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## Designing Base Station for Living Routes Auroville, India

Item Type	Masters Project
Authors	Mudgal, Vandita
Download date	2025-11-05 13:26:21
Link to Item	<a href="https://hdl.handle.net/20.500.14394/32041">https://hdl.handle.net/20.500.14394/32041</a>

*Living Routes*

*Living Routes Student Projects*

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University of Massachusetts - Amherst

Year 2008

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Designing a Base Station for Living  
Routes in Auroville, India

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**Designing Base Station for Living Routes  
Auroville,India**

A Master's Project  
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May 2008

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## **ACKNOWLEDGEMENT**

Nothing can be done independently, there exists a support system behind that helps you in moving forward. The following people have given me that support to look ahead and beyond, and I would like to thank them.....

Peter Kumble for his advice, enthusiasm and patience in understanding an Indian site, totally alien to his past experience. Understanding the Indian point of view on certain design issues and helping me in moving forward.

Jack Ahern for his critical comments and feedback which were indispensable in the design process.

Daniel Greenberg (Director, Living Routes) for his enthusiasm and support in envisioning a new base station for Living Routes in India.

To all the Living Routes faculty, staff and students especially Tlaloc Tokuda and Alexander in India for helping me during my site visit and coordination with students.

To Neetu Singh( M'Arch candidate, Department of Architecture and Design, Umass), for her enthusiasm and hard work to make this project a collaborative effort between the two departments of Landscape Architecture and Architecture.

And most of all to my family back home in India who supported me throughout my academic endeavors and friends here Mayank and Aarti for their constant support and encouragement day and night.

## **ABSTRACT**

Living Routes is a Non Governmental Organization based in Amherst, MA that sends students overseas for semester long courses affiliated by the University of Massachusetts, Amherst. The courses comprise of sustainable living practices, ecological studies and a lifestyle that supports nature. These sites are primarily eco-villages spread throughout the world. In some of them Living Routes has its own campus and in others they function from temporary guest houses and hired accommodations.

This Master's study project worked to develop the spatial design for a campus located in Auroville, India for Living Routes. As the course is more established in Auroville, India; Living Routes feels the need to establish a new base station (campus). This campus would serve as a holistic site with classrooms, accommodations and outdoor activity area. The campus would also serve as an example of an ideal campus setting for running such courses. The master's project thus looks into the possibility of proposing a campus plan that could be seen as a live laboratory of systems and practices that the organization preaches.

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# 1. INTRODUCTION

## 1.1 Project Background

In the past few decades tourism has taken shape of a very important industry in India. With the globalization and the world coming closer because of the technology and ease in traveling, India has experienced an increasing influx of travelers over the past few years. It is noteworthy that tourism has changed into an industry of its own and the awareness has brought interest in travelers and the service providers to make this sector more influential.



Fig 1.1: Map of India  
Source: [www.investmentcommission.in/images.jpg](http://www.investmentcommission.in/images.jpg)



Fig 1.2: Map of South India : Auroville in red  
Source: [www.quiethealingcenter.info/images.gif](http://www.quiethealingcenter.info/images.gif)

Eco tourism is considered one of the fastest growing markets in the tourism industry, according to the world tourism organization. As any other developing nation, India also wants to match pace with the current trends in the developed world. In the past one decade, the awareness about eco tourism has grown tremendously in India, and this has attracted added interest of the investors, government organization, NGO's and private travel agencies.

Living Routes is one such NGO that wants to promote Auroville in South India as an eco-village site in the global eco tourism map. The organization is based in Amherst, MA and is involved in sending students for semester long courses to various eco-village sites around the world. The aim of the organization is not to promote eco tourism per say but to bring in increased awareness for travelers, students and residents of these eco-villages about sustainable and ecofriendly ways of living.

**Eco-tourism:** Tourism which is developed and maintained in an area (community, environment) in such a manner and at such a scale that it remains viable over an indefinite period and does not degrade or alter the environment in which it exists to such a degree that it prohibits the successful development and wellbeing of other activities and processes.

**Eco-village:** A human-scale, full-featured settlement in which human activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development and can be successfully continued into the indefinite futures.”

## 1.2 Study Area

The site is located in the Southern coastal region of India, 14 km away from a major South Indian city called Pondicherry. The site primarily is a large cluster of eco-villages encompassing an area of almost 20 km radius. It is a spiritual hub for the followers of Sri Aurobindo and the Mother, spiritual gurus of India from the late 1940s.

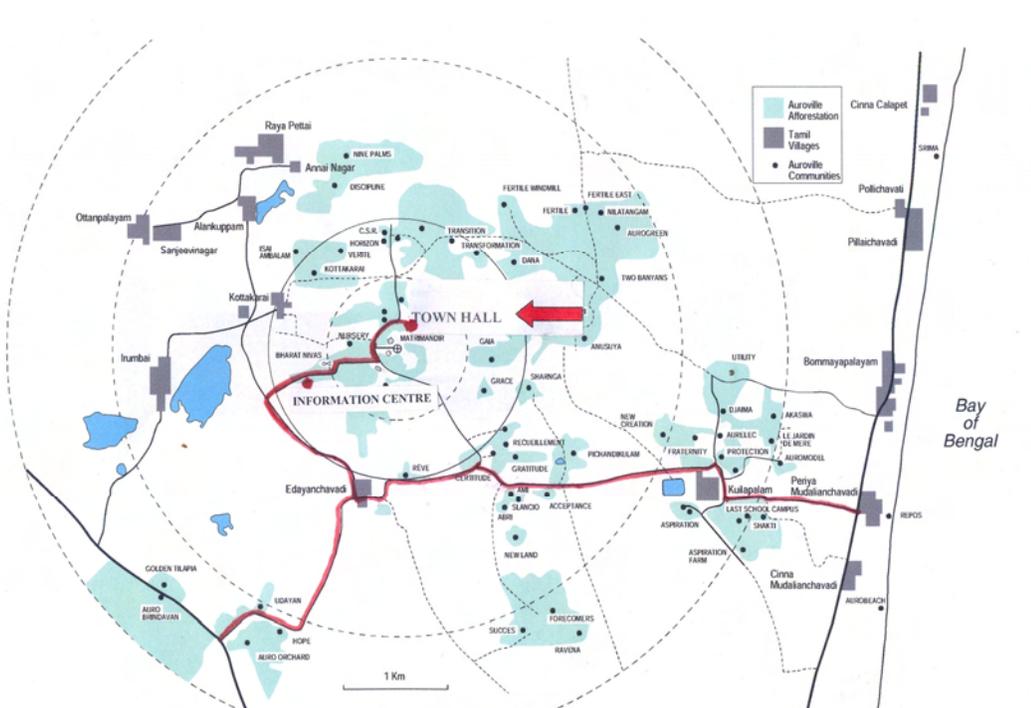


Fig 1.3: Plan showing the spread of Auroville and the various eco-villages  
Source: [http://www.community-media.org/img/map\\_large.jpg](http://www.community-media.org/img/map_large.jpg)

Auroville is seen as a visionary city. The whole settlement is based on the principal of humanity and spiritual beliefs. The city is supposed to belong to the world and not to a particular nation. Anyone and everyone are invited to work and enjoy the community living practiced in Auroville. People from all over the world are attracted by the modest ways of

living and spiritual enlightenment that Auroville offers to its residents. Auroville as a whole is seen as a laboratory for the people to experiment sustainable ways of living. There is a town planning commission that regulates all the developments in the area and is responsible of the implementation of the visionary master plan of the city. This master plan basically revolves around the main meditation hall called the Matrimandir and is surrounded by a circular vehicular road called the Crown Road. The whole development is divided into four zones: Industrial, Residential, Cultural and International.

Living Routes is one of the organizations that work in Auroville. It has some of its permanent faculty based on site. They operate from a temporary campus called the College Guest House, which they hire every year for six months to run their course, and the rest of the year it works as a commercial guest house for the visitors coming to Auroville. The college guest house site located in the residential zone is a one acre spread of land which has a few residential units, a common kitchen and dining area, common bathroom and toilets and a small administrative block. The faculty of Living Routes stays close to the site but not on site. Although Living Routes has connections with other organizations and guest houses in the area, the college guest house still works as the main activity hub for the course. The other areas where students can stay are Sadhana Forest and the American Pavilion.

The site is in close proximity to a proposed greenbelt on the western side and proposed Crown Road on the northern side. The restriction of proposed development within a one acre parcel of land makes the site small and compact. It is proposed that the existing buildings on the site will be removed and new campus buildings will be planned keeping some existing characters of the site intact. At present the small mud road on the western side of the site is the main entry area for the campus and it is proposed that the new campus should also keep the entry at the same position.

### **1.3 Existing scenario-problems, challenges and opportunities**

The existing college guest house site does not fully accommodate the functions and requirements of the course run by Living Routes. The increasing number of students and the restriction of open areas to demonstrate sustainable living principals have encouraged Living Routes to propose a new campus on the same site. Some of the existing problems on the site are:

- 1) The existing buildings are very old and have a thatched roof which gives a temporary feel to the campus.
- 2) Because of the old construction, many of existing buildings have acoustical and storm water drainage problems.
- 3) The guest house is very small to cater to the larger group of students.
- 4) The campus works well as a guest house but does not accommodate the needs of a working educational campus.
- 5) The link to the proposed Crown Road in the future does not exist.

Some of the challenges that the site presents:

- 1) How can a campus work as an educational site for half a year and function as a regular guest house for the rest of the months?
- 2) How to accommodate future link of the campus to the crown road in the northern side?
- 3) How can the campus justify its contextual placement in India for the students coming from abroad?
- 4) How can a proposed new design for the campus support the existing green belt on the western side of the site, hence merging with the rest of the surroundings?
- 5) How can a campus showcase what Living Routes teaches to the students through design and practical implementation?

There are some opportunities in the project that add to the educational value of the effort.

- 1) The implementation of sustainable design ideas in a campus layout for an organization that teaches these principals to its students is a great opportunity for creating a live working laboratory. Students can join and work at the time of their stay and have hands on experience of some of the lessons they learn in the course of their studies.
- 2) To design the campus as an educational site for visitors staying in the later half of the year through the means of technology, pod casting, placards and posters.
- 3) This site could work as an icon for promoting Living Routes to the greater public.
- 4) Living Routes can also use this design as a template for designing other base stations in various parts of the world.

## 2. LITERATURE REVIEW

The literature review is focused on finding the relevant information about the topic of discussion. It establishes a definition of eco-tourism, explains terms related to the topic and develops an understanding of the current state of affairs. The main questions that the literature review focuses on are:

- 1) *What is eco-tourism? Understanding its definition and its relevance in the tourism industry.*
- 2) *What is an eco-village? How does it connect to Eco-tourism?*
- 3) *The state of eco-tourism in India.*
- 4) *About Auroville and what type of eco-village site is Auroville?*
- 5) *What is Living Routes and how does it connect with Auroville?*

These questions lead to the discussion of the actual thesis project - the design proposal for a Living Routes base station in Auroville. The project is seen as an opportunity to understand the process of eco-village design and showcase the aspects of Living Routes teachings in the practical applied scale.

Thus, the literature review presented will primarily deal with all the questions stated above. It will also try to formulate and showcase the working of a global eco-tourism issue into smaller applied scale by taking a campus design project in Auroville.

## 2.1 What is Eco-tourism?

Broadly speaking there are six major types of holidays that consumers take:

- 1) Business travel
- 2) Rural tourism
- 3) Cultural tourism
- 4) Nature/adventure tourism
- 5) Sun/beach tourism
- 6) Fitness/wellness

Nature-based tourism is the fastest growing segment in the tourism industry and it is estimated that it generates 7% of all international travel expenditure and accounts for 20% of all international travel . (Nadkarni 2003)

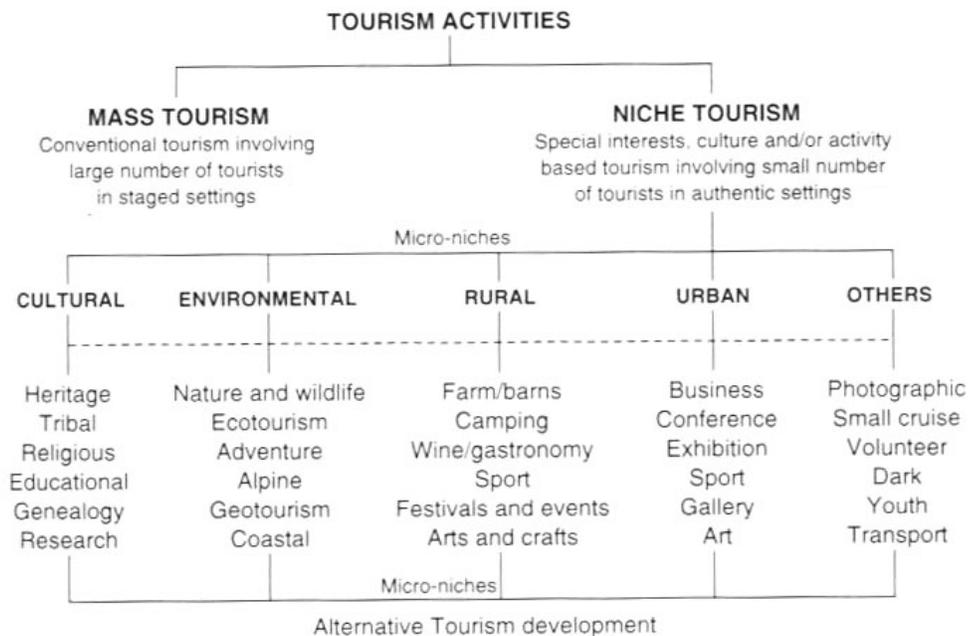


Fig 2.1: Mass Tourism vs Niche Tourism

Source:

The origins of nature travel date back many years. We might say that Herodotus during the 5<sup>th</sup> century B.C was one of the first nature tourists. His extensive travels included visits to the

Black Sea, Egypt, southern Italy, Athens and the Aegean Sea. Inferences drawn from his remarks show that he was deeply interested not only in history, but also in geography, the natural environment and ancient monuments such as the pyramids of Egypt. Aristotle also praised nature tourism (Ceballos-Lascurian 1996) . However, the globetrotters and explorers of the past were exceptional people, endowed with formidable energy and willpower, who undertook their journeys in a highly individual manner, often experiencing many privations and difficulties. Nature travel as a popular pastime cannot be considered to have truly developed until the late 19<sup>th</sup> Century, following advances in mass travel. Not until the mid 20<sup>th</sup> century did worldwide travel become possible for more than just an elite (Ceballos-Lascurian 1996) .This was possible because of the advance in air and automobile transportation.

Eco-tourism is generally seen as a smaller segment of the nature tourism sector, yet it combined all other categories of tourism, and often overlaps with adventure tourism. This is because, rather than being a ‘thing’, eco-tourism is more a set of principles pertaining to sustainable and ethical tourism (Nadkarni 2003) .

Eco-tourism is really an amalgamation of interests arising out of environmental, economic and social concerns (Lindberg and Hawkins 1993) . Although a subset of one of the world’s most important industry, eco-tourism derives its meaning not from the revenue generated but from the untouched natural land areas and the scenic beauty and serenity they possess. Steele (1993) for example, describes it as an economic process where rare and beautiful eco-system areas are marketed internationally to attract tourist (Cater and Lowman 1994) .

“Tourism is like a fire; you can cook your soup in it; but you can also burn down your house with it.”- Asian proverb (Moli 2003) . Proper planning and management are critical to eco-tourism’s development or it will threaten the biological diversity upon which it depends (Wood 2002) . The tragedy of mass tourist spots digging their own graves and the emerging global market for ethnic and unique experience gave rise to enterprises under the banner of eco-tourism in various parts of the world ( P,T.D et al. July 2006)(.

According to the World Travel and Tourism Council (WTTC), tourism is now the world’s largest industry (Lindberg and Hawkins 1993) . No other forms of economic activity transects so many sections, levels and interests as tourism (Cater and Lowman 1994). The 1980s were a key turning point both in tourism and in society. Concepts like eco-tourism, responsible tourism and sustainable tourism emerged during the 1980s as the alternative to mass tourism (Novelli 2005) . The popularity of eco-tourism can be seen as dependent on the technological advancement. The enormous popularity of nature and travel documentations on television, and the rising interest in conservation and environmental matters have allowed eco-tourism to truly become a phenomenon characteristic of the end of the 20<sup>th</sup> century (Lindberg and Hawkins 1993).

Eco-tourism is an idea that emerges when two independent trends intersect. One of these trends lies in the conservation field and the other in the travel industry (Boo 1992). Although it is a globally used term, its implementation is typically specific to a region and at a small scale. Eco-tourism development is most likely to be at a small scale, preferably locally owned, and with low impact and a higher proportion of profit remaining in the local economy

( Khan 1997). “ Small scale development seems to be essential in eco-tourism, as it assures slow development, allow for maximum local participation, contributes direct and indirect macro and microeconomics effects locally, mobilizes local money reserves, reduces leakages and induces local re-investment (Gossling 1999) .”

The most commonly used definition is of the Brundtland Commission Report “development which meets the needs of the present without compromising the ability of future generations to meet their own needs”(Cater and Lowman 1994) . Because different definitions and interpretations of the term eco-tourism can be found, it is connected at various levels to a local economy, nature conservation, sustainability, and ecology. However it is important to note that “If tourism is to contribute to sustainable development, then it must be economically viable, ecologically sensitive and culturally appropriate (Wall 1997)” .It therefore becomes important to understand that not all eco-tourist sites are ecologically sustainable and economically viable. Thus term eco-tourism is surrounded by confusion. Is it a form of ‘alternate tourism’? It is responsible? It is sustainable? (Cater and Lowman 1994) . It can be said that, sustainable tourism and eco-tourism are not synonyms. Many forms of eco-tourism may not be sustainable, and if eco-tourism is to contribute to sustainable development then careful planning and management will be required (Wall 1997). The terms like ecotour, ecotravel, ecovacation, eco(ad)venture, ecocruise, ecosafari, and so on, are often little more than examples of environmental opportunism. Eco-tourism, thus interpreted, may be ecologically based but not ecologically sound (Cater and Lowman 1994). This concept of ‘niche tourism’ has emerged in recent years in contrast to what is commonly referred to as

mass tourism. Niche tourism implies a more sophisticated set of practices that distinguish and differentiate tourists ( Novelli 2005) .

“Take nothing but photographs and leave nothing behind but footprints (Nadkarni 2003)” .

Butler (1993), who is one of the most articulate critics of sustainable tourism, has defined it as follows: “Tourism which is in a form which can maintain its viability in an area for an indefinite period or time.” He contrasts this with a definition of sustainable development in the content of tourism as, “Tourism which is developed and maintained in an area (community, environment) in such a manner and at such a scale that it remains viable over an indefinite period and does not degrade or alter the environment in which it exists to such a degree that it prohibits the successful development and wellbeing of other activities and processes (Wall 1997) .”

Eco-tourism can then be seen as a particular variant of alternative tourism. The attribute of ecological and socio-cultural integrity, responsibility and sustainability are qualities which may or unfortunately may not, pertain to eco-tourism as a product (Cater and Lowman 1994). The range of interest involved in eco-tourism by the service providers and the consumers might be loosely grouped into four categories: tourist guests, tourism organization, the host populations and the natural environment (Cater and Lowman 1994) . More than this within eco-tourism there are various levels of involvement. Eco-tourism can adhere to core criteria yet embrace a spectrum of motivations, levels of involvement and outcomes, ranging from ‘hard’ to ‘soft’ types of eco-tourism, and from the ‘active’ to the ‘passive’ (Weaver 2001) .

The demand for eco-tourism partly depends on the type of eco-tourist. Four types of eco-tourist are described:

- 1) Hard core: members of tours or groups designed specifically for education, removal of litter or similar purpose.
- 2) Dedicated: travelers who come to see a protected area and understand local natural and cultural history.
- 3) Mainstream: tourists primarily interested in an unusual trip, such as to the Amazon to see wild gorillas.
- 4) Casual: natural and cultural travel is an incidental component of a broader trip.

(Brandon, 1993)

Although the number of eco-tourist and their origin of can differ in large amount, there is a clear trend which indicates some specifics. The 'typical' eco-tourist, it appears, tends to originate from more developed country, is female, has higher than average income and education levels, and is somewhat older than the average tourist (Weaver 2001) . Ceballos-Lascurianin (1996) estimated the potential number of eco-tourist globally at between 157 to 236 million, capable of generating expenditures of up to US \$ 1.2 trillion . Eco-tourism practices vary from wildlife and heritage to health and adventure. Eco-tourism is generally perceived as 'high value low volume enterprise' depending on a few interested tourist with high willingness to pay (Seema.P, T.D et al. 2006). In contrast to conventional tourists eco-tourist's stay in facilities that are likely to be owned and managed by local people (Gossling 1999:309) rather than multinational hotels, and often eat local food and consume local services (West and Carrier 2004) .

It is clear that within the eco-tourism industry there are specifics about the type of user preference, based on the tourist class the user comes from. Although most eco-tourists are committed to the conservational and importance of these natural areas, still there are reasons behind seeing it as an environmentally disruptive activity. Four such reasons will be:

- 1) Eco-tourism is usually directed to very special places that may have limited ability to withstand use pressure.
- 2) Visitation may also occur at critical times, such as in the mating or breeding season etc.
- 3) In the absence of information, it is often assumed that the relationship between volumes of use and associated impacts is linear.
- 4) Even if the on-site impact is small, the off site and en route impacts may be substantial.

(Wall 1997)

It cannot be denied that a great deal of money is spent by participants of eco-tourism. However, a large proportion of this money is spent at the place of origin, primarily to pay for travel, with usually relatively little being spent at the destination ( Wall 1997). The notion of an increasingly experienced group of tourist demanding a specialist holiday to meet their specific desires provides a necessary condition for the growth of niche tourism, but it is far from sufficient ( Novelli 2003) .



Fig 2.2: Facilities from various sources  
Sources: (Fennell 1999)

But as two faces of one coin, eco-tourism has its own advantages. Claims for eco-tourism's potential are generally based on three key assumptions; i.e. eco-tourism can:

- 1) Offer a source of financing for development or maintenance of natural or culturally important sites.
- 2) Serves as a catalyst for local economic development.
- 3) Provides needed foreign exchange and national level benefits to the developing nations because a large amount of eco tourist come from developed nations.

(Brandon 1993)

Although eco-tourism has its own pros and cons, what needs to be understood is the realistic evaluation of the benefits vs. the adverse effects to judge the importance of this subset in the tourism industry. The benefits claimed are fairly straightforward:

- 1) Revenue for conservation of wilderness, community benefits or the built environment.
- 2) Employment, both for local people and nationally.
- 3) Foreign exchange and national revenue for government.

4) Greater appreciation and understanding of the other cultures and environments .

(Brandon 1993)

Browski (1976) suggested that the relationship between tourism and conservation may be mutually beneficial. However, unless the requirements for safeguarding the environment are met, eco-tourism is in danger of being a self destructive process, destroying the very resources upon which it is based (Cater and Lowman 1994) .

Eco-tourism can be the thin edge of a wedge, which opens the door to mass tourism and has every possible scope to be used by general tourism practitioners as brand name (Bhattacharya and Kumari 2004).

## **2.2 The state of Eco-tourism in India**

Eco-tourism in India has significant implications for nature and culture conservation, rural livelihood and conservation education (Seema.P. T.D et al 2006).

India is one of the few countries of the world endowed with an array of tourism resources from bio cultural diversity to a wealth of histories and antiquities (Panigrahi 2005) .The diversity is not only in the climate but is all pervasive and as J.Nehru put it, “India is a land of contrasts-with the rural tranquility of simplicity and urban bustles, pomp and show” (Moli 2003). Though tourism in India is one of the largest foreign exchange earners and one among the fastest growing industries, the natural resources base that supports tourism is “heavily stressed” in and around the main tourist destination area (Moli 2003) .

A review of the Indian case reveals that tourism has helped in maximizing economic benefits rather than ensuring social benefits (Panigrahi 2005) . International tourism in India, in terms of volume remains relatively insignificant. Modern tourism to the subcontinent dates back on the colonial relationships with Britain (the British were also instrumental in developing hill stations, such as Simla, as retreats from the summer heat and, by 1980, Thomas Cook enjoyed a virtual monopoly on all international tourism to the country (Sharpley and Sundaram 2005) .

India has consistently included environmental and ecological safeguards in the development of eco-tourism in order to avoid gross commercialism .

In general, a sound and sensitive environmental approach is adapted to tourism development planning and is integrated with other activities to ensure the following:

- 1) Levels of development are to be compatible with the general capacity of the physical environmental resource.
- 2) Sufficient facilities and services need to be provided to serve tourists and the local population.
- 3) Lodging must be located in such a manner that the natural characteristic and qualities of the area are enhanced.
- 4) The overall manifestation of tourism development should be designed carefully and with a sensitivity that merges with the surroundings and enhances the natural beauty.
- 5) Architectural heritage sites and other areas of historical value are to be adequately protected . (Raveendran 1988)

Hence we could say that Indian policies are made considering the protection of these natural and cultural sites.

The modernization of Indian tourism goes back to the beginning of 1945 when Sargent Committee surveyed the potentialities of developing tourist traffic in India (Bhardwaj and Kamra 1999).

Tourism has looked up on its status and importance, from being a mere department under the ministry of shipping and transportation in 1950 to become a full fledged ministry in 1986 and also getting status of an 'Industry' (Bhardwaj and Kamra 1999).

India has legislation to protect untouched ecologies and sensitive eco-systems. Some important laws are the three following:

- 1) The Forest Conservation Act, 1980 controls the use of forests for non-forestry uses.
- 2) The Wildlife Protection Act, 1972 designates the national parks and wildlife sanctuaries and stipulates a comprehensive framework for wildlife protection and conservation.
- 3) The Environmental Protection Act, 1986 stipulates several measures for protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution. Coastal Regulation Zone (CRZ) were announced officially by a notification under the act in 1991 and a wide range of activities have been prohibited within 500 meters of the high tide line ( Raveendran 1988).

The only document available with regards to eco-tourism policy at the national level is the Eco-tourism Policy and Guidelines, 1998, which identifies key players in eco-tourism as: Government, developers/operators & suppliers, visitors, host community, NGOs, and research institutes. It also prescribes operational guidelines for these key players. The policy defines and hence approaches eco-tourism with a clear conservation bias. It lays out cardinal principles suggesting the importance of involvement of local communities. Minimizing the conflict between livelihoods and tourism and environmental and socio-cultural carrying capacities. It also perceives that eco-tourism should be part of integrated development of the area ( P, T.D et al. July 2006).

India is promoting tourism in a big way, consequently the number of tourist is continuously on the rise. However, its natural tourism resources have come under heavy pressure and these cannot be protected for long unless used judiciously, managed effectively and with care (Bharadwaj and Kamra 1999).

Over the last decade, understanding of these complex and interconnected issues by the world tourism industry, tourists, governments and communities have increased as indicated by the evolution of numerous alternative forms of tourism such as ‘green’ tourism, ‘alternate’ tourism, ‘responsible’ tourism, ‘sustainable’ tourism, ‘eco’ tourism, ‘eco-cultural’ tourism (ECT), ‘eco-development’ tourism, ‘Heritage eco cultural’ tourism (HECT), ‘community’ tourism, ‘ethical’ tourism, ‘fair-trade’ tourism and even most recently, the particularly uncatchy, ‘pro-poor’ tourism (PPT). Unfortunately, India has not sufficiently re-oriented itself,

to meet the future international market demand for this specialized form of tourism (Moli 2003) .

In many countries ‘home grown’ definitions are in vogue (Edward et al 1998), grounded to meet specific needs of the context. Based on various definitions of eco-tourism, it can distinguish eco-tourism by the following four essential characteristics:

- 1) Nature based activities
- 2) Eco-cultural sustainability
- 3) Conservation education (for tour operators and the tourist) as a major component
- 4) Significant involvement of and benefit to local people

.(P,T.D et al. July 2006)

### **2.3 What is an Eco-village and how does it connect to eco-tourism ?**

Eco-tourism is a broad term which needs to be understood at various levels of practical implementation and forms. The growing demand for eco tourism provides a significant opportunity to link between tourism and nature conservation.

Member nations at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 agreed on such a process in Agenda 21, a process aimed at national and local government in partnership with other sectoral organizations, NGOs, women, trade union and ethnic groups to assist in the implementation of sustainable lifestyles at the local level. This challenge to plan more sustainably was taken up by a

number of national governments and by many regional and local government bodies around the world (Gilbert 1996), (Craig 2001). The idea of a sustainable planet is to see a society functioning primarily through integrated clusters of eco-villages or more broadly-sustainable communities (Craig 2001). When referring to cities, towns or eco villages for example, the term sustainability fundamentally implies a limit to environmental impacts and the consumption of natural resources (Beatley and Manning 1997). To achieve this, settlements need to meet the following challenges in building and in operating more sustainable systems:

- 1) The challenge of integrating eco-village activities harmlessly into the surrounding environment.
- 2) The built environment challenge of using sustainable materials and technology for shelter, transport and economic activity.
- 3) The economic system challenge of providing sustainable economic activity that is non-exploitative of nature and humans and which is satisfying.
- 4) The governance challenge of defining the roles, expectations and practices of decision making and resources allocation within such communities, and their relationship with other (Craig 2001).

Trainer (2002) described this global movement as an innovative type of development taking place at the community and villages scale. A primary motivation for this is a spirit of self-reliance in which groups have decided to take charge of their own development (Irrgang 2005).

“A human-scale, full-featured settlement in which human activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development and can be successfully continued into the indefinite futures” (Joseph and Bates 2003).

Other researchers associate the eco-village as a way of living giving more importance to the human activities which take place within rather than the physical form of the village itself. Eco-village embodies a way of living. They are grounded in the deep understanding that all things and all creatures are interconnected, and that our thoughts and actions have an impact on our environment (Jackson and Svensson 2002) , indicating that the eco-village is an amalgamation of sustainable and self reliant neighborhood where the physical form would follow the functions they are meant for.

It is difficult to chart the emergence of eco-villages as many of them were founded before the term itself came into existence. During the 1960s several initiatives for projects with spiritual and ecological foundations happened around the world. These, according to Global Eco-village Networks (2005), include Findhorn in Scotland, Auroville in India, The Farm in Tennessee, USA and Sarvodaya in Sri Lanka. Kennedy (2004) mentions that, while the term ‘eco-village’ is relatively new (from the mid-1980s), communities described by that term have been around for much longer time. Examples of Steinerian communities, like Solhemer in Iceland and Jarna in Sweden that emerged in the late 1920s and early 1930s, are cited by this author (Irrgang 2005) .

The conference ‘Eco-villages and Sustainable Communities,’ held at Findhorn in the autumn of 1995, attracted over 400 people from over 40 countries. Here the Global Eco-village Network (GEN) was created, formally founded by a number of communities from around the world (Bag 2005). Eco-villages are described by the Global Eco-village Movement (2005) as “urban or rural communities of people, who strive to integrate a supportive social environment with a low-impact way of life” (Irrgang 2005). Ross and Hildur Jackson, who had set up the Gaia Trust a few years before, had been looking for wise ways to use the money they had made available for the ecological projects. They had asked Diane and Robert Gilman to write a report on Eco-villages, and it was this that had created the thinking that eventually led up to the creation of GEN. The Gilman’s had defined an eco-village as follows and this definition has more or less followed GEN’s thinking since then:

- Human scale usually thought of as somewhere between 50 and 500 members, but with exceptions.
- A full featured settlement, in which the major function of life, food provision, manufacturer, leisure, social life and commerce- are all present in balanced proportions.
- Human activities harmlessly integrated into the natural world.
- Supportive of healthy human development
- Successfully able to continue into the indefinite future (Bang 2005).

These set of principles and guidelines that are given either by the United Nations or other smaller organizations form the basis of such ecological communities and eco-villages. Eco-villages are created in response to the environmental and social problems of our times. It is

an attempt to live sustainably and to renew the quality of life with a reconnection to nature (Irrgang 2005).

Based on the philosophy of the eco-village given by Karen Svensson and Hildur Jackson in 2002, eco-villages build on varying combinations of three key aspects:

- Ecology
- Community (the social dimension)
- Culture-spirituality (Jackson and Svensson 2002)

Eco-villages can be any combination of the three aspects which forms the root of evolution for the settlement. Sustainability is the basis of any eco-village, which has become the catch phrase for the new Millennium (Craig 2001).

The following are some of the “what not to do” steps by Declan Kennedy while designing an eco-village (Jackson and Svensson 2002):

- 1) Avoid long discussions- do not talk too long about founding an eco-village; get started on site as soon as possible. One tip that helped often was a regular meeting for an hour or so every Friday; however there should not be more than 12 months from the “Start” to the moment of breaking ground for the first building.
- 2) Avoid a “green field” site; using an urban, suburban or existing village location will make getting started much easier.
- 3) Avoid an empty site; a plot with even one old existing building on it allows all potential members to experience where they might live and can be temporary housing while building new homes nearby.

- 4) Avoid weekend commuters who travel to the next town during the week, to their old homes or an apartment. This will make community building more difficult. Full commitment is necessary, especially at the start.



Fig 2.3: Elements of Eco-village  
Source: (Jackson and Svensson 2002)

## **2.4 About Auroville and what type of eco-village site is Auroville?**

Varying the focus on one or more of the three dimensions of eco-villages results in different patterns of village design. In other words, people's motivation for building the village will to a large extent determine the design pattern which they opt for (Jackson and Svensson 2002). Auroville, in Tamil Nadu, is one of the oldest territorially-based intentional communities, located in the southeast corner of India, Auroville has been in existence for almost 50 years. Intentional communities are often described as those created by groups of people who come together to actualize a shared vision outside of the cultural mainstream (Anderlini-D'Onofrio 2006). With a spiritual orient, the Auroville eco-village is built around a meditation hall, so it is easy for everybody to access. At Auroville, the Matrimandir is located in center, including the meditation hall and meeting rooms (Jackson and Svensson 2002).

The city was started by the disciples of Sri Aurobindo, a great spiritual guru of India from the early 21<sup>st</sup> century. In his (Sri Aurobindo) mind, and Mirra's (his greatest disciple also known as The Mother), Auroville was the imagined community, the, 'city of dawn', where this consciousness and bio political practices would begin. The city was actually founded 18 years after his death in 1968 (Anderlini-D'Onofrio 2006). The 34 year old community of Auroville in South India is not an eco-village per se. It is rather a cluster of small eco-villages on the verge of being a unified city of the future, imbued with values that make intentional communities exciting and relevant (Jackson and Svensson 2002).

The Sri Aurobindo Ashram in Pondicherry, a former French colony in the south-eastern state of Tamil Nadu, is unique in as much as it is directly associated with the founding and development of a nearby city, Auroville, the purpose of which is to realize the ideal of human unity (Sharpley and Sundaram 2005). It is clear that Auroville is a city which was created in support of the Aurobindo ashram in Pondicherry. The term 'ashram' is derived from the Sanskrit work 'srama', meaning religious exercise, although it is now used generically to describe a spiritual retreat or college, usually established by a Hindu sage or 'guru' (Sharpley and Sundaram 2005). Auroville can therefore be seen as a direct derivative of the ashram in Pondicherry. If Auroville had not been founded on spiritual ideas, it is unlikely that it would have survived at all because the spiritual grounds were the strongest hold that any city can have in India for its survival (Jackson and Svensson 2002). The strong spiritual roots of Indian culture and society contributed in the development of Auroville.

As a utopian space, Auroville is a laboratory for the western residents and visitors to learn from the lifestyle of Tamil villagers. "For the local populations, it is an opportunity to become familiar with the eco-friendly technologies and collaborative disciplines these spiritual seekers bring here-in what might be described as a postmodern 'contact zone' where transculturation and border gnosis occur" (Anderlini-D'Onofrio 2006). It was given a special status as an international community by the Indian government through an act of parliament in 1990s. Auroville has also been recognized as a eco-tourist site by UNESCO (Jackson and Svensson 2002).

From a small pioneering community, Auroville has grown into a burgeoning international settlement. Today, nearly 2000 Aurovillians live in some 90 settlements, and steward some 3000 acres of land; nearly two million trees have been planted. There are more than a dozen farms, two dozen experimental schools and more than a hundred small handicraft businesses. There's a center for research in appropriate energy systems and experimental architecture, including low-cost ecohousing (Jackson and Svensson 2002). In 1974 there were already 322 Aurovillians. With an average yearly growth of 3-5%, the number of Aurovillians has reached close to 2000 by 2007. Out of that number approx 40% were Indian, 15% French, 13% German, 5% Italian and 45 Dutch (Alain 2007). Apart from this there is a varying number of day to day and long term visitors/tourist who come to Auroville for different reasons. The motivation and experience of Western tourists visiting Sri Aurobindo Ashram and the nearly utopian city of Auroville in Pondicherry helps to identify two principal groups of visitors, namely 'permanent tourist' who have immersed themselves indefinitely in a spiritual lifestyle, and temporary visitors who come for the experience of staying in a eco-village for a short duration. The latter are categorized into sub-groups which point to a variety of spiritual and non-motives (Sharpley and Sundaram 2005).

Apart from the outsiders and visitors this city has also helped to uplift the neighbouring villages. There are 14 villages in the immediate area of Auroville, comprising approximately 40,000 people. Auroville has several centers providing education and meeting other needs for the Tamil villagers. New Creations (an organization working out of Auroville), for example, for example has established a small community with educative facilities for nearly 260 village children and a training centre for young people in wood-work, tailoring, metal

working and electricity (Alain 2007). The extent to which the mutual educational experiment works for the Tamil populations can also be appreciated from the Auroville's website's recent statistics, which indicates an incidence of poverty 50% below the rest of Tamil Nadu, accompanied by higher rates of literacy, education, labor skills, female employment and small business initiatives (Anderlini-D'Onofrio 2006).

The area technically designated to Auroville is within a 2.5 Km radius circle about 6 Km north of Pondicherry. It extends over an area of some 20 square Km, 2 km away from the seashore (Anderlini-D'Onofrio 2006). "A land which was returned to life" as quoted by the Aurobindo society was chosen to host the Auroville experiment was earlier largely eroded, and officially described as being in an advanced state of desertification. Through consistent tree planting-mostly using indigenous species, and through organic farming methods. The Aurovillians have reversed the desertification process and regenerated the land on a long term basis, at the same time building in control and conservation features for rainwater (Alain 2007).

## **2.5 What is Living Routes and how does it connect with Auroville?**

Living Routes is helping build one new model by creating accredited, college level educational programs that are based in eco-villages around the world. On these programs, students and faculty create "learning communities" within "living communities" and apply critical reflection and academic studies to their immense experience within eco-villages (Jackson and Svensson 2002). Living Routes is a carbon neutral organization. "We believe

that we must learn to live sustainably. It is not enough to read about it, we must live it (Living.Routes 2005)”. Eco-villages are truly living laboratories for a sustainable future, and are now creating new models of education that can train leaders capable of addressing and transforming today’s environmental and social challenges. Living Routes works because it is based upon mutually beneficial relationships for students, eco-villages, the organization itself and for affiliated colleges and universities. Students benefit by being able to study and learn within eco-villages as part of their academic career. Eco-villages benefit from the tuition, labor and research that dedicated students and universities provide.

Living Routes benefits by gaining access to academia’s resources, expertise, and large student population and by being able to fulfill its mission of educating for sustainability.

Colleges and universities benefit by being able to expand their home-campus curriculum with higher quality off-campus programs while avoiding associated administrative financial and logistical burdens (Jackson and Svensson 2002). As an organization Living Routes teaches the aspects of sustainable living. “Education for sustainability, at its core, must recognize and honor our fundamental interdependence with all life. It must provide a deep and direct experience of the concept, skills, and tools of sustainable living and empower students to help build a more sustainable future (Living.Routes 2005)”.

Eco-villages, the ‘campuses’ for Living Route’s programs, are ideal places for holistic interdisciplinary education because they are living examples of social, ecological and spiritual sustainability (Living.Routes 2005).

A large segment of this field experience expose students to the complexities and immensity of Auroville's aspirations to design and realize an international community that restores the land, is self-sustaining and promotes the evolution of humanity to a culture of tolerance, non-violence, and peace within the pre existing cultural context of South India (Living Routes 2005).

There are many ways to build bridges between an eco-villages and an academic institution, particularly if one is near each other. Following are some of them:

- Thematic eco-villages tour (eg. appropriate technology, social structure, sustainable agriculture, ecological design)
- Collaborative research projects at both eco-village and campus sites that can be monitored and studied by students and thesis candidates.
- Eco-village based courses (residential or non-residential) taught by both university and eco-villages faculty.
- Opportunity to pursue internship and independent study
- Joint educational and service programs for youth and others in the surrounding community.
- A set of eco-villages based programs forming the basis of a 'major' or "minor" in sustainable development and living (Jackson and Svensson 2002).

### 3 CASE STUDIES

The two case studies presented here are selected from different parts of the world. They are not specifically eco-village examples but have characteristics related to sustainable living. All these studies are unique as they look into either social, cultural, technological, contextual or sustainable issues related to the site or project.

#### 3.1 American Pavilion, Auroville, India Source: [www.faculty.washington.edu](http://www.faculty.washington.edu)

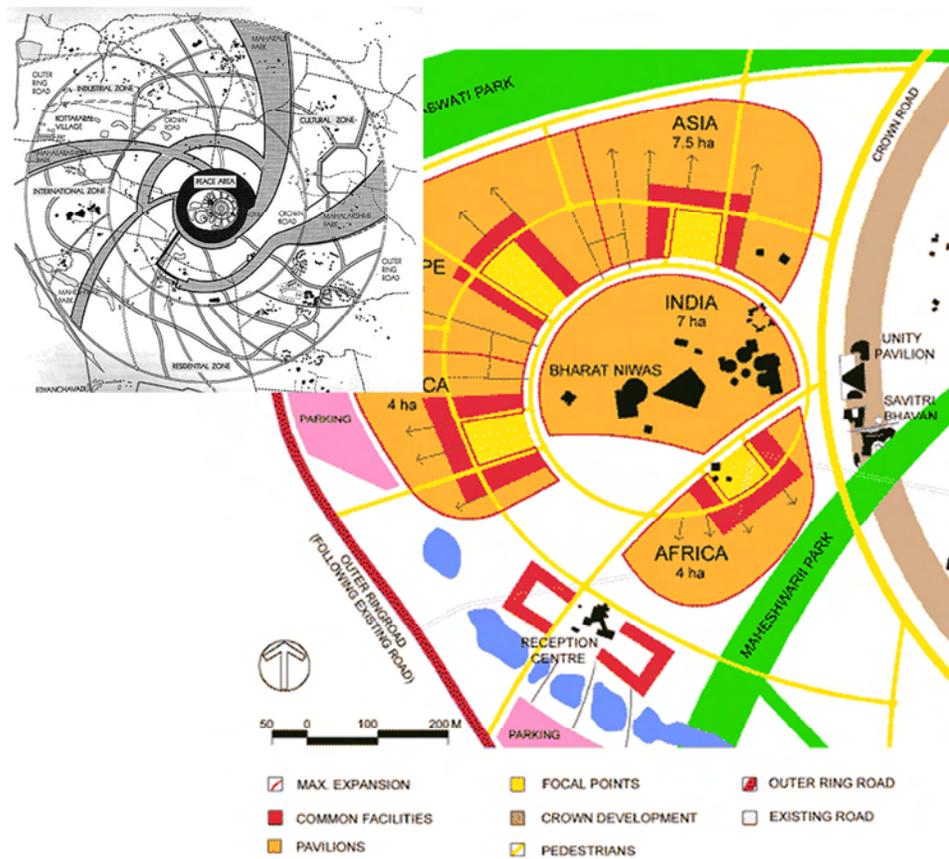


Fig 3.1: The International Zone of Auroville  
Source: [www.auroville.org](http://www.auroville.org)

American pavilion is located in the international zone of Auroville. It is a small 15 bed guest house comprising of a common kitchen area, common toilet and bathrooms, dormitories and shared bedrooms all located in the same building. This was a design-built project done in collaboration with University of Washington students. The project is a real world example of how to make a sustainable campus/building in Auroville, using these principles.

The response to site context was a very important aspect of this design-built project. The building is inspired by an Indian banyan tree with its spreading branches and roots.

The roof of the building is seen as the main canopy of the banyan tree and the columns as the roots meeting the ground.

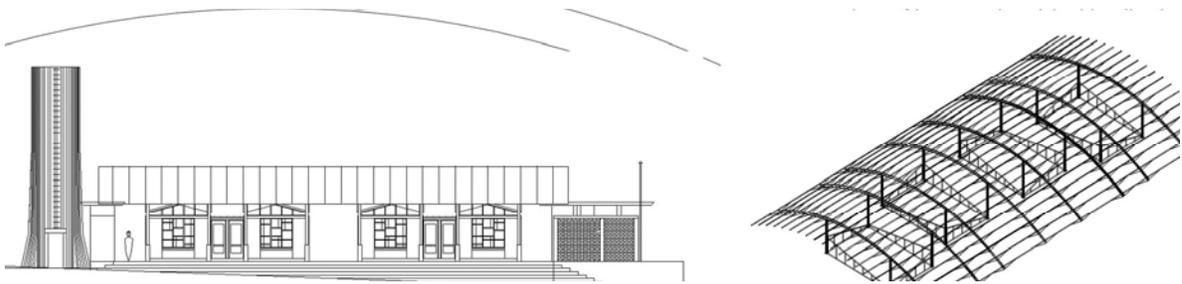


Fig 3.2: The elevation & roofing of American pavilion  
Source: [www.faculty.washington.edu](http://www.faculty.washington.edu)

Fig 3.3: The layout of the American pavilion campus (only the main guest house is existing right now)  
Source: Base plan: [www.faculty.washington.edu](http://www.faculty.washington.edu)  
Rendering: Author



Some of the main aspects related to sustainable principles are:

1) A composting toilet :

- The solid waste collects in the composting bins attached to the toilet waste disposal sewage pipe.
- The grey water is passed through settling tanks and later through the reed bed, where plants naturally filter out the pollutants.
- Finally the treated water is set free into the irrigation trenches of banana grove as the banana has tolerance for poor quality water.

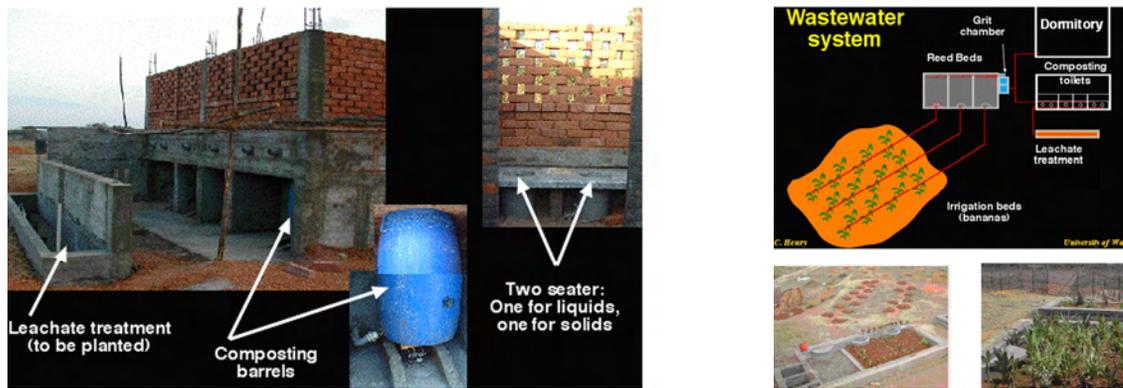


Fig 3.4: The composting barrels and reed bed treatment of grey water (See site map for location)  
 Source: [www.faculty.washington.edu](http://www.faculty.washington.edu)

- 2) The water moat around the entire building is used to keep the ants and crawling insects away from living area.
- 3) The use of ferro-cement slabs for roof construction.
- 4) The rain water harvesting is made possible as a part of the larger building structure; the curved roof directs water into gutters on the side then takes the water through the hollow metal pillars to the underground water storage tanks.

### 3.2 Sonora Co-housing, Tucson , Arizona ([www.sonoracoho.com](http://www.sonoracoho.com))

Sonora Co-housing is an example of alternate community living, the conceptualization of the project started in 1993 and the community has been in existence from the past 10 years in a parcel lot of 4.7 acres. It is important to understand this aspect of site planning because the Living Routes campus would be promoting community participation and shared spaces. Co-housing dwelling units clusters around a common facility such as a

community house, and open green space. Some of the main characteristics of Co-housing are:

- Participatory process
- Neighborhood design
- Common facilities
- Resident management
- Non hierarchal structure and decision making
- No shared community economy

Co-housing is a unique example of segregating some of the activities and facilities typically found in a single family house and making these elements common and accessible to everyone in the community. One of the main examples of such a shared facility is common kitchen and dining area. As a community space used by everyone. People cook in groups and the whole activity of cooking and eating promotes a greater level of community interaction and participation.



Fig 3.5: Layout of Sonora cohousing  
Source: [www.sonoracoho.com](http://www.sonoracoho.com)

This particular community comprises approximately 100 residents with their dwelling units clustered in groups of three or four around the larger landscaped area and community house. Some other examples of community participation are seen in the common composting area and the organic farming done in the common park.



Fig 3.6: Composting area and Xeri culture for landscaping  
Source: [www.sonoracoho.com](http://www.sonoracoho.com)

## **4 ABOUT AUROVILLE AND ITS MASTER PLAN**

**4.1 Context:** Auroville is located in Tamil Nadu, India, about 14 km from Pondicherry and 150 km from a major south Indian city called Chennai, adjacent to the Coromandel coast. The Auroville development has always been, and will always be, closely related to that of the surrounding villages. There are 13 villages in the immediate vicinity of Auroville, and altogether 126 villages in the wider bio-region of 825 sq km.

**4.2 Climate:** Auroville has a tropical climate. The dry season usually lasts seven months, from January to July. May and June are the hottest months, with occasional showers starting in June. The main rainy season is from October to December, sometimes continuing into early January. The average rainfall is 1,230 mm a year. The prevailing winds blow from the South East.

Out of the 20 sq Km of the designated area of the township, only about 15.5% is presently under various built uses. Out of developed area, approximately 55% is residential and 21% developed to public and semi-public uses.

**4.3 Developed area:** The roads within the township area are mostly temporary gravel and dirt roads, providing access to the many activities and settlements spread throughout the township.

**4.4 Land Ownership:** The designed area of the urban core of Auroville is made up of 5 sq km. This area is then surrounded by 15 sq km of Green belt. Out of the 5 sq km of the urban area the Auroville foundation owns 387 Ha. Out of the Green belt area, a large part- namely 825 Ha is still under village ownership.

**4.5 Demographic Character:** There are presently some 1700 Aurovillians settled within the designated area and outside it. The population growth in the last decade has been approximately 5% per annum. There is an average growth of 90 persons per year in Auroville's population over the last decade. In addition to the resident's population there are:

- 1) Researchers and students, who come for short duration to learn and contribute to Auroville's development.
- 2) Day-workers from neighboring villages working in Auroville's economic and service activities.
- 3) Short term visitors, including casual visitors coming to experience Auroville's work in diverse fields.

**4.6 Physical Infrastructure:** The physical infrastructure in Auroville serves a dual purpose. Firstly, to provide the required facilities for the development that has taken place. Secondly, to innovate and experiment with low cost and environmentally friendly alternatives.

Auroville is a visionary city. The master plan of Auroville states: “It is a unique opportunity for the manifestation of an actual human unity in diversity.” (Auroville, Masters Plan) The township was founded on 28<sup>th</sup> February 1968. It was established in the barren plateau area 14 km away from Pondicherry. The barren area was regenerated with great reforestation efforts for the initial 20 years by the members of the Sri Aurobindo society. Later on the township was developed based on the visionary idea of the Mother (one of the greatest disciples of Sri Aurobindo). The plan is popularly called as a galaxy plan which revolves around a center point which is the Matri Mandir or the mediation hall. The Matri Mandir is a spherical structure located at the centre of Auroville, seen as the ‘soul’ of the city. Because of the spiritual orientation of the city, the whole Aurovillian community works on the lines of a charter set by The Mother:

- 1) Auroville belongs to nobody in particular. Auroville belongs to humanity as a whole.  
But to get in line with Auroville one must be willing servitor of the Divine Consciousness.
- 2) Auroville will be the place of an unending education, of constant progress, and a youth that never ages.
- 3) Auroville wants to be the bridge between the past and the future. Taking advantage of all discoveries from without and from within, Auroville will boldly spring towards future realization.
- 4) Auroville will be a site of material and spiritual research for a living embodiment of an actual Human Unity.

Apart from these spiritual goals of the Auroville community, the Auroville Town Planning Commission has charted out a road map for the future, indicating directions for its growth in the coming five years. It has now become imperative to develop a largely self-sustaining mechanism for the growth of the township, in line with the vision and maters plan for development proposed. Building upon the relevant skills at appropriate levels for establishing a sustainable society has become of major importance. The immediate steps to implement the program should include:

- 1) Identifying the fields of study in sustainable development that would attract students from within India and around the world, who would be willing to contribute to the development of Auroville.
- 2) Identifying resource persons from Auroville, and resource persons from elsewhere in India and abroad who value “high thinking and simple living”, and put into practice numerous sustainable development courses.

To start with, no expensive infrastructure will be needed, either for the accommodation of the students or resource persons or for new classrooms and laboratories, optimizing the use of Auroville’s present land and open space area, many of the existing buildings will be the starting point.

The proposed campus development for Living Routes illustrated in this document is an effort to add an educational campus in Auroville which would be leased out for residential accommodation in the off seasons to visitors (eco-tourists).



#### **4.8 Some other statistics related to Auroville:**

Climatic Zone: Warm and Humid

Latitude: 11 degree 55 N

Longitude: 70 degree 52 E

Altitude: 50 m above MSL

Annual mean maximum temperature: 34.43 degree Celsius

Annual mean minimum temperature: 22.62 degree Celsius

Annual mean temperature: 27.20 degree Celsius

Annual global solar radiation: 439 Cal/sq.cm

## **5 SITE ANALYSIS AND ASSESSMENT**

The site is located in the residential zone of Auroville and as mentioned earlier the principal feature, is an existing guest house. The total site is not more than one acre area. The analysis of site presented in this chapter will primarily deal with the following:

**5.1** Site's connection to the larger Auroville master plan

**5.2** The physical setup of the site: circulation, major approach roads, existing buildings on the site and their usage.

**5.3** The orientation of the site.

**5.4** Area chart

### **5.1 Site's connections to the larger Auroville Master Plan**

The Master Plan of Auroville has fingers of green belts that radiate out from the center of Auroville in all sides. These are the connection of the inner core of Auroville to the fringes of the township, specially the outermost greenbelt. One of the green belts passes right next to the site and can be seen as a contextual opportunity to connect the site with the larger design layout of Auroville. (See Fig 5.1)

Following image shows the green belt passing right next to the college guest house site.

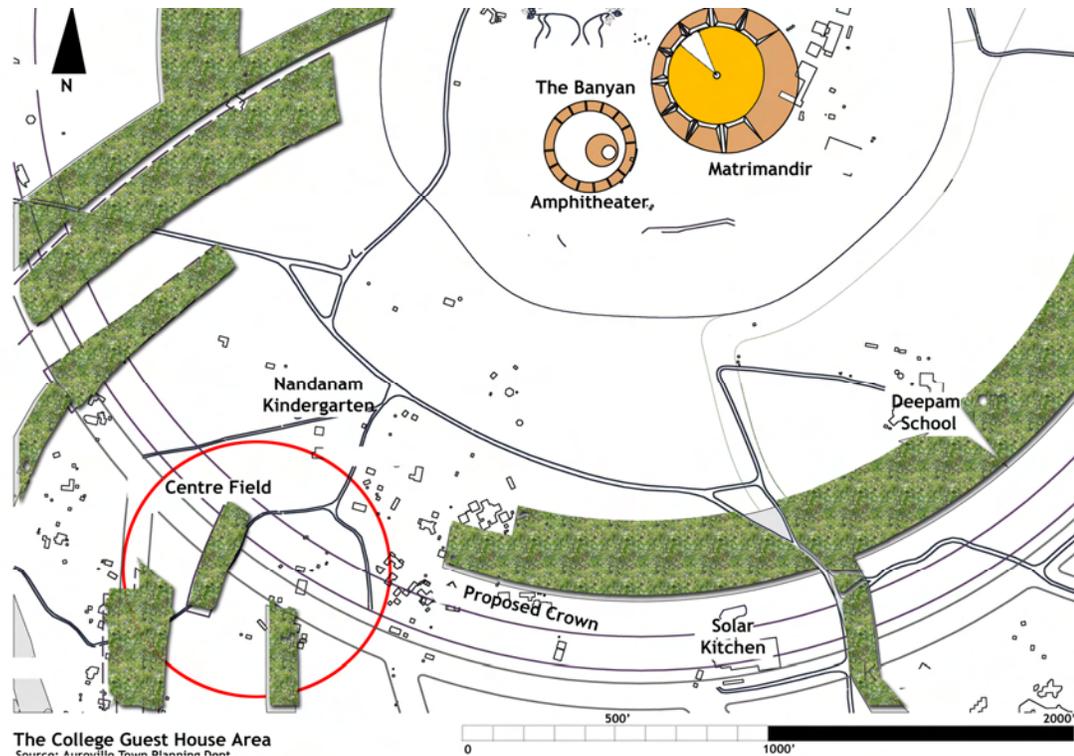


Fig 5.1: Master Plan of Auroville and the College Guest House site  
 Source: www.auroville.com

## 5.2 The physical setup of the site

The existing site of the College Guest House is a one acre land with about 10 buildings spread out all throughout the campus. The entrance of the campus at present is from the mud road on the western side of the site; the only gated entrance to the campus. Although the campus does not have a boundary wall or barbed wire edges, because of the heavy plantation around. The site looks like a closed and secure campus. In the future, a new crown road will be the main vehicular connection of the whole Auroville Township and this new road will pass right next to the northern part of the existing campus site. The campus therefore could be planned with two entrances: the existing one and form the crown road.



Fig 5.2: Main point of entrance onsite  
Source: Author

The internal circulation on the site is strictly pedestrian. The whole site is connected with a burnt brick pathway of approximately 1.2 meter width. The pathway starts from the bicycle parking area in the west and takes the visitor inside the campus. Some of the connecting pathways and spill out seating areas have pebbles surfaces.

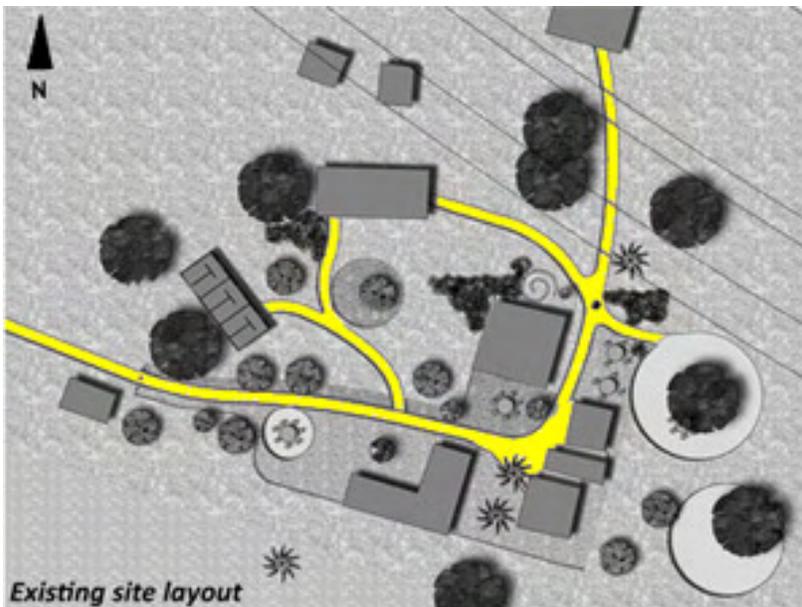


Fig 5.3: Pedestrian circulation on site  
Source: Author

Existing buildings on the site are primarily use-based and there is no particular campus planning that has been followed. The first building that one sees at the entrance to the campus is the thatched roof double height bicycle parking area. This is just next to the entrance which marks the entrance to the only pedestrian zone inside. The next building on the left of the pathway is the common bathroom and toilet facility with a small open area for washing and drying the clothes in the outdoors. This is a brick structure. Further into the campus are the residential buildings that are a combination of thatched roof and brick walls with very low acoustical insulations. The rooms contain two to four beds each with a small study table and a steel cupboard for storage. The campus also has a small common kitchen and administrative cum library block and semi covered dining area which spill out into outdoor seating around huge existing bamboo and Neem (*Azadirachta indica*) trees. It is interesting to note that there is no particular service area designated for washing the utensils and other services on the site.

Following few images illustrate the existing site plan and the buildings.



Fig 5.4: Existing buildings on site  
Source: Author



Fig 5.5: Pictures of existing buildings and spaces on site  
 Source: Author

Some of the other analysis of the site was done to understand the built mass relationship, the usage and land use pattern of the existing buildings, and the outdoor space utilization study to get an in-depth knowledge of open space requirements.

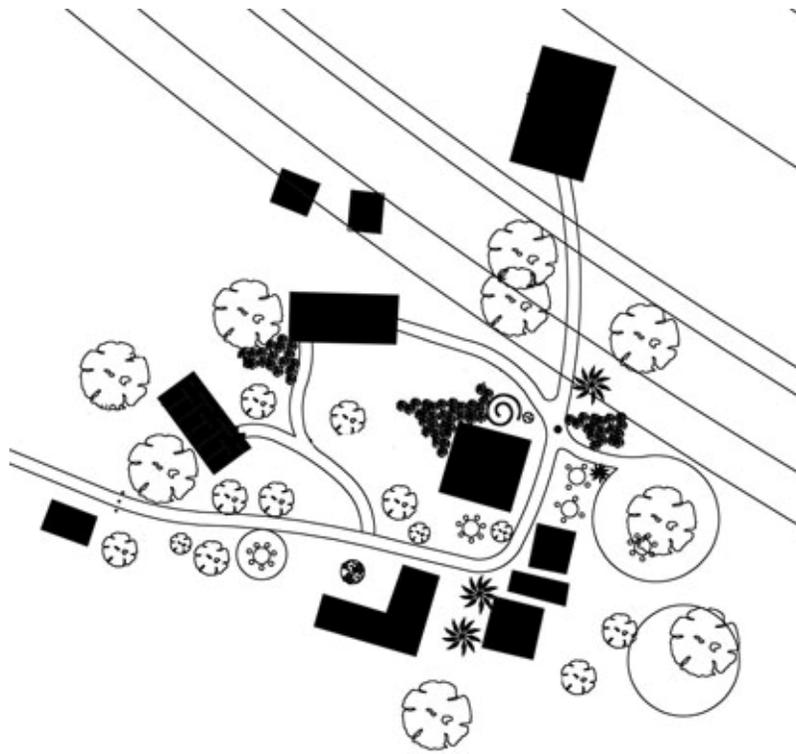


Fig 5.6: Site analysis: Built mass and void relationship  
Source: Author

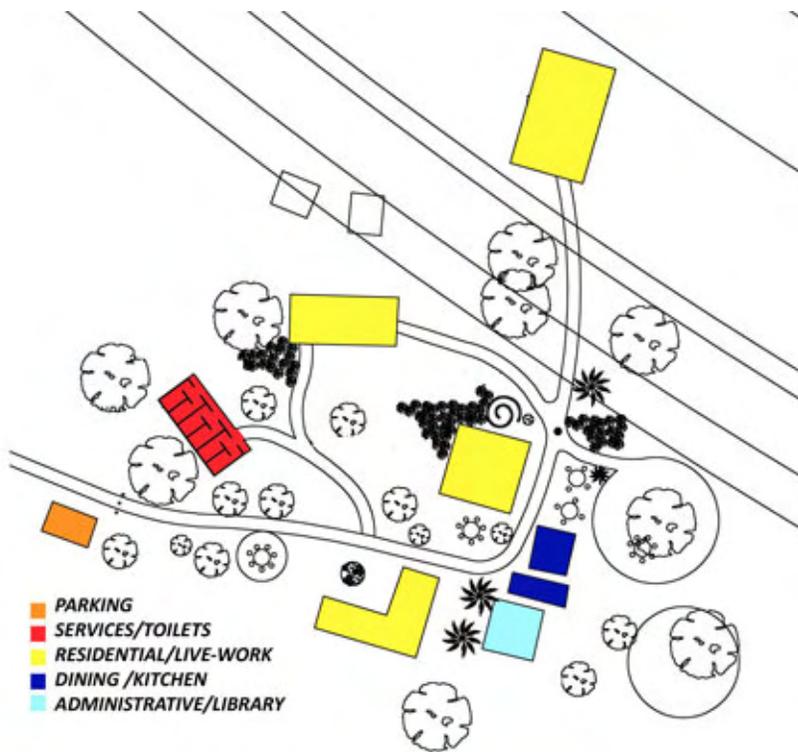


Fig 5.7: Site analysis: Existing Land use pattern  
Source: Author

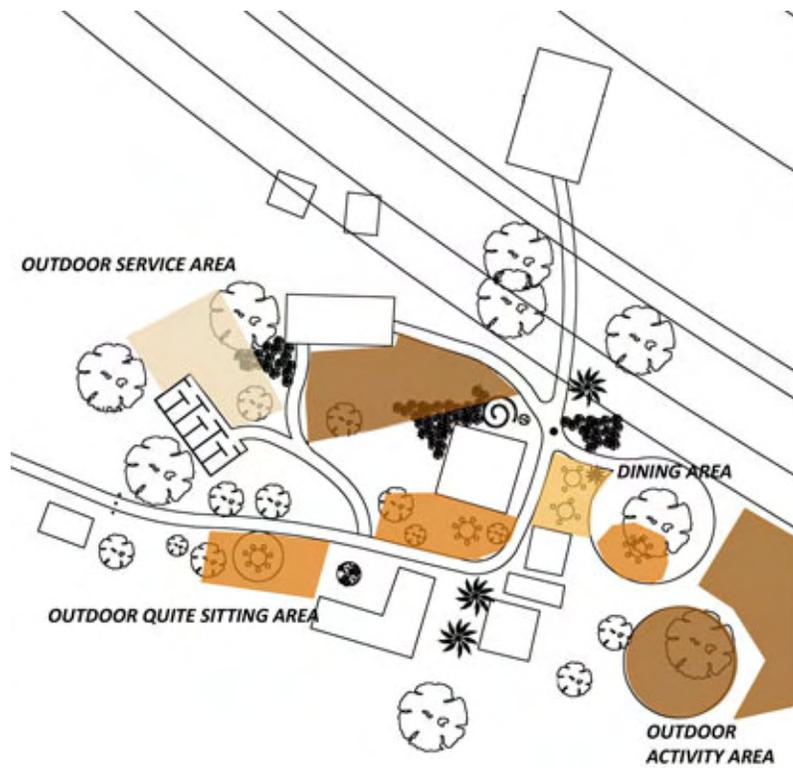


Fig 5.8: Site analysis: Open space study  
Source: Author



Fig 5.9: Materials used on existing site  
Source: Author

### 5.3 The orientation of the site

The orientation of the site decides the placement of buildings and open area in the campus. The wind direction helps in understanding the mass void relationship that should be achieved with tree planting and architectural blocking to help in directing the cool breezes inside the campus in summers. Also the architectural blocking in the western side of the campus should be heavy to block the sun and shade the rest of the campus. The northern light should be used for open areas and reading purposes.

The few analysis drawings presented below diagrammatically show the aspects of sun and win direction on site, which would help in design decisions later.

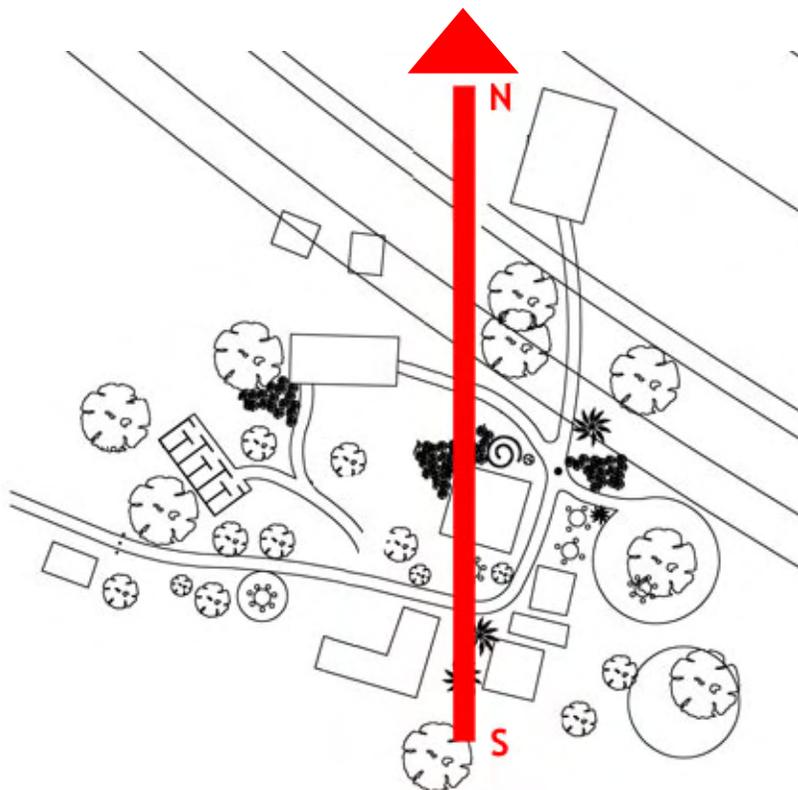


Fig 5.10: Site orientation  
Source: Author

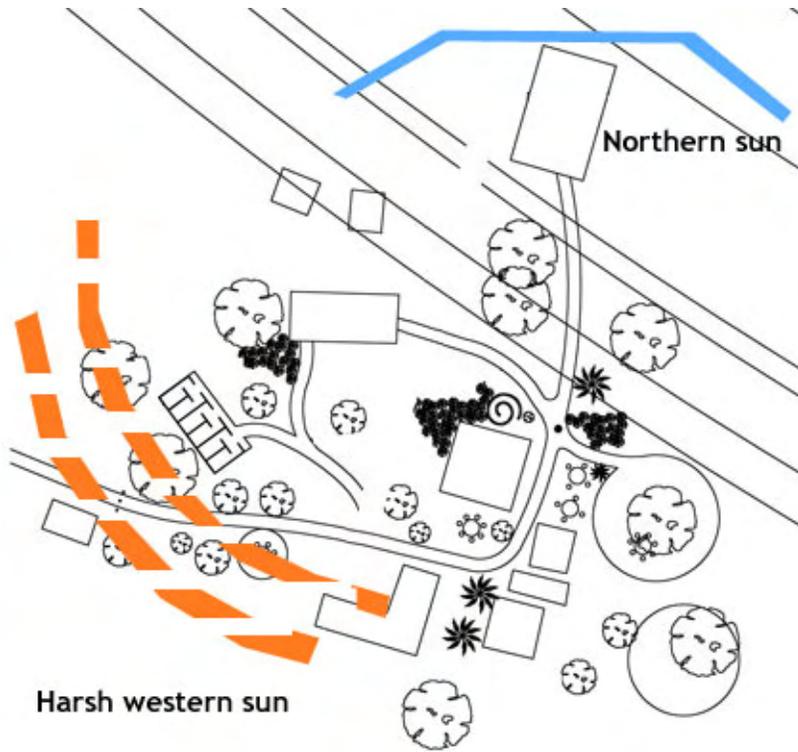


Fig 5.11: Effect of sunlight  
Source: Author

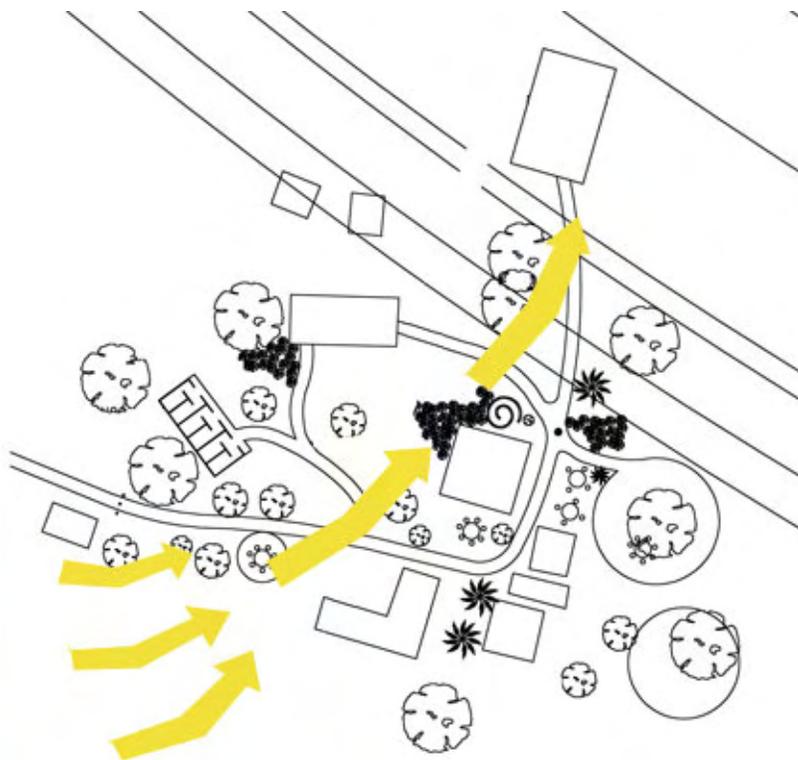


Fig 5.12: Wind direction  
Source: Author

## **6 DESIGN PROPOSAL**

### **6.1 Claim, Scope, Project Goals and Objectives**

#### **Claim**

Living Routes, an institute that teaches sustainable living courses, should showcase these same ideas and principals in physical design and spatial layout of their on-site campuses, such as Auroville, India. Living Routes' campuses replicate a laboratory with real working models of structural systems and natural ecosystem from which the student can learn. Recognizing this, it is therefore important to view the campus as a live classroom and design the systems as mechanisms from which students can learn the implementation of certain aspects of sustainability in the context of a real life scenario.

#### **Scope**

The scope of the project is wide. The study starts at an urban level where Auroville Township is studied. The master plan and zoning of the eco-village clusters and the green belt configuration is examined in relation to the college guest house site. On a smaller scale, the one acre site design looks into the details of waste water treatment, waste disposal, farming, etc.

#### **Goals and Objectives**

As the Masters Project deals with a real site, it is important to have implementable/practical goals and objectives for the study:

- 1) To understand what kind of eco-tourist site Auroville is and how does it function with respect to the ideologies of Living Routes.
- 2) To design the proposed layout of the campus for an organization that teaches sustainable living courses to students on site.

The primary objective of the study is to analyze how a campus can showcase the principles of sustainable living to its students while teaching them the same onsite. The project also visualizes students being a part of the whole building process and implementation phasing.

## **6.2 Methodology**

Stage 1: Develop a detailed area chart for holding classes and providing a permanent administrative wing for Living Routes.

Stage 2: Develop understanding the Mater Plan of Auroville and the current status of development.

Stage 3: Surveys with the student and faculty based in Auroville to understand their preferences and ideas about a campus of sustainable living.

Stage 4: Analyze the site against the requirements stipulated in Stage 1 and select one appropriate scheme for design development.

Stage 5: Design development with ecologically sustainable design principals, permaculture, compost toilets etc.

Stage 6: Final Design presentation.

### 6.3 Survey with Living Routes students and faculty and Area Chart

As the new campus would be made for the students traveling from overseas for semester long courses in Auroville, it becomes important to understand their needs for the base station/campus. The following set of questions were administered as an online survey to the students and faculty members in Auroville. These answers are not the definitive answers to the questions and design clues but they do provide direction for certain design decisions.

The survey response was collected from almost ten students and faculty members.

Q1. Please rank your sense of personal safety in Auroville on a scale of 1 to 5: 1 being poor and 5 being very good

Average 4 (very safe). Some concerns about the safety of girls specially during the night time were shown but on an whole students feel comfortable and safe inside the campus.

Q2. Are there community meditations? What kind of practice? What are the timings? What is the group size?

Mindfulness, chanting, yoga and meditation all this happens early in the morning in groups of 15 most of the time and 30 sometimes.

Q3. How are community meetings facilitated? How frequently do they occur? Where do they occur? How many people attend the meeting?

Daily and sometimes multiple times in a day. At the college guest house and it invites all the Living routes people.

Q4. Accommodation-How much occupancy per room for students- 1 bed, 2 beds, 3 beds?  
What kind of faculty accommodation would you prefer-live work space, single family or rooms within student dorms, How close should the student facility be to the common areas?  
Pantry space preference-independent, shared between 2 or more. Specific room requirements?

Preferred bed -2, live work space. Students want little privacy from the faculty.  
Separate storage area.

Q5. Meals and Dining-Would students like to prepare their meal-breakfast, lunch, dinner?  
Would students like to prepare meals with community like solar kitchen? What kind of dining facility would students prefer-enclosed or semi open?

Students prefer preparing their own breakfast. Bigger meals can be made together. Semi covered space is preferred.

Q6. Meeting and Study area-How many individuals would be studying at a time? Is there a requirement for black/white or chalk board? Approximately how many books are there in the library? Is there a need for a separate Office space for faculty and staff? Is there a need for computer access (ideal: 1 computer for 4 students) Is there a need for secluded study area: either in library or separate? Other comments?

Concerns shown about the existing study area being awful, students demand separate study and library area. High internet speed and more comfort.

Q7 What do you think is the basic ideology of Living Routes and how does it integrate or overlap with Auroville community?

To show students, in a experiential setting, the various elements to living sustainability.  
Both Living Routes and Auroville works on all aspects of sustainability and strive for human unity.  
Living Routes and Auroville integrate with each other very naturally and the environment allows students to learn so many different aspects of sustainability by being a part of the Auroville community.

Q8. What is the sustainability infrastructure of the community/eco-village is available to students? (Describe)-energy, water, food production, waste, building design, social, personal and spiritual

Photovoltaic, water catchment systems, organic farming, composting, greywater treatment, sustainable building construction techniques.

Q9 Services- How many shower rooms/toilets do you prefer?-1 shared between 4 persons or 1 shared between 6 persons, Do students want to share shower/toilet facility with the faculty? Is there a requirement for common laundry drying area? Waste Disposal ideas?

Shared between 4 people with a common laundry and a composting system

The above survey results show that the student's are aware of the sustainability practices that should be employed in a campus for making it self sustaining. It is interesting to note that within a few days they develop a good understanding of the relationship between Auroville and Living Routes.

### **Area Chart**

Though there are several requirements for the built spaces, the design should treat it as one whole community unit. The individual unit should provided for private, semi-private and public spaces which further integrate with other individual units to form a larger cluster, also zoned in its respective semi-private and public zones.

#### 1. Accommodation

##### **a) 30 Students – Grouped in 2 dorms**

- Dorm requirements – double occupancy rooms
- Small breakfast preparation area
- Utilities – bath, toilets

**Design Criteria:** Both the dorms should have a visual identity of their own, yet integrating the two groups in terms of sustainable life-styles. It should evoke a feeling of healthy competition in both the groups for minimizing their ecological footprint on this earth. The design can also provide ways or measures to keep track of the amount of energy being consumed by individuals, such as an adequate facility for timing showers, usage of artificial light, etc.

The design should also be responsive to the privacy needs of the students along with generating a sense of community and mixing with other fellow students.

- **Two apartments for faculty members ( two permanent faculty members and two visiting)**
- Live work apartment model

**Design Criteria:** The faculty needs living spaces in a segregated zone from that of students. The living space in the apartment should also double up as meeting space with the students. Kitchen space is not a requirement but a pantry for breakfast and small meal preparation can be accommodated.

b) Guest/ Visitors/ Alumni/Donors accommodation – This should facilitate the stay of any visitors to the center, guests of Auroville or Living Routes, and Alumni who wish to spend some time in Auroville.

## 2. Dining

- Breakfast preparation space to be provided within individual living areas/rooms. This space can also be common between two rooms.
- A common dinner preparation and serving facility to be designed for the entire base.
- Dining space for approximately 30 students + 5 faculty and family + 5 guests.

## 3. Meeting, Conference/Seminar Space

- Enclosed or semi-enclosed space for such activities
- Computer stations availability

4. Library

- To hold 350- 400 books
- Semi-open reading spaces, enclosed niches for solitary reading
- Security enabled, i.e. main entry/exit should be lockable

5. Yoga/ Meditation spaces can be combined with informal meeting spaces.

6. Indoor Classroom Space – a basic enclosure to hold classes, no formal seating arrangement required.

7. Outdoor classroom/gathering spaces – open, shaded spaces

8. Kitchen Garden/Medicinal garden/fruit trees and a small plant nursery or greenhouse of native plant samples for students.

9. Cultural performance or presentation area in outdoors- a amphitheater or small seating.

## **6.4 Site Design**

### **6.4.1 Concept**

From the start of the project, it was important to emphasize two main design issues:

- 1) The Indian context
- 2) Sustainability

The Indian context is a very important aspect of the campus design in India as the campus becomes an icon or representative of the Indian architecture, materials and traditions of living for the students traveling from abroad. It also is important as the site is in Auroville, which promotes Indian living and ways of construction. The whole township is also a major international tourist destination and hence the site has to justify its context and Indian roots in everyway possible.

Vaastu was taken as a main concept based on which the site planning and architecture was conceptualized. Vaastu is an ancient art of architecture in India. It has its roots in Vedic times thousands of years ago. Although a lot of its core design ideas have faded with time, it is still practiced in India at local and regional levels. The science of Vaastu is based on cardinal axis and climatologically data of a site. The whole side is seen as a square and the various directions on the site are assigned with different spaces and usage based on the sun and wind direction. The site is compared with a body of a human being and it is said that the head of the Vaastu Purush (Purush = man) should be in a particular direction. Following are a few reference images of the Vaastu Purush and the Vaastu data chart.

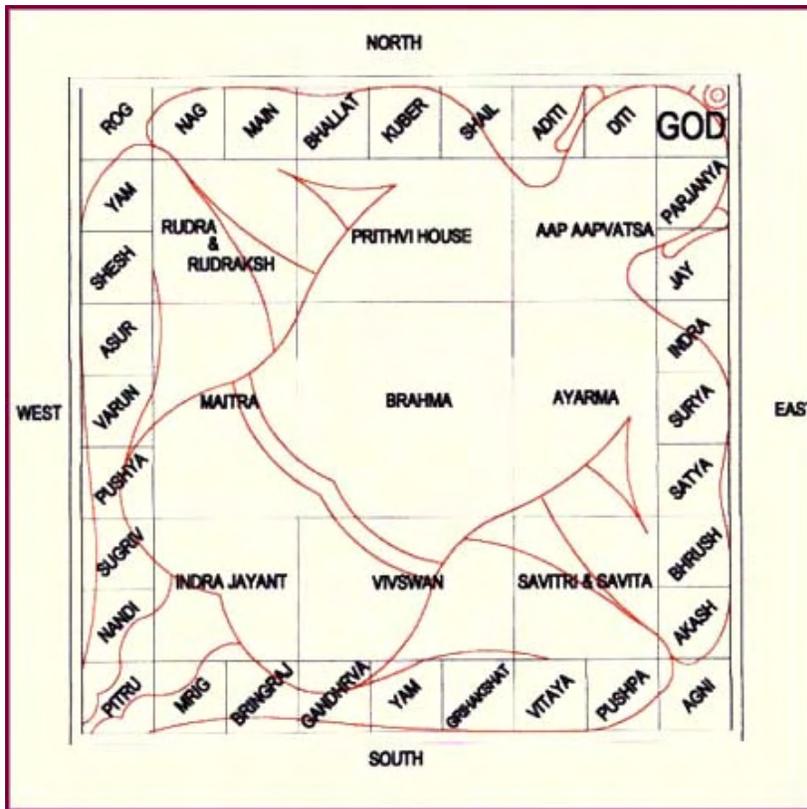


Fig 6.1: Vaastu Purush  
Source: www.vastu-ds.com

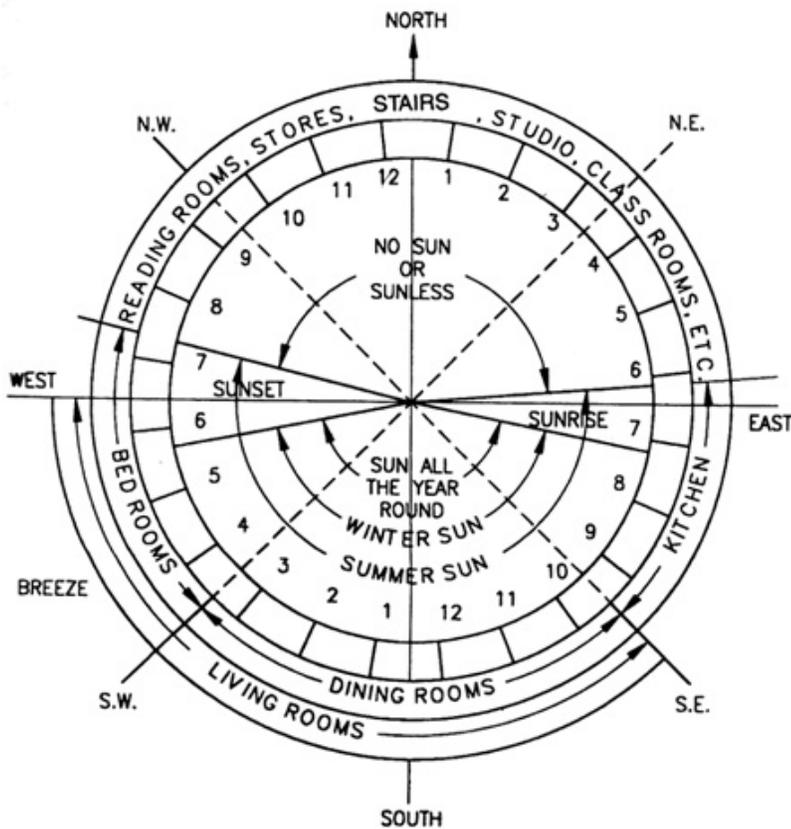


Fig 6.2: Vaastu Chart  
Source: www.vastu-ds.com

The second issue of sustainability was addressed with the help of Permaculture. Permaculture is the art of creating an edible landscape which becomes a part of a living ecology and creates its own self-sustaining living system. It is important to understand here that although the literal meaning of Permaculture comes from the word permanent agriculture, it is not just agriculture and farming. According to Bill Mollison, the father of Permaculture, the ethical basis of Permaculture is:

- a) Care of earth: Provisions for all life systems to continue and multiply.
- b) Care of people: Provision for people to access those resources necessary to their existence.
- c) Setting limits to population and consumption by governing our own needs, we can set resources aside to further the above principles. (Mollison 1998)

From the above it is clear that Permaculture is based on sustainability in terms of resource usage and production. The concept of Permaculture emphasizes on giving back what humans take from nature and hence the base station/campus is designed on the basis of the three R's of Permaculture: Reduce-Recycle-Reuse.

**Reduce:** Energy is generated on the site by using solar panels for heating water and electricity, designing in accordance with Vaastu and climatologically orienting buildings for low energy usage.

**Reuse:** Reusing resources such as rainwater harvesting, onsite bamboo, old construction materials, etc.

**Recycle:** Recycling waste water and using solid waste as manure through the process of biological composting.

### 6.4.2 Initial design

The initial design was based on combining the two concepts of Vaastu and Permaculture together and giving a form to the site planning. The main emphasis was given to the form and not to the functionality of the campus and the architecture combined with landscape. Spiral and rectangular forms were tried out. Also the initial design stage was the time when the details like pathway layout and pond zoning were also worked out. The effort was to explore the possibility of a design at a larger and smaller detailed level and then bring it all together.



Fig 6.3: The spiral of resource use  
Source: Author

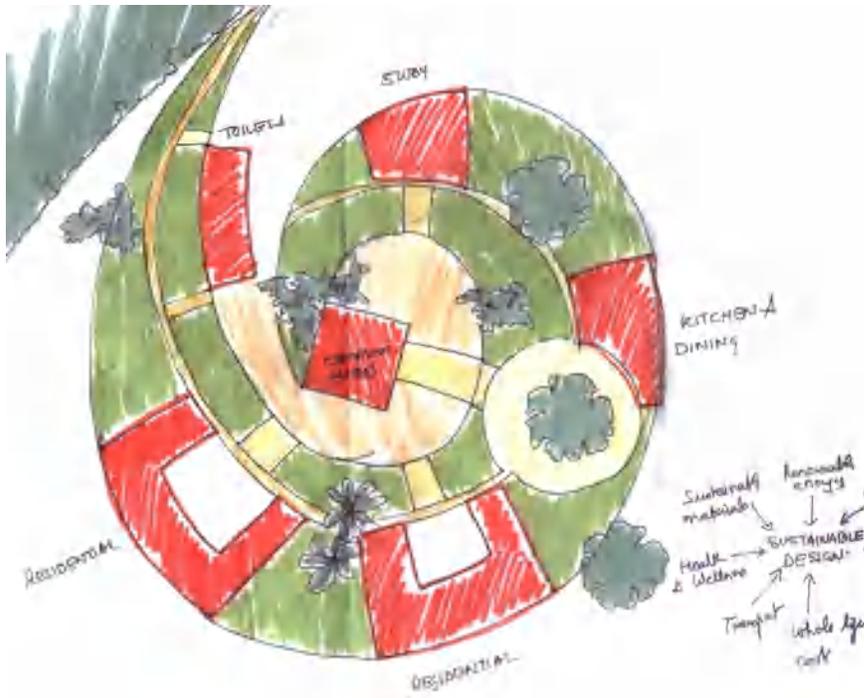


Fig 6.4: The spiral implemented on site-1  
Source: Author

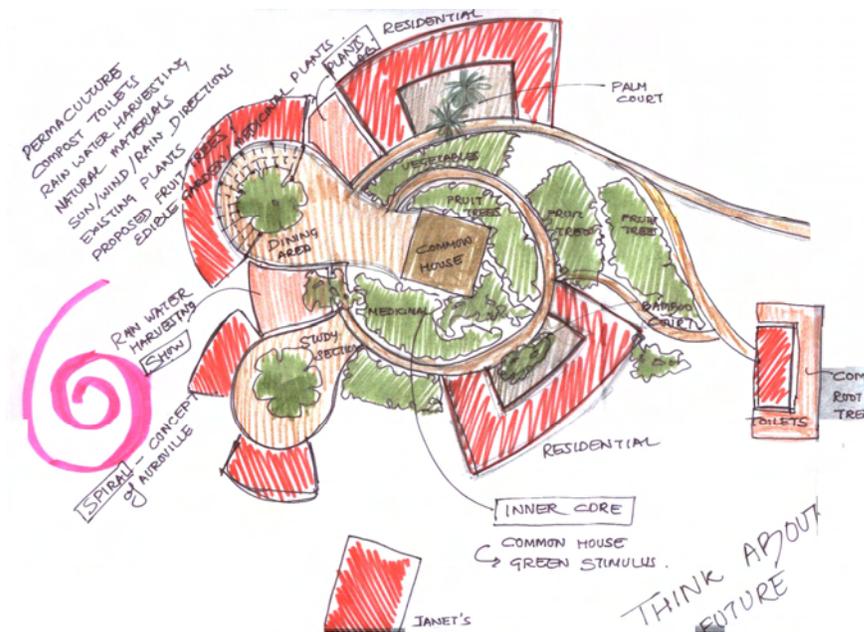


Fig 6.5: The spiral implemented on site-2  
Source: Author

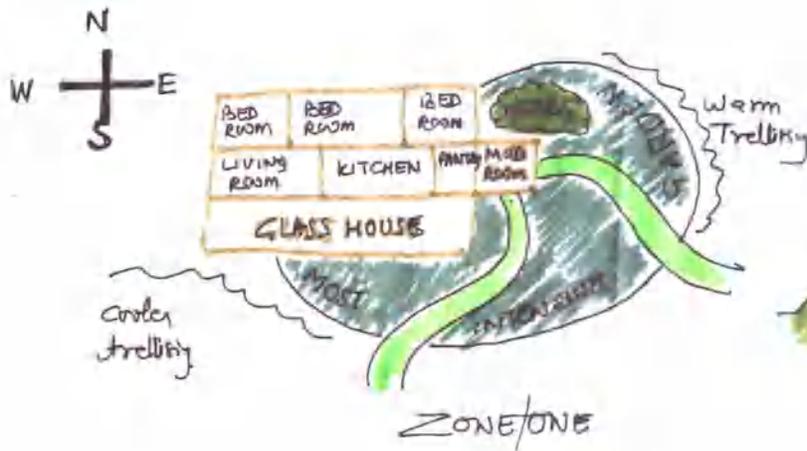


Fig 6.6: Permaculture details: House and the surrounding  
Source: Author



Fig 6.7: Permaculture detail: Pathway  
Source: Author

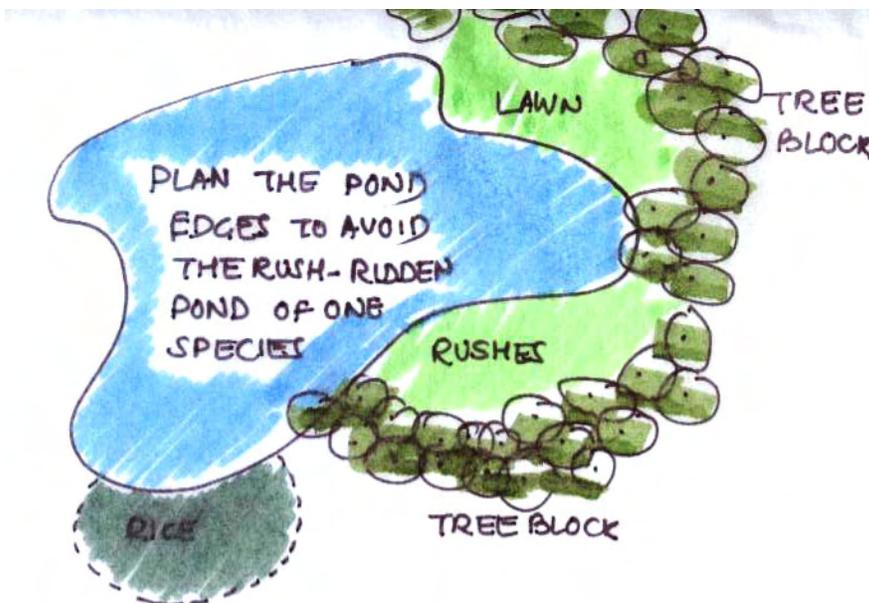


Fig 6.8: Permaculture detail: Pond and surrounding area  
Source: Author

### 6.4.3 Site Plan

The final site plan was based on the combination of Vaastu orientation and Permaculture zoning. The following sketch shows the initial sketching out of all the architectural blocks and the Permaculture zones on site. Based on this the site plan was further developed with the surrounding green belts from the Auroville master plan and the existing and proposed entry roads to the site.



Fig 6.9: Initial site plan  
Source: Author

The site as can be seen in the above sketch is divided into two main zones: Residential and Educational. The only connection to all the areas on the site is through the main pathway which bisects the site. This is the existing burnt brick pathway which is proposed to be kept.

Also, the visitor's center is in the existing residential building on site which is in good condition. The final site plan illustrates the design in a clearer form. (See Fig 6.10)

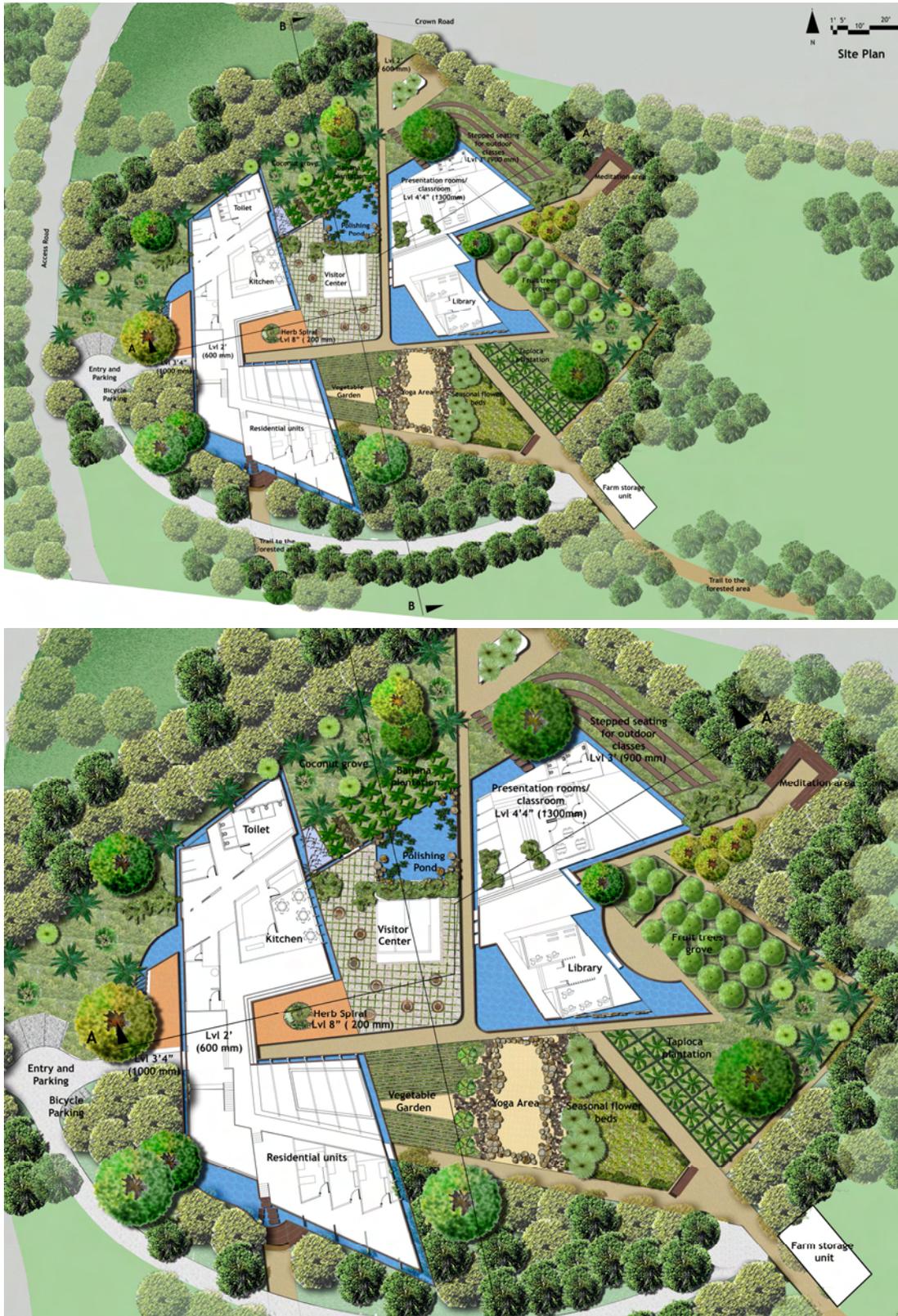


Fig 6.10: Final site plan  
Source: Author



Fig 6.11: Sections  
Source: Author

#### 6.4.4 Permaculture Zone

The whole site plan is based on zones of Permaculture. The landscape aims to create a self sustaining ecology on site which is primarily based on the principles of zones. These zones use the energy available on site like machines, people (manual labor), wastes and fuels of the family or society. The zones can be visualized as series of concentric circles, the innermost circle being the area we visit the most frequently and which we manage most intensively. Zones of use are basic to conservation of energy and resources on site.

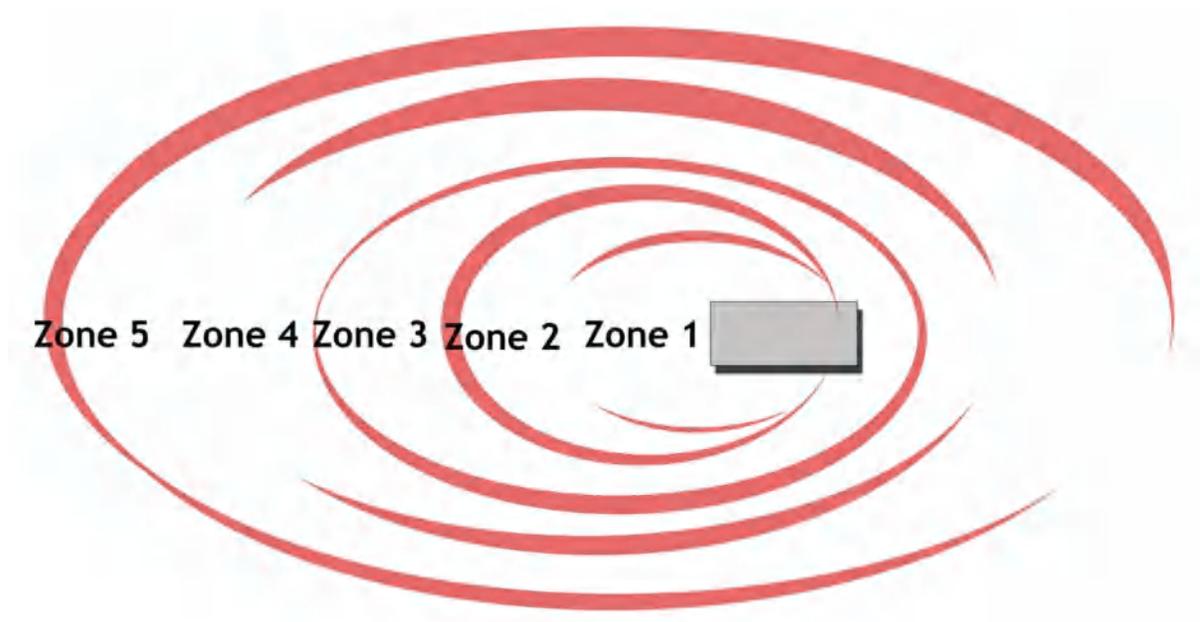


Fig 6.12: Permaculture Zones  
Source: Author

It is important to note here that these zones are not traditional planting zones based on temperature or climate. They although include planting primarily, features such as water harvesting, waste disposal, water treatment, windmills and animal farming are also included.

- Zone 0: The house, campus or the village.

- Zone 1: Those components needing continual observation, frequent visits and work input. eg.: herb gardens, vegetable gardens within 6 meter (20') or so from the house.
- Zone 2: This zone is little less intensively managed with smaller fruit orchards, small ponds, hedges and trellis.
- Zone 3: This area is the farm zone which includes larger fruit orchards, large water storage, and little pruned trees.
- Zone 4: This zone is the area bordering on forest or wilderness, but still managed for wild gathering, forest and fuel needs. This is planted with hardy, unpruned, or volunteer trees.
- Zone 5: This zone is the natural unmanaged environmental zone. Used for occasional foraging, recreation etc.

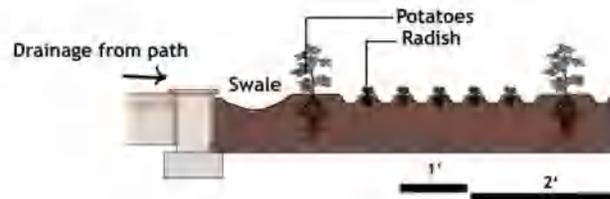
This project tries to include planting, waste disposal, water harvesting and waste water treatment in the designed zones. A huge separate area for animal farming has been provided in Auroville to support all eco-villages and settlements.



Fig 6.13: Permaculture Zones on site  
Source: Author

**ZONE 1:** It is evitable from the design that the zoning revolves around the built mass of the campus. The zone 1 of the Permaculture which mainly includes vegetable gardens and herb spiral are located within the six meter radius of the residential block. This makes it comfortable for the caretakers for the daily maintenance and watering of the plants. It also supports the food preparation in the kitchen.

## Raised Bed Vegetable Garden



- Raised beds of 150 mm (6") width and 50 mm (2") high with 380 mm (15") beds after every 5 smaller beds.
- Growing media-manure from the composting pits.
- Vegetable combinations:
  - \* Lettuce a row of 3000 mm (10') long Peas a row of 9000 mm (30') long.
  - \* Pumpkins 1 to 3 plants radishes a row 1200 mm (4') long.
  - \* Tomatoes 10 to 15 plants.

Fig 6.14: Vegetable garden planting detail  
Source: Author

The herb spiral is one of the interesting features of the Permaculture planning. It is an earth mound which spirals up creating small planting areas at all levels. These planting areas are used for planting spices and herbs that are used daily in the food preparation. As Indian cooking involves a lot of spices, this herb spiral becomes more useful. (See Appendix 1 for details)

## Indian Herb Spiral



Fig 6.15: Herb Spiral schematic detail  
Source: Author

**ZONE 2:** The next zone of Permaculture surrounds Zone 1 primarily and has small fruit tree plantation and waste water treatment facility. The fruit trees that are used in this are banana, guava, sugar cane etc. (See Appendix 2) for details. The waste water treatment in Zone 2 is based on a locally available DEWAT system. This is a root zone treatment that has been successfully employed in many projects around Auroville. The treatment comprises of series of tanks and filtration techniques finally taking from anaerobic to aerobic filtration and finally releasing the water in a polishing tank from where it is directly taken for irrigation.

The banana plantation next to the polishing tank is supposed to accept treated waste water, and hence it has been placed strategically.

DEWAT stands for Decentralized Wastewater Treatment system. It is a locally practiced wastewater treatment that uses several processes to treat and dispose off waste water (sewage). DEWAT is based on three or four technical treatment elements which are designed in relation to the wastewater influent and the necessary effluent quality after treatment.

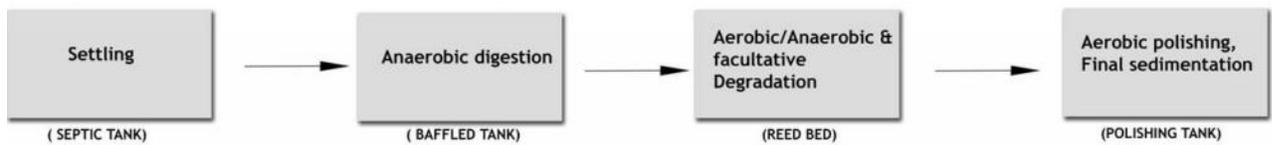


Fig 6.16: DEWAT steps for water treatment  
Source: (CSE)



Fig 6.17: DEWAT system on site  
Source: Author

## Tank Size Calculations

The object with septic tank sewage treatment is to retain the effluent in the septic tank for at least 30 hours. This allows time for solids to settle on the bottom and grease to float to the top. As a general rule of thumb, a two bedroom home will require a 1000 gallon septic tank; three bedroom 1250 gallon septic tank; and four bedroom 1500 gallon septic tank. All of these are minimum requirements - to some extent, the bigger the better. A longer retention time allows the solid waste to decompose more completely.

- **Thumb rule** > Area required = 0.5 sq m / cum wastewater/day

**E.g.:** If volume = 10 cum, then area required = 5 sqm.  
Settler dimensions L = 2.5 m; B = 2 m; D = 1.5 to 2 m

Fig 6.18: Calculations from DEWAT  
Source:

Ours is six bedroom + one faculty that makes it 3500 gallon capacity (1000 extra for visitors etc) This is only for toilets, kitchen water will have to be stored and treated separately because the kitchen capacity is more than the residence capacity. 3500 gallon capacity i.e. 16 cubic meters.

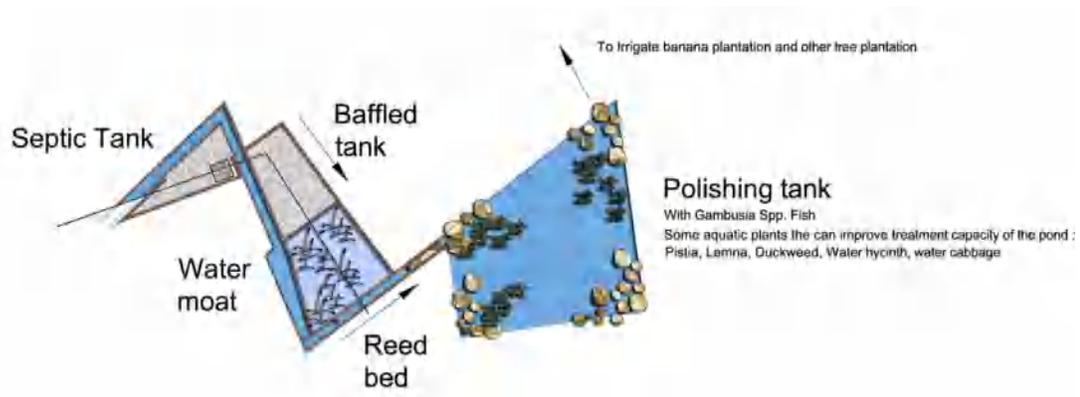


Fig 6.19: Detailed plan of water treatment system  
Source: Author

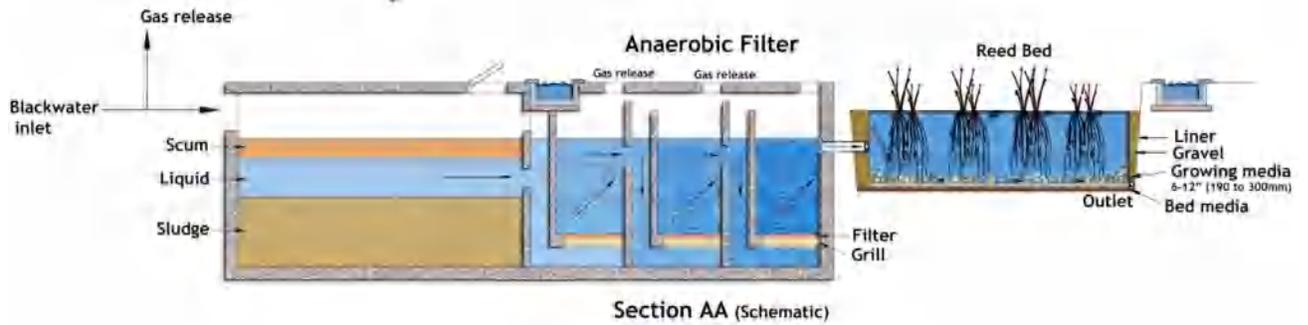


Fig 6.20: Detailed section of water treatment system  
Source: Author

As evident from the figures above, the waste water treatment on site is carried out in various stages. The solid waste is collected in the septic tank where the initial settling of solid takes place. The waste water then moves in to closed series of baffle chambers. This is an anaerobic process and the solid particles are allowed to settle more in these chamber. The water then is passed through the aerobic root zone bed. Wetland plants are used for filtering the water and dissolved nutrient. Some of the plants that can be used in root zone treatment are *Phragmites australis*, *Juncus efusus* and *Typha latifolia*.

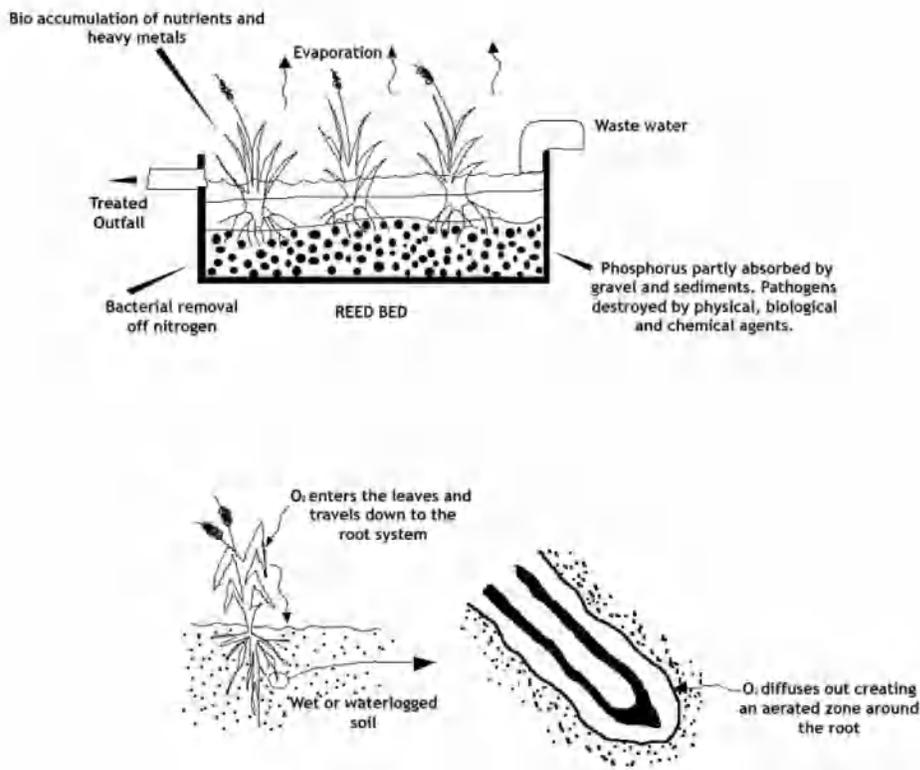


Fig 6.21: Working of wetland plants in root zone bed  
Source: Author



Fig 6.22: Plants for root zone treatment  
Source: (CSE)

The treated water then finally goes to the polishing pond where aquatic species of plants help in removing the dissolved nutrient more and making water ready for irrigation purposes.

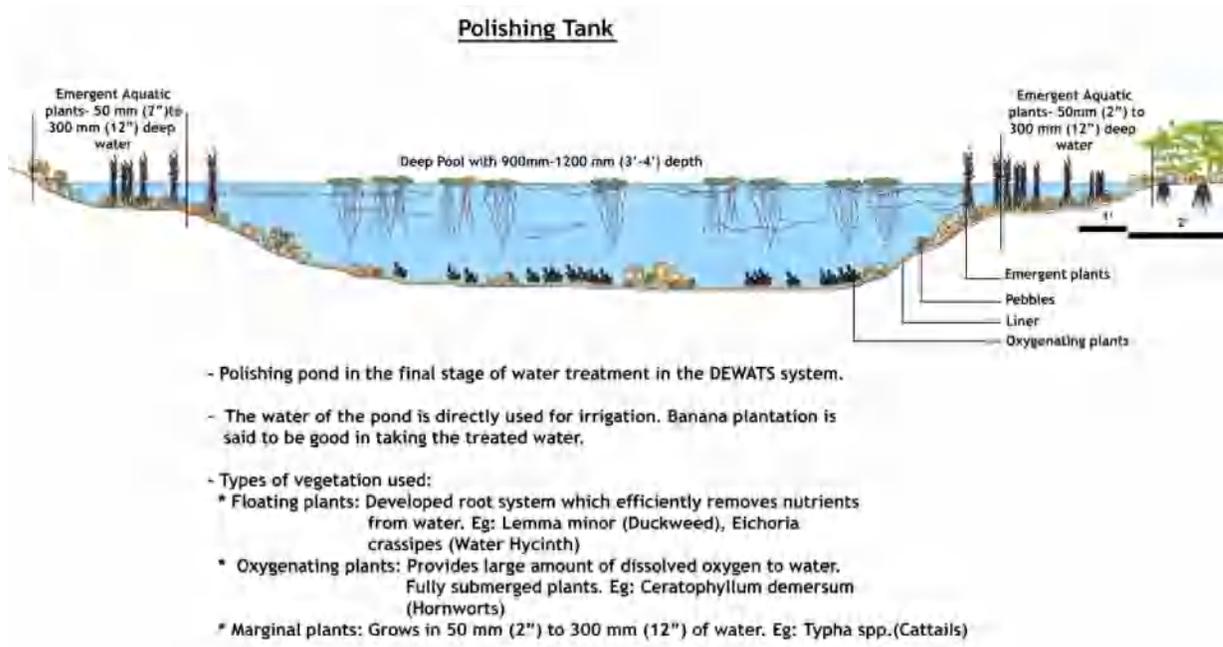


Fig 6.23: Detail of the polishing tank  
Source: Author

As mentioned earlier the Banana plantation is said to be good in taking treated water for irrigation and hence it has been sited right next to the polishing tank in Zone 2. Following is a schematic sketch of the banana plantation detail.

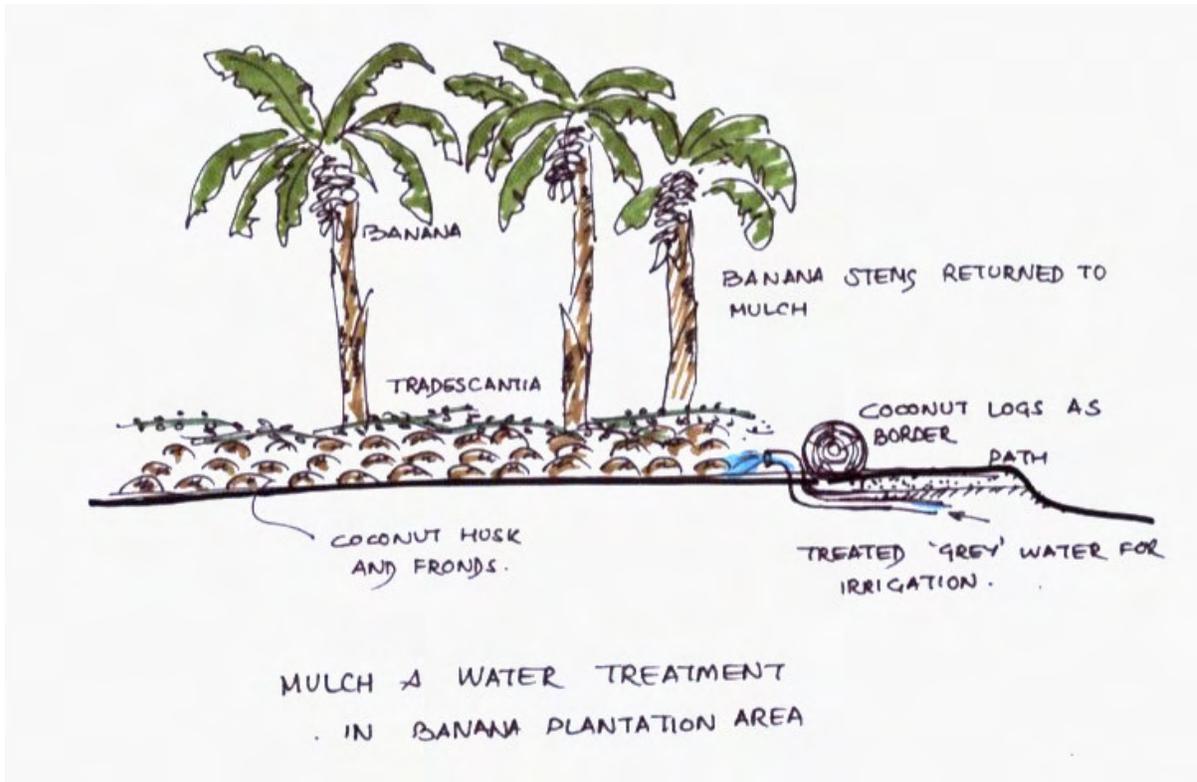


Fig 6.24: Irrigation detail in the banana plantation area  
Source: Author

The other aspect of waste water treatment is the solid waste collected in the septic tanks. This waste can be treated through various bio composting techniques. These are some basic types of composting that are used in Auroville in various eco-village settlements:

- 1) Anaerobic Composting: a composting pit is dug and the compost is dumped into it and closed air tight. The pit is then opened up after many months or a year to get fairly well decomposed compost.
- 1) Aerobic Composting: A better matured compost and in a shorter period of time (around 4 months). A pit is dug with twiggly roughage as a base, the heap of compost

is aerated and hence the aerobic composting process takes place. It is recommended to turn the heap atleast once, not for aeration, but for a thorough breakdown of thicker wood pieces.

1) Composting with earthworms-vermicomposting: Every good aerobic compost heap harbors earthworms, but vermicomposting is set up in such a way that the worms can multiply optimally and do thorough processing of all compostable matter. Vermicompost unit has to be set up in such a way that the worms are protected against chickens, other birds and rodents. Daily attention is a must. It is important to use the locally available species of worms such as.: *Lampito mauritii* and *Perionyx excavatus*.

1) Effective micro-organism (EM): EM technology is use of a liquid culture of “effective microorganism”- it can also be used for composting. EM is sprinkled during build-up of the compost heap layer by layer. This type of compost can and should be used very fast-within two weeks- to achieve the maximum benefit from the organism inoculated into the heap. The fact that lots of organic matter may not yet be decomposed is desirable in this case, as the propagation and metabolic activity of the organisms depends on the availability of carbon from organic matter.

**ZONE 3:** This zone comprises of larger fruit orchards and also focuses on creating a self sustaining ecology on site. The planting technique in this zone is primarily mixed with levels of understory plantatation under the larger fruit trees. The base of the planting is proposed to

have leguminous plants for nitrogen fixation to help in regeneration of soil. (See Appendix 2 for plant list). Following diagrams show some of the examples of planting details on site in zone 3.

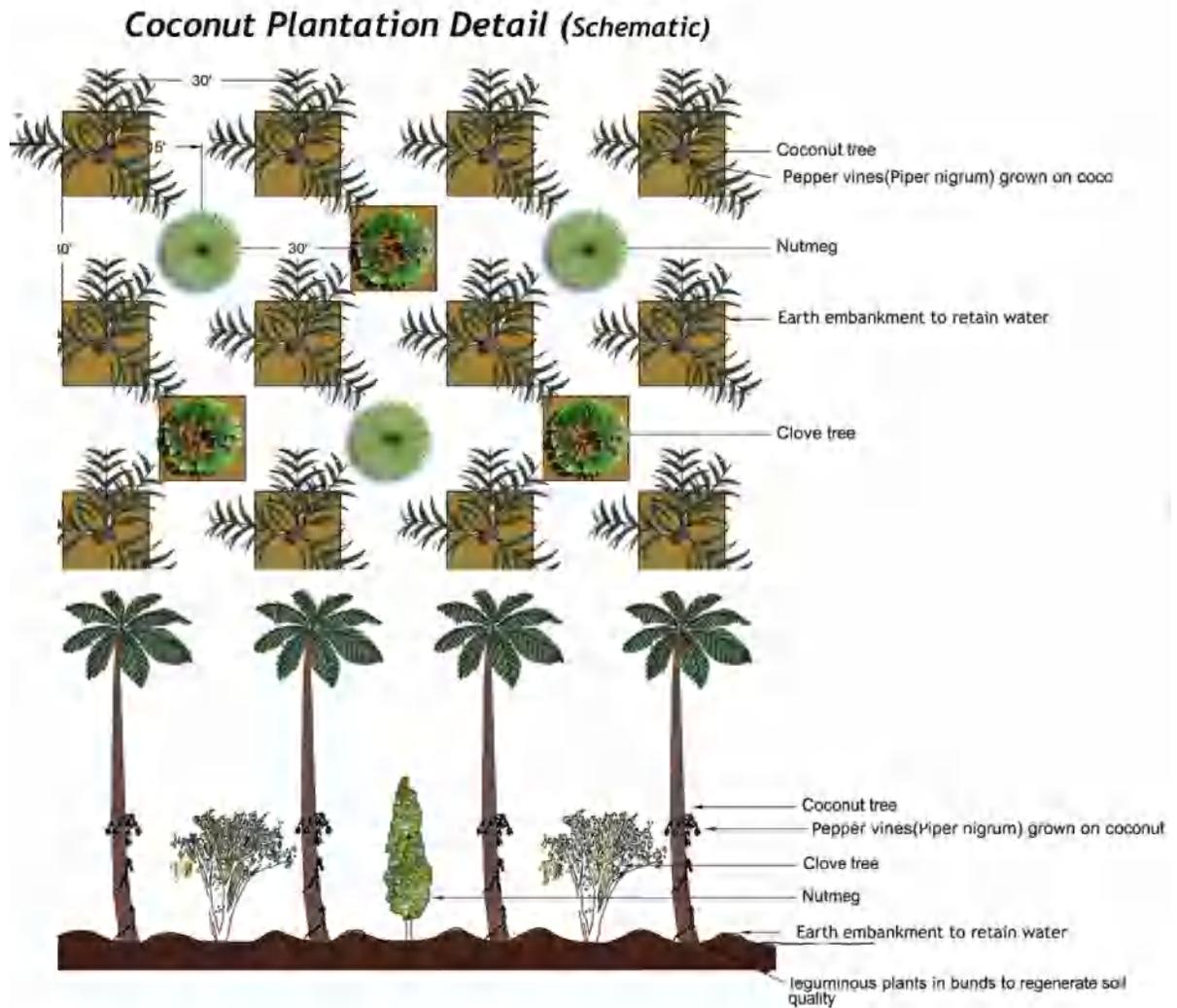


Fig 6.25: Coconut plantation detail  
Source: Author

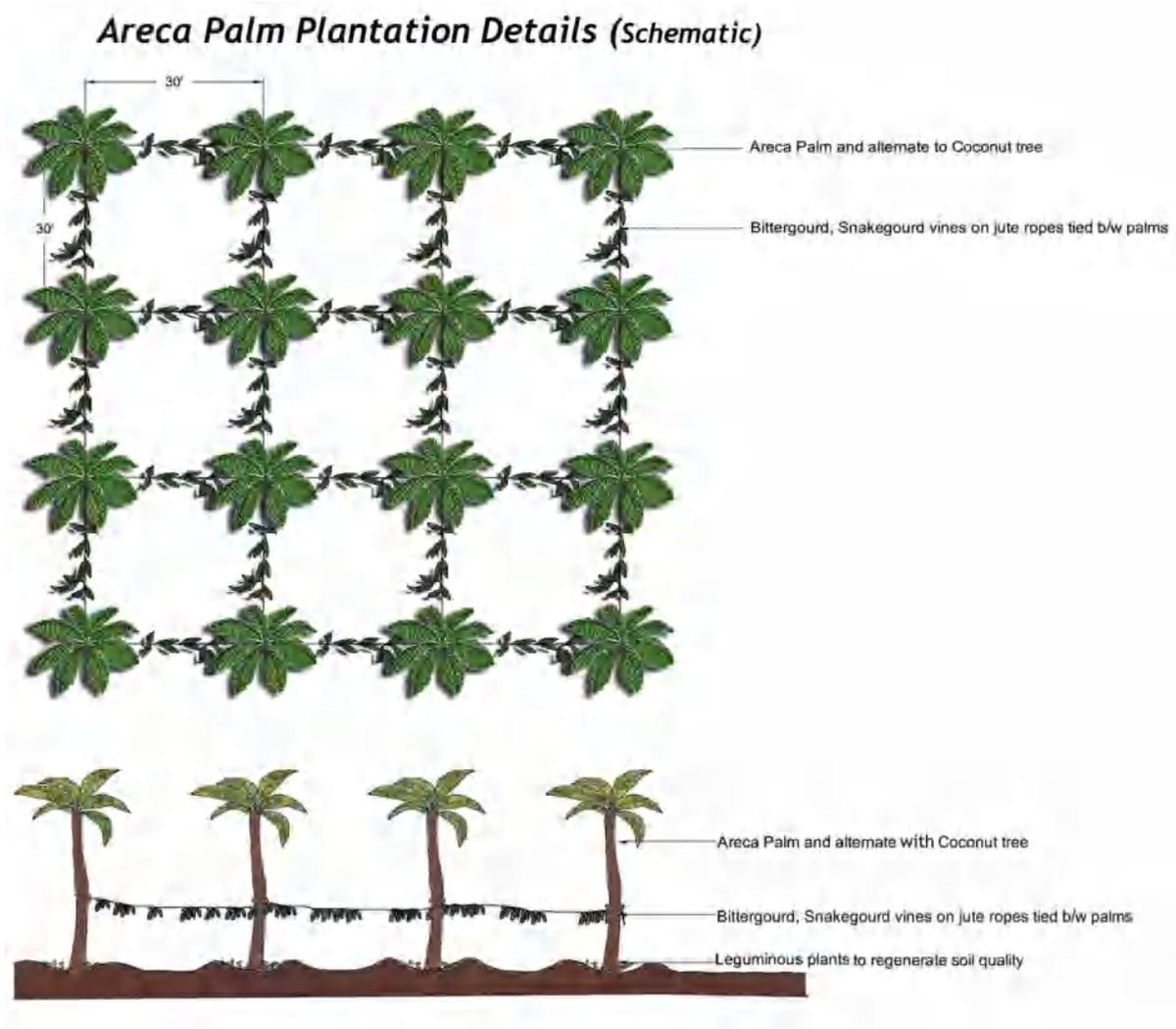


Fig 6.26: Areca palm plantation detail  
Source: Author

**ZONE 4:** This zone concentrated on planting woodlot trees. The tree species selected for Zone 4 are locally available trees used for construction and fuel. This zone will also become the main buffer area for the campus from the Crown Road to the north and other campuses. It is proposed that the composting pits can be placed in this area. The self sustaining ecology created through the Permaculture zoning would become more prominent here as this area

would be the designated wild forest. The nutrient cycle which comprises of exchange of important nutrients from the insects and birds to the soil and plants would take place in this area. The tree litter on the forest floor would decompose with time to form humus which is nutrient rich natural fertilizer. Also, the dense planting would have a under soil root system which would help in holding earth during heavy rain and retain water for the plants. Following diagram is a demonstration of one such nutrient cycle.

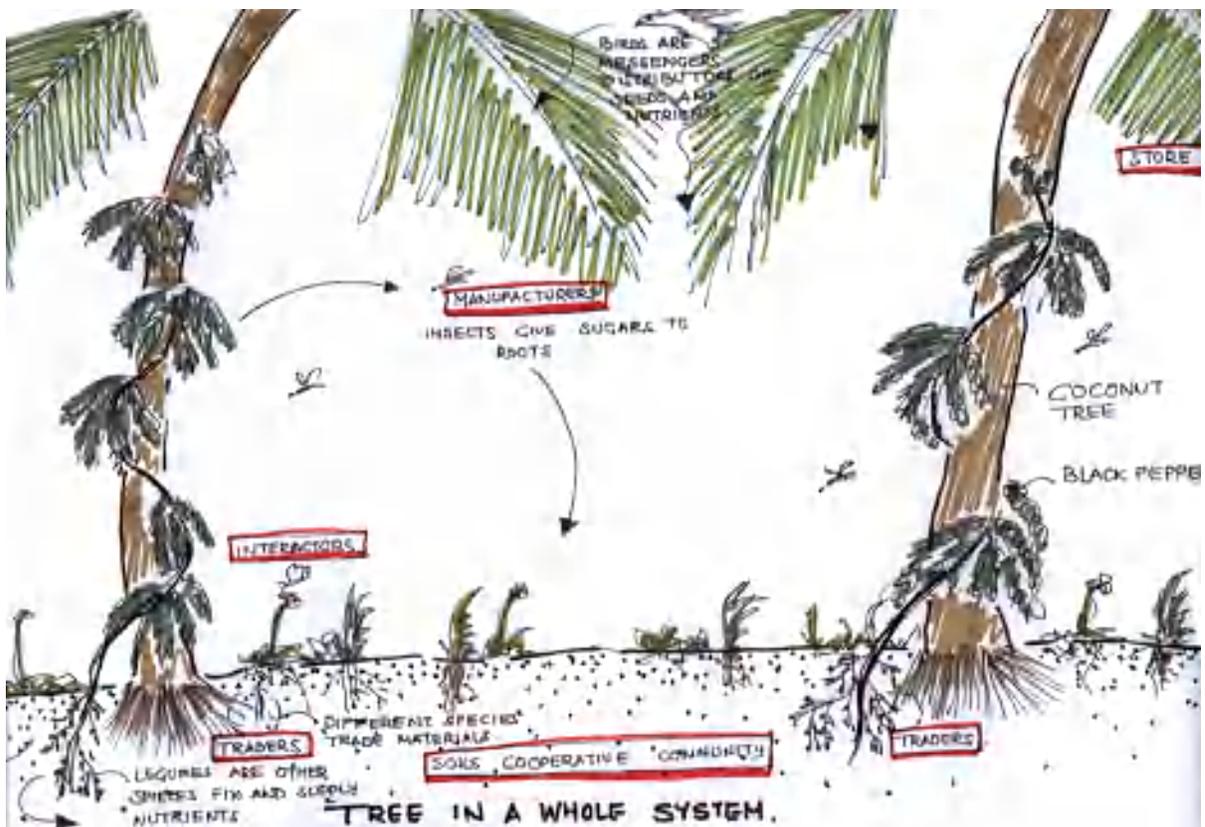


Fig 6.27: Nutrient cycle in the forest area  
Source: Author

ZONE 5: This zone is designated as the reforestation zone. This is the undefined zone which meets the larger greenbelt proposed in the Auroville Master Plan on the western side of the site.



- Entire root ecosystem exists under the surface which helps in nutrient exchange and favours rain water seepage and stops soil erosion.
- Leguminous trees and grasses help in nitrogen fixation.
- Layers of rotting leaves and litter decomposes to form humus which is rich in nutrients.

Fig 6.28: Forest floor  
Source: Author

#### 6.4.5 Site planning based on Vaastu Chart

According to Vaastu the whole site should be oriented in north south direction and the major selection of areas should be based on the sun and wind direction. The prevalent wind direction on the site is south-west. The sun is harsh on the western side and the southern and northern sides are generally considered good for construction. The northern light according

to Vaastu is good for study areas and the southern and south western sides are the ones where heavy massing should be done. These are the directions where the residential blocks of the campus can be sited. Following is the illustration of the site plan based on the vaastu chart.

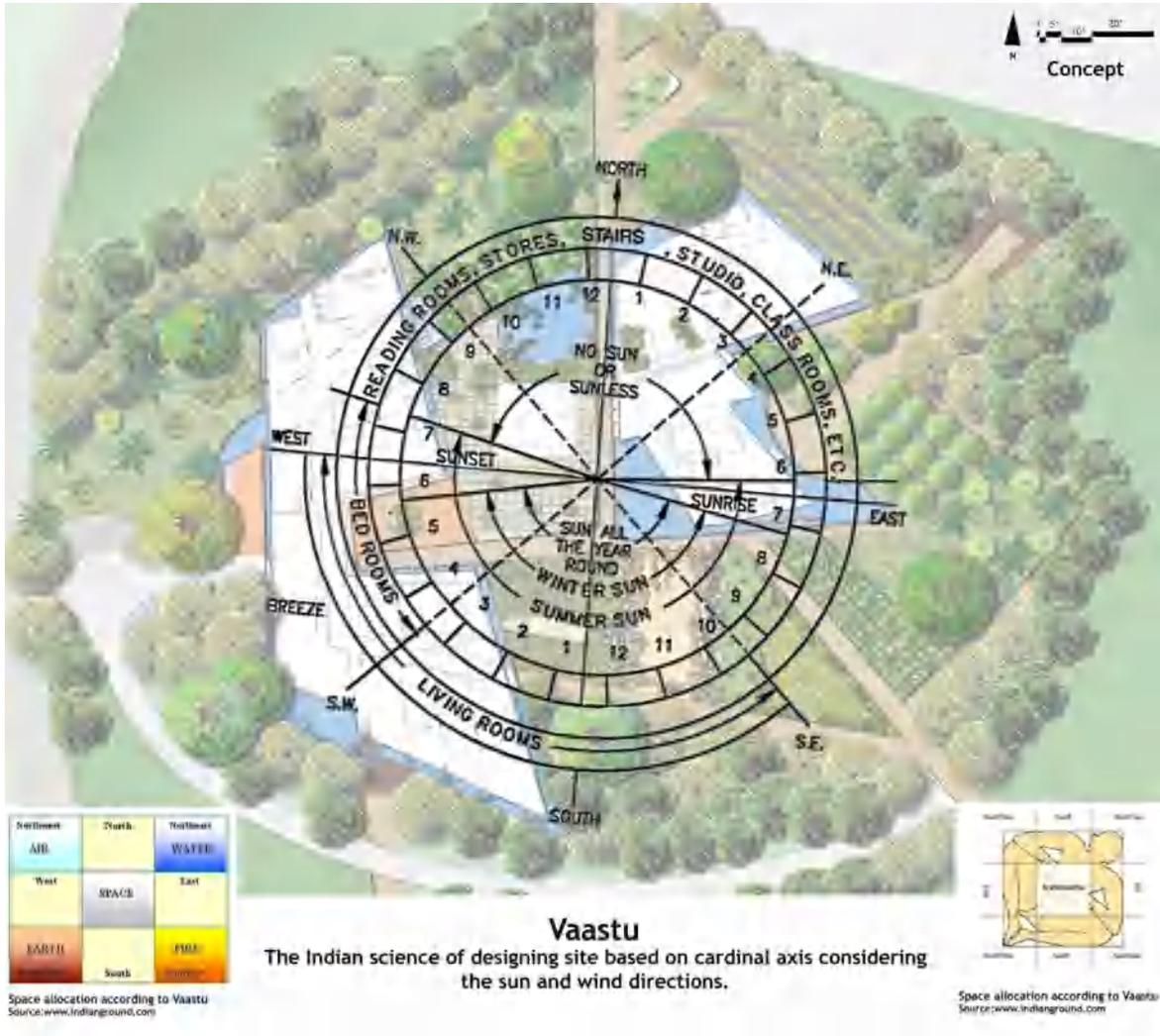
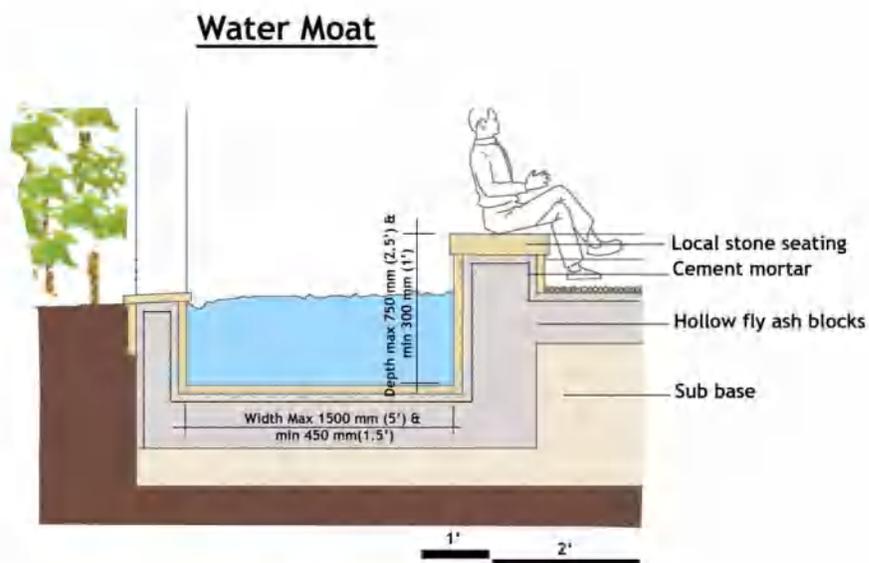


Fig 6.29: Vaastu Zoning map  
Source: Author, www.evastu.org

## 6.5 Details

The detailing for the project are based on the locally available materials and construction techniques hence making the project more feasible and accepted in the traditional environment of Auroville. This section of the report would cover the sectional details of pathways, seating area, etc.

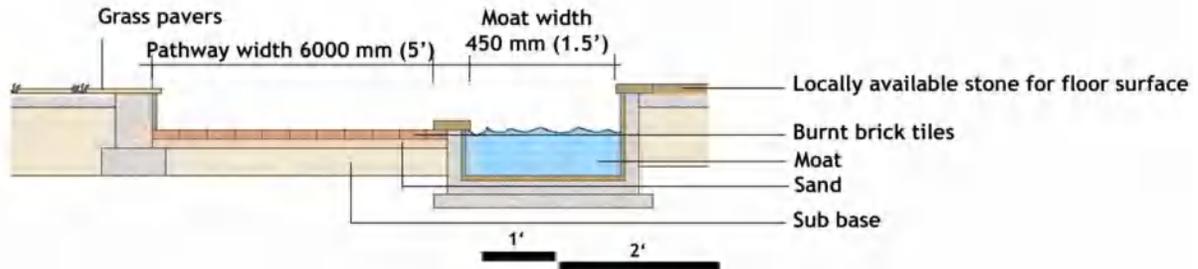
The water moat that surrounds the campus building is a tool to keep reptiles and ants away from the inhabited spaces. This also helps in collection of rainwater draining down from the sloped roofs.



- Envelops all the buildings.
- Helps in preventing insects and reptiles from entering the buildings.
- Fish of *Gambusia Spp.* used in the moat for mosquito control.

Fig 6.30: Water moat detail  
Source: Author

## Main Pathway and Moat

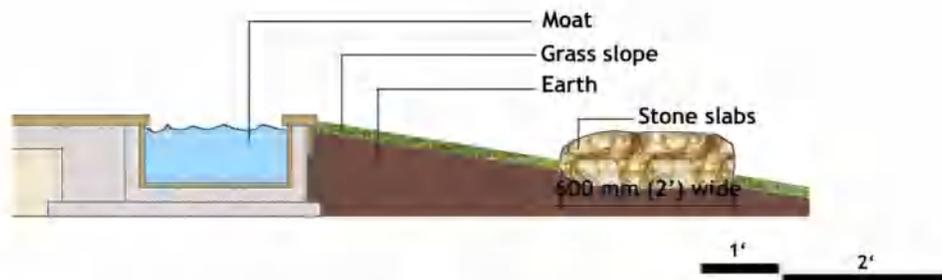


- Grass pavers used for the seating area, pervious and green.
- Burnt brick tiles in the main pathway-locally available material.
- Adjoining water moat

Fig 6.31: Main pathway detail

Source: Author

## Outdoor Seating



- Secluded and open space for students to study.
- Open grass slope merges with zone 4 of wooded trees.
- Locally available stone slab placed on the grass slope for seating.

Fig 6.32: Outdoor seating area

Source: Author

## 6.6 Architecture and Views

As the project was a collaborative effort between a student from architecture department and landscape architecture department at UMass, a lot of architectural details are provided. These details show the construction of the building blocks with interior spaces. Following are some of the related floor plans.



Fig 6.33: Architectural plan  
Source: Masters Project, Neetu singh



Fig 6.34: Architectural elevation of the residential block  
 Source: Masters project, Neetu Singh

The materials used for architectural and landscape detailing were kept constant. They were selected based on the local availability and production of these materials in the Auroville area. The extensive research done on the materials was based on case studies of other building projects in the area and the existing college guest house campus. For example hollow fly ash blocks are made in the production units of Auroville. They are made from the fly ash residue form the coal used for electric power generation in the local area around. These are light weight blocks and are good as structural material for the buildings. Some of the materials proposed are:

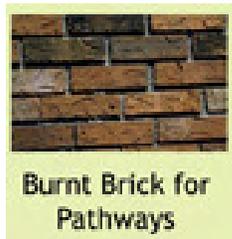


Fig 6.35: Materials proposed  
 Source: www.auroville.org



Fig 6.36: View of the visitor center seating area  
Source: Author



Fig 6.37: The internal residential court with bamboo screening  
Source: Master's project, Neetu Singh

## 7 Conclusion

The purpose of this project was to establish a permanent campus for Living Routes in Auroville. The area of research concentrated on the aspects of eco-tourism at global and national level and then moves into more specific aspects of Auroville as an eco-tourist and educational site. The project also explored the idea of designing a campus for an organization based on the principles they teach, therefore looking into the actual implementation of ideas and making the site a live laboratory.

The site would be used for six months to run courses for Living Routes and in the rest of the year it would be given to the community of Auroville to function as a guest house for eco-tourists visiting the area. It is proposed that the site should function as an educational campus full year long for students and eco-tourist visitors. For doing so the principles and techniques used in the campus for making it sustainable should be exhibited in various parts of the campus in the form of posters, placards and information boards. Following are some of the areas where these information boards can be installed.



Fig 7.1: Poster installation points  
Source: Author

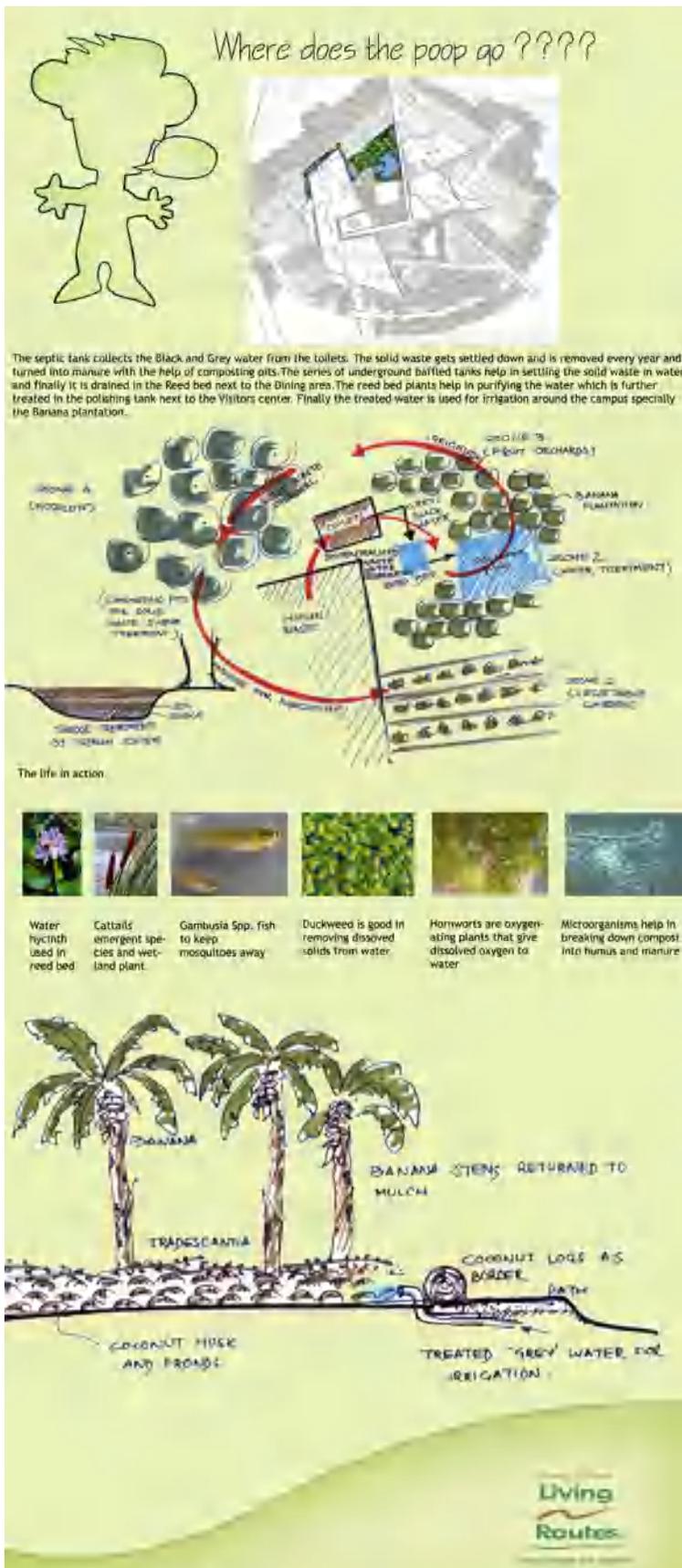


Fig 7.2: Example of informational poster  
 Source: Author

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[www.Auroville.org](http://www.Auroville.org).

## Appendix 1 - Indian Herb Spiral

Common Indian name	Common name	Scientific name	Picture	Description	Uses
<b>Podina</b>	Field mint, Spearmint	Mentha Arvensis		It is an herbaceous perennial plant growing up to 10-60 cm. The leaves are in opposite pairs, simple, 2-6.5 cm long and 1-2 cm broad, hairy, and with a coarsely serrated margin. The flowers are pale purple (occasionally white or pink), in clusters on the stem, each flower 3-4 mm long.	The entire plant is antibacterial and antifibrile. It is effective in headache, rhinitis, cough, sore throat, colic, prurigo and vomiting. Menthol obtained from this is used in balms. It is also used as flavoring agent in culinary preparations.
<b>Adrak</b>	Ginger	Zingiber Officinale		Ginger is a creeping perennial and a thick tuberous rhizome. The plant has narrow, lanceolate to linear-lanceolate leaves 15 to 30 cm long, which die off each year. The flower scape grows directly from the root and terminates in a long, curved spike. A white or yellow flower grows from each spike.	Clinically proved as prophylactic of nausea and vomiting associated with motion, sickness, seasickness and pregnancy. Ginger is also known for its gastrointestinal benefits and as an anti inflammatory and carminative.
<b>Tulsi</b>	Basil	Ocimum Sanctum		An annual plant found wild in the tropical and subtropical regions of the world. The bushy stems grow to 1 to 2 feet high. The toothed leaves are often purplish hued. The flowers appear from June to September and vary in color, from white to red, sometimes with a tinge of purple. The plant emits a spicy scent when bruised. This plant is an important Ayurvedic herb. It is grown near Indian houses.	It is used in malaria, catarrh, bronchitis coughs, colds, fevers, headaches, lung problems, abdominal distention, absorption, arthritis, colon (air excess), memory, nasal congestion, nerve tissue strengthening, purifies the air, sinus congestion, clears the lungs, heart tonic and gastric disorders. It also lowers blood sugar levels and its powder is used for mouth ulcers. It is considered sacred and widely worshiped in India.
<b>Genda</b>	Marigold	Calendula Officinalis		Calendula is an annual garden plant with an angular, branched, hairy stem 1 to 2 feet high. The leaves are alternate, sessile, spatulate or oblanceolate, dentate with widely spaced teeth and hairy.	Calendula flowers have been considered beneficial in reducing inflammation wound healing and used as an antiseptic. Calendula has been used to treat a variety of skin diseases and has been seen effective in treatment of skin ulcerations and eczema.

<b>Ajwain</b>	Bishop s weed	Carum Copticum		<p>Also known as Ajwain, Bishops Weed is an aromatic spice with a wondrous flavor. Traditionally, India has been one of the most important sources of Bishops Weed with Rajasthan and Gujarat as the main producing regions. Roasting or frying in combination with potatoes or fish enhances the strong aroma of Bishops Weed. Legumes (lentils, beans) are however the most important field of application; in India. In South Indian cuisine (which is predominantly vegetarian), tadka (frying in butter or ghee) of preparations are not only applied to dried legumes but also to green vegetables and boiled rice.</p>	<p>Diarrhoea, Indigestion Abdominal pain, Flatulence. Cholera, Rheumatism, Heart disease, Spleno-megally, spermatorrheal and gives colic relief. .</p>
<b>Jeera</b>	Cumin seed	Cuminam cyminum		<p>Cumin is one of the most typical spices for India, especially the Southern part. The fruits are used as a whole, and are fried. Furthermore, the seeds form an important part of curry powder. The fragrance of toasted cumin, typically in combination with corriander is the most characteristic of South indian cooking.</p>	<p>Diarrhoea, Indigestion, Flatulence, Fever, Vomiting, Urinogenital system disorder, Gonorrhoea, Calculii, Disuria, Anorexia. Dyiscrasia. Fruits are particularly very useful in the indigestion of child. .</p>
<b>Dhaniya</b>	Corriander	Coriandrum sativum		<p>Coriander is an essential part of <i>curry</i> powder nd Indian masalas as well in Northern India.</p>	<p>Flatulence, Abdominal weakness , diarrhea due to indigestion, Eye infections, Fever inflammalion, Vomiting, Colicpain, Asthma, Cough, Allays thirst, Anthelmintic, Brain and heart tonic; Paste if Fruits checks bleeding from wounds. .</p>
<b>Curry patta</b>	Curry leaves	Murraya koenigii Spreng.		<p>In Indian cuisines, curry leaves are used fresh; for some recipes, the leaves should be oven-dried or toasted immediately before usage. Another common technique is short frying in butter or oil. Because of their soft texture, they are never removed before serving, but can be eaten without any hazard.</p>	<p>Diarrhoea, Dysentery, Piles, Paste of leaves applied locally on: Eruptions, Bruised and Piosonous bites; Root bark: Relieves renal pain: leucoderma, blood disorders.</p>

<b>Haldi</b>	Turmeric	Curcuma longa L.		Turmeric is a very important spice in India, which produces nearly the whole world's crop and uses 80% of it. Turmeric usage dates back nearly 4000 years, to the Vedic culture in India, when turmeric was the principal spice and also of religious significance. It is employed in some Hindu rituals, where the yellow colour symbolizes the sun.	Cold, Cough, Skin disease, Abdominal worms, Diabetes, Scabies, Leucoderma, Polyuria, Ulcer, Swelling, Anaemia, Indigestion. Jaundice, Conjectivities, blood purifier, Liver tonic, Promote Complexon, catarrh and purulent ophthalmia.
<b>Saunff</b>	Fennel	Foeniculum vulgare Mill.		Fennel is quite important in several regional cuisines of the Indian subcontinent, particularly in Bengal, where it is part of the typical five-spice-mix. The leaves and stalks of fennel can be eaten as a vegetable.	Fever, Urine-in flammation, Thirst, Dysentery, Diarrhoea, Cholera, colic, Spleenomegaly, Anthelmintic, Analgesic, Braintonic, Antacid, Also useful in Flatulance, Cough, Asthma, Kedney disease, as Vehicle, flavouring agent.
<b>Mirchi</b>	Chilly	Capsicum frutescens L.		In tropical climate, chiles are available ripe in any time of the year. Therefore, in the cuisines of tropical South East Asia, they are much preferred fresh. People in India have it raw with food. They also make pickel out of it.	
<b>Methi</b>	Fenugreek Leaves	Trigonella foenum graecum		Fenugreek has a strong, pleasant and a peculiar odor and grows best in well-drained soils with a low rainfall into brownish- yellow rhombic shape seeds. In India, this spice is often cultivated as a cover crop in citrus-fruit groves to take advantage of their leguminous nature. Indians like the fresh leaves, which are eaten as tasty vegetable and prepared like spinach and sometimes found in Indian yeast bread.	Kasoori Methi leaves are generally used as a condiment for flavoring and giving special delicious taste. Steaming is considered the best method of cooking leaves; in this the vitamins are retained and the vegetable become palatable. The dried leaves can be composed to pulses for their protein content. They supplement the lysine-deficient cereal diets. They have an aromatic odor and agreeable spicy taste. Kasoori Methi leaves is an important ingredient of curry powder and juicy and fry vegetables .

## Appendix 2 - Plant list

Common name	Scientific name	C/C distance	Permaculture Zone	Tree/Plant type	Picture	Remarks
<b>Lentils,Dal,Pulses</b>	Lens Culinaris	12 plants / ft2	Zone 1	Food		The lentil plant (Lens Culinaris) belongs to the family Leguminosae (legume) and is a cousin to peas. The plants are grown for their seeds, which are contained in pods. They are used in countless cuisines worldwide and are a staple in many middle eastern countries and India.
<b>Garden peas,Matar</b>	Pisum sativum L.	300mm c/c	Zone 1	Food		green peas as vegetable (fresh, frozen, preserved), mature peasa cooked for soup and broth and the plant is used as fodder.
<b>Indian Spinach</b>	Spinacea oleracea	12-18" between the rows	Zone 2	Food		India Spinach Beet is a fast growing vegetable, native to Indian hot and raining summer weather. This vegetable is strongly resistant to heat and is one of the most popular greens during hot summer in India and Southern Asia.
<b>Beans</b>	Phaseolus vulgaris	Space seeds 3-4 in. apart	Zone 2	Food		Beans will grow in any good garden loam. Heavily-fed, rich soils will grow larger plants and will hasten productivity for some varieties. Most beans will grow and produce well with a balanced soil fertility achieved through general fertilization with compost.
<b>Eggplant,Brinjal,Bai gan</b>	Solanum melongena		Zone 2	Food		Used in South indian cooking

<b>Cauliflower</b>	Brassica oleracea		Zone 2	Food		Used in south indian cooking
<b>Indian Beetroot</b>	Beta vulgaris	100 mm c/c	Zone 2	Food		Beetroot can also be eaten as a cooked vegetable, it's also great for salads. With a high sugar content it's an ideal ingredient for home-made wine and
<b>Drumsticks</b>	Moringa oleifera Lam.		Zone 2	Food		The vegetable drumstick plant is also named as "ben oil tree" after commercial oil extracted from the seeds. The root of the drumstick tree is sometimes used as a substitute for horseradish and hence it is also called the "horseradish tree." The drumstick leaves fruits and flowers are edible and a common vegetable in India,
<b>Tomato</b>	Lycopersicon Esculentum L	2 feet apart in a	Zone 2	Food		Tomato (latin-juicy wolf peach) is a popular, versatile, easily grown plant with a great tasting fruit. Tomato is technically a fruit not a vegetable but, they belong to the vegetable garden.
<b>Sugarcane</b>	Saccharum officinar	750 -900 mm c/	Zone 2	Food		Sugarcane if used in hindu temple rituals and is believe to be a sacred plant
<b>Nutmeg</b>	Myristica fragrans	8 m x 8 m pits	Zone 3	Food		They are important to confectionery, culinary and pharmaceutical industries. Nutmeg and mace also yield 7 to 16 and 4 to 15% of oil respectively. This oil is used for flavouring food products and liquors and also in perfumery industries.

<b>Clove</b>	Syzygium aromaticu	150mm- 200mm	Zone 3	Food		The clove tree has a pyramidal shape. It is a pretty and broad leaved evergreen plant growing only in tropical climes. The characteristic strong aromatic fragrance produced by the living tree is mainly from as a result of the glands dotting the smooth and shiny leaves.
<b>Black Pepper</b>	Piper nigrum		Zone 3	Food		Black pepper is produced on vines. The plant is propagated from vegetative cuttings, and it is often interplanted with shade trees, especially tree crops such as coffee ( <i>Coffea</i> ). Black pepper has long been recognized as a stimulant to appetite as well as an aid in the relief of nausea. In India it is being used since time immemorial as a medicine for a number of health problems.
<b>Coconut</b>	Cocus nucifera	9 m c/c	Zone 3	Fruit		It is found at the area of sea level on the coastal areas. It is common world wide on the coastal region. In India whole peninsular region is being covered by it. It is said in South India that every part of this tree is of some use.
<b>Mango</b>	Mangifera indica		Zone 3	Fruit		Mango tree is an important fruit tree and it has important significance as a religious/auspicious tree.
<b>Banana</b>	Musa x paradisiaca	8 ft c/c	Zone 2 or 3	Fruit		The plant is totally green, has a very thick stem and stands up very well to wind. The leaves are wider than those of most bananas growing up to 3 feet wide. It is the best plant to grow in marginal areas or where a grower does not intend to put much care into the cultivation of bananas. The heads of fruit are of moderate size with medium sized fruit that are very sweet.

<b>Guava</b>	Psidium guajava	2.5 m c/c	Zone 3	Fruit		Very popular small fruit tree.
<b>Custard Apple</b>	Annona reticulata		Zone 3	Fruit		Also known as sugar apple, this fruit has a lumpy green skin covering masses of sweet, scented white flesh: in most varieties the fruit can easily be divided into two pieces by hand and the creamy flesh eaten with a spoon.
<b>Pomegranate</b>	Punica granatum		Zone 3	Fruit		Pomegranate juice is mainly used as a health drink. However, most phytochemicals can be found in the rind of the fruit. The roots and bark are also used.
<b>Cashew nut</b>	Anacardium occider	10-12 mt c/c	Zone 3	Fruit		The cashew-nut tree is a fast grower and an evergreen tropical tree. It grows to a height of 12 m.
<b>Banyan tree</b>	Ficus bengalensis		Zone 4	Religious		It is a remarkable tree of India and it sends down from its branches great numbers of shoots, which take root and become new trunks. A single tree thus may spread over a large area and look like a small forest. This tree, belonging to the family <i>Moraceae</i> , is considered to be sacred in some places in India

<b>Pepal</b>	Ficus religiosa		Zone 4	Religious		Ficus religiosa is a variety of Fig tree that was already known as the Bodhi tree, even before Gautama Buddha sat under its branches meditating and achieved enlightenment. It is a sacred tree to both Hindus as well as Buddhists. It is the oldest depicted tree in Indian art and literature and it can be said that this is the mythical 'World Tree' or the 'Tree Of Life' of the Indian subcontinent
<b>Teak</b>	Tectona grandis		Zone 4	Wood		Teak plantation is basically done because of the high quality of Teak wood that is used for construction and furniture.
<b>Sandalwood</b>	Santalum album		Zone 4	Wood		Sandalwood is a small tree that grows primarily in India. The wood of its stem, which grows from 20 to 30 feet high, is heavy and straight-grained and varies in color from white when young to yellow or orange when older. Its oval leaves are covered with a whitish bloom; its small flowers, varying in color, grow in numerous cymes.
<b>Anjan</b>	Hardwickia binata		Zone 4			It is a moderate-sized to large tree, up to 24-30 m tall, girth 1.8-3 m with a clean cylindrical bole up to 12-15 m; graceful, drooping slender branches; crown conical in early life, becoming broader later.
<b>Zone 5:</b> Thevetia peruviana, Plumeria sp., Kigelia pinnata, Salmalia malabarica, Crataeva nurvala, Casuarina equisetifolia, Shorea robusta, Terminalia arjuna & Terminalia catapa, Acacia nilotica, Albizia lebbek, Bauhinia species, Butea monosperma, Emblica officinalis, Cassia fistula, Dalbergia sissoo, Species of Erythrina, Pongamia pinnata, Saraca indica, Tamarindus indica, Azadirachta indica, Artocarpus heterophyllus (jackfruit), Bamboo varieties, Milingtonia hortensis, Michelia champaka						

Source: [www.ecoindia.com](http://www.ecoindia.com), [www.flowersofindia.net](http://www.flowersofindia.net), [www.vidhyaonline.com](http://www.vidhyaonline.com)