Shoolini University

6 CLEAN WATER AND SANITATION

WASTEWATER TREATMENT

2025

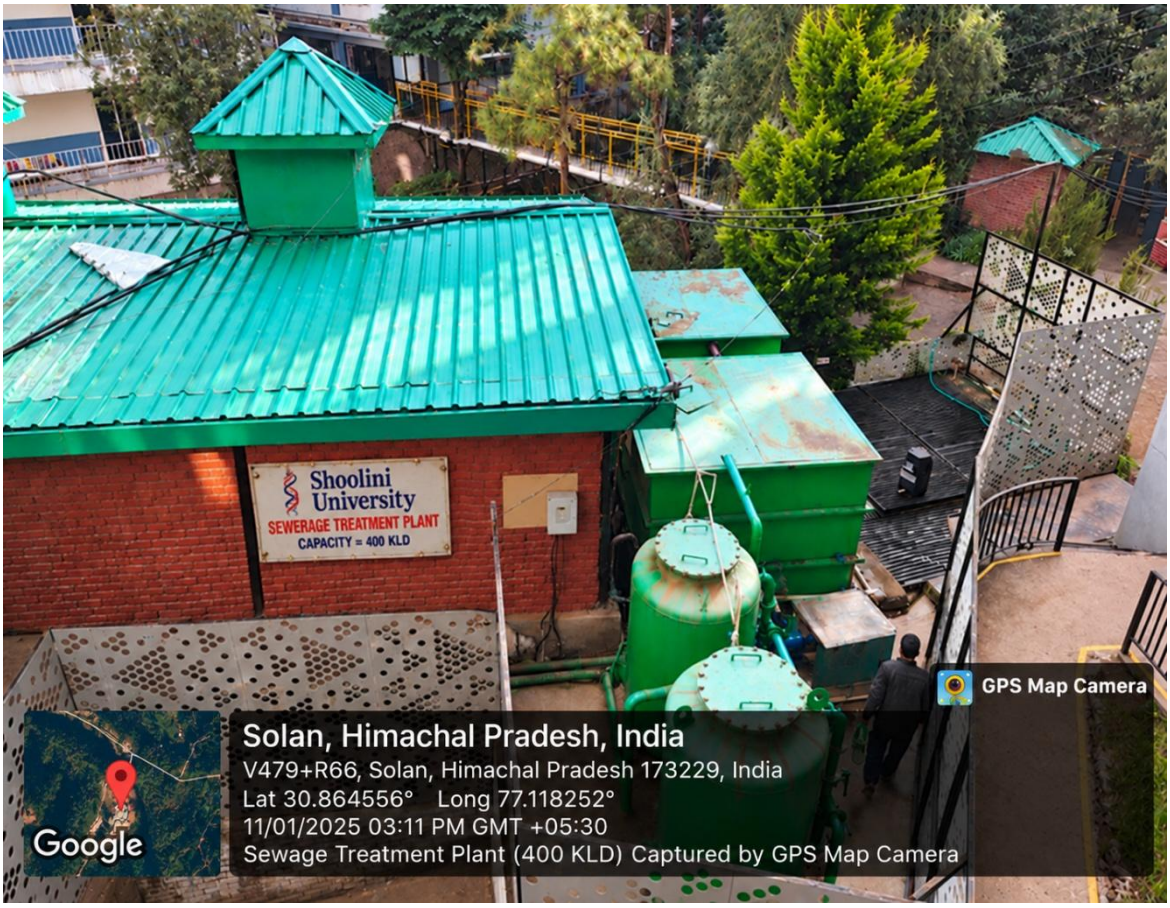


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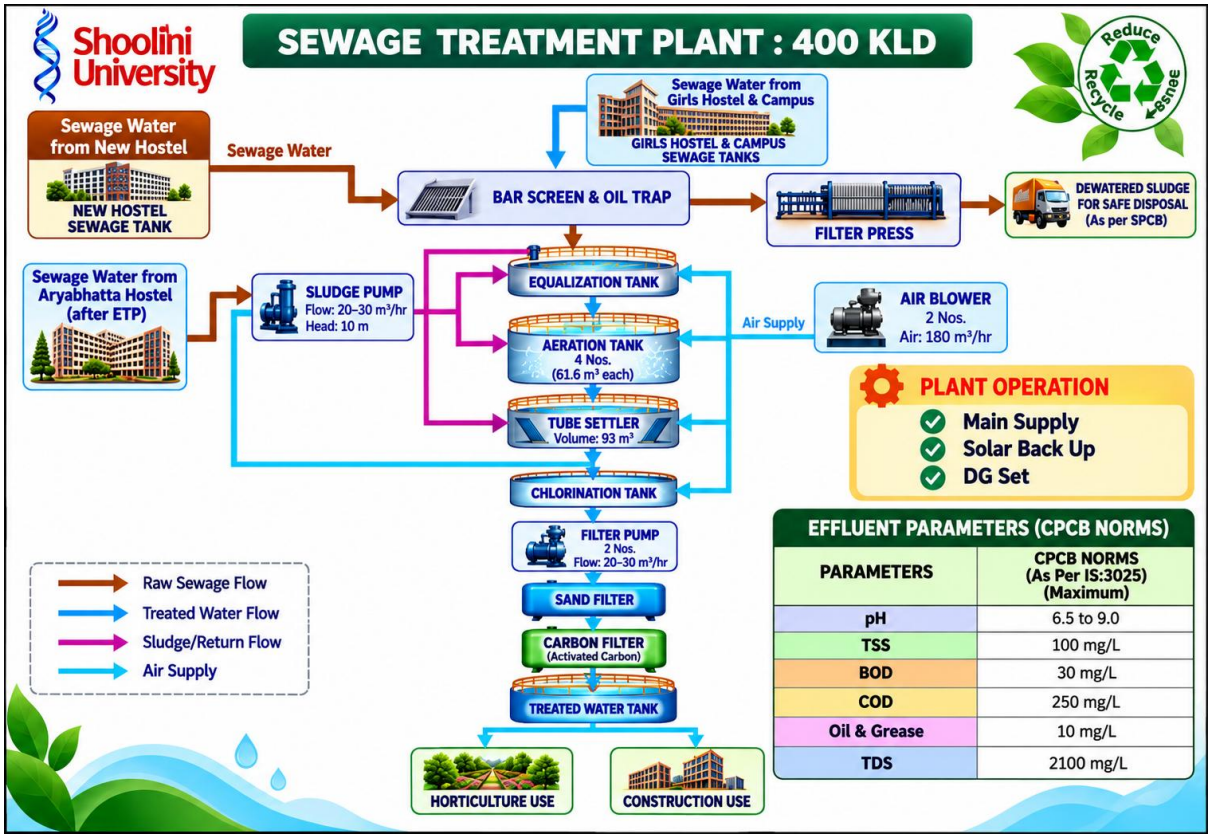
6.3.1. Wastewater treatment

Shoolini University has strengthened its commitment to responsible wastewater management and environmental sustainability through its **upgraded Sewage Treatment Plant (STP)**. The University is dedicated to the effective treatment of wastewater and the maximum reuse of treated water for suitable non-potable purposes, thereby promoting water conservation and resource efficiency.

The University operates a Sewage Treatment Plant (STP) with a treatment capacity of **400 Kilolitres per Day (KLD)**. In addition, an **Effluent Treatment Plant (ETP) with a capacity of approximately 50 KLD** is used, where required, for the treatment of laboratory effluents before their integration into the main wastewater treatment stream. The University's treatment system combines biological treatment processes with **activated carbon-based treatment technologies** to achieve **effective purification of wastewater**. The treated water is subsequently reused for various non-potable applications, thereby reducing the demand for freshwater and supporting the University's commitment to sustainable water management.



Sewage Treatment Plant having 400 KLD capacity



Process Flow Diagram of the 400 KLD Sewage Treatment Plant

This integrated approach supports the University's efforts to minimize wastewater discharge, improve water reuse, and strengthen sustainable water management practices.

The treatment and reuse of wastewater are undertaken through the following key stages:

1. Wastewater collection

Wastewater generated from different parts of the University campus is collected through a well-designed underground sanitary drainage network and conveyed to the central Sewage Treatment Plant (STP).

Major sources of wastewater include:

- Bathrooms and sanitation facilities
- Kitchens and mess areas
- Academic and administrative buildings
- Residential and hostel facilities
- Laboratories and other associated facilities

In certain cases, laboratory effluents are treated through an Effluent Treatment Plant (ETP) with a capacity of approximately 50 KLD before being introduced into the main STP stream.

This centralized collection system facilitates the systematic transportation and treatment of wastewater generated across the campus.

2. Pre-liminary Treatment (Screening and Grit Removal)

The collected wastewater first undergoes pre-liminary treatment, which removes large and heavy physical impurities before the wastewater enters the subsequent treatment stages.

Screening

The wastewater passes through bar screens, which remove large solid materials such as:

- Plastic
- Cloth
- Paper
- Other coarse debris

This process prevents unwanted materials from entering and damaging or obstructing the downstream treatment equipment.

Grit Removal

Following screening, the wastewater passes through grit chambers, where heavier inorganic particles such as:

- Sand
- Gravel
- Grit
- Other heavy particulate matter is removed.

This stage protects the treatment equipment and improves the efficiency of the subsequent treatment processes.

3. Primary Treatment (Sedimentation)

After preliminary treatment, the wastewater is directed to a primary sedimentation tank.

During this stage:

- Heavier suspended solids settle at the bottom of the tank as sludge.
- Oil and grease present in the wastewater float to the surface and are removed.
- The partially clarified wastewater is then transferred to the secondary biological treatment stage.

Primary sedimentation reduces the suspended-solid load and prepares the wastewater for efficient biological treatment.



Aeration blowers installed at the Sewage Treatment Plant

4. Secondary Treatment (Biological Treatment in STP)

The University's STP uses a biological treatment process involving activated sludge or Moving Bed Biofilm Reactor (MBBR) technology. In this stage, the wastewater enters aeration tanks where oxygen is supplied to promote the growth and activity of aerobic microorganisms. These microorganisms play an important role in the treatment process by:

- Digesting and decomposing organic matter
- Breaking down harmful biodegradable substances
- Reducing the organic pollution load
- Improving the overall quality of the wastewater

After biological treatment, the wastewater flows into a secondary clarifier, where the microbial biomass settles as secondary sludge. The clarified water then moves to the tertiary treatment stage for further purification.



Treatment process involving activated sludge

5. Tertiary Treatment (Polishing Stage)

The clarified wastewater undergoes tertiary treatment to further improve its quality and make it suitable for designated reuse applications.

Sand Filtration: Sand filters are used to remove fine suspended particles remaining after secondary treatment and to improve water clarity.



Sand filtration unit installed as part of the Sewage Treatment Plant

Activated Carbon Filtration: Activated carbon filters are used to remove residual organic substances, unwanted odour, and other impurities, thereby improving the quality of the treated water.

Disinfection: The treated water is subjected to chlorination or UV disinfection to eliminate or reduce remaining pathogens and microorganisms.

Additional Treatment: Where required for applications, additional membrane filtration or RO treatment may also be used.



Chlorine Dosing, Settler, and Activated Carbon Filtration Tanks for Wastewater Treatment

6. After wastewater treatment Storage and Reuse

After completion of the treatment and disinfection processes, the final treated water is collected and stored in a separate storage tank.

The treated wastewater is reused for suitable non-potable purposes, including:

- Irrigation of lawns and gardens
- Toilet flushing
- Construction purposes
- Cleaning and laboratory applications
- Groundwater recharge through soak pits

The reuse of treated wastewater helps reduce the University's dependence on freshwater resources and promotes efficient utilization of available water resources.

7. Sludge Handling and Management

Sludge is generated during both primary and secondary wastewater treatment processes. The generated sludge is managed systematically through appropriate treatment and handling procedures.

The sludge management process includes:

- Thickening of sludge
- Dewatering using drying beds or filter presses
- Appropriate handling and disposal
- Beneficial reuse, where applicable

The dewatered sludge may be used as compost or disposed of appropriately in accordance with regulatory norms. This approach supports the University's efforts to promote resource recovery and sustainable waste management.

8. Monitoring and Quality Testing

Regular monitoring and water-quality testing are carried out to assess the performance of the wastewater treatment system and to ensure that the treated water meets the required standards.

The major parameters monitored include:

- pH
- BOD
- COD
- TSS
- TDS
- Coliform levels

Water-quality records are maintained by the concerned authorities, and third-party audits are conducted periodically.

The treated wastewater is monitored to ensure compliance with standards prescribed by the Central Pollution Control Board (CPCB). This systematic monitoring process helps ensure the effective functioning of the treatment plant and the suitability of treated water for its intended non-potable applications.

9. Feasibility Report: Wastewater Treatment and Reuse System

A feasibility assessment was conducted to evaluate the technical, environmental, and economic feasibility of the University's wastewater treatment and reuse system. The assessment confirms that the existing 400 KLD Sewage Treatment Plant (STP) and 50 KLD Effluent Treatment Plant (ETP) are operating efficiently and fully meet the requirements of the current campus population and infrastructure.

9.1 Technical Feasibility

The wastewater treatment system incorporates a combination of biological treatment and tertiary treatment technologies. The biological treatment system uses MBBR/activated sludge, followed by tertiary treatment involving:

- Sand filtration
- Carbon filtration
- UV disinfection

The treated water quality complies with CPCB and HP State Pollution Control Board norms, making the treated water suitable for non-potable reuse. Regular maintenance, automation of aeration systems, and the use of energy-efficient blowers support smooth and reliable operation of the treatment system while minimizing downtime.

9.2 Environmental Feasibility

The reuse of treated wastewater for:

- Gardening
- Toilet flushing
- Cleaning
- Groundwater recharge

helps reduce the University's dependence on freshwater resources.

The feasibility assessment indicates that the recycling and reuse of treated wastewater reduces dependence on freshwater sources by approximately 35–40%. The sludge generated during wastewater treatment is dewatered and used as compost, promoting a circular approach to waste management. Overall, the wastewater recycling system significantly minimizes environmental impact and supports the University's Net-Zero Water Campus vision.

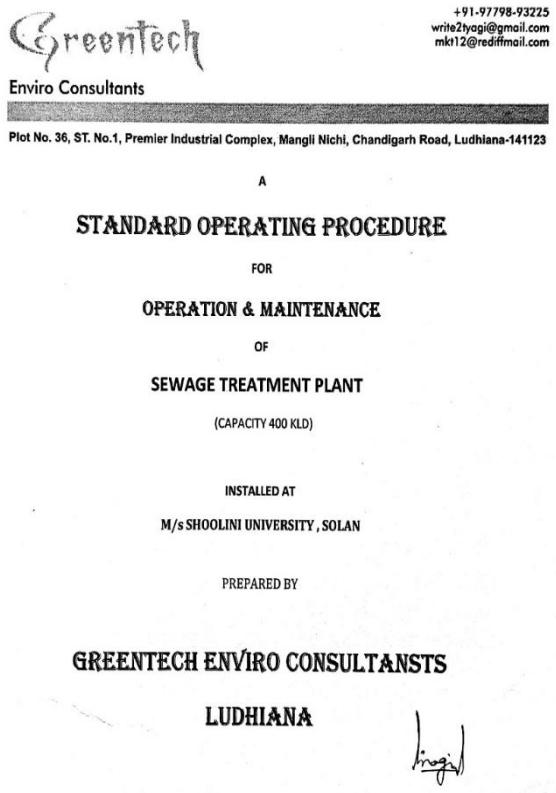
9.3 Economic Feasibility

The reuse of treated wastewater provides economic benefits by reducing dependence on freshwater procurement and municipal water supply charges. Based on the feasibility assessment, the estimated payback period for the STP system is approximately 5–6 years, considering the operational efficiency and benefits obtained through wastewater reuse. The relatively low energy and maintenance requirements of the system contribute to its financial sustainability and support its long-term operation.

9.4 Future Expansion Feasibility

Considering the University's ongoing campus expansion and the construction of additional academic and residential buildings, the wastewater treatment infrastructure has been assessed for future expansion. The STP capacity is scalable up to 600 KLD. Provisions for modular upgradation and renewable energy integration, including the possibility of solar-powered aeration, have been considered as part of the future expansion plan. This scalability will enable the University to accommodate increased wastewater generation associated with future campus development.

Standard operating procedure for Sewage Treatment Plant (400 KLD):



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A

STANDARD OPERATING PROCEDURE

FOR

OPERATION & MAINTENANCE

OF

SEWAGE TREATMENT PLANT

(CAPACITY 400 KLD)

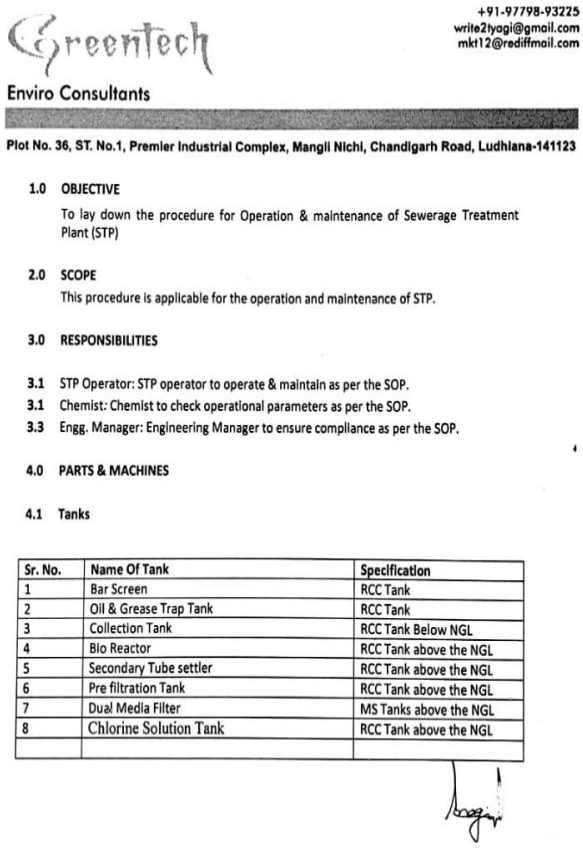
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1.0 OBJECTIVE

To lay down the procedure for Operation & maintenance of Sewerage Treatment Plant (STP)

2.0 SCOPE

This procedure is applicable for the operation and maintenance of STP.

3.0 RESPONSIBILITIES

3.1 STP Operator: STP operator to operate & maintain as per the SOP.
3.1 Chemist: Chemist to check operational parameters as per the SOP.
3.3 Engg. Manager: Engineering Manager to ensure compliance as per the SOP.

4.0 PARTS & MACHINES

4.1 Tanks

Sr. No.	Name Of Tank	Specification
1	Bar Screen	RCC Tank
2	Oil & Grease Trap Tank	RCC Tank
3	Collection Tank	RCC Tank Below NGL
4	Bio Reactor	RCC Tank above the NGL
5	Secondary Tube settler	RCC Tank above the NGL
6	Pre filtration Tank	RCC Tank above the NGL
7	Dual Media Filter	MS Tanks above the NGL
8	Chlorine Solution Tank	RCC Tank above the NGL

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4.2 Pumps & Blowers

Sr. No.	Name of Machine	Function	Remark
1	Sewage Feed Pump 1 &2	To Transfer Sewage from Collection Tank to Primary Tube settler	Sub Merged Pump With Auto On / Off system
2	Air blower 1&2	Root Blower For Bio rectors 01 W 01 S. By	With Auto Change System
3	Sludge Recirculation & Filter Press Feed Pumps	Settled Sludge Secondary Tube settler to Bio Reactor 1	
4	Filter Feed Pump 1 &2	To Feed The Water from Pre Filtration Pit to Sand Filter	With Auto On / Off system 01 W 01 S. By
5	Chlorine Dosing Pump	To dose the Chorine in Treated Sewage	With E dose Metering Pump
6	Sludge Filter Press	To Dewater The Sludge	With Hydraulic Power Pack

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5.0 PROCEDURE

Domestic Effluent from the toilets & Urinals go to the septic tank from where over flow Goes to the STP.

5.1 Bar Screen & Oil – Grease Trap

- Ensure the Frequently Cleaning of Foreign Material & Floating Oil.

5.2 Collection Tank

- Ensure The Feed Pumps in Auto Mode so that the pump starts automatically when the effluent is available.
- Ensure Proper Aeration to avoid any Settling in the Tank.B

5.3 Bio Rector

- Always ensure a running blower for Bio reactor.
- Check the MLSS volume of the Bio Reactor on regular Intervals of 4 Hrs. It should be in the range of 300- 450 ML / Litres. However This Unit Has enough MBBR Media to look after any Shock loading.
- The MLSS may be checked on fortnightly basis it should be in the range of 3500 – 4500 Mg/ Liter.
- Dose the Urea 5 Kg, DAP 1 Kg in Bio reactor on daily Basis.

5.4 Secondary Tube settler

- Recycle the settled sludge to bioreactor 1 partially to Bio rector on the basis of MLSS to maintain the MLSS.
- Drain the excess sludge to Sludge collection Pit on daily basis.

6.0 filtration

- Add @ 6 LPM 0.01% aquas Solution of Cationic Poly electrolyte in Filter Feed Water.
- The Pumps sets are equipped with Auto Level Sensor ensures then in Auto Mode.
- Filters are Down Flow Type.
- Change the Valve to feed the Water from down to upward to back wash the Filters.
- The Back wash water goes to Collection tank.
- Back washing should be done every 12 Hrs .
- Ensure the Trouble Free Movement of Treated Water Meter & Check it on every 4 Hrs intervals.

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7. 0 Chlorination

- Destroy any Traces of Bacteria the Aqua Solution of Sodium Hypochlorite is Dosed by The Dosing Pump. (Add 5 Liters of Sod. Hypo Chlorite in 45 Liters of Waters.) Dose this Solution in required concentration after checking the initial Chlorine Demand testing at site once in a day.

8.0 Sludge Filter Press

- The Collected sludge In Sludge Pit will be de-watered by sludge Filter Press.
- Add enough Solution of Cationic Poly Electrolyte to enhance filtration.
- Filtrate Water will go to the Collection Pit.
- Dewatered Sludge should be Disposed after digestion in Sludge Drying Bed.

Dos & Don't Dos

- Never operate the Blowers In a valve OFF position.
- Don't run a blower For More Than 4 Hrs.
- Always Check the Blowers for Oil Leakage, Grease the bearings
- Check the belt tension, alignment, Nut Bolts abnormal Noise.
- Clean air filter with a compress air.
- Follow the Blower manual for Maintenance.
- Never Run the Effluent Pump Dry, Check the seals / Glands on daily basis.
- Use Lubricants / Greasing as per manufacturer instructions.
- Use The Chemicals of Good Quality.
- Drain the Water from The Air Grids by the Drain Line on Daily Basis.
- Never Disturb the Level Sensors of the Pumps.
- Never Disturb the Air Distribution Valves