



# St. Xavier's Institute of Education, Churchgate, Bombay St. Xavier's Boys' Academy, Marine Lines, Bombay

*Note: Both Institutes are in the same building.*

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(Data Generated for JAAI West Zone Conference 14-16 Nov 2025)

## Rainwater Harvesting, Terrain-Based Recharge Assessment Solar Installation, Carbon Sequestration Study



### 1 RAINWATER HARVESTING ANALYSIS

#### Area-Based RWH Formula:

$$RWH = P \times A \times C$$

Where:

- **P** = Average annual rainfall (in meters)
- **A** = Catchment area (m<sup>2</sup>)
- **C** = Runoff coefficient
  - **Paved area:** 0.7
  - **Rooftop area:** 0.875 (midpoint of 0.8–0.95)



## Data Considered:

- **Rainfall Data (CHIRPS - Last Three Years)**

Year	Rainfall (mm)	Rainfall (m)
2024	3501.24	3.501
2023	2651.15	2.651
2022	3134.59	3.135

- **Mean Rainfall (P)** =  $(3.501 + 2.651 + 3.135) / 3 = 3.095$  m/year

- **Area Data**

Surface Type	Area (m <sup>2</sup> )	Runoff Coefficient (C)
Paved	767.05	0.7
Rooftop	776.51	0.875

## RWH Calculations

- **RWH from Paved Area**  
=  $3.095 \times 767.05 \times 0.7$   
= **1,666.18 m<sup>3</sup>**
- **RWH from Rooftop Area**  
=  $3.095 \times 776.51 \times 0.875$   
= **2,109.73 m<sup>3</sup>**
- **Total Annual Harvestable Rainwater**  
=  $1,666.18 + 2,109.73 = 3,775.91$  m<sup>3</sup>  
= **3,775,910 liters**

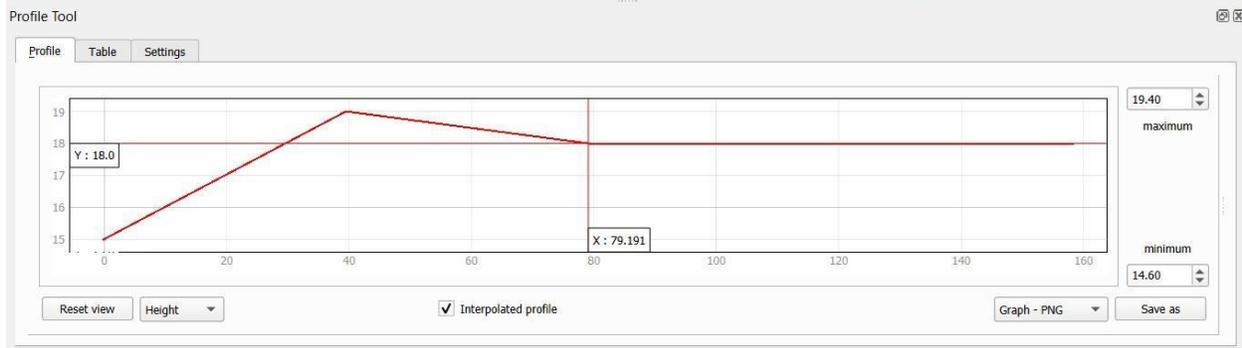
## TERRAIN PROFILE ANALYSIS

### Profile 1: North–South Direction

- **Elevation Range:** 14.60 m (min) to 19.40 m (max) → **Relief: ~4.80 m**
- **Slope Pattern:**
  - Elevation increases from the southern edge (~15 m) to a central high (~19.4 m), then stabilizes.
- **Drainage Implication:**
  - Central ridge drains surface runoff toward both the north and south boundaries.



- Southern low point is favorable for recharge pits or small tanks.



## Profile 2: East–West Direction

- **Elevation Range:** 13.60 m (min) to 18.40 m (max) → **Relief:** ~4.80 m
- **Slope Pattern:**
  - Gentle slope westward to central peak (~18.4 m), then declining eastward.
- **Drainage Implication:**
  - Runoff expected to flow from the center toward east and west sides.
  - **Eastern edge** suitable for surface collection or filtration trench.



## RECOMMENDATIONS: Storage & Recharge Zones

- **South and East edges** are low-lying and ideal for **groundwater recharge features**.
- **North-west quadrant** could support surface water diversion toward recharge pits.
- Avoid recharge pit placement too close to foundations without proper lining.

## 2 POTENTIAL OF RWH WATER THAT CAN BE USED FOR TOILET FLUSHING, GARDENING, TREES

- Rain Water Harvesting Potential: 3,775.91 m<sup>3</sup>/year
- If RWH water is used *for toilet flushing* then the number of students whose flushing needs can be met in a year is: 1,430
- If RWH water is used *for Gardening* then the garden area that can be supported annually is : 2069 m<sup>2</sup>
- If RWH water is used for watering of trees, then the number of trees that can be irrigated annually is: 629



**Formulas (with planning assumptions) :**

**Number of students who can flush for the school year :**

Assumptions: 220 school days, 6 L per flush, 2 flushes per student per day

Supported Flushing =  $RWH (L) / (6 L/flush \times 2 flushes/student/day \times 220 days)$

**Garden area watering supported annually :**

Assumption: 5 L/m<sup>2</sup>/day year-round (365 days)

Garden Area =  $RWH (L) / (5 L/m^2/day \times 365 days)$

**Number of trees watering supported in the dry season :**

Assumptions: 50 L/tree/day, dry season = 120 days

Trees Supported =  $RWH (L) / (50 L/tree/day \times 120 days)$

**Notes:**

Unit equivalence used: **1 m<sup>3</sup> = 1 kL = 1,000 liters.**

If a school uses low-flow fixtures (e.g., 4 L/flush), swap **6** with **4** in the formula to show a conservative/efficient scenario.

**References:**

**Flush volume (6 L/flush baseline):** WHO/UNICEF Joint Monitoring Programme (JMP) documentation and sector guidance indicate typical modern cistern volumes of **~6 L/flush** (with dual-flush/low-flow options ~3–4.5 L).

**Garden water demand (5 L/m<sup>2</sup>/day):** Based on FAO irrigation planning practice using crop evapotranspiration (ET<sub>c</sub>). FAO Irrigation & Drainage Paper 56 (Allen et al.) gives the ET<sub>c</sub> methodology.

**Tree water need (50 L/tree/day):** Practical planning baseline used in municipal/urban forestry guidance for **medium-sized** trees under warm conditions. This aligns with typical dry-season irrigation allowances derived from canopy size and ET; it's an assumption you can scale by species/size if schools provide

### 3 CARBON SEQUESTRATION POTENTIAL

Total Green Area: XIE, SXBA are housed within a building. The greenery area could not be located on the Google Earth.

### 4 SOLAR INSTALLATION

- Refer to : <https://ecosjwestzone.org/solar-dashboard/> for Province/School information.
- Installed On Grid kW Capacity : 40kW
- Installed Off Grid kW Capacity : No off Grid
- Zero Bill Status: Not clear

### 5 Legend

- RWH: Rain Water Harvesting
- CHIRPS: Climate Hazards Group InfraRed Precipitation with Station data ( It is a



quasi-global dataset that blends satellite infrared imagery with ground-based rain gauge observations.)

- IPCC: Intergovernmental Panel on Climate Change (a United Nations body that assesses the science related to climate change, its causes, impacts, and possible solutions.)
- Carbon Sequestration: the process of capturing carbon dioxide (CO<sub>2</sub>) from the atmosphere and storing it long-term in reservoirs like oceans, soil, trees. For the report the Trees/Greenery area in the school is considered.