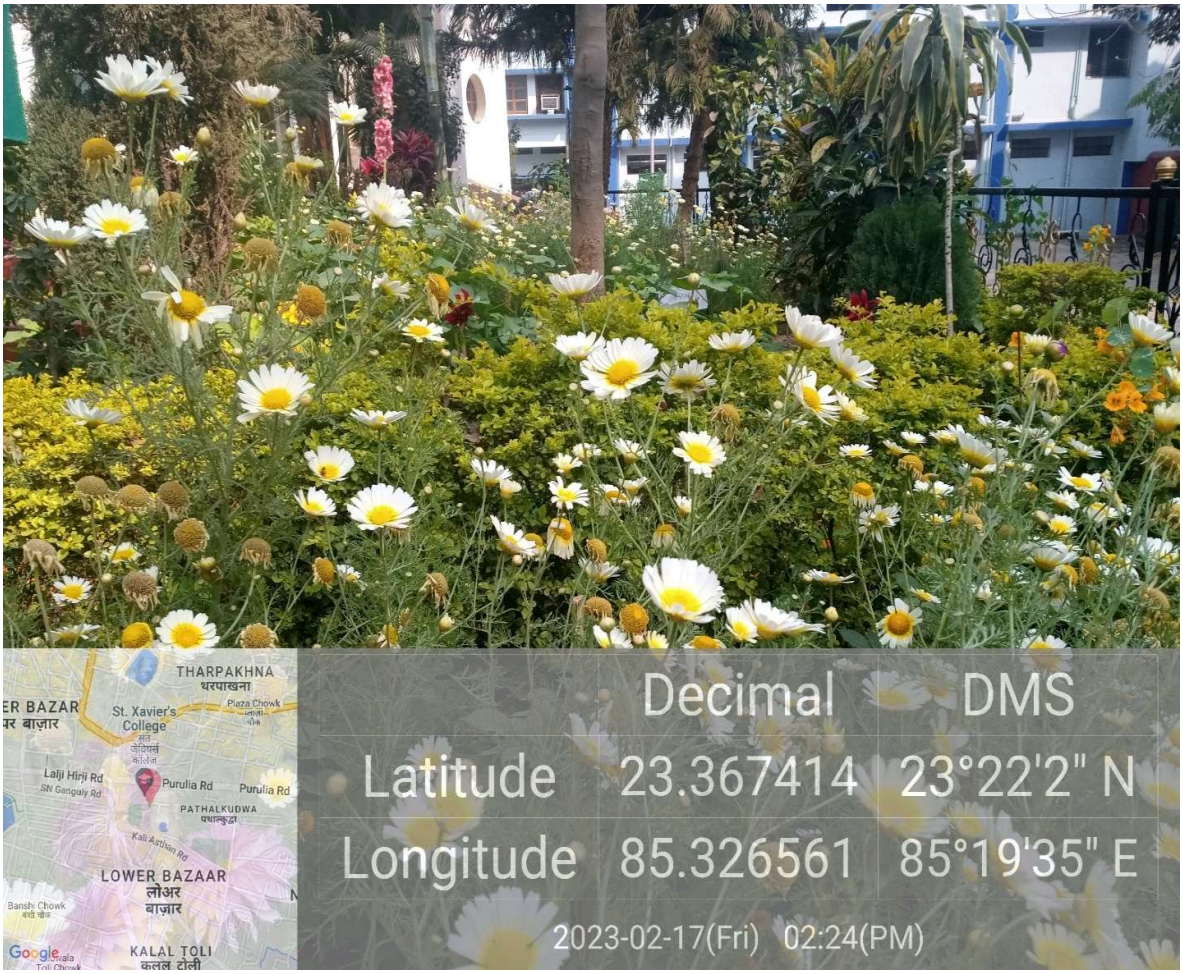
GREEN AUDIT REPORT

2022-2023



ST. XAVIER'S COLLEGE RANCHI

Dr. Camil Bulcke Path

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Ranchi, Jharkhand

Preparedby

Green Campus Committee of SXC RANCHI

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Executive Summary

In the past, human beings were less concern with the protection and preservation of natural resources available on the earth but in recent time they are more concern with the conservation of natural resources because now humans have faced many natural disasters which threatened human existence. Economic development is necessary as it provides better facilities for life but it threatens human life as it causes pollution.

Green campus is a concept implemented in many educational institutions, all over the world to make them sustainable because of their mass resource utilization and waste discharge in to the environment and educational institutions are the places where students learn for life how to use resources of the earth sustainably therefore waste minimization plans for the educational institute are now mandatory to maintain the cleanliness of the campus, to find out the environmental performance of the educational institutions and to analyze the possible solutions for converting the educational campus as eco-campus.

St. Xavier's College, Ranchi is deeply concerned and believes that there is an urgent need to address this fundamental problem and reverse the trend. Being a premier institution of higher learning, the college has green policy to keep college campus clean and green so that students may learn to take care of our mother earth our common home and be eco sensitive and be responsible citizens of our country India.

Policy for management of alternative source of energy

Non- renewal energy is limited and causes pollution. Now humans have to look for the renewable sources of energy. In the college, energy sources will be supplied electricity from Jharkhand Vidyuth Board, generators, solar energy (roof as well as street light), invertors, UPS, Biogas, mushroom cultivation. College will replace old tube lights with LED tube lights and bulbs to reduce electricity consumption. There will be people in charges to switch off the tube lights if they are on unnecessarily. Meters will be there to indicate energy consumption.

Green campus policy of St. Xavier's College Ranchi

St. Xavier's College, Ranchi is a NAAC B+ Grade College. It was established in 1944. College celebrated platinum jubilee in 2019. College has - Arts, Commerce, Science and Vocational courses faculties and 9901 students are studying here.

The college is located in a beautiful campus of 6445.24 M^2 in the heart of Ranchi city. The latitude and altitude of college is 23.3680 N, 85.3263 E

The college has a beautiful campus situated in the heart of Ranchi city. As college has travelled long way and has expanded its dimension, number of students has increased, requirements have also increased yet college will adopt the 'Green Campus Clean Campus' system for environmental conservation and sustainability as MDG and SDG also aim for sustainable development and educational institutions have to play a vital role to achieve these goals especially in NEP. College will manage efficient use of energy, water,

waste and reduce CO_2 level to create an atmosphere where students can learn to be eco sensitive and healthy. College will actively promote the various green initiatives by different committees like **(Green campus committee, Eco Task Force, Geo Club, B.Ed. Environment Club, Rotaract Club and Individual department, students and staff members)**. The college administration will work on the several facets of 'Green and Clean Campus' including Water Conservation, Tree Plantation, Waste Management, Paperless Work, Alternative Energy and Mapping of Biodiversity etc.

The main objectives of green policy will be

- To introduce and make students aware of real concerns of environment and its sustainability
- To secure the environment and cut down the threats posed to human health by analyzing the pattern and extent of resource use on the campus.

Main areas

- Water use and management
- Energy use and Conservation
- Alternative source of energy
- Waste management
- E-waste management
- Green area management
- Mapping of Biodiversity
- Cleanliness of the Campus
- Green initiatives

Water management

Avail water sources (pond, well, bore well, supply water) store rain water (ground and roof), proper use and no wastage of water, there will be some people in charges to control water supply. Waste water will be recycled and reused. College will avail pure drinking water etc.

Management of alternative source of energy

Energy sources will be supplied electricity from Jharkhand Vidyuth Board, generators, solar energy (roof as well as street light), invertors, Biogas, mushroom cultivation, use of LED bulbs and tube light. There will be people in charges to switch off the tube lights if they are on unnecessarily.

Waste Management

There will be a waste dumping yard where segregated waste will be disposed. Some of them will be cleaned by municipality but college will have a composter to recycle leaf and food waste, vermicomposting techniques will be used to recycle leaf material. Use of plastics will be band in the campus, teachers and students will be conscientized through captions and quotations, through awareness programmes, cleaners and sweepers will be instructed to segregate the different types of waste material. Dustbins will be placed in the campus and corridors. Science labs which use chemicals will keep the inventory record of the chemicals. The chemical waste will be disposed in a proper way. Physics and chemistry lab will not use kerosene to produce fuel for the lab they will use LPG gas. Zoology lab will not use animals for practical. Single sided used papers will be used for writing and printing in all departments. Exams papers will be sent for pulping and recycling after completion of their preservation period. Metal waste and wooden waste will be given to the authorized

scrap agents for further processing. Some glass bottles will be reused in the laboratories.

E-Waste Management

E-waste generated in the campus (cartridges, old computers, printer, Xerox machines, batteries) will be given to the approved E-waste management groups.

Green management and environment

There will be green campus committee to make campus green and clean. College will keep the campus neat and clean. Greenery will be maintained. Green areas will be divided into different zones and there will be people in charges to look after them. There will a greenhouse to keep plants safe and sound. Gardeners will be appointed to look after the plants. Plants will be named and tagged. Birds and butterflies will not be disturbed. Some quotations will be put up at different places to sensitize students. Tree plantation, awareness programmes will be conducted by different clubs.

The purpose of the audit was to ensure that the practices followed in St. Xavier College Campus are in accordance with the green policy adopted by the College. The methodology includes: documentation of the initiatives, physical inspection of the campus, observation and review of the documentation, interviewing key persons and data analysis, measurements and recommendations. It worked on the several facets of 'Green Campus' including **water use and management, energy use and conservation, alternative source of energy, waste management, e-waste management, green area management, mapping of biodiversity and eco consciousness level of the students of the institution.** With this in mind, the specific objectives of the audit were to evaluate the adequacy of the management control frame work of environment sustainability as well as the degree to which the departments are in compliance with the applicable regulations, policies and standards. It can make a tremendous impact on students' health and learning, college operational costs and the environment. The criteria, methods and recommendations used in the audit were based on the identified risks.

INTRODUCTION

Green Audit is systematic identification, quantification, recording, reporting and analysis of components of environmental diversity. It aims to analyze environmental practices within and outside the college campus, which will have an impact on the eco-friendly ambience. It was initiated with the motive of inspecting the work conducted within the college campus and departments whose exercises can cause risk to the health of inhabitants and the environment. Green Audit gives a direction to improve the condition of environment. It also tells whether the campus is green or not and indicates the threatening area of risk. Green audit is assigned to the criteria 7 of NAAC, National Assessment and Accreditation Council which is a self-governing organization of India which declares the institutions as Grade A++, A+, A, B++, B+ or B according to the scores assigned during the accreditation.

About college

St. Xavier's College, Ranchi is a NAAC A (third cycle), B+ (fourth cycle) Grade college. It was established in 1944. College celebrated platinum jubilee in 2019. College has - Arts, Commerce, Science and Vocational courses faculties and more than 9901 students are studying here.

The college is located on a beautiful campus of 6445.24 M^2 in the heart of Ranchi city. The latitude and altitude of college is 23.3680 N, 85.3263 E

Vision Statement of the College

St. Xavier College, Ranchi was started by the Ranchi Jesuits Society

called (Society of Jesus) a Christian Religious Order founded by St. Ignatius Loyola in 1540. Since its foundation, the Jesuits have contributed in the field of education throughout the world. The vision drawn from the life and teachings of Jesus Christ gives Jesuit educational institutions a recognizable character and sets before their management, staff, students, parents and the community high ideals of life and service which will inspire them continuously to strive to meet the emerging needs and challenges.

Inspired by this vision the Jesuits in India has been active in the field of higher education serving the nation in the context of plurality of religions and diversity of cultures. Across the world, the Society of Jesus, is responsible for over 1,865 Educational Institutions in 65 Countries. In India, the Society of Jesus, runs 153 High Schools, 38 University College, 14 Technical Institutes and 5 Business Administration Institutes. While Jesuit educational work has always been at the service of the whole nation, irrespective of caste and creed, it recognizes a special responsibility towards the Catholic community.

The Ranchi Jesuit Province through St. Xavier's College envisions the educational development of the Jharkhand state with special attention to the needs of the tribal students of the region.

Mission Statement of the College

To translate the vision and commitments into action:

A) the college community will strive

1) to set and achieve high academic standards

in an atmosphere of autonomy.

2) to develop Christian leadership of high calibre and integrity.

3) to preserve and promote the cultural heritage of the region.

4) to strengthen its own faith life.

5) to engage in research and extension activities related to the developmental issues of Jharkhand.

6) to accord priority to the education of Catholic as well as Scheduled Tribe and Scheduled Caste students.

7) to promote vocational and entrepreneurial education.

8) to involve parents, staff and students in fruitful interaction.

9) to function as a critique and conscience of society.

B) The College aims to enable the students

1) to set high standards for themselves in every field.

2) to seek and apply knowledge critically to the solution of contemporary problems.

3) to think in a creative, fearless and independent manner.

4) to value and responsibly use their own freedom and respect the freedom of others.

5) to appreciate and respect other faiths and foster religious harmony.

6) to be clear and firm on principles and values and

act accordingly.

7) to contribute to the sustainable socio economic development of the neighborhood, locality and region.

8) to be sensitive to those in need and unselfish in service.

9) to set themselves free from socio-economic, religious, caste and gender prejudices and act as catalysts of social change.

10) to protect, preserve and judiciously use the resources of the earth for the welfare of all.

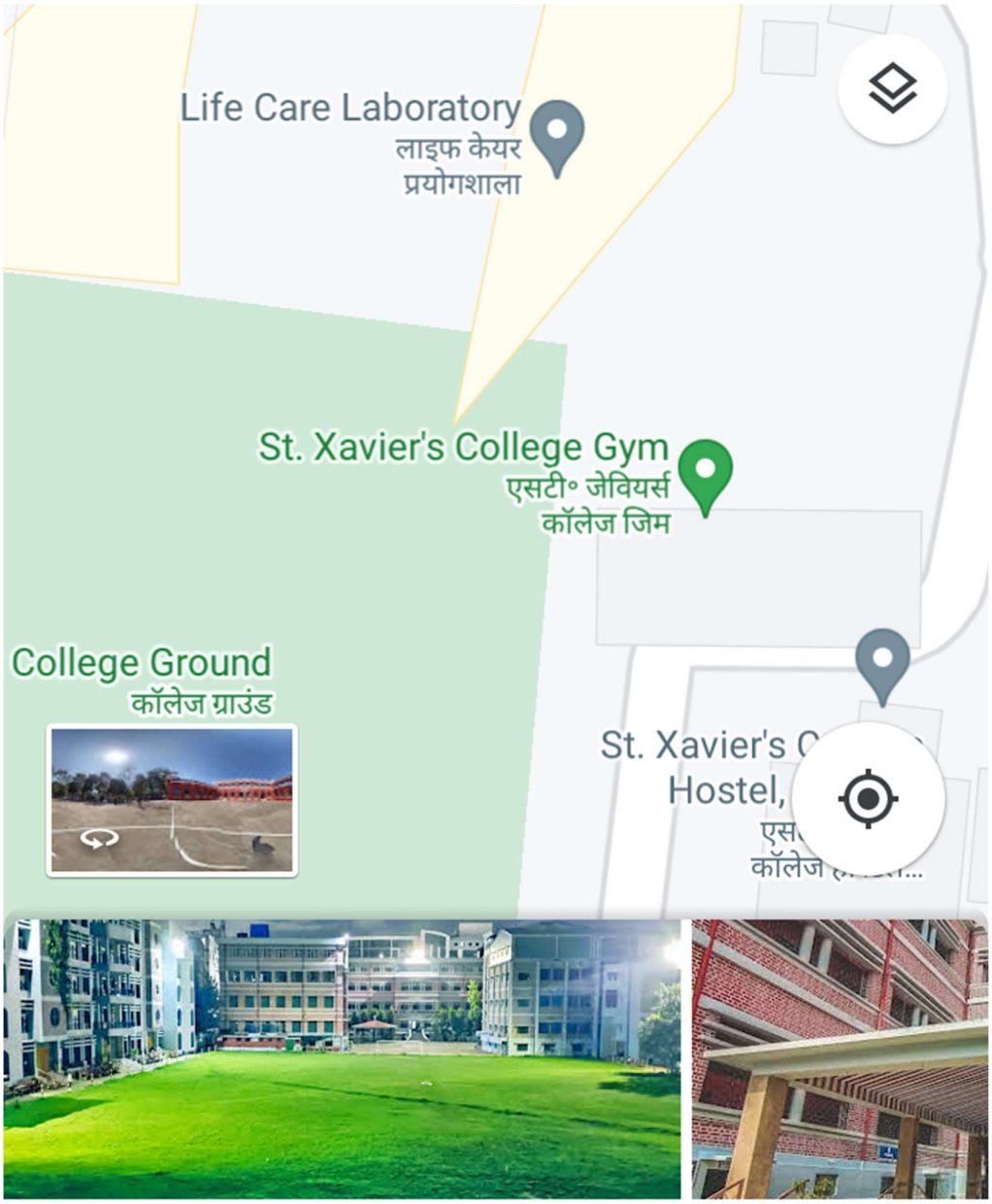


Fig. 1 Location of St. Xavier's college Ranchi

Courses offered by the College

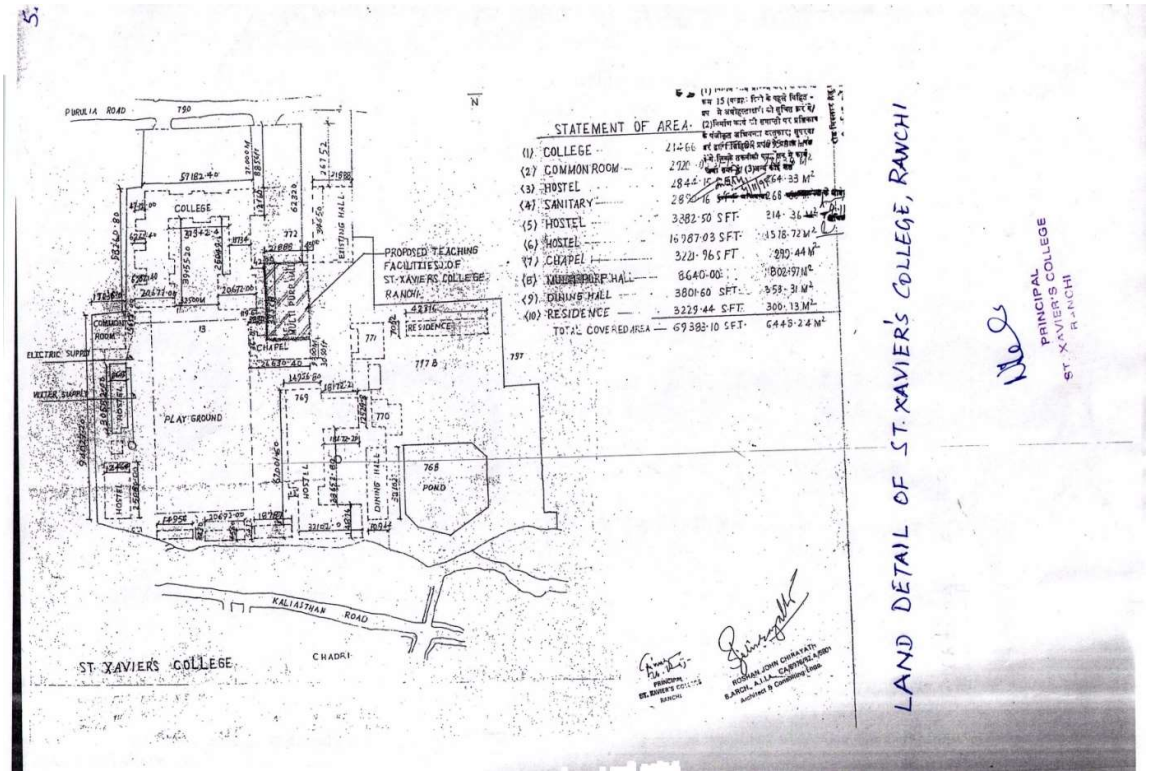
P G Courses – 13			
M.Sc.	M.Sc. Chemistry	M.Sc. Zoology	M.Sc. Geology

Botany			
M.Sc. Mathematics	M.A Hindi	M.A English	M. A Economics
Mass Com	M.A Political Science	M.A Geography	M.A History
M. COM			
U G Courses –			
Aided Courses	B.A English	B.A Economics	B.A History
	B.Sc. Physics	B.Sc. Botany	B.Sc. Zoology
	B.Sc. Geology	B.Sc. Chemistry	B.Sc. Mathematics
	B.Com	B.A Geography	B. A Hindi
	B.A Political Science		
Self-Financing	ELL	Sociology	B Ed
	B.Voc. Fashion Technology	Biotechnology	BBA
	Statistics	BJMC	BCA
	Animation	IT	OMSP

The student and faculty strength of the college is listed below:

No of students		9901
No of teachers		103
No of Non-teaching staffs		163
Gents		117
Ladies		46

Physical Structure



The college is located in about 6445.24 M^2 of land. The built-up area of the college is 27917.25 sqm

Departments	UG 31 PG 13

Laboratories	14
Conference halls	5
Libraries	3 main library+ 31 department libraries
Auditorium	2
Canteens	3

OBJECTIVES OF GREEN AUDIT

The main objectives of this green audit is to assess the environmental quality and the management strategies being implemented in St. Xavier's College, Ranchi. The specific objectives are:

1. To assess the quality of the water and soil in the St. Xavier's college campus
2. To monitor the energy consumption pattern of the college
3. To quantify the liquid and solid waste generation and management plans in the campus.
4. To assess the carbon foot print of the college
5. To assess whether the measures implemented by St. Xavier's College have helped to reduce the Carbon Footprint.
6. To impart environment management plans to the college
7. Providing a database for corrective actions and future plans.
8. To assess whether extracurricular activities of the Institution support the collection, recovery, reuse and recycling of solid wastes.

9. To identify the gap areas and suggest recommendations to improve the Green Campus status of St. Xavier's College.

TARGET AREAS OF GREEN AUDITING

Green audit forms part of a resource management process. Although they are individual events, the real value of green audit is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Eco-campus concept mainly focuses on the efficient use of energy and water; minimize waste generation or pollution and also economic efficiency.

All these indicators are assessed in the process of "Green Auditing of this educational institute". Eco-campus focuses on the reduction of contribution to emissions, procure a cost effective and secure supply of energy, encourage and enhance energy use conservation, promotes personal action, reduce the institute's energy and water consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts. Target areas included in this green auditing are water, energy, waste, green campus and carbon footprint.

Auditing for Water Management

Water is a natural resource; all living organisms depend on water. While freely available in many natural environments, in human settlements potable (drinkable) water is less readily available. Groundwater depletion and

water contamination are taking place at an alarming rate. Hence it is essential to examine the quality and usage of water in the college. Water auditing is conducted for the evaluation of facilities of raw water intake and determining the facilities for water treatment and reuse. The concerned auditor investigates the relevant method that can be adopted and implemented to balance the demand and supply of water.

Auditing for Energy Management

Energy conservation is an important aspect of campus sustainability which is also linked with carbon foot print of the campus. Energy auditing deals with the conservation and methods to reduce its consumption related to environmental degradation. It is therefore essential that any environmentally responsible institution examine its energy use practices.

Auditing for Waste Management

Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health. Pollution from waste is aesthetically unpleasing and results in large amounts of litter in our communities which can cause health problems. Solid waste can be divided into three categories: bio-degradable, non-biodegradable and hazardous waste. Bio-degradable wastes include food wastes, canteen waste, wastes from toilets etc. Non-biodegradable wastes include what is

usually thrown away in homes and educational institutions such as plastic, tins and glass bottles etc. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals, acids and petrol. Unscientific management of these wastes such as dumping in pits or burning them may cause harmful discharge of contaminants into soil and water supplies, and produce greenhouse gases contributing to global climate change respectively. Special attention should be given to the handling and management of hazardous waste generated in the college. Bio-degradable waste can be effectively utilized for energy generation purposes through anaerobic digestion or can be converted to fertilizer by composting technology. Non-biodegradable waste can be utilized through recycling and reuse. Thus the minimization of solid waste is essential to a sustainable college. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

Auditing for Green Campus Management

Trees play an important ecological role within the urban environment, as well as support improved public health and provide aesthetic benefits to campus. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen released by the trees of the campus is good for the people in the campus. So while you are busy studying and working on earning those good

grades, all the trees in campus are also working hard to make the air cleaner for you.

Auditing for Carbon Footprint

Burning of fossil fuels (such as petrol, coal) has an impact on the environment through the emission of greenhouse gases into the atmosphere. The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions. Vehicular emission is the main source of carbon emission in the campus, hence to assess the method of transportation that is practiced in the college is important.

METHODOLOGY ADOPTED

The methodology adopted to conduct the Green Audit of the Institution had the following components

Onsite Visit

ten-day field visit was conducted by the Green Audit Team that is green campus committee members. The key focus of the visit was on assessing the status of the green cover of the Institution, its waste management practices and energy conservation strategies etc. The sample collection (water, soil) was carried out during the visits. The water samples from two open wells and two tap water sources

were taken and soil samples from three different places of the campus was collected. The sample collection, preservation, and analysis were done in the scientific manner as prescribed by the standard procedures.

Focus Group Discussion

The Focus Group discussions were held with the Eco task force, Geo club, SEOC, NSS, Rotoract club members, staff members and the management focusing various aspects of Green Audit. The discussion was focused on identifying the attitudes and awareness towards environmental issues at the institutional and local level.

Energy, waste management and Carbon foot print analysis Survey

With the help of teachers and students, the audit team has assessed the energy consumption pattern and waste generation, disposal and treatment facilities of the college. The monitoring was conducted with a detailed questionnaire survey method.

Survey forms

1. Water management

S.N	Parameters	Response	Remarks
1	Source of water		
2	No of Wells		

3	No of motors used		
4	Horse power – Motor		
5	Depth of well –Total		
6	Water level		
7	Number of water tanks		
8	Capacity of tank		
9	Quantity of water pumped every day		
10	Any water wastage/why?		
11	Water usage for gardening		
12	Waste water sources		
13	Use of waste water		
14	Fate of waste water from labs		
15	Whether waste water from labs mixed with ground water		
16	Any treatment for lab water		
17	Whether any green chemistry method practiced in labs		
18	No of water coolers		
19	Rain water harvest available?		
20	No of units and amount of water harvested		
21	Any leaky taps		

22	Amount of water lost per day		

23	Any water management plan used ?		
24	Any water saving techniques followed ?		
25	Are there any signs reminding peoples to turn off the water?		

2. Energy audit

Room No. / name	**Electrical device/ items**	**Number**	**Power**	**usage time (hr/day)**

Item: Bulbs (CFL, incandescent, LED);
A/c, fan, computer, instruments

3. Waste management

Approximate quantity of waste generated per day (in kg)

Office				
		Non -		

Approx	Biodegradable	biodegradable	Hazardous	Others
<1Kg				
2-10Kg				
>10Kg				

Laboratories				
Approx	Biodegradable	Non - biodegradable	Hazardous	Others
<1Kg				
2-10Kg				
>10Kg				

Canteen/kitchen				
Approx	Biodegradable	Non - biodegradable	Hazardous	Others
<1Kg				
2-10Kg				
>10Kg				

Total strength of students, teachers, and Non-teaching staffs

No of Students	
No of Teachers	

No of Non-teaching staffs		
Gents		
Ladies		
Total		

How the waste generated in the college is managed?

A) Composting/ Vermicomposting	Yes/no	Remark
B)Recycling		
C)Reusing		
D)Other ways		

Waste generated in the college?

E-waste		
Hazardous waste		
Solid waste		
Dry leaves		
Canteen waste		
Liquid waste		
Glass		
Unused equipment		
Napkins		
Others (specify)		

Do you use recycled paper in college ?	
Any waste management methods used ?	

4. Carbon foot print analysis

1. Total number of vehicles used by the stakeholders of the college. (per day)
2. No of cycles used
3. No of two wheelers used (average distance travelled and quantity of fuel and amount used per day)
4. No of cars used (average distance travelled and quantity of fuel and amount used per day)
5. No of persons using public transportation
6. No of persons using college conveyance
7. No of generators used per day
8. Amount of fuel used
9. Number of LPG cylinders used in canteen/labs
10. Use of any other fossil fuels in the college
11. Any suggestion to reduce the use of fuel

AUDIT STAGE

Green auditing in St. Xavier's **college, Ranchi** began with the assessment of the status of the green cover of the Institution followed by waste management practices and energy conservation strategies etc. The team monitored different facilities at the college, determined different types of appliances and utilities (lights, taps, toilets, fridges,

etc.) as well as measuring the usage per item (Watts indicated on the appliance or measuring water from a tap) and identifying the relevant consumption patterns (such as how often an appliance is used) and their impacts. The staff and learners were interviewed to get details of usage, frequency or general characteristics of certain appliances. Data collection was done in the sectors such as Energy, Waste, Greening, Carbon footprint and Water use. College records and documents were verified several times to clarify the data received through survey and discussions. The environment samples including water, soil were from various location of the campus were collected and analyzed at School of Environmental Sciences, …

GREEN AUDIT REPORT

Water Quality assessment

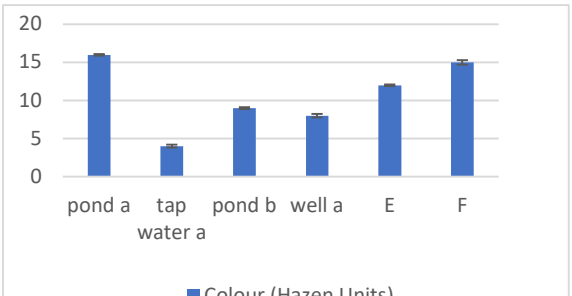
Water samples from four different locations were collected and analyzed for its quality parameters. The samples include two well water which are the main water source of the college campus and two tap water samples which is used for canteen and drinking water cum cooler systems. The samples were collected, preserved and transported to school of Environmental Sciences and analyzed for various physio-chemical parameters. The major parameters analyzed include dissolved oxygen, acidity, alkalinity, chloride, hardness, pH, conductivity, total dissolved solids and salinity. The results are presented in the Table 1 The results are comparable with the values of

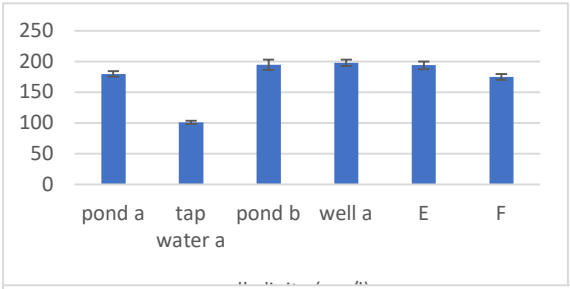
drinking water standards prescribed by different agencies.

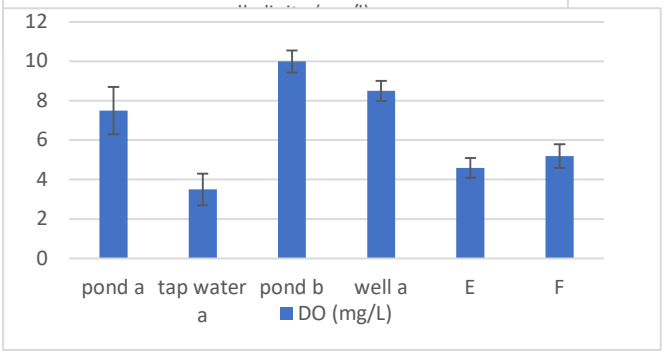
Table 1. Results of water quality

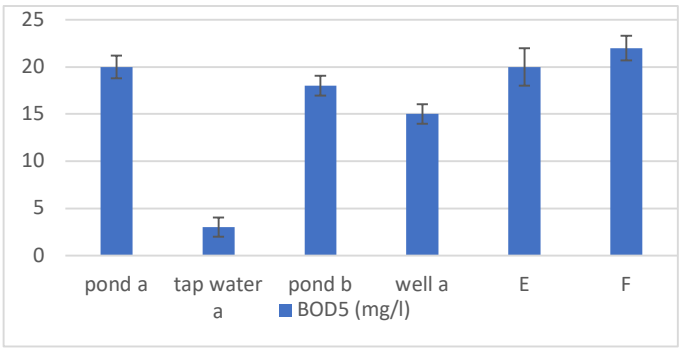
Parameters	Well water 1	Well water 2	Tap water 1	Tap water2	Standard value (BIS)
Dissolved Oxygen (mg/l)					
Acidity (mg/l)					
Alkalinity (mg/l)					
Chloride (mg/l)					
Hardness (Total)					
Conductivity (µs)					
pH					
Total Dissolved Solids (ppm)					
Salinity (ppt)					
Total coliform					
Fecal coliform					

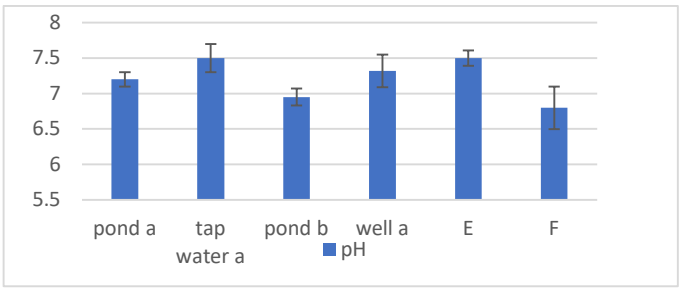
n= 3; SD of above data											
pond a	0.1	0.5	10	3.2	1.2	1.2	0.95	4.5	0.005	5.75	
tap water	0.2	1.2	15.2	4.2	0.8	1.02	1.45	2.5	0.004	8.66	
pond b	0.12	0.8	12.5	3.65	0.56	1.05	1.99	8.3	0.05	4	
well a	0.23	0.6	21.5	4.55	0.51	1.04	2.04	5.26	0.5	4.655	
E	0.11	0.7	18.23	1.25	0.5	2	1.54	6.25	0.012	6.58	
F	0.3	0.9	5.2	3.84	0.6	1.3	2.321	4.84	0.42	3.25	

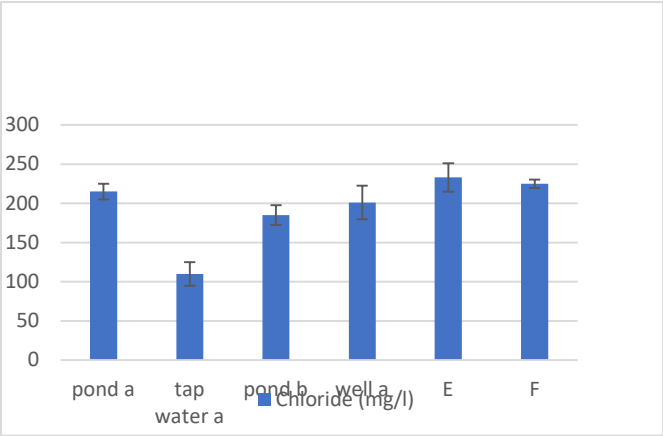



250
200
150
100
50
0
pond a
tap water a
pond b
well a
E
F


12
10
8
6
4
2
0
pond a
tap water a
pond b
well a
E
F
DO (mg/L)


25
20
15
10
5
0
pond a
tap water a
pond b
well a
E
F
BOD5 (mg/l)


8
7.5
7
6.5
6
5.5
pond a
tap water a
pond b
well a
E
F
pH



The source of water used in the College are two wells present in the campus. These wells are recharging with rainwater from the roof. A total of 18000L of water is pumped out from the well every day (Table 2). Wastage of water from the lab is reduced by adopting microscale analysis. An average of 3,60,000 L of water is used by the College per month.

Table 2.

SL NO	**PARAMETERS**	**Response**	Remarks
1	Source of water	Wells, Boring, supply water, pond	
2	No of Wells	6	
3	No of motors used	7	
4	Horse power – Motor	5hp-1pc, 3hp- 3pc,	

		1.2hp-3pc	
5	Depth of well –Total	40ft	
6	Water level	180 average	
7	Number of water tanks	19	
8	Capacity of tank	5000lt-10 2000lt-18 1000lt-1 10000lt-3 20000lt-1	

9	Quantity of water pumped every day	75000 lt/day	
10	Any water wastage/why?	no	
11	Water usage for gardening	yes	
12	Waste water sources	Kent water filter, lab, wash basin,wash rooms, kitchen,	
13	Use of waste water	Recycled and used for watering the plants	
14	Fate of wastewater from labs	Water with	

		chemical to toxic tank	
15	Any wastewater treatment for lab water		
16	Whether any green chemistry method practiced in labs	yes	
17	Rain water harvest available?	yes	
18	No of units and amount of water harvested	5 500000lt	
19	Any leaky taps	no	
20	Amount of water lost per day		
21	Any water management plan used?	Keys to control water supply, pipe lines are interconnected	
22	Any water saving techniques followed?	Water floater, water recycled	
23	Are there any signs reminding peoples to turn off the water?	Yes	

Waste management

Approximate quantity of waste generated per day (in kg)

Office				
Approx	Biodegradable	Non - biodegradable	Hazardous	Others
<1Kg	✓	✓	nil	
2-10Kg				
>10Kg				

Laboratories				
Approx	Biodegradable	Non - biodegradable	Hazardous	Others
<1Kg	✓	✓	✓	
2-10Kg				
>10Kg				

Canteen/kitchen				
Approx	Biodegradable	Non - biodegradable	Hazardous	Others
<1Kg				

2-10Kg	✓	✓		
>10Kg				

Total strength of students, teachers, and Non-teaching staffs

No of Students		9901
No of Teachers		103
No of Non-teaching staffs		163
Gents		117
Ladies		46

How the waste generated in the college is managed?

B) Composting/ Vermicomposting	Yes	Remark
B)Recycling	✓	
C)Reusing	✓	
D)Other ways	✓	

Waste generated in the college?

E-waste	✓	
Hazardous waste	✓	
Solid waste	✓	
Dry leaves	✓	
Canteen waste	✓	
Liquid waste	✓	
Glass	✓	
Unused	✓	

equipment		
Napkins	✓	
Others (specify)		

Do you use recycled paper in college ?	
Any waste management methods used ?	Both side of the paper used, separation waste, separate Dustin for dry, wet, solid, liquid, biodegradable and non-biodegradable, water served in glass during exam not in package drinking bottles

Soil Quality assessment

Soil samples were collected from four locations of the campus and analyzed for the basic parameters. The results are tabulated and presented in the table 3.

Table 3

Parameter	Location 1 (fruit garden)	Location 2 (ground)	Location 3 (Teak plantation)	Location 4 (Butterfly garden)
pH	6.5	5.9	6.1	6.2
Total Nitrogen (mg/kg)	55	41	51	53

Total organic carbon (%)	4	4	4	4
Phosphate (mg/kg)	630	580	621	626

Energy Audit Report

The electricity bill from June 2022 to May 2023 was rupees 2964917. Per month bill was rupees 247076.4166.

Table 4

Sl No	Electrical appliances/instruments	Number
1	CFL	
2	Tube	454
4	LED bulb	75
5	LED tube	307
6	Projector	38
7	Speakers	12
8	Fan	Celing401,Wall 140
9	Computer	624
10	Laptops	12
11	Printers	54
12	Photostat machine	9
13	Scanner	9

14	UPS	61
15	Induction	
16	A/C	176
17	Refrigerator	12
18	Table fan	7
19	Mixer grinder	
20	Oven	5
22	Centrifuge	3
23	Autoclave	4
24	Ultrasound	
25	Laminar flow	3
26	Exhaust fan	25
27	Iron box	1
28	Sewing machine	33
29	Colour bulb	
30	Incubator	6
31	Distillation unit	3
32	Sanitary napkin Incinerator	5
33	LED dispaly	1
34	Elevator /lift	4

Waste management

Waste management is important for an ecofriendly campus. In a college different types of wastes are

generated, its collection and management are very challenging. The following data provide the details of the waste generated and the disposal method adopted by the college.

Total number of stakeholders in the college:

Total number of building (Class rooms, canteens, office, auditorium, library etc):

Class rooms	99
Canteens	3
offices	17
Auditorium	2
Libraries	2 Main and each Department

Table 5. Different types of waste generated in the college and their disposal

Types of waste	Particulars	Disposal method
E-Waste	Computers, electrical and electronic parts	Direct selling
Plastic waste	Pen, Refill, Plastic water bottles and other plastic containers, wrappers etc	Direct selling
Solid wastes	Damaged furniture,	Reuse after

	paper waste, paper plates, food wastes	maintenance energy conversion
Chemical wastes	Laboratory waste	Neutralise with water
Waste water	Washing, urinals, bathrooms	Soak pits, water recycling
Glass waste	Broken glass wares from the labs	Direct selling
Sanitary Napkin	-	Napkin Incinerators

Fig. 2 Per day waste generation in class rooms, offices and canteen

place	biodegradable	Non-biodegradable	Other waste
office	2-3 kgs		
Class room	3-4 kgs		
canteen	3-4 kgs		

Waste management Practices adopted by the college

For the last few years, college is following zero organic waste protocol throughout the campus. The food waste generated

by the students and staffs are taken by them to their own home, so that, minimum waste is generated inside the campus. In addition, the organic waste generated in the canteen is used as feed for biogas plant and the biogas is used as fuel in college canteen. Vegetable waste and other leaf litters were used to fed in the vermi-compost pit and the resulting vermin-cast is used as manure in the garden. The chemicals from the laboratories are disposed in a sealed tank along with water, so that the chemicals undergo neutralization with the water.

Biodiversity report of St. Xavier's College Ranchi, Jharkhand

Table 6. List of plants in the campus

S N	Common/Local name	Scientific Name	No of trees	Family

	Scientific name	Parking area	Qudrangle	Entrance	Intermidiate	Chapal	Hostel area	Field	Jesuit	Total
	Alstonia scholaris (L.) R.Br.	0			4	1				5
	Swietenia macrophylla King in Hook.	11			4				1	16
	Swietenia mahagoni (L.) Jacq.	9		5	28		9	4	9	64
	Anacardium occidentale L.	0				1				1
	Artocarpus heterophyllus Lam.	1			1				1	3
	Cassia javanica L.	0					1			1
	Haldina cordifolia (Roxb.) Ridsdale	1	1		1			1		4
	Magnolia champaca (L.) Baill. ex Pierre	0					2	1		3
	Mangifera indica L.	1			7		11	3	2	24
	Psidium guajava L.	1			4					5
	Ficus elastica Roxb. ex Hornem.	1			1					2
	Gmelina arborea Roxb. ex Sm	0			9				1	10
	Grevillea robusta A.Cunn. ex R.Br.	1						15		16
	Holoptelea integrifolia (Roxb.) Planch.	0								0
	Jacaranda mimosifolia	1								1
	Litsea glutinosa (Lour.) C.B.Rob.	0				1				1
	Madhuca longifolia J.F.Macbr.	0	`	1						1
	Millettia pinnata	1								1
	Monoon longifolium (Sonn.) B.Xue & R.M.K.Saunders	7	10	4	24	7	23		18	93
	Roystonea regia	10	5							15
	Schleichera oleosa (Lour.) Oken	3		1	8					12
	Shorea robusta		1			1			2	4
	Tectona grandis L.f.	21			3				12	36
	Pterocarpus indicus				1	1				2
	Persea americana				1					1
	Unknown 2				1					1
	Dalbergia sisso				8				2	10
	Melia azedarach				4		1			5
	Delonix regia				7			1		8

	Moruspapyrephera				2					2
	Peltopharum pterocarpum				1					1
	Bombax ceiba				1					1
	Caryota urens				1					1
	Melaleuca viminalis				5	1				6
	Taberanemontana coronaria				3					3
	Thuja .sp				1					1
	Cascabela thevetia				2					2
	ficus unknown				1					1
	ixora				3					3
	pterospermum acerifolium				1					1
	phyllanthus emblica					1				1
	bauhinia purpurea					1				1
	tamarindus indica						1			1
	ravenala madagascariensis						2			2
	phoenix sp.						1			1
	punica granatum						1			1
	carica papaya						1			1
	moringa oleifera							1	3	4
	unknown 3								1	1
	cocos nucifera								2	2
	annona squamosa								1	1
	Grand Total									**459**

	HERBS AND SHRUBS			
1	Kamal cactus	*Agave americana*		Aspargaceae
2	Chirchithi	*Achyranthus aspara*		Amaranthaceae
3	Shatawar	*Asparagus recemosa*		asparagaceae
4	Musk basil	*Basilicum polystachyon*		Lamiaceae
5	Akwan	*Calotropis gigantea*		Asclepediaceae
6	Kordiline	*Cordyline fruticosa*		Asparagaceae
7	Cycas	*Cycas revoluta*		Cycadaceae
8	Cakor	*Cassia tora*		Fabaceae
9	Sastanput	Chromolaena odorata		Astraceae
10	Bhasat	*Clerodendron infortunatum*		Lamiaceae
11	Areca palm	*Dypsislutescens*		Arecaceae
12	Lucky bamboo	*Dracaena sanderiana*		Aspragaceae
13		*Emblica robusta*		Phyllantheaceae
13	Dudhiya	*Euphorbia hirta*		Euphorbiaceae
14	Christ thorn	*Euphorbia milli*		Euphorbiaceae
15	Mexican flame leaf	*Euphorbia pulcherima*		Euphorbiaceae
16	Masarpakha	*Platycladus orientalis*		Cupressaceae
17	Sword fern	*Polystichum munitum*		Dryopteridaceae
18	Travelers palm	*Ravenala madagareinsis*		Strelitziaceae
19	Brahma kamal	*Saussurea obvallata*		Astearceae

20	Boat lily	*Tradscantia spathacea*		Commoleniaceae
21	Dracaena	*Dracaena*		Asparagaceae
22	chasku	*Glochidion lanceolarium*		Phyllanthaceae
23	Dasmas	*Grona heterocarpos*		Fabaceae
24	Ethas	*Helicteres isora*		Malvaceae
25	Swiss cheese plan	*Monstera deliciosa*		Araceae
26	Putus	*Lantana camara*		Verbenaecae
27	Hyssop	*Cuphea hyssopifolia*		Lythraceae
28	Peace lilly	*Spathiphyllum kochii*		Araceae
29	Cast iron	*Aspidistra spp*		Asparagaceae
30	Poinsettia	*Euphorbia pulcherima*		Euphorbiaceae
31	Thaumatop hyllum	*Thaumatophyllum Xanadu*		Araceae
32	Lajwanti	*Mimosa pudica*		Fabaceae
33	Harsingar	*Nyctanthus arobortristris*		Oleaceae
34	Bhuinamla	*Phyllanthus niruri*		Phyllanthacae
35		*Phyllanthus virgatus*		Phyllanthacae
36	Rattan jat	*Jatropha curcus*		Euphorbiaceae
37	Mahbal	*Sida acuta*		Malvaeae
38	Bal	*Sida cordifolia*		Malvaeae
39	Bal	*Sida rhombifolia*		Malvaeae
40	Macoi	*Solanum nigrum*		Solanaceae
41	lemon	*Citrus limon*		Rutaceae
42	Rangaini	*Solanum xanthcarpum*		Solanaceae
43	Creeping wood sorrel	*Oxalis corniculata*		Oxalidaceae

44	Chagra	*Oxalis latifolia*		Oxalidaceae
45	Congress grass	*Parthenium hysterophorus*		Asteraceae
46	Texas fog fruit	*Phyla nodiflora*		Verbenaceae
47	Beery	*Physalis minima*		Solanaceae
48	Small knotweed	*Polygonum plebeium*		Polygonaceae
49	Wild petunia	*Ruellia prostrata*		Acanthaceae
50	Licorice weed	*Scoparia dulcis*		Scrophulariaceae
51	Spiny sowthistle	*Sonchus apsera*		Asteraceae
52	Toothache plant	*Sonchus oleraceus*		Asteraceae
53	Akarkara	*Spilanthes calva*		Asteraceae
54	Sindwar	*Vitex negundo*		Verbenaceae
55	Coat buttons	*Tridax procumbens*		Asteraceae
56		*Volutarella divaricata*		Asteraceae
57	Cocklebur	*Xanthium strumarium*		Helianthaceae
58	Ber	*Zizyphus oenoplia*		Rhamnaceae
GRASSES				
1	Dub grass	*Cynodon dactylon*		Poaceae
2	Little leaf canary grass	*Phalaris minor*		Phalaridacee
3	Rabbitfoot	*Polypogon monspeliensis*		Poaceae

	grass			
4	Green foxtail	*Setaria viridis*		Poaceae
5	Johngrass	*Sorghum halapense*		Poaceae
6	Indian drop seed	*Sporobolus diander*		Poaceae
7	Wavy leaf	*Oplismenus burmannii*		Poaceae
8	Charikata	*Chrysopogon aciculata*		Poaceae
9	Nanuh	*Chrysopogon montanus*		Poaceae
10	Finger grass	*Fimbristylis miliacea*		Cyperaceae
11	Love grass	*Eragrostis tenella*		Poaceae
12	Finger grass	*Chloris barbata*		Poaceae
13	Makra	*Dactyloctenium aegyptium*		Poaceae
CLIMBERS				
1		*Clematis spp.*		Ranunculaceae
2	Scarlet clock vine	*Thunbergia coccininea*		Acanthaceae
3	Morning glory	*Ipomea cairica*		Convulvulaceae
4		*Cissus repanda*		Vitaceae
	FAUNA BIRDS			
1	Domestic goose	*Anser anserdomesticus*		
2	Kite	*Milvus migrans*		
3	Rock pigion	*Columba livia*		
4	Cattle egret	*Bubulcus ibis*		
5	Black drogo	*Dicurus macrocercuser*		

6	House crow	*Corvus splendens*		
7	Common myna	*Acridotheres tristis*		
8	House sparrow	*Passer domesticus*		
9	Jungle babber	*Argya striata*		
	SNAKES			
1	Keelback	*Rhabdophis subminiatus*		
2	Braminy blind snake	*Indotyphlops brahminus*		
3	Buff stripped keelback	*Amphiesmas tolatum*		
	LIZARDS			
1	Oriental garden lizard	*Calotes versicolor*		
2	Indian stink	*Sphenomorphus indicus*		
3	Common wall lizard	*Podarcis muralis*		
	DRAGONFLIES			
1	Green mask hawk	*Orthetrums abina*		
2	Blue marsh hawk	*Brachydiplaxs obrina*		
3	Indian blue	*Caconeura ramburi*		

	bambootail			
4	Saffron faced blue dart	*Pseudagrio nrubriceps*		
	BUFFERFLIES			
1	Common crow butterfly	*Euplea core*		
2	Common emigrant	*Catopsilia pomona*		
3	Indigo flash	*Rapala varuna*		
4	Common bush brown	*Mycalesis perseus*		
	SPIDERS			
	Cross spider	*Argiope aemula*		
1	House jumper	*Hasarius adansoni*		
2	Heavy bodied jumper	*Hyllus semicupreus*		
3	Wall jumper	*Heteropoda venatoria*		
	CRICKET AND GRASSHOPPERS			
1	Field cricket	*Gryllus campestris*		
2	House cricket	*Acheta domesticus*		
3	Mole cricket	*Gryllotalpidae*		
4	Long horned	*Tettigoniidae*		

	grasshopper			
5	Cone headed grasshopper	*Acrida ungarica*		
6	Migratory locust	*Nomadacris succincta*		
	MAMMALS			
1	House mouse	*Mus musculus*		
2	Fruit bat	*Pteropus medius*		
	ANTS			
1	Yellow crazy ant	*Anoplolepis gracilipes*		
2	Carpenter ant	*Camponotus radiatus*		
3	Indian black ant	*Camponotus compressus*		
4	Fire ant	*Solenopsis invicta*		
5	Little black ant	*Monomorium minimum*		

Campus farming

The college has started a novel venture of cultivation of fruit trees in a 30 cent area of the campus. In addition, Organic vegetable farm, medicinal plant gardens were also properly maintained outside the campus.

Routine Green Practices

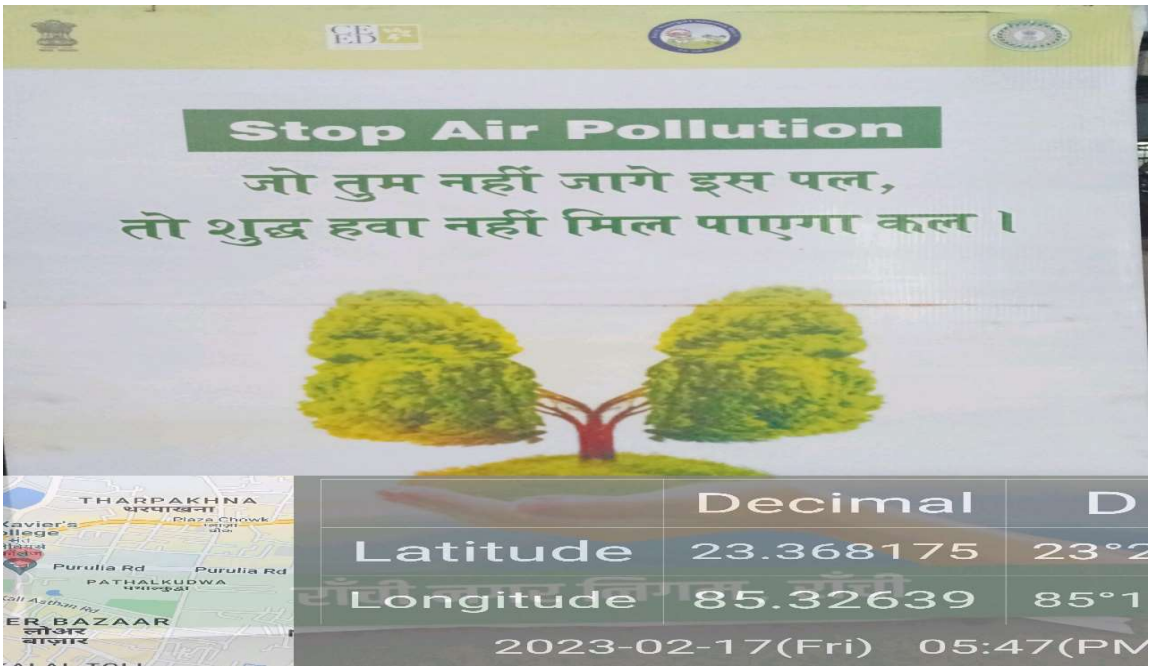
Every year college celebrates World Environment Day, Van Mahotsav, World Water Day and Ozone Day in the campus. The main focus of these programems is to provide awareness to the students about the importance of the environment, its conservation and sustainable use of environmental resources. The programmes are conducted through seminars, poster presentation, quiz competition debates etc.

Reports of some of the activities (31 August 22-31August 2023)

Water harvesting for PG and Hostel B block, waste water storage and recycling, tree plantation, deepening of water shade, butterfly diversity study, naming of the plants, soil testing, water tasting

Green slogans

Green campus clean campus, ban on use of plastics, cleanliness is next to Godliness



Carbon Foot Print Analysis

1. Total number of vehicles used by the stakeholders of the college

2. Number of cycles used:

3. No: of two wheelers used: 120 teachers + 1268 students

Average distance travelled: 2 km

Average quantity of fuel used: ½ Ltr/Day

4. No: of cars used 85

Average distance travelled: 3 km

Average quantity of fuel used: 1 Ltr

5. No: of persons using public transportation:

6. No: of persons using college conveyance: ----

7. No: of generators used per day: 2 (180 KVA AND 250 KVA JAKSON) (21 hrs. / Month)
8. Amount of fuel used: 1449 Ltrs/ Month
9. No: of LPG cylinders used in canteen/ Labs:
10. Use of any other fossil fuels in the college: Using firewood in the college canteen: burnt coal and fire wood
11. Any suggestion to reduce the use of fuel: -----

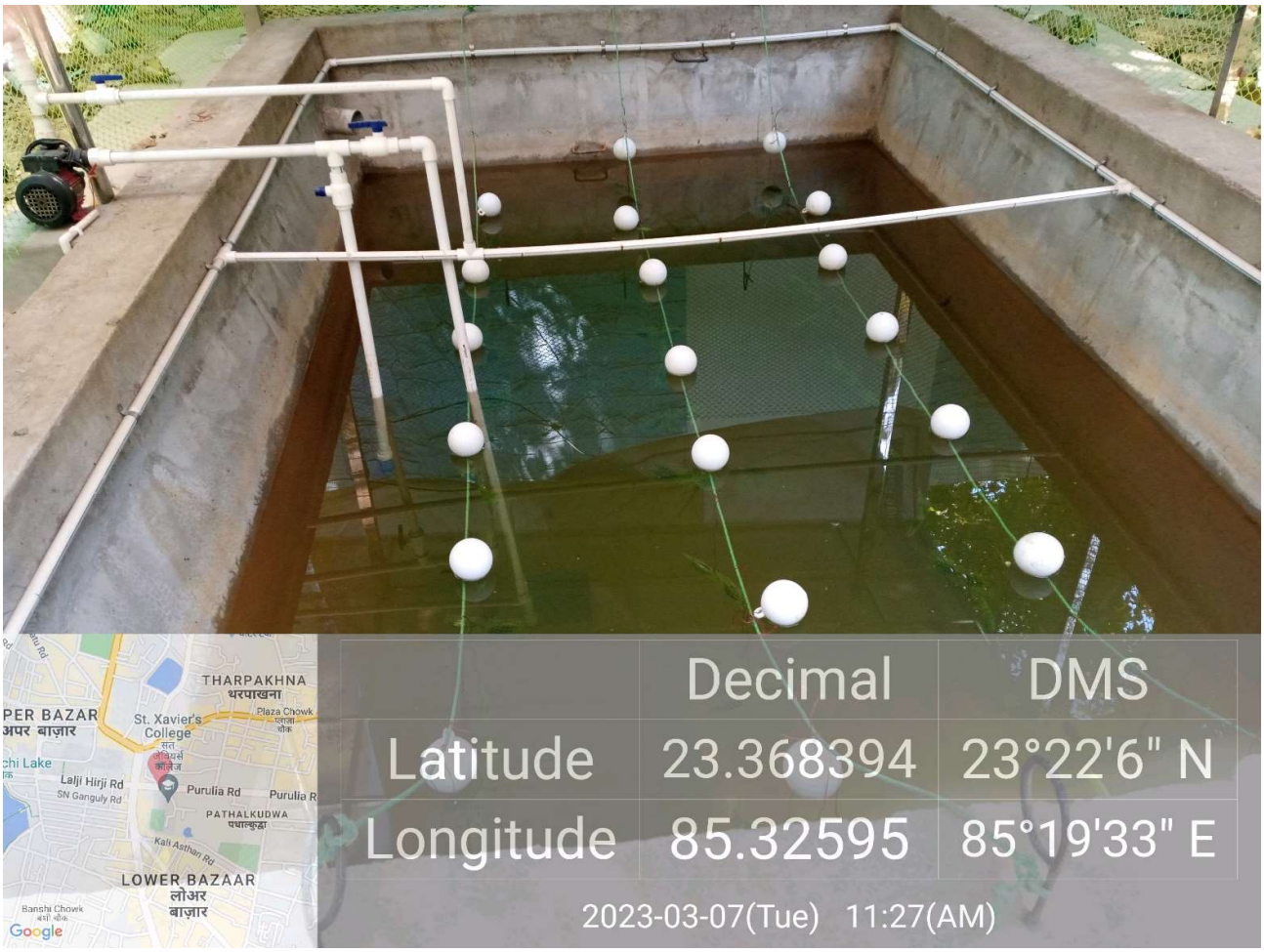
Green initiative of 22-23

1. Water shade for storing and remediation
2. Installation of composter machine
3. Waste dumping pit for leaf composting
4. Installation of lighting conductor

Plantation on world environmental day

Van mahotsav day

Land fill for dumping bottles



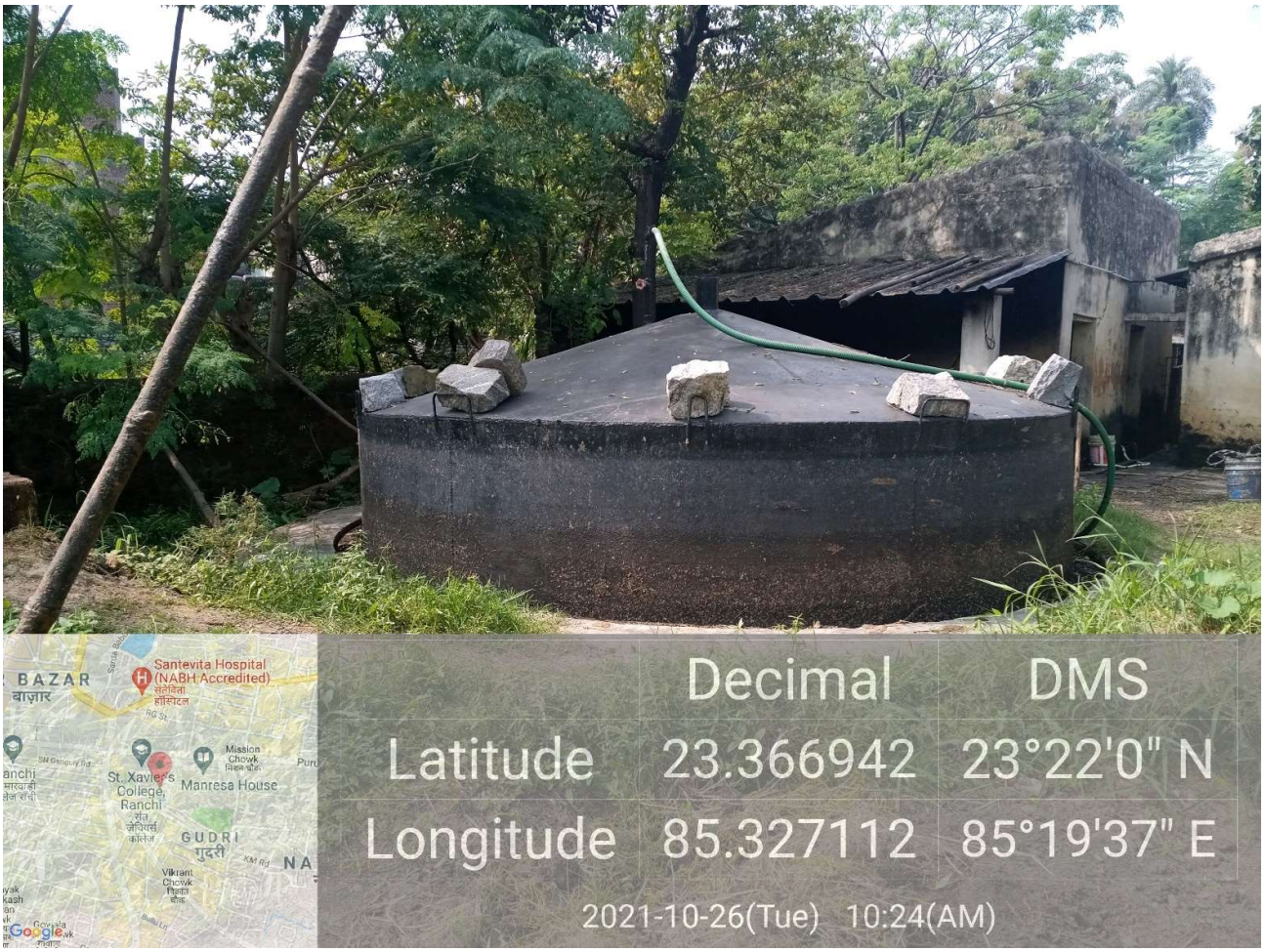
Pearl Culture

Water storage

Water reused

Rain water harvesting

Lab chemical waste disposal



Bio gas plant

Water shade

Solar panel

Composter machine

Dry leaves composting pit

Vermi composting

Mushrooms cultivation and training

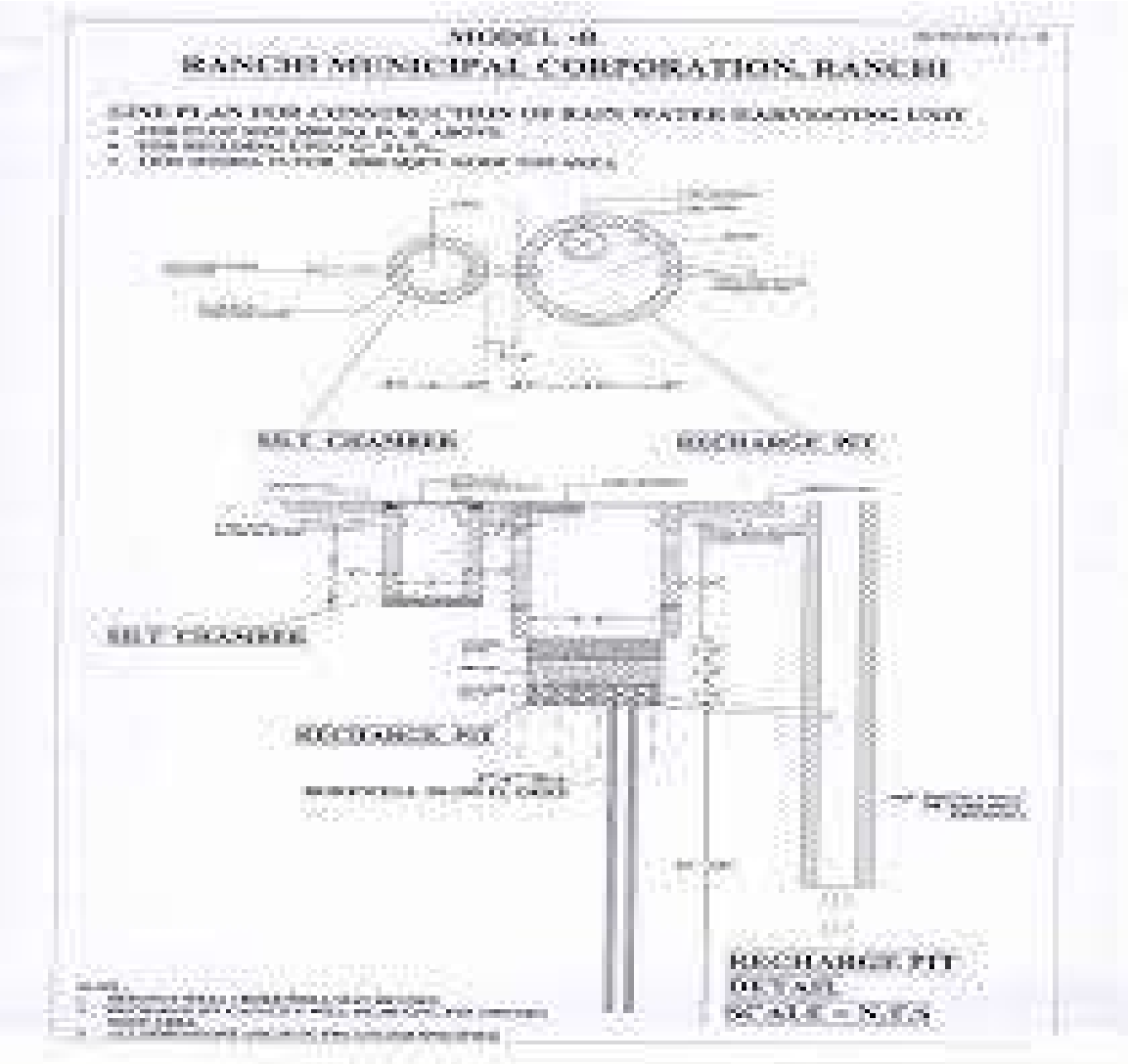


Fig. 3 Schematic diagram of water harvesting and its utilization

SUGGESTIONS AND RECOMMENDATIONS

Water Management

The wells can be recharged with rainwater from rooftops of new building. The rain water can also be used as source for drinking water. The coolant water can be recycled

through a separate plumbing system.

The canteen waste can also be subjected to aerobic composting by setting-up of few composting yards in the campus. This will provide a chance for the students to learn by seeing and operating such compost yards by themselves.

Energy management

The energy audit recommends to avoid the use of more energy consuming electrical appliances and to replace with more environment friendly and energy efficient appliances in the college. The potential of renewable energy sources has to be explored.

In order to increase the carbon credit and greenery of the campus, it is recommended to plant more indigenous and evergreen / fruit trees inside the campus.

Waste Management

Try to avoid the use of plastic in the campus, and to encourage the use of biodegradable materials as alternatives. Try to achieve the goal of plastic free campus. Recycle the paper waste.