultural waste, food waste, and industrial byproducts, play an important role in sustainable bioplastic production by lowering dependency on fossil fuels and strengthening waste valorization.

Table 1. List of waste resources used as substrates for cost-effective bioplastic production

S. No.	Waste carbon source	Microorganisms	Cultivation technique	Maximum biomass production	Biobased plastic produced	Maximum production	References
1	Mixture of crude and saponified SCG oil	*Cupriavidus necator* DSM 545	Shake flask technique	8.5 g/L	Polyhydroxyalkanoate (PHA)	84.4% (w/w)	(Ingram, Martin and Winterburn, 2022)
2	Nitrogen-deficient cheese whey mother liquor	*Paracoccus homiensis*	Shake flask technique	3.3 g/L	Poly (3-hydroxybutyrate-co-3-hydroxyvalerate) P(3HB-co-3HV)	1.1 g/ L	(Mozejko-Ciesielska *et al.*, 2022)
3	Fermented concentrated cheese whey permeates	Mixed microbial culture (MMC)	Sequencing batch reactor	-	PHA	62% g PHA/ g VSS	(Colombo *et al.*, 2019)
4	Fermented secondary cheese whey			-		55.1% g PHA/ g VSS	
5	Digestate of chicken manure with sunflower frying oil	*Cupriavidus necator* H16	Shake flask technique	75.1 % cell dry mass	PHA	4.6 g/ L	(Altun, 2019)
6	Waste frying oil with 40 g/ L NaCl	*Halomonas hydrothermalis*	Shake flask technique	3.64 g/ L	Polyhydroxybutyrate (PHB)	2.26 g/ L	(Pernicova *et al.*, 2019)
7	Onion peel	*Bacillus siamensis* PD-A10	Shake flask technique	90.86 g/ L	PHA	67.56 g/L	(Vijay and Tarika, 2019)
8	Paper industry effluent	*Ancylobacter aquaticus*	Shake flask technique	-	PHA	41.7% w/w	(Tyagi and Sharma, 2021)
9	Beer brewery wastewater	*Cupriavidus necator*	Batch system	7.90 g/ L	PHB	3 g/ L	(Amini *et al.*, 2020)
10	Candy industry wastewater	*Cupriavidus necator* H16	Flask culture	1.11 g/ L	PHB/ Polylactic acid (PLA)	65% (w/w)	(Hernández-Herreros *et al.*, 2024)
11	Digested sludge	*Rhodopseudomonas* sp. S16-VOGS3	Photobioreactor	0.37 g/ L	PHB	18.5 mg/ L	(Touloupakis *et al.*, 2023)
12	Olive mill wastewater	*Rhodopseudomonas* sp. S16-FVPT5	Tube culture	0.13 g/ L	PHB	101 mg/ L	(Carlozzi *et al.*, 2019)

3. Objectives

- Design a novel cost-effective artificial media mimicking seawater and optimize the parameters for the growth of *R. palustris.*
- Optimize culture conditions for high PHA production under different sets of nutrients limiting and stress conditions.
- Screen and qualitatively characterize the PHA granules via staining and microscopy and quantify the percentage of PHA accumulation.
- Augment the extraction of PHA from cell biomass and analyse its molecular structure.

4. Methodology:

The *Rhodopseudomonas palustris* MDOC01 strain, isolated in our lab from dairy waste, was cultured in a synthetic medium called Designed Synthetic Water Medium (DSWM) containing minerals along with glycerol and monosodium glutamate as carbon and nitrogen sources. The cells were grown in 500 ml glass bottles with Q series GL45 caps for sampling and argon gas purging to maintain an anoxic environment. The cultures were kept at 30-35°C with continuous stirring at 500 rpm and 4000 lux light from 60 W incandescent bulbs (Syed, Sogani, Kumar, *et al.*, 2022). Figure 1 describes the detailed methodology followed during the work

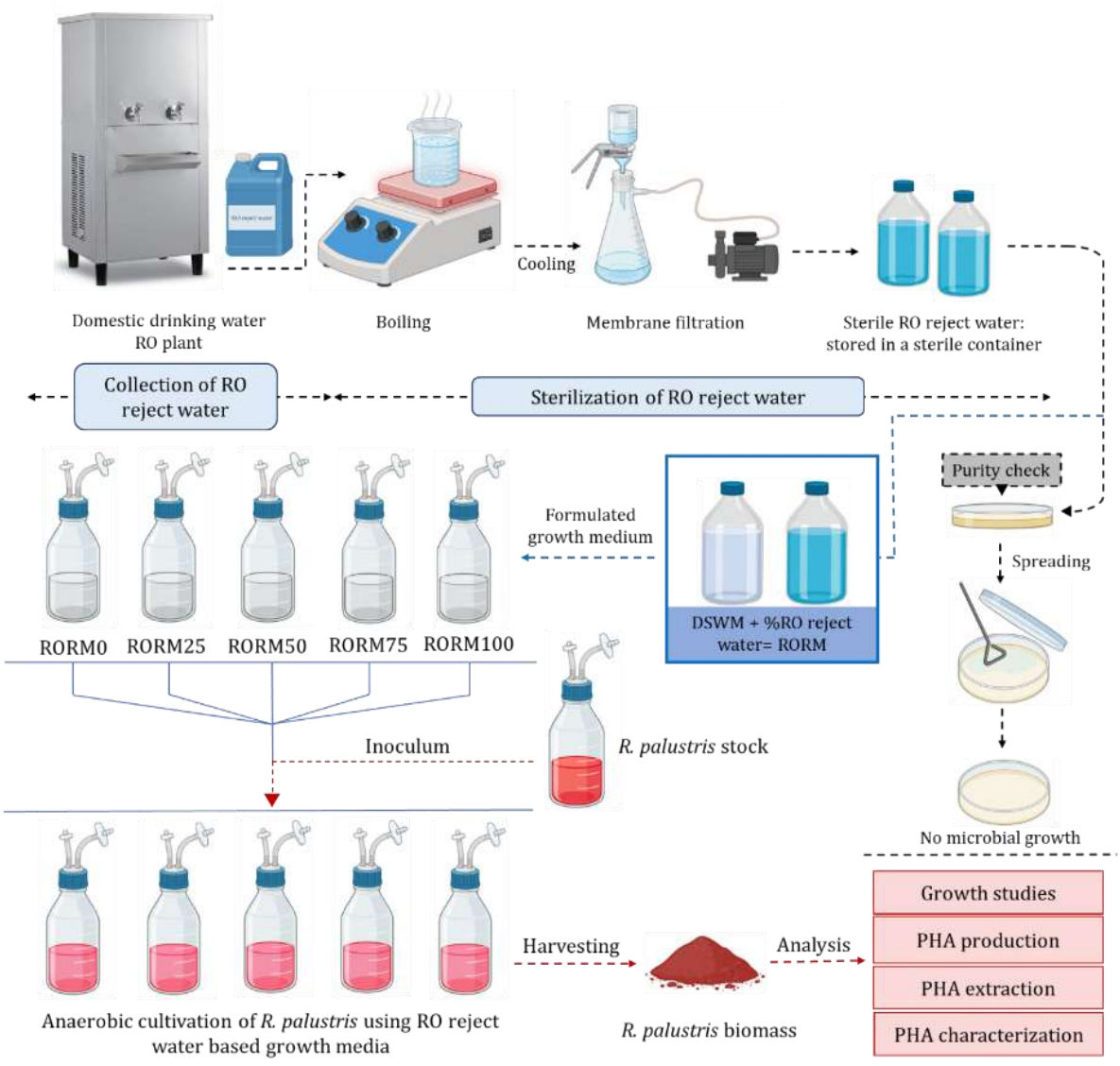

Figure 1. Detailed methodology of the research work

5. Results and discussion:

OBJECTIVE 1

Collection of RO reject water: The reject water coming from a domestic drinking water RO plant has a consistent nutrient and pathogen-free composition (Bhandari and Prajapati, 2022b). RO reject water, collected from a drinking water RO plant, located at Bagru, Rajasthan, was used to develop a novel cost-effective growth media for *R. palustris* culturing. Initially, the water was subjected to physicochemical analysis to determine its composition and suitability as a growth medium. Table 2 reveals that upon comparison with DSWM, the RO reject water was found to be very similar in the ionic and mineral composition to the DSWM. This, in addition to the metabolic adaptability of *R. palustris,* supports RO reject water as a cost-effective growth medium.

Table 2. Physicochemical analysis of the RO reject water

Parameters	**Results**
pH	7.9
TDS (ppm)	1318
Electrical conductivity (µS cm^{-1})	2636
Salinity (PSU)	1.34
Alkalinity (mg L^{-1})	258.5
Total hardness (mg L^{-1} as $CaCO_3$)	82.9
Chloride (mg L^{-1})	409
Sodium (mg L^{-1})	265.75
Potassium (mg L^{-1})	6.32
Nitrate nitrogen (ppm)	16.6
Nitrite (ppb)	2.0
Calcium (ppm)	200
Magnesium (ppm)	1000
Ammonical nitrogen (mg L^{-1})	<2.0
Ammonia (ppm)	0.06
Phosphate (ppm)	0.90
Phosphorus (mg L^{-1})	<0.50
Sulphate (mg L^{-1})	54.8
Fluoride (mg L^{-1})	<0.05
Iron (mg L^{-1})	<0.1

As the work was on pure microbial strain, the RO reject water was first subjected to sterilization via boiling followed by filtration. The sterility was confirmed by the spread plate technique and no microbial growth was observed within 24-48 hours of incubation. Further, the RO reject water was provided with glycerol and sodium glutamate as carbon and nitrogen sources, forming RO Reject water Medium (RORM). This, in addition to the metabolic adaptability of *R. palustris,* supports RO reject water as a cost-effective growth medium.

Suitability of RORM as a growth medium for *R. palustris* in terms of biomass and bacteriochlorophyll *a* (Bchl *a*) yields (Syed, Sogani, Sharma, *et al.*, 2022)**:** For this, the sterile RO reject water was mixed with different concentrations of DSWM (RORM0 (Positive control), RORM25, RORM50, RORM75, RORM100) and the N: C ratio of 5.4 mM: 10 mM was made consistent in all media sets (Sogani *et al.*, 2020). During 10 days of growth, RORM75 showed good biomass and Bchl *a* concentration and productivity (Biomass: 1.75 g L^{-1}; 92.44 mg L^{-1} d^{-1}; Bchl *a*: 15.10 mg L^{-1}; 1.223 mg L^{-1} d^{-1}), comparable to the control (RORM0; 2.0 g L^{-1}, 148.8 mg L^{-1} d^{-1}).

Microscopic analysis of *R. palustris* in RORM75: Scanning Electron Microscopy (SEM) was used to observe the morphology of *R. palustris*. As illustrated in Figure 2, no significant morphological differences were observed between the cells grown in RORM75 and DSWM (control). This finding suggests that RORM75 does not substantially alter the cell morphology, which is a positive indication regarding its impact on *R. palustris*.

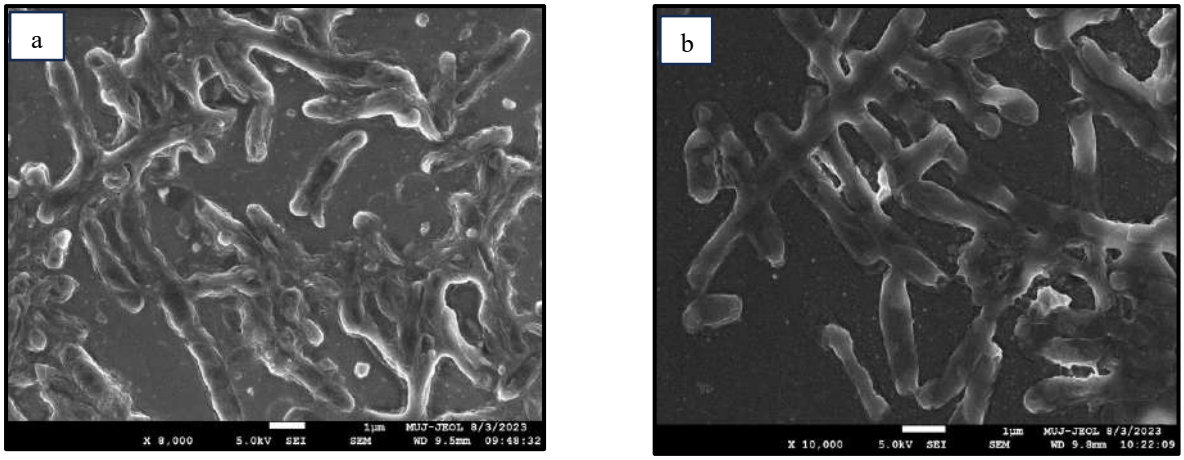

Figure 2. SEM images of *R. palustris* cells grown in (a) DSWM and (b) RORM75

Deliverables:

- RO reject water stream, otherwise discarded and not managed properly, can be repurposed for microbial cultivation for high biomass yield, hence suggesting an environmentally sustainable approach for RO reject water recycling.
- With appropriate adjustments, RORM75 offers both environmental and economic advantages for *R. palustris* cultivation, by replacing expensive nutrients present in the conventional growth media.

OBJECTIVE 2:

Production of PHA under PHA-producing culture conditions: As reported earlier, PHAs are produced by microbial cells under stress conditions (e.g. Nutrient limitation) and high carbon concentration in the form of energy and carbon storage granules (Mannina *et al.*, 2020)**.** The present work used the concept of feast and famine conditions for microbial PHA production. In the feast phase, *R. palustris* was provided with abundant nutrients for maximum growth and then subjected to the famine phase with limited nutrients for PHA production. As RORM75 showed the maximum biomass, it was taken further for PHA production along with RORM0 and RORM100. Figure 3 shows the culture conditions for PHA production from *R. palustris.*

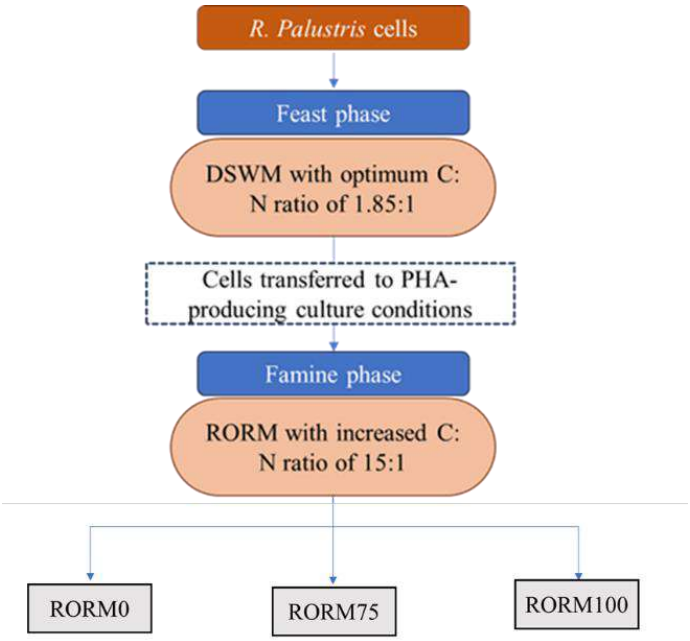

Figure 3. Various culture conditions for PHA production from *R. palustris*

After 7 days of the famine phase, PHA was extracted using the hypochlorite method, and the percent PHA of cell dry weight (CDW) was calculated in each condition (Marudkla *et al.*, 2018). Figure 4 depicts the white-colored PHA extracted from *R. palustris* from RORM75 with a C: N ratio of 15:1 and Table 3 shows the PHA yield

obtained in each culture condition and it can be concluded that RORM75 with a C: N ratio of 15:1 yielded the maximum PHA of 130 % CDW.

Figure 4. PHA extracted from *R. palustris* cultured in RORM75 with C: N= 15:1

Table 3. Amount of PHA obtained from *R. palustris* in various culture conditions

S. No	Culture conditions with C: N= 15:1	Amount (mg)	% PHA of CDW
1	RORM0	196	10.6
2	RORM75	1336	130
3	RORM100	27	2.4

Deliverables:

- The most suitable combination of feast and famine phases for high PHA production from *R. palustris* is DSWM with an optimum C: N ratio as the feast phase and RORM75 with a high C: N ratio of 15:1 as the famine phase.

OBJECTIVE 3 and OBJECTIVE 4

Characterization of the extracted PHA: The extracted PHA was subjected to Fourier Transform Infrared Spectroscopy (FTIR) and Proton Nuclear Magnetic Resonance (^{1}HNMR) analysis for its chemical and molecular characterization (El-Kadi *et al.*, 2021). Figures 5 and 6 show the FTIR and ^{1}HNMR spectra of PHA extracted from RORM75 and the standard PHA obtained from Sigma Aldrich.

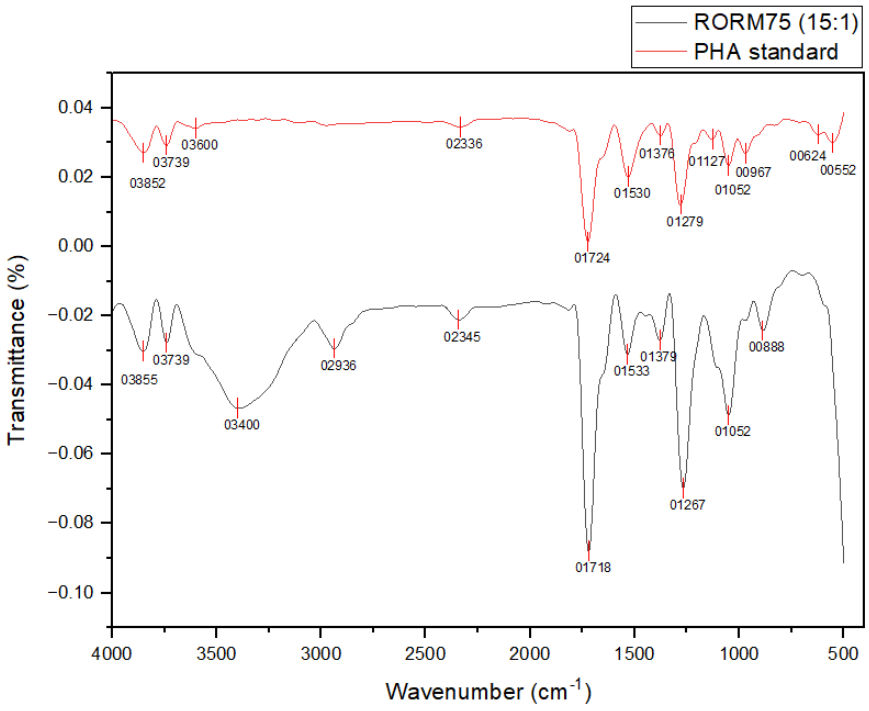

Figure 5. FTIR spectra of PHA extracted from RORM75 and the standard PHA obtained from Sigma Aldrich

PHA was characterized in the range of 500–4000 cm^{-1}. A broad and weak band around 3600 cm^{-1} in the standard indicates O-H stretching, showing the presence of hydroxyl groups like alcohols or carboxylic groups. A similar but less prominent band is seen around 3700–3600 cm^{-1} in the case of PHA extracted from RORM75 (15:1), The O-H or N-H stretching is seen in both the cases but the intensity in PHA extracted from RORM75 (15:1) is weaker, possibly due to lower concentration or interaction of the hydroxyl groups. A sharp and intense peak at 1724 cm^{-1} in standard PHA might indicate strong C=O stretching, which is typical for esters or carboxylic acids. This is a defining feature of PHA, which contains ester bonds. PHA from RORM75 (15:1) also has strong C=O peaks, but it is slightly shifted (1718 cm^{-1}) which may reflect different carbonyl environments or interactions with other groups. Peaks at 1376 cm^{-1} and 1279 cm^{-1}, correspond to C-H bending and C-O stretching in esters in the standard. Similar peaks are present but with some shifts in the PHA extracted from RORM75 (15:1), such as peaks at 1379 cm^{-1} and 1267 cm^{-1}. This region may also show contributions from other functional groups. The fingerprint region which is unique to each compound, shows that PHA extracted from RORM75 (15:1) has structural differences compared to the PHA standard, likely due to differences in its polymeric structure or side chain composition.

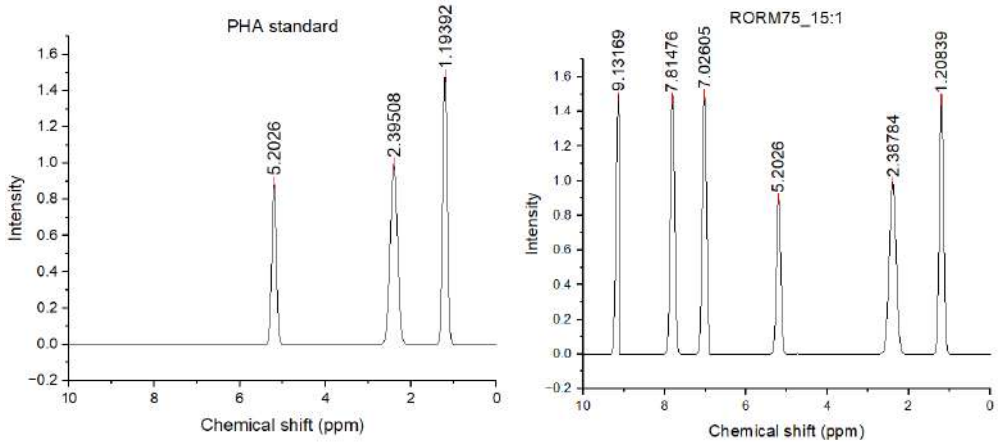

Figure 6: ^{1}HNMR spectra of PHA extracted from RORM75 (15:1) and the standard PHA obtained from Sigma Aldrich

The key observations from the spectra of standard PHA include a peak at 5.20 ppm showing the methine proton (-CH), attached to the carbonyl group in the polymer backbone, typical of PHA. This indicates an ester linkage where a proton is adjacent to a carbonyl group. Another peak at 2.39 ppm corresponds to methylene protons (-CH_2) adjacent to the carbonyl group in the PHA structure, again indicating ester functionality. Lastly, a peak at 1.19 ppm represents a methyl group (-CH_3) at the end of the alkyl chain, commonly found in PHAs where the chain ends with methyl groups. Comparing both spectrums, additional peaks at 9.13 ppm, 7.81 ppm, 7.02 ppm are unique to PHA extracted from RORM75 and absent in the PHA standard, suggesting the presence of aromatic groups, but the common peaks at 5.20 ppm, 2.38 ppm, and 1.20 ppm, in the spectrum of PHA obtained from RORM75 (15:1) are comparable to the standard and indicates that both materials contain ester groups (C=O) and aliphatic chains.

Deliverables:

- FTIR: PHA extracted from RORM75 (15:1) appears to share a similar backbone to PHA but with structural variations, possibly due to the presence of different side groups, chain lengths, or copolymer compositions.
- ^{1}HNMR: The PHA produced by *R. palustris* in RORM75 (15:1) is a modified version of the PHA, containing the same core ester and aliphatic groups as the PHA standard, but with significant modifications involving the addition of aromatic components.

6. Conclusion:

RO reject water can be used as a growth medium for cost-effective culturing and high biomass production of *R. palustris*.This concept not only makes the process of microbial cultivation economical but also provides an environmentally sustainable and safe approach for RO reject water management, thus avoiding environmental issues like groundwater and soil contamination caused by its current improper management strategies. Further, in the study, *R. palustris* stands out as an efficient microbial system for high PHA production, using RO reject water for the famine phase, thus also suggesting an approach for large-scale cost-effective production of PHA from *R. palustris*. The present study addresses various environmental issues, including improper RO reject water management, huge freshwater and expensive nutrient demand for high microbial biomass production, and plastic

pollution caused by the increased use of petro-based plastic materials. Moreover, a switch from using nonrenewable resources to renewable ones for developing materials like plastics would also help in dealing with climate change mitigation. Overall, the study focuses on exploiting the possible benefits of versatile microbes like *R. palustris* in maintaining the quality, health, and sustainability of the environment.

Outcomes:

Journal publications

- Rajvanshi, J., **Sogani, M.**, Kumar, A., Arora, S., Syed, Z., Sonu, K., Gupta, N.S. and Kalra, A., 2023. Perceiving biobased plastics as an alternative and innovative solution to combat plastic pollution for a circular economy. *Science of The Total Environment*, *874*, p.162441; (Q1, Impact factor: 8.2)
- Rajvanshi, J., **Sogani, M.**, Tziouvaras, G., Kumar, A., Syed, Z., Sonu, K., Gupta, N.S. and Sen, H., 2024. An analytical review on revamping plastic waste management: exploring recycling, biodegradation, and the growing role of biobased plastics. *Environmental Science and Pollution Research*, pp.1-19; (Q1, Impact factor: 5.8)
- Rajvanshi, J., **Sogani, M.**, Kumar, A. and Arora, S., 2023. Biomaterials: A Sustainable Solution for a Circular Economy. *Engineering Proceedings*, *59*(1), p.133; (SCOPUS Indexed conference proceeding).

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SCS ENVIRO SERVICES PRIVATE LIMITED

7, KESAR VIHAR, OPPOSITE KHATU SHYAMJI TEMPLE,
RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.: U74140RJ2013PTC042216

TC-6960

MoEF&CC RECOGNIZED LABORATORY vide S.O. 5768(E) Dated 15.11.2018 Valid upto 14.11.2023
ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/WW/20231025/15	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/WW/20231025/15(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address of Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sample Receipt : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : STP Inlet Water (350 KLD)
Sample sent by : University Representative

RESULTS

Parameter	Results	Norms as Per EP Act	Protocol
pH	7.81	-	APHA (23rd Edition) 4500 H
Total Suspended Solids	169 Mg/L	-	APHA (23rd Edition) 2540 D
COD	520 Mg/L	-	APHA (23rd Edition) 5220 B
$BOD_{3Days\ at\ 27^{o}C}$	126 Mg/L	-	IS 3025 (Part 44)
Oil & Grease	45 Mg/L	-	APHA (23rd Edition) 5520 B
Total Kjeldhal's Nitrogen as NH_3	158 Mg/L	-	APHA (23rd Edition)4500 Norg B & C
Ammonical Nitrogen as N	61 Mg/L	-	APHA (23rd Edition)4500 NH3 B/C
Total Residual Chlorine	< 0.1 Mg/L	-	APHA (23rd Edition) 4500 Cl B
Phosphorus as P	2.5 Mg/L	-	APHA (23rd Edition) 4500 P- C

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
(Technical Manager)
Authorised Signatory

SCS ENVIRO SERVICES PVT. LTD. JAIPUR

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CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/WW/20231025/15	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/WW/20231025/15(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client	:	M/s. Manipal University Jaipur,
Address Client	:	VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling	:	25.10.2023
Date of start of testing	:	26.10.2023
Date of end of testing	:	31.10.2023
Details of Sample	:	STP Inlet Water (350 KLD)
Sample collected by	:	University Representative

Parameters	Result	Protocol
Fecal Coliform	> 1600 MPN/100 ml	IS 15185

Per pro SCS Enviro Services Pvt. Ltd,

Dr. D. S. Parihar
(Technical Manager)
Authorized Signatory

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CIN NO.: U74140RJ2013PTC042216

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Sample ID No.: SCS/WW/20231025/16	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/WW/20231025/16(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address of Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sample Receipt : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : STP Outlet Water (350 KLD)
Sample sent by : University Representative

RESULTS

Parameter	Results	Norms as Per EP Act	Protocol
pH	7.12	5.5 to 9.0	APHA (23rd Edition) 4500 H
Total Suspended Solids	9 Mg/L	Not to exceed 100 Mg/L	APHA (23rd Edition) 2540 D
COD	53 Mg/L	Not to exceed 250 Mg/L	APHA (23rd Edition) 5220 B
$BOD_{3Days\ at\ 27°C}$	10 Mg/L	Not to exceed 30 Mg/L	IS 3025 (Part 44)
Oil & Grease	< 5 Mg/L	Not to exceed 10 Mg/L	APHA (23rd Edition) 5520 B
Total Kjeldhal's Nitrogen as NH_3	6 Mg/L	Not to exceed 100 Mg/L	APHA (23rd Edition) 4500 Norg B & C
Ammonical Nitrogen as N	5.8 Mg/L	Not to exceed 50 Mg/L	APHA (23rd Edition) 4500 NH3 B/C
Total Residual Chlorine	< 0.1 Mg/L	Not to exceed 1 Mg/L	APHA (23rd Edition) 4500 Cl B
Phosphorus as P	0.6 Mg/L	Not to exceed 1 Mg/L	APHA (23rd Edition) 4500 P- C

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
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CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
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ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/WW/20231025/16	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/WW/20231025/16(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client	:	M/s. Manipal University Jaipur,
Address Client	:	VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling	:	25.10.2023
Date of start of testing	:	26.10.2023
Date of end of testing	:	31.10.2023
Details of Sample	:	STP Outlet Water (350 KLD)
Sample collected by	:	University Representative

Parameters	Result	Protocol
Fecal Coliform	Absent	IS 15185

Per pro SCS Enviro Services Pvt. Ltd,

Dr. D. S. Parihar
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Authorized Signatory

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Sample ID No.: SCS/W/20231025/17	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/17(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : Borewell Water near 1-C
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
Table 1: Organoleptic and Physical Parameters				
pH	7.75	6.5 – 8.5	No Relaxation	APHA (23rd Edition) 4500 H
Color, Hazen Units	< 1	5	15	APHA (23rd Edition) 2120B
Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part 5)
Taste	Agreeable	Agreeable	Agreeable	IS 3025 (Part 7)
Turbidity, NTU	0.18	1	5	APHA (23rd Edition) 2130
Total Dissolved Solids	731.00 Mg / L	500 Mg / L	2,000 Mg / L	APHA (23rd Edition) 2540 C
Table 2: General Parameters Concerning Substances Undesirable in Excess Amounts				
Calcium as Ca	28.80 Mg / L	75 Mg / L	200 Mg / L	APHA (23rd Edition) 3500 Ca B
Chloride as Cl	151.95 Mg / L	250 Mg / L	1,000 Mg / L	APHA (23rd Edition) 4500 Cl^- B
Fluoride as F	1.00 Mg / L	1.0 Mg / L	1.5 Mg / L	APHA (23rd Edition) 4500 F D
Free Residual Chlorine	< 0.1 Mg / L	0.2 Mg / L	1.0 Mg / L	APHA (23rd Edition) 4500 Cl B
Iron as Fe	0.03 Mg / L	0.3 Mg / L	No Relaxation	APHA (23rd Edition) 3111B
Magnesium as Mg	14.58 Mg / L	30 Mg / L	100 Mg / L	APHA (23rd Edition) 3500 Mg B
Nitrate as NO_3	39.08 Mg / L	45 Mg / L	No relaxation	APHA (23rd Edition) 4500 NO_3^-B
Sulphate as SO_4	25.72 Mg / L	200 Mg / L	400 Mg / L	APHA (23rd Edition) 4500 E
Total Alkalinity as $CaCO_3$	296.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2320
Total Hardness as $CaCO_3$	132.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2340 C

Per pro SCS Enviro Services Pvt. Ltd.,

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CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/17	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/17(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client	:	M/s. Manipal University Jaipur,
Address Client	:	VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling	:	25.10.2023
Date of start of testing	:	26.10.2023
Date of end of testing	:	31.10.2023
Details of Sample	:	Borewell Water near 1-C
Sample collected by	:	SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
E. Coli	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Total Coliform	10 CFU	Shall not be detectable in any 100 ml sample		IS 15185
Fecal Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185

Per pro SCS Enviro Services Pvt. Ltd.,

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JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.: U74140RJ2013PTC042216

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ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/18	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/18(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client	:	M/s. Manipal University Jaipur,
Address Client	:	VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling	:	25.10.2023
Date of start of testing	:	26.10.2023
Date of end of testing	:	31.10.2023
Details of Sample	:	Borewell Water near Cricket Ground
Sample collected by	:	SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
Table 1: Organoleptic and Physical Parameters				
pH	7.86	6.5 – 8.5	No Relaxation	APHA (23rd Edition) 4500 H
Color, Hazen Units	< 1	5	15	APHA (23rd Edition) 2120B
Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part 5)
Taste	Agreeable	Agreeable	Agreeable	IS 3025 (Part 7)
Turbidity, NTU	0.15	1	5	APHA (23rd Edition) 2130
Total Dissolved Solids	687.00 Mg / L	500 Mg / L	2,000 Mg / L	APHA (23rd Edition) 2540 C
Table 2: General Parameters Concerning Substances Undesirable in Excess Amounts				
Calcium as Ca	32.00 Mg / L	75 Mg / L	200 Mg / L	APHA (23rd Edition) 3500 Ca B
Chloride as Cl	111.97 Mg / L	250 Mg / L	1,000 Mg / L	APHA (23rd Edition) 4500 Cl^- B
Fluoride as F	1.02 Mg / L	1.0 Mg / L	1.5 Mg / L	APHA (23rd Edition) 4500 F D
Free Residual Chlorine	< 0.1 Mg / L	0.2 Mg / L	1.0 Mg / L	APHA (23rd Edition) 4500 Cl B
Iron as Fe	0.03 Mg / L	0.3 Mg / L	No Relaxation	APHA (23rd Edition) 3111B
Magnesium as Mg	14.58 Mg / L	30 Mg / L	100 Mg / L	APHA (23rd Edition) 3500 Mg B
Nitrate as NO_3	50.24 Mg / L	45 Mg / L	No relaxation	APHA (23rd Edition) 4500 NO_3^-B
Sulphate as SO_4	21.80 Mg / L	200 Mg / L	400 Mg / L	APHA (23rd Edition) 4500 E
Total Alkalinity as $CaCO_3$	304.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2320
Total Hardness as $CaCO_3$	140.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2340 C

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
(Technical Manager)
Authorised Signatory

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ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/18	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/18(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : Borewell Water near Cricket Ground
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
E. Coli	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Total Coliform	7 CFU	Shall not be detectable in any 100 ml sample		IS 15185
Fecal Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185

Per pro SCS Enviro Services Pvt. Ltd.,

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ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/19	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/19(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : 1-C Building Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
Table 1: Organoleptic and Physical Parameters				
pH	7.96	6.5 – 8.5	No Relaxation	APHA (23rd Edition) 4500 H
Color, Hazen Units	< 1	5	15	APHA (23rd Edition) 2120B
Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part 5)
Taste	Agreeable	Agreeable	Agreeable	IS 3025 (Part 7)
Turbidity, NTU	0.11	1	5	APHA (23rd Edition) 2130
Total Dissolved Solids	290.00 Mg / L	500 Mg / L	2,000 Mg / L	APHA (23rd Edition) 2540 C
Table 2: General Parameters Concerning Substances Undesirable in Excess Amounts				
Calcium as Ca	6.40 Mg / L	75 Mg / L	200 Mg / L	APHA (23rd Edition) 3500 Ca B
Chloride as Cl	79.98 Mg / L	250 Mg / L	1,000 Mg / L	APHA (23rd Edition) 4500 Cl^- B
Fluoride as F	0.52 Mg / L	1.0 Mg / L	1.5 Mg / L	APHA (23rd Edition) 4500 F D
Free Residual Chlorine	< 0.1 Mg / L	0.2 Mg / L	1.0 Mg / L	APHA (23rd Edition) 4500 Cl B
Iron as Fe	0.02 Mg / L	0.3 Mg / L	No Relaxation	APHA (23rd Edition) 3111B
Magnesium as Mg	2.92 Mg / L	30 Mg / L	100 Mg / L	APHA (23rd Edition) 3500 Mg B
Nitrate as NO_3	39.77 Mg / L	45 Mg / L	No relaxation	APHA (23rd Edition) 4500 NO_3^-B
Sulphate as SO_4	6.43 Mg / L	200 Mg / L	400 Mg / L	APHA (23rd Edition) 4500 E
Total Alkalinity as $CaCO_3$	68.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2320
Total Hardness as $CaCO_3$	28.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2340 C

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
(Technical Manager)
Authorised Signatory

SCS ENVIRO SERVICES PVT. LTD. JAIPUR

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SCS **SCS ENVIRO SERVICES PRIVATE LIMITED**

7, KESAR VIHAR, OPPOSITE KHATU SHYAMJI TEMPLE,
RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/19	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/19(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : 1-C Building Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
E. Coli	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Total Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Fecal Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
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Authorised Signatory

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SCS ENVIRO SERVICES PRIVATE LIMITED

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RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.: U74140RJ2013PTC042216

TC-6960

MoEF&CC RECOGNIZED LABORATORY vide S.O. 5768(E) Dated 15.11.2018 Valid upto 14.11.2023
ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/20	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/20(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : 2 AB 001 Building Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
Table 1: Organoleptic and Physical Parameters				
pH	7.43	6.5 – 8.5	No Relaxation	APHA (23rd Edition) 4500 H
Color, Hazen Units	< 1	5	15	APHA (23rd Edition) 2120B
Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part 5)
Taste	Agreeable	Agreeable	Agreeable	IS 3025 (Part 7)
Turbidity, NTU	< 0.10	1	5	APHA (23rd Edition) 2130
Total Dissolved Solids	201.00 Mg / L	500 Mg / L	2,000 Mg / L	APHA (23rd Edition) 2540 C
Table 2: General Parameters Concerning Substances Undesirable in Excess Amounts				
Calcium as Ca	6.40 Mg / L	75 Mg / L	200 Mg / L	APHA (23rd Edition) 3500 Ca B
Chloride as Cl	47.98 Mg / L	250 Mg / L	1,000 Mg / L	APHA (23rd Edition) 4500 Cl^- B
Fluoride as F	0.27 Mg / L	1.0 Mg / L	1.5 Mg / L	APHA (23rd Edition) 4500 F D
Free Residual Chlorine	< 0.1 Mg / L	0.2 Mg / L	1.0 Mg / L	APHA (23rd Edition) 4500 Cl B
Iron as Fe	< 0.01 Mg / L	0.3 Mg / L	No Relaxation	APHA (23rd Edition) 3111B
Magnesium as Mg	3.89 Mg / L	30 Mg / L	100 Mg / L	APHA (23rd Edition) 3500 Mg B
Nitrate as NO_3	18.70 Mg / L	45 Mg / L	No relaxation	APHA (23rd Edition) 4500 NO_3^- B
Sulphate as SO_4	< 5.00 Mg / L	200 Mg / L	400 Mg / L	APHA (23rd Edition) 4500 E
Total Alkalinity as $CaCO_3$	68.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2320
Total Hardness as $CaCO_3$	32.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2340 C

Per pro SCS Enviro Services Pvt. Ltd.

SCS ENVIRO SERVICES PVT. LTD. JAIPUR

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SCS **SCS ENVIRO SERVICES PRIVATE LIMITED**

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RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/20	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/20(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : 2 AB 001 Building Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
E. Coli	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Total Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Fecal Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185

Per pro SCS Enviro Services Pvt. Ltd.,

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RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.: U74140RJ2013PTC042216

TC-6960

MoEF&CC RECOGNIZED LABORATORY vide S.O. 5768(E) Dated 15.11.2018 Valid upto 14.11.2023
ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/21	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/21(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : 1 AB 001 Building Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
Table 1: Organoleptic and Physical Parameters				
pH	7.73	6.5 – 8.5	No Relaxation	APHA (23rd Edition) 4500 H
Color, Hazen Units	< 1	5	15	APHA (23rd Edition) 2120B
Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part 5)
Taste	Agreeable	Agreeable	Agreeable	IS 3025 (Part 7)
Turbidity, NTU	< 0.10	1	5	APHA (23rd Edition) 2130
Total Dissolved Solids	147.00 Mg / L	500 Mg / L	2,000 Mg / L	APHA (23rd Edition) 2540 C
Table 2: General Parameters Concerning Substances Undesirable in Excess Amounts				
Calcium as Ca	6.40 Mg / L	75 Mg / L	200 Mg / L	APHA (23rd Edition) 3500 Ca B
Chloride as Cl	31.99 Mg / L	250 Mg / L	1,000 Mg / L	APHA (23rd Edition) 4500 Cl^- B
Fluoride as F	0.12 Mg / L	1.0 Mg / L	1.5 Mg / L	APHA (23rd Edition) 4500 F D
Free Residual Chlorine	< 0.1 Mg / L	0.2 Mg / L	1.0 Mg / L	APHA (23rd Edition) 4500 Cl B
Iron as Fe	< 0.01 Mg / L	0.3 Mg / L	No Relaxation	APHA (23rd Edition) 3111B
Magnesium as Mg	2.92 Mg / L	30 Mg / L	100 Mg / L	APHA (23rd Edition) 3500 Mg B
Nitrate as NO_3	23.56 Mg / L	45 Mg / L	No relaxation	APHA (23rd Edition) 4500 NO_3^-B
Sulphate as SO_4	< 5.00 Mg / L	200 Mg / L	400 Mg / L	APHA (23rd Edition) 4500 E
Total Alkalinity as $CaCO_3$	44.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2320
Total Hardness as $CaCO_3$	28.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2340 C

Per pro SCS Enviro Services Pvt. Ltd.,

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JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/21	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/21(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : 1 AB 001 Building Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
E. Coli	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Total Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Fecal Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185

Per pro SCS Enviro Services Pvt. Ltd.,

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JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.: U74140RJ2013PTC042216

TC-6960

MoEF&CC RECOGNIZED LABORATORY vide S.O. 5768(E) Dated 15.11.2018 Valid upto 14.11.2023
ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/22	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/22(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : Food Court (MUJ) Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
Table 1: Organoleptic and Physical Parameters				
pH	7.86	6.5 – 8.5	No Relaxation	APHA (23rd Edition) 4500 H
Color, Hazen Units	< 1	5	15	APHA (23rd Edition) 2120B
Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part 5)
Taste	Agreeable	Agreeable	Agreeable	IS 3025 (Part 7)
Turbidity, NTU	< 0.10	1	5	APHA (23rd Edition) 2130
Total Dissolved Solids	171.00 Mg / L	500 Mg / L	2,000 Mg / L	APHA (23rd Edition) 2540 C
Table 2: General Parameters Concerning Substances Undesirable in Excess Amounts				
Calcium as Ca	9.60 Mg / L	75 Mg / L	200 Mg / L	APHA (23rd Edition) 3500 Ca B
Chloride as Cl	45.98 Mg / L	250 Mg / L	1,000 Mg / L	APHA (23rd Edition) 4500 Cl^- B
Fluoride as F	0.23 Mg / L	1.0 Mg / L	1.5 Mg / L	APHA (23rd Edition) 4500 F D
Free Residual Chlorine	< 0.1 Mg / L	0.2 Mg / L	1.0 Mg / L	APHA (23rd Edition) 4500 Cl B
Iron as Fe	< 0.01 Mg / L	0.3 Mg / L	No Relaxation	APHA (23rd Edition) 3111B
Magnesium as Mg	3.89 Mg / L	30 Mg / L	100 Mg / L	APHA (23rd Edition) 3500 Mg B
Nitrate as NO_3	16.95 Mg / L	45 Mg / L	No relaxation	APHA (23rd Edition) 4500 NO_3^- B
Sulphate as SO_4	< 5.00 Mg / L	200 Mg / L	400 Mg / L	APHA (23rd Edition) 4500 E
Total Alkalinity as $CaCO_3$	52.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2320
Total Hardness as $CaCO_3$	40.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2340 C

Per pro SCS Enviro Services Pvt. Ltd.,

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JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/22	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/22(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : Food Court (MUJ) Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
E. Coli	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Total Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Fecal Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185

Per pro SCS Enviro Services Pvt. Ltd.,

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CIN NO.: U74140RJ2013PTC042216

TC-6960

MoEF&CC RECOGNIZED LABORATORY vide S.O. 5768(E) Dated 15.11.2018 Valid upto 14.11.2023
ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/23	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/23(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : Workshop Water Cooler
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
Table 1: Organoleptic and Physical Parameters				
pH	7.28	6.5 – 8.5	No Relaxation	APHA (23rd Edition) 4500 H
Color, Hazen Units	< 1	5	15	APHA (23rd Edition) 2120B
Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part 5)
Taste	Agreeable	Agreeable	Agreeable	IS 3025 (Part 7)
Turbidity, NTU	< 0.10	1	5	APHA (23rd Edition) 2130
Total Dissolved Solids	123.00 Mg / L	500 Mg / L	2,000 Mg / L	APHA (23rd Edition) 2540 C
Table 2: General Parameters Concerning Substances Undesirable in Excess Amounts				
Calcium as Ca	4.80 Mg / L	75 Mg / L	200 Mg / L	APHA (23rd Edition) 3500 Ca B
Chloride as Cl	27.99 Mg / L	250 Mg / L	1,000 Mg / L	APHA (23rd Edition) 4500 Cl^- B
Fluoride as F	0.15 Mg / L	1.0 Mg / L	1.5 Mg / L	APHA (23rd Edition) 4500 F D
Free Residual Chlorine	< 0.1 Mg / L	0.2 Mg / L	1.0 Mg / L	APHA (23rd Edition) 4500 Cl B
Iron as Fe	< 0.01 Mg / L	0.3 Mg / L	No Relaxation	APHA (23rd Edition) 3111B
Magnesium as Mg	< 2.00 Mg / L	30 Mg / L	100 Mg / L	APHA (23rd Edition) 3500 Mg B
Nitrate as NO_3	11.99 Mg / L	45 Mg / L	No relaxation	APHA (23rd Edition) 4500 NO_3^- B
Sulphate as SO_4	< 5.00 Mg / L	200 Mg / L	400 Mg / L	APHA (23rd Edition) 4500 E
Total Alkalinity as $CaCO_3$	40.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2320
Total Hardness as $CaCO_3$	20.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2340 C

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
(Technical Manager)
Authorised Signatory

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SCS ENVIRO SERVICES PRIVATE LIMITED

7, KESAR VIHAR, OPPOSITE KHATU SHYAMJI TEMPLE,
RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/23	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/23(2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client	:	M/s. Manipal University Jaipur,
Address Client	:	VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling	:	25.10.2023
Date of start of testing	:	26.10.2023
Date of end of testing	:	31.10.2023
Details of Sample	:	Workshop Water Cooler
Sample collected by	:	SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
E. Coli	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Total Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Fecal Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
(Technical Manager)
Authorised Signatory

SCS ENVIRO SERVICES PVT. LTD. JAIPUR

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7, KESAR VIHAR, OPPOSITE KHATU SHYAMJI TEMPLE,
RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO.: U74140RJ2013PTC042216

TC-6960

MoEF&CC RECOGNIZED LABORATORY vide S.O. 5788(E) Dated 15.11.2018 Valid upto 14.11.2023
ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/24	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/24(1/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : Facility House WTP Treated water
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
Table 1: Organoleptic and Physical Parameters				
pH	7.38	6.5 – 8.5	No Relaxation	APHA (23rd Edition) 4500 H
Color, Hazen Units	< 1	5	15	APHA (23rd Edition) 2120B
Odour	Agreeable	Agreeable	Agreeable	IS 3025 (Part 5)
Taste	Agreeable	Agreeable	Agreeable	IS 3025 (Part 7)
Turbidity, NTU	0.10	1	5	APHA (23rd Edition) 2130
Total Dissolved Solids	126.00 Mg / L	500 Mg / L	2,000 Mg / L	APHA (23rd Edition) 2540 C
Table 2: General Parameters Concerning Substances Undesirable in Excess Amounts				
Calcium as Ca	6.40 Mg / L	75 Mg / L	200 Mg / L	APHA (23rd Edition) 3500 Ca B
Chloride as Cl	27.99 Mg / L	250 Mg / L	1,000 Mg / L	APHA (23rd Edition) 4500 Cl^- B
Fluoride as F	0.15 Mg / L	1.0 Mg / L	1.5 Mg / L	APHA (23rd Edition) 4500 F D
Free Residual Chlorine	< 0.1 Mg / L	0.2 Mg / L	1.0 Mg / L	APHA (23rd Edition) 4500 Cl B
Iron as Fe	< 0.01 Mg / L	0.3 Mg / L	No Relaxation	APHA (23rd Edition) 3111B
Magnesium as Mg	2.92 Mg / L	30 Mg / L	100 Mg / L	APHA (23rd Edition) 3500 Mg B
Nitrate as NO_3	11.82 Mg / L	45 Mg / L	No relaxation	APHA (23rd Edition) 4500 NO_3 B
Sulphate as SO_4	< 5.00 Mg / L	200 Mg / L	400 Mg / L	APHA (23rd Edition) 4500 E
Total Alkalinity as $CaCO_3$	44.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2320
Total Hardness as $CaCO_3$	28.00 Mg / L	200 Mg / L	600 Mg / L	APHA (23rd Edition) 2340 C

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
(Technical Manager)
Authorised Signatory

SCS ENVIRO SERVICES PVT. LTD. JAIPUR

- The results refer only to the tested sample and applicable parameters.
- This report in full or in part, shall not be used for advertising or as evidence in any court of law.
- This report cannot be reproduced without the written permission of the director.
- The sample will be destroyed after 15 days from the date of issue of the test report.
- The liability of the laboratory is limited to the invoiced amount.
- All disputes are subjected to Jaipur jurisdiction.

SCS ENVIRO SERVICES PRIVATE LIMITED

7, KESAR VIHAR, OPPOSITE KHATU SHYAMJI TEMPLE,
RAMNAGARIYA ROAD, JAGATPURA,
JAIPUR-302017, RAJASTHAN (INDIA)
CIN NO: U74140RJ2013PTC042216

ISO-9001:2015 CERTIFIED LABORATORY
ISO-14001:2015 CERTIFIED LABORATORY
ISO-45001:2018 CERTIFIED LABORATORY

Sample ID No.: SCS/W/20231025/24	**Date of Registration: 25.10.2023**
Report No. SCS/MUJ/W/20231025/24 (2/2)	**Date of Report: 31.10.2023**

TEST REPORT

Name of Client : M/s. Manipal University Jaipur,
Address Client : VPO: Dehmi Kalan, Tehsil: Sanganer, Off Jaipur-Ajmer Expressway, Jaipur
Date of Sampling : 25.10.2023
Date of start of testing : 26.10.2023
Date of end of testing : 31.10.2023
Details of Sample : Facility House WTP Treated water
Sample collected by : SCS Representative

Parameter	Results	IS – 10500:2012		Protocol
		Requirement (Acceptable Limit)	Permissible Limit in absence of alternate source	
E. Coli	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Total Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185
Fecal Coliform	Absent	Shall not be detectable in any 100 ml sample		IS 15185

Per pro SCS Enviro Services Pvt. Ltd.,

Dr. D. S. Parihar
(Technical Manager)
Authorised Signatory

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Year 2022-23			
WTP		STP	
Domestic water in KL		Flush water in KL	
200 KLD (MUJ)	80 KLD (Housing)	150KLD	350KLD
6015	1505	194	3706
4750	1360	480	4197
4715	1310	260	4406
3665	1225	164	5068
2460	1070	2	4816
2965	1300	177	5027
2985	1345	147	4323
2835	1300	55	4492
3210	1295	48	4217
4130	1210	16	4066
3530	1195	0	3954
3320	1270	0	4058
44580	15385	1543	52330

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

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Water Consumption and Treatment 2022–2023

MANIPAL UNIVERSITY
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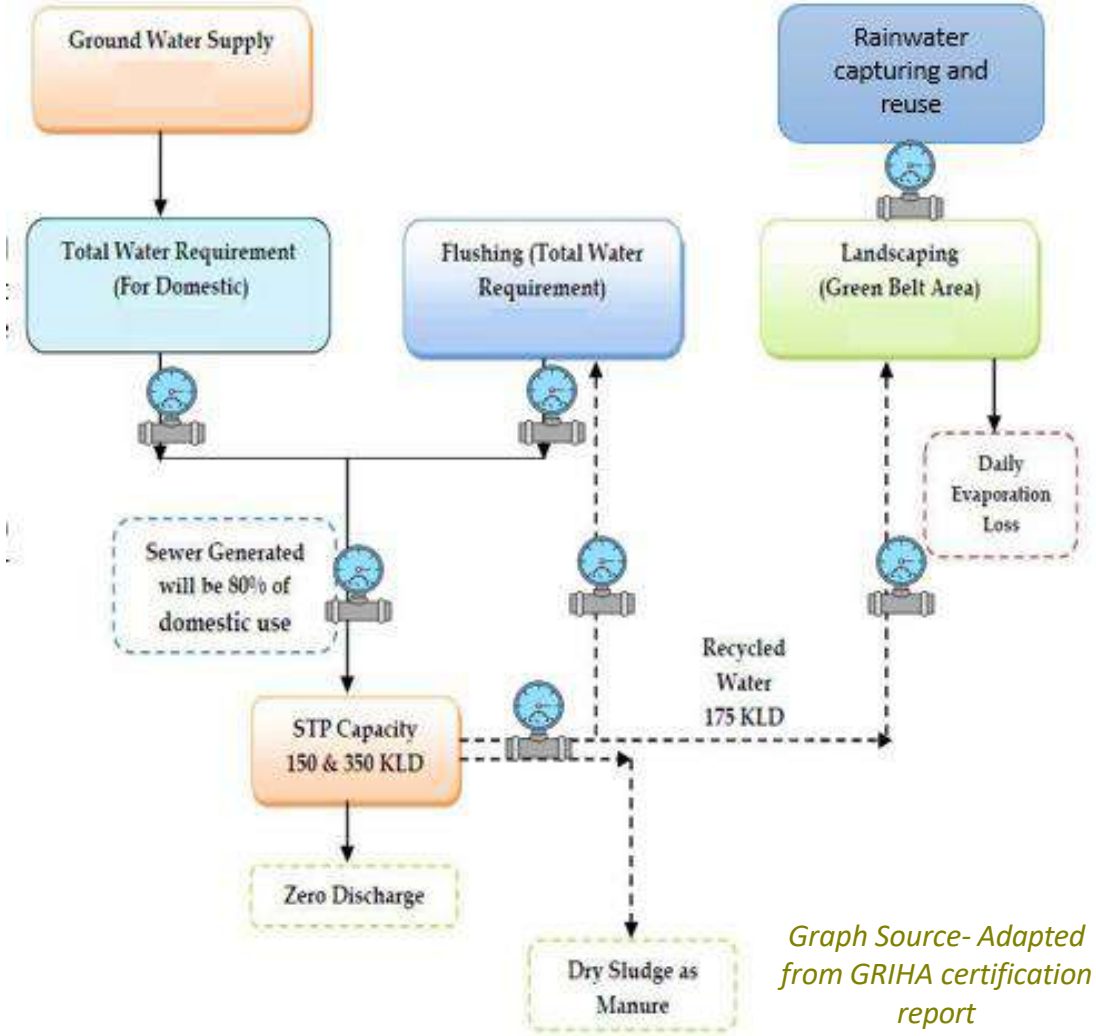
(University under Section 2(f) of the UGC Act)

Criteria- Water

Water Source and Distribution in MUJ Campus

Manipal university has an Integrated Water management strategies that are designed & implemented for the campus mainly focusing on triple bottom line benefits i.e., social, economic and environmental benefits. This created a flexible, resilient water infrastructure which helped MUJ progress towards water neutrality.



Graph Source- Adapted from GRIHA certification report

OBSERVATIONS:

The groundwater supply meets the water demand for MUJ University, designed at 220 liters per capita per day (LKD). This total water requirement is divided into domestic use, flushing, and landscape irrigation. Groundwater is used to meet domestic needs, while treated water from the Sewage Treatment Plant (STP) supplies water for flushing and landscaping. Additionally, rainwater from Rainwater Harvesting (RWH) tanks is utilized for irrigation. Dry sludge from the STP is converted into manure for on-site landscaping.

RECOMMENDATIONS

Water meters to be installed at all water sources/distribution lines at every building in the campus to monitor water consumption

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MANIPAL UNIVERSITY JAIPUR
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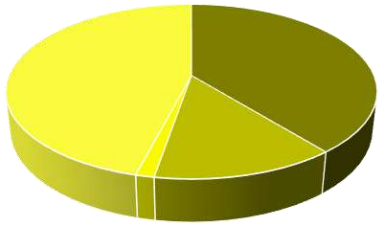
Criteria- Water

Water Consumption

- MUJ consumes 59965 kL/year of water annually for the university blocks & 53873 kL/year for hostel blocks
- Total water consumption is 113,838 kL/year
- 100% wastewater is treated on site and used for flushing and landscape purposes within the campus

Water Consumption 2022-23



200 KLD (MUJ) 80 KLD (Housing) 150KLD 350KLD

University (Administrative +Academic Blocks) data for domestic and flushing comes is shared by MUJ

To reduce the water usage, all the building toilets in MUJ are equipped with automatic, low flow fixtures and low flush fixtures. These fixtures when compared with conventional fixtures can save significant amount of water.

FIXTURE TYPE	CONVENTION AL FLOW/ FLUSH FIXTURE FLOW RATE LPF/LPM	FIXTURE FLOW RATES INSTALLED IN MUJ LPF/LPM	Estimated Water Savings (%)
WC Flush	≤ 6 LPF	3 & ≤6 LPF	50%
Sensor Urinals	≤ 3.8 LPF	≤ 0.5 LPF	86%
Restroom Faucets	≤ 9.4 LPM	≤ 2.75 LPM	70%
Pillar cock	≤ 9.4 LPM	≤ 2.75 LPM	70%
Health faucet	≤ 9.4 LPM	≤ 6.4 LPM	32%
Kitchen Faucet	≤ 9.4 LPM	≤ 7.5 LPM	20%

OBSERVATIONS:

The total water consumption in the campus is segregated for domestic and flushing purposes. 80% of waste-water from domestic and flushing purpose is treated and this recycled water is used for landscape irrigation and the dry sludge generated in the sewage treatment plant is used as manure for landscape

RECOMMENDATIONS

Regular monitoring of water use at the building level and regular maintenance checks for leaks will ensure additional water savings

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MANIPAL UNIVERSITY JAIPUR
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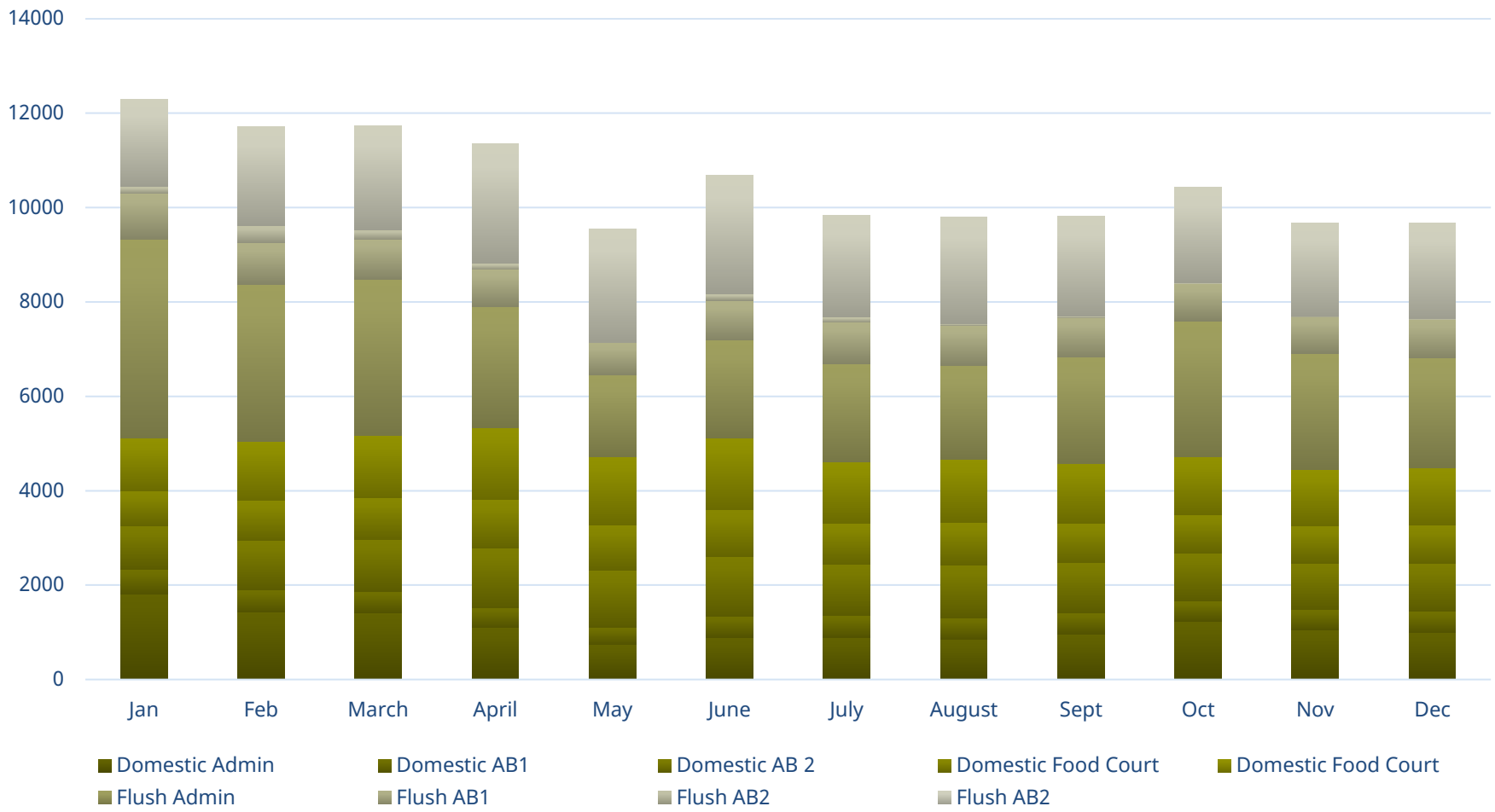
Criteria- Water

Monthly Water Consumption: Admin, AB-1 and AB-2, Hostels

January 2023 to December 2023



OBSERVATIONS:

•Seasonal Trends and Efficiency: Although there are minor fluctuations, summer months (May to August) see slightly reduced consumption. This might be due to reduced campus activity or more efficient water usage during this period.

•Consistent Distribution Across Categories: Each category, whether domestic or flushing, maintains a similar volume of water use each month, indicating that water distribution patterns across the campus are predictable and well-regulated.

RECOMMENDATIONS

The chart highlights a well-managed water system with minimal variation in monthly consumption, which could imply that water-saving measures or consistent practices are in place.

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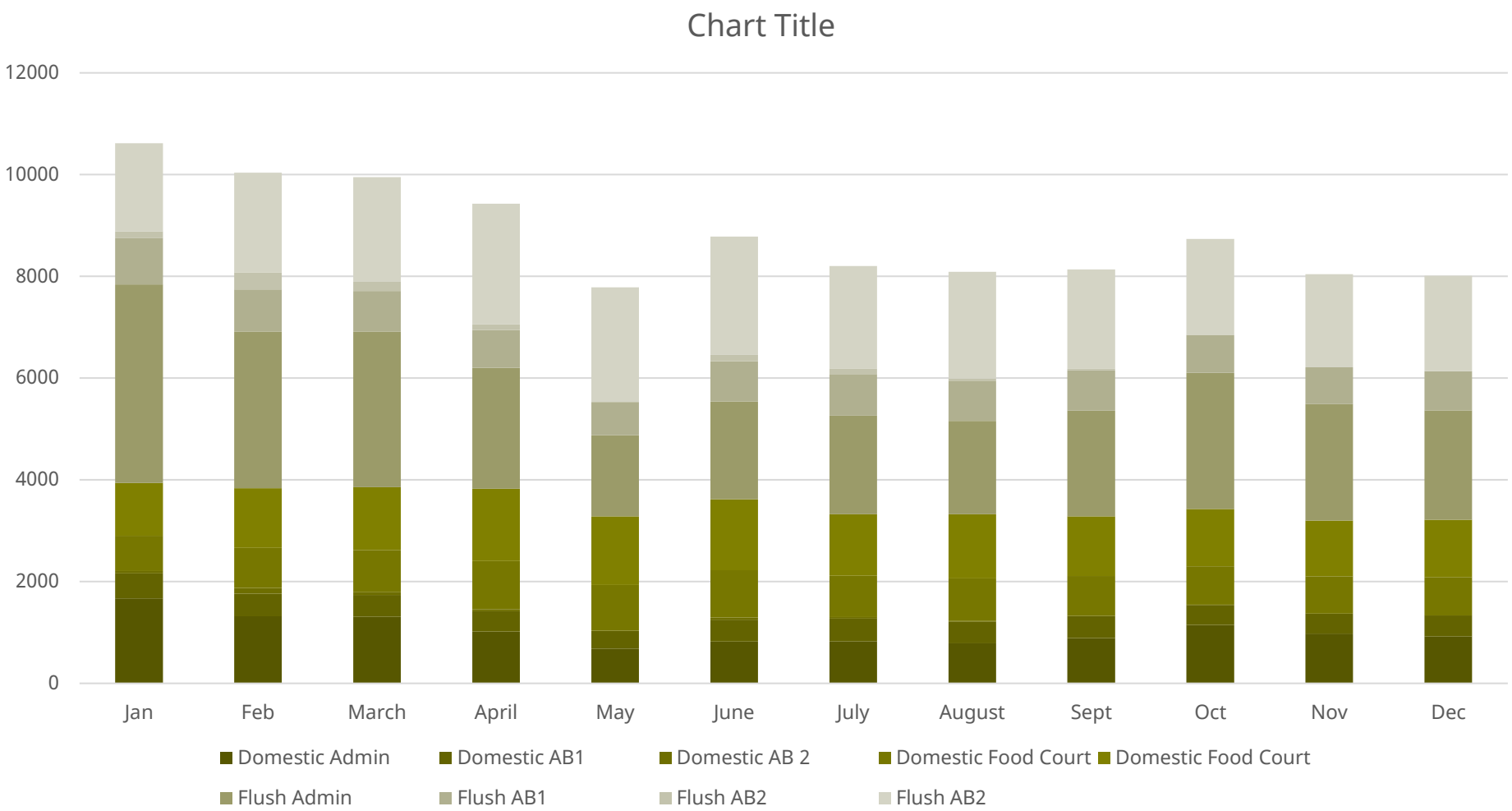
Criteria- Water

Monthly Water Consumption: Admin, AB-1 and AB-2, Hostels

January 2022 to December 2022



OBSERVATIONS:

- Consistent Usage: Water usage appears to be relatively stable across the months, with only slight fluctuations. This indicates a steady demand throughout the year.
- Highest Consumption in Jan and April: The highest total water usage is seen in January and April, slightly exceeding other months, which could correspond to seasonal factors or increased campus activities.

RECOMMENDATIONS

Regular monitoring of water use at the building level and regular maintenance checks for leaks will ensure additional water savings

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Criteria- Water

Sewage Treatment plant

Manipal University Jaipur has zero discharge waste-water policy. Hence 100% of the wastewater generated on site is treated to tertiary standards and reused within the campus for various purposes like Flushing, cooling tower makeup, Horticulture etc.

MUJ has two Sewage treatment plants with 150kLd and 350 kLd respectively. Membrane Bioreactor(MBR) type Sewage Treatment plant with total capacity of 500 kLd is commissioned at MUJ university campus considering the future developments & excess wastewater from hostels.

A standalone 350 kLd Sewage Treatment plant is commissioned to serve only the Hostel blocks,excess wastewater is sent to University STP. Wastewater treated on site will have projected water quality standards meeting central pollution control board (CPCB) norms.

OBSERVATIONS:

- Consistent Usage: Water usage appears to be relatively stable across the months, with only slight fluctuations. This indicates a steady demand throughout the year.
- Highest Consumption in Jan and April: The highest total water usage is seen in January and April, slightly exceeding other months, which could correspond to seasonal factors or increased campus activities.

RECOMMENDATIONS

HYPOTHESIS-
If the treated water used for landscape can be reduced by 10- 15% then this water can be used for flushing purpose as the 2019 water consumption was flushing is not 100% catered by treated water

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(University under Section 2(f) of the UGC Act)

Criteria- Water

USAGE OF RECYCLE WATER

Key Points

- Zero Water Discharge Campus (Water Recycling)
- Sludge From STP Used As Manure For Landscaping. Reusing the debris waste for the pathways and road areas base compaction
- Vehicle Washing
- Gardening and Horticulture

HYPOTHESIS-
If the treated water used for landscape can be reduced by 10- 15% then this water can be used for flushing purpose as the 2019 water consumption was flushing is not 100% catered by treated water

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Criteria- Water

WATER EFFICIENT APPLIANCES

Water Aerator Installed in all Taps for handwash

Sensor Based Urinals

Storm water drain and Drip Irrigation

BENEFITS

•Reduced Water Bills: By using less water, these appliances lower monthly utility costs.

•Environmental Conservation: Lower water consumption reduces strain on local water resources and supports environmental sustainability.

•Energy Savings: Many water-efficient appliances also use less energy, especially those involved in heating water, such as washing machines, further decreasing energy bills and carbon footprints.

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Criteria- Water

WATER USE REDUCTION WITH WATER EFFICIENT FIXTURES:

Some of the key highlights of sustainable water management at MUJ:

- Potable water use reduction by using water efficient fixtures
- Recycling 100% of waste water generated on site and reuse on site.
- Use of treated water for non-potable water requirement
- Reduction in landscape water use by choosing right species of plants which are regional and adaptable to local conditions & reduction of turf areas
- Use of Highly efficient Irrigation equipment like micro drips for landscape needs
- A well-developed stormwater management infrastructure to capture and use rainwater for both building and landscape needs

FIXTURE TYPE	CONVENTIONAL FLOW/FLUSH FIXTURE(base case) FLOW RATE LPF/LPM	FIXTURE FLOW RATES INSTALLED IN MUJ (design case) LPF/LPM
WC Flush	≤ 6 LPF	3 & ≤6 LPF
Sensor Urinals	≤ 3.8 LPF	≤ 0.5 LPF
Restroom Faucets	≤ 9.4 LPM	≤ 2.75 LPM
Pillar cock	≤ 9.4 LPM	≤ 2.75 LPM
Health faucet	≤ 9.4 LPM	≤ 6.4 LPM
Kitchen Faucet	≤ 9.4 LPM	≤ 7.5 LPM

BENEFITS

•Reduced Water Bills: By using less water, these appliances lower monthly utility costs.

•Environmental Conservation: Lower water consumption reduces strain on local water resources and supports environmental sustainability.

•Energy Savings: Many water-efficient appliances also use less energy, especially those involved in heating water, such as washing machines, further decreasing energy bills and carbon footprints.

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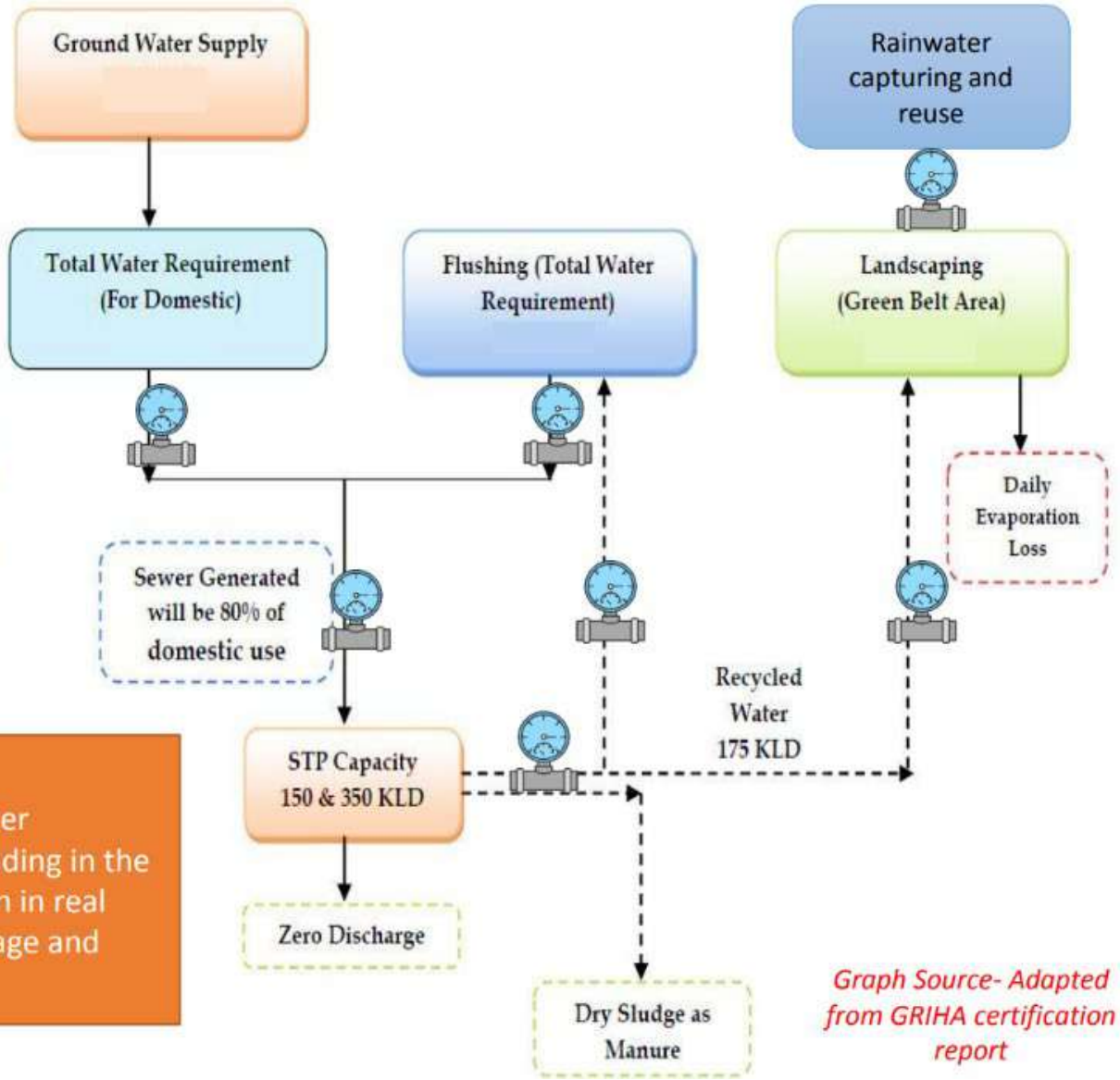
Water Discharge Procedure MUJ

Water Source and Distribution in MUJ Campus

Manipal university has an Integrated Water management strategies that are designed & implemented for the campus mainly focusing on triple bottom line benefits i.e., social, economic and environmental benefits. This created a flexible, resilient water infrastructure which helped MUJ progress towards water neutrality.



RECOMMENDATIONS -
Water meters to be installed at all water sources/distribution lines at every building in the campus to monitor water consumption in real time basis to understand excessive usage and leaks

Graph Source- Adapted from GRIHA certification report

Water Quality Parameter Testing Equipments available in the Lab

1. **Multiparameter – HANNA's HI98194 meter**

The HANNA HI98194 multiparameter meter is a versatile tool that measures key water quality parameters, making it ideal for environmental and field applications. It provides readings for pH, indicating the water's acidity or alkalinity; dissolved oxygen (DO), conductivity (EC), and total dissolved solids (TDS) along with ORP, salinity, and temperature. Together, these measurements provide a comprehensive view of water quality, crucial for environmental monitoring and research.

Multiparameter Photometer – HANNA's - HI97115 Model

- Alkalinity, Ammonia, Calcium, Magnesium, Nitrate, Nitrite, and Phosphate were measured using HANNA's Marine Master waterproof wireless meter kit (HI97115).

HR Fluoride portable photometer kit- HANNA's - HI93739-01 Model

Fluoride levels were evaluated with HANNA's HR Fluoride portable photometer kit (HI93739-01).

Water Analyzer- for field visits

- It provides readings for pH, dissolved oxygen (DO), conductivity (EC), and total dissolved solids (TDS) along with salinity and temperature.
-

Microprocessor-based flame photometer (ESICO, model-1385/1382)

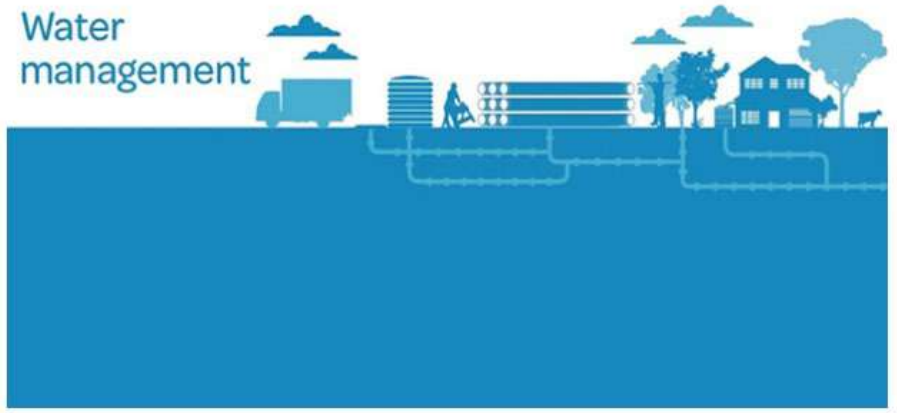
- Sodium and potassium concentrations were typically determined using a microprocessor-based flame photometer (ESICO, model-1385/1382).

Water Conservation at Manipal University Jaipur: Through STP

INTEGRATED WATER MANAGEMENT AT MANIPAL UNIVERSITY

SUSTAINABLE INTEGRATED WATER MANAGEMENT AT MANIPAL UNIVERSITY JAIPUR

Integrated Water management strategies that are designed & implemented for Manipal University Jaipur mainly focus on triple bottom line benefits i.e social, economic and environmental benefits. This creates a flexible, resilient water infrastructure which helps us progress towards WATER NEUTRALITY.



Some of the key highlights of sustainable water management at MUJ:

- Potable water use reduction by using water efficient fixtures
- Recycling 100% of waste water generated on site and reuse on site.
- Use of treated water for non-potable water requirement
- Reduction in landscape water use by choosing right species of plants which are regional and adaptable to local conditions & reduction of turf areas
- Use of Highly efficient Irrigation equipment like micro drips for landscape needs
- A well-developed stormwater management infrastructure to capture and use rainwater for both building and landscape needs

WATER USE REDUCTION WITH WATER EFFICIENT FIXTURES:

Approach:

Manipal University Jaipur has implemented dual plumbing for all its buildings, this helps in efficiently separating the potable water from reclaimed water for building use.

- To reduce the water usage, all the building toilets in MUJ are equipped with automatic, low flow fixtures and low flush fixtures. These fixtures when compared with conventional fixtures, low flow fixtures can save significant amount of water.
- 100% wastewater is treated on site and used for flushing purposes within the building .
- Regular monitoring of water use in the building and regular maintenance checks for leaks

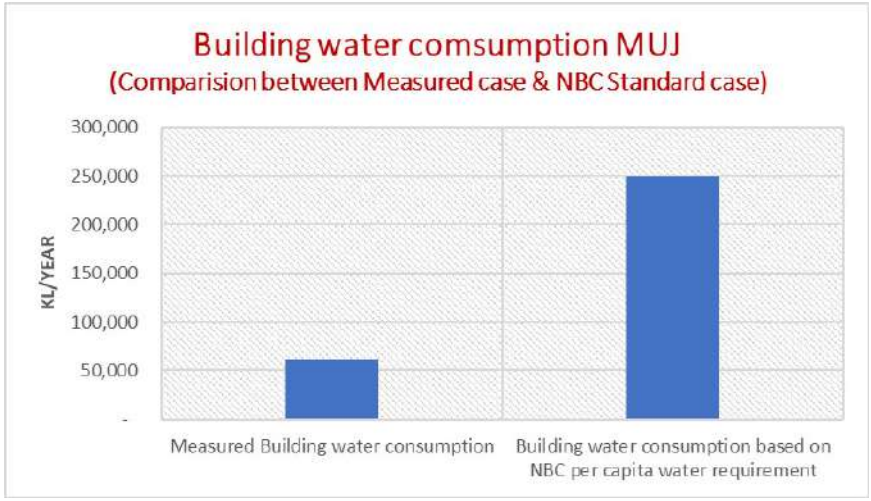
FIXTURE TYPE	CONVENTIONAL FLOW/FLUSH FIXTURE(base case) FLOW RATE LPF/LPM	FIXTURE FLOW RATES INSTALLED IN MUJ (design case) LPF/LPM
WC Flush	≤ 6 LPF	3 & ≤6 LPF
Sensor Urinals	≤ 3.8 LPF	≤ 0.5 LPF
Restroom Faucets	≤ 9.4 LPM	≤ 2.75 LPM
Pillar cock	≤ 9.4 LPM	≤ 2.75 LPM
Health faucet	≤ 9.4 LPM	≤ 6.4 LPM
Kitchen Faucet	≤ 9.4 LPM	≤ 7.5 LPM

Projections:

- Based on the water saving measures in MUJ, we have anticipated at least 50% reduction in per capita building water use.
- At least 50% reduction of fresh water use in the building
- Based on our design case implementations which were documented for GRIHA rating, we have anticipated a minimum of 40% water saving through efficient fixtures.

Results:

- As per the recorded data from water meters, Buildings in University currently consume **62,027 Kl/year** for building out of which **14,676kl/year** is domestic water & **47,361 kl/Year** is flushing water
- Based on the metered data MUJ has achieved **76.3%** fresh water savings in building consumption
- Per capita water usage of MUJ is ***37.16 ltr/per person/day*** as per the measured data
- **75%** reduction in per capita water consumption when compared to NBC standard (per capita building water requirement.)

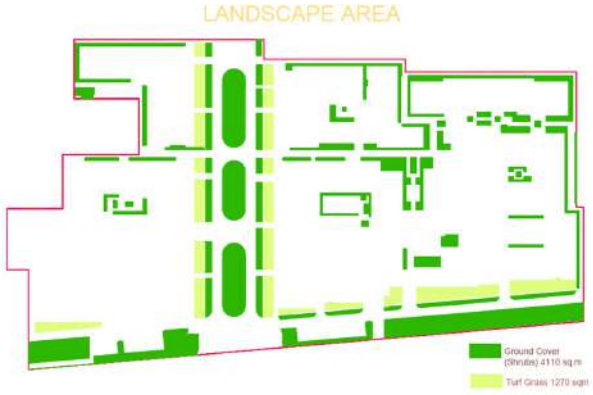


POTABLE WATER USE REDUCTION FOR LANDSCAPE

Manipal University Jaipur has a green cover of about 60,400sqm, this accounts almost 42.4% of total site area. Since the project location is declared as the notified area by Central Ground Water Authority, MUJ strictly implemented plans to manage water efficiently and recharge groundwater. The whole system has been designed to be a zero discharge stormwater and wastewater from the site.

Approach:

- Native and adaptive plant species with larger canopy cover are chosen & lawn areas are reduced wherever possible in landscape design.
- Water efficient irrigation systems are used for landscaping which comprises of micro drips and highly efficient sprinklers. The irrigation efficiency of the systems used for landscape watering is less than 0.75
- Wastewater is treated to tertiary standards and used for landscaping need along with collected rainwater



Projections & Results:

- Estimated water requirement for landscape needs in MUJ through calculations is 1,16,845 kl annually.
- When compared to base case design which was documented for GRIHA, the project could achieve nearly 63.4% water savings by using efficient irrigation equipment and native and adaptive species in the landscape.
- Roughly 72% of the annual landscape water demand after savings is met only by Treated waste water from hostels & campus buildings.

GRIHA Exemplary Performance Awards

WASTE WATER TREATMENT

Manipal University Jaipur has zero discharge waste water policy. Hence 100% of the wastewater generated on site is treated to tertiary standards and reused within the campus for various purposes like Flushing, cooling tower makeup, Horticulture etc.

Approach:

- MBR Type STP with a capacity of 500kld (150+350) is commissioned at MUJ university campus considering the future developments & excess wastewater from hostels
- A standalone 350kld STP is commissioned to serve only the Hostel blocks, excess wastewater is sent to University STP.
- Wastewater treated on site will have projected water quality standards meeting CPCB norms

Projections & Results:

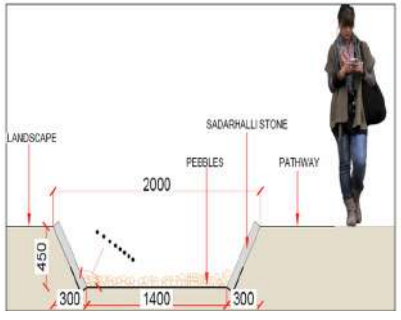
- Annually ***1,14,609 kl/year*** of treated water is available for building and landscape uses in MUJ Academic side
- ***30726 kl/year*** i.e. ***26.7%*** of total available treated wastewater is used for non potable uses in all the buildings.
- ***83,883 kl/ year*** i.e. ***73.3%*** of total available treated wastewater is used for landscape requirement in university campus.

STORM WATER MANAGEMENT AND RAIN WATER REUSE

Stormwater from building rooftops will be collected in rainwater collection tanks These tanks are connected to the WTP.

Storm water from the site is collected in swales. Part of this water is diverted to a collection tank that also works as a sedimentation pit. The rest of the stormwater is diverted to 2 recharge pits located in the lowest part of the site. The collection tank is in turn connected to the WTP.

- Rainwater holding capacity at MUJ University blocks is ***490 C.um + 2576 C.um***
- Annually available rainwater at overall MUJ is ***56508.12 kl/year*** in which ***49.9%*** i.e. ***28180.7 kl/year*** is used for the project requirements & ***50.1%*** i.e. ***28327.42 kl/year*** is recharged into the ground
- Collected rain water from roofs is treated with WTP on site and conveyed to the various buildings in Manipal University Jaipur
- Rain water from different areas on site is conveyed to ground water recharge pits through percolation swales. These swales reduce the rate of flow during conveyance and allow stormwater to percolate into the ground as it reaches the recharge pits
- These percolation swales also act as structural BMP's to control the pollutants, sediments & debris reaching the recharge wells



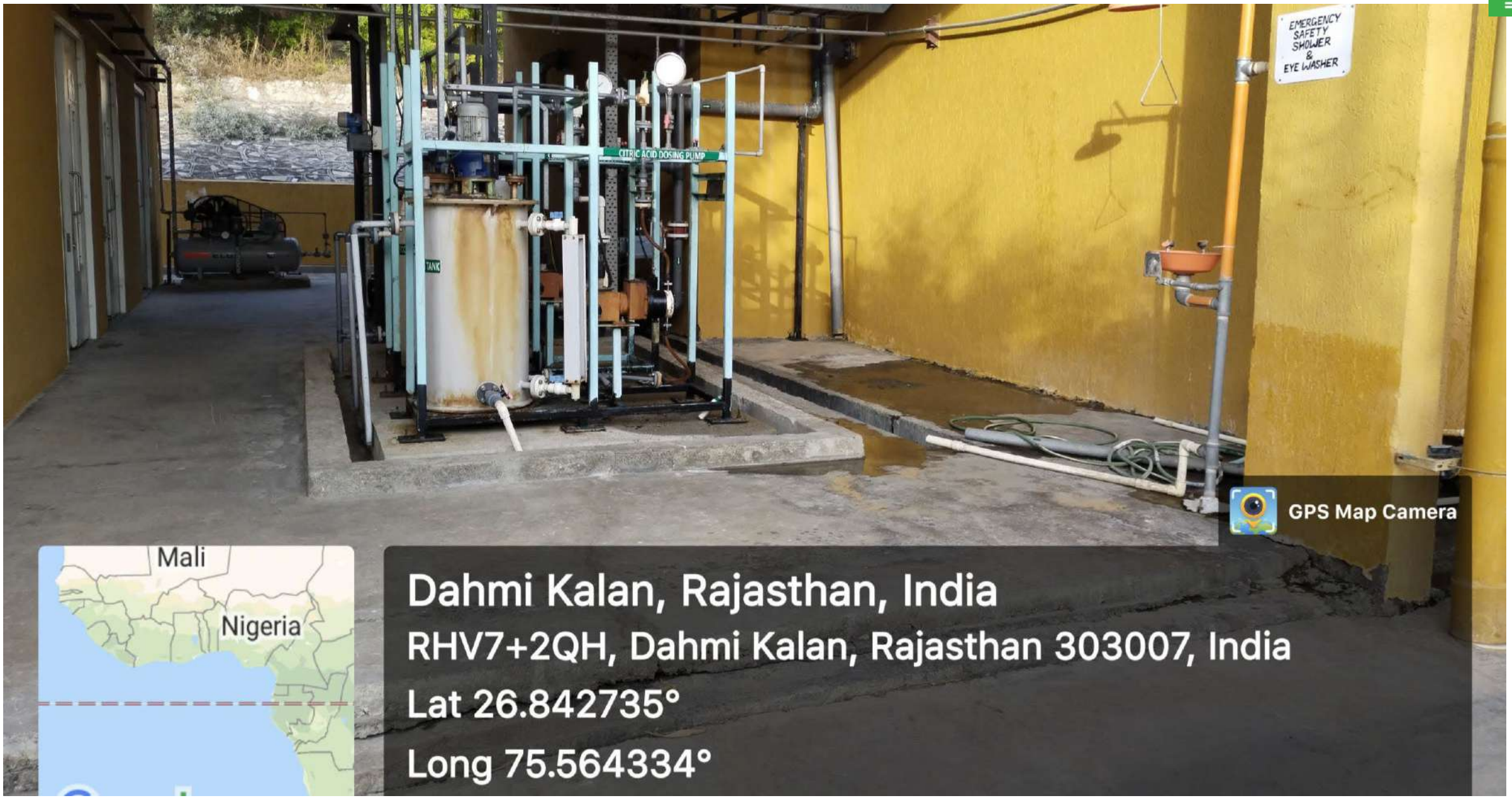

SEWAGE TREATMENT PLANT
STP

LIQUID WASTE MANAGEMENT-INHOUSE-SEWAGE TREATMENT PLANT

- MUJ is equipped with **4 STP** Plant with different capacity
- 1000 KLD, 350 KLD(two) and 150 K
- Sewage treatment remo wastewater, which includes phy processes to remove these environmentally safer treated wate and gardening). In normalcy are per day


SAFETY FIRST
Safety glasses
Safety shoes
Hard hats required
Beyond this point
SAND FILTER
Mali
Nigeria
Google
GPS Map Camera
Dahmi Kalan, Rajasthan, India
RHV7+2QH, Dahmi Kalan, Rajasthan 303007, India
Lat 26.842735°
Long 75.564334°
17/12/21 04:29 PM


SAFETY FIRST
GPS Map Camera


CITRIC ACID DOSING PUMP
TANK
EMERGENCY SAFETY SHOWER & EYE WASHER
GPS Map Camera
Mali
Nigeria
Dahmi Kalan, Rajasthan, India
RHV7+2QH, Dahmi Kalan, Rajasthan 303007, India
Lat 26.842735°
Long 75.564334°


GPS Map Camera
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Dahmi Kalan, Rajasthan, India
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Long 75.564334°
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- After Treatment, Conserved water used for Irrigation purpose in MUJ Campus