6.3

Water Usage and Care

6.3.1 Waste Water Treatment Process

MRIIRS Weblink to SDG 6:

https://mriirs.edu.in/sdg06-clean-water-and-sanitation/

Waste Water Treatment Process

MRIIRS has installed a **200KL/Day** Sewage Treatment Plant (STP) to treat the sewage generated within the campus. Underground drains are constructed connecting all the buildings to the STP. The site of STP is kept in the down slope end of the campus, so as to facilitate the gravitational movement of sewage to STP. The detailed procedure of collection and treatment has been depicted as schematic diagram of STP. Annual discharge of STP is **1810 KL (2021-22).** From the measurement it is calculated that **Av 5.7KL/Day** discharge obtained from STP. It uses to generate sufficient treated waste water per day to irrigate **2.87ha** planted landscape within the lush green campus and for flushing purposes. The output water quality of STP is maintained keeping Biochemical Oxygen Demand (BOD) within permissible level. Frequent analysis of output water is done to keep check on its quality.

As evidence in support to 6.3.1, a **detailed report on STP including components and process description, monthly records of MRIIRS STP discharge and Geotagged photo graphs of STP** have been provided. A link to **video of STP and Geotagged link Google maps showing STP** at MRIIRS has also been provided.

All the data are available in public domain through web site of MRIIRS.

Report

on

Sewage Treatment Plant (STP)

installed at MRIIRS

- ✓ **Video of STP installed at MRIIRS**

- ✓ **Geotag Link to Google Maps showing STP installed at MRIIRS:**

https://www.google.co.in/maps/place/STP/@28.4501691,77.2854833,18z/data=!4m12!1m6!3m5!1s0x390ce0ab6fec0aab:0x87c9e10e1ae0b0fc!2sManav+Rachna+International+Institute+Of+Research+And+Studies!8m2!3d28.4503781!4d77.2837474!3m4!1s0x390ce76550791101:0x258f2807dc40ea99!8m2!3d28.4501966!4d77.2875689

INTRODUCTION:

Sewage treatment (domestic wastewater treatment, municipal waste water treatment) is a type of wastewater treatment which aims to remove contaminants from sewage to produce an effluent that is suitable for discharge to the surrounding environment or an intended reuse application, thereby preventing water pollution from raw sewage discharges. Such a system is now an indispensable, incumbent and thus a prerequisite in fulfilling an institution's obligation and responsibility to the environment. Such a system is also serviceable in the campus. This report examines the said system.

Status of STP at MRIIRS: The sewage generated in the campus is collected and processed at installed STP of 200 m^3/day capacity. It can be noted from the results that the performance of plant is adequate to achieve discharge standards with respect to Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS).

Table 1: Characteristics of sample

Parameters	Raw Sewage	Treated Water
pH	6.53	6.54
Oil and Grease	< 2	< 2
Odour	Faint	Odourless
TSS (mg/L)	112	29
BOD (mg/L)	46	8
COD (mg/L)	660	60

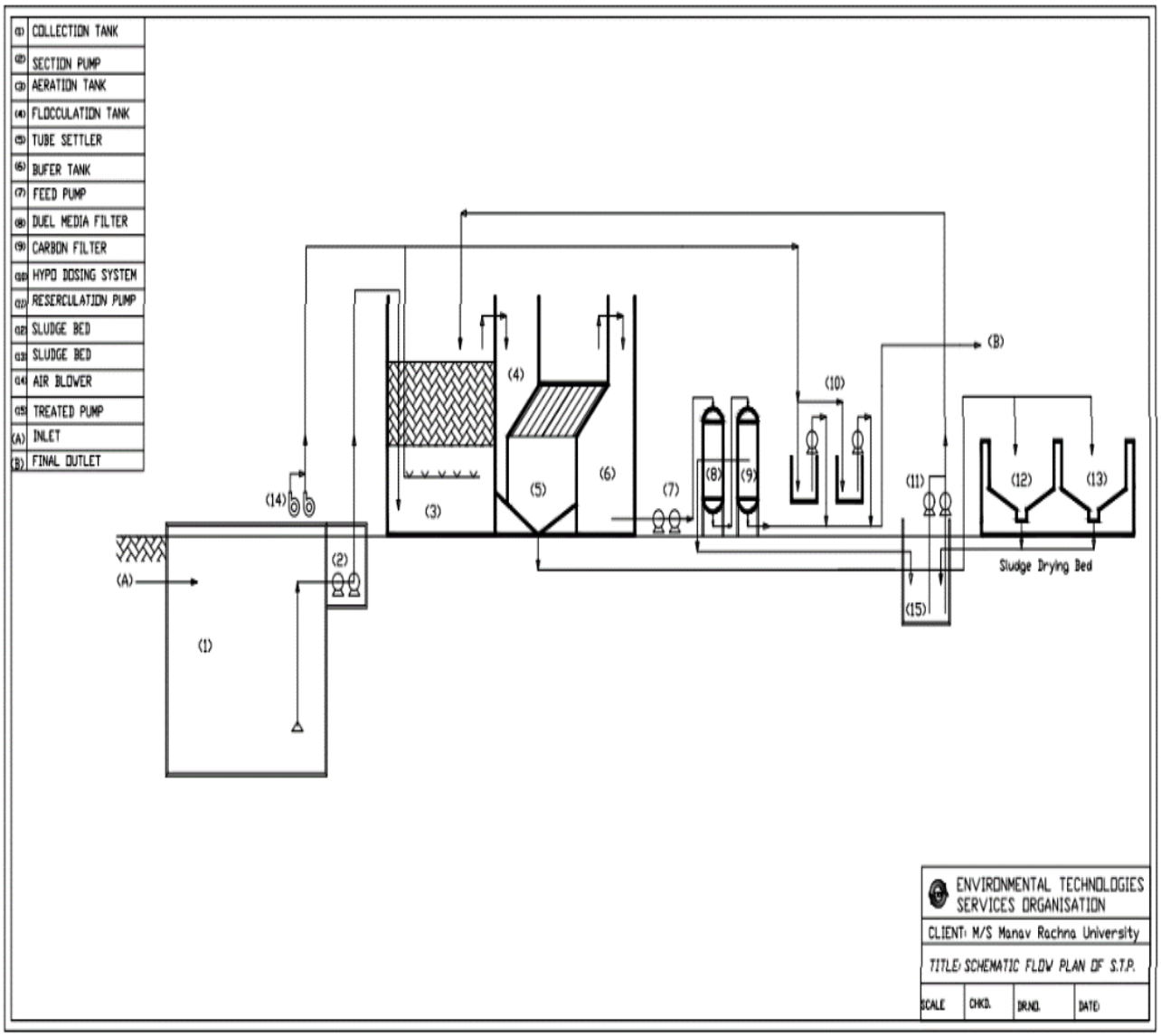
Process description

The sewage treatment plant has been designed based on the following criteria:

The oil & grease trap has been installed at three locations of campus canteen to avoid any load of oil & grease in STP System. The raw sewage coming from the campus is constantly pumped to the aeration tank, in which four air blower is fixed to supply sufficient oxygen needed for metabolizing organic compounds in the wastewater. In this process, the majority of organic matter present is oxidized by the bacterial biomass in the system. Aeration for mixing and oxidation is done by diffused aeration process (fine pore diffusers). After aeration the water is allowed to go into the tube settler unit to allow for sedimentation and settling in which multiple

tubular channels are provided at an angle of 60 degrees and adject to each other. This helps in increasing the settling area effectively. After aeration and settling the water is pumped to clean water and then pumped passed through the pressure sand filter, activated carbon filter to remove the residual suspended solids, organic traces and odour, is then chlorinated for disinfection. The treated water is collected in the final sump. The treated water from final sump can be used for gardening through final pumping system.

Schematic diagram of STP



The excess bio-sludge from the secondary clarifier tank (biological system) is let out to sludge drying beds for drying. The dried sludge can be used as manure. The processed and treated water is used for maintaining green belt.

Components of STP

- MBBR aeration tank
- Tube settler
- Filtration Unit: Dual media filtration system &Activated carbon adsorption system
- Treated water tank
- Pumping station
- Sludge drying bed

Movable bed bio reactor

The raw sewage is pumped in to the MBBR (Movable Bed Bio Reactor) aeration tank where it is allowed to develop the required MLSS (Mixed Liquor Suspended Solids). MLSS is generated by creating an aerobic environment conducive to the growth of microorganisms in the reactor tank through the introduction of diffused air bubbles by using submerged UPVC tubes and fine diffuser membranes. This along with appropriate bio-media structures facilitates bacterial growth in the reactor tank. The MBBR system is designed in such a way to achieve complete mixture of microorganisms with raw sewage thus facilitating accelerated bacterial digestion of organic solids.

Inlet of sewage water into STP

Aeration tank

Air Blowers

Tube settler

After achieving the required bacterial digestion, the effluent is allowed to flow in to the tube settler. The main aim of tube settlers is to minimize the vertical distance that a small floc particle must settle before agglomerating into larger particles. Tube settler design involves the use of multiple tubular channels sloping at an angle of 60 degrees and adjacent to each other.

Tube settler

This helps in increasing the settling area effectively. It reduces the depth significantly compared to the conventional clarifier and also helps in reduction of settling time.

Filtration unit

Filtration unit consists of dual media filtration system & activated carbon adsorption system.

Dual media filtration system

The treated effluent from the settler tank is pumped to multigrade sand filter where further reduction in TSS, BOD5, odour and colour will take place. This is a pressure vessel equipped with a perforated under drain plate. Here the sewage will filter with polystyrene strainers filled with filter media comprising of graded gravel, sand and

pebbles. The suspended particulates are arrested and the clean filtered water coming out from the multigrade sand filter is led to Activated carbon filter for further processing.

Filtration Unit

Activated carbon adsorption system

The filter water from the multigrade sand filter passes through the activated carbon filter, which is also a vertical pressure vessel. It is also equipped with perforated plate with polystyrene strainers at the bottom and top perforated brass strainers. In between is the filter media comprising of activated carbon granules (ID700) over a bed of graded gravel. In ACF any odour and to certain extent colour in the waste water is absorbed by the carbon and the filter water is absolutely sparklingly clear.

Treated water storage tank

The clear water is collected in a treated water tank. This water is generally had desired characteristics required for water to be used for maintaining the greenbelt area of the campus.

Pumping system of clean water

Sludge drying bed

Sludge-drying beds provide the simplest method of dewatering. A digested sludge slurry is spread on an open bed of sand and allowed to remain until dry. Drying takes place by a combination of evaporation and gravity drainage through the sand.The dried sludge is used as manure for plants present in the campus.

Sludge drying bed

The monthly records of MRIIRS STP discharge during the year are as presented below:

MRIIRS STP Discharge Data Log (1 unit=1000 L)					
Month	**Start Reading**	**End Reading**	**Total monthly unit discharge**	**Unit Discharge Av/day**	**Per day Unit Discharge - Act days**
Nov-21	6030	6120	90	3.000	3.9130
Dec-21	6120	6190	70	2.258	3.3333
Jan-22	6190	6212	22	0.710	3.1429
Feb-22	6212	6300	88	3.143	4.0000
Mar-22	6300	6430	130	4.194	5.0000
Apr-22	6430	6617	187	6.233	7.1923
May-22	6617	6835	218	7.032	7.2667
Jun-22	6835	7065	230	7.667	8.2143
Jul-22	7065	7236	171	5.516	6.5769
Aug-22	7236	7458	222	7.161	7.1613
Sep-22	7458	7674	216	7.200	7.2000
Oct-22	7674	7840	166	5.355	5.5333
			1810	**4.9557**	**5.7112**

Annual discharge of STP is 1810 KL (2021-22). From the measurement it is calculated that Av 5.7KL/Day discharge obtained from STP. It is used to generate sufficient treated waste water per day to irrigate 2.87ha planted landscape within the lush green campus. The output water quality of STP is maintained keeping Biochemical Oxygen Demand (BOD) within permissible level. Frequent analysis of output water is done to keep check on its quality.

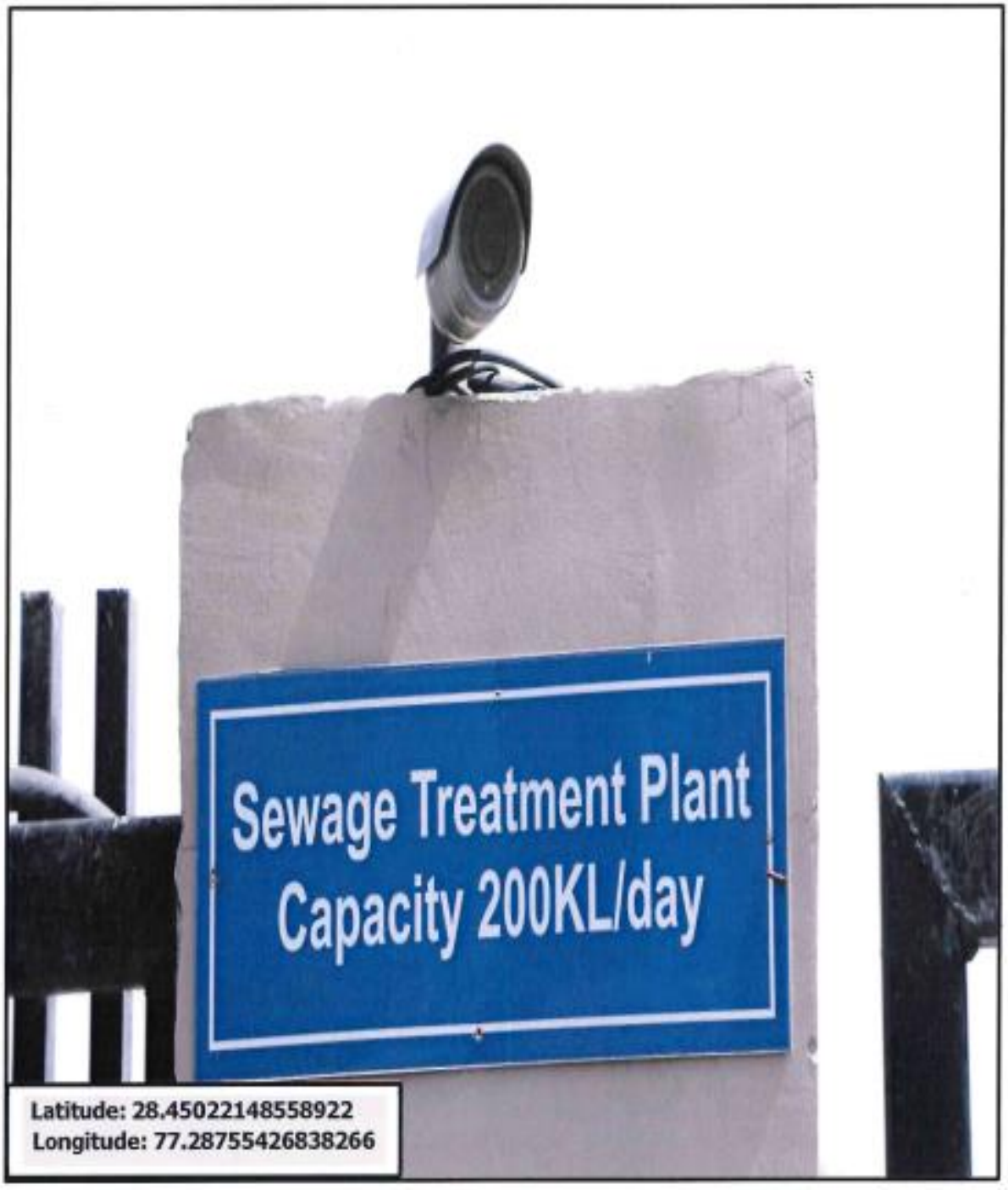
Geotagged Pictures
of
Sewage Treatment Plant (STP)
installed at MRIIRS

S. No	Relevant documents
1	Sewage Treatment Plant -Geotag Link to Google Maps
2	Sewage Treatment Plant Display Board
3	Sewage Treatment Plant Specifications
4	Sludge Tank Sewage Treatment Plant
5	Sludge Dry Bed Sewage Treatment Plant
6	Treated Water Distribution, Sewage Treatment Plant

Sewage Treatment Plant: Screenshot of Geotag Link to Google Maps

Geotag Link to Google Maps showing STP installed at MRIIRS:

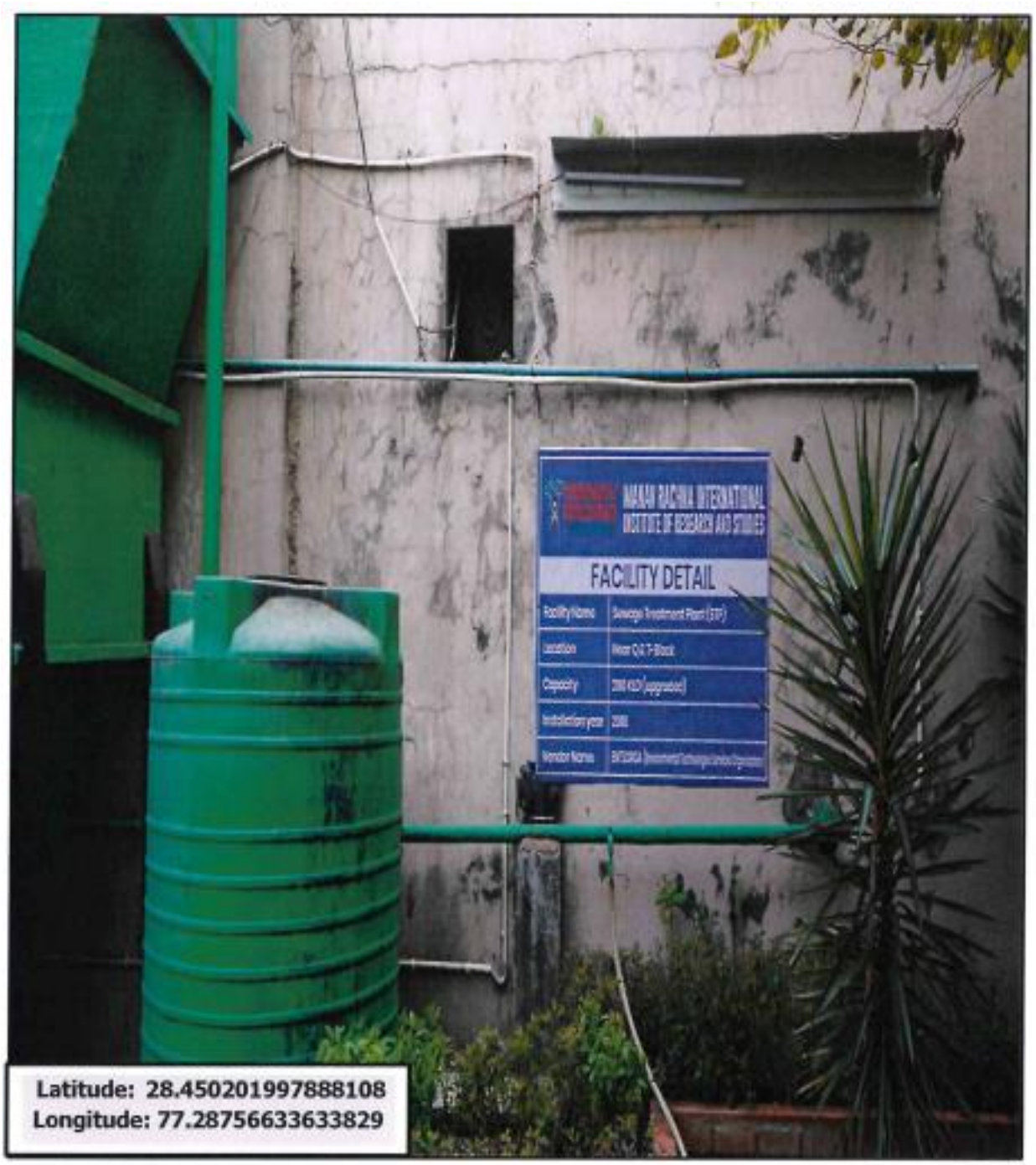
https://www.google.co.in/maps/place/STP/@28.4501691,77.2854833,18z/data=!4m12!1m6!3m5!1s0x390ce0ab6fec0aab:0x87c9e10e1ae0b0fc!2sManav+Rachna+International+Institute+Of+Research+And+Studies!8m2!3d28.4503781!4d77.2837474!3m4!1s0x390ce76550791101:0x258f2807dc40ea99!8m2!3d28.4501966!4d77.2875689



Sewage Treatment Plant Display Board

Latitude: 28.45022148558922, Longitude: 77.28755426838266
28°27'00.8"N 77°17'15.2"E

SDG 6- CLEAN WATER AND SANITATION

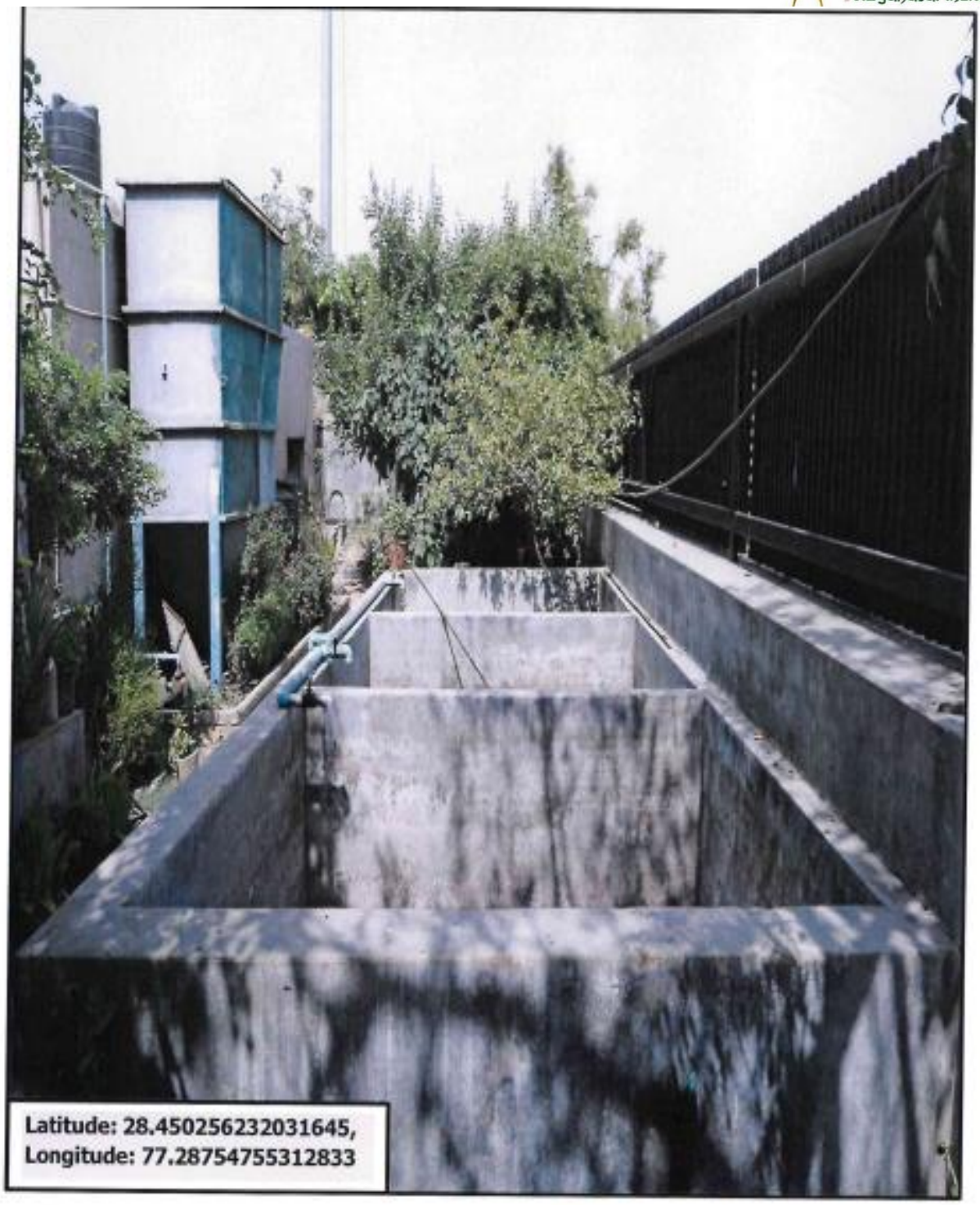


Sewage Treatment Plant Specifications

Latitude: 28.450201997888108, Longitude: 77.28756633633829
28°27'00.7"N 77°17'15.2"E

Sludge Tanks ,Sewage Treatment Plant

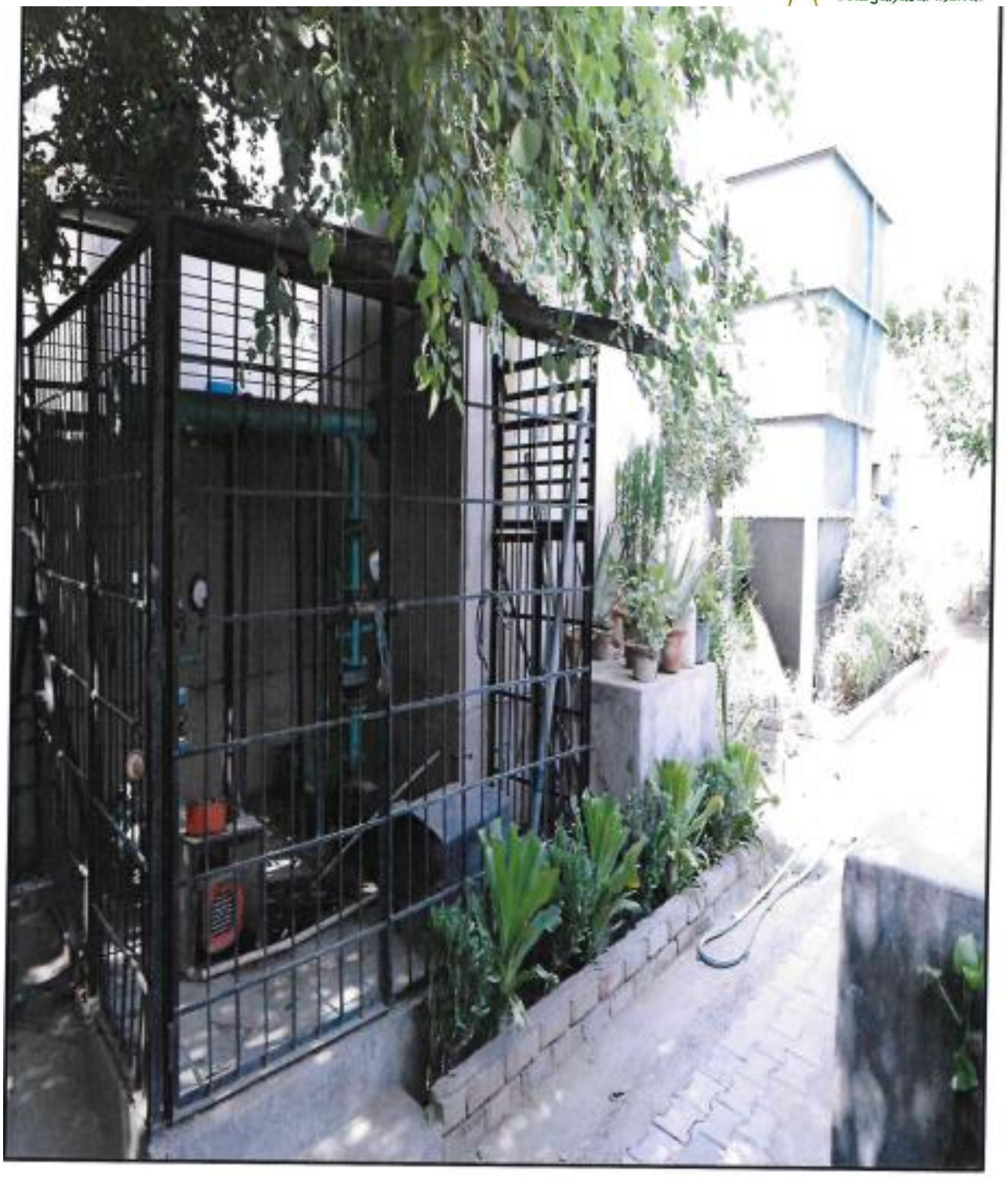
Latitude: 28.450211432035662, Longitude: 77.28756361756224
28°27'00.8"N 77°17'15.2"E



Sludge Dry Bed Sewage Treatment Plant Alternate View

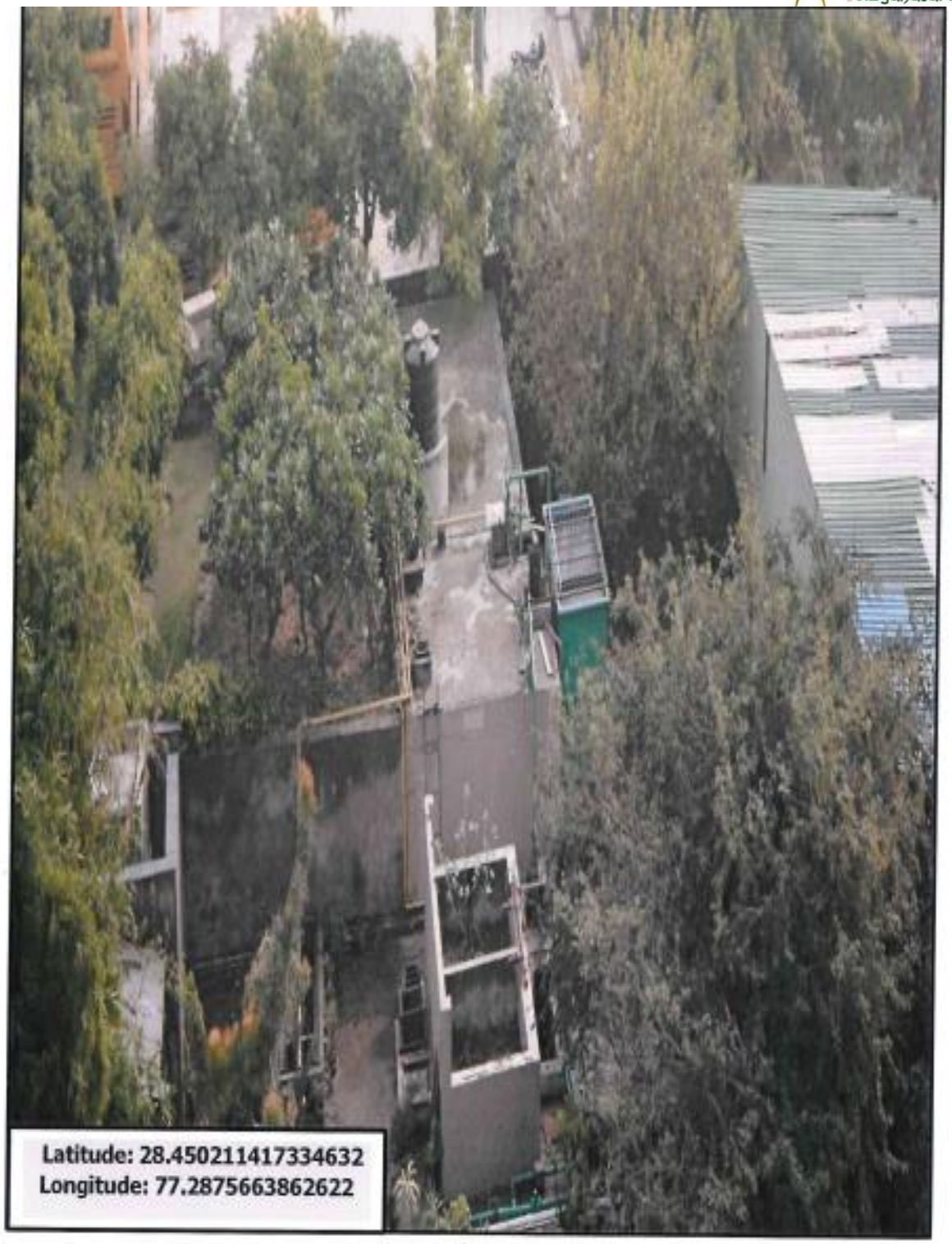
Latitude: 28.450256232031645, Longitude: 77.28754755312833
28°27'00.9"N 77°17'15.2"E

SDG 6- CLEAN WATER AND SANITATION



Treated Water Distribution, Sewage Treatment Plant

Latitude: 28.45024675657095, Longitude: 77.28755558871049
28°27'00.9"N 77°17'15.2"E



Sewage Treatment Plant Aerial View

Latitude: 28.450211417334632, Longitude: 77.2875663862622
28°27'00.8"N 77°17'15.2"E