



St. Mary's High School (ICSE Section), Mazgaon, 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:

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

Where:

- **P** = Average annual rainfall (m)
- **A** = Surface area (m²)
- **C** = Runoff coefficient
 - Rooftop: 0.875
 - Paved: 0.7
 - Unpaved: 0.6
 - Green: excluded from RWH, used for carbon sequestration



Data Considered:

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

Year	Rainfall (mm)	Rainfall (m)
2024	3,671.24	3.671
2023	2,697.01	2.697
2022	3,371.12	3.371

- **Mean Annual Rainfall (P) = $(3.671 + 2.697 + 3.371) / 3 = 3.246$ m/year**

- **Surface Area Data**

Surface Type	Area (m ²)	Runoff Coefficient (C)
Roof	5,202.59	0.875
Paved	2,417.41	0.7
Unpaved	4,618.02	0.6
Green	3,034.67	— (used for CO ₂ only)

RWH Calculations

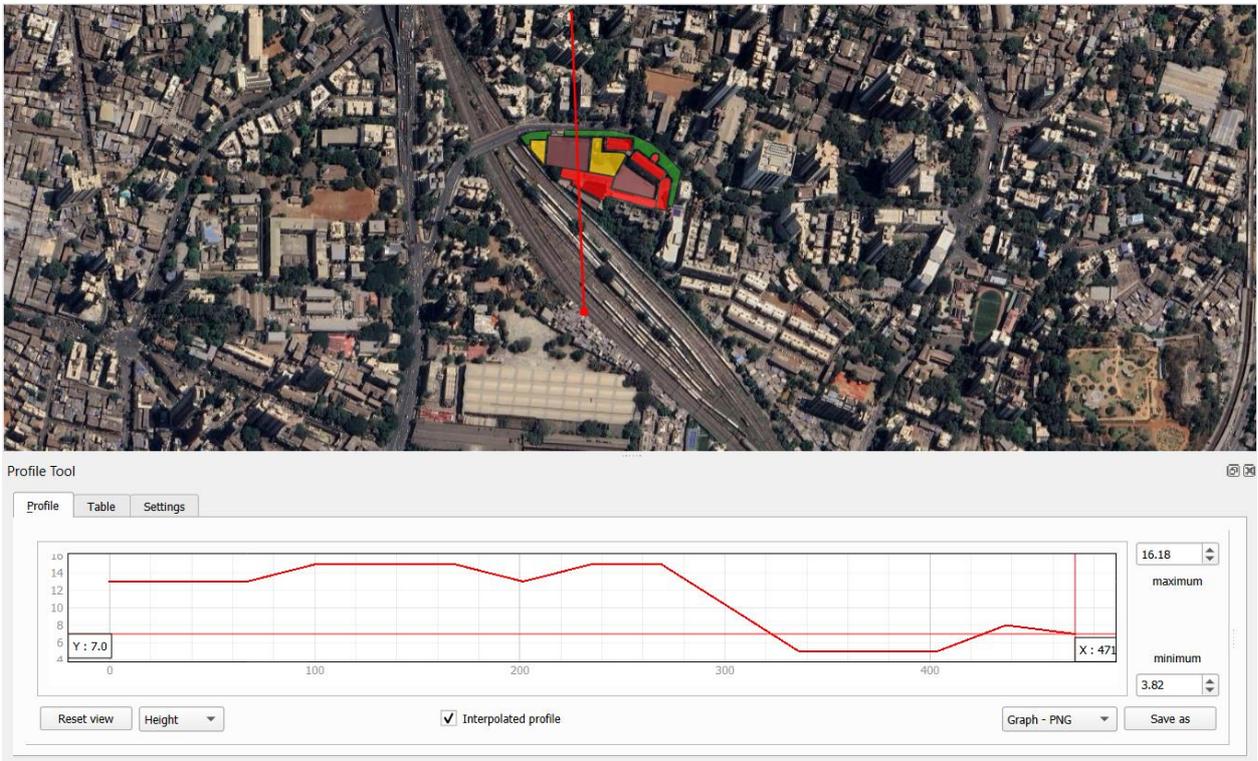
- **RWH from Rooftop = $3.246 \times 5,202.59 \times 0.875 = 14,832.76$ m³**
- **RWH from Paved Area = $3.246 \times 2,417.41 \times 0.7 = 5,498.88$ m³**
- **RWH from Unpaved Area = $3.246 \times 4,618.02 \times 0.6 = 8,994.46$ m³**
- **Total Annual Harvestable Rainwater = $14,832.76 + 5,498.88 + 8,994.46 = 29,326.10$ m³ = 29,326,100 liters**

TERRAIN PROFILE ANALYSIS

Profile 1: North–South Direction

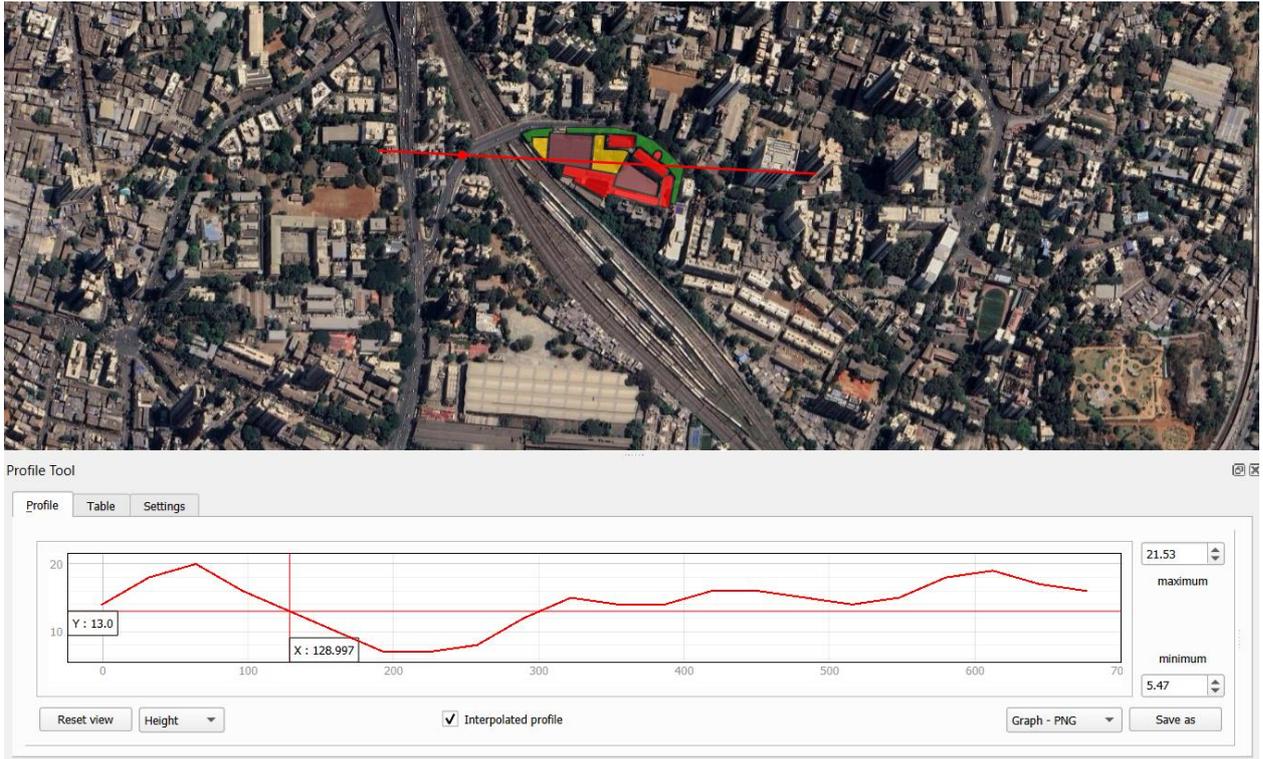
- **Elevation Range: 3.82 m to 16.18 m → Relief: ~12.36 m**
- **Slope Pattern:**
 - Gradual slope from central high to lower south.
 - Low-lying area toward southern boundary.
- **Drainage Implication:**
 - Site drains predominantly southward from a central ridge.

- Southern edge is ideal for storage tanks or recharge pits.



Profile 2: East–West Direction

- Elevation Range: 5.47 m to 21.53 m → Relief: ~16.06 m
- Slope Pattern:
 - Multiple ridges and troughs with a wavy pattern.
 - Localized depressions may support pocket recharge zones.
- Drainage Implication:
 - East–west drainage is complex due to undulating terrain.
 - Site supports distributed runoff management, especially on eastern and central segments.



Recommendations: Storage & Recharge Zones

- Prioritize south and southeast edges for tank placement and infiltration structures.
- Use green buffer zones for bioswale integration.
- Rooftop and paved runoff can be diverted toward central or southern recharge features.

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

- Rain Water Harvesting Potential: 29,326.1 m³/year
- If RWH water is used *for toilet flushing* then the number of students whose flushing needs can be met in a year is: 11,108
- If RWH water is used *for Gardening* then the garden area that can be supported annually is : 16,069 m²
- If RWH water is used for watering of trees, then the number of trees that can be irrigated annually is: 4,888



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/m²/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 m³ = 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/m²/day): Based on FAO irrigation planning practice using crop evapotranspiration (ET_c). FAO Irrigation & Drainage Paper 56 (Allen et al.) gives the ET_c 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 (Green Zone)

- Total Green Area = 3,034.67 m²
- IPCC standard: 0.9 kg CO₂/m²/year
- Estimated Annual Carbon Sequestration = 3,034.67 m² × 0.9 = 2,731.20 kg CO₂/year = 2.73 metric tons CO₂/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 : 85 kW
- Installed Off Grid kW Capacity : 0
- 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 (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.