International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 04 | Apr-2016 www.irjet.net p-ISSN: 2395-0072

Environmental Impact Assessment and Post Environmental Auditing with Environmental Management Plan for Pondicherry Engineering College Campus

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Abstract - *In developing college has a huge impact on anthropogenic and natural ecosystems. Pollution sources, material waste, electricity uses, increases with the expansion of college and cause contamination of water, air and soil. The absence of green environmental planning and management strategies has resulted in greater concern for feature college development. The main objective of this paper is presents assessment of the water, air, solid waste, waste water and land environment at and around the site for an existing college of Pondicherry Engineering College (PEC) is located at pillaichavady, Puducherry. The number of people in PEC Campus is 3000 like student, staffs, residential areas, hostels and nursery home. On the basis of the Environmental Impact Assessment (EIA) we have prepared an Environmental Management Plan (EMP). The EMP for the existing PEC campus has been drawn up to ensure that no adverse impact is caused to the institution. The solid waste, waste water, water, and soil environment at and around the project site has also been studied in detail. The EMP aims at managing the project in a manner that the project doesn't adversely affect any of the dimensions of its environment. Hence, the proposed establishment will not have adverse effect on air quality and water quality. Strategies to maximize water use and prevent any harmful accumulation of wastes have been delineated. College aims to establish a sustainable country that demonstrates our corporate and community commitment to the environment and reflects our responsibility to feature generations.*

Key Words: Water, Noise, solid waste, impact, mitigation measures & EIA, PEC Puducherry

1. INTRODUCTION

Environmental impact assessment (EIA) is a decision tool employed to identify and evaluate the possible environmental consequences of certain proposed development actions. The first formal EIA system was established on the 1st January 1970 by the US National Environmental Policy Act (NEPA) (1). Environmental impact assessment (EIA) is being used globally, either as a planning or management tool, in order to reduce the harmful consequences of development. Its emphasis is on prevention and it is hence an example of the precautionary principle (2). Ministry of Environment & Forests has taken several policy initiatives and enacted environmental and pollution control legislations to prevent indiscriminate exploitation of natural resources and to promote integration of environmental concerns in developmental projects. Environmental management plan (EMP) is suggested on the basis of the identified impact in the Environmental Impact Assessment. EIA is a planning tool that is now generally accepted as an integral component of sound decision-making. The environmental parameters under consideration in present work are Air, Water, Noise, Soil and Socio-Economic. The impact of this existing project of several environmental parameters has been forecast and accordingly various mitigation measures have been suggested (3).

2. MATERIAL & METHODOLOGY

2.1 Study Area

The Pondicherry engineering college (PEC) was established in the year 1984 under the Seventh five year plan with liberal seed grant from MHRD, Government of India. The institution fully funded by the government of puducherry and is administrated by a board of government under the aegis of Engineering College Society.

TABLE-1: College Description

College Description		
1.	Total Area of college	186 acre
2.	Built-up area	16.022 acre
3.	Total Population (departments and quarters)	3000
4.	Location	Pillaichavady, pondicherry
5.	Latitude ,Longitude	12.0133° N, 79.8538° E

The 186 acres of the college campus has department building, an auditorium, library, hostels, student amenities center, open air theatre, and residential quarters for staff and lay out with roads, lawns and gardens. The annual intake of students for various academic programs is: 450 for UG programme; 28 for PG programme; 30 for MCA degree and 10 for M.SC degree in Material Science and Technology & M.Phil., in physics.

2.2 ENVIRONMENTAL AUDITING AND ENVIRONMENTAL IMPACTS

2.2.1 Water

The water supply network of Pondicherry engineering college campus is very complex and old. Many of the major water lines running in the campus were laid in 1980's at the campus time of establishment of the institution. This water is used for various purpose in the campus by various uses like residential, hostel, academic and hospitality uses, laboratory uses, used for landscaping/ gardening, etc.,. The four bore well water sample is collected and analysis the physical and chemical characteristic (Table 3). Drinking water quality underlies various parameters, but in general it should guarantee potable, wholesome and palatable water.

TABLE-2: Characteristic Of Water

Characteristic	Sample				Required/Limit Is 10500/2012	
	Sa_1	Sa_2	Sa_3	Sa_4	Desirable Limit	Permissible Limit
Physical Characteristic						
Odor	agreeable				agreeable	-
Taste	agreeable				agreeable	-
Ph	7.12	7.34	7.15	7.28	6.5-8.5	-
Chemical Characteristic						
EC	112.8	89.13	110.58	128.26	-	-
Total Dissolved Solids (mg/l)	345	421	326	315	-	-
Total alkalinity (mg/l)	110.51	98.2	105.27	119.26	200	600
Total Hardness (mg/l)	51	21.01	48.3	35.87	300	600
Chloride (as Cl) (mg/l)	33.	28.15	15.26	22.47	250	1000
DO(mg/l)	5.12	7.12	8.59	7.64	-	

Source: Indian drinking water standard (IS 10500:2012)

2.2.2 Solid Waste

A lot of waste is accumulated owing to our busy life style. Things like plastic bags, paper, water bottle, aluminums foils, chocolate wrappers, peels of fruits and vegetables are thrown away after use. Unwanted substance formed during a process or substances which cannot be reused are called waste or effluents. Garbage are generated in places like houses, class rooms, OAT, auditorium, streets, parks and hostel. The garbage is segregated in two type's namely bio-degradable waste and non bio- degradable waste. The bio-degradable is treated and it is used for gardening purpose. The different waste categories segregated were then weighed using a weighing machine and respective weights were noted down.

The procedure was repeated on a daily basis for a month. The average per day weight of each category waste and total waste generated was calculated. The waste generated for whole college is given in table 4.

TABLE - 3: Collection of Solid Waste Data

DEPT./DAYS	Day 1 (Kg)	Day 2 (Kg)	Day 3 (Kg)	Day 4 (Kg)	Day 5 (Kg)
Library	1.046	0.748	0.748	0.526	0.861
Dispensary	0.853	0.281	0.360	0.391	0.209
Computer Science	1.195	0.484	0.640	0.812	1.141
E&I	0.736	0.958	0.360	0.470	0.708
Information Technology	1.0304	2.109	1.141	1.312	1.714
Electrical Communication	0.675	1.021	0.581	0.989	1.568
EEE	1.059	1.589	1.361	1.811	1.112
Chemical	0.780	0.605	0.615	0.745	0.723
Civil	1.028	2.393	1.956	2.429	1.161
Science	1.520	0.623	1.782	0.811	0.611
Mechanical	1.905	2.010	1.876	1.200	1.355
Stores	7.241	8.150	7.161	7.021	5.021
Ponlait	9.01	9.262	9.541	9.921	8.546
Canteen	19.5	20.1	20.8	19.4	19.01
Quarters (for 1house)	1.846	1.541	1.74	1.551	1.501
Boys hostel	18.1	18.6	18.9	17.8	19.1
Girls hostel	10.9	10.7	10.7	9.8	10.1
Total	291.03	381.202	296.46	300.6	321.002

Per capita solid waste generation for residential are 0.6 kg / capita / day and for other working population it is 0.2 kg/capita/day.

Source: Central Public Health and Environmental Engineering Organization (CPHEEO).

2.2.3 Waste Water

The waste water coming from barthroom, toilets are collected in concrete sealed primary septic tanks where the outflow will be piped direct to the treatment ponds for further treatment. The characteristic of the waste water is given below

TABLE - 4: Characteristic of Waste Water

Characteristic	Sample	
	Sa_1 (Black Water)	Sa_2 (Grey water)
pH	5.8	6.1
Temperature	29C	38C
DO (mg/l)	8.83	7.26
COD (mg/l)	300	128
BOD (mg/l)	150	65

2.2.4 Flora and Fauna

TABLE - 5: List of Floral Species

S.No	Common Name	Boytanical Name
1	Neem	Azadirachta Indica
2	Jack Fruit	Artocarpus Herterophyllus
3	Almond	Prunus Dulcis
4	Cashew	Anacardium Occidentale
5	Indian Blackberry	Syzygium Cumini
6	Gooseberry	Ribes Uva-Crispa
7	Mango	Mangnifera Indica
8	Sapota	Manikara Zapota
9	Palm Tree	Arecaceae
10	Jathi Malli/ Pitchi	Jasminum Grandiflorum
11	Lilly	Lillium
12	Lemon	Lemon lumonum
13	Lantana	Lanthanum Camara
14	Christmas Tree	Araucaria Columnaris
15	Carolina Sapphire Arizona Cypress	Cupressus Arizonica Varglatara
16	Mattese Cross	Lychnis Chalcedonia
17	Green Santoline	Santoline Rosmarinfolia

TABLE - 6: List of Faunal Species

S.NO	COMMON NAME	ZOOLOGICAL NAME
1	Frog	Rana tigrina
2	House lizard	Hemidactylus
3	Cat	Felis catus
4	Dog	Canis lupus familiaris
5	Rat	Rattus rattus
6	Crow	Corves splendens
7	Parrot	Psittacula krameri
8	Myna	Acridotheres tristis
9	Snake	Serpents
10	Toad	Bufo
11	Squirrel	Sciuridae
12	Sparrow	Passer domesticus
13	mangoose	Herpestes edwardsii

3. RESULT AND DISCUSSION

3.1 *Study about mitigation measures*

3.1.1 Water environment

As seen in the table, the quality of water is fit for drinking water. The study area is fast developing commercial and residential areas, the extraction of ground water is increases now a day, the proper distribution network, rainwater harvesting and storm water drains has been designed in the PEC College. Its increases the recharge of ground water table and to improve the ground water quality.

Water Requirement/Usage Summary

Total water requirements :275.315m^3/day

Total Daily fresh water required : 1400 m^3/day
Daily fresh water requirement for quarters : 234m^3/day
Daily fresh water requirement for Lab : 10 m^3/day
Daily fresh water requirement for Dept. : 98 m^3/day
Water requirement for canteen : 10 m^3/day
Wastage @ 20% due to leaks &unclosed taps :280m^3/day
Gardening water Requirement : 768m^3/day

The total water consumption is five times higher when compare to the total water requirement (guidelines for MOEFCC). The main reason for the higher water consumption is wastage and continuous usage of water.

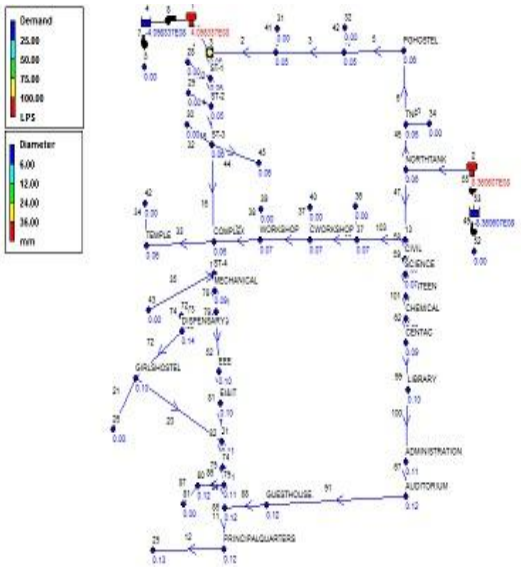


Fig. 1: Distribution Network Whole Campus Using EPANET

The wastage is high because of leakage due to correction of pipe. Now, to redesign the Water Distribution Network using EPANET software for whole campus. Assume design period is 30 years and ductile iron pipe is used. The input data is elevation is Diameter of pipe, dimension of tank, capacity of reservoir and pumps. The output data is flow direction and corrected discharge in pipe.

After redesign the distribution network the electromagnetic sensor will be fixed in equal intervals. The full distribution network is proper maintenance with SCADA software. And the senor is connecting to Programme logical computer through transformer. If any leakage, overhead tank overflow and any theft in distribution network is find when electromagnetic sensor is used and send to the PC. This SCADA is automatic control system is available.

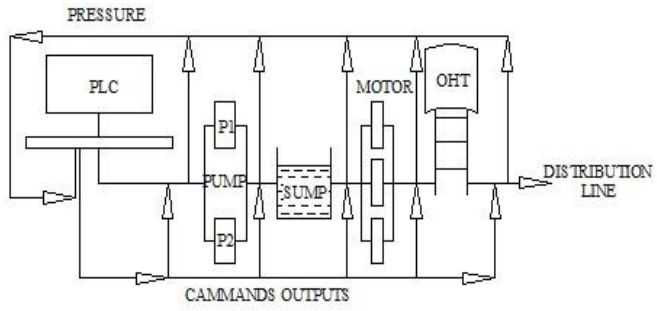


Fig. 2: Distribution Network Control System Using SCADA

3.1.2 Rainwater Management

Design parameters

Total Plot Area considered : 186 acres.
Total Roads and Pavement : 24000Sqm.
Total Landscape Area : 663878 Sqm.
Total Roof Area : 64837 Sqm.

Intensity of rainfall considered in Pondicherry is 998 mm per year
Co – efficient of runoff considered for roof area : 0.90
Co – efficient of runoff for road/paved : 0. 75
Co – efficient of runoff for landscape area : 0. 25

Hence, the total quantity of rainfall will be q= a x p x r
q = quantity of rainwater run - off in cum / hr.
a = area of catchments drained in Sq. m.
Hence, total volume of rainwater run - off will be : (a) + (b) + (c) = 2,41,839 Cum. /yr

However, the rainwater collection drain and recharge pit is designed for highest hourly peak flow according to the site condition.

TABLE - 7: Rainwater Runoff

Description	Area in Sq.m	Coefficient runoff	Rainfall intensity in m	Total Rainwater Runoff Cum/yr
Roof area	64837	0.90	0.998	58237
Roads & Pavement	24000	0.75	0.998	17964
Landscape & Green Area	663878	0.25	0.998	165638
Total				**241839**

3.1.3 Solid waste management

Total waste generation : 300 kg/day
Total biodegradable waste generation : 200 kg/day
Total non-biodegradable waste generation : 100 kg/day

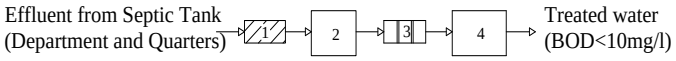
TABLE 8: Segregations of Waste

S. No	Description	Quantity (kg/day)	Mode of treatment / disposal
1	Biodegradable waste	200	Proposed to be treat part of solid waste in organic waste converter and used as manure in gardening and the paper waste is recycle
2	Non-biodegradable waste	100	Proposed to be Integrated municipal solid waste management facility (IMSWF)

3.1.4 Waste water

Waste water produce inside the campus is about 1120m3/day. Liquid waste is being collected in septic tank and drawn down under gravity, collected through a collection tank and sewage treatment plant is installed. For treating the liquid waste DEWATS method which is the type of sewage treatment method should be adopted.

fig 3: Flow Diagram for DEWATS



1. Setttler
2. Anaerobic Baffled Reactor
3. Anaerobic Filter
4. Planted Gravel Filter

DEWATS stands for "Decentralized Wastewater Treatment Systems". DEWATS represents a technical approach rather than purely a technology package. DEWATS applications are designed to be low-maintenance: most important parts of the system work without utility management services inputs and cannot be switched off deliberately.

DEWATS applications provide state-of-the-art technology at inexpensive prices because all of the materials used for construction are locally available.

- DEWATS applications provide treatment for both domestic and industrial sources
- Systems can be designed to handle organic wastewater flows
- Systems are built to be dependable, long lasting and tolerant towards fluctuations in loads
- DEWATS applications do not require wordly maintenance

Without considering facilities for necessary chemical pre-treatment of wastewater from college, DEWATS applications are designed with four basic technical treatment modules which are combined and configured to provide a custom solution for a given sanitation/wastewater challenge:

- Primary treatment: sedimentation and floatation
- Secondary anaerobic treatment in fixed-bed reactors: baffled upstream reactors or anaerobic filters
- Tertiary aerobic treatment in sub-surface flow filters
- Tertiary aerobic treatment in polishing ponds

TABLE - 9: Dimension For Treatment Chamber

Name Of Chamber	Volume (m3)	Length(m)	Breath(m)	Width (m)	Detention time
Settler	1402.5	187	3	2.5	3 hrs
Anaerobic Baffled Reactor	1680	116.67	7.2	2	18 hrs
Anaerobic Filter	673.92	2.4	117	2	24hrs
Planted Gravel Filter	4500	45	100	1	-

4. ENVIRONMENTAL MANAGEMENT PLAN

Environmental Impact	Mitigation Measure	Time Frame
Water environment	Redesign the water distribution network and install SCADA monitoring devise	Check once in a month
Waste water environment	Construct DEWATS treatment system	Six months
Solid waste environment	Construct composting yard and (IMSWF)	Once in a year
Rainwater Harvesting	Rainwater Harvesting Pits	Once in a year
Flora and fauna	Provide Green Belt	Once in a Year

5. CONCLUSION

Study on environmental impact assessment and preparation of environmental management plan is required for formulation, implementation and monitoring of environmental protections. This management plant should be necessarily based on consideration of resources conservation and measure taken to reduce pollution.

- Reduce total water consumption
- Reduce quantity of waste water and its recycle.
- Reduce , recycle and reuse the solid waste
- Increase the ground water level
- Reducing waste to landfill
- Maximize sustainable transport
- Sustainability-related professional training and development opportunities through internships, facilitated workshops, national and international alliances.

Use of SCADA for management of water networks results in many intangible benefits, which are as important as the financial improvements. If only the quantifiable benefits are taken into consideration, investment is such system might not in all cases justify the expenditure.

6. Acknowledgments

I thanks the department of Civil Engineering and My college of Pondicherry Engineeering college , India for financial support..

Reference

[1] Ajoy Debbarma, Environmental Impact Assessment and Management: Protecting Ecological - Green Country; a Study on INDIA, 1,1 (2012) 49-56

[2] Rafique Ahammed A.K.M. , Bronte Merrick Nixon, Environmental impact monitoring in the EIA process of South Australia, Environmental Impact Assessment Review 26 (2006) 426 – 447

[3] Akhil Shetty et al, Environmental Impact Assessment and environmental management plan for multi level parking project 8,2, (2015)2349-2163

[4] A.A. Saleh Etal., An Approach To Facilities Management (Fm) Practices In Higher Learning Institutions To Attain A Sustainable Campus (Case Study: University Technology Mara – (Uitm), Procedia Engineering 20(2011)269-278

[5] Merchant Etal., Analytics Driven Water Management System For Bangalore City, Procedia Engineering 70(2014)1137-1146

[6] Merchant Etal., Analytics Driven Water Management System For Bangalore City, Procedia Engineering 70 (2014) 1137 – 1146

[7] Kwangbok Jeong, Etal., A Model For Predicting The Environmental Impacts Of Educational Facilities In The Project Planning Phase, Journal Of Cleaner Production (2014) 1-12
[8] Minakshi M.Yengale Etal.,Analysis Of Water Distribution Network For Karanja Village -A Case Study, International Journal Of Engineering Research And Applications Vol. 2, Issue 3, May-Jun 2012, Pp.2352-2355
[9] Xiwang Li, Etal., Carbon Footprint Analysis Of Student Behavior For A Sustainable University Campus In China, Journal Of Cleaner Production (2015) 1e12
[10] Hongwei Tan Etal., Development Of Green Campus In China, Journal Of Cleaner Production 64 (2014) 646-653
[11] Adrian Gligor, Etal., Development Of A Service Oriented Scada System, Procedia Economics And Finance 3 (2012) 256 – 261
[12] Shaila Bantanur, Etal., Emerging Dimensions Of Sustainability In Institutes Of Higher Education In India, International Journal Of Sustainable Built Environment (2015)
[13] Policyduzgun Agdas, Etal., Energy Use Assessment Of Educational Buildings: Toward Acampus-Wide Sustainable Energy Policy, Sustainable Cities And Society 17 (2015) 15–21
[14] Dan Ehrenreich, Etal., Operating Benefits Achieved With Scada For Water Distribution, Bcwwa Conference, Vancouver, November 28-29, 2005
[15] Minakshi M.Yengale Etal.,Analysis Of Water Distribution Network For Karanja Village -A Case Study, International Journal Of Engineering Research And Applications Vol. 2, Issue 3, May-Jun 2012, Pp.2352-2355
[16] Hongwei Tan Etal., Development Of Green Campus In China, Journal Of Cleaner Production 64 (2014) 646-653
[17] Adrian Gligor, Etal., Development Of A Service Oriented Scada System, Procedia Economics And Finance 3 (2012) 256 – 261
[18] Shaila Bantanur, Etal., Emerging Dimensions Of Sustainability In Institutes Of Higher Education In India, International Journal Of Sustainable Built Environment (2015)
[19] Dan Ehrenreich, Etal., Operating Benefits Achieved With Scada For Water Distribution, Bcwwa Conference, Vancouver, November 28-29, 2005
[20] Nermin Akyeletal., Etal., Strategic Planning In Institutions Of Higher Education: A Case Study Of Sakarya University, Procedia - Social And Behavioral Sciences 58 (2012) 66 – 72
[21] Najm O. Etal., The use of SCADA system in water resources management, management of Shatt Al-Hilla in Iraq as a case study, International Journal of Environmental Monitoring and Analysis. Vol. 1, No. 5, 2013, pp. 237-247
[22] Mohamed Najeh Lakhoua, Etal., Project Management Phases Of A Scada System For Automation Of Electrical Distribution Networks, International Journal Of Computer Science Issues, Vol. 9, Issue 2, No 2, March 2012
[23] Adil Fahad, Etal., Ppfscada: Privacy Preserving Framework For Scada Data Publishing, Future Generation Computer Systems 37 (2014) 496–511
[24] M. Duran-Ros, Etal., Definition Of A Scada System For A Microirrigation Network With Effluents, Computers And Electronics In Agriculture 6 4 (2 0 0 8) 338–342
[25] Mr. Prashant palkar, Etal., Automation in drinking water supply distributed system and testing of water, ISSN : 2278-2834, ISBN : 2278-8735, PP : 36-38