South Konkan Education Society's

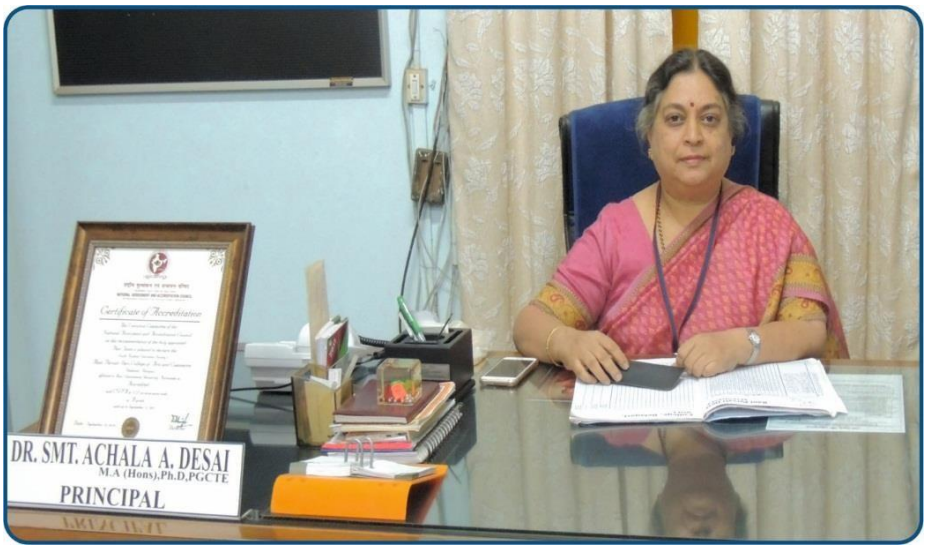
RANI PARVATI DEVI COLLEGE OF ARTS & COMMERCE, BELAGAVI.

GREEN AUDIT REPORT

ENERGY AUDIT

ENVIRONMENT AUDIT

FOREWORD



I am very happy to write a foreword to the "Green Audit Report" of the SKE Society's Rani Parvati Devi College of Arts & Commerce (RPD). The importance of undertaking the process of Green auditing within the academic environs is the need of the hour.

Indian Literature abounds in showcasing man's relationship with the environment. Great minds like Rabindranath Tagore wrote and sang of this way of life that made Indian life syncretic with the land, the rivers, the mountains and the sky. A socio-cultural attitude was woven into the very fabric of man's life in Nature. Unfortunately, we have long abandoned this approach and seem to have taken to a self-destructive road in the name of development. India has been ranked 168th out of 180 countries in the 2020 Environmental Performance Index (EPI). Our country presently faces a number of serious environmental health risks. Air pollution, poor management of waste, growing water scarcity, poor air quality, water pollution, preservation and quality of forests, biodiversity loss, and land/soil degradation are some of the major environmental issues. In a sense it is a do or die situation.

The Green Audit reiterates that we hope to convert this environmental challenge into an opportunity. In taking account of our immediate environs and in defining our approach to the myriad issues that make for healthy environmental alternatives we build hope for the future. The Green Audit of our campus is an effort in this direction. I sincerely hope that the suggestions given will act as a road map for change so that each one becomes environment sensitive.

Finally, the Green Audit has been made possible by the initiative taken by the GSS College (a sister college of RPD under the SKE banner) especially by the Department of Botany and in particular Prof. B. L. Majukar, Prof. Y. B. Dalvi, Mr. Rahul S. Sawant and Miss. Priyanka S. Kundekar to whom I express my gratitude. I am sure that your report will help us be more responsible to our immediate environment.

Dr. Achala A. Desai

Principal

SKES's R.P.D College, Belagavi.

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NAAC III Cycle ACCREDITED WITH GRADE A 3.27 CGPA

Ref. No. RPP/ 2020-21/ 87

Date. 10 OCT 2020

CERTIFICATE

This is certified that the Department of Botany G. S. Sc College Belagavi, has conducted "Green audit" of S.K.E Society's R.P.D, G.S.S College Belagavi, during the academic year 2015 to 20. This audit was conducted in consultation with Mr. Rahul Prabhukhanolkar (Environment management consultant) in accordance with the applicable standards. The audit involves water, waste water, energy, carbon sequestration, solid waste etc. and gives a basic assessment on various environmental factors in the campus, the guidelines and recommendations given in this report shall be followed and implemented by the college to minimize impact of the institutional working framework. While all reasonable care has been taken in its preparation, details contained in this report have been compiled in good faith based on information gathered.

Mr. Rahul Prabhukhanolkar,
Environment management consultant.

Prof. B. L. Majukar
HOD Dept. of Botany,
G.S.Sc College Belagavi.
Co-ordinator
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G. S. Science College, Belagavi

EDITORIAL….

In the Era of global warming and climate change, every citizen has to reduce their carbon footprint to deal with the adverse impacts of climate change. A green audit of any academic institution reveals ways in which it can reduce energy consumption, water use, and reduction in emission of carbon dioxide in the environment. It is a process to look into and ask ourselves whether we are also contributing to the degradation of the environment and if so, in what manner and how we can minimize this contribution and bring down to zero and preserve our environment for the future generation. This process of green audit enables us to assess our lifestyle, action, and assess its impact on the environment.

SKE Society's Rani Parvati Devi College of Arts & Commerce (RPD). administration has already taken a step towards the green approach and conducted a Green Audit of college in the year 2014. As an outcome of this the college has taken green steps to reduce its carbon footprints by using solar photo-voltaic panels and planting a large number of trees. The responsibility of carrying out the Scientific Green Audit was given to the SKE Society's Department of Botany of G.S.S College Belagavi. The task focus was to assess the consumption of energy, electricity, water, as well as disposal of solid waste, hazardous waste, and make an inventory of trees on the campus to check how much CO2 is sequestered. A questionnaire was prepared for this purpose.

The questionnaire included the total number of students and employees, the work environment, etc. The information related to the consumption of resources like water, electricity, and handling of solid and hazardous waste was collected from various departments. The data collected were tabulated in Excel sheets and analyzed. Graphs of the analyzed data were prepared for getting a clear and quick idea of the status.

During the preparation of the "Green Audit Report" the team received support and encouragement from Principal Dr. Achala Desai. All Head of the Departments, Directors, Coordinators, in the college also gave full co-operation. The Pollution Control Department, Belagavi, also helped in monitoring the noise. Humidity and temperature status of the campus were obtained from authenticated reports.

We thank all teaching and non-teaching staff of the various Departments of our college without whose participation this report could not have been completed. We hope this report will be of some help to the college in taking one greener step ahead.

Prof. B. L. Majukar.
Prof. Y. B. Dalvi.
Prof. Miss. Priyanka S. Kundekar.
Prof. R. S. Sawant.

Date: 10.10.2020

S.K.E SOCIETY, BELAGAVI

GREEN AUDIT REPORT

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CHAPTER-1

1.1 Introduction about Society

South Konkan Education Society is a premier organization running a full range of educational institutions in Belagavi. SKE Society is committed to providing quality education to the students of the region, many of whom come from economically backward groups and rural areas. The society provides a complete range of educational services for all students and its Vision is “Empowering the Individual with Knowledge”.

South Konkan Education Society (SKE Society as it is commonly known) has its origin in the heady days of the early 1940s. Mahatma Gandhi had given the "Quit India" call in 1942. Patriotic zeal stirred a group of individuals, originally from the Konkan region, to take an active part in nation-building. They believed that freedom would be meaningless if it did not bring development and improve the quality of people's lives. They also knew that education was the key to development. As a result, the S.K.E. Society came to be formed in 1944 at Savantwadi. The Society's first educational institution, Rani Parvati Devi College (named after its first patron member, the late Rajamata of Savantwadi) was started in 1945 at Savantwadi. The college offered courses in both the Arts and Science streams.

Rani Parvati Devi College was relocated to Belagavi in 1948. Rani Parvati Devi College was relocated to Belagavi in 1948. The College was housed in the beautiful summer palace of Raja Patwardhan of Jamakhandi in the quiet suburb of Tilakwadi. Today S.K.E Society’s campus sprawls over 28 acres with tall trees, a mango grove, a botanical garden, and a large playground. In 1966 on the recommendation of Karnataka University, R.P.D College was bifurcated into two colleges namely, Rani Parvati Devi College of Arts and Govindram Seksaria Science College. The Commerce section was added to RPD College in 1995 and subsequently, the College has renamed Rani Parvati Devi College of Arts & Commerce. The College started the Bachelor of Business Administration course from the year 2007-2008. The College has been accredited by NAAC at ‘A’ grade with 3.27 CGPA in the third cycle.

Govindram Seksaria Science College, commonly called as GSS, offers Courses in the Science stream from PUC to Post graduation along with B.C.A. It offers 7 Subject Combinations at B. Sc., and M. Sc. in Chemistry, Botany, and Zoology. The College has been accredited by NAAC at ‘A’ grade with 3.16 CGPA in the third cycle.

1.2 Goals of Green Audit

1. Identify and assess environmental risk.
2. Avoid interruptions in an environment that are difficult to handle and expensive to correct.
3. Conduct various types of surveys related to waste generated water resources and electrical energy utilized.
4. To suggest the best protocols to follow for sustainable development.
5. Protect the environment in and around the campus.
6. Recognize the cost-saving methods through waste minimization and energy conservation.
7. To project the Institution's image through green initiatives and improve ratings in the upcoming NAAC visit.

1.3 Objectives of Green Audit:

1. To examine the impact of current practices such as resource utilization, waste management, etc. on the environment.
2. To identify and analyze significant environmental issues.
3. Setup goal, vision, and mission for Green practices on the campus.
4. Establish and implement Environmental Management in various departments.
5. Continuous assessment for betterment in the performance of green practices and their evaluation.
6. To prepare an Environmental Statement Report on green practices followed in the different departments, support services, and administration building.

1.4 Area of study.

SKE Society's GSS and PRD College are located in Tilakwadi, Belagavi on the west side of a national highway designated as NH-4 the society's campus has red lateritic soil. The maximum temperature recorded is 38^{o}C (Source-weather.com) during the summer months of March to May, and the minimum temperature is 12^{o}C during the winter months of November to January. The average rainfall is about 1500 mm received during the rainy season of June to the end of September.

Google map showing the boundary of the SKE Society's GSS and RPD college campus.

1.5 Location of the study area.

SKE Society Campus lies between North latitude 15º83'37.6" and 15º83'38.9" and East longitude 74º50'85.4" and 74º50'55.9". It is in Belagavi taluk and the District of Karnataka. The SKE Society's GSS and RPD colleges have an area in Tilakwadi near the RPD cross. It is accessible by road on NH-4 connecting Belagavi to Bangalore or Belagavi to Pune. Further, the city of Belagavi is linked by railway in South zone Rail network to Bangalore 550 km. The airport is located near Sambra with flights to 8 cities (Source-www.airportia.com).

2. METHODOLOGY

2.1 Background of SKE Society's Green Audit Preparation.

S.K.E Society G.S.S and R.P.D Colleges prepared the first Green Audit report in the year 2014. This is the second Green Audit of the S.K.E Society campus. The report not only includes data regarding the use of resources but also highlights the biodiversity status of the College. The resource utilization of Water, Electricity, Solid waste generation, Noise, Temperature, Humidity monitoring, wastewater generation, Carbon sequestration, etc., on the college campus, are studied through this Green Audit process. The audit process was carried out in three phases. First, all the secondary data required for the study was collected from various departments. A broad reference work was carried out to rich the idea of green auditing. Different case studies and methodologies were studied and the following methodology was adopted for the present audit. To perform a green audit, the methodology included different techniques such as physical inspection of the campuses, observation and review of the documentation, interviewing key persons, and data analysis, measurements, and recommendations. The study covered the following area to summarize the present status of environmental management on the campus:

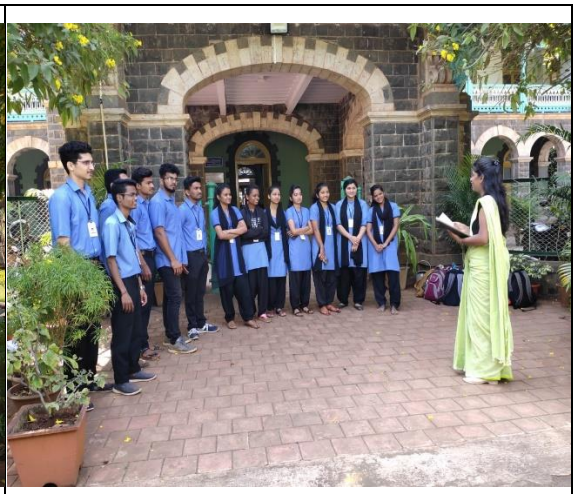
- Water quality assessment
- Water Consumption and management
- Electricity consumption and management
- Sound pollution monitoring
- Waste management
- Biodiversity status of the campus.
- Carbon Sequestration

2.2 A survey by Questionnaire:

Baseline data for green audit report preparation was collected by the questionnaire-survey method. Maintaining records of the handling of solid and hazardous waste is very important in a green audit. There are possibilities of loss of resources like water, energy due to improper maintenances, and assessment of this kind of probability is necessary for any green audit. One separate module of questions is devoted to this aspect. Another module is related to maintaining records - like records of disposal of solid waste, records of solid waste recovery, etc. For better convenience of the surveyor, some statistics like basic energy consumption characteristics for electrical equipment was provided with the questionnaires themselves.

2.3 Onsite Visits and Observations:

The GSS & RPD Colleges have a vast built-up area comprising of various departments, administrative buildings, staff quarters, student hostels, guest houses, sports complexes, and counseling centers. All these amenities have different kinds of infrastructure as per their requirement. All these buildings were visited by the surveyors and the existing condition is observed with the help of the questionnaires. Personal observations were made and noted during the onsite visit. The raw data were tabulated, analyzed and graphs were prepared using a computer. Suitable interpretations were made depending upon the observations and data collected, Lacunae and good practices were documented. Finally, all the information was compiled in the form of a Green Audit Report.



Photographs of the team being given instruction by the mentor teacher.

CHAPTER 3

3.1 Energy Audit

Energy is one of the major inputs for the economic development of any country. The fundamental goal of energy management is to produce goods and provide services at the least cost and the least environmental impact. Also, it can be said to be "the strategy of adjusting and optimizing energy, using the system and procedure to reduce energy requirements per unit of output while holding constant or reducing total costs of producing the output from these systems". The energy audit is key to a systematic approach for decision-making in the area of energy management. It attempts to balance the total energy inputs with its use and serves to identify all the energy streams in a facility.

3.2 Aim and objective

1) To save conventionally produced electric energy
2) Use of non-conventional sources of energy
3) Minimization of electricity expenses

3.3 Observations

The following Energy Sources are used in the college:

1. Solar
2. Electrical
3. Diesel
4. Petrol
5. LPG

3.4 Electricity Audit: An Energy resource utilized by all the departments, support services, and the administrative buildings of SKE Society, GSS College, and RPD College. The campus includes electricity and liquid petroleum as energy sources. The major use of the energy is in the Office, Canteen, hostels, and laboratories, for purpose of lighting, cooking, and workshop instruments. The college has installed a solar power plant in the year 2017-2018.

There are not many issues in the demand and supply chain of the overall energy-electricity management. Campus gets its electricity supply from the urban feeder of HESCOM, Karnataka.

Table no. 3.1 Electrical Energy consumption details

Sl.NO	TYPE	TOTAL NO.
1.	Tube lights	1113
2.	Fan	686
3.	LED bulbs/battens	89
4.	CFL bulbs/battens	141
5.	Computers	314
7.	Projectors	20
8.	Water Cooler	5
10.	Refrigerator	5
12.	CCTV	77
13.	Biometric Machine	7
15.	Street Light	102
16.	Solar Bulb	10
17.	Air Conditioner	4

Table no. 3.1.1 Energy Consumption Details other than Electrical

SL.NO	TYPE	QUANTITY
1.	Generators	08
2.	L.P.G. Cylinders	17

Electrical instruments in New building

Classrooms with adequate lights and fans

Table no. 3.2 Energy expenditure details before installation and after installation of solar panel.

Energy expenditure details before installation of solar panel			
Month & Year	**Electricity Bill (Rs.)**	**Total**	**Total energy saved**
June2018	97441/-	**325501/-**	$= \frac{155346}{325501} \times 100$ **= 47.72%**
July2018	111439/-		
Aug 2018	116621		
Energy expenditure details after installation of solar panel			
Sep 2018	57053/-	**155346/-**	
Oct 2018	51915/-		
Nov 2018	46378/-		

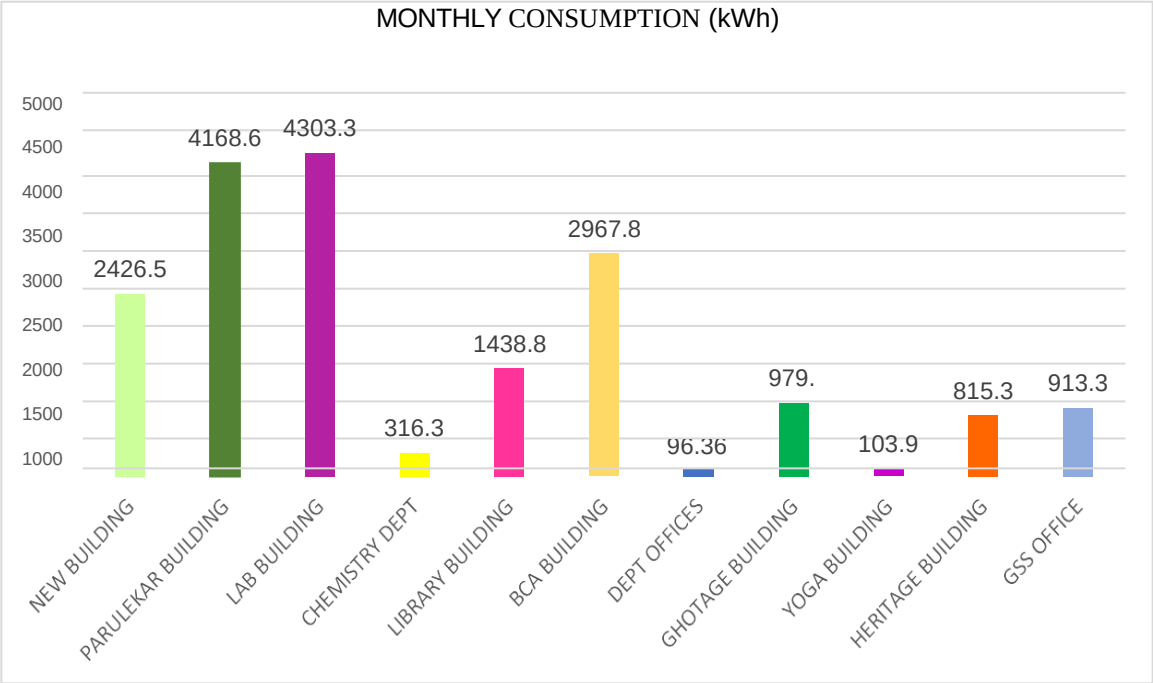
In 2018 the college campus has installed **59 KWH** capacity solar panel on the terrace of lab building. The college has also installed a single solar panel at the entrance of each building with a single bulb.

As mentioned in table 3.2 the energy expenditure of three months before solar installation was 325501/- and after installation of the panels the energy expenditure was 155346/- .which shows that the introduction of this project has helped to reduce the usage of electricity by **47.72%.**

Table no. 3.3 Energy Consumption in Various Buildings of the Campus.

Sr. No.	Name Of Building	Max. Load In kWh
1.	New Building	2426.52
2.	Parulekar Building	4168.62
3.	Lab Building	4303.38
4.	Chemistry Dept. Building	316.32
5.	Library Building	1438.86
6.	BCA Building	2967.84
7.	Departmental Offices	96.36
8.	Ghotage Building	979.8
9.	Yoga Building	103.95
10.	Heritage Building	815.34
11.	GSS Office	913.32

Graph no. 3.1 Energy Consumption of Various Buildings in the Campus.



To analyze electricity consumption, lights, fans, and other illumination equipment were taken into consideration. The maximum use of electricity is for lighting and fans in all the buildings. The electricity consumption of Parulekar building and lab building is maximum

due to more usage of computers and Electrical equipment. The bar diagram of fig. 3.1 illustrates graphically the energy load of the various building. Fig. 3.1 is constructed based on the data given in table 3.3.

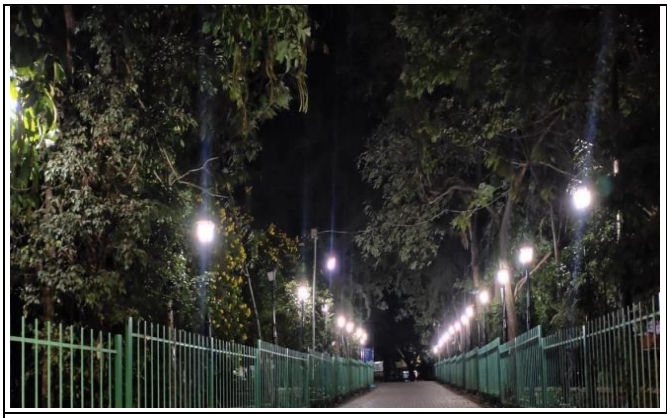
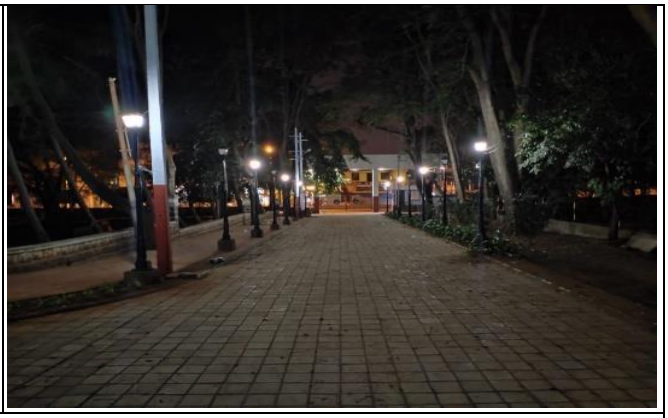
3.5 Energy conservation efforts:

Solar Panels

Single Bulb Capacity Solar Panel

Solar bulb in front of New building and Parulekar building

- Initiative for use of solar energy: **59 KWH capacity** solar panels were installed in the year 2018 which has saved 47.72 percent of total energy to date.
- All over the campus, the wiring system was done underground.
- Single bulb capacity solar panels were installed as a part of Non-conventional energy source.

Street Light in the Campus

3.6 Recommendations

1. Use of LED lights instead of sodium bulbs and fluorescent tubes to reduce the consumption of electricity.
2. Energy-saving awareness shall be promoted by displaying suitable boards at different places.
3. Encourage natural ventilation and illumination in the building structures whenever going for new constructions.
4. "No Vehicle Day" was observed every second Saturday to reduce fossil fuel use. The college needs to continue this activity.

Save Energy Message Should be Displayed on Each Board	No Vehicle Day

CHAPTER-4

4.1 Water Audit

Water is a valuable natural resource available with fixed quantum. Per capita availability of utilizable water is going down due to the increasing population. Demand for fresh water is increasing day by day due to ever-rising standard of living of people, and increasing urbanization and industrialization. The discharge of industrial effluent in the available water bodies is reducing the quality of these ample sources of water continuously. Hence, the national mission on water conservation of 'Jal Shakti Abhiyan' was declared by Prime Minister Narendra Modi who appealed to all citizens to collectively address the problem of water shortage by conserving every drop of water and suggested conducting water audit for all sectors of water users.

A Water Audit is a full analysis of water processed by a utility. Water audit comprises preparation of layout of water sources, distribution network, and service/delivery points to water users, and return flow of waste or excess water. Water audits trace water use from its point of entry into the facility/system to its discharge into the sewer/river/canal etc.

4.2 Advantages of a water audit.

- Water Audit provides decision-making tools to utility managers and operators. It helps them to know where water is being used in our system and helps to make an informed decision about investing resources such as time, labor, and money.
- Water audit allows managers to efficiently reduce water losses in the system.
- A water audit is an effective management tool for minimizing losses, optimizing various uses, and thus enabling considerable conservation of water.
- Creating awareness among water users..
- Water audit also identifies which water uses are earning revenue for utility and which water uses are not.

4.3 Findings.

A. Sources of water:

The major source of water for the SKE Society's campus is the water supply by the Belagavi city municipal corporation and its four own water wells. Each building has an overhead Storage tank and demand is satisfied by the regularly managed continuous supply.

Well in coconut plantation garden

Well near GSS office

Well in Botanical garden

The college stores the water in ten overhead tanks present on six different buildings having a storage capacity of 1 lakh (100000) liters from where water is supplied to different labs and usage points. All water tanks are in good condition few of them showing a silt problem where there is need to clean frequently and also display the date of the last cleaning.

Water tank showing accumulation of silt

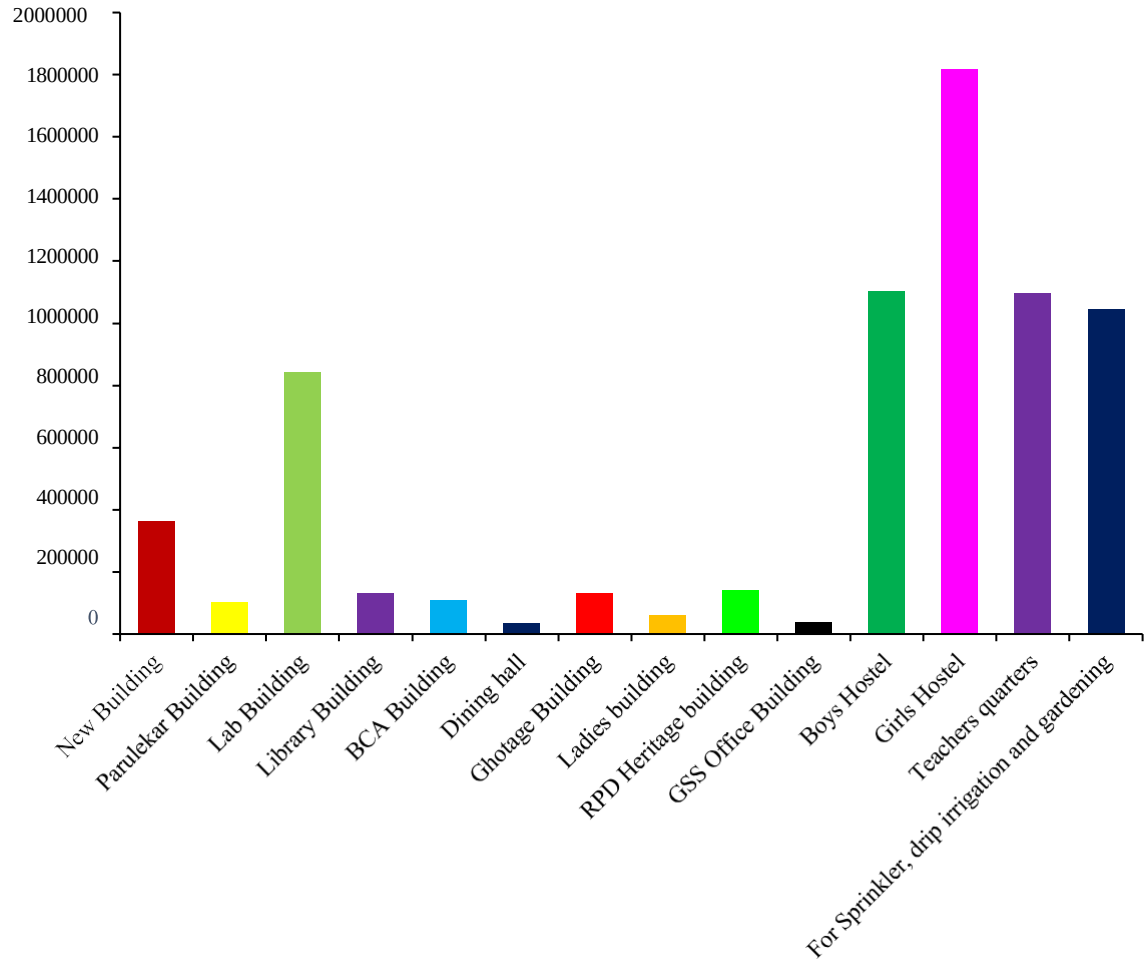
B. Water consumption:

Table no 4.1: Total water consumption in various buildings

Sr. No.	Name of building	Tank capacity (Lit)	Total daily use (Lit)	Total yearly use (Lit)
1	New Building	19000	1510	362400
2	Parulekar Building	-	424	101760
3	Lab Building	28500	3500	840000
4	Library Building	12000	538	129120
5	BCA Building	4000	455	109200
6	Dining hall	-	145	34800
7	Building	18000	545	130800
8	Ladies building	-	250	60000
9	RPD Heritage building	5600	578	138720
10	GSS Office Building	-	150	36000
11	Boys Hostel	5000	4597	1103280
12	Girls Hostel	8000	7564	1815360
13	Teachers quarters	-	4563	1095120
14	For Sprinkler, drip irrigation and gardening	-	4352	1044480
Total		**100100**	**29171**	**7001040**

* For Parulekar building, Ladies building, Quarters and Dining hall the water is supplied from Ghotage building tank.

Graph no 4.1: Total water consumption in various buildings.



C. Water quality assessment

Water quality assessment is the overall process of evaluation of the physical, chemical, and biological nature of the water. In the present report water from two different wells in SKE society, GSS RPD campus is tested at an external laboratory (Jawaharlal Nehru Medical College, Belagavi).

As per this report, both the well water was **unfit** for human consumption hence, we have advised the horticulture officer to add $KMnO_4$ and Alum in respective wells of the college campus, to control the growth of pathogenic bacteria.

After this treatment, we have tested the water sample in the same laboratory once again and the result of water sample found was **fit** for human consumption. The scanned copy of the respective reports is attached with Annexure-3

D. Water assessment:

The team collected building-specific data from the 18 buildings on the campus on parameters like source, storage, leakage of water, and simultaneously gathered suggestions for the improvement.

Table 4.2: Water assessment parameters in all buildings.

Sr. No.	Parameter Assessed	Observations	Condition / Remarks
1	No. of the pipes inspected for leakage.	18 buildings pipes	Leakage was found in only four pipes.
2	Number of water taps inspected.	200	Only 2% of water taps having leakage Problem.
3	No of toilets inspected	38	Only few toilets found in bad condition.
4	No. of drinking water facility	9	All in bad condition, need to improve and Install new drinking water units.

In general, there are no issues in the demand-supply process and storage facilities. But the drinking water infrastructure is very poor and inadequate for the student and staff population, which needs to be addressed on an urgent basis.

4.4 Rain Water Harvesting pits

Society has created a rainwater harvesting facility on the campus by building a network of BCA Building, Boys hostel, and Girls hostels with pipelines spread over the campus. The 4 wells are charged by water flowing from the catchment area and rooftops of the buildings. Benefits derived through this system are: wells are recharging resulting in a remarkable rise in water levels. There is a provision for rainwater harvesting and recycling on the campus.

- **The benefit of water harvesting pits:**

During 2005 one well was dug in the Botanical Garden but it didn't have water. But due to installing one water harvesting pit near this well now well has 7 to 8 feet of water throughout the year which used for various purpose.

	
“Water harvesting pit” near girls’ hostel	**“Water harvesting pit” in Botanical garden**

Rain Water Harvesting – There is a current system of collecting rainwater from the drains it into an open percolation tank in the coconut garden and percolation through water harvesting pits.

The roof-top water of some buildings can be collected and released into water harvesting pits and in the open percolation tank, which would increase the groundwater table. Considering average rainfall of 1500 mm in the Belagavi region, around 7.1 crore liters of water is harvested by society every year.

Table No 4.3: Rooftop area of different buildings.

Sr. no.	Name of building	Rooftop area in sq meter
1	New Building	10427.7
2	Parulekar Building	642.1
3	Lab Building	1421.4
4	Chemistry office	685.6
5	Library Building	712.5
6	Gymkhana	518.0
7	BCA Building	721.8
8	Departmental Offices	622.4
9	Dining hall	396.8
10	Ghotage Building	538.8
11	Rande hall	150.5
12	Yoga building	240.0
13	Ladies building	172.9
14	RPD Heritage building	1662.2
15	GSS Office Building	450.5
16	Boys Hostel	395.7
17	Girls Hostel	708.4
18	Quarters	712.5
Total area in square meter		11890.3

Calculation of Rainwater harvesting

The rain fall in the Belagavi region = 1500 mm

The rooftop of building in the campus = 11890 sq meters (18 buildings)

Coefficient = C (collection efficiency in %)

(Rooftop area in square meter) X (Total annual rainfall in mm) X (efficiency coefficient/runoff coefficient)

(11890.3) X (1500) X 0.25 =71,340,000 liters = **7.1 crore liters** of rainwater is percolate in soil through five water harvesting pit and open percolation tank annually.

1.1 Effluent Treatment Plant.

The Effluent treatment plant (ETP) is used for the removal of high amounts of organic compounds, debris, dirt, grit, pollution, toxic, non-toxic materials, and polymers, etc. from effluent discharged by the laboratories on the campus.

The effluent treatment plant in the Botanical Garden.

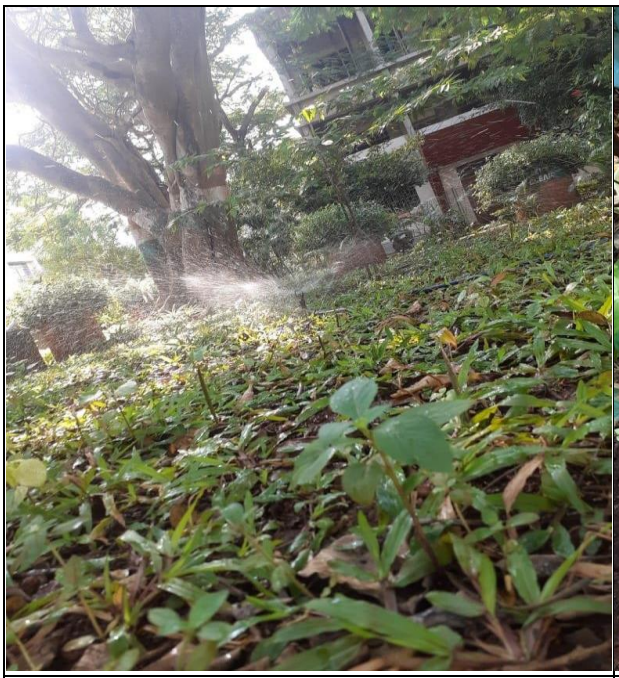
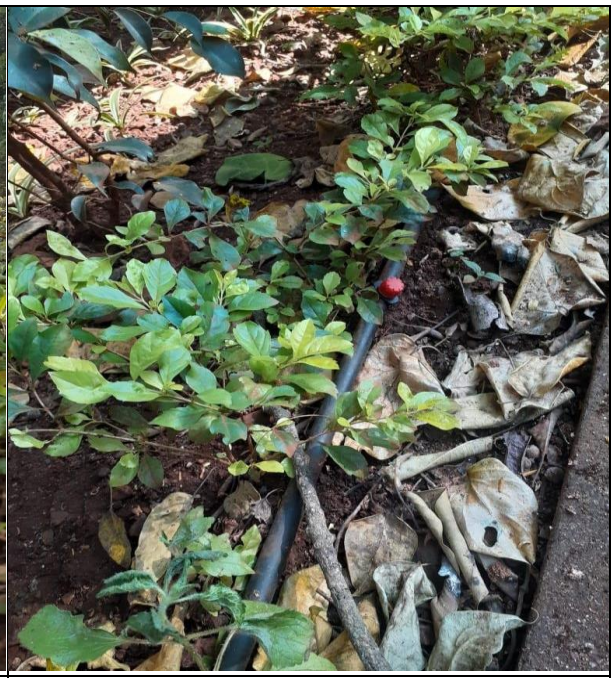
- **Benefits of Effluent treatment plant:**

Every day about 3000 liters of effluent water generated from chemistry Department labs are collected and treated by the Effluent Treatment Plant established in the Botanical garden. The water after treatment is not discharged directly into water reservoirs but it is used for the gardening purpose on the college campus.

4.4 Drip Irrigation and Sprinkler Irrigation

Society has a big green campus including Botanical Garden, Anant Manohar Garden, Coconut Garden, Garden near chemistry, Garden near Society Hall, and Garden near Library. Drip irrigation and the sprinkler irrigation system has been installed at Anant Manohar Garden, Garden near chemistry, Garden near society hall, and Garden near library which helps to save water and nutrients by allowing water to drip slowly to the

roots of plants. The goal is to save water by feeding water directly into the root zone and thereby minimize evaporation.

	
Sprinkler irrigation in Garden near Library	**Drip irrigation in Garden near Gymkhana**

4.5 Precautionary measures.

- For conservation of resources and their management Society has appointed a well-trained horticulturist, 4 inside sweepers, 4 outside sweepers, and 4 gardeners.
- The duties are assigned respectively to control the wastage of water, energy, and other resources of a college campus.

4.6 Recommendations:

- Society has a future plan for recycling of water from ETP. At present, the water from ETP is used for watering the various gardens.
- Need to conduct Water Conservation Awareness Program on World Water Day, 22nd March every year
- Green Chemistry Methodology in laboratories to be considered, viz. solvent extraction from Chemistry and Environment Laboratories of the college.
- Display boards for turning the taps off to be put on at appropriate places.
- Drinking water facility is required to be provided at each floor of all buildings. The current facility is inadequate.

CHAPTER-5

5.1 Solid waste.

Solid waste is a heterogeneous mixture of waste comprising papers, plastic, cloth, metal, glass, organic matter, construction and demolition debris, dust, and so on. Solid waste generation and its management is a serious problem all over the world. The rate and amount of generation of solid waste are very high. However, we do not have satisfactory technology to manage the generated waste. Solid waste can give rise to significant health problems and a very unpleasant living environment if not disposed of safely and appropriately. Thus, it is essential to manage solid waste appropriately to reduce the load on the waste management system. The purpose of a solid waste audit is to find out the quantity and current management practices of solid waste generation in Society GSS and RPD college campus. The report will help in the waste management and development of the green campus.

5.2 Conducting a solid waste audit.

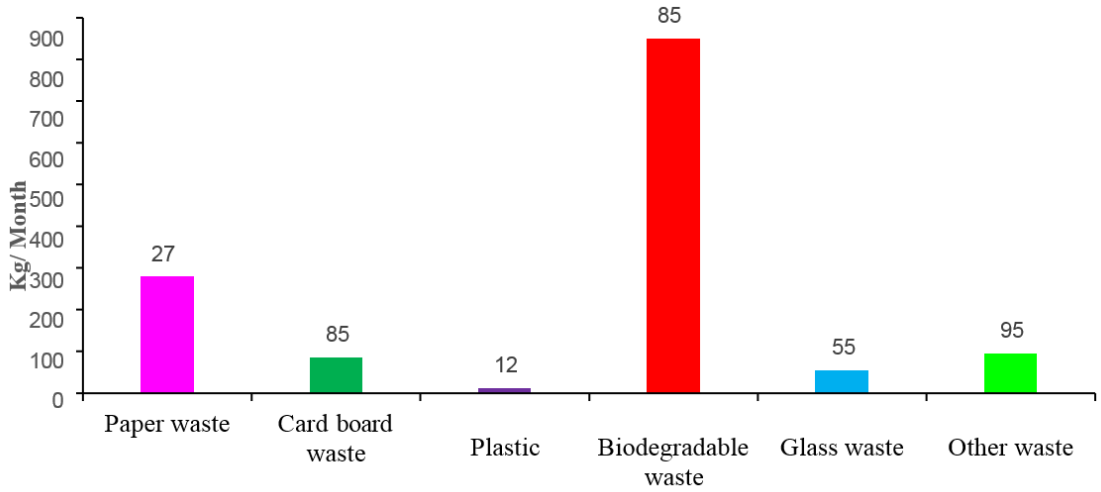
The estimates of solid waste generation were carried out on the basis of a questionnaire and direct interviews with all attenders, swipers, and stakeholders of society. The solid waste audit is envisioned for providing basic amenities to keep the campus clean and green. Table 5.1 gives information on the type of solid waste generated on campus per month during the sampled duration of the work.

The waste generated in society campus is 1155 kg per month out of these wastes large amounts of biodegradable waste and paper waste earlier one is used for vermicomposting unit and later one is sold to Shree Ganesh stores for recycling. The remaining waste generated on the campus is collected by swipers and give to Municipal corporation Belagavi city once in three days.

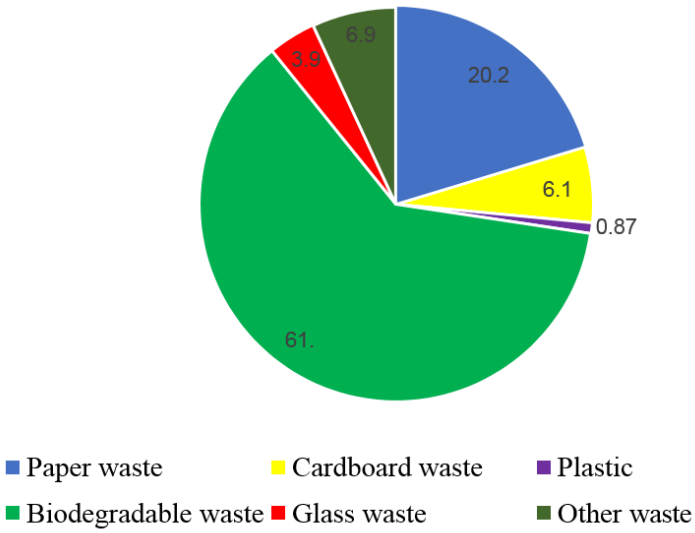
Table No. 5.1: Status of solid waste (kg/month).

Category of waste	Paper waste	Card board waste	Plastic waste	Biodegradable waste	Glass waste	Other waste	Total waste
Quantity kg/month	279	85	12	850	55	95	**1376**
Percentage (%)	20.27	6.17	0.87	61.7	3.9	6.9	**100**

Graph 5.1 Category wise solid waste generated in SKE College campus.



Graph 5.2 Percentage of solid waste generated in SKE College campus.



The result of the survey reveals various solid waste generated are as follows: Paper waste 5.2%, Cardboard waste 7.3%, Plastic waste 1.3%, Biodegradable waste 73.5%, Glass waste 6.3% and Other waste 8.2% the above-stated statistics are illustrating in pictorial form as graph 5.2. The amount of plastic generated is 1.3% is negligible. The biodegradable waste includes waste collected from different gardens from the college campus. The same used in generating vermicomposting manure as “wealth from waste”

5.3 Status of paper waste generation in SKE society:

Every month 279 Kg of paper waste is generated in society college campus but all paper waste is not directly giving to corporate stakeholders. But a large amount of paper waste was collected by society from various departments every day. The collected paper waste further sells by society once in a year for recycling of papers. The details of these mention in the following table.

Table No.5.2 Status of recycling paper waste.

Sr. No.	Particulars	Amount in kg.	Rate	Amount (Rs)
1	Answer paper and Journals	2006	8	16048/-
2	Newspaper Marathi	67	8.5	569.5/-
3	Newspaper English	23	9	207/-
4	Colour papers	559	4	2236/-
5	Card Sheet (Ratha)	10	5	50/-
Total				19,110/-

5.4 Status of biodegradable waste generation in SKE society (Vermicompost unit):

The garbage management always tries to make the college campus Eco-friendly. Vermicompost is prepared with the help of a mulch of tree leaves that occurs around the college campus. These vermicomposts are again utilized as vermicompost manure for plants in the botanical garden and various gardens of a college campus. For this purpose, four lady swipers are recruited by college management that collects the plant debris from the college campus and dumps it on vermicompost units. Every day approximately 30 kg of plant debris including leaves and dry stem of the plant is dumped in five different vermicompost units with size 20 feet long, 5 feet wide, and 3 feet height.

	
Vermicompost units in Botanical Garden	**Swipers collected plant debris.**

The college produces vermicompost from the mulches of leaves of trees that are scattered on the campus. The produced vermicompost was used as fertilizers for trees. This vermicompost fertilizer project has been proved very useful for the college.

5.5 Management of E-waste generated in the campus.

E-waste is any electrical or electronic equipment that's been discarded. The information and technology revolution has exponentially increased the use of new electronic equipment, it has also produced growing volumes of obsolete products; e-waste is one of the fastest-growing waste streams. Although e-waste contains complex combinations of highly toxic substances that pose a danger to health and the environment, many of the products also contain recoverable precious materials, making it a different kind of waste compared with traditional municipal waste.

Observation:

- The E-waste generated by various departments in the campus is properly disposed i.e., collected by the licensed person from Hubli once in a year.

5.6 Preventive Measures:

1) Paper waste is generated by all departments particularly one side is used for printing and writing which is a good practice.
2) Answer sheets and old journals are sent for pulping and recycling after completion of their period.
3) Glass waste is generated from laboratory mainly in the form of bottles; Many times, bottles are reused for storing of other chemicals.

5.7 Recommendations:

1) As per the requirement of Belagavi Municipal Corporation there is need to separate all types of waste.

CHAPTER-6

6.1 Introduction.

Carbon is the basis of life on mother Earth. It is incorporated into plants through photosynthesis, consumed by animal species as food, present in the form of carbon dioxide (CO_2) in the atmosphere, locked into rocks like limestone, and transformed into different fossil fuels such as coal and oil. As CO_2 levels in the atmosphere continue to increase, trees will keep soaking up more than half of CO_2.

The starting of the 21st century brought growing concern about global warming, climate change, food security, poverty, and population growth. In the 21st century, more carbon has been released into the atmosphere than that has been absorbed. CO_2 is a principal component causing global warming. Atmospheric carbon dioxide levels have increased to 40 % from pre-industrial levels to more than 390 parts per million CO_2. In this background, it is a need for time to cover the research areas interrelated with climate change.

The "Carbon Sequestration is a current status of tree cover and vegetation carbon storage assessment of area under the South Konkan Society (GSS & RPD College) campus. In an era of climate change and global warming carbon emission, carbon footprints, carbon sequestration, and adaptations are the keywords in academia. In carbon sequestration conversion of atmospheric carbon i.e., CO_2 into other sinks of carbon such as vegetation, soil, ocean, etc. takes place.

6.2 Carbon sequestration.

Carbon is found in all living organisms and is the major building block for life on Earth. Carbon exists in many forms, predominately as plant biomass, soil organic matter, and as the gas carbon dioxide (CO_2) in the atmosphere and dissolved in seawater.

The term "carbon sequestration" is used to describe both natural and manmade processes by which CO_2 is either removed from the atmosphere or diverted from emission sources and stored in the ocean, terrestrial environments (vegetation, soils, and sediments), and geologic formations. Before human-caused CO_2 emissions began, the natural processes that make up the global "carbon cycle" maintained a near balance between the uptake of

CO_2 and its release back to the atmosphere. However, existing CO_2 uptake mechanisms (sometimes called carbon "sinks") are insufficient to offset the accelerating pace of emissions related to human activities.

6.3 Methodology.

Study Area: South Konkan Education Society GSS & RPD College is situated at North Karnataka at 15050'00" N and 74030'23" E, in the Belagavi city and it is at the altitude of 784m above mean sea level. SKE Society GSS & RPD College covers an area of about 28 acres. The major area of the campus is covered with vegetation.

Field survey: Current tree census methodology has been adopted from the guidelines set by the Indian Institute of Remote Sensing, Dehradoon. The campus area of 28 acres is divided into 2 sectors with the help of Google Earth. Two teaching staff and six B.Sc. II life-sciences students were involved in the field survey. A team of one teaching staff and 3 students were made and one sector was allocated to a team. Each team is provided with a measuring tape, chalks, writing pad, and tree census form. A tree with girth (circumference of tree) more than 10 cm at chest level and height more than 4 feet were considered as a tree and taken for enumeration. The girth of each tree was measured with the help of tailoring tape and approximate height by the visual method. Identification of tree species was done with the help of field guides, web sources, floras, and with the help of the expertise of the Botany Department of GSS College.

The marked area shows a green campus of SKE society GSS and RPD College. (Source-Google earth) Data Analysis: All the collected data were tabulated and analyzed with the help of MS-Excel spreadsheets.

All the tabulated data is analyzed by the following standard formulae:

A. Measurement of the circumference of the tree: To estimate the biomass of each tree species non-destructive method was used. To calculate the circumference Diameter at Breast Height (DBH) can be determined by measuring tree Girth at Breast Height (GBH), approximately 1.3 meters from the ground. The Girth at Breast Height of trees having a diameter greater than 10 centimeters were measured directly by measuring tape.

B. Height measurement: Tree height is an important factor for calculating tree biomass and evaluating tree life history. There are several different methods that are used for the measurement of tree height from the ground. For the present tree census, the height of the individual tree is measured by the visual method of the theodolite. (A theodolite is a precision optical instrument for measuring angles between designated visible points in the horizontal and vertical planes.)

C. Weight Above Ground (WAB) of the tree: The Weight Above Ground is the most abundant and visible pool of carbon in all its forms. The above-ground biomass of the tree includes branches, stem, fruit, whole shoots, and flowers.

The specific wood density is used from the standard guidelines. By using the above formula, the AGB of all the tree species is calculated. The total above-ground biomass is calculated by using the formulae given by Brown et al., 1989; Negi et al. 1988.

Formulae: Weight above-ground= $0.25\ D^2\ H$ (for trees with D<11)

Weight above-ground= $0.15\ D^2\ H$ (for trees with D>11)

D- Diameter of the tree.

H- Height of tree.

D. Estimation of carbon: Generally, in any plant species 50 % of its biomass is considered to consist of carbon.

Formula: Weight of carbon = 0.5 × Dry weight of the tree.

E. Determination of the weight of carbon dioxide (CO_2) sequestrated in the tree: Trees are the autotrophs, which make their own food by using photosynthesis. They take CO_2 and release O_2. The sequestrated CO_2 is calculated by using the Carbon Sequestration Factor is used given by the standard guidelines by IPCC.

Formula: Weight of carbon-dioxide = 3.67 × Weight of carbon.

Audit team calculating diameter and height of tree

6.4.Findings

The total number of trees enumerated in SKE Society Campus:

The total 28 acres area of the Institution contains 902 numbers of trees with 10 cm or more girth and height 4 feet or more have been enumerated. The girth and height of every tree have been measured by using tailoring tape and chalks. Total of 86 tree species have been identified during the census. It shows rich plant diversity on the present on the college campus.

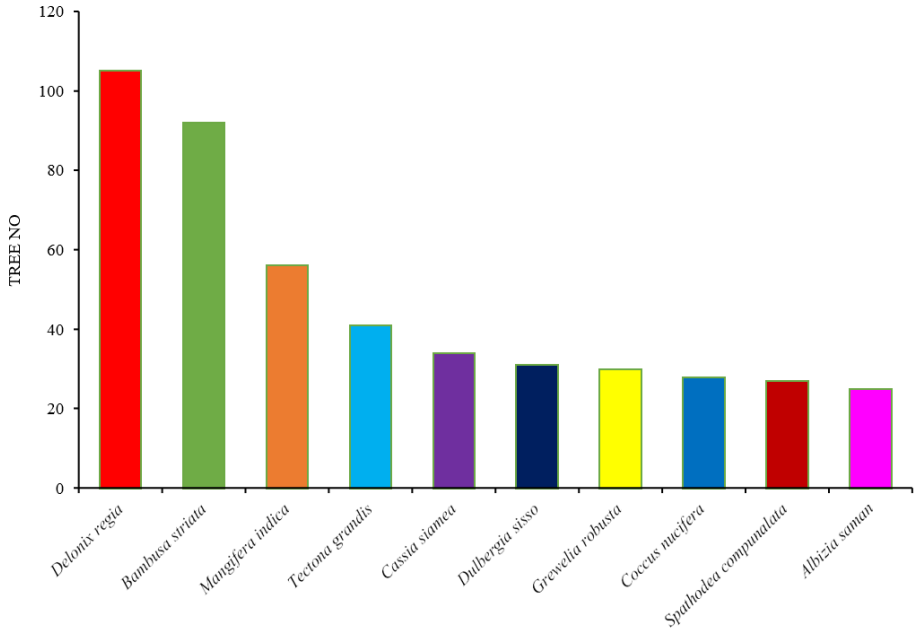
Tree species with the highest population:

The tree species with the highest population is *Delonix regia* contributing much in biomass generation accompanied by *Bambusa striata*. It is followed by *Mangifera indica,* which is deciduous and adds a large amount of biomass in the soil every year. They are multipurpose as they provide fuelwood, edible fruits. Followed by *Tectona grandis* which is useful for timber. *Cassia siamea,* biomass and helps in carbon sequestration. Followed to this *Dulbergia sisso* is a species placed in sixth place which is indigenous. *Dalbergia sissoo* is a perennial tree that is economically important for its value in forestry, agroforestry, and horticulture. It provides timber, fuelwood, fodder, has medicinal value, and is used extensively as an ornamental tree as well as for shading, erosion control, and soil fertility. The seventh and eighth positions are of *Grewelia robusta and Coccus nucifera* respectively. The former is used for timber and the latter is regarded as 'kalpvruksh' and used for various purposes. In the last two places are *Spathodea companulata* and *Albizia saman.*

Table 6.1: Tree species with the highest population

Sr. No.	Botanical Name	Common Name	Number
1	*Delonix regia*	Gulmohar	105
2	*Bambusa striata*	Golden bamboo	92
3	*Mangifera indica*	Mango	56
4	*Tectona grandis*	Teak	41
5	*Cassia siamea*	Cassia	34
6	*Dulbergia sisso*	Shisham	31
7	*Grewelia robusta*	Silver oak	30
8	*Coccus nucifera*	Coconut	28
9	*Spathodea compunalata*	Pichkari	27
10	*Albizia saman*	Rain tree	25

Graph 6.1: Tree species with highest population



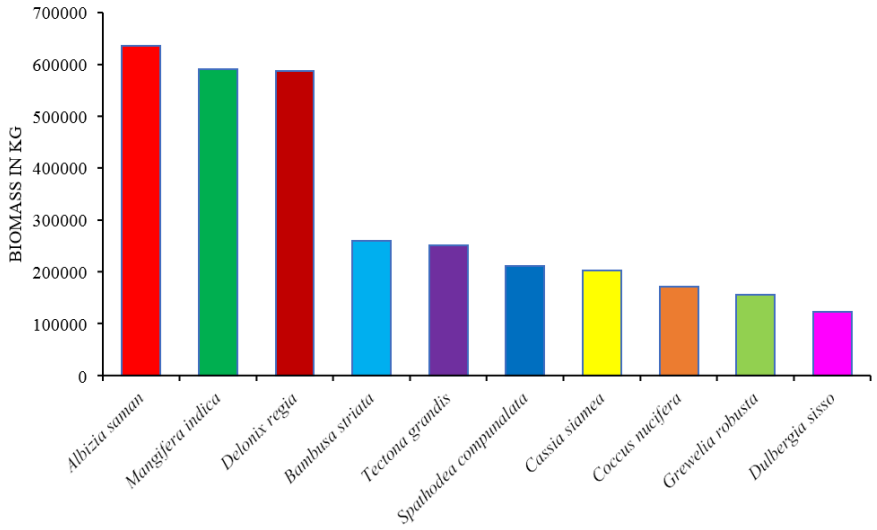
Total biomass:

In ecology, the mass of living biological organisms in a given area or ecosystem at a given time is called biomass. Biomass can refer to species biomass and community biomass. 60,64,166.20 Kg of the total biomass of woody vegetation has been recorded on the SKE Society GSS and RPD College during the current tree census. *Albizia saman* shows the highest biomass as it is with the highest volume with large sized trees on the campus. Followed by *Mangifera indica*, *Delonix regia* and *Bambusa striata* are ranked at second, third, and fourth places respectively.

Table 6.2: Tree species with the highest biomass (Kg)

Sr. No	Botanical Name	Common Name	Total Biomass (Kg)
1	*Albizia saman*	Rain tree	635144.7845
2	*Mangifera indica*	Mango	590328.6971
3	*Delonix regia*	Gulmohar	587304.0071
4	*Bambusa striata*	Golden bamboo	260497.644
5	*Tectona grandis*	Teak	251941
6	*Spathodea compunalata*	Pichkari	212441.801
7	*Cassia siamea*	Cassia	203659.345
8	*Coccus nucifera*	Coconut	171944.167
9	*Grewelia robusta*	Silver oak	156201.91
10	*Dulbergia sisso*	Shisham	123458.0274

Graph 6. 2: Tree species with highest biomass (Kg)



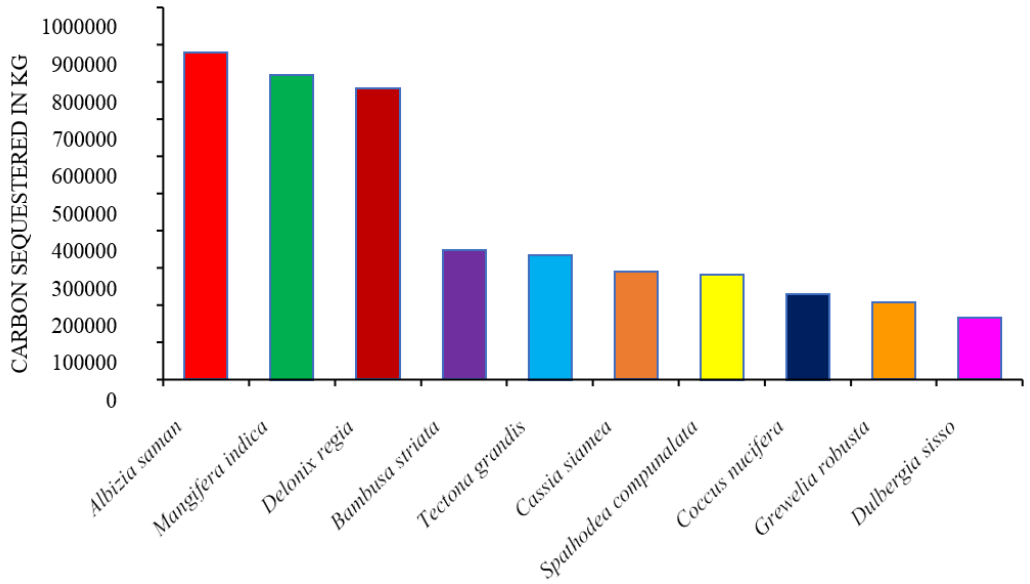
Carbon Stock:

The main carbon sink in tropical forest ecosystems includes the living biomass of trees, under-story vegetation, dead mass of litter, woody debris, and soil organic matter. The carbon stored in the Above Ground Biomass (AGB) of trees is the largest pool and is directly impacted by deforestation and degradation. Trees and forests act as natural carbon stores, but this carbon is released when the trees are felled and the area deforested. The amount of carbon stored within an area of land varies according to the type of vegetation cover. 21,98,260.21Kg of total carbon stock is present at the Society college campus.

Table 6. 3: Tree species with the highest carbon stock.

Sr. No	Botanical Name	Common Name	Total Biomass (Kg)
1	*Albizia saman*	Rain tree	878595.2393
2	*Mangifera indica*	Mango	817851.8682
3	*Delonix regia*	Gulmohar	781334.5889
4	*Bambusa striata*	Golden bamboo	346559.993
5	*Tectona grandis*	Teak	335175.7
6	*Cassia siamea*	Cassia	290359.4899
7	*Spathodea compunalata*	Pichkari	282627.2959
8	*Coccus nucifera*	Coconut	228750.5921
9	*Grewelia robusta*	Silver oak	207807.121
10	*Dulbergia sisso*	Shisham	167084.378

Graph no.6.3: Tree species with the highest carbon stock.



Carbon Sequestration:

Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. It is one method of reducing the amount of carbon dioxide in the atmosphere to reduce global climate change. It has been considered as a way to slow the atmospheric and marine accumulation of greenhouse gases, which are released by burning fossil fuels and

other activities. In the current study, the focus is given on the assessment of existing carbon stock stored in the S.K.E Society campus in the form of woody vegetation by enumerating every tree species. Overall, a total of 92,57,147.33 Kg of CO_2 has been captured and stored by the woody plants present on the College campus. A total of 522.20 Kg of CO_2 is consumed yearly by 902 woody plants from the campus.

Oxygen released:

The Released oxygen is directly proportional to CO_2 sequestrate in the ratio of 32/12. Thus, it is supposed to release 195.87 Kg of oxygen annually.

6.5. Conclusion:

Forests and woody trees are the biggest carbon pool on Earth, act as a major source and sinks of carbon in nature. The trees present on the Society's campus sequester 522.20 kg of CO_2 and release 195.87 Kg of oxygen annually. Thus, the campus is working as a good carbon sink and a productive oxygen park.

- The total tree count on the campus recorded is 902. The highest number shows by *Delonix regia.*
- Along with Botanical garden, Society has an 'Amrai' near the ground where a large no of mango trees is located.
- The GSS College Botanical Garden contains many medicinally important plants. The usefulness of these plants is highlighted by the college every year during the "Science Fest" and throughout the year for visitors.
- In the year 2019, the Department of Botany has put an effort to conserve many species of palms endemic to 'Andaman and Nicobar'.
- GSS college Botany department started Innovative technique i.e., QR Code system for identification and characterization of plants from the whole campus which is the first QR Code system in Karnataka state.

तरुण भारत

एस. के. ई. सोसायटीतर्फे वृक्षारोपण

अमृत महोत्सवी वर्षानिमित्त उपक्रम : अनगोळ येथील आमराईत आज १५० झाडे लावणार

प्रतिनिधी
बेळगाव

येथील एस. के. ई. सोसायटीतर्फे यावर्षी अमृत महोत्सवी वर्ष साजरे करण्यात येणार आहे यानिमित्ताने सोसायटीतर्फे विविध उपक्रम राबविण्यात येत असून त्याअंतर्गत एस. के. ई. सोसायटी आणि जी. एस. एस. महाविद्यालयाचे वनस्पती शास्त्र विभाग यांच्या संयुक्त विद्यमाने २३ जुलै रोजी जी. एस. एस. कॉलेजच्या आवारात वृक्षारोपण करण्यात आले. 'दि प्लान्टेशन ड्राईव्ह' या नावाने उपक्रमाला सुरुवात करण्यात आली यावेळी सोसायटीचे व्यवस्थापन मंडळाचे सदस्य, जी. एस. एस. कॉलेज, एन. एस. एस. युनिट, रेड क्रॉस विभाग,

बेळगाव : वृक्षारोपण करताना उपस्थित मान्यवर व विद्यार्थी.

आरपीडी आणि एनसीसी युनिट कॉलेजमधील प्राचार्यांबरोबरच इतर कर्मचारी उपस्थित होते.

नवग्रह - नक्षत्र गार्डन बनविण्याचा संकल्प

या उपक्रमाचा आणखीन एक भाग म्हणून सोसायटीच्या संत मीरा

स्कूल अनगोळ येथील आमराईत दि २७ जुलै रोजी सकाळी ११ वाजता १५० हून अधिक झाडे लावण्यात येणार आहेत. नवग्रह आणि नक्षत्र गार्डन बनविण्याचा सोसायटीचा मानस आहे. यासाठी सोसायटीअंतर्गत येणाऱ्या सर्व शाळा,

महाविद्यालयातील आजी-माजी विद्यार्थ्यांसह ज्यांना या योजनेत सहभागी व्हायचे आहे त्यांनी उपस्थित रहावे, असे आवाहन करण्यात आले.

ज्यांना झाडे दतक घेऊन सोसायटीने ठरविलेल्या जागेमध्ये लावायची असतील त्यांच्यासाठी १ हजार रुपये भरून त्यांच्या नावाने झाड लावून त्याची तीन वर्षे निगा राखण्याची सोय देखील उपलब्ध करण्यात आली आहे. या कार्यक्रमाला बेळगाव येथील गार्डनर्स क्लबने सुद्धा पाठिंबा दिलेला आहे. त्या दिवशी त्याचे सदस्य उपस्थित राहणार आहेत. तरी या उपक्रमाला मोठ्या संख्येने उपस्थित रहावे, असे आवाहन करण्यात आले आहे.

Tree plantation programme.

तरुण भारत

क्यूआर कोडद्वारे मिळतेय झाडांची माहिती

जीएसएसच्या वनस्पती शास्त्र विभागाचा राज्यातील पहिलाच उपक्रम

प्रतिनिधी
बेळगाव

तंत्रज्ञानाचा योग्य वापर केल्यास अनेक गोष्टी साध्य करता येतात. आपल्याला एखादे झाड दिसते पण त्याचे गुणधर्म, त्याची प्रजाती, त्याच्या उपयोगाची माहिती नसते. झाडांना विविध भाषांमध्ये असणारी नावे, त्याचे गुणधर्म माहिती व्हावे याकरिता जीएसएस कॉलेजच्या वनस्पती शास्त्र विभागाने प्रत्येक झाडाला क्यू आर कोड लावला आहे. राज्यात प्रथमच असा उपक्रम जीएसएस कॉलेजने राबविला असल्यामुळे त्याचे सर्वत्र कौतुक होत आहे.

जीएसएस कॉलेजच्या परिसरात असणाऱ्या ४८० हून अधिक झाडांना क्यूआर कोड लावण्यात आला आहे. कॉलेजच्या वनस्पतीशास्त्र विभागाने प्रत्येक झाडाची माहिती संकलीत करून त्याद्वारे ऑप्लिकेशन बनविण्यात आले आहे. यामुळे झाडावर असणारा क्यूआर कोड मोबाईलमध्ये स्कॅन करताच त्या झाडाची संपूर्ण माहिती मोबाईलवर उपलब्ध होत आहे.

बेळगाव : अशाप्रकारे झाडांना क्यूआर कोड बसविण्यात आलेले आहे.

वनस्पती शास्त्र विभागाच्या विद्यार्थ्यांना झाडांविषयी माहिती असते परंतु इतर विद्यार्थ्यांना ही माहिती समजावी याकरिता हा अनोखा उपक्रम राबविण्यात आला आहे. यामध्ये त्या झाडाचे नाव, वैज्ञानिक नाव, त्याचे वर्गीकरण, त्याची मूळ प्रजात कोठून आली आहे, त्याचे औषधी गुणधर्म या विषयीची माहिती या ॲपद्वारे देण्यात आली आहे. जीएसएस कॉलेजच्या कंपाउंडमध्ये अनेक औषधी व दुर्मिळ अशी झाडे आहेत. त्याची माहिती विद्यार्थ्यांना सहजगत्या समजत आहे.

या उपक्रमासाठी वनस्पती शास्त्र विभागाचे प्रमुख मंजुकर यांनी परीश्रम घेतले आहेत. त्यांना प्रा. प्रवीण पाटील, राहुल खानोलकर यांचे सहकार्य मिळाले आहे. माहिती संकलनाचे काम अद्याप सुरू असून, येत्या काही दिवसात सर्व माहिती क्यूआर कोडवर उपलब्ध असणार आहे.

या बातमीचा व्हिडिओ पाहण्यासाठी QR Code Scan करा.

QR code displayed on the trees in college campus.

6.6. Recommendations:

- Plantation of endemic species like *Mangifera indica*, *Artocarpus intigrifolia*, *Butea monosperma*, *Azadirachta indica*, etc., will be helpful for the conservation of native biodiversity.
- Plantation activity should be taken yearly to increase the green cover on the College campus.
- Avoid plantation of exotic species like *Acacia australia* which is fast-growing species with less ecological values.

6.7 Biodiversity of the campus

List of plants

Sr. No	Botanical Name	Family
1.	*Acalypha Indica* Linn.	Euphorbiaceae
2.	*Achyranthes aspera* Linn.	Amaranthaceae
3.	*Aegle marmelos* (Linn.) Corr.	Rutaceae
4.	*Albizia lebbeck* (Linn.) Benth.	Mimosaceae
5.	*Aloe barbadensis* Mill (A.vera (linn.) Burm.)	Liliaceae
6.	*Anacardium occidentale* Linn.	Anacardiaceae
7.	*Areca catechu* Linn.	Arecaceae
8.	*Aristolochia indica* Linn. (A.lanceolata Wt.)	Aristolochiaceae
9.	*Artemisia nilagirica* (Clarke) Pamp.	Asteraceae
10.	*Artocarpus heterophyllus* Lam.	Moraceae
11.	*Asparagus racemosus* Willd.	Liliaceae
12.	*Bambusaa rundinacea* (Retz.)	Bambusaceae:
13.	*Bauhinia variegate*, Linn	Caesalpiniaceae
14.	*Bombax ceiba*, Linn. (schott&Endlicher)	Bombacaceae
15.	*Borassus flabellifer*, Linn.	Arecaceae
16.	*Butea monosperma* (Lam.) Taub.	Fabaceae
17.	*Caryota urens* Linn.	Palmae
18.	*Cassia tora* Linn	Caesalpiniaceae
19.	*Catharantbus roseus* (Linn.) G.Don (Vinca rosea Linn.)	Apocynaceae
20.	*Cinnamomum verum* Presl (Czeylanicum BL)	Lauraceae
21.	*Citrus medica* Linn.	Rutaceae
22.	*Clitoria ternatea* Linn.	Fabaceae
23.	*Bcocos nucifera* Linn.	Arecaceae
24.	*Croton tilglium* Linn.	Euphorbiaceae
25.	*Cuminum cyminum* Linn.	Apiaceae
26.	*Curcuma longa* Linn.	Zingiberaceae
27.	*Cycas Circinalis Linn.*	Cycadaceae
28.	*Cynodon Dactylon (Linn.) Prs.*	Poaceae
29.	*Cyperus rotunduslinn*	Cyperaceae
30.	*Erythrina variegate linn.(E. varegata (linn) var.*	Fabaceae
31.	*Eucalyptus Globulus Labill.*	Myrtaceae
32.	*Ficus Benghalensis Linn.*	Moraceae
33.	*Ficus racemose linn*(F. Glomerata Roxb.)	Moraceae
34.	*Ficu sreligiosa linn.*	Moraceae
35.	*Flacourtiaindica (Burm.f.) Merr.* (F. ramontehi l. Herit)	Flacourtiaceae
36.	*Arcinia Morella (Gaertn.) Desr.*	Clusiaceae
37.	*Gloriosa superb* Linn	Liliacease
38.	*Glycyrrhiza glabra.* Linn	Fabaceae
39.	*Gmelina arborea* Roxb.	Verbenaceae
40.	*Grewia tiliifolia* Vahl	Tiliaceae
41.	*Gymnema sylvesre* (Retz.) R. Br.	Apocynaceae
42.	*Helictere sisora* Linn	Sterculiaceae
43.	*Hibiscus rosa-sinensis* Linn	Malvacease
44.	*Dxora coccinea* Linn	Rubiaceae

45.	*Jasminum granfiflorum* Linn.	Oleaceae
46.	*Kalanchoe pinnata* (Lam.) Pers.	Crassulaceae
47.	*Lawsonia Inermis* Linn. (L. alba Lam)	Lythraceae
48.	*Mallotus philippensis* (Lam.) Muell. Arg.	Euphorbiaceae
49.	*Melia azedarachta* Linn.	Meliaceae
50.	*Michelia Champaca* Linn.	Magnoliaceae
51.	*Mimusops elengi* Linn.	Sapotaceae
52.	*Mitragyna parvifolia* (Roxb.) korth.	Rubiaceae
53.	*Murrayako enigii* (Linn.) Spreng.	Rutaceae
54.	*Mussa endafrondosa* Linn.	Rubioaceae
55.	*Nerium oleander* Linn.	Apocynaceae
56.	*Nyctanthes arbor-tristis* Linn.	Oleaceae
57.	*Ocimum tenuiflorum* Linn. (O. sanctum Linn.)	Lamiasease
58.	*Pandanuso doratissimis* Linn.f.	Pandanaceae
59.	*Phyllanthus emblica* Linn. (Emblica offcinalis Gaertn.)	Euphorbiaceae
60.	*Pinus roxburghii* Sarg.	Pinaceae
61.	*Polyalthia longifolia* (Sonn.) Thwaites	Annonaceae
62.	*Pasidium guajava* Linn.	Myrtaceae
63.	*Psoralea corylifolia* Linn.	Fabaseae
64.	*Punica granatum* Linn.	Lythraceae
65.	*Rauvalfia serpentine* (Linn.)	Apocynaceae
66.	*Ricinus communis* Linn.	Euphorbiaceae
67.	*Santalum album* Linn.	Santalaceae
68.	*Sapindus laurifio* liaVahl	Sapindaceae
69.	*Saraca asoca* (Roxb.) de Wilde	Caesalpiniaceae
70.	*Semecarpus anacardium* Linn.f.	Anacardicaceae
71.	*Strychnos nux-vomica* Linn.	Loganiaceae
72.	*Syzygium jambos* (Linn.)	Myrtaceae
73.	*Tamarindus indica* Linn.	Caesalpiniaceae
74.	*Tectona grandis* Linn.f.	Verbenaceae
75.	*Terminalia bellirica* (Gartn.) Roxb.	Combretaceae
76.	*Vitex negundo* Linn.	Verbenaceae
77.	*Delomix regia* Boj. Ex Hook.	Fabaceae
78.	*Albizia odoratisima* L.f Benth.	Fabaceae
79.	*Acasia catechu* (L.F) P.J.H Huter & mabb.	Fabaceae
80.	*Alstonia scholaris* (L.) R.Br.	Apocynaceae
81.	*Annona Reticulata* L.	Annonaceae
82.	*Acasia austrialina*.	Fabaceae
83.	*Senna siamea* (Lam.) H.S. Irwin & Barneby)	Fabaceae
84.	*Cassurina equisetifolia* L.	Casurinaceae
85.	*Citharexylum subserratum Sw.*	Verbinacaeae
86.	*Coccus nucifera* L.	Arecaceae
87.	*Cupressus semipervens* L.	Cupressaceae
88.	*Cycus revolute* Thunb.	Cycadaceae
89.	*Dabanga grandiflora* DC.	Leguminoceae
90.	*Delomix regia (*Hook) Raf	Caesalpiniaceae
91.	*Dulbergia sisso* Roxb.	Fabaceae
92.	*Duranta repens* Linn.	Verbinaceae

93.	*Dypsis lutescen*	H.Wendl.
94.	*Erythrima indicanum* Lam.	Fabaceae
95.	*Eucylaptus globulus* Labill.	Myrtaceae
96.	*Ficus amplicia* Ress.	Moraceae
97.	*Ficus bengaminac* L.	Moraceae
98.	*Ficus glomurata* Roxb	Moraceae
99.	*Gliricedia sepium*(Jacq) steud	Fabaceae
100.	*Babusa striata Schrad* ex J. C wendl.	Poaceae
101.	*Grewelia robosta* A.Cunn ex R. Br.	Proteaceae

List of Amphibians

Sr. No	Common Name	Scientific Name
1	Indian bull frog	*Haplobatrachus tigerinus*
2	Indian tree frog	*Polypedates maculatus*
3	Common Indian toad	*Duttaphrynus melanostictus*
4	burrowing frog Indian	*Sphaerotheca breviceps*
5	Reddish burrowing frog	*Fejervarya rufescens*
6	Common skittering frog	*Euphlyctis cyanophlyctis*
7	Knob headed shrub frog	*Raorchestes tuberohumerus*
8	Common Bush frog	*Pseudophilautus sps*
9	Ornate narrow mouthed frog	*Microhyla ornata*

List of Butterfly species

Family: Papilionidae (Swallowtails)	
1	Southern Birdwing, *Troides minos*
2	Common Mormon, *Papilio polytes*
3	Blue Mormon, *Papilio polymnestor*
4	Red Helen, *Papilio helenus*
5	*Common jay, Graphium doson*
Family: Lycaenidae (Blues)	
6	Common Pierrot, *Caleta rosimon*
7	Tiny Grass Blue, *Zizula hylax*
8	Common Cerulean, *Jamides celeno*
9	Red Pierrot, *Talicada nyseus*
Family: Pieridae (Whites & Yellows)	
10	Common Emigrant, *Catopsilia pomona*
11	Mottled Emigrant , *Catopsilia pyranthe*
12	Common Grass Yellow, *Eurema hecabe*
13	*Common jezebel, Delias eucharis*
14	Psyche, *Leptosia nina*
15	Great Orangetip, *Hebomoea glaucippe*
16	Common Wanderer, *Pareronia valeria*
Family: Nymphalidae (Brush-footed Butterflies)	
17	Common Evening Brown, *Melanitis leda*
18	Common Bushbrown, *Mycalesis perseus*

19	Nigger, *Orsotrioena medus*
20	Common Five Ring, *Ypthima baldus*
21	*Common four ring, Ypthima huebneri*
22	Rustic, *Cupha erymanthis*
23	Common Sailer, *Neptis hylas*
24	Common Castor, *Ariadne merione*
25	Lemon Pansy, *Junonia lemonias*
26	Blue Pansy, *Junonia orithya*
27	Soldier (Chocolate Pansy), *Precis iphita*
28	Grey Pansy, *Junonia atlites*
29	Danaid Eggfly, *Hypolimnas misippus*
30	Blue Tiger, *Tirumala limniace*
31	Glassy Tiger, *Parantica aglea*
32	*Striped tiger, Danaus chrysippus*
33	Common Indian Crow, *Euploea core*

Reptile diversity in campus

Sr. No	Common name
1	Common calotis
2	Garden lizard
3	Common skink
4	Common house Gecko
5	Brook’s Gecko
6	Dwarf gecko
7	Indian Rat snake
8	Spectacled cobra
9	Green keel back
10	Striped keel back
11	Checkered keel back
12	Common cat snake
13	Common shield tail

Listing of Bird diversity

Sr. No	Common name
1.	Red whiskered bulbul
2.	Red-vented bulbul
3.	Magpie robin
4.	Indian robin
5.	Tailor bird
6.	Purple rumped sunbird
7.	Loten’s sunbird
8.	Crested lark
9.	Pied bush chat*
10.	Red wattle lapwing
11.	Black drongo
12.	Cattle egret
13.	Indian pond heron
14.	house sprrow
15.	Green bee-eater
16.	Greater coucal
17.	White eye
18.	Common kingfisher
19.	Eurasion golden oriole
20.	Black headed oriole
21.	Barn owl
22.	Spotted owlet
23.	White cheeked barbet
24.	Coppersmith barbet
25.	Ashy prinia
26.	Jungle crow
27.	House crow
28.	Crow pheasant
29.	Indian Grey hornbill
30.	Malabar paid hornbill
31.	Blue rock pigeon
32.	Oriental turtle dove
33.	Common iroa
34.	Indian scoops owl
35.	Common myna
36.	Brahmany myna
37.	Common grey babbler
38.	Indian night jar
39.	Indian roller
40.	Long tailed shrike
41.	Rose ringed parakeet
42.	Black shoulder kite
43.	Common kite
44.	Asian paradise flycatcher
45.	Tickle’s blue flycatcher

CHAPTER-7

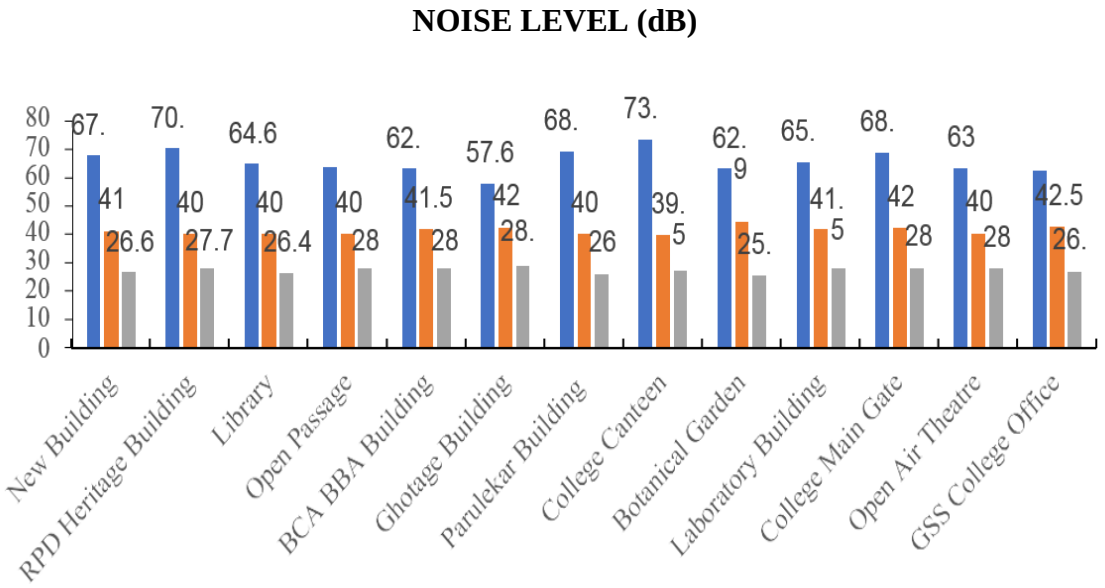
Table no. 7.1 Noise quality, Humidity, Temperature monitoring at the college campus.

Location	Noise (dB)			Humidity (%)			Temperature (^{0}C)		
	Leq	Min	Max	Summer	Rainy	Winter	Summer	Rainy	Winter
New Building	67.5	31.6	108.4	40	80.1	51	34	25	25.6
Heritage Building	70.1	62	75	40.2	80	50	32	22.8	25.7
Library	64.6	60.7	68.9	38.9	79.6	50.2	33	23.1	25.4
Open Passage	63.5	59.3	67.4	39.1	80.8	50	33.2	24	26
BCA,BBA Building	62.9	31.6	108.4	38	81.3	51.5	33	23	26
Ghotage Building	57.6	31.6	108	38	79	49	32	23	25.6
Parulekar Building	68.9	60.5	72.8	39.5	81.2	50	32.5	24.6	25
College Canteen	73.1	31.6	108.4	38	79	39.5	33.8	25	26
Botanical Garden	62.9	59.3	65.2	40.4	82.5	51.5	30	22.9	25.3
Laboratory Building	65.2	54	71.9	39.6	79.9	49.5	32	24.7	26
College Main Gate	68.7	56.6	76.4	38.8	79	48.5	34.4	25	26
Open Air Theatre	63	48.3	74.6	39	79.1	49.3	34	24.9	26.1
GSS College Office	62.5	53.7	69.5	40	80	50.4	33.6	23.1	26.6

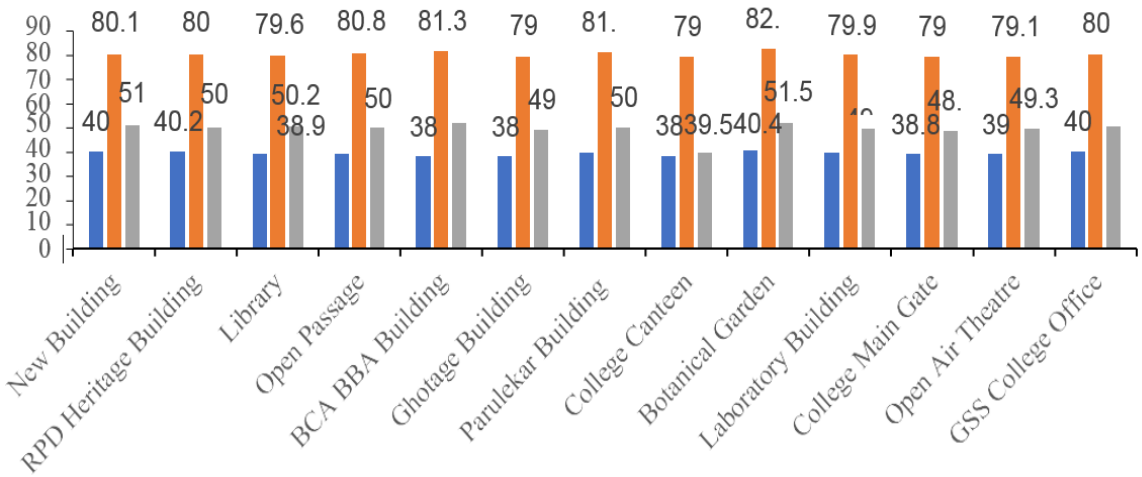
7.1 Noise quality, Humidity, Temperature monitoring at the college campus.

Noise pollution is an important parameter that is taken into account for this Green Audit of the college campus. SKE Society's campus is a green campus. The College campus records minimum noise pollution as compared to other locations in Belagavi city. **Model 1900 Quest Technologies** scientific instruments are used and different locations are selected to monitor noise quality in the College. The **mercury thermometer** is used to check the temperature in Celsius which provides a measure of heat in degrees and the humidity in the air is measured by **wet and dry bulb hygrometer** and is given in table No. 7.1 and graphs 7.1, 7.2, and 7.3 respectively.

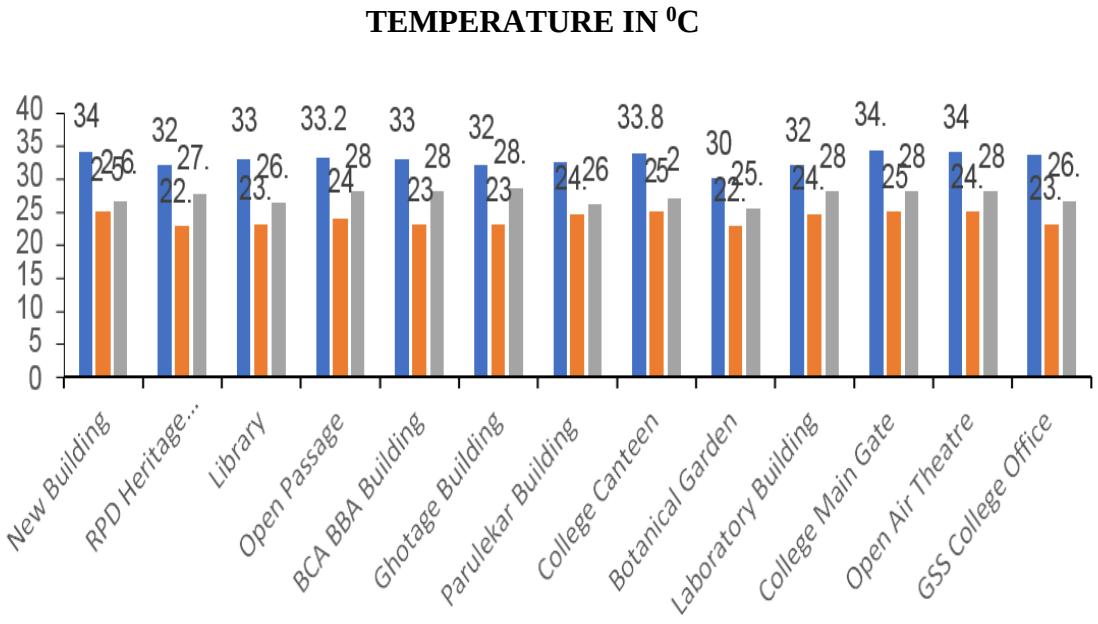
Graph no. 7.1. Noise quality monitoring at the college campus.

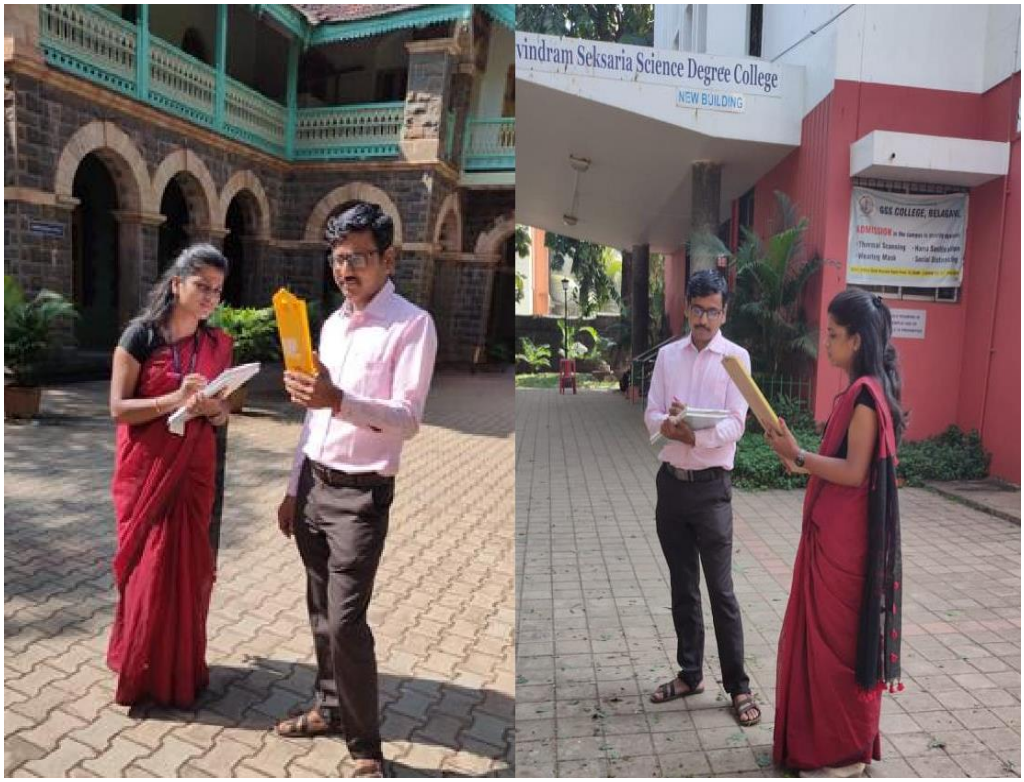


Graph no. 7.2 Humidity monitoring at college campus



Graph no. 7.3 Temperature monitoring at college campus.





The Audit Team while Monitoring Temperature, Humidity, and Noise Level at Different Locations.

7.2 Observations:

- The Noise Monitored at 13 different locations on the campus by **Model 1900 Quest Technologies** scientific instrument. The readings are under the limits and do not come in the Range of Noise pollution.
- The campus is rich in biodiversity and the number of trees planted. Hence there is no issue with the temperature as well as humidity.
- The recorded temperature in the summer is high but as all the classrooms are provided with a sufficient number of fans hence in summer there is no issue of heat.

CHAPTER-8

8.1 Conclusion

The Department of Botany G.S.S. College Belagavi has conducted a "Green Audit" of S.K.E Society's R.P.D, G.S.S College Belagavi. The main objective to carry out a green audit is to check the green practices followed by College and to conduct a well-defined audit report to understand whether the college is on the track of sustainable development.

After completing the audit procedure of the college for green practices, there are following conclusions, recommendations, and Environmental Management Plan (EMP) which can be followed by the college in the future for keeping campus environment friendly.

From the green audit following are some of the conclusions which can be taken into consideration

1. The Botany Department has introduced "Bar- Code (QR Code) best practice" for the identification of plants within the campus.
2. ETP plant has been installed in the Botanical Garden where the effluent water collected from laboratories is treated and used for gardening purposes.
3. In the year 2005, Rainwater Harvesting Pits were dug to recharge the well in the Botanical Garden which used to go dry during the summer season. After implementing this practice, the well now has sufficient water throughout the year.
4. 2021 onwards S.K.E Society is going to start "Fruiting Plants Nursery" to train grafting and layering techniques to the students, especially those who belong to the financially weaker sections so that students get the opportunity to earn while learn.
5. The college has a Botanical Garden, Zoology Museum, and Geology Museum, which is open for students of schools and colleges to visit and expand their knowledge.
6. The college has installed Solar panels in the year 2018 which helped to save 47.72% of total energy.

Recommendations:

1. The effluent water generated from the laboratories is treated by ETP and used for the gardening purpose, but there is no scope for recycling the treated water. Hence this can be implemented in the coming years.
2. Installation of sensor-based electrification items like fans, lights, etc. can save electricity.
3. A rainwater harvesting system to every terrace of the building will be useful in conserving the natural resources.
4. The college takes efforts to dispose of the majority of waste by proper methods. Green computing i.e., online payment system, online circulars, and examination procedures (SRPD) help reduce the use of papers and ultimately reducing the carbon footprint.

The management of SKE Society G.S.S., R.P.D College Belagavi is well focused and has a vision. Management meets every Tuesday of the week where several activities are discussed and planning is done. The Principal holds a meeting every Monday with the Head of the Departments to discuss the weekly calendar that helps for the development of academics and administration.

ANNEXURE -1

Energy Audit

Electrical Instruments

	Electrical machinery	Year & Make	Capacity	Diesel cost
1	Generators			
2	Pump set			
3	Air conditions			
4	Number of Computers	RPD	GSS	
5	Any other Equipment			
	Data Filled by			

Expenditure

Energy management efficiency & alternatives		
Electricity Expenses	2013	2014
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		
Total		

Stationary/ Paper/Print Expenses			
	2012	2013	2014
Total			

Gift - Bouquet Expenses		
2012	2013	2014
Total		

ANNEXURE-2

Water Audit

Sample questioner

Observations: Name of department……
Month and year……..
Total no of employee…….
Average working days in a month……
Area of rooftop/terrace……..
Daily water supply…….

Formula:

Total daily use=Rate of discharge × average duration of use.
No. of users = Number of times used × Number of students or staff members.

Water storage: Storage capacity of tank

Calculation: Length × Breadth × Height

Amount of water intake in-tank = Discharge capacity of motors × time (when the motor is on)

Water consumption:

Storage tanks	Capacity (Liter)	Number	Number of times it is topped daily	Average time of water overflow	Total no of leakages	Rate of discharge
New Building						
Lab Building						
Library Building						
BCA Building						
RPD Heritage building						
Ghotage building						
Boys Hostel						
Girls Hostel						
For Sprinkler, drip rrigation and gardening						

ANNEXURE-3

Solid Waste Audit

Department/ Building: …….

No of classrooms and laboratory: …….

Total no of students: …..……..

Total no of employees: …….

Visitors: …….

Form for maintaining the record of solid waste:

Sr. No	Specification	Yes	No
1	**Whether street sweepings burned, dumped to vermicompost pits?**		
2	**Whether solid waste properly stored/ containerized for offsite disposal?**		
3	**Are solid accumulation areas labeled?**		
4	**Are the dustbins being present in all classrooms?**		
5	**Are one side papers reused by departments?**		

ANNEXURE-4

4.1 Water assessment report

KLE Academy of Higher Education And Research
(Deemed-to-be-University)
Jawaharlal Nehru Medical College, Belagavi.
Department of Microbiology

BACTERIOLOGY REPORT

Lab No: 26927,/ 20

Sample received: Water sample

1) S.K.E SOCIETY G.S.S R.P.D COLLEGE WELL 1.

Test Performed: Macro broth dilution technique using Mac Conkey's Broth.

Observation :
Color - Changed
Turbidity - Present

Remarks : The Water sample tested is **UNFIT** for human consumption.

Date: 26.08.2020

I/C Dr.Sumati Hogade

Dr.Manjula Vagarali
HOD Microbiology

KLE Academy of Higher Education And Research
(Deemed-to-be-University)
Jawaharlal Nehru Medical College, Belagavi.
Department of Microbiology

BACTERIOLOGY REPORT

Lab No: 26926/ 20

Sample received: Water sample

1) G.S.S R.P.D COLLEG S.K.E SOCIETY WELL 2.

Test Performed: Macro broth dilution technique using Mac Conkey's Broth.

Observation :

Color	-	Changed
Turbidity	-	Present

Remarks : The Water sample tested is **UNFIT** for human consumption.

Date: 26.08.2020

I/C Dr.Sumati Hogade

Dr.Manjula Vagarali
HOD Microbiology

KLE Academy of Higher Education And Research
(Deemed-to-be-University)
Jawaharlal Nehru Medical College, Belagavi.
Department of Microbiology

BACTERIOLOGY REPORT

Lab No: W-26927/ 2020

Specimen 1. S.K.E SOCIETY G.S.S R.P.D COLLEGE WELL 1

Observation :

Color	-	Not Changed
Turbidity	-	Not Present

Remarks : The Water sample tested is **FIT** for human consumption.

Date: 08.09.2020

I/C Dr. Sumati Hogade

Dr.Manjula Vagarali
HOD Microbiology

KLE Academy of Higher Education And Research
(Deemed-to-be-University)
Jawaharlal Nehru Medical College, Belagavi.
Department of Microbiology

BACTERIOLOGY REPORT

Lab No: W-26926/ 2020

Specimen 1. S.K.E SOCIETY G.S.S R.P.D COLLEGE WELL 2

Observation :

Color	-	Not Changed
Turbidity	-	Not Present

Remarks : The Water sample tested is **FIT** for human consumption.

Date 08.09.2020

I/C Dr. Sumati Hogade

Dr.Manjula Vagarali
HOD Microbiology

4.1 Noise quality report

Regional Office : Karnataka State Pollution Control Board
Plot No.-1 Main Road, Auto Nagar,
Kanbargi Industrial Area, Belagavi-590 015
Telefax : 0831-2459121
GSTIN No. 29AAALK0537G1Z7 An ISO 9001-2015 & BS OHAS 18001-2007 CERTIFIED Labaratory

ಪ್ರಾದೇಶಿಕ ಕಛೇರಿ : ಕರ್ನಾಟಕ ರಾಜ್ಯ ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ
ಪ್ಲಾಟ್ ನಂ. ೦೧ ನೇ ಮುಖ್ಯ ರಸ್ತೆ, ಆಟೋ ನಗರ,
ಕಣಬರ್ಗಿ ಕೈಗಾರಿಕಾ ಪ್ರದೇಶ, ಬೆಳಗಾವಿ-೫೯೦೦೧೫
ದೂರವಾಣಿ : ೦೮೩೧-೨೪೫೯೧೨೧

towards a cleaner Karnataka

Ambient Air Quality Monitoring

Location : GSS College, Belgavi.	**Date**: 17.8.2020			
Noise Level Meter				
Make	: Quest Technologies			
Model	: 1900			
Serial No	: CCB 020015			
Caliberation Result of Noise Level Meter				
Caliberation				
Initial	: 94 dB at 1000 Hz			
Final	: 114.2 dB at 1000 Hz			
Sampling Rate:				
Sl No.	Time Duration	Location Nos.	LEQ	LMIN	LMAX
1	01:00 Hrs to 01:15 Hrs	11	67.5	31.6	108.4
2	01:20 Hrs to 01:35 Hrs	12	70.1	62	75
3	01:45 Hrs to 02:00 Hrs	13	64.6	60.7	68.9
4	02:10 Hrs to 02:25 Hrs	14	63.5	59.3	67.4
5	02:30 Hrs to 02:40 Hrs	15	62.9	31.6	108.4
6	02:45 Hrs to 03:00 Hrs	16	57.6	31.6	108
7	03:10 Hrs to 03:25 Hrs	17	68.9	60.5	72.8
8	03:30 Hrs to 03:15 Hrs	20	73.1	31.6	108.4
9	03:20 Hrs to 03:40 Hrs	22	62.9	59.3	65.2
10	03:45 Hrs to 04:00 Hrs	23	65.2	54	71.9
11	04:10 Hrs to 04:20 Hrs	24	68.7	56.6	76.4
12	04:25 Hrs to 4:35 Hrs	25	63	48.3	74.6
13	04:40 Hrs to 04:55 Hrs	26	62.5	53.7	69.5
Average L Equivalent dB(A) Between (01:00 to 4:55Hrs.)					
Monitoring team and Signature					

Climatic Conditions: Clear

Latitude N 15°83' 29.9"

Longitude E 74°50' 71.9"

Location 11	New Building	Location 17	Parulekar Building
Location 12	RPD Heritage Building	Location 20	College Canteen
Location 13	Library	Location 22	Botanical Garden
Location 14	Open Passage	Location 23	Laboratory Building
Location 15	BCA Building	Location 24	College Main Gate
Location 16	Ghotage Building	Location 25	Open Air Theater
		Location 26	GSS college Office

Monitored By: 1. Mr: R. S Sawant. 2. Miss: P. S. Kundekar

Scientific Officer
Regional Laboratory
Karnataka State Pollution Control Board
Belgaum.