UWR Rainwater Offset Unit Standard

(UWR RoU Standard)

Concept & Design: Universal Water Registry

www.uwaterregistry.io

Project Concept Note & Monitoring Report

(PCNMR)

Project Name : Wastewater Recycling and Reuse Program by Vettuvapalayam CETRP in Tamil Nadu

UWR RoU Scope: 5

Monitoring Period: 01/10/2016 - 31/12/2024

Crediting Period: 01/10/2016 - 31/12/2024

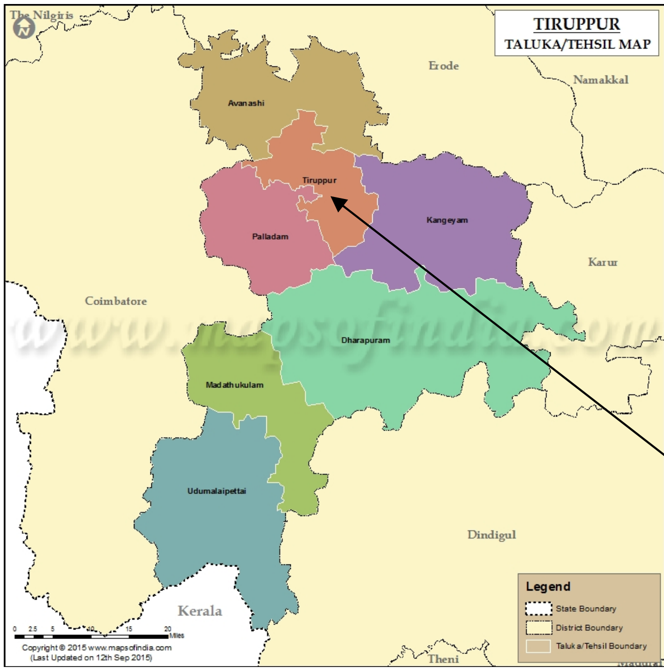
UNDP Human Development Indicator: 0.644 (India)[1]

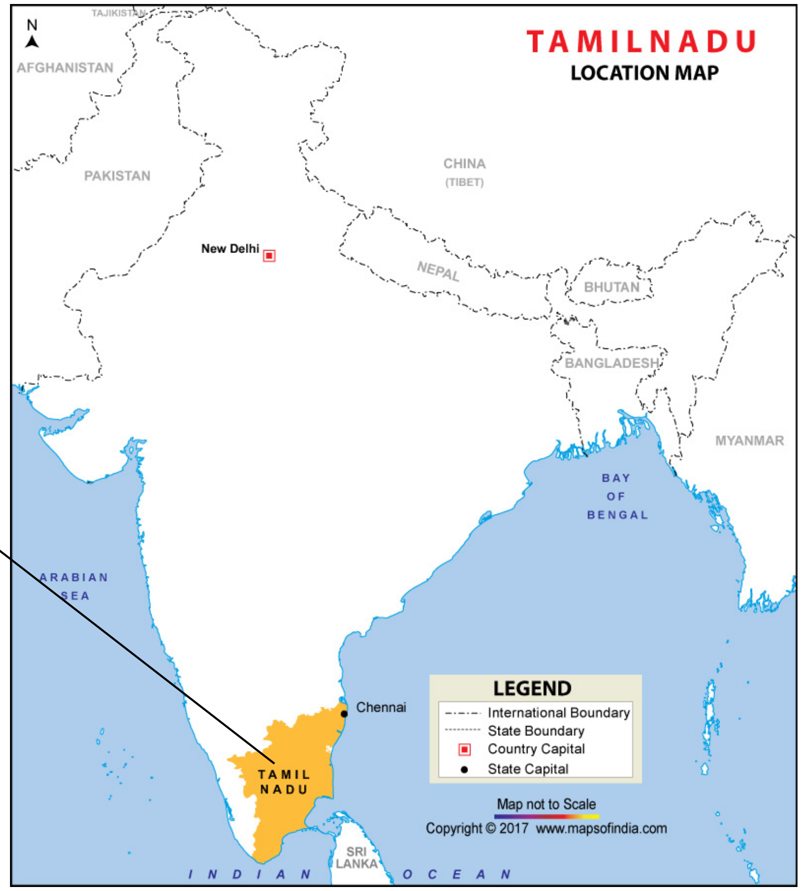
[1] https://hdr.undp.org/data-center/country-insights#/ranks[1]

A.1 Location of Project Activity

Title	Wastewater Recycling and Reuse Program by Vettuvapalayam CETRP in Tamil Nadu		
Country	India		
State	Tamil Nadu		
District	Tiruppur		
Block Basin/Sub Basin/Watershed	Noyyal River[2]		
Project location	**Name of the Village**	**Latitude**	**Longitude**
	Vettuvapalayam	11°06'08.8"N	77°15'44.6"E
Type and Scope of RoU Project Activity	Type Scope 5: Conservation measures taken to recycle and/or reuse water, spent wash, wastewater etc. across or within specific industrial processes and systems, including wastewater recycled/ reused in a different process, but within the same site or location of the project activity. Recycled wastewater used in off-site landscaping, gardening or tree plantations/forests activity are also eligible under this Scope.		

[2] https://www.mapsofindia.com/maps/tamilnadu/[2]





Project Site

A.2. Project owner information, key roles and responsibilities

Project Proponent (PP):	Vettuvapalayam Common Effluent Treatment and Recycling Plant Private Limited
UCR Project Aggregator	Viviid Emissions Reductions Universal Private Limited
Contact Information:	lokesh.jain@viviidgreen.com

Purpose of the project activity

The project participant, Vettuvapalayam Common Effluent Treatment and Recycling Plant Private Limited, operates a vertically integrated Common Effluent Treatment Plant with a capacity of 1.3 MLD. The project activity started its operations from October 2016. The project is 0.5 km from Noyyal River, the total area required for the project is approximately 3.25 acres. The Effluent Treatment Plant (ETP) consists of Primary treatment, biological treatment and Reverse osmosis (R.O) to treat the textile effluents and is designed for Zero liquid discharge with an aim to treat dyeing and bleaching effluents arising from its 9 member units.

The Project Proponent (PP) affirms that they meet all the requirements outlined in the management plan regarding ownership, legal rights, permits, and cost details for the successful implementation of the project. Specifically.

Water User Rights: The PP holds the necessary water user rights for the area within the project's boundary. These rights are legally secured and ensure that the PP has full entitlement to use the water resources required for the project's operations accredited By TNPCB.

Legal Land Title: The Project proponent (PP) holds an uncontested legal land title for the entire project area within the project's boundary. The title is fully documented and free of any disputes, confirming the PP's legal right to utilize the land for project purposes.

Necessary Permits: The PP has obtained all the required permits for the implementation of the project. In cases where certain permits are pending, the PP has already applied for the necessary approval and is working in full compliance with the relevant regulatory requirements to ensure the timely commencement of the project.

Cost Details: The PP has thoroughly assessed and documented the cost details for project implementation. A detailed cost breakdown is available in the DPR, Capital Cost of project was RS. 60

Crores. covering all aspects of project development, including infrastructure, permits, equipment, and operational costs.

By meeting these criteria, the PP ensures that all legal and regulatory requirements for the project are satisfied, enabling the project to proceed without hindrance.

A.2.1 Project RoU Scope

PROJECT NAME	Wastewater Recycling and Reuse Program by Vettuvapalayam CETRP in Tamil Nadu
UWR Scope:	Type Scope 5: Conservation measures taken to recycle and/or reuse water, spent wash, wastewater etc. across or within specific industrial processes and systems, including wastewater recycled/ reused in a different process, but within the same site or location of the project activity. Recycled wastewater used in off-site landscaping, gardening or tree plantations/forests activity are also eligible under this Scope.
Date PCNMR Prepared	24/07/2025

The project consists of the development of a 1.3 MLD Common Effluent treatment plant, aiming to significantly reduce reliance on freshwater resources. In the absence of the initiative taken by Vettuvapalayam Common Effluent Treatment and Recycling Plant Private Limited water would have sourced through groundwater extraction to meet, exacerbating the already critical issue of water scarcity in India. With urban and industrial sectors generating over 72,368 million liters of wastewater daily, only 28% of which is currently treated[3], the challenge of wastewater management remains a pressing concern[4]. The baseline scenario involved the discharge of untreated or partially treated wastewater, leading to groundwater depletion and environmental pollution. However, through the advanced treatment processes implemented—including Effluent Treatment Plants (ETPs), ultrafiltration

[3] NITI Aayog Report, 2022: Urban Wastewater Scenario in India

[4]https://pib.gov.in/Pressreleaseshare.aspx?PRID=1779784#:~:text=As%20per%20the%20report%20of,of%2031841%20mld%20is%20available.

(UF), and reverse osmosis (RO) systems, the project now ensures the recycling and reuse of water, reducing the dependency on groundwater and promoting a sustainable water management approach.

A.3. Land use and Drainage Pattern

Not Applicable.

This project activity involves treating and reusing wastewater. It doesn't include any land-use practices. Also, this is an industrial process designed with technical requirements and following the specified norms of the local pollution control board. Hence, the project activity does not harm any land and Drainage system.

A.4. Climate

The project activity does not rely on the climatic conditions of the area as it treats and reuses only the wastewater from the dying & textile without letting the water be exposed to any climatic condition

A.5. Rainfall

The project activity is not dependent on the rainfall pattern of the area as it treats and reuses the wastewater from the dying Industry.

A.6. Ground Water

Not Applicable.

The project activity is not dependent on groundwater in the area, and it treats and reuses the wastewater from its own operations

A.7. Alternate methods

1. **Stormwater Harvesting:**
   Stormwater harvesting offers an alternative method for addressing water scarcity, especially in regions with high rainfall variability. But due to the high-water demand of the textile industry rainwater harvesting alone cannot meet operational needs year-round.

2. **Traditional Groundwater Extraction**:
   Industries and institutions often rely on groundwater abstraction for non-potable water requirements, particularly in regions where aquifers are accessible. But due to the depleted groundwater resources it further exacerbates water scarcity

3. **Surface Water Utilization:**

An innovative method gaining traction is nutrient recovery from wastewater, particularly in agricultural applications. By recovering nutrients like nitrogen and phosphorus from treated wastewater, it is possible to reduce the need for chemical fertilizers. This method not only helps in managing wastewater but also supports sustainable agricultural practices. With India generating significant amounts of wastewater daily, implementing nutrient recovery could reduce both environmental and agricultural dependency on chemical fertilizers, providing dual benefits of waste management and improved crop yields.

A.8. Design Specifications

This project entails the installation and operation of Common Effluent Treatment Plants (CETPs) and Ultra-Filtration Plant with Reverse Osmosis System of 1.3 MLD.

The CETP was designed to treat effluents from the bleaching and dyeing units listed in Table 1. The treatment scheme included Pre-treatment (equalization and biological oxidation followed by clarification, quartz filtration, resin filtration and softening filtration) and the Reverse Osmosis System for water and brine recovery.

S.No	**Name of Member Units**	**Consent quantity (KLD)**
1.	Vignesh Bleachers	150
2.	Senthil Velavan Bleaching	200
3.	Shree Alagappa Bleaching Company	100
4.	HM Bleachers	200
5.	Gokul Bleaching	150
6.	Gangai Bleaching	100
7.	Sri Thiruppathi Bleachers	150
8.	SRI Vetrivel Bleachings	100
9.	Deepthy Fenishers	150
Total		**1300**

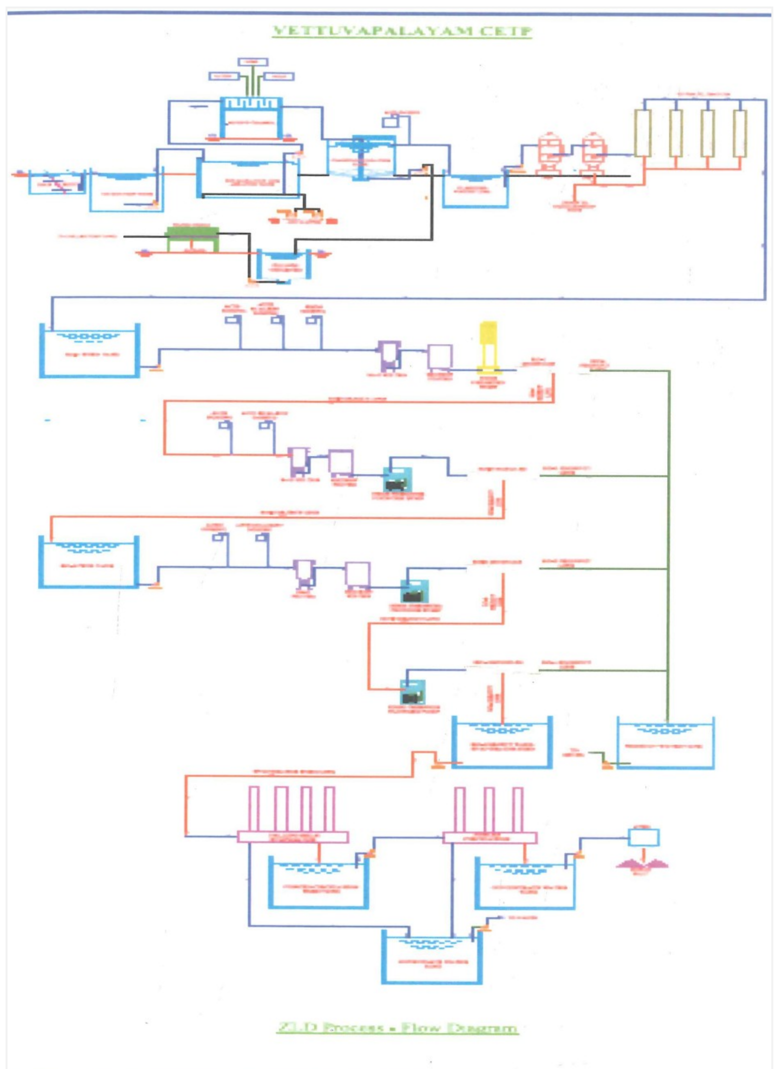
The effluent from the members' dyeing industries is taken to the collection tank via gravity pipelines. This effluent contains color, dissolved salts, and organic load (COD and BOD). The CETP currently receives effluent from its 9 operating member units in this collection tank, which helps maintain a desired flow rate. The collected effluent is then transferred to a storage and homogenization tank (SHT) after passing through a screening chamber to remove solids like plastics and cloth. The SHT also collects backwash water, spillage, and chemical cleaning water.

From the SHT, the equalized effluent moves to a neutralization tank where its pH is corrected to 7. The neutralized effluent then undergoes biological treatment using an activated sludge process to reduce the organic load. After biological treatment, the effluent overflows into a secondary clarifier. The biomass is recirculated back to the aeration tank, with excess biomass sent for sludge dewatering. The clarifier overflow enters a holding tank.

The stored effluent from the holding tank is transferred to a chlorine contact tank, where it is de-colored using liquid chlorine. Before leaving this reactor, the de-colored effluent is treated with sodium thiosulphate. It then proceeds to a filtration system, including a Pressure Sand Filter (PSF) and a Micro Filter (MF), which are used to remove suspended solids, fines, organic matter, and odor. The outlet product from the MF is collected in an RO feed tank.

The effluent is then fed to the Reverse Osmosis (RO) system via a Micron Cartridge Filter for desalination. The RO reject is treated with the Lime-Soda process in a High Rate Solids Contact Clarifier (HRSCC) for hardness removal. Subsequently, the effluent's pH is corrected before it is sent to a high-pressure RO system, preceded by a Pressure Sand Filter (PSF) and a Micro Filter (MF), for further concentration.

The RO concentrate is returned to the member units as a Sodium Sulphate brine solution for reuse. Any excess brine is directed to a Multiple Effect Falling Film Evaporator (FF) for further concentration. The concentrate from the FF Evaporator is then sent to a Multiple Effect Forced Circulation Evaporator (FC) for additional desalination, where sodium sulphate salt is crystallized by a pusher centrifuge. The mother liquor from the FC Evaporator is finally sent to an Agitated Thin Film Dryer



ZLD Process - Flow Diagram

(ATFD) to produce a solid reject powder. A solar pan is optionally used for handling evaporator cleaning waste, which typically has high hardness and salt content.

Design Philosophy and Treatment Approach

The project design incorporates advanced physico-chemical and biological treatment processes, integrated with membrane filtration technologies (UF and RO). The treatment system is configured to achieve significant reductions in the following:

- Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD),
  - Organic pollutants, which originate from food & other material etc., are also present in sewage. Such impurities are reflected in analysis of biochemical oxygen demand (BOD) and COD. These pollutants are controlled by use. of biological treatment processes
- Suspended solids:

The presence of SS in the sewage is one of the main problems in domestic wastewater. SS are easily visible to human eye at very low concentration.

Treatment Process

The core treatment process of this wastewater recycling project is centred around advanced biological treatment using the Moving Bed Biofilm Reactor (MBBR) technology, followed by high-rate solid-liquid separation. In this design, the clarified effluent from the primary tube settler is conveyed to the MBBR tank, where biological degradation of organic pollutants occurs. MBBR technology utilizes specially designed plastic carriers, known as biofilm carriers or media, which provide a large surface area for microbial biofilm growth. These carriers are kept in continuous motion within the reactor by fine bubble diffusers placed at the bottom of the tank. The diffusers not only supply the necessary oxygen for aerobic biodegradation but also provide the mixing energy required to maintain the suspension of biofilm carriers, ensuring uniform contact between the wastewater and the biofilm. The aerobic microorganism. The aerobic microorganisms growing on the biofilm carriers consume organic pollutants as a substrate, effectively reducing Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) by up to 90-95%.

The effluent from the MBBR tank flows through a sieving grid that retains the biofilm carriers within the reactor while allowing the treated water to pass to the secondary tube settler. This clarified effluent, with significantly reduced suspended solids, BOD, and COD concentrations, is then directed to the pre-filtration tank and subsequently pumped through a dual-stage filtration system. The first stage employs Dual Media Filters (DMF) comprising layers of sand and anthracite to remove fine suspended solids and colloidal particles, enhancing water clarity and protecting the downstream membrane units from fouling. The second stage utilizes Activated Carbon Filters (ACF), which absorb residual organic compounds, color, and odor-causing substances, acting as a polishing step to ensure high-quality effluent. The treated water from the ACF is then fed to the Ultrafiltration system. The UF system is designed to remove remaining colloids, bacteria, and high molecular weight organics, serving as an effective pretreatment step for the Reverse Osmosis (RO) system. This pretreatment significantly reduces membrane fouling in the RO unit. The RO system having vertical multistage pumps has been designed for high recovery and sustainability, using semi-permeable membranes housed in Fiber Reinforced Plastic (FRP) pressure vessels. The reject water, accounting for approximately 25% of the feed, is repurposed for plantation, and the rest 75% is repurposed for the process. The RO-UF provides a robust treatment, employing membranes with pore sizes typically 0.01-0.1 µm to remove suspended solids, colloids, bacteria, and viruses. This significantly reduces turbidity and the Silt Density Index (SDI) of the feedwater. Subsequently, Reverse Osmosis (RO) utilizes semi-permeable membranes with much finer pores (<0.001 µm) and applied pressure exceeding osmotic pressure to reject dissolved salts, ions, and low molecular weight organic molecules. The process requires significant applied pressure, substantially exceeding the osmotic pressure of the feedwater, to force water molecules across the membrane while rejecting dissolved salts, multivalent ions, and most organic contaminants. The UF permeate becomes the RO feed, protecting the RO membranes from fouling and scaling, thereby ensuring high rejection rates and producing high purity permeate for reuse or discharge.RO systems are typically designed with multiple pressure vessels in series (stages) and/or parallel arrays to optimize permeate recovery and minimize concentrate volume. Anti-scalant chemicals are commonly dosed upstream of the RO to inhibit precipitation of sparingly soluble salts like calcium carbonate, calcium sulfate, and silica on the membrane surface. Monitoring includes feed pressure, permeate pressure, concentrate pressure, permeate flow, concentrate flow, and conductivity/TDS of the feed, permeate, and concentrate streams to assess salt rejection and recovery rate. Membrane cleaning-in-place (CIP) with specialized chemicals (e.g., acidic or alkaline cleaners) is performed to remove fouling and scaling and restore performance. Permeate quality is critical and assessed against specific water quality requirements for the intended reuse application or discharge standards. The RO reject water utilized for purposes including irrigation and cleaning, while the treated water is used in the processing stages , especially for operations where water quality is less critical.

DETAILS OF FEED, PERMEATE, REJECT

Figure 6 :Clariflocculator

Figure 7 :Ultrafiltration

RO Treatment Steps

Following treatment steps are envisaged in the RO process;

a) Pressure sand filtration,

b) Dechlorination

c) Micron filtration

d) Antiscalant dosing

e) RO-stage-1

f) RO-stage-2

g) Degasser tower

h) RO product water storage and distribution

Figure 8: RO 1st Stage

Figure 9 :RO 2nd Stage

Description

The treated water from biological section after passing through resin filters is collected in the resin filter storage tank and is drawn by centrifugal pumps and is passed through Pressure sand filters to remove any possible suspended solids formed due to the addition of sodium hypochlorite in the resin filter storage tank (pretreatment section). The filtered Water is collected in a sump, from where this water is pumped to a set of cartridge filters loaded with 5-micron (nominal rating) polypropylene fiber, honeycomb type cartridge filter elements. Also there exists two stages of filtration prior to feeding the RO membranes. The two stages of filtration comprises of a coarse. sand filtration followed by the fine filtration through 5 microns cartridge filter elements. These ensure the removal of any fine particles of less than 5 microns and further reduce the Silt Density Index.

The RO membranes shall be standard 8-inch spiral wound polyamide membranes with FRP Pressure vessels suitably selected to withstand maximum operating pressure with adequate safety factor. The RO permeate is then passed through a degasser tower to strip off the carbon di oxide gas, the pH is adjusted by suitable addition of alkali and the permeate stored in the permeate storage tank. A set of pumps deliver the recovered water to the industries through the recovered water transmission system.

List of Flow Meters at Vettuvapalayam CETP		
SI. No	Flow Meters Inside CETP	No. of Flow meters
1.	Collection to Equalization Tank	1
2.	Equalization Tank to Flash Mixer	1
3.	PSF Feed	1
4.	UF-1 Feed	1
5.	UF-3 Feed	1
6.	RO-1 Feed	1
7.	RO-1 Reject	1
8.	RO-2 Feed	1
9.	RO-2 Reject	1
10.	RO-3&4 Feed	1
11.	RO-3&4 Reject	1
12.	RO-5 Feed	1
13.	RO-5 Reject	1
14.	RO COMMON Permeate	1
15.	MEE- Feed	1
16.	MEE common condensate	1
17.	MEE Reject	1
18.	MEE Forced Feed	1
19.	Permeate to Member Unit	1
20.	ATFD Feed	1

COMPONENT DETAIL - VETTUVAPALAYAM CETP - 1300 KLD								
S.R NO	**COMPONENT DETAIL**	**QUANTITY**	**DIMENSION**			**VOLUME/ CAPACITY**	**NO OF PUMPS**	**PUMPING CAPACITY**
			L	**W/D**	**H (LD)**			
			m	m	m	KL/KLD		
1.	Screen Chamber	1 No.	2.0	1.0	0.40	0.80 m^3		
2.	Collection Well	1 No.	6.0 m Dia. X 2.5 m LD			70.7	2	120m^3/h
3.	Equalization tank	1 No.	21.0 m Dia. X 3.0 m LD			1038.6	2	80 m^3/h
4.	Flash Mixer	1 No.	1.75	1.75	1.5	4.6	-	
5.	Clariflocculator	1 No.		9	3	190.8	1	
6.	Sludge well	1 No.		2	4	12.6	2	10M^3/h
7.	Clarified water sump	1 No.		8	3	150.7	2	80m^3/h
8.	Activated Carbon Filter	1 No.	2.5 m Dia. x 2.5 m H			1 No.		80m^3/h
9.	Pressure sand filter	1 No.	2.5 m Dia. x 2.5 m H			1 No.		80m^3/h
10.	Stabilization tank	1 No.	7	7	2.5	122.5	1	80m^3/h
11.	Ultra filtration unit	1 No.	24 m x 24 Module			100 m^3/h	2	80m^3/h
12.	RO I feed tank	1 No.	7	7	2.5	122.5	1	80m^3/h
13.	RO I	1No.	4E/15V : 5E/5V , 85E			90m^3/h	1	80M^3/h
14.	RO II Feed tank	1 No.	7	7	2.5	122.5	-	-
15.	RO II	1No.	5E/6V:6E/2V, 42 E			24 m^3/h	1	25m^3/h
16.	RO III Feed tank	1 No.	2.75	2.75	2.5	18.9	1	20M^3/h
17.	RO III	1 No.	4E/4V, 16 E			14 m^3/h	2	15M^3/h
18.	RO IV	1 No.	4E/2V, 8 E					
19.	RO V Feed tank	1 To.	2.75	2.75	2.5	18.9	1	14M^3/h
20.	RO V	1No.	5E/2V, 10 E			8 m^3/h	1	8M^3/h
21.	Permeate collection tank	1 No.	8	7	2.5	140.0	1	80M^3/h
22.	MEE - FF Feed tank	1 No.	2.75	2.75	2.5	18.9	1	5M^3/h
23.	MEE - Falling Film	1 No.	4 Effect			4 m^3/h		
24.	MEE - FC Feed tank	1 No.	2.75	2.75	2.5	18.9	1	3M^3/h
25.	MEE - Forced Circulation	1 No.	2 Effect			1.5 m^3/h		-
26.	ATFD Feed tank	1 No.	3	3	1	9.0	1	1M^3/h
27.	ATFD	1 No.	500 LPH			10 KLD		
28.	Condensate Collection tank	1 No.	2.75	2.75	2.0	15.12 m^3	-	-
29.	Sludge drying bed	4 NOS	8	4	1	40 m^3	-	-
30.	Solar evaporation pan I	5 NOS.	9.5	9.5	0.4	451.25 m^3	-	-
31.	Solar evaporation pan ll	4 Nos.	12	8.5	0.4	408 m^2	-	-

A.9. Implementation Benefits to Water Security

Overextraction of groundwater for intensive agriculture has led to a critical decline in the water table. According to the Central Ground Water Board, 79% of Tamil Nadu's blocks are overexploited, leading to groundwater depletion at an alarming rate of 0.5 meters annually. Climate change exacerbates these challenges through erratic rainfall patterns and increased evaporation rates, heightening water scarcity risks.

The wastewater recycling project in Tamil Nadu represents a significant step toward addressing the region's water security challenges. By treating and reusing wastewater generated from industrial sources, this project reduces dependency on groundwater, thereby conserving a vital resource under severe stress. The project integrates advanced treatment technologies, including physico-chemical treatment, MBBR bioreactors, and membrane filtration systems like ultrafiltration (UF) and reverse osmosis (RO). These processes effectively eliminate contaminants, ensuring high-quality recycled water suitable for industrial reuse and non-potable applications such as landscaping and toilet flushing. Additionally, reuse minimizes the environmental impact of wastewater disposal, reducing pollution in water bodies and protecting aquatic life. This circular approach significantly reduces the reliance on groundwater, a precious natural resource. By minimizing the demand for fresh water, the operations of the plant can contribute to water conservation efforts and alleviate pressure on depleting aquifers.

This project aims to inspire the industry, particularly large multinational corporations, to implement sustainable water management practices. By demonstrating effective strategies for reducing captive water consumption and responsibly managing groundwater, the project hopes to foster a broader adoption of environmentally responsible approaches within the industry.

The wastewater recycle and reuse project aligns closely with several United Nations Sustainable Development Goals (SDGs) as it addresses interconnected global challenges by conserving freshwater, reducing environmental pollution, and enhancing resilience to climate change, which are core tenets of the SDGs. The ability of the project to integrate environmental, social, and economic benefits ensures they contribute to the SDG framework's holistic vision of creating a balanced, inclusive, and sustainable future for all.

A9.1 Objectives vs Outcomes

Objectives:
The primary objective of the wastewater recycling project at the industrial facility is to enhance water security by significantly reducing groundwater abstraction through the implementation of advanced Common Effluent Treatment Plants (CETPs). The project aims to recycle wastewater generated from

domestic and industrial processes using state-of-the-art treatment technologies, including physico-chemical treatment, MBBR bioreactors, adsorption, ultrafiltration (UF), and reverse osmosis (RO). By increasing the total CETP capacity to 1.3 MLD and recycling treated water for non-potable applications within the plant, the project seeks to minimize the reliance on freshwater sources and contribute to sustainable water management practices. Furthermore, the project aims to demonstrate the economic and environmental viability of adopting high-efficiency water treatment systems, thereby encouraging other industries to implement similar solutions for resource conservation. An additional objective is to comply with stringent environmental regulations by achieving high reductions in BOD, COD, and suspended solids, ensuring that the treated effluent meets regulatory discharge standards. This contributes to environmental protection and safeguards local water bodies from contamination. The project also aims to optimize operational efficiency by utilizing high-recovery RO systems with vertical multistage pumps and FRP pressure vessels, thereby enhancing energy efficiency and reducing the overall environmental footprint of the wastewater treatment process.

Outcomes:
The implementation of the wastewater recycling project successfully achieved the desired outcomes by significantly reducing groundwater abstraction by 75-80%, thereby enhancing water security and contributing to sustainable water resource management. By recycling treated wastewater for non-potable applications, the project effectively offset the demand for freshwater, conserving valuable water resources and reducing the environmental impact of industrial water consumption. Additionally, the adoption of advanced treatment technologies, including MBBR bioreactors and high-recovery RO systems, resulted in a substantial reduction in BOD, COD, and suspended solids, ensuring compliance with environmental regulations and preventing water pollution. The high efficiency of the RO system and the strategic utilization of reject water for plantation further demonstrated the project's commitment to resource optimization and circular water management. The project also showcased the successful integration of sustainable practices within industrial operations, setting a benchmark for other industries to follow. By achieving operational efficiency and environmental sustainability, the project not only contributed to water security but also enhanced the industry's reputation as an environmentally responsible entity. Moreover, the project's success in demonstrating the economic viability of water recycling systems encouraged broader adoption of similar technologies, thereby supporting regional and national water conservation initiatives.

A9.2 Interventions by Project Owner / Proponent / Seller

The successful implementation of the wastewater recycling project at the industrial facility was achieved through strategic interventions by the project owner. These interventions played a pivotal role in optimizing water management, reducing environmental impact, and promoting sustainability. The key interventions are as follows:

1. **Comprehensive Planning and Design**

- **Assessment of Wastewater Generation:** A detailed analysis of wastewater generation from domestic sources and the humidity plant was conducted to design an efficient treatment system. This included evaluating flow rates, contaminant levels (BOD, COD, suspended solids), and variability in wastewater composition.

- **Custom-Tailored Design Approach:** The CETPs at were designed using advanced treatment technologies, including physico-chemical treatment, MBBR bioreactors, adsorption, ultrafiltration (UF), and high-recovery reverse osmosis (RO). This ensured maximum water recovery while achieving high-quality treated water suitable for non-potable applications.

- **Integration of High-Efficiency Systems:** The project incorporated energy-efficient components such as vertical multistage pumps and FRP pressure vessels to minimize power consumption and operational costs.

2. **Sustainable Water Management Practices**

   - **Water Recycling and Reuse:** Treated wastewater was strategically recycled within the plant for non-potable uses, such as in the humidity plant and other industrial applications. This intervention reduced groundwater abstraction by 75-80%, contributing significantly to water security.

   - **Circular Water Management:** Reject water from the RO system was innovatively utilized for plantation purposes, showcasing a closed-loop approach to water management. This minimized waste generation and supported sustainable landscaping practices.

3. **Stakeholder Engagement and Capacity Building**

   - **Collaboration with Technology Providers:** The project owner collaborated with leading technology providers to ensure the deployment of best-in-class wastewater treatment solutions. This partnership facilitated the integration of cutting-edge technology for optimized performance.

4. **Regulatory Compliance and Environmental Stewardship**

   - **Strict Adherence to Environmental Standards:** The project ensured compliance with stringent environmental regulations by achieving significant reductions in BOD, COD, and suspended solids, safeguarding local water bodies from contamination.

   - **Promotion of Best Practices:** By showcasing successful wastewater recycling and reuse, the project demonstrated the economic and environmental viability of advanced water treatment systems, encouraging wider adoption in the industry.

5. **Monitoring, Evaluation, and Continuous Improvement**

- **Automated Monitoring Systems:** The project implemented real-time monitoring systems to track water quality parameters, system performance, and operational efficiency, ensuring optimal functioning of the treatment plants.
- **Performance Evaluation and Feedback Mechanisms:** Regular assessments were conducted to evaluate the effectiveness of the CETPs. Feedback mechanisms were established to incorporate stakeholder inputs and continuously improve the treatment processes.

6. **Community and Environmental Impact**

- **Water Security and Conservation:** By reducing groundwater extraction and promoting water recycling, the project contributed to long-term water security for the community and the industry.
- **Environmental Awareness and Advocacy:** The project showcased the potential of advanced wastewater treatment technologies to conserve natural resources, setting an example for other industries to implement sustainable practices.

A.10. Feasibility Evaluation

PP has performed a feasibility study as per a detailed project description report. The findings and results of the report have been taken into consideration, the evaluation also established that the installed ETP by the PP is robust and can handle wastewater effluent fluctuations in load easily.

A.11. Ecological Aspects & Sustainable Development Goals (SDGs):

a) Inundation of Habitated Land:

The project helps prevent land inundation by efficiently managing wastewater through an advanced Effluent Treatment Plant (ETP) and evaporators, reducing uncontrolled discharge. In the absence of such systems, untreated industrial effluents could flood surrounding land areas, leading to soil contamination and loss of productive land. By implementing wastewater recycling, the project ensures that excess water is treated and reused rather than indiscriminately released, preventing potential habitat displacement and waterlogging in nearby settlements.

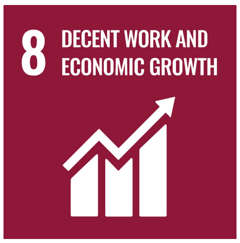
b) Creation of Water Logging and Vector Disease Prevention Mitigation

Uncontrolled discharge of industrial effluents and untreated sewage often leads to stagnant water accumulation, creating breeding grounds for mosquitoes and other disease-carrying vectors, which increase the risk of malaria, dengue, and other waterborne diseases. The project mitigates this risk by treating and reusing wastewater, ensuring that water does not stagnate in open areas. The use of high-recovery reverse osmosis (RO) and evaporators further ensures minimal residual wastewater, significantly reducing the chances of waterlogging and associated health hazards.

c) Deterioration of Quality of Groundwater

India faces severe groundwater depletion and contamination due to unregulated extraction and industrial pollution. In the absence of this project, the Project Proponent (Vettuvapalayam Common Effluent Treatment and Recycling Plant Private Limited) would have continued relying on groundwater, further depleting this critical resource. Additionally, untreated effluent discharge contributes to groundwater contamination, affecting both human consumption and agricultural productivity. By implementing a closed-loop water recycling system, the project reduces groundwater dependency, prevents pollutants from infiltrating aquifers, and supports long-term water sustainability in the region.

Sustainable Development Goals Targeted	Most relevant SDG Target/Impact	Indicator (SDG Indicator)
	13.2: Integrate climate change measures into national policies, strategies and planning	Recycling and reusing wastewater is an effective solution for climate change adaptation because it helps mitigate the impacts of droughts, floods, and other extreme weather events that are becoming increasingly common due to climate change due to water scarcity. The quantity of wastewater recycled and reused by the PP is the SDG indicator.
	3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	The PP showcases how recycling and reusing wastewater can prevent depletion of natural water reserves and prevent water scarcity during droughts. The hazardous impact of industrial wastewater is now avoided due to this project. The PP ensures water availability in water-scarce zones that help promotes healthy lives and well-being in the region.

	6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	The PP has showcased recycling and safe reuse of approximately **178,577 KL** within the industry during this monitored period, which directly correlates to this indicator 6.3.
	8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	Number of jobs created and also the Number of people trained as part of this project activity.

A.12. Recharge Aspects :

NA

Water Budget Component	Typical Estimated Uncertainty (%)	Description
Surface Inflow	1%	In accordance with the RoU Standard version 7, and considering that the flow meters are calibrated, PP has accounted for a 1% uncertainty factor in both inflow and outflow volumes to maintain a conservative approach. Consequently, an uncertainty factor of 0.98 is applied to all ROUs.
Precipitation	NA	Not available
Surface Outflow	1%	In accordance with the RoU Standard version 7, and considering that the flow meters are

		calibrated, PP has accounted for a 1% uncertainty factor in both inflow and outflow volumes to maintain a conservative approach. Consequently, an uncertainty factor of 0.98 is applied to all ROUs.
Evapotranspiration	NA	Not available
Deep Percolation	NA	Not available

A.13. Quantification Tools

Baseline scenario

The baseline scenario is the situation where, in the absence of the project activity, the PP would have had implemented one or all of the below mentioned options:

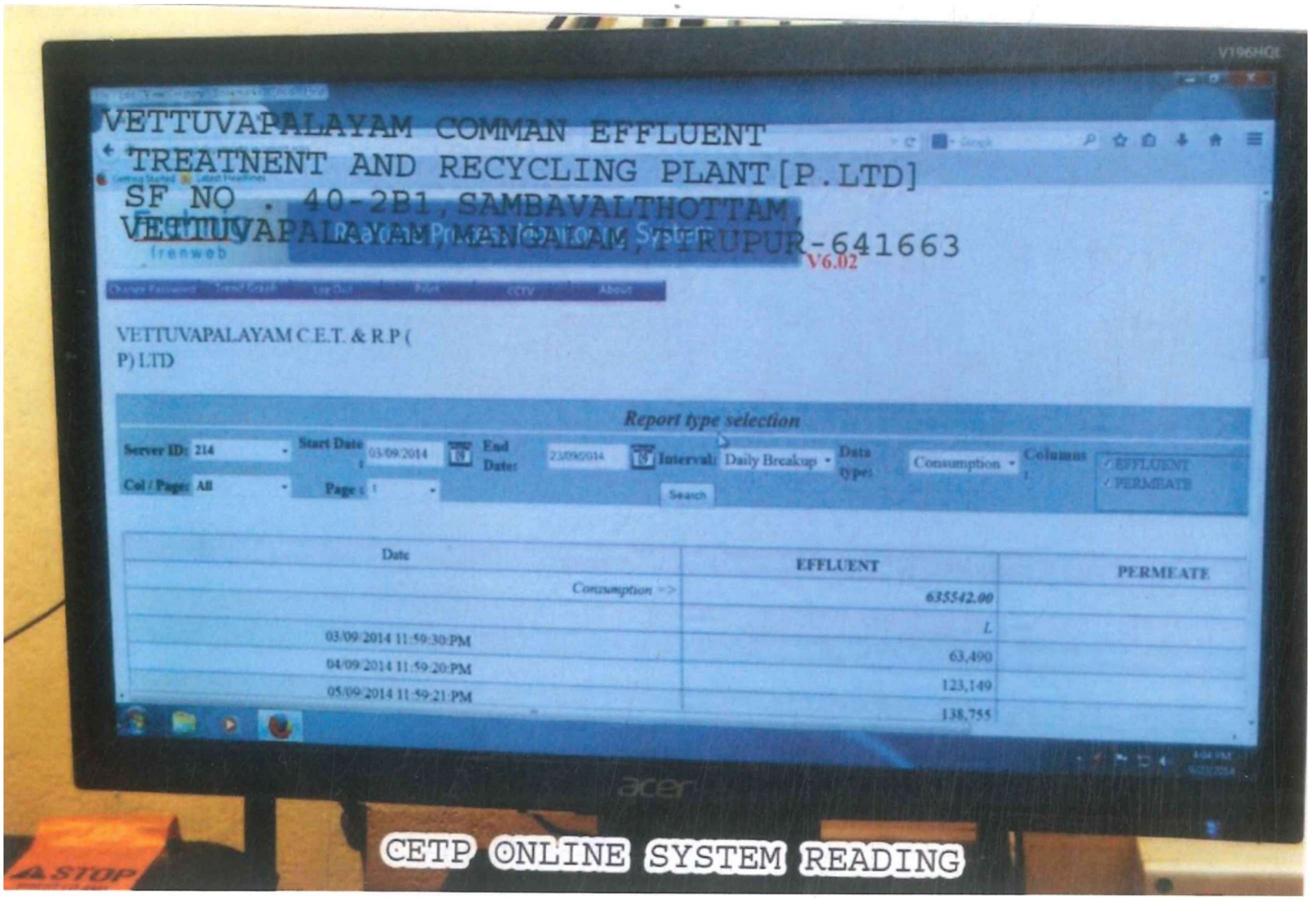
a) installed multiple bore wells within the project boundary which would have depleted the local groundwater resources (aquifers); and/or

b) diverted existing safe drinking water resources from the surrounding residential area; and/or

c) discharged the ETP effluent without further treatment, recycling and reuse.

Hence the baseline scenario applicable is: "the net quantity of treated ETP effluent / wastewater that would be discharged directly into the local drain/sewer without further being recycled and/or reused daily post treatment per year

Year	RoUs with Uncertainty Factor of 0.98 (Rounded Down)
2016	1703
2017	16,565
2018	11,299
2019	13,010
2020	17,670
2021	24,383
2022	25,375
2023	30,084
2024	38,488
Total (RoU)	**178,577**



A.14. UWR Rainwater Offset Do No Net Harm Principles

According to the UWR RoU Standard principles, the wastewater recycling project accomplishes the following:

1. **Improved Sustainable Water Yield:** The project activity significantly enhances sustainable water yield in the region by reducing dependence on groundwater sources. The installation of advanced Common Effluent Treatment Plants (CETPs) with a combined capacity of 1.3 MLD enables the recycling and reuse of treated wastewater for non-potable purposes, such as in the humidity plant and industrial applications. This intervention reduces groundwater abstraction by 75-80%, thereby conserving vital groundwater reserves and contributing to long-term water security.

   According to the Central Groundwater Board, groundwater exploitation is critically high in industrial regions, leading to aquifer depletion and water scarcity. By treating and reusing wastewater, the project minimizes the need for freshwater withdrawal, ensuring a sustainable water balance in the area. This initiative not only demonstrates responsible water management but also reduces the burden on local water resources, promoting ecological sustainability.

2. **Preventing Unutilized Water and Rainwater from Entering Storm Drains:** The project effectively prevents unutilized wastewater from being discharged into storm drains or sewers by implementing a closed-loop water management system. The state-of-the-art CETPs are designed to treat 1.3 MLD of wastewater, ensuring that all effluents are processed and recycled within the facility.
   This approach not only prevents pollution of natural water bodies but also showcases an innovative method of capturing and reusing unutilized water resources. By integrating ultrafiltration (UF) and high-recovery reverse osmosis (RO) systems, the project maximizes water recovery, reducing wastewater discharge and enhancing resource efficiency.

3. **Conservation and Storage of Excess Water for Future Use:** The project activity conserves and stores excess treated water for future use, thus reducing reliance on external water sources. With the high-recovery RO system, the project achieves a recovery rate of approximately 75-80%, significantly conserving water resources. The stored treated water is strategically reused within the plant for non-potable purposes, ensuring its availability during periods of water scarcity.
   Additionally, the reject water from the RO process is utilized for plantation purposes within the facility, showcasing an innovative and sustainable approach to water management. This not only minimizes water wastage but also supports green landscaping, contributing to environmental sustainability.

4. **Enhancing Locals' Participation and Professional Development:** The project promotes gender inclusivity and women's empowerment by actively involving women in water management and operational roles. Through strategic capacity-building programs, the project provides skill development and employment opportunities for local women, enhancing their participation in sustainable water management practices.. This empowerment initiative not only supports gender equality but also contributes to community well-being by creating livelihood opportunities.
   By integrating social sustainability with environmental stewardship, the project sets an example of holistic community development, aligning with the UWR RoU Standard's principles of ethical and inclusive practices.

Category of the Industry :

RED

CONSENT ORDER NO. 2408158248160 DATED: 02/04/2024.

PROCEEDINGS NO.T5/TNPCB/F.0500TPN/RL/TPN/W/2024 DATED: 02/04/2024

SUB: Tamil Nadu Pollution Control Board - RENEWAL OF CONSENT – M/s. VETTUVAPALAYAM COMMON EFFLUENT TREATMENT AND RECYCLING PLANT PRIVATE LIMITED , S.F.No. R.S.No.30/1,2&3, MANGALAM village, Tiruppur south Taluk and Tiruppur District - Renewal of Consent for the operation of the plant and discharge of sewage and/or trade effluent under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988 (Central Act 6 of 1974) – Issued- Reg.

REF: 1. Board Proc. No. T5/TNPCB/F.0485TPN/RL/TPN/W&A/2023 dated: 24.03.2023

2. DEE/TPR(N), IR.No : F.0500TPN/RL/AEE/TPN/2024 dated 27.03.2024

RENEWAL OF CONSENT is hereby granted under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974 as amended in 1988 (Central Act, 6 of 1974) (hereinafter referred to as "The Act") and the rules and orders made there under to

The Director
M/s . VETTUVAPALAYAM COMMON EFFLUENT TREATMENT AND RECYCLING PLANT PRIVATE LIMITED
S.F No. R.S.No.30/1,2&3
MANGALAM Village
Tiruppur south Taluk
Tiruppur District.

Authorising the occupier to make discharge of sewage and /or trade effluent.

This is subject to the provisions of the Act, the rules and the orders made there under and the terms and conditions incorporated under the Special and General conditions stipulated in the Consent Order issued earlier and subject to the special conditions annexed.

This RENEWAL OF CONSENT is valid for the period ending **March 31, 2026**

S RAGUPATHI Digitally signed by S RAGUPATHI Date: 2024.04.02 19:14:23 +05'30'

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

Category of the Industry :

RED

CONSENT ORDER NO. 2506262372600 DATED: 07/03/2025.

PROCEEDINGS NO.T5/TNPCB/F.0500TPN/RL/TPN/A/2025 DATED: 07/03/2025

SUB: TNPC Board-Consent for Establishment FOR EXPANSION- I VETTUVAPALAYAM COMMON EFFLUENT TREATMENT AND RECYCLING PLANT PRIVATE LIMITED , S.F. No. R.S.No.30/1,2&3, MANGALAM Village, Tiruppur south Taluk, Tiruppur District- for the establishment or take steps to establish the industry for Expansion under Section 21 of the Air(Prevention and control of Pollution)Act,1981, as amended in 1987 (Central Act, 14 of 1981)- Issued- Reg. (Industry User ID- R15TPN2112141)

REF: 1.Board Proc.No.T5/TNPCB/ F.0500TPN/ RM/ TPN/W&A/2024 dated: 02.04.2024
2.DEE/TPR(N), IR.No : F.0500TPN/RL/AE/TPN/2024, dated 15.10.2024
3.CCC Resolution vide Item No. 329-40 dated 24.10.2024
4.CCC Resolution vide Item No. 333-16 dated 27.02.2025

Consent to establish or take steps to establish for Expansion is hereby granted under Section 21 of the Air (Prevention and control of Pollution) Act,1981, as amended in 1987 and the Rules and Orders made there under to

The Director,
M/s . VETTUVAPALAYAM COMMON EFFLUENT TREATMENT AND RECYCLING PLANT PRIVATE LIMITED

Authorizing occupier to establish or take steps to establish the industry in the site mentioned below:

S.F No. R.S.No.30/1,2&3
MANGALAM Village
Tiruppur south Taluk
Tiruppur District.

This Consent to establish for Expansion is valid upto **March 31, 2029** , or till the industry obtains consent to operate under Section 21 of the Air (Prevention and control of Pollution) Act, 1981, as amended in 1987 whichever is earlier subject to special and general conditions enclosed.

J JOSEPHINE SAHAYA RANI

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

To
The Director,
M/s.VETTUVAPALAYAM COMMON EFFLUENT TREATMENT AND RECYCLING PLANT PRIVATE LIMITED,
S.F.No.30/1,2 & 3,Ayyapillai Thottam, Somanur Road,Vettuvapalayam, Mangalam , Tiruppur District

Pin: 641663

Category of the Industry :

RED

CONSENT ORDER NO. 2506262372600 DATED: 07/03/2025.

PROCEEDINGS NO.T5/TNPCB/F.0500TPN/RL/TPN/A/2025 DATED: 07/03/2025

SUB: TNPC Board-Consent for Establishment FOR EXPANSION- I VETTUVAPALAYAM COMMON EFFLUENT TREATMENT AND RECYCLING PLANT PRIVATE LIMITED , S.F. No. R.S.No.30/1,2&3, MANGALAM Village, Tiruppur south Taluk, Tiruppur District- for the establishment or take steps to establish the industry for Expansion under Section 21 of the Air(Prevention and control of Pollution)Act,1981, as amended in 1987 (Central Act, 14 of 1981)- Issued- Reg. (Industry User ID- R15TPN2112141)

REF: 1.Board Proc.No.T5/TNPCB/ F.0500TPN/ RM/ TPN/W&A/2024 dated: 02.04.2024
2.DEE/TPR(N), IR.No : F.0500TPN/RL/AE/TPN/2024, dated 15.10.2024
3.CCC Resolution vide Item No. 329-40 dated 24.10.2024
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Consent to establish or take steps to establish for Expansion is hereby granted under Section 21 of the Air (Prevention and control of Pollution) Act,1981, as amended in 1987 and the Rules and Orders made there under to

The Director,
M/s . VETTUVAPALAYAM COMMON EFFLUENT TREATMENT AND RECYCLING PLANT PRIVATE LIMITED

Authorizing occupier to establish or take steps to establish the industry in the site mentioned below:

S.F No. R.S.No.30/1,2&3
MANGALAM Village
Tiruppur south Taluk
Tiruppur District.

This Consent to establish for Expansion is valid upto **March 31, 2029** , or till the industry obtains consent to operate under Section 21 of the Air (Prevention and control of Pollution) Act, 1981, as amended in 1987 whichever is earlier subject to special and general conditions enclosed.

J JOSEPHINE SAHAYA RANI

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

To
The Director,
M/s.VETTUVAPALAYAM COMMON EFFLUENT TREATMENT AND RECYCLING PLANT PRIVATE LIMITED,
S.F.No.30/1,2 & 3,Ayyapillai Thottam, Somanur Road,Vettuvapalayam, Mangalam , Tiruppur District

Pin: 641663

A.15. Scaling Projects-Lessons Learned-Restarting Projects

1. **Challenges in Scaling Wastewater Recycling Projects**

    - **Public Perception and Acceptance:** One of the major challenges faced in scaling wastewater recycling projects is public perception. In many regions, the notion of using treated wastewater for industrial or non-potable applications faces resistance due to misconceptions about safety and quality. Lessons from other projects indicate that effective communication strategies are crucial to changing public perception. Engaging stakeholders through awareness programs and transparent information dissemination can help build public trust and acceptance.

    - **Cost and Operational Challenges:** Initial capital investment and operational costs can be high for advanced wastewater recycling technologies such as ultrafiltration (UF) and reverse osmosis (RO). Additionally, maintenance of sophisticated systems requires skilled personnel, which can be a limiting factor for scaling up. Projects must explore cost-effective solutions, optimize operational efficiencies, and seek revenue from carbon credits or water credits to ensure financial sustainability.

    - **Regulatory and Policy Barriers:** Inconsistent regulations and lack of comprehensive policies for wastewater reuse can hinder project scaling. Coordinated efforts with regulatory authorities are necessary to establish clear guidelines that promote wastewater recycling while ensuring environmental safety.

2. **Lessons Learned from Project Implementation**

    - **Integration with Industrial Processes:** The success of the wastewater recycling project is largely attributed to its seamless integration with the existing industrial processes. By recycling treated water for non-potable applications like the humidity plant and plantation activities, the project effectively reduces groundwater abstraction by 75-80%. This approach highlights the importance of designing projects that align with the operational needs of industries, ensuring continuous demand and utilization of recycled water.

    - **High Efficiency and Sustainability through Advanced Technologies:** The use of high-recovery RO systems and energy-efficient vertical multistage pumps has demonstrated significant water conservation and energy savings. Implementing state-of-the-art technologies that enhance efficiency and sustainability is a key takeaway for scaling similar projects.

    - **Demonstrating Tangible Environmental and Economic Benefits:** The project's ability to significantly reduce BOD, COD, and suspended solids while ensuring cost savings from reduced groundwater usage has been instrumental in gaining stakeholder support. It underscores the importance of showcasing both environmental and economic benefits to drive acceptance and scalability.

3. **Restarting Projects and Overcoming Setbacks**

    - **Learning from Abandoned Initiatives:** In some instances, wastewater recycling projects are abandoned due to financial constraints, technical failures, or lack of public acceptance. However, with the availability of revenue from water credits (RoUs) under the UWR Program, previously abandoned projects can be revived. This financial mechanism provides a much-needed incentive for industries to voluntarily treat and reuse wastewater, ensuring long-term sustainability.

    - **Adapting to Changing Regulations and Market Dynamics:** The wastewater recycling industry is influenced by evolving regulations and market conditions. Projects must be agile in adapting to new policies, technological advancements, and changing stakeholder expectations. Revisiting and updating project designs to align with current standards is essential for restarting stalled projects.

    - **Building Resilience through Strategic Partnerships:** Collaboration with stakeholders, including government agencies, technology providers, and financial institutions, plays a vital role in restarting and scaling wastewater recycling projects. Strategic partnerships can provide access to funding, technical expertise, and policy support, ensuring resilience against future setbacks.

4. **Roadmap for Scaling and Expansion**

    - **Replicability and Standardization:** To achieve large-scale implementation, standardizing processes and replicating successful models in different industrial settings is crucial. The current project demonstrates a replicable model of wastewater recycling that can be adapted to various industries facing water scarcity challenges.

    - **Leveraging Carbon and Water Credits for Financial Viability:** The sale of water credits under the UWR Program presents an opportunity to create a revenue stream that supports scaling and expansion. This financial model incentivizes industries to adopt wastewater recycling practices, ensuring economic feasibility while contributing to environmental sustainability.

    - **Community Engagement and Awareness Building:** Public acceptance remains a challenge, especially in regions where recycled water usage is not culturally accepted. Building community awareness through targeted communication campaigns, stakeholder workshops, and transparent reporting of environmental and health benefits is critical for scaling up.