GREEN AUDIT REPORT

Bodoland University

Kokrajhar (BTR),
(Assam)

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED

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(2021-22)

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ACKNOWLEDGEMENT

Empirical Exergy Private Limited (EEPL), Indore (M.P) takes this opportunity to appreciate & thank the management of **Bodoland University, Kokrranjhar (BTR), (Assam) for** allowing us to conduct the green audit for the university.

We are indeed touched by the helpful attitude and co-operation of all faculties and technical staff, who rendered their valuable assistance and co-operation during the study.

Rajesh Kumar Singadiya

(Director)

M.Tech (Energy Management), PhD (Research Scholar)
Accredited Energy Auditor [AEA-0284]
Certified Energy Auditor [CEA-7271]
(BEE, Ministry of Power, Govt. of India)
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Certified Water Auditor (NPC, Govt of India)
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ENERGY IS LIFE
BEE
CONSERVE IT

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA- 7271

Accreditation Registration No.: AEA-284

Certificate of Accreditation

This is to certify that Mr./Ms. Shri. Rajesh Kumar Singadiya having its trade/registered office at ..... has been given accreditation as accredited energy auditor. The certificate shall be effective from 9th day of May, 2018

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 284 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 5th day of October, 2018

Secretary,
Bureau of Energy Efficiency
New Delhi

Green Monitoring Committee.

OFFICE OF THE INTERNAL QUALITY ASSURANCE CELL
(IQAC)
BODOLAND UNIVERSITY
DEBARGAON, KOKRAJHAR, BTR, ASSAM-783370

Ref. BU/IQAC/2022/Letter/01 Dated 16/09/2022

OFFICE ORDER

As approved by the Honorable Vice-Chancellor dated 1/09/22, the Green Audit Committee, Bodoland University, is constituted with the following member's effect from the date of issue of the order till the further order.

S/N	Profile	Name
1.	Convener	Dr Hemen Sarma, Dept of Botany
2.	Members	Chairperson, Kokrajhar Municipal Corporation
3.		Prof. Haremba Bailung, Dept. of Physics
4.		Prof. Hilloljyoti Singha, Dept. of Zoology
5.		Prof. Sanjoy Basumatary, Dept of Chemistry
6.		Dr. Kushal Choudhury, Dept of Zoology
7.		Dr. Sanjib Barua, Dept of Botany
8.		Dr. Yutika Narzary, Dept of Botany
9.		Dr. Rebecca Daimary, Dept of Botany

(Prof. Sujit Deka)
Director
IQAC, Bodoland University

Director, IQAC
Bodoland University
Kokrajhar, 783370

File No. BU/IQAC/Essential/2022/01

Copy to –

1. P.S. to the Vice-Chancellor, Bodoland University for information
2. Members Concerned
3. Office File

The Audit Team

The study team constituted of the following senior technical executives from **Empirical Exergy Private Limited, Indore (M.P.)**

- **Mr. Rajesh Kumar Singadiya** [Director & Accredited Energy Auditor AEA-0284]
- **Mr. Rakesh Pathak**, [Director & Electrical Expert]
- **Mr. Sachin Kumawat** [Sr. Project Engineer]
- **Mrs. Laxmi Raikwar Singadiya** [Energy Engineer]
- **Mr. Ajay Nahra** [Sr. Accountant]
- **Mr. Charchit Pathak** [Mechanical Engineer]
- **Mr. Aakash Kumawat** [Jr. Engineer]
- **Mr. Mohan Choudhary** [Sr. Electrician]

EXECUTIVE SUMMARY

Green Initiative Taken by University

- **CAMPAIGN OF PLANTATION AND GREEN CAMPUS**

University has around **315 No's trees** on campus. It's a good initiative taken by management for a green campus under the campaign of a plantation. **It's APPRECIABLE.**

RECOMMENDATION: -

- **5 DUST BIN SYSTEM**

It is observed that university has adopted two dust bin system for all kind of waste generated in university campus. It is recommended to 5 dust bin system for segregation of all type of waste generated in university campus.

- **INSTALLATION ORGANIC CONVERTOR**

There is good potential for installation of organic convertor to treat organic waste generated from kitchen, canteen, trees and lawn area of the university campus. The output of above organic convertor is good manure for garden and plants in the campus.

- **QR CODE SYSTEM ON TREE**

While the world seems to be going digital, people lack the time to read books and process the information they contain. Hence, university can provide QR codes on the trees for its information and to exploit the rapidly growing platform for a unique purpose.

- **AIR MONITORING SYSTEM**

Installation of **"Cloud based (IoT based) Air Quality monitoring system in the Campus"** to monitor air quality index for university campus.

OTHER SUGGESTIONS & RECOMMNEDATION

Some of the very important suggestions.

- Adopt the proposed Environmentally Responsible Purchasing Policy, and work towards creating and implementing a strategy to reduce the environmental impact of its purchasing decisions.
- Increase recycling education on campus.
- Increase Awareness of Environmentally Sustainable Development in university campus.
- Practice Institutional Ecology- Set an example of environmental responsibility by establishing institutional ecology policies and practices of resource conservation, recycling, waste reduction, and environmentally sound operations.
- Involve All Stakeholders- Encourage involvement of government, foundations, and industry in supporting interdisciplinary research, education, policy formation, and information exchange in environmentally sustainable development.
- Collaborate for interdisciplinary approaches- To develop interdisciplinary approaches to curricula, research initiatives, operations, and outreach activities that support an environmentally sustainable future.
- Increase reduce, reuse, and recycle education on campus.
- Develop a butterfly garden that arouses appreciation towards flora and fauna diversity.
- Name all the trees and plants (Plant DNA barcodes) with its common name and scientific name.
- Arrange training programmes on environmental management system and nature conservation.
- Ensure participation of students and teachers in local environmental issues.
- Renovation of cooking system in the canteen to save gas by installation solar water heater system with heat pump.
- Avoid plastic/thermocole plates and cups in the university level or department level functions.

CHAPTER-1
INTRODUCTION

1.1 About University

Bodoland University was established by Bodoland University Act 2009, passed in the Assam legislative Assembly. The present Bodoland University is an up-gradation of the Kokrajhar campus of Gauhati University to a full fledged state University as per the provision of the Act

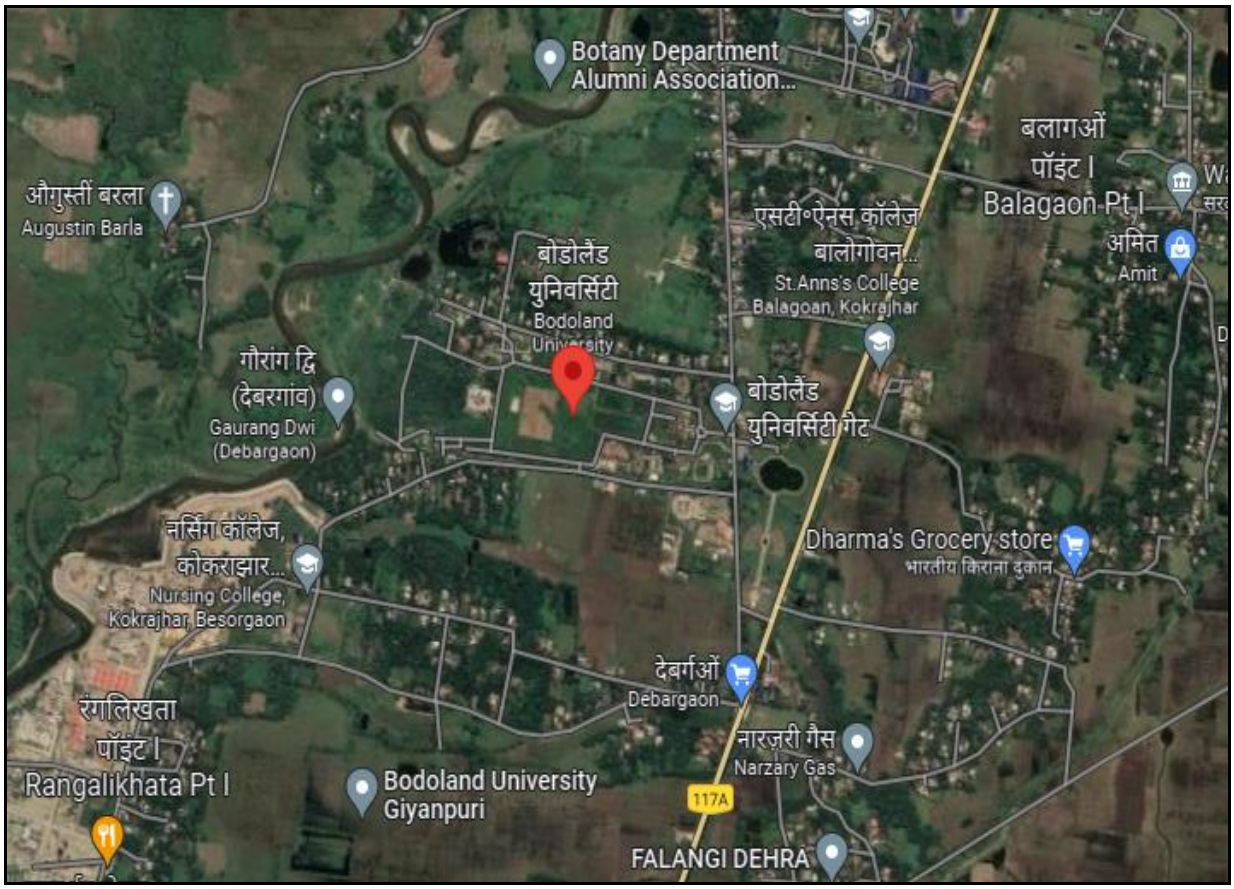


Figure 1.1: - Satellite Image of Bodoland University, Kokrajhar, Assam

VISION:-

Bodoland University aspires to be a lead public university that can indoctrinate its student's moral values, scientific temper, socio-cultural, economic and political leadership qualities in order to meet the regional, national and global challenges.

MISSION:-

1. To impart value based education leading to holistic sustainable development.
2. To conduct need based location-specific research and development of the highest quality with a wide range of interests.
3. Keeping clear focus on the advancement of technology, effort to be made to increase efficiency of existing technology, optimize the use of natural resources and preserve the environment.
4. To ensure access of all sections of the society for higher education keeping in view the prevailing socio-economic deprivations.
5. To inculcate woman empowerment potential through education.
6. To protect, preserve and promote ethics and cultural heritage pertinent to the location in particular and country in general for furtherance of national integrity.
7. To provide up-to-date, relevant and need-based knowledge.
8. To promote flexible, effective governance.
9. To create linkage with concerned centre of advancement/excellence in country /abroad.
10. To produce high-caliber students who are expected to play leading roles in their chosen careers ensuring effective and sustainable social actions. The University should be a breeding ground of new generation of human resource who would be job-creators and not job-seekers.

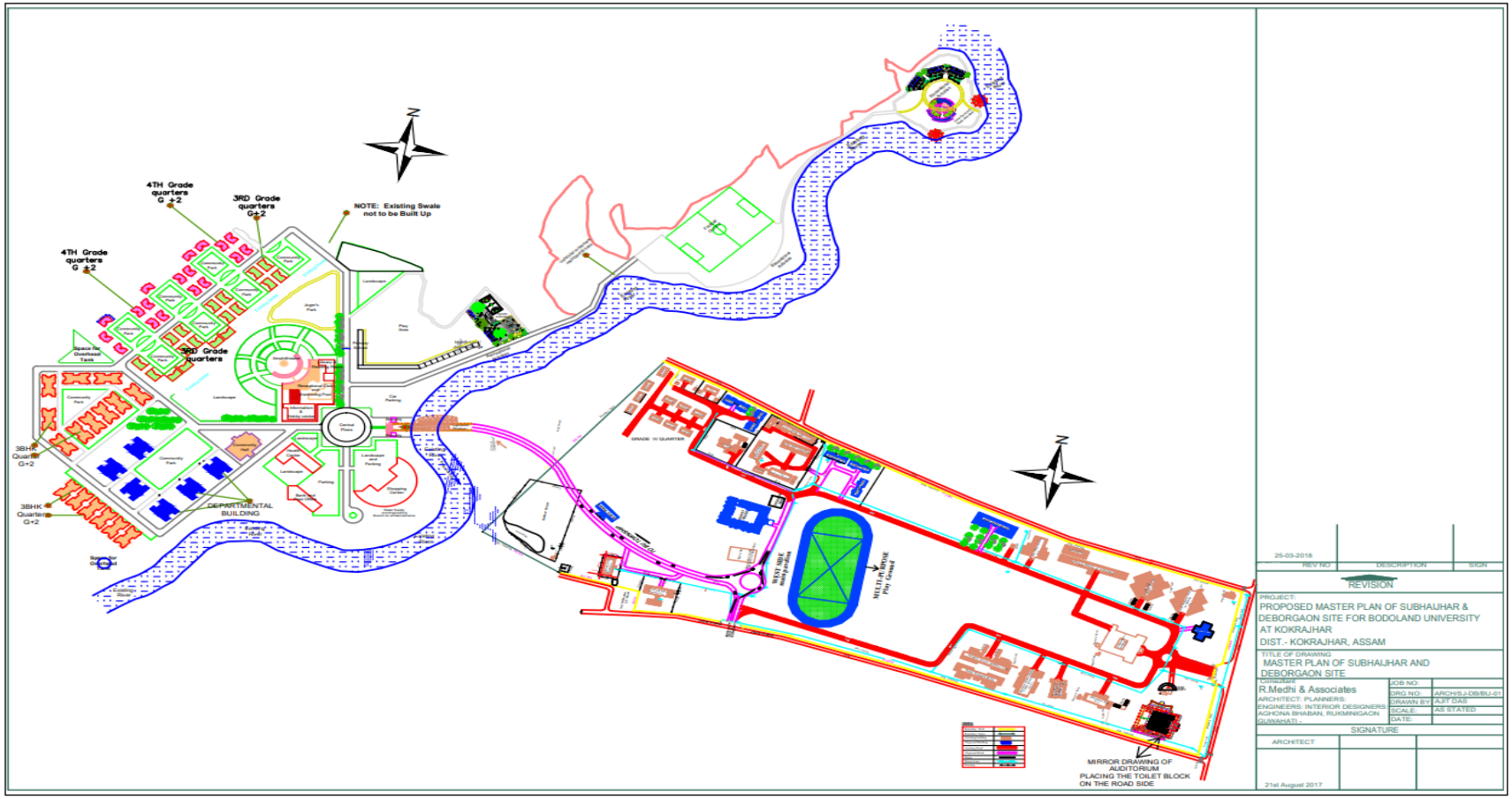
University Build-up area

The Total build up area of the university in the given table. Total build-up area for all floors 57869 SQ.MT

Total overall build-up all floors area:- 57869 SQ.MT

Sr. no.	Building Name	Total Area Sq.mt.
1	Administrative	2000
2	Academic Science Building	860
3	Teaching Staff Quarter	240
4	Vice Chancellor Residence Complex	520
Technical Staff Quarter		
5	Grade IV	125
6	Grade III	152
7	Academic Art	957.8
8	Academic Art	957.8
9	New Science	289
10	Library	306
11	Assam Type	865
12	Bodo Study Centre	1007.5
13	New teaching Staff Quarter	240
14	Officers Quarter	331.36
15	Art building	938.5
16	SC Girls Hostel	348
17	ST Girls Hostel	348
18	Girls Hostel	468
19	Girls Hostel	468
20	ST Boys Hostel	468
21	General Boys Hostel	348
22	PSGUOffice Building	120
23	Canteen Building	270
24	Auditorium Hall	1500
25	Technology Incubation Centre	510
26	Development Play Ground	40000
27	Chemistry Department	860
Haldibhari Complex		
Sr.no.	**Building Name**	**Total Area Sq.mt.**
28	Teaching Staff Quarter	240
29	Plant Tissue Culture lab	540
30	Dept. of Zoology	796
31	Dept. of Botany	796

Bodoland University layout: -



1.2 About Green Auditing

Eco 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 into the environment.

Green audit means to identify opportunities for sustainable development practices, enhance environmental quality, improve health, hygiene, and safety, reduce liabilities achieve values of virtue. A green audit also provides a basis for calculating the economic benefits of resource conservation projects by establishing the current rates of resource use and their associated costs.

Green auditing of **"Bodoland University"** enables assessment of the lifestyle, action, and its impact on the environment. This green audit was mainly focused on greening indicators like utilization of green energy (solar energy) and optimum use of secondary energy sources (petrol and diesel) in the University campus, vegetation, carbon footprint of the campus, etc. Green auditing aims to help the institution to apply sustainable development practices and to set examples before the community and young learners.

1.3 Objectives of Green Auditing

The general objective of a green audit is to prepare a baseline report on "Green campus" and alternative energy sources (solar energy), measures to mitigate resource wastage, and improve sustainable practices.

The specific objectives are:

- To inculcate values of sustainable development practices through a green audit mechanism.
- Providing a database for corrective actions and plans.
- To identify the gap areas and suggest recommendations to improve the green campus status of the University.

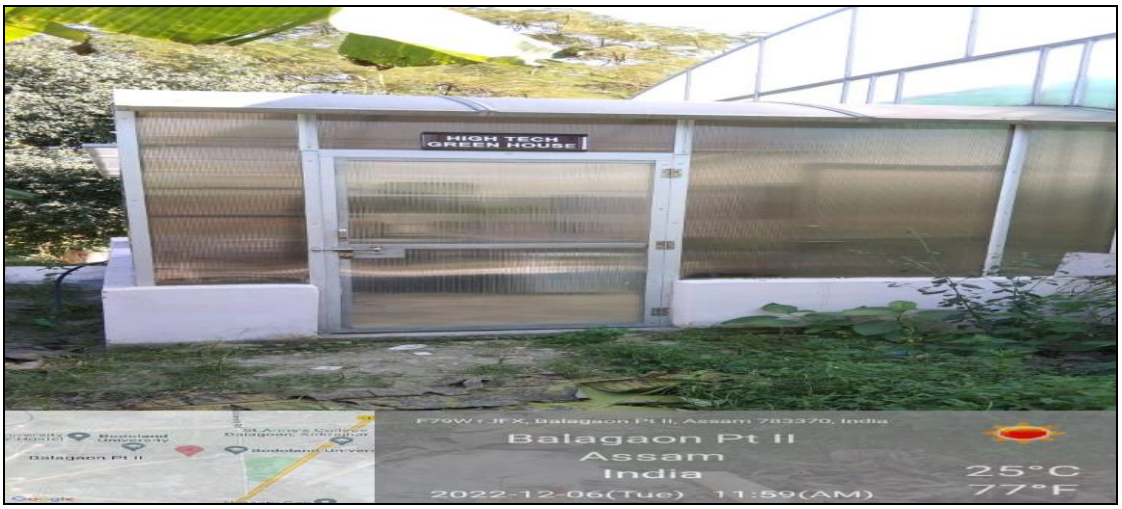
CHAPTER- 2
GREEN CAMPUS & SUSTAINABLE DEVELOPMENT

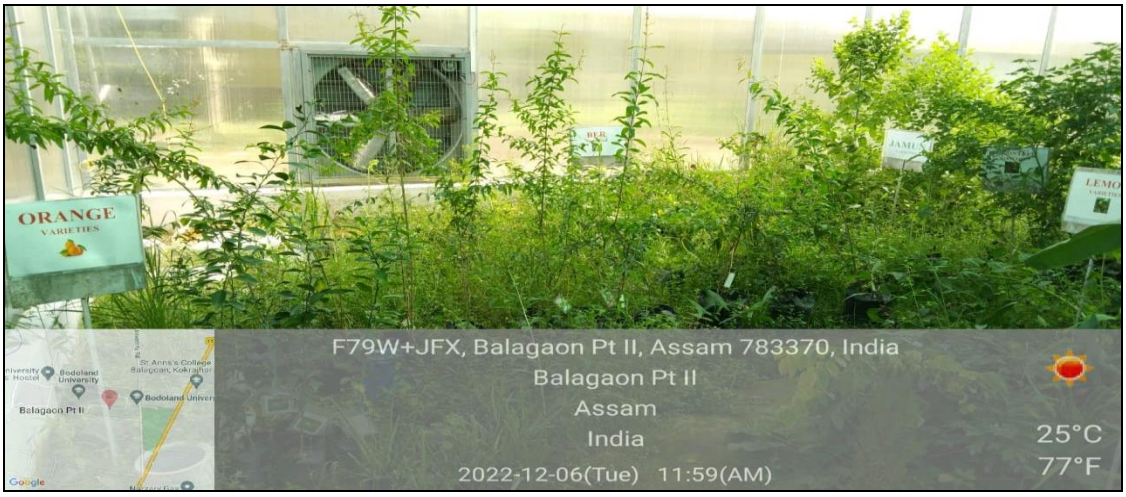
2.1 Green Audit

In the survey, the focus has been given to the assessment of the present status of plants and trees on the university campus and efforts made by the university authorities for nature conservation. The campus is in the vicinity of approximately more than 315 trees. The detail is given below:

Green Campus

High Tech Green House





2.2 List of plants in the university campus.

Sr. no.	Tree Name	Botanical Name	Family Name	Quantity
1	Nahor (Bd., Ass.)	Mesua ferrea	Calophyllaceae	30
2	Tita-sap (Bd.); Tita-sopa (Ass.)	Magnolia champaca	Magnoliaceae	21
3	Aowjar (Bd.); Ajar (Ass.)	Lagerstroemia speciosa	Lythraceae	5
4	Neem (Bd., Ass.)	Azadiracta indica	Meliaceae	5
5	Arjun (Bd., Ass.)	Terminalia arjuna	Combretaceae	11
6	Debdaru (Bd., Ass.)	Polyalthia longifolia	Annonaceae	45
7	Mistang (Bd.); Ghura Neem (Ass.)	Melia azedarach	Meliaceae	2
8	Bwigri (Bd.); Bogori (Ass.)	Rhamnaceae	Zizyphus mauritiana	7
9	Gerguwa (Bd.)	Dypsis lutescens	Arecaceae	
10	Korangso (Bd.); Korosh (Ass.)	Pongamia pinnata	Papilionaceae	13
11	Amlai (Bd.); Amlokhi (Ass.)	Phyllanthus emblica	Phyllanthaceae	7
12	Muga-song Biphang (Bd.); Sowalu (Ass.)	Lauraceae	Litsea monopetala	1
13	Sal (Eng., Ass., Bd.)	Dipterocarpaceae	Shorea robusta	1
14	Sendur (Ass.)	Bixaceae	Bixaceae	2
15	Krishna-sura (Bd., Ass.)	Delonix regia	Caesalpiniaceae	31
16	Kharira (Ass.)	Acacia auriculiformis	Mimosaceae	1
17	Sonalu (Bd.); Sonaru (Ass.)	Cassia fistula	Caesalpiniaceae	7
18	Bokul (Bd.; Ass.)	Mimusops elengi	Sapotaceae	31
19	Sumpram (Bd.); Madhuri (Ass.)	Psidium guajava	Myrtaceae	2
20	Taijwo (Bd.); Aam (Ass.)	Mangefera indica	Anacardiaceae	2
21	Narengkol (Bd.); Narikal (Ass.)	Cocos nucifera	Arecaceae	4
22	Jolpi (Bd.); Jolphai (Ass.)	Elaeocarpus floribundus	Elaeocarpaceae	3
23	Taigir (Bd.); Owtenga (Ass.)	Dillenia indica	Dilleniaceae	6
24	Radha-sura (Bd.; Ass.)	Caesalpiniaceae	Cassia javanica	2

Sr. no.	Tree Name	Botanical Name	Family Name	Quantity
25	Jiya (Bd.; Ass.)	Toona ciliata	Meliaceae	2
26	Kantal (Bd.); Kothal (Ass.)	Artocarpus heterophyllus	Moraceae	5
27	Mehgony (Ass.)	Swietenia mahagoni	Meliaceae	6
28	Pakri (Bd.); Ahot (Ass.)	Ficus religiosa	Moraceae	4
29	Baora (Bd.); Bhomora (Ass.)	Terminalia bellirica	Combretaceae	7
30	Seleka (Bd.; Ass.)	Terminalia chebula	Combretceae	11
31	Sepali (Bd.); Sewali (Ass.)	Nyctnthes arbor-tristis	Oleaceae	3
32	Jori (Ass.)	Ficus benjamina	Moraceae	1
33	Gupur-jam (Bd.); kola-Jamuk (Ass.)	Syzygium cumini	Myrtaceae	9
34	Lisu (Bd.; Ass.)	Litchi chinensis	Sapindaceae	2
35	Stauna (Bd.); Sationa (Ass.)	Alstonia scholaris	Apocynaceae	2
36	Sishu (Bd., Ass.)	Dalbergia sissoo	Papilionaceae	1
37	Silky oak	Alstonia scholaris	Apocynaceae	1
38	Mojlai (Bd.), Som (Ass.)	Machilus gamblei	Lauraceae	1
39	Tingklang (Bd.); Teteli (Ass.)	Tamarindus indica	Caesalpiniaceae	1
40	Lai-dolor (Bd.); Laru bandha (Ass.)	Mallotus tetracoccus	Euphorbiaceae	1
41	Kaju-badam (Bd.; Ass.)	Anacardium occidentale	Anacardiceae	3
42	Kasod (Ass.)	Senna siamea	Caesalpiniaceae	4
43	Sondon-gwja (Bd.); Ku-chndan (Ass.)	Adenanthera pavonina	Mimosaceae	1
44	Gongar-taisib gidir (Bd.); Nuni (Ass.)	Morus macroura	Moraceae	1
45	Muli Bah (Ass.)	Melocanna baccifera	Poaceae	1
46	Kotoha (Ass.)	Bambusa multiplex	Poaceae	-
47	Awowa gwmw (Bd.)	Bambusa vulgaris	Poaceae	4

Sr. no.	Tree Name	Botanical Name	Family Name	Quantity
48	NA	Bambusa multiplex var. fernleaf	Poaceae	1
49	NA	Pleioblastus fortunei	Poaceae	4
		Total		315

University has **315 trees** on the campus. This is a good initiative taken by management for a green campus under the campaign of the plantation. **It's APPRECIABLE.**

Word Environment Day Celibration Year-2022

International Day of Forests

Chief Minister's Plantation Programme

Chapter-03
CARBON FOOTPRINT ANALYSIS

3.1 About Carbon footprint.

Climate change is one of the biggest challenges faced by the world, nations, governments, institutions, businesses, and mankind today.

Carbon footprint is a measure of the impact your activities have on the amount of carbon dioxide (CO_2) produced through the burning of fossil fuels and is expressed as a weight of CO_2 emissions produced in tonnes.

We focus on consumption in each of our five major categories: housing, travel, food, products, and services. In addition to these, we also estimate the share of national emissions over which we have little control, government purchases, and capital investment.

For simplicity and clarity, all our calculations follow one basic method. We multiply a user input by an emissions factor to calculate each footprint. All use inputs are per individual and include things like fuel use, distance, calorie consumption, and expenditure. Working out your inputs is a matter of estimating them from your home, travel, diet, and spending behaviour.

Although working out your inputs can take some investigation on your part the much more challenging aspect of carbon calculations is estimating the appropriate emissions factor to use in your calculation. Where possible you want this emissions factor to account for as much of the relevant life cycle as possible.

We all have a carbon footprint…

3.2 Methodology and Scope

The carbon footprint gives a general overview of the Bodoland University greenhouse gas emissions, converted into CO_2 -equivalents and it is based on reported data from internal and external systems. The purposes of the carbon indicators are to measure the carbon intensity per unit of product, in addition to showing environmental transparency towards external stakeholders. The carbon footprint reporting approach undertaken in this study follows the guidelines and principles set out in the "Greenhouse Gas Protocol Corporate Accounting and Reporting Standard" (hereafter referred to as the GHG Protocol) developed by the Greenhouse Gas Protocol Initiative and international standard for the quantification and reporting of greenhouse gas emissions -ISO 14064. This is the most widely used and accepted methodology for conducting corporate carbon footprints. The study has assessed carbon emissions from the Bodoland University Campus. This involves accounting for and reporting on, the GHG emissions from all those activities for which the company is directly responsible. The items quantified in this study are as classified under the ISO 14064 standards: The report calculates the greenhouse gas emissions from Bodoland University. This includes electricity, as well as emissions associated with diesel consumption in the institute vehicle. The emission associated with air travel, waste generation, administration, and marketing-related activities has been excluded from the current study. Emissions from business activities are generally classified as scope 1, 2, or 3 areas classified under the ISO 14064 standards.

3.3 Carbon Emission from Electricity

Direct emissions factors are widely published and show the number of emissions produced by power stations to produce an average kilowatt-hour within that grid region

Unlike other energy sources, the carbon intensity of electricity varies greatly depending on how it is produced and transmitted. For most of us, the electricity we use comes from the grid and is produced from a wide variety of sources. Although working out the carbon intensity of this mix is difficult, most of the work is generally done for us.

Electricity used in the site is a significant contributor to GHGs emissions from the unit. Electricity used onsite is the most direct, and typically the most significant, a contributor to a unit's carbon footprint. Thus, using an average fuel mix for generating electricity, the carbon dioxide intensity of electricity for the national grid is assumed to be 0.9613 KgCO2/Kwh

(Reference: Central Electricity Authority (CEA) Baseline Carbon Dioxide Emission database http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/database_11.zip). Electricity is purchased from the grid

Table:- 4.1 Electricity Purchased from the grid and Emissions from the electricity Import

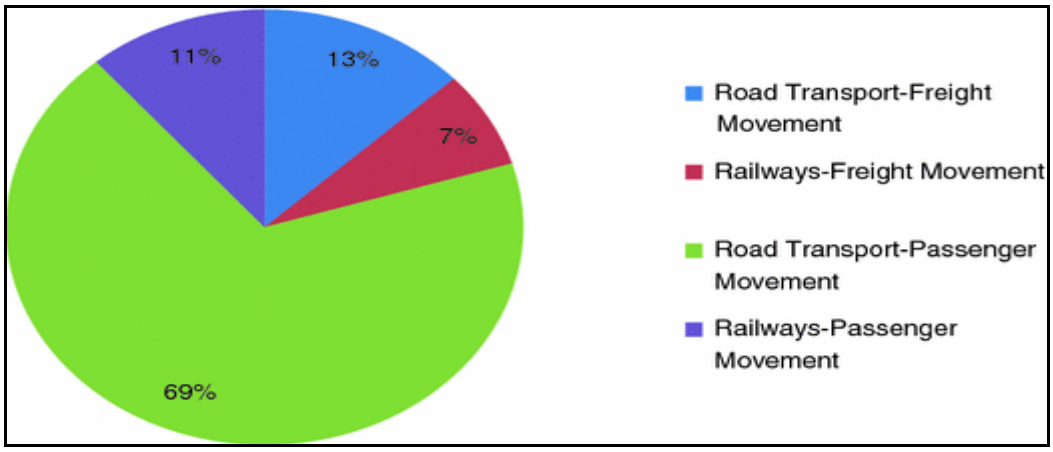
Sr. no	Year	Total unit Consumption by APDCL	Unit	Emission Factor kg CO^2e/kWh	Emission ton CO^2e/year
1	2019-20	1,54,412	kWh	0.9613	148.43
2	2020-21	1,65,072	kWh	0.9613	158.68
3	2021-22	2,64,546	kWh	0.9613	254.30

Observation:-

Total CO_2 Emission by indirectly from electricity is 254.30 Ton CO_2 e/year in 2021-22. It will be reduced to installation of Solar system.

3.4 Carbon Emission from Vehicles.

In India, it is the third most CO_2 emitting sector, and within the transport sector, road transport contributed more than 90% of total CO_2 emissions (IEA, 2020; Ministry of Environment Forest and Climate Change, 2018)



Transportation (29 percent of 2019 greenhouse gas emissions) – The transportation sector generates the largest share of greenhouse gas emissions. Greenhouse gas emissions from transportation primarily come from burning fossil fuels for our cars, trucks, ships, trains, and planes.

We have also considered the total GHGs emission done by transportation facilities available buses,

The energy team has analysed the following vehicle movement for university campus.

Calculation of carbon footprint analysis: -

As per discussion by the concerned department in the university and data provided by Management.

The following details are given in the table: -

Sr. No.	Month & Year	Diesel Consumption (Litre.)	Travelling per month (KM)	No of Days
1	Jul-21	1,200	7,200	25
2	Aug-21	1,152	6,912	24
3	Sep-21	1,152	6,912	24
4	Oct-21	1,104	6,624	23
5	Nov-21	1,152	6,912	24
6	Dec-21	1,200	7,200	25
7	Jan-22	1,104	6,624	23
8	Feb-22	1,056	6,336	22
9	Mar-22	1,200	7,200	25
10	Apr-22	1,104	6,624	23
11	May-22	1,152	6,912	24
12	Jun-22	1,152	6,912	24
	Total	13,728	82,368	286

- CO_2 Emissions from a gallon of gasoline: 8,887 grams CO_2/ gallon
- CO_2 Emissions from a gallon of diesel: 10,180 grams CO_2/ gallon

(1 US Gallon = 3.7854 liters)

- CO_2 Emissions from a Littre of gasoline: 2347.95 grams CO_2/ Liter.
- CO_2 Emissions from a Littre of diesel: 2689.56 grams CO_2/ liter.

$$\text{Total } CO_2 \text{ Emissions} = \frac{CO_2 \text{ Per liter}}{\text{Average Mileage (Km/Liter)}} \times \text{Distance (in km)}$$

$$\text{Total } CO_2 \text{ Emissions} = \frac{2689.59}{18} \times 82368 = \mathbf{12307563 \text{ gram per year}}$$

Annually Co2 Emission :- 12307563 gram/year or 12307.5 kg/year or 12.30 ton/year

3.5 Carbon emission from DG sets

University has 07 no. DG sets installed on the university campus

Table 4.5 :- Total diesel consumption in a year July-2021 to Jun-2022.

Sr. No.	Month & Year	Diesel (DG)
1	Jul-21	1020
2	Aug-21	1020
3	Sep-21	1080
4	Oct-21	780
5	Nov-21	780
6	Dec-21	840
7	Jan-22	660
8	Feb-22	1,020
9	Mar-22	960
10	Apr-22	1,080
11	May-22	1,020
12	Jun-22	1,080
	Total	**11,340**

Every liter of diesel fuel contains 720 grams of pure carbon. In an average liquid hydrocarbon burning engine. It can be assumed that about 99 % of the fuel is Oxidized (It is assumed that somewhat less than 01 % will fail to fully oxidize and will be emitted as a particulate of unburned hydrocarbons instead of CO_2.

Calculation of Total CO_2 =

- CO_2 Emissions from a Littre of diesel: 2689.56 grams CO_2/ liter.
- Diesel consumption Jul-2021 to Jun-2022 = 11340 Liter
- 11340 x 2689 = 30493260 gram. or **30.49Ton/year**

3.6 Biomass Calculation and CO^2 Sequestration of the Trees

1. Estimation of above-ground biomass (AGB)

$$K= 34.4703 – 8.0671D + 0.6589 D^2$$

Where = K is above-ground biomass.
D is Breast height diameter in (cm)

1 Estimation of below ground biomass (BGD)

$$BGB = AGB \times 0.15$$

2 Total Biomass (TB)

$$TB = AGB + BGB$$

3 Calculation of carbon dioxide Weight sequestered in the tree in Kg.

$$C = W \times 0.50$$

4 Calculate the weight of CO_2 sequestered in the tree per year in Kg.

$$CO_2 = C \times 3.666$$

Where: -

AGB = Above ground biomass.

D = Diameter of tree breast height.

BGB = Below Ground Biomass.

C = Carbon

TB = Total Biomass.

Biomass calculation of the tree

Sr. no.	Tree Name	Average Diameter CM (10 to 100)	AGB	BGB	Total	Carbon Storage	Amount of Co2 Sequestered	Total	Total Amount of Co2 Sequestered	Annually Co2 Sequestered amount (Ton/year)
1	Nahor (Bd., Ass.)	26	283.7	42.5	326.2	163.1	598.0	30	17939	0.24
2	Tita-sap (Bd.); Tita-sopa (Ass.)	20	144.7	21.7	166.4	83.2	305.0	21	6405	0.09
3	Aowjar (Bd.); Ajar (Ass.)	18	109.2	16.4	125.6	62.8	230.2	5	1151	0.02
4	Neem (Bd., Ass.)	27	311.6	46.7	358.3	179.2	656.8	5	3284	0.04
5	Arjun (Bd., Ass.)	44	993.9	149.1	1143.0	571.5	2095.0	11	23045	0.31
6	Debdaru (Bd., Ass.)	52	1450.7	217.6	1668.3	834.2	3058.1	45	137613	1.88
7	Mistang (Bd.); Ghura Neem (Ass.)	48	1211.4	181.7	1393.2	696.6	2553.7	2	5107	0.07
8	Bwigri (Bd.); Bogori (Ass.)	16	79.2	11.9	91.1	45.5	166.9	7	1169	0.02
9	Gerguwa (Bd.)	15	66.2	9.9	76.2	38.1	139.6		0	0.00
10	Korangso (Bd.); Korosh (Ass.)	34	545.0	81.8	626.8	313.4	1148.8	13	14935	0.20
11	Amlai (Bd.); Amlokhi (Ass.)	26	283.7	42.5	326.2	163.1	598.0	7	4186	0.06
12	Muga-song Biphang (Bd.); Sowalu (Ass.)	13	44.3	6.6	51.0	25.5	93.5	1	93	0.00
13	Sal (Eng., Ass. Bd.)	12	35.4	5.3	40.7	20.4	74.7	1	75	0.00
14	Sendur (Ass.)	10	21.7	3.3	24.9	12.5	45.7	2	91	0.00
15	Krishna-sura (Bd., Ass.)	38	708.3	106.2	814.5	407.2	1493.0	31	46282	0.63
16	Kharira (Ass.)	13	44.3	6.6	51.0	25.5	93.5	1	93	0.00
17	Sonalu (Bd.); Sonaru (Ass.)	32	471.5	70.7	542.2	271.1	993.9	7	6958	0.09
18	Bokul (Bd.; Ass.)	26	283.7	42.5	326.2	163.1	598.0	31	18536	0.25
19	Sumpram (Bd.); Madhuri (Ass.)	40	798.0	119.7	917.7	458.9	1682.2	2	3364	0.05

Sr. no.	Tree Name	Average Diameter CM (10 to 100)	AGB	BGB	Total	Carbon Storage	Amount of Co2 Sequestered	Total	Total Amount of Co2 Sequestered	Annually Co2 Sequestered amount (Ton/year)
20	Taijwo (Bd.); Aam (Ass.)	30	403.5	60.5	464.0	232.0	850.5	2	1701	0.02
21	Narengkol (Bd.); Narikal (Ass.)	45	1046.2	156.9	1203.2	601.6	2205.4	4	8822	0.12
22	Jolpi (Bd.); Jolphai (Ass.)	32	471.5	70.7	542.2	271.1	993.9	3	2982	0.04
23	Taigir (Bd.); Owtenga (Ass.)	40	798.0	119.7	917.7	458.9	1682.2	6	10093	0.14
24	Radha-sura (Bd.; Ass.)	15	66.2	9.9	76.2	38.1	139.6	2	279	0.00
25	Jiya (Bd.; Ass.)	18	109.2	16.4	125.6	62.8	230.2	2	460	0.01
26	Kantal (Bd.); Kothal (Ass.)	54	1578.5	236.8	1815.3	907.7	3327.5	5	16637	0.23
27	Mehgony (Ass.)	32	471.5	70.7	542.2	271.1	993.9	6	5964	0.08
28	Pakri (Bd.); Ahot (Ass.)	42	893.2	134.0	1027.2	513.6	1882.9	4	7532	0.10
29	Baora (Bd.); Bhomora (Ass.)	38	708.3	106.2	814.5	407.2	1493.0	7	10451	0.14
30	Seleka (Bd.; Ass.)	40	798.0	119.7	917.7	458.9	1682.2	11	18504	0.25
31	Sepali (Bd.); Sewali (Ass.)	22	185.6	27.8	213.4	106.7	391.2	3	1174	0.02
32	Jori (Ass.)	20	144.7	21.7	166.4	83.2	305.0	1	305	0.00
33	Gupur-jam (Bd.); kola-Jamuk (Ass.)	15	66.2	9.9	76.2	38.1	139.6	9	1256	0.02
34	Lisu (Bd.; Ass.)	14	54.6	8.2	62.8	31.4	115.1	2	230	0.00
35	Stauna (Bd.); Sationa (Ass.)	46	1099.9	165.0	1264.9	632.5	2318.6	2	4637	0.06
36	Sishu (Bd., Ass.)	48	1211.4	181.7	1393.2	696.6	2553.7	1	2554	0.03
37	Silky oak	38	708.3	106.2	814.5	407.2	1493.0	1	1493	0.02
38	Mojlai (Bd.), Som (Ass.)	26	283.7	42.5	326.2	163.1	598.0	1	598	0.01

Sr. no.	Tree Name	Average Diameter CM (10 to 100)	AGB	BGB	Total	Carbon Storage	Amount of Co2 Sequestered	Total	Total Amount of Co2 Sequestered	Annually Co2 Sequestered amount (Ton/year)
39	Tingklang (Bd.); Teteli (Ass.)	32	471.5	70.7	542.2	271.1	993.9	1	994	0.01
40	Lai-dolor (Bd.); Laru bandha (Ass.)	20	144.7	21.7	166.4	83.2	305.0	1	305	0.00
41	Kaju-badam (Bd.; Ass.)	16	79.2	11.9	91.1	45.5	166.9	3	501	0.01
42	Kasod (Ass.)	14	54.6	8.2	62.8	31.4	115.1	4	460	0.01
43	Sondon-gwja (Bd.); Ku-chndan (Ass.)	18	109.2	16.4	125.6	62.8	230.2	1	230	0.00
44	Gongar-taisib gidir (Bd.); Nuni (Ass.)	20	144.7	21.7	166.4	83.2	305.0	1	305	0.00
45	Muli Bah (Ass.)	26	283.7	42.5	326.2	163.1	598.0	1	598	0.01
46	Kotoha (Ass.)	22	185.6	27.8	213.4	106.7	391.2		0	0.00
47	Awowa gwmw (Bd.)	22	185.6	27.8	213.4	106.7	391.2	4	1565	0.02
48	NA	16	79.2	11.9	91.1	45.5	166.9	1	167	0.00
49	NA	13	44.3	6.6	51.0	25.5	93.5	4	374	0.01
Total Co2 Emission neutralize By the trees										5.34

University has **315 trees** on campus. This is a good initiative taken by management for a green campus under the campaign of the plantation. **It's APPRECIABLE.** There are total CO_2 sequestered of **5.34 Tons /Year.** It's Appreciable.

Calculation of CO_2 Emission of Bodolend University: -

Total Carbon Footprint generated By the campus	=	Carbon footprint by electricity + Carbon footprint by vehicle + Carbon footprint by DG Sets. - Carbon Neutralize by the tree,

Total Carbon Foot Print by campus: 254.30+ 12.30 +30.49 – 5.34= 291.75 tons/year

Recommendation: - Install solar system for reduce Co2 emission per year.

3.7 Other Emissions Excluded

This study did not evaluate the carbon sequestration potential of existing plantation activities and emissions from the staff commuting, food supply, official flights, paper products, water supply, and waste disposal and recycling due to limited data availability. The current study identifies areas where data monitoring, recording, and archiving need to be developed for enlarging the scope of mapping of GHGs emissions in the future years. Accordingly, a set of tools and record-keeping procedures will be developed for improving the quality of data collection for the next year's carbon footprint studies.

CHAPTER- 4
WASTE MANAGEMENT

4.1 About Waste

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 public health waste management is important for an eco-friendly campus. In universities, different types of waste are generated, and its collection and management are very challenging.

Solid waste can be divided into three categories: biodegradable, non-biodegradable and hazardous waste. A bio-degradable waste includes food waste, canteen waste, wastes from toilets, etc. Non-biodegradable wastes include what is usually thrown away in homes and schools 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 at the University. 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 University. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

Table 4.1 Different types of waste generated on the university campus.

Sr. No.	Types of Waste	Particulars
1	Solid wastes	Damaged furniture, paper waste, paper plates, food waste, etc.
2	Plastic waste	Pen, Refill, Plastic water bottles and other plastic containers, wrappers, etc.
3	E-Waste	Computers, electrical and electronic parts, etc.
4	Glass waste	Broken glass wares from the labs etc.
5	Chemical wastes	Laboratory waste etc.
6	Bio-medical Waste	Sanitary Napkin etc.

4.2 Waste management practices adopted by the university

Audit team also visited various departments, canteen, and other areas, to find out waste generation area and waste collection points for further improvement. Details are given in the the

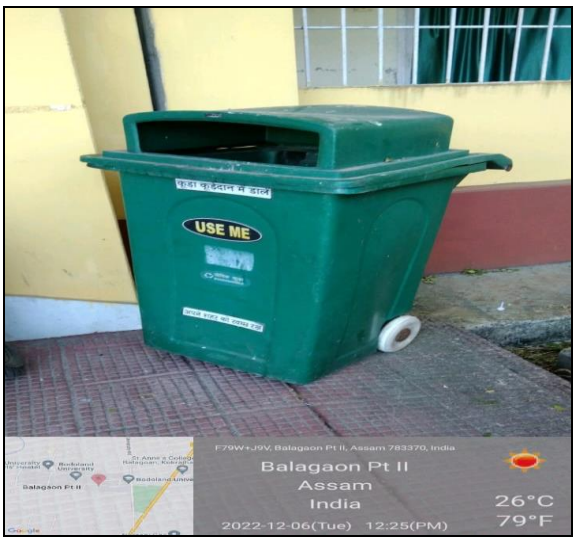


Figure: - 4.1 Dustbin Collection system on the university campus

Recommendation

It is recommended adopted 5 bin waste collection system for collect different type of waste generated in university premises.

Recommended 5 dust bin waste collection System

Table: 4.2 List of waste collection dustbin system

Sr.no.	Location	Dustbin
1	Chemistry Dept.	2
2	Incubation Centre	2
3	Central Library	2
4		2
5	Alongbar Science Building	2
6		2
7		2
8	Arts Building	2
9	Suniti Kr. Chatterjee Hall	2
10	Dept. of Zoology	2
11	Br. Ambedkar Social Science Building	2
12	Admin Building	2
13	SC Girls Hostel	12
14	ST Girls Hostel	8
15	General Girls Hostel	8
16	New Girls Hostel	30
17	Guest House	2
18	Boys Hostel 01	6
19	ST Boys Hostel 02	2
20	Animal House	1
21	Near Main Gate	2
	Total	**95**

Chemical Waste Water in laborateris.

It is observ that in chemical used water drain in atmospahre after use of chemical activity in chemistry lab, Zoology lab and botany lab etc in university .It is highly recommended to install ETP plant for treatment of chemical water.

Chemistry Department lab

Solid Waste in laborateris

It is also observ that all solid waste like used hand gloves, Mask , Tissue paper etc are burned in university . So it is highly recommended to collected all chemical waste daily basis and treat the soild waste in the university or out side of the university.

All Type waste are collected open area

Observation :-

1.Thare are requirement of eye shower in labs for avoid any accident .

2. Thare are requirement of Shower in labs area for avoid any hazardes in chemical.

CHAPTER - 5
AIR QUALITY MEASUREMENT

5.1 Air Quality Measurement

Green audit team was conducted air monitoring survey in university campus. Details are givenin table 5.1

Sr. No.	Location	PM2.5 µg/m3	PM10 µg/m3	CO_2 Ppm
1	Chemistry Dept.	16.7	26.2	672
2	Physics Dept.	15.6	25.9	624
3	Chemistry Lab	15.3	26.5	601
4	General Lab Physics	14.4	22.4	587
5	Nuclear Physics Lab	20.2	31.2	617
6	Incubation Centre	14.2	22.4	525
7	Central Lab	17.5	38.3	811
8	Central Library	15.1	23.4	586
9	Computer Science Dept.	16.2	23.4	645
10	Dept. of Biotechnology	15.4	25,3	588
11	Dept. of Mathematical Science	16.3	23.4	634
12	Dept. of Management Studies	15.9	22.5	590
13	Dept. of Geography	16.3	23.4	543
14	Dept. of Education	15.3	24.6	577
15	Dept. of Commerce	16.8	25.3	629
16	Bodo Study Centre	15.6	23.4	538
17	Microbiology Lab	14.3	24.3	621
18	Dept. of Zoology	15.3	23.1	546
19	Dept. of Botany	16.2	25.3	578
20	Auditorium Hall	15.3	24.3	567
21	History Dept.	15.4	23.5	589
22	Economics Dept.	16.1	24.3	647
23	Dept. of Political Science	15.4	23.2	654
24	English Dept.	14.2	24.3	589
25	Dept. of Assamese	15.8	23.8	568
26	Admin Block	14.2	24.3	522

Photographs of air monitoring survey.

Observation: -

- $PM_{2.5}$ value is higher Side. The 24-hour concentration of $PM_{2.5}$ is considered unhealthy when it rises above **35.4** µg/m^3
- PM 10 value is acceptable range .It should be below 155 µg/m^3
- CO2 value is acceptable range. It should be below 1000 ppm.

CHAPTER- 6

RECOMMENDATIONS AND SUGGESTIONS

6.1 QR Code system

While the world seems to be going digital, people lack the time to read books and process the information they contain. Hence, university can be provided QR codes on the trees for its information and to exploit the rapidly growing platform for a unique purpose.

Fig: 6.1 QR code systems for plants

These codes can give students all the information they need to know about the tree — from its scientific name to its medicinal value. They only need to put their smart-phones to use. QR codes to them, making it easier for everybody to learn about a plant or a tree at the tip of their fingers," If any app generating a QR code, which is available for free on the online stores, can be used to avail the information of the trees.

- **Eco-restoration programmes**
  - Frame long-term eco-restoration programmes for replacing exotic Acacia plantations with indigenous trees and need of the hour is to frame a holistic campus development plan.

6.2 Other Suggestions

Some of the very important suggestions are: -

- Adopt the proposed Environmentally Responsible Purchasing Policy, and work towards creating and implementing a strategy to reduce the environmental impact of its purchasing decisions.
- Increase recycling education on campus.
- Increase Awareness of Environmentally Sustainable Development in University campus.
- Practice Institutional Ecology- Set an example of environmental responsibility by establishing institutional ecology policies and practices of resource conservation, recycling, waste reduction, and environmentally sound operations.
- Involve All Stakeholders- Encourage involvement of government, foundations, and industry in supporting interdisciplinary research, education, policy formation, and information exchange in environmentally sustainable development.
- Collaborate for Interdisciplinary Approaches- To develop interdisciplinary approaches to curricula, research initiatives, operations, and outreach activities that support an environmentally sustainable future.
- Increase reduces, reuse, and recycle education on campus.
- Develop a butterfly garden that arouses appreciation towards flora and fauna diversity.
- Name all the trees and plants (Plant DNA barcodes) with its common name and scientific name.
- Arrange training programmes on environmental management system and nature conservation.
- Renovation of cooking system in the canteen to save gas by installation solar water heater system with heat pump.
- Establish a procurement policy that is energy saving and eco-friendly.

END OF THE REPORT

THANKS