St. Xavier Technical Institute, Mahim, Bombay

Xavier's Institute of Engineering, Mahim, Bombay

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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

RWH Formula:

RWH = P × A × C

Where:

- **P** = Mean annual rainfall (m)
- **A** = Area of the surface (m^2)
- **C** = Runoff coefficient
    - Rooftop: 0.875
    - Paved: 0.7
    - Unpaved: 0.6

- Green: excluded from RWH, used only for CO_2 sequestration

Data Considered:

- Rainfall Data (CHIRPS – Last Three Years):

Year	Rainfall (mm)	Rainfall (m)
2024	3,739.78	3.740
2023	2,714.70	2.715
2022	3,589.92	3.590

- **Mean Annual Rainfall (P)** = (3.740 + 2.715 + 3.590) / 3 = **3.348 m/year**
- **Surface Area Data**

RWH

Surface Type	Institute	Area (m^2)	Runoff Coefficient
Rooftop	Xavier Technical Institute	904.28	0.875
Rooftop	Xavier Institute of Engineering	1,847.12	0.875
Paved (shared)	Both	2,917.61	0.7
Unpaved (shared)	Both	2,865.24	0.6

Calculations

1 Xavier Technical Institute (Rooftop only):

- **RWH (Roof)** = 3.348 × 904.28 × 0.875 = **2,648.58 m^3**

2 Xavier Institute of Engineering:

- **RWH (Roof)** = 3.348 × 1,847.12 × 0.875 = **5,404.21 m^3**

Shared Surfaces:

- **RWH (Paved)** = 3.348 × 2,917.61 × 0.7 = **6,832.13 m^3**
- **RWH (Unpaved)** = 3.348 × 2,865.24 × 0.6 = **5,759.04 m^3**

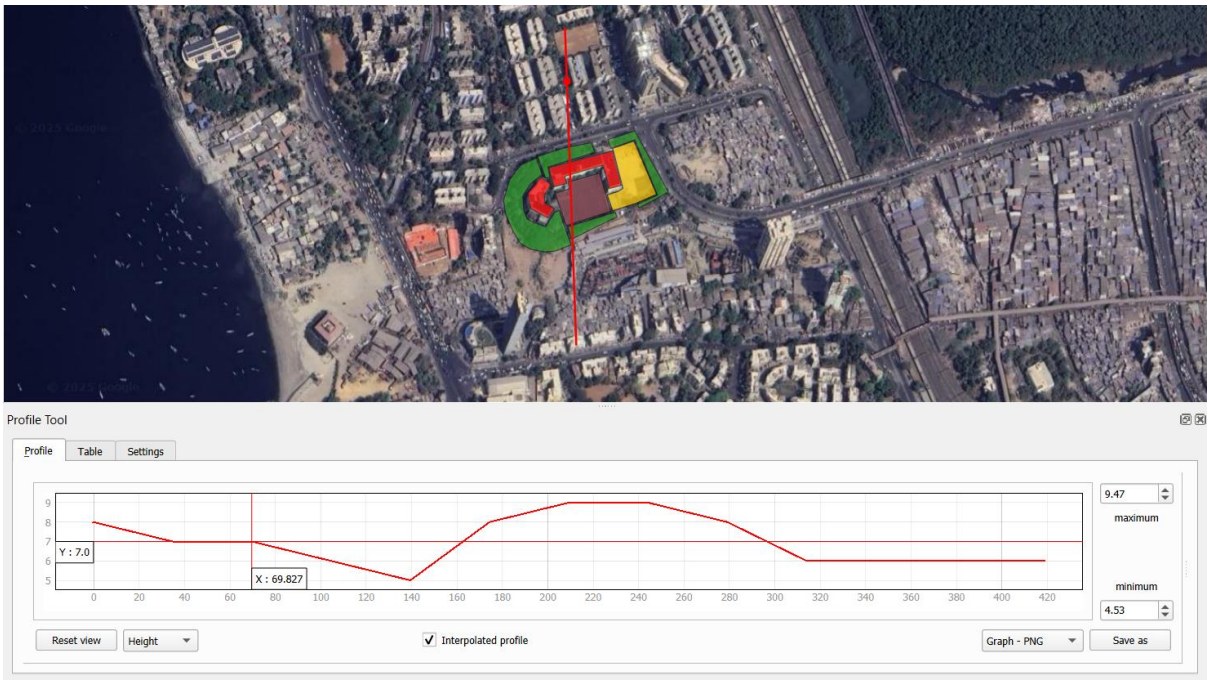
Total Annual Harvestable Rainwater

Institute	Total RWH (m^3)	Total RWH (liters)
Xavier Technical Institute	2,648.58 + 6,832.13 + 5,759.04 = **15,239.75 m^3**	**15,239,750 L**
Xavier Institute of Engineering	5,404.21 + 6,832.13 + 5,759.04 = **17,995.38 m^3**	**17,995,380 L**

TERRAIN PROFILE ANALYSIS (Shared for Both Institutions)

Profile 1: North–South

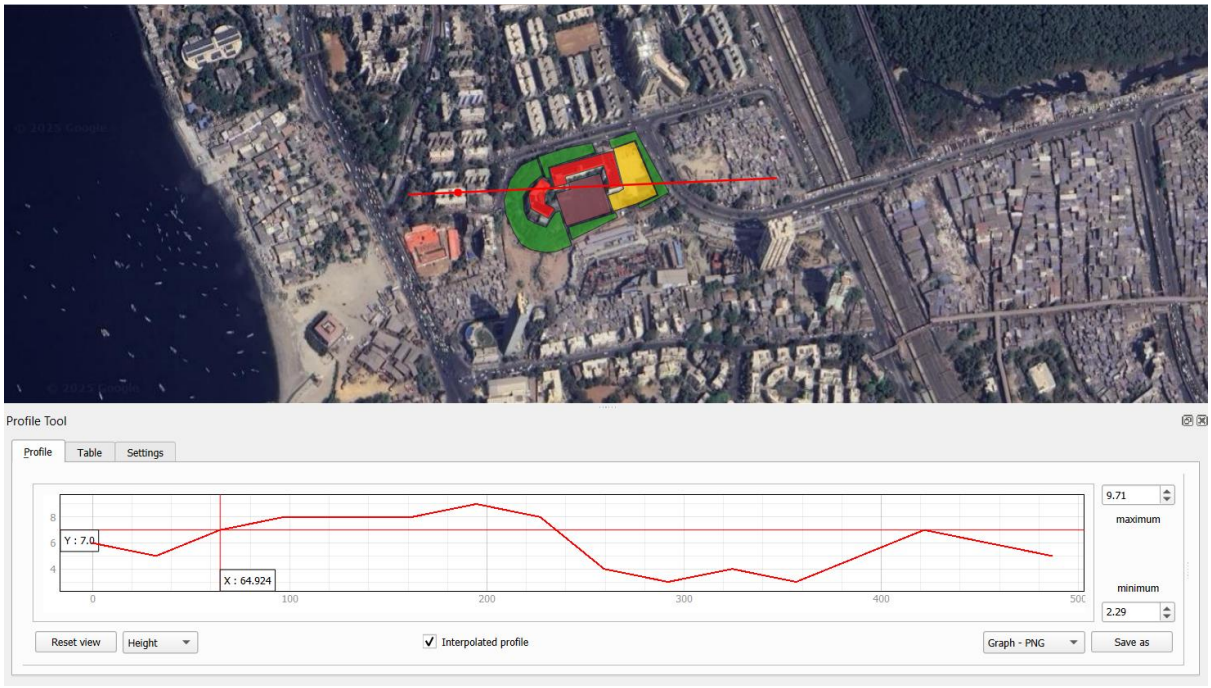
- Elevation Range: 4.53 m to 9.47 m → Relief: ~4.94 m
- Slope Pattern:
    - Low point near southern edge, central rise, followed by flattening toward north.
- Drainage Implication:
    - Runoff likely accumulates south of the built-up zones; ideal for infiltration pits or shallow tanks.



Profile 2: East–West

- Elevation Range: 2.29 m to 9.71 m → Relief: ~7.42 m
- Slope Pattern:
    - Multiple peaks and troughs, gradual fall toward east.

- Drainage Implication:
    - Eastern boundary shows potential for stormwater collection and recharge.



Carbon Sequestration Potential

Institute	Green Area (m^2)	CO_2 Factor ($kg/m^2/year$)	Sequestration (kg CO_2/year)
Xavier Technical Institute	4,323.97	0.9	3,891.57 kg = 3.89 t
Xavier Institute of Engineering	3,138.39	0.9	2,824.55 kg = 2.82 t

Recommendations: Storage & Recharge Zones (Shared)

- South and southeast edges are most suitable for placing:
    - Recharge pits
    - Underground storage tanks
    - Overflow channels for excess runoff
- Encourage routing roof and paved runoff into distributed infiltration structures.
- Combine vegetated areas with bioswales or rain gardens to enhance percolation and reduce load on storage.

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

- Rain Water Harvesting Potential: 33,235.13 m^3/year
- If RWH water is used *for toilet flushing* then the number of students whose flushing needs can be met in a year is: 12,589

- If RWH water is used *for Gardening* then the garden area that can be supported annually is : 18,211 m^2
- If RWH water is used for watering of trees, then the number of trees that can be irrigated annually is: 5,539

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 × 2 flushes/student/day × 220 days)

Garden area watering supported annually :
Assumption: 5 L/m^2/day year-round (365 days)
Garden Area = RWH (L) / (5 L/m^2/day × 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 × 120 days)

Notes:
Unit equivalence used: ***1 m^3 = 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^2/day): *Based on FAO irrigation planning practice using crop evapotranspiration (ETc). FAO Irrigation & Drainage Paper 56 (Allen et al.) gives the ETc 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 = 3,034.67 m^2
- IPCC standard: 0.9 kg CO_2/m^2/year
- Estimated Annual Carbon Sequestration = 3,034.67 m^2 × 0.9 = 2,731.20 kg CO_2/year = 2.73 metric tons CO_2/year
- The school's vegetation helps offset emissions and provides environmental co-benefits.

4 SOLAR INSTALLATION

- Refer to : https://ecosjwestzone.org/solar-dashboard/ for Province/School information.
- Installed On Grid kW Capacity (mentioned under Xavier Insti. Engineering/XTECH) : 220 kW
- Installed Off Grid kW Capacity : 0
- Zero Bill Status: Yes

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 (CO2) 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.