ECO RESORT AND TOURIST COMPLEX
Thandachhori, Chittagong

By

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A thesis submitted to the Department of Architecture in partial fulfillment of the requirements for the degree of Bachelor of Architecture

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Declaration

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Approval

The thesis/project titled “Eco resort and tourist complex” submitted by Umme Nabila Uddin (14208008) of Fall 2019 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Architecture on 22.12.19.

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Abstract

Ecotourism has gained wide popularity in the tourism industry over the past decade. Reasons behind such demand is mainly the environmentally responsive attitude of these resorts. The purpose of this paper is to try and attempt to design an ecologically responsive resort in coherence with the topography, nature and environment of the site and create the least harmful impact on its surroundings and its biota. To achieve such ecological sustainability the primary goal will be to have as less carbon foot print as possible in the site and to enhance the biodiversity as much as possible. This paper will thus attempt to connect the realms of sustainable tourism and ecological footprint thinking through possible design solutions.

Keywords: ecosystem, ecotourism, sustainability, ecological corridor, eco resort

Table of Contents

List of Figures

Chapter 1: Introduction

1.1 Introduction to the Project

An ecological resort can be defined as a tourist resort whose facilities are intended to have a minimal impact on the natural environment. It also intends to be an environmentally sustainable and responsible accommodation that makes important environmental improvements to its structure in order to minimize its impact on the local environment. An ecological resort is thus one that is fully integrated into the environment without damaging it, contributing in some way to progress and improve the local community and sustainable growth of the tourism industry. Eco-resorts have become an increasingly popular alternative in the tourism industry, the increase in demand has led therefore to a large range of resorts with planet friendly options.

This project “Eco resort and Tourist Complex” is planned to be built in Thandachhori, Chittagong within a site area of 20 acres. The client of the project is Chittagong City Corporation and the entire project will be funded by them. This project provides opportunities for the people of the city to get away from the monotonous urban life and come closer to the nature every once in a while. The project not only allows to address environmental issues like sustainability, biodiversity, climatic conditions and ecological balance but will also provide facilities for the visitors to experience the rich culture of the largest port city of the country. Besides having resorts that will provide full exposure to nature, the project has scopes to culturally engage and employ the local people. Simultaneously, the recreational facilities of the project will help in integrating people with nature through experiential activities. Along with promoting a healthy environment and creating environmental awareness, the impact of this project will also be beneficial for the tourist industry of the country.

1.2 Project Rationale:

Chittagong being the second largest city of the country still lacks resorts that address nature and are responsible towards the environment. Nature tourism is almost near to non-existence in the city. An eco-resort that is environmentally sustainable and has less impact on the nature can be an example for future environmental development of the city. Chittagong also lacks recreational spaces where people can engage in experiential activities all the while enjoying the nature. It is unfortunate that in spite of being rich in culture and nature, the city doesn't get much exposure due to lack of proper space and opportunity. Thus, tourists from outside the country, or even from outside the city are deprived of the beauty of the city.

The site Thandachhori even though closer to the city but is still at a distant from the hustle and bustle of the urban life. Having environmental amenities in abundance and a rich eco system this site becomes the right spot for tourism. The enhanced environmental amenities already attract people to visit the site during weekends. However, the lack of accommodation and activities do not encourage people to explore the place any further. The site therefore demands a project that not only respects the existing natural elements of the site but also creates awareness among people and make them environmentally more conscious at the same time. An eco-resort is a project that ties the string between such ecologically rich environmental setting and tourism while promising to keep the site's natural condition intact.

1.3 Aim and Objectives of the Project

The aim of the project is to design an environmentally responsible resort that has a minimal impact on the nature, enhances the eco system and restores the ecological characters of the site. The ecological protection can be achieved in two hierarchies: the first hierarchy is emission of carbon foot print, and the second hierarchy is restoration through enhancing the environment. These hierarchies can be achieved through preservation of afforestation, water environment treatment, atmospheric environment treatment, solid waste pollution prevention, natural conservation of intensely bio-diversified areas, nourishment of areas that are rich in indigenous growth of plants, passive lighting, using eco-friendly materials consuming less energy, and recognizing the biota that is comprised within that area. Plant and animal life can be quite unique to its particular setting and it becomes essential to understand how the animals currently live within that ecosystem to ensure the built form does not cause disruptions.

1.4 Project Summary

Name of the Project: Eco resort and tourist complex

Implementer of the Project: Chittagong City Corporation

Location: Thandachhori, Chittagong

Site area available for the Project Development: 20 acres

Proposed built-up area of the Project: 92,500 sq.ft

Proposed facilities to be accommodated in the project:

- Administrative
- Residential (for short-stay)

- Recreational (for day-long activities)
- Dining

Figure 1: Location of the site within Chittagong City Corporation area

(Source: Chittagong City Corporation)

The following chapters of the paper will elaborate literature review, site appraisal, case studies, program analysis, design considerations etc.

Chapter 2: Literature Review

Ecosystems are essential to the survival of human societies and economies. Ecosystems provide a huge range of services to living beings. These include basic necessities as clean air, clean water, and the production of food. However, people modifying the ecosystems have turned it into a global threat. The substantial risks of ecological degradation might diminish the future well-being of humanity. Our current socioeconomic progress is not sustainable because it reduces the capacity of the biosphere to provide the ecological services that we depend on. Irreversible ecological changes, such as extinctions and species invasions, are now the primary concern. (Briassoulis, H. 2002). It is likely that changes in production systems, ecological management, and social organization will be necessary if we are to sustain human well-being.

2.1 Ecosystem and sustainable development

Ecology is a sub-discipline of biology and a part of environmental science that studies how organisms interact with one another and within their physical environment. And an ecosystem is a community of those living organisms in conjunction with the nonliving components of their environment, interacting as a system. The system links biotic and abiotic components together through nutrient cycles and energy flows.

Ecosystem services are the varied benefits that humans freely gain from the natural environment and properly-functioning ecosystems. These services mainly include agro ecosystems, forest ecosystems, grassland ecosystems and aquatic ecosystems. Tangible benefits include supplies of food and freshwater, flood mitigation and improvements to water quality whereas less tangible benefits include contributions to cultures.

Ecosystem services are grouped into 4 broad categories:

- Provisioning services: food, raw material, genetic resources, biogenic minerals, energy etc.
- Regulating services: climate regulation, waste decomposition, purification of water and air, pest and disease control etc.
- Cultural services: recreational, spiritual and cultural experiences that includes ecotourism, use of nature for religious values, outdoor sports etc.
- Supporting services: nutrient cycling, soil formation, habitat provision etc.

As a society, we depend on a healthy and balanced ecosystems to do many things, such as to purify the air we breathe in, sequester carbon for climate regulation, cycle nutrients so we have access to clean drinking water without costly infrastructure, and pollinate our crops so we don't go hungry.

Sustainable development is the principle for meeting human development goals while simultaneously sustaining the ability of natural systems to provide the natural resources and ecosystem services on which the economy and society depend. Human societies have been failing to attain or retain this process of sustainable development for various reasons. Factors like loss of biodiversity, scarcity of natural resources, climate change have been placing the human societies under stress for the last couple of decades. Indications like human consumption is extracting more natural resources than can be replenished by ecosystems have make sustainability a huge threat for our future generations. Even though the nature is resilient and it does regenerate, there are limits to what can be extracted (Geoffrey, W.1997).

Herein lies the connection between ecosystem services and sustainable development. The key to sustainable development is achieving a balance between the man-made exploitation of natural resources for socio-economic development, and conserving ecosystem services that are critical to everyone’s wellbeing and livelihoods. Environmental or ecological restoration is one of the important pillars of sustainable development to regain the natural cycle of a balanced

ecosystem again. The term ecological restoration emerged as a separate concept in ecology in the late twentieth century. This concept deals with the practice of renewing and restoring degraded, damaged, or destroyed ecosystems and habitats in the environment by active human intervention and action. The maintenance of the prime services an ecosystem provides are the main target of this concept.

2.2 Ecotourism

The acceptance of the concept of sustainable development in the majority of countries when discussing tourism leads to ecotourism. This term consists of two terms of ecology and tourism. Eco-tourism has been developed during the environmental movement which appeared at the beginning of the seventies. The concept of ecotourism is mainly of ambiguity and dispute. Ecotourism needs to be both ecologically and socially conscious. Its goal is to minimize the impact that tourism has on specific areas through cooperation and management and encouraging travelers to have a positive impact on their surroundings. Besides, the growing interest of people for environment and trips oriented towards fresh air and nature, in addition to the growing dissatisfaction towards mass tourism, highlighted the need for ecotourism in the tourism industry. It is a sustainable form of environment-based tourism that combines environment and economy while seeking to minimize harmful impacts focusing on local culture. This category of tourism industry also helps in the local and global economic development by making employment opportunities for local people. (Anindya, H. 2013)

Eco-tourism ensures a destination that is abundant in environmental amenities. Environmental amenity refers having access to environmental good such as clean air or clean water and also refers to its quality of reducing adverse health effects for the residents. To promote such tourism it is significantly necessary to have a destination that offers healthy environmental amenities. Generally natural environment which is not polluted, minimizes the negative impacts of tourism, contributes to conservation efforts, cooperates with local people to manage natural

areas and supports the local economy are suitable for such tourism. Eco-tourism in today's world is very important regarding the global climate change as well as environmental development conflict. Because, it actively contributes to the natural and cultural heritage protection including local and native populations in its planning and development. (Fennell, D (1999).

Bangladesh is a land of hills, valleys, forests, beaches, lakes and rivers and an enriched culture. Specially the Chittagong Hill Tracts that provides a truly pristine destination for travelers. She can be an eco-tourist hub with all the attractions lying hither and thither, if all the eco-tourism development aspects are properly addressed. Bangladesh has already adopted National Tourism Policy in the year 2010 (National Tourism Board Bangladesh). Since eco-tourism considers community gain and cultural appropriateness, the main objective of this policy is to develop eco-tourism with a wing of sustainable development. And it can be achieved through conservation and preservation of cultural values of the local community via their participation and sharing benefits. Through this policy, a platform has already been created to improve the inflow of national and international currencies at local level of Bangladesh. Preserving our lands and unearthing new innovative measures to sustain a responsibly managed and nature-preserving environment is one of the growing concerns now. The practice of eco-tourism can help both the economic trends and environmental management if properly developed philosophies can be formed and implemented.

Bangladesh Economic Review (2010) states that Bangladesh has three principal sectors of generating revenue: industry, agriculture and service. Tourism is an important part of the service sector which contributes to the GDP of Bangladesh. The contribution of tourism in GDP has raised from 7% in 2004-05 to 9.44% by the year 2009-10. The number of tourist arrivals in Bangladesh has increased to 258,650 in 2015 from 207,662 in 2006 which shows

the increase in demand. But the GDP decreased to 4.1% in 2014-15. This happened due to lack of nourishment, available research, fund and proper marketing strategy (Hossain, M. A. 2006). Bangladesh Parjaton Corporation could not yet develop effective promotional strategies. As a result, tourism industry could not get room to grow correctly in Bangladesh. Effective promotional strategies like advertising, sales promotion, public relations, direct marketing, interactive marketing, niche marketing etc. are very essential for the improvement of tourism industry in a developing country like Bangladesh. The country would be able to combine economy and environment if Bangladesh attempts to focus on our land as an eco-tourist destination and attracts tourists through effective promotional policies (Haque, M. 2005).

Besides promotional strategies there are a lot of other challenges of eco-tourism marketing in Bangladesh that need to be addressed. Degradation of evergreen forests, extinction of plants and animals species, land encroachment in forests, commercial cultivation, violation of forest and environmental laws, changes of landscape, salinity intrusion, expansion of settlements and over-exploitation of fisheries resources, sanitation problems, uncontrolled urbanization, lack of pollution free environment, lack of biodiversity and absence of training institute related to eco-tourism are some major issues that create obstacles for eco-tourism to flourish in Bangladesh.

2.3 Eco-resort

A resort generally means a self-contained commercial establishment that tries to provide most of a vacationer's wants, such as food, drink, lodging, sports, entertainment, and shopping, on the premises. An ecological resort can be defined as environmentally sustainable resort whose facilities are intended to have a minimal impact on the local environment. One of the interpretations of the term ecology includes "defense and protection of nature and environment", an ecological resort is thus one that is fully integrated into the environment

without damaging it and benefitting the sustainable growth of the tourism industry. An eco-resort must usually meet some criteria such as dependence on the natural environment, ecological sustainability, provision of environmental training programs and incorporation of cultural considerations.

Eco-resorts have become an increasingly popular alternative in the tourism industry. The main reasons behind the growing popularity of eco-resorts are: the widespread changes in the environmental attitude, development in the environmental education and environmental mass media. Gray's travel-motivation theory also gives us a motive which can help us understand why people prefer such natural settings for recreation. It is the desire to go from a known to an unknown place. For example, people who live in cities are motivated to travel as tourists to less chaotic areas because they need to escape from an artificial, monotonous environment. Moreover, the intrinsic motivation of the tourists can also encourage them to pursue such kind of tourism. Four intrinsic tourist motives for such encouragements are: motive to experience the environment, motive to rest and relax in pleasant settings, motive to pursue special interests and skills (swimming, fishing), and motive to be healthy and fit. Meanwhile, the aim of such built forms are to create a harmonizing relationship between human and nature without disturbing the ecological balance (Pearce, Morrison and Rutledge, 1998). In a developing country such as ours, eco-resorts are still more of a new concept. They are ventures brimming with benefits that are economic, social, and environmental. At present there are a few eco resorts established in Bangladesh like the Mermaid eco-resort in Cox’s Bazar, Rajendra eco-resort in Gazipur, Rainforesrt resort in Sreemangal, Hill side resort in Banderban etc.

2.4 Design standards and guidelines for eco-resort development

The design guidelines of an eco-resort comprises of both architectural and non-architectural interventions and strategies that help maximize the emission of carbon foot print (Early, K. 2011). Those suggest the followings:

- Minimum use of energy consuming and pollutant machines
- Maximum use of renewable energies especially solar storage with water
- Reduction of environmental pollution resulted from use of fossil fuels
- Reduction of the need to finite energies for heating and cooling
- Ensuring natural ventilation (fresh-air exchange system)
- Grey water recycling and waste management

2.5 The key development considerations of an eco-resort

The following design considerations are suggested for designing an eco-resort:

- Contribute in the sustainable development of ecosystem: To maintain a healthy balance of the ecosystem services, protecting the encompassing flora and fauna is very important. Avoiding utilization of poisons and pesticides and mixing cleanser in water bodies are to be considered to retain the existing ecological nature. Polythene and plastics being non-biodegradable must not be utilized and littered within the area. It is expected to carry back all non-degradable litter, for example, empty bottles, tins, plastic items etc. and should be arranged to be littered in metropolitan dustbins.
- Promote efficient use of energies: Maximizing energy efficiency through elective and manageable methods can help minimize carbon foot print. Passive lighting, rainwater harvesting, watchful taking care of strong waste and transfer of sewage, grey water recycling and avoiding use of wood for fuel are some of the ways to reduce demand for energy imports and the amount of energy required to provide products and services.

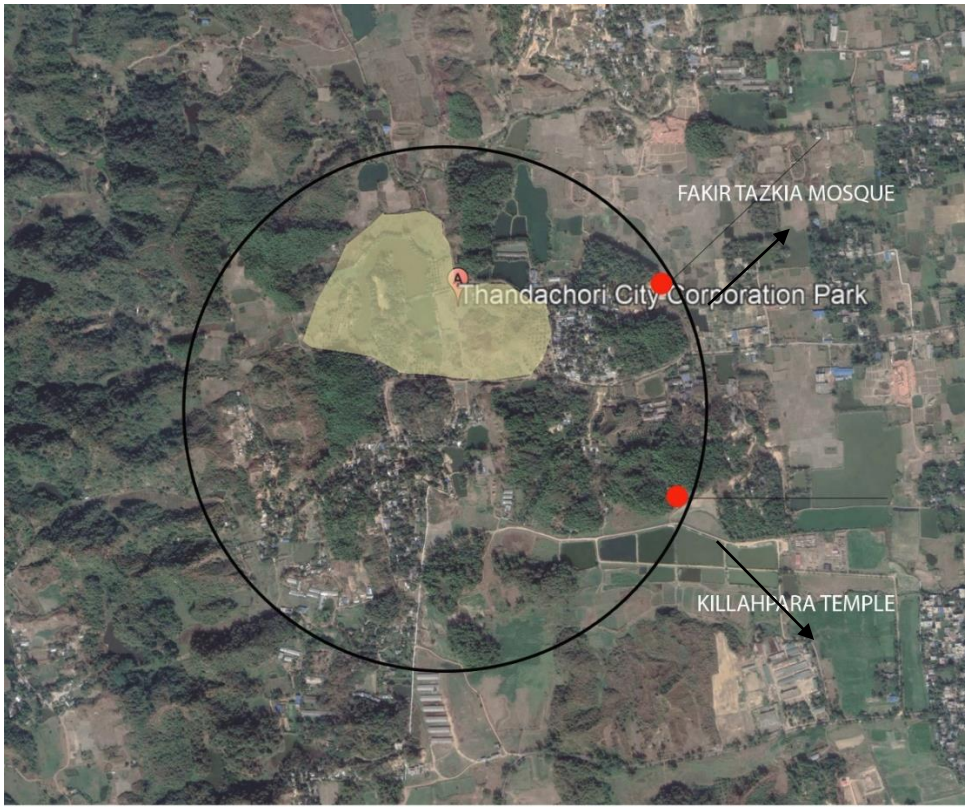
Chapter 3: Site Appraisal

The site location of this project is Thandachhori, Chittagong. The site offers a pristine nature due to being surrounded by lush greeneries, lakes and hills. The scenic beauty of the site has turned it into a park where a large number of people gather every weekend to escape the hustle and bustle of the chaotic city life.

3.1 Site surroundings

The site is surrounded mostly by hilly areas and dense forestations with hints of water bodies here and there. The only landmarks available around the site area are Fakir Tazkia mosque and Killahpara temple.

Figure 2: Landmarks surrounding the site



(Source: Google Earth)

3.2 Historical development of the site

The site initially was not as rich in environmental amenities as it is today. It was mostly a barren land with hills and hillocks. Over the years it has been nurtured with care and dedication by the owners to form an ecological hub. A huge portion of the planation in the site is man-made, so is the lake which is located in the middle of the site. The goal of Chittagong City Corporation was to create a bio diversified zone that enhances the ecosystem of the site. Their interventions have made the site ecologically more developed than it originally was.

3.3 Geographical Characteristics of the Site

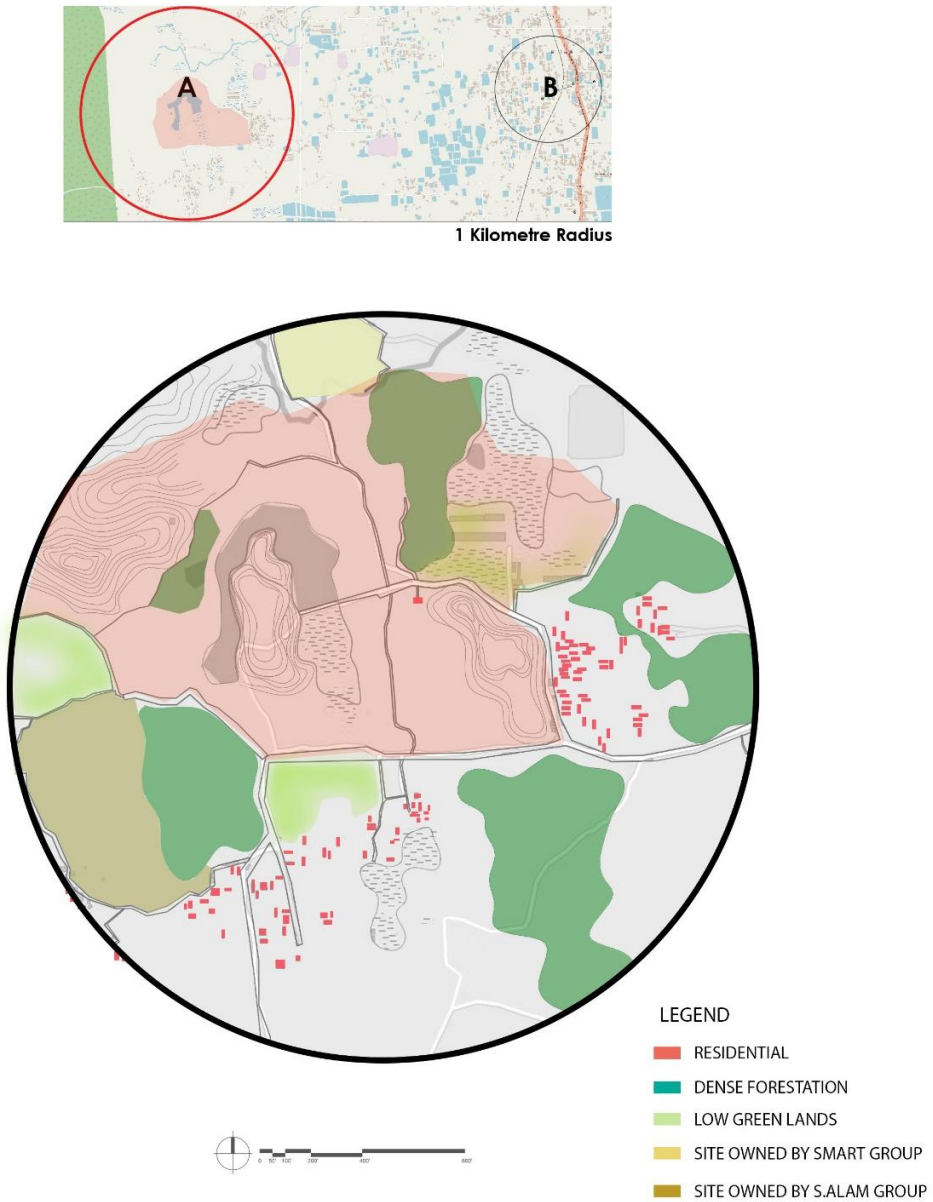
The site is rich and diverse in its topographical nature. It is surrounded by hills and hillocks, green low lands, water bodies and densely planted trees from all sides. The largest hill surrounds the site from the north western part and the rest of the two hills are inside the site. One of which is located in the entrance (south-eastern side) and has the highest peak of 60 feet. The other one is right in the middle of the site surrounded by a U-shaped lake and has a peak of 40 feet. The rest of the site is mainly flat land which is home to multifarious indigenous plants. The lake has a depth of 15 feet and has the highest water level of only 12 feet during monsoon season.

3.4 Land-use Pattern of the Surroundings

The immediate surroundings of the site is mainly densely populated with forestations and hills. The only trace of land use pattern around the site is residential, having residents of lower-lower income group. Apart from the residences, two properties located near the site are owned by two of the renowned private groups of Chittagong named as S.Alam group and Smart group, having said that the rest of the lands are mostly owned by Chittagong City Corporation. Where smart group has future plans of developing an electro-chemical industry in their plot, S.Alam group has plans of making a solar power plant in theirs. Mostly barren lands or green fields can

be detected on both sides of the road that lead towards the site from the main road, with a hint of scattered settlements here and there. Only a few mixed use and commercial land use patterns are noticeable in the areas around the main road. These act as sources of supporting facilities for the people residing within the area. The main road is however packed with some of the important community based functions, such as the Fateyabad College, Fateyabad post office, Chowdhuryhat bazar, Chowdhuryhat mosque and Chowdhuryhat nursing home.

Figure 3: Land-use pattern of the immediate site surrounding



(Source: Open Street view map)

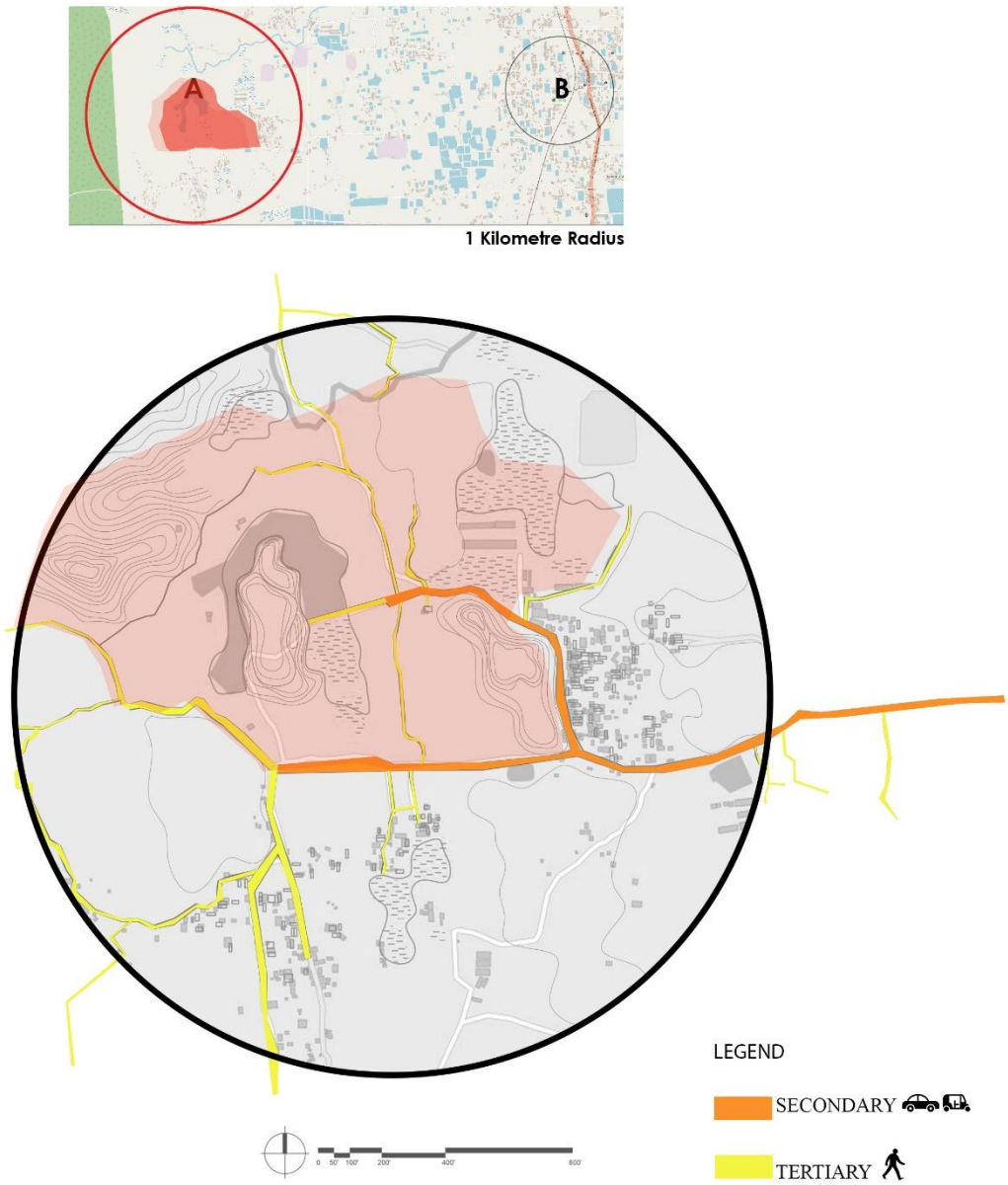
Figure 4: Land-use pattern around the main road (point B)

(Source: Open Street view map)

3.5 Accessibility and Connectivity

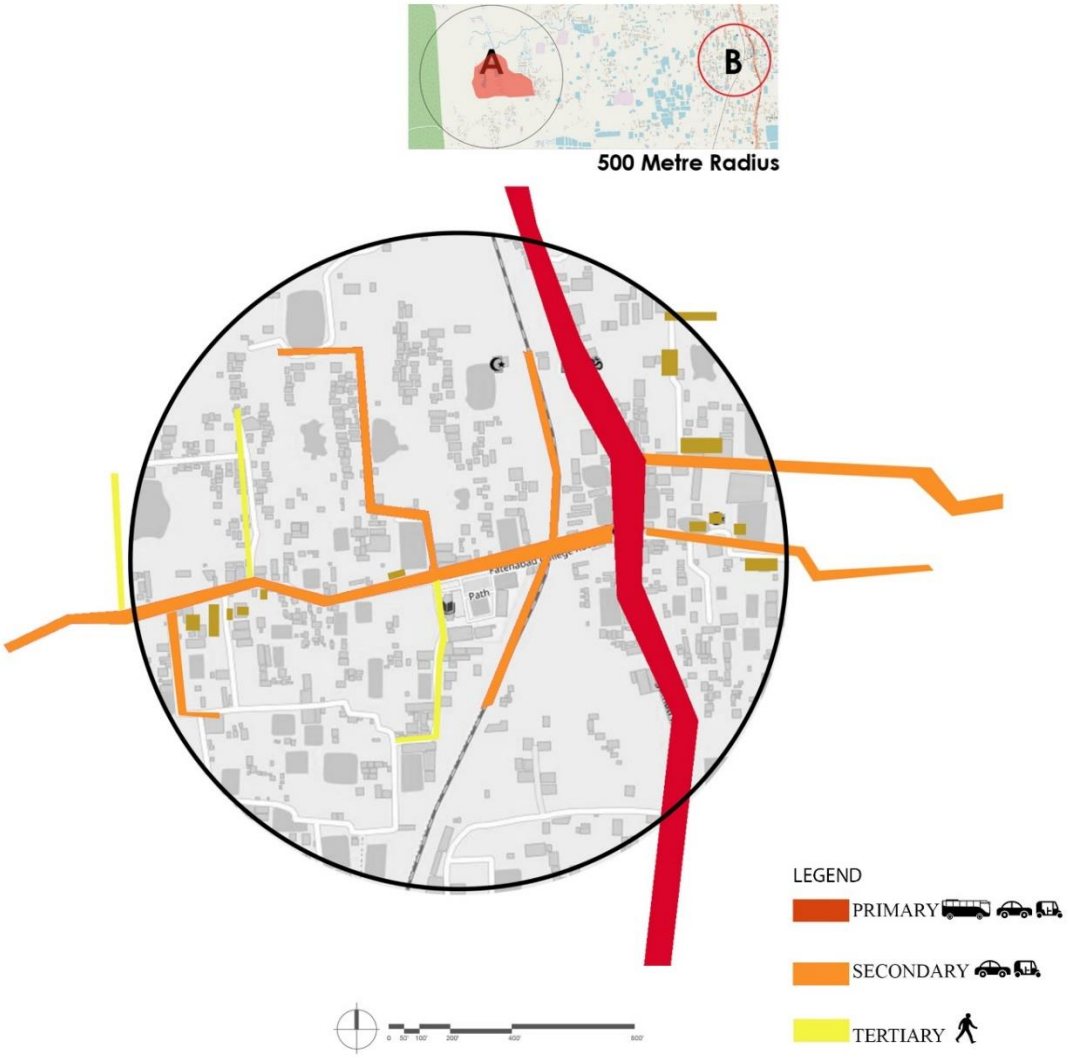
The site is accessible by a secondary road that branches out of the primary road. The primary road leads from Bara dighir par to Fateyabad and only motorized vehicles such as buses, cars, taxis are allowed on that road. However, the secondary road that goes to the site from the main road gives access to only cars and taxis. This road ends around the private plot of S.Alam group from where the rest of the site and its surroundings have to be explored on foot. Some of the pedestrian walkways around the site have been there for a long time whereas some were made for the conveniences of the people living around the site. One of such man-made walkways leads to the site and insensitively divides the lake into two portions. The site is directly accessible only from the southern and eastern side via both secondary and tertiary roads.

Figure 5: Accessibility to the site



(Source: Open Street view map)

Figure 6: Accessibility to the site from the main road



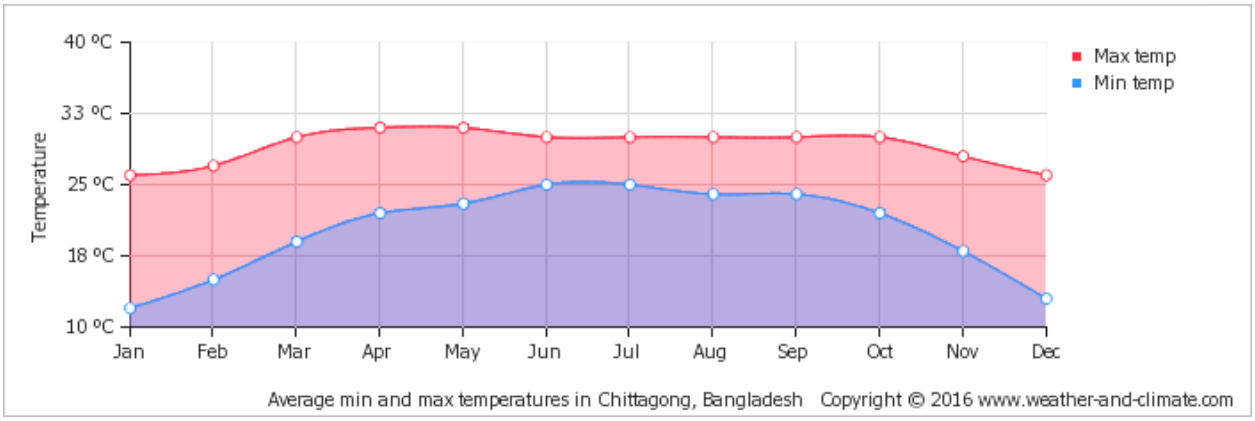
(Source: Open Street view map)

3.6 Climatic Conditions

The weather of Chittagong is characterized by tropical monsoon climate. The dry and cool season is from November to March; pre-monsoon season is from April to May which is very

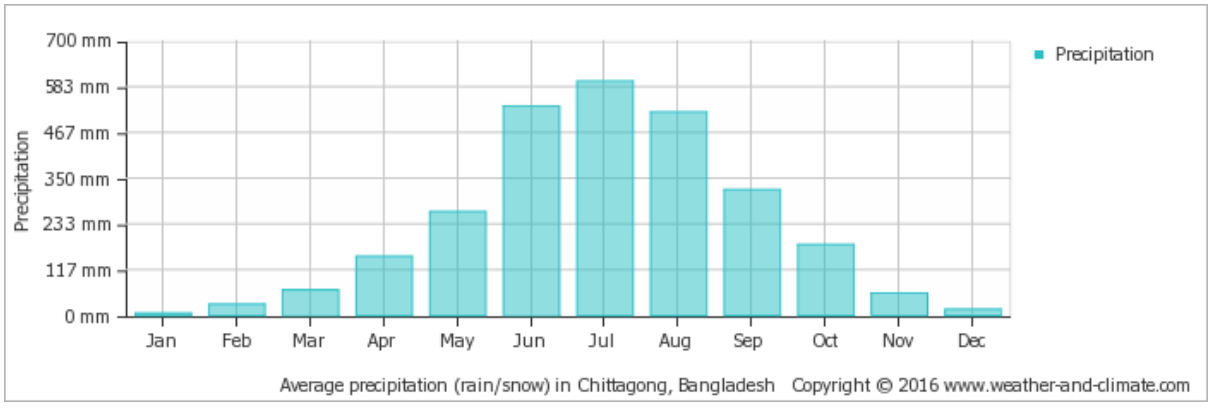
hot. The sunny and the monsoon season is from June to October, which is warm, cloudy and wet. The climatic condition of the site is significantly similar to the climatic condition of the entire city. On an average, rain prevails from the month of April-October, the temperature is moderately high around the year but the warmest in the month of April, December and January comparatively has a dry and cold weather and it is the wettest in the month of July.

Figure 7: Average minimum and maximum temperature of the year



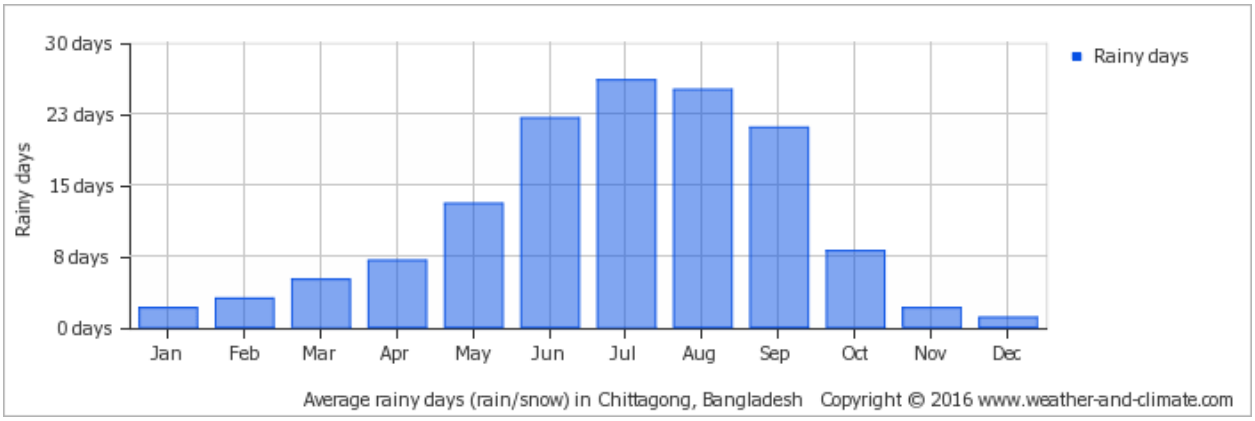
(Source: Bangladesh meteorological department)

Figure 8: Average monthly precipitation of the year



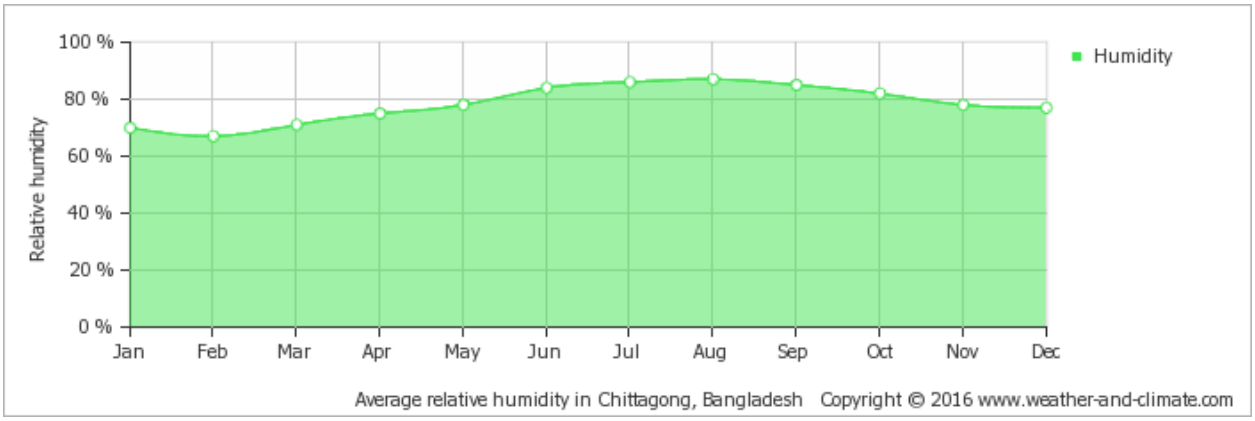
(Source: Bangladesh meteorological department)

Figure 9: Average monthly rainy days in Chittagong



(Source: Bangladesh meteorological department)

Figure 10: Average humidity of the year



(Source: Bangladesh meteorological department)

These climatic conditions can be addressed in the project through design solutions by having proper shading elements for the summer season and rainwater management system for the rainy season to avoid excessive water clogging.

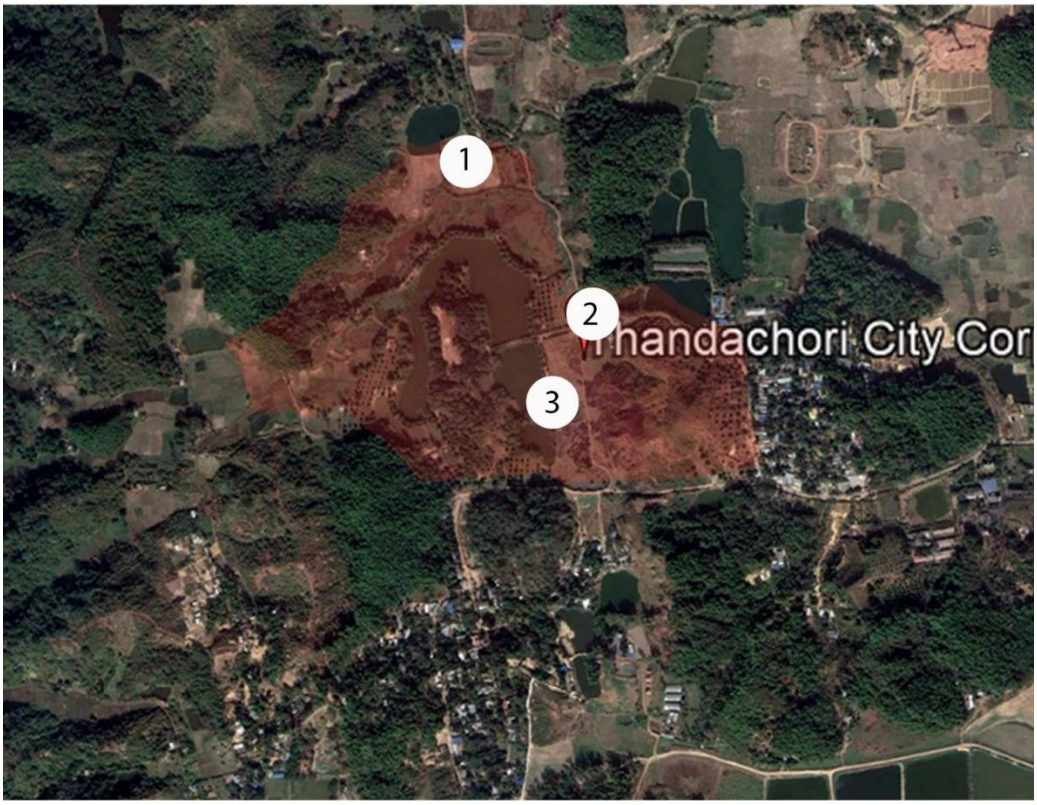
3.7 Socio-Cultural and Economic Contexts

Settlements located in a closer proximity to the site mainly consists of lower-lower income group of people. They are mainly daily labors with an average salary of 700/800 Tk per day. Scattered human habitats found in the nooks and corners within a 2km radius of the site has

residents of varying income group from lower-lower to lower-middle. The socio-economic condition around the site suggests that the potential users of the site will come mainly from the city which takes about 30 minutes of travel time. The lack and need of such category of tourism in Chittagong is bound to have visitors from all around the main city (both for short stay and daily visits). Apart from that, one of the main targets of the project is to attract visitors from different cities and even countries to promote the idea of ecotourism.

3.8 Site images

Figure 11: Indication of images from the site



(Source: Google Earth)

Image 1: View of the mountains in the entrance from eastern side

Image 2: View of the man-made road that divided the lake

Image 3: View of the U-shaped Lake at the turning point

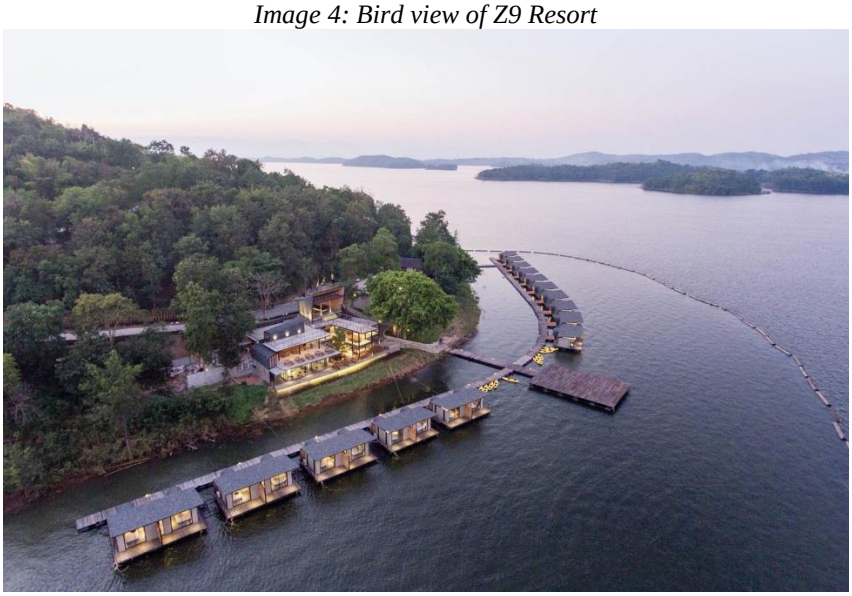
Chapter 4: Case Study Appraisal

Case studies are processes of researching a project to gain adequate knowledge about that particular project. It helps in intense observation of methods, characteristics, standards etc. and assists in understanding the functional, contextual and ideological aspects of a design. In this following chapter four case studies will be discussed. One of which is local and the rest three are international. The reasons behind choosing the case studies were based on their environmental responsive designs and addressing sustainability factors.

4.1 Z9 Resort

- Architect: Dersyn Studio
- Location: Kanchanaburi, Mueang Kanchanaburi District, Kanchanaburi, Thailand
- Site Area: 3100.0 sqm
- Category: Sustainability
- Project year: 2017
- Rationale: To study methods of approaching a design for minimizing its carbon foot print all the while respecting the topographic characteristics of the site.

Image 4: Bird view of Z9 Resort



(Source: ArchDaily)

4.1.1 Environment and micro climate

Mueang Kanchanaburi is the capital district of Kanchanaburi Province in central Thailand. The site of the resort is located right beside Sinakharin Lake on Tambon Tha Kradan road. The Erawan national park waterfalls and mountains are about 15km away from the site and is one of the popular tourist attractions among the guests. The main climate of this place is very similar to the rest of the central Thailand. The month with the highest temperature is April (38.2°C) and the month with the lowest is during the coldest month of December (19.6°C). The month with the highest relative humidity is October (80%) and the month with the lowest relative humidity is March (61%). The wettest month of the year is generally around September while the driest month (with the lowest rainfall) is January. The climate does change quite often around the year.

4.1.2 Form and function

The form of the resort resembles the curvilinear lines of the waves of a lake and contours of a hill. The shapes and color has intimately been blended with the attractiveness of mountain and lake view. The proportion of the resorts is also in line with the environment. While the curve lines represent the natural lake-side context the lobby is designed based on lunar direction that allows guests to enjoy the scenic sunrise and sunset. The architecture has a compelling curvilinear roof that is both easily extendible and in harmony with its natural context. The main service zone is on the land visibly separated from the resorts and the floating resorts on the water have a view of the mountains on one side and lake on the other. This separation was intended to secure privacy for the guests while they enjoy the serenity of the nature.

Image 5: Curvilinear roof of the resort

Figure 12: Zoning of Z9 Resort

(Source: ArchDaily)

4.1.3 Design details

Sustainable design approaches based on the 3R (Reuse, Reduce and Recycle) concept have been used in this project in many ways. Reuse concept was achieved by using wood from the previously existing resort before this resort was rebuilt. The old wood were used for resort decorations. OSB Board which has been used as the ceiling material was also another aspect of the reuse concept. This is because the OSB Boards used there were created by compressing layers of wood flakes. Secondly, very few site contour adjustments were applied in the site to create as less environmental footprint as possible. This helped in the reduction of adverse effects on the topography of the site. Thirdly existing large woods were recycled and adjusted for in-door furniture. Moreover close circuit water treatment was applied to treat and recycle the water before drainage into the lake.

Image 6: Design details of the resort

(Source: ArchDaily)

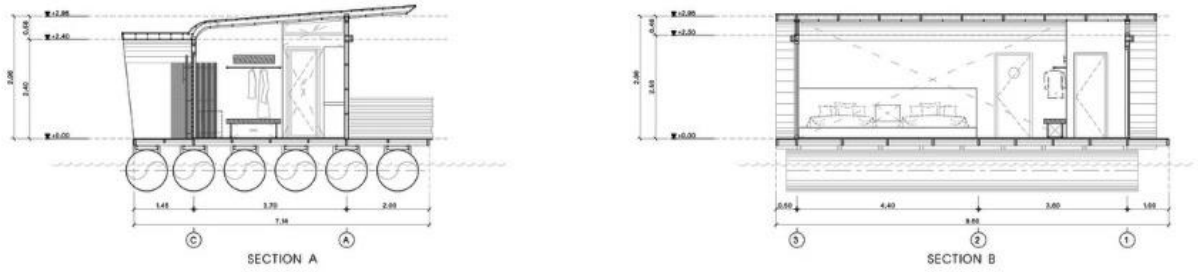
4.1.4 Structural details

The resort is famous for their appropriate use of materials and its nature-oriented structure. Each building ensures natural ventilation and proper light. Light-weight structure like steel structure was used to build this resort. Steel structure promote eco-friendly outcome in many ways. For example, the wider span which means less on-ground touching and can be adjusted

to suit with the existing footing, faster and cleaner construction in comparison with concrete structure.

Image 7: Structural details

Figure 13: Sections of Z9 Resort



(Source: ArchDaily)

4.2 Dali Munwood Lakeside Resort Hotel

- Architect: Init Design Office
- Location: Dali, Yunan, China
- Site Area: 1000 sqm
- Category: Extension
- Project year: 2015
- Rationale: To study the connection between the resort and the environmental amenities of the site.

Image 8: Perspective of Dali Munwood Resort

(Source: ArchDaily)

4.2.1 Environment and micro climate

Dali lies on high plateau which is about 1,975 meters above sea level and on a low latitude in the northern hemisphere. The climate of Dali is typically characterized as a subtropical highland monsoon climate with sunny and breezy weather most days. The site is located in west road, Erhai Lake, Jiapeng village, Dali. It is known as the smallest natural village around Erhai Lake. The village is surrounded by the unique landscape of Haixi wetland that offers a pristine view of clear blue sky, lake and waterfalls and with willow catkins seen fluttering everywhere. The village is beautiful and quiet with five or six resorts along the shoreline, Munwood Lakeside Resort being one of them. This resort is mainly an expanded and reconstructed version of a rentable farm house that was transformed from an area of 300 sqm to 1000 sqm.

4.2.2 User behavior and requirements

“A building belonging to the site”-Architect Chen Jun. The team of architects working in the extension of this project wanted to make sure that this project would serve and welcome users of all group from around the site. There was a boundary of stone walls separating the surrounding neighbors completely from the resort. The boundary wall wasn’t completely eliminated but rather treated in some places to create sitting spots for passersby.

Multi-level public spaces were also created inside the resort to establish a relationship between the guests and Erhai Lake from multi dimensions, without the guests having to interfere with each other. The separation in levels of spaces make sure the guests enjoy the lake view in solitude.

Image 9: Boundary wall turned into sitting spots

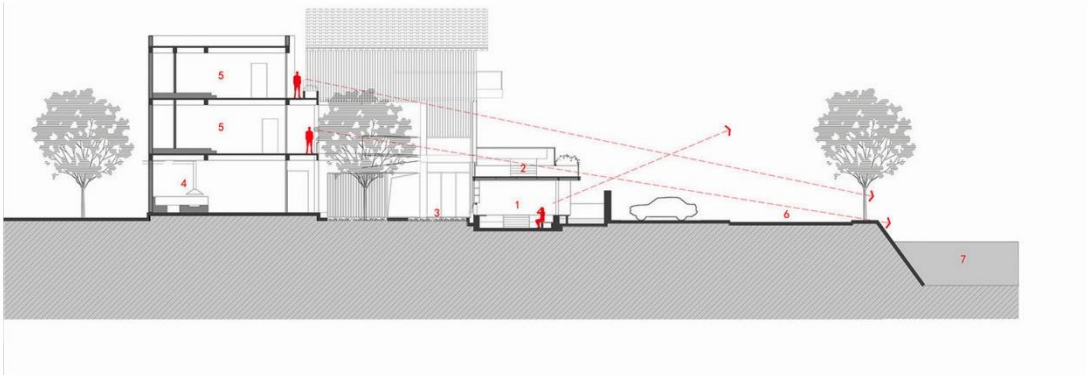
(Source: ArchDaily)

4.2.3 Site planning and landscape detailing

The most difficult part of the design was to cross the front road and enjoy the Erhai Lake closely. The road separating the building from the lake was quite difficult to deal with. Which is why a half sinking public space was designed to make a link. Space below the partition helps make a psychological link with the water. The platform built on the space established a more direct relationship with the Erhai Lake and being made in steel structure it stood out uniquely

from the main body. Moreover, the building on the right side of the platform was kept open to give the resort a lighter look from the roadside among all the thick surrounding houses.

Figure 14: Section of the resort showing the interactive platform that links the resort and the water body

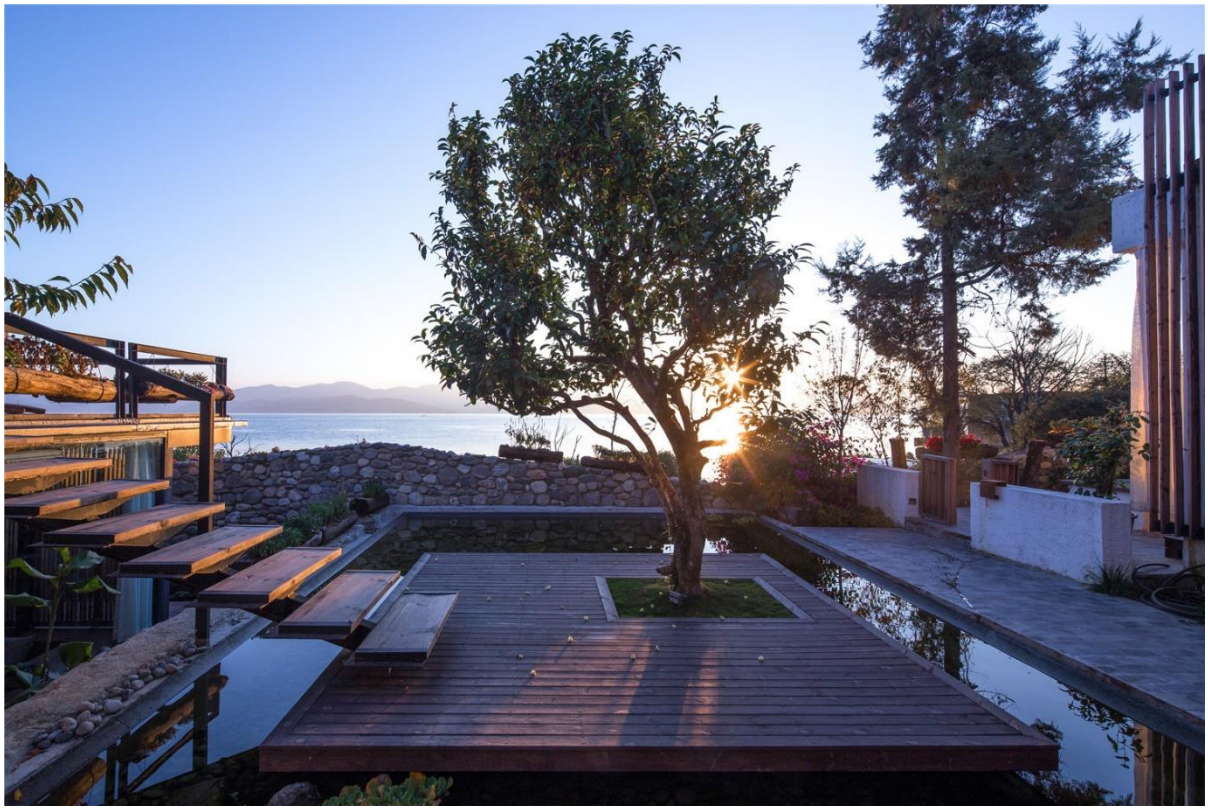


(Source: ArchDaily)

4.2.4 Design details

One of the important considerations of this project was to take full advantage of the local climate through introducing solar hot water system. This initiative helped saving both water and energy. Recycling water was particularly a major concern of the project since the municipal sewage pipe network did not function properly. This dysfunctional pipe system caused both wastage and scarcity of water. The architects managed to set a 10 ton water treatment system to purify and reuse grey water for landscape. To create awareness and portray a responsible attitude towards natural environment they set up the display window of the water system at the main entrance of the hotel. Furthermore, to convey the idea of environmental protection and preservation design to the guests a one-hundred-year old tea tree was planted in the heart of water courtyard.

Image 10: A hundred year old tree planted in the heart of water courtyard



(Source: ArchDaily)

4.2.5 Horizontal and vertical circulation

Vertical circulation like stairs are not only used to go to one floor from another but also used to go the terraces and decks designed at multiple levels. The stairs make it easier to see the levels visually and help go from one level to another. However the horizontal circulation is kept quite minimum in the first floor, it only leads to the rooms and one public terrace from the stairs.

Figure 15: Vertical and horizontal circulation of the plans

(Source: ArchDaily)

4.2.6 Structural details

The structure of the resort focuses on the relationship between modern and traditional architectures. Low technology was one of the strategic approaches, it means to select the regular structure and construction system but under the restriction of cost and local construction conditions. However, the contemporary expression of the resort was achieved with plain materials by employing stone walls in frame system which also creates an opportunity to approach the local artisans. Reuse of old materials like local dismantled woods were used in indoor furniture furnishings and as internal structural elements (beams).

Image 11: Structural detals: Use of recycled woods

(Source: ArchDaily)

4.3 Naman Retreat and Spa Resort

- Architect: MIA Design Studio
- Location: Da Nang, Da Nang, Vietnam
- Site Area: 1600 sqm
- Category: Retreat and spa
- Project year: 2015
- Rationale: To study the flow of natural ventilation and the integration of green spaces within the building.

Image 12: Perspective of Naman Resort

(Source: ArchDaily)

4.3.1 Environment and micro climate

The site is located near to My Khe Beach, Danang, Vietnam. The beachfront resort is situated at a distance of 5km from the popular tourist attraction Marble Mountains. The climate of this site is generally tropical. While dry season lasts from February-August, monsoons are possible in the wet season of September-January.

4.3.2 Design details

The resort is comprised of 1-3 bedroom villas with private pools, hot tubs, kitchens, living rooms, dining areas and terraces, some of which are set on rooftops with sea views. Dining options include a Vietnamese restaurant, a BBQ cafe, and a poolside bar with live music. The resort also offers beachside yoga decks, cooking classes, an outdoor pool and a premium spa with steam rooms, sauna and a gym.The rooms are endowed with lush open air gardens. The beautiful landscape of those gardens flow into the interior spaces of the resort giving the guests a refreshing experience. While the natural ventilation keeps the building cool the local plants from the vertical garden create a healing environment throughout the entire resort. The ground floor of the resort contains lobby spaces connected to relaxing platforms surrounded by serene lotus ponds and hanging gardens.

Image 13: Interior perspectives (play of shades and lights)

(Source: ArchDaily)

Figure 16: Flow of air via several layers of green roofs

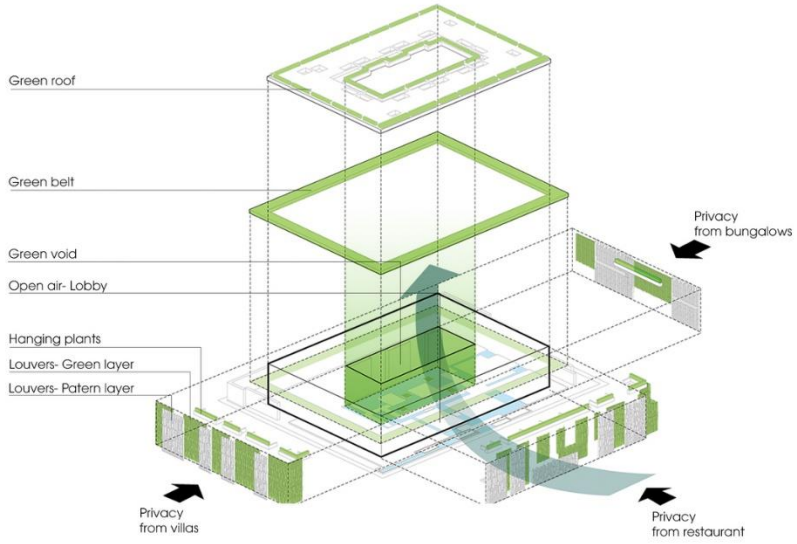
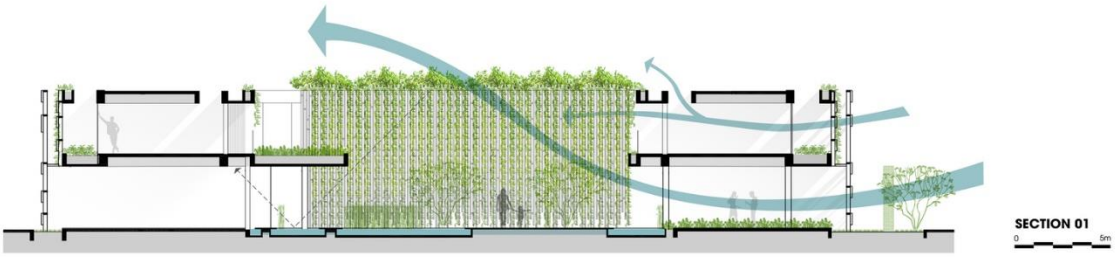


Figure 17: Natural ventilation flow through central courtyard



(Source: ArchDaily)

4.3.3 Horizontal and vertical circulation

The horizontal circulation is like an ambulatory path that surrounds the central courtyard space. It connects all the recreational facilities of the ground floor to the courtyard and connects the rooms to the double height space in the second floor. The vertical circulation is situated in a symmetrical position at both ends of the plan.

Figure 18: Vertical and horizontal circulation in the plans

(Source: ArchDaily)

4.3.4 Structural details

The facade of the resort is composed by white lattice patterns alternated with hanging gardens that filter the strong tropical sunlight into a pleasant play of light and shadow on the textured walls. Various plants are carefully allocated in the vertical landscape of the facade to form

screen like elements. The purpose of the screens are to make the internal spaces more breathable.

Image 14: Structural details (white lattice work to form screen like elements)

(Source: ArchDaily)

4.4 Sairu Hill Resort

- Architect: DOMUS Architects
- Location: Bandarban, Chiittagong
- Site Area: 12 acres.
- Category: Hill resort
- Project year: 2016
- Rationale: To study the flow of natural ventilation and the integration of green spaces within the building.

Image 15: Perspective of Sairu Hill Resort

(Source: Naila Binte Zakaria, Showcase Magazine, 2017)

4.4.1 Environment and micro climate

Sairu Hill Resort is located against the spectacular greeneries and mountain range of Bandarban in the Chittagong Hill Tracts. It is renowned for its natural beauty and considered as the heart of Buddhist culture within Bangladesh. Bandarban is a district located in the South-Eastern part of Bangladesh. The resort is conveniently located only 18 km away from the main Bandarban Town, at the Y junction of the road from Bandarban to Chimbuk. It takes approximately 40 minutes to drive through this scenic hilly terrain on a road that ascends and descends along the curves of the hills. The site of the resort has a 360º panoramic view with low drifting clouds from March-September which creates an ambience of cohabitation with the clouds. The site also overlooks Shangu River, the Bay of Bengal and the hilly range along the Myanmar border. The Bay of Bengal is visible on the horizon on a clear sunny day. The climate of Bandarban is generally tropical with an average temperature of 25.9 °C and significant rainfall most months, with a very short dry season.

4.4.2 Site planning and landscape details

The concept behind designing this contemporary hill resort was the ‘less is more’ principle. Because of being a hilly area and lacking solid chunk of plane land, the planning and designing of the resort was quite a challenging task. Thus the master plan was designed being considerate and sensitive towards the site and surroundings. Not only the existing trees were left untouched but also more plants were added while shaping the landscape of the resort. It was kept into consideration that besides keeping the contours intact the pristine beauty of nature could not be damaged unless it blended with the topography. Even though the construction of Sairu Resort is a sensitive response to nature, only exception to it was the driveway. It had to be scrapped and curved out of the hill. Water had to be sourced from a spring almost 1200 feet below the Resort site which turned out to be hazardous task.

Image 16: Plan of Sairu Hill Resort from bird eye view

(Source: Naila Binte Zakaria, Showcase Magazine, 2017)

4.4.3 Design details

There are five types of rooms at Sairu Hill Resort. All rooms are fully air-conditioned, well-furnished and comes with private bathrooms and balconies. The types of rooms are as follows:

- Premium suites
- Executive suites
- Rooms with Shangu river view
- Rooms with Shangu river view and terrace
- Cottage

The other functions provided by the resort are dining facilities, conference rooms and pool zones. The internal spaces of the resort were designed taking full advantage of the topography to help obtain maximum panoramic views of the hills and river. Because of such panoramic sights of the tall hills and river, every view from the resort is a treat to the eyes. The terraces offer scenic beauty of the cotton clouds floating in the sky. Cottages on the other have beautiful balconies that is surrounded around an 80 feet tall old Shimul tree. The 60 feet diameter podium around the Shimul tree is a perfect venue for leisure hangout and conducting various cultural program.

Image 17: Family cottages and the common space that connects t each balconies

Image 18: Design details (use of vernacular materials)

(Source: Naila Binte Zakaria, Showcase Magazine, 2017)

4.4.4 Structure details

To respect the topography of the site most of the structures were built on steel stilts to minimize any change in the natural contours. To achieve the rustic outlook which seamlessly blend with nature local materials such as stones and bamboos were used.

Image 19: Structural details

(Source: Naila Binte Zakaria, Showcase Magazine, 2017)

Chapter 5: Program Appraisal

The following chapter discusses the given programs for Eco Resort and Tourist Complex. The given program mainly consists of administrative facilities, accommodation, recreational facilities, dining facilities and supporting facilities. However, the programs have been revised in order to achieve the maximum efficiency of a space as per case study, standards and site study.

5.1 Administrative facilities

The administrative facilities initially did not consist of accountant's office and sales and marketing managers' office. To run a resort the financial aspects need to be monitored under an accountant's supervision, so is sales and marketing department necessary for the commercial sector of the project to function. However, the allocated number of tourist guide has been reduced from 6 to 4 as there are not many touristic activities for them to guide. The number of meeting rooms has also been decreased from 10 to 4 as only limited number of people from administrative department will be using those rooms for meeting.

	Functional space	Number of units	Number of users	Area per unit (in sft)	Total area (in sft)
A.	Administrative facilities				
1	Reception lobby	1	30	800	800
2	Luggage room	1	variable	220	220
3	GMA office	1	1	350	350
4	GMC office	2	2	250	500
5	Tour guide's office	2	4	600	1200
6	Accountant's office	1	2	250	250
7	Meeting rooms	4	variable	250	1000
8	Sales and marketing manager's office	1	2	250	250
9	Prayer room	1	12	120	120
10	Security guard room	1	1	100	100
11	Storage	1	variable	300	300
12	Medical services	1	3	500	500
13	Toilet	2	variable	130	260
				Subtotal	5,850

5.2 Accommodation

The given list of programs only had options of three variety of cottages and luxury suites for the guests who will come for a short stay. But the socio economic aspects of Bangladesh suggest that it is necessary to have deluxe and deluxe twin rooms for the resort to be accessible and affordable to a wide range of user groups from all over the country and the city Chittagong itself. However the numbers of housekeepers and their accommodation for 20 rooms have been suggested on the basis of housekeeping radius cover of a resort. A housekeeper cleans approximately 15-18 rooms per shift and a resort of 100 rooms thus require 8/9 housekeepers.

B.	Accommodation				
14	Double bed cottage	12	2	700	8400
15	2 bed duplex cottage	8	4	1200	9600
16	3 bed duplex cottage	2	6	1200	2400
17	Luxury suites	2	2	1000	2000
18	Deluxe rooms	15	30	400	6000
19	Deluxe twin room	15	30	400	6000
20	Staff quarter	10	20	280	2800
21	Housekeeping	10	20	280	2800
				Subtotal	40,000

5.3 Supporting recreational facilities for guests

These are the functions accessible to only the guests staying in the resort. Recreational functions like Karaoke lounge and VR lounge have been added to provide entertainment for varying age groups visiting the resort. Facilities like swimming pool with a pool bar and a badminton court with children play zone are also available.

C.	Supporting facilities for guests				
22	Indoor game zone	1	80	1600	1600
23	Children play zone	1	50	800	800
24	Meditation and Zen garden	1	55	1000	1000
25	Fitness Centre and Spa	1	150	3500	3500
26	Karaoke Lounge	1	100	1600	1600
27	VR Lounge	1	50	1600	1600
				Subtotal	10,100

5.4 Supporting recreational facilities for visitors

The following functions will be provided for the daily visitors visiting the site only for recreational purpose. However, the given list of programs had an additional auditorium proposed besides the multipurpose hall. But since the multipurpose hall can be rented for various occasions and has flexibility in sitting arrangements, the auditorium hall was eliminated.

D.	Facilities for visitors				
28	Manager's room	1	2	400	400
29	Restaurant	1	300	3500	3500
30	Auxiliary kitchen	1	12	1000	1000
31	Swimming pool and supporting facilities	1	250	4500	4500
32	Indoor games	1	100	1200	1200
33	Multipurpose hall	1	400	5500	5500
				Subtotal	16,100

5.5 Dining facilities

Since the main dining hall will be accessible to guests only, its capacity has been reduced from 250 to 150 users depending on the number of rooms and guests. An additional juice bar has been added to the programs.

F.	Dining facilities				
39	Main dining hall	1	150	4500	4500
42	Buffet serving area	1	variable	500	500
41	Juice and coffee bar	1	100	2000	2000
42	Cafe	1	80	1000	1000
43	Kitchen	1	20	2500	2500
44	Chef's room	1	2	350	350
45	Pantry and storage	1	variable	300	300
				Subtotal	11,150

5.6 Services

Hotel security and surveillance facility has been added to the given list of programs.

E.	Services				
35	Mechanical facilities	1	variable		8000
36	Telecommunication room	1	2		500
37	Laundry and dry cleaning service	1	4		500
38	Hotel security and surveillance	1	2		300
				Subtotal	9300

The ground total of built area = 92,500 sft

Chapter 6: Design Considerations

Design considerations are a set of guidelines that bring to the attention of the designers the requirements and demands of a particular buildings and facilities. Design considerations are formulated to help identify barriers and to overcome them through design solutions. The following design considerations align with the aims and objectives of the project and help achieve the goals to make it a sustainable and an ecologically responsible resort.

6.1 Enhancing environmental amenities

Protecting and enhancing the environmental amenities of the site is one of the important design considerations for this project. This can be achieved through recognizing and nourishing the existing biota. Biota means the specific type of animal and plant life that resides and functions within a particular region or habitat. The site is already intensely bio diversified and demands to have this character retained. Certain measures like minimizing use of harmful and toxic elements are necessary to create room for the existing biota to flourish and grow. Maintaining the balance of ecosystem services requires regular and healthy biotic interactions. The natural cycle of an ecosystem suggests that once these interactions can be assured, the other natural elements of the site like the water bodies, hills and forestations will automatically be in

synchronization.

6.2 Carbon foot print emission

Carbon foot print is the amount of carbon dioxide released into the atmosphere as a result of the activities done by a particular individual or an entire community. Any activity to fulfil a human need that requires energy emits carbon dioxide, such as the electricity we use is mostly made from fossil fuels by burning the fuels (coal, natural gas and oil) in the environment. In this particular case, the three R's - reduce, reuse and recycle principle can be used to minimize it. The strategy helps conserving natural resources by using renewable sources for energy, reusing water and recycling waste all together to make a contribution in the reduction of carbon dioxide. Moreover, this will also help create an example to raise consciousness and awareness among people to adapt to a lifestyle that causes less carbon emission.

Chapter 7: Design Development

7.1 Conceptual Ideas:

Given the ecological condition of the site and with the idea of enhancing it, the concept was to create or design an ecological corridor. An ecological corridor is a passage of network between zones of natural elements existing under a certain ecological setting. To enhance it, the first step was to identify the environmental amenities within the site such as its lake, forestation, dense growth of native indigenous plants and hillocks. After which these natural zones were connected to each other in order to identify the existing corridor. Now, the branches of this ecological corridor connects itself to the potential zones of the site where ecological features can be added. By addition of these features a new enhanced ecological corridor can be

proposed.

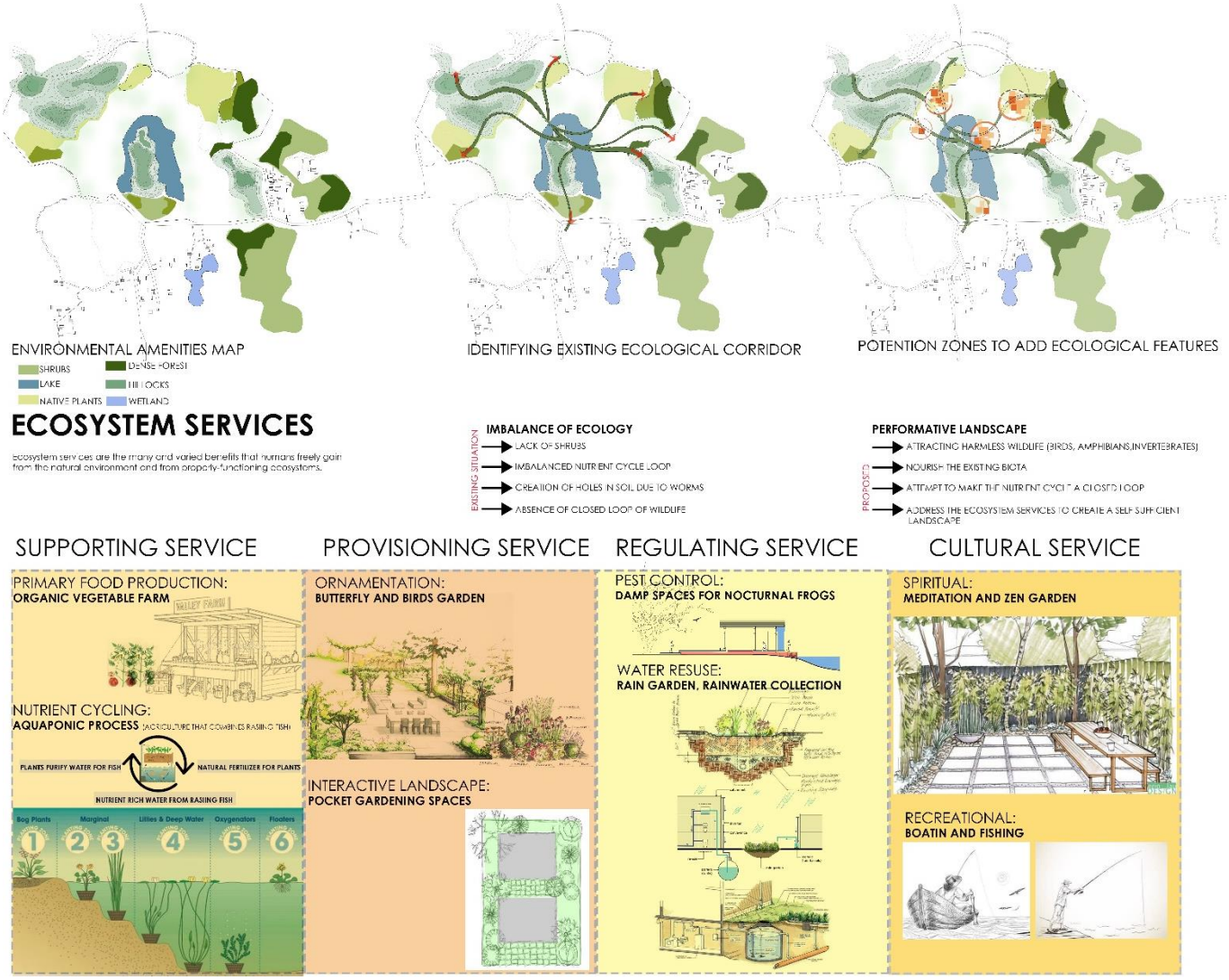


Figure 19: Maps and categories of ecosystem services

Source : (Forestry Department, Chittagong University)

The existing condition of the site creates an imbalanced ecological loop. To have a balanced ecological cycle it is necessary to have a mixed group of trees, shrubs, herbs and creepers as landscape elements. The site not only lacks in variety of trees but also has a huge imbalance in the ratio of trees and shrubs. This causes an imbalanced nutrient cycle loop and creates holes in the soil due to worms. To get rid of these issues the site demands to have a self-sufficient landscape to turn the cycle into a closed balanced loop. And to turn it into an independent

closed loop the ecosystem services are needed to be addressed. Thus, the ecological features that will be added to the potential zones marked on the way of the ecological corridor will be directly addressed under the various categories of an ecosystem services. For example under primary food production category of supporting ecosystem service, an organic vegetable farm is suggested. Similarly, birds and butterfly garden under ornamentation (provisioning service), rain garden for rainwater collection and recycling workshops under waste management (regulating service), meditation garden, boating and fishing under spiritual and recreational category (culture service) has been proposed as landscape design elements.

7.2 Design Decisions:

Before taking any design decisions certain alterations to the site were made first. The alterations took place in three first steps. The first step was to accentuate the lake. The reason behind this was to create a larger waterscape for the aquaponic process (an agriculture where aquatic plants and fishes can dwell in the same water) and to create an indirect segregation between the public and private functions. Secondly, the roadside hillock was extended following the lines of the water body to escape soil erosion. Thirdly a layer of shrubs has been proposed that spreads inside the entire site.

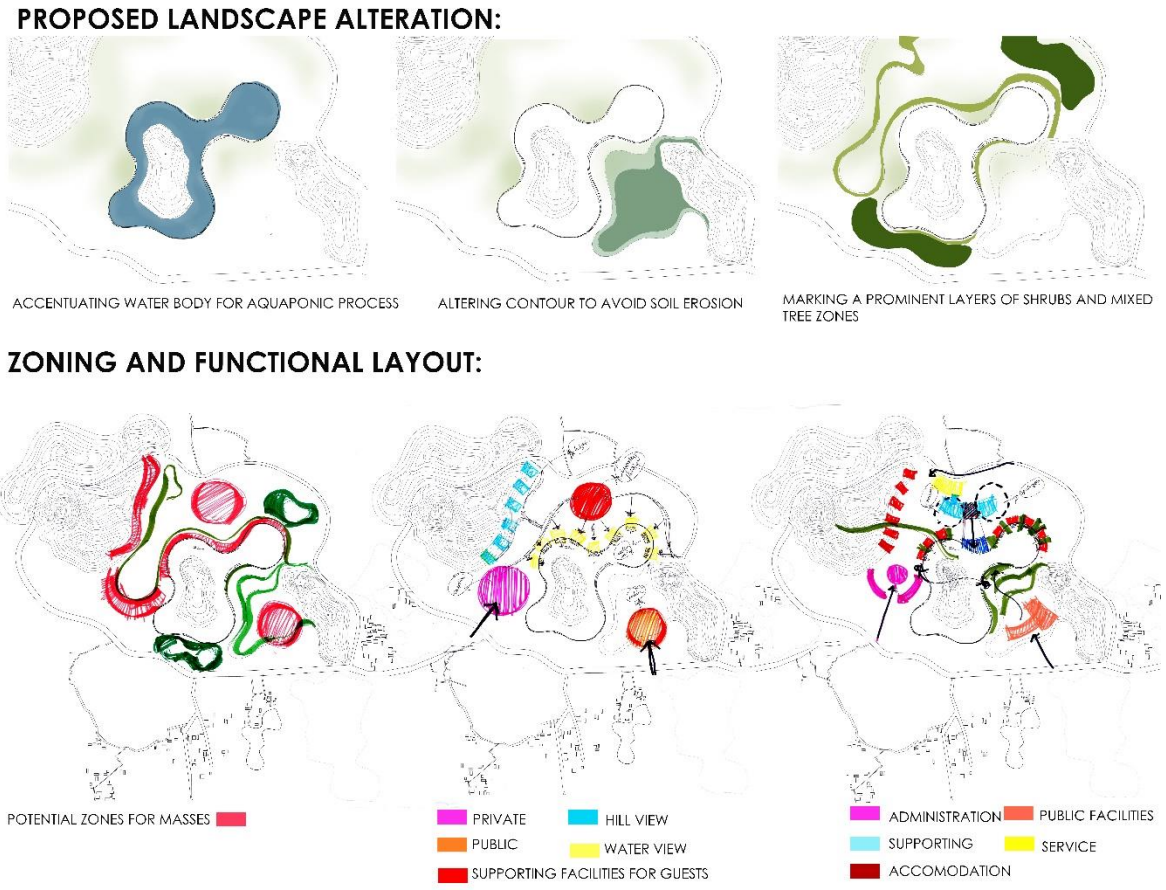


Figure 20: Desicion making maps

Marking all the landscape elements and after making the specific site alterations, the next step was to determine the potential zones for the masses. Keeping the water body central both the public and private functions were placed on both sides of it. The resorts were placed respecting the curved line of the lake and the hills and the supporting facilities for the guests of the resort were placed in a centralized position.

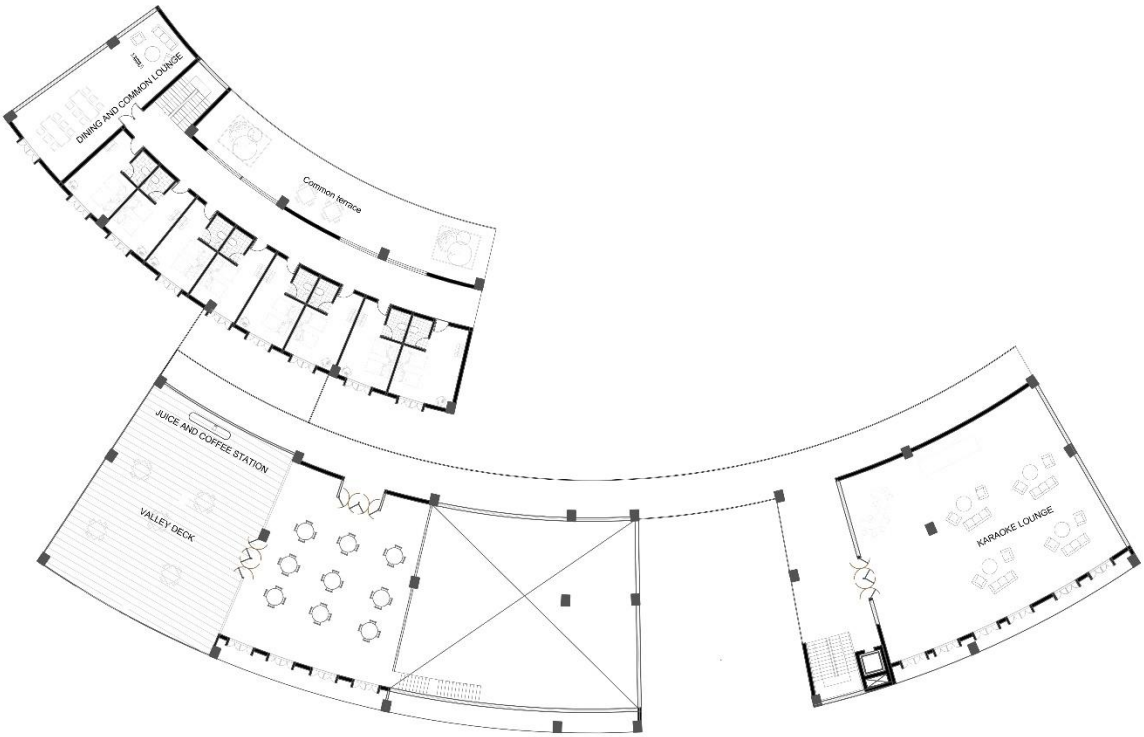
7.3 Drawings:


SITE PLAN

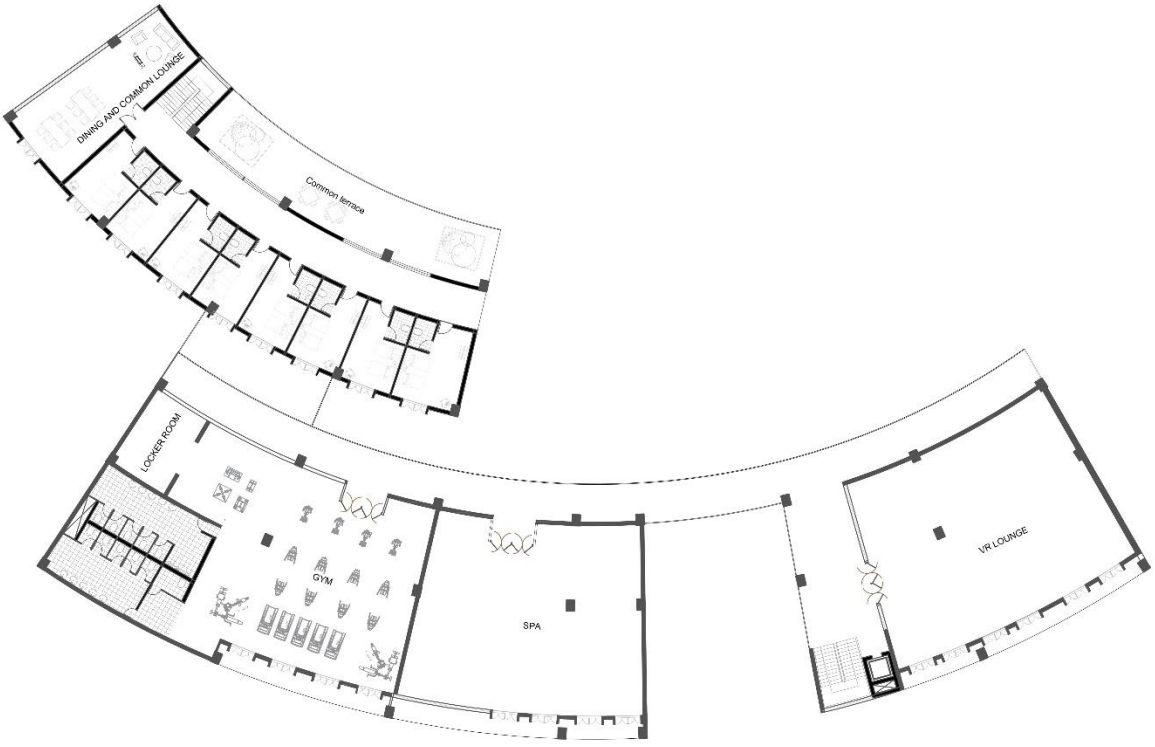
GROUND FLOOR PLAN

PLAN AT LEVEL +11'

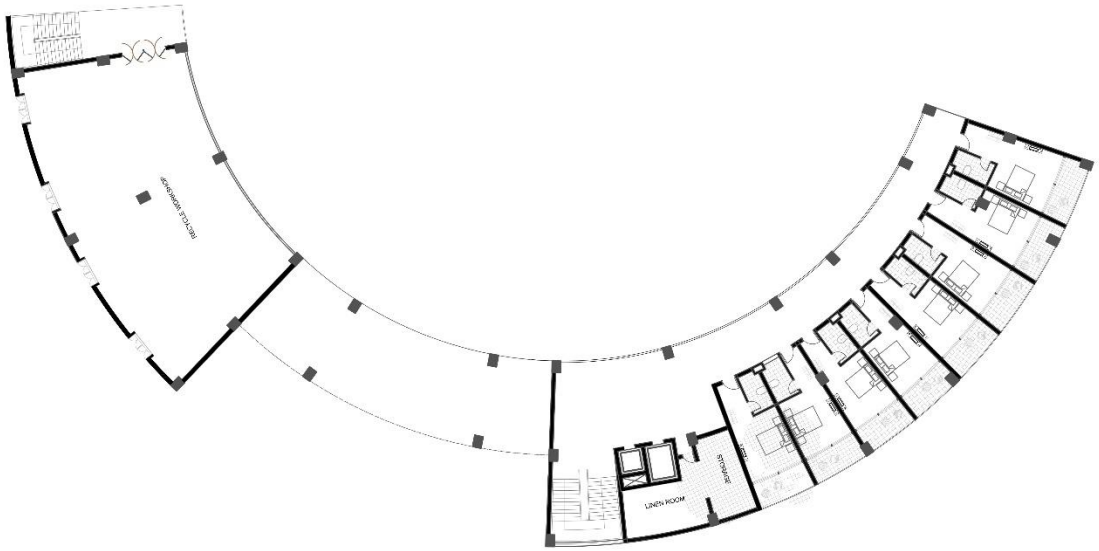
PLAN AT LEVEL +16'



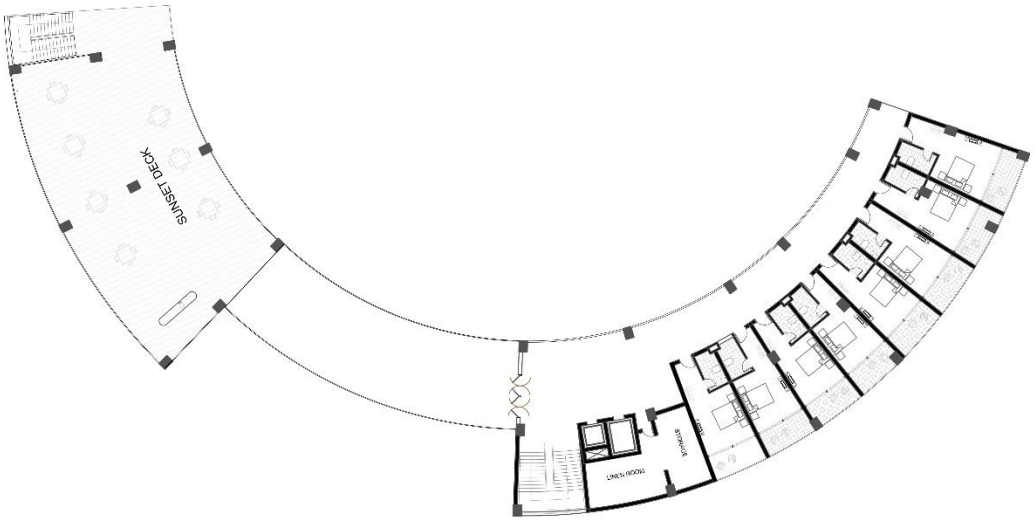
BLOCK B: (SUPPORTING) FIRST FLOOR



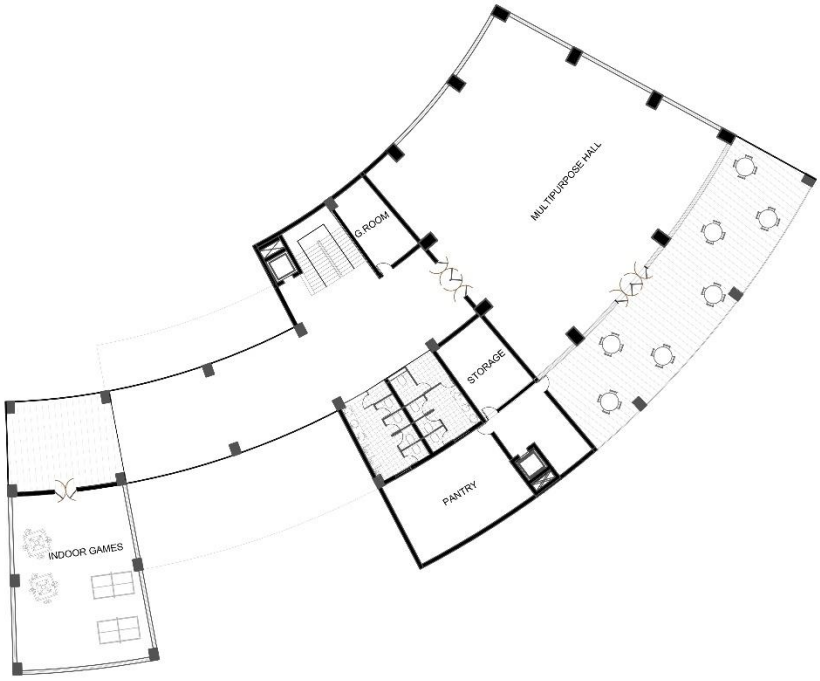
BLOCK B: (SUPPORTING) SECOND FLOOR



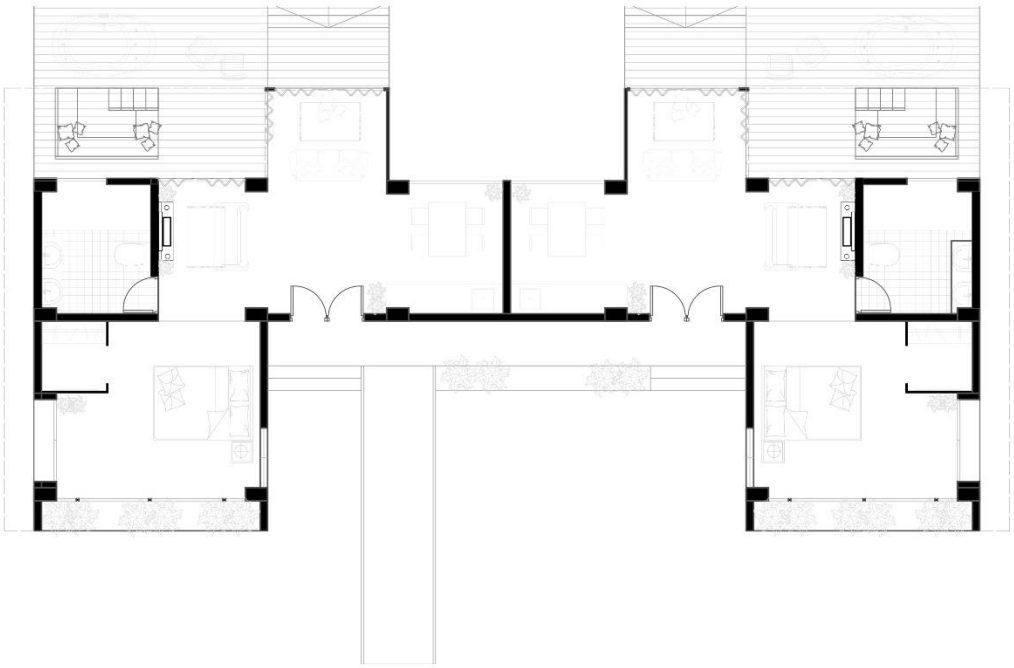
BLOCK A: FIRST FLOOR



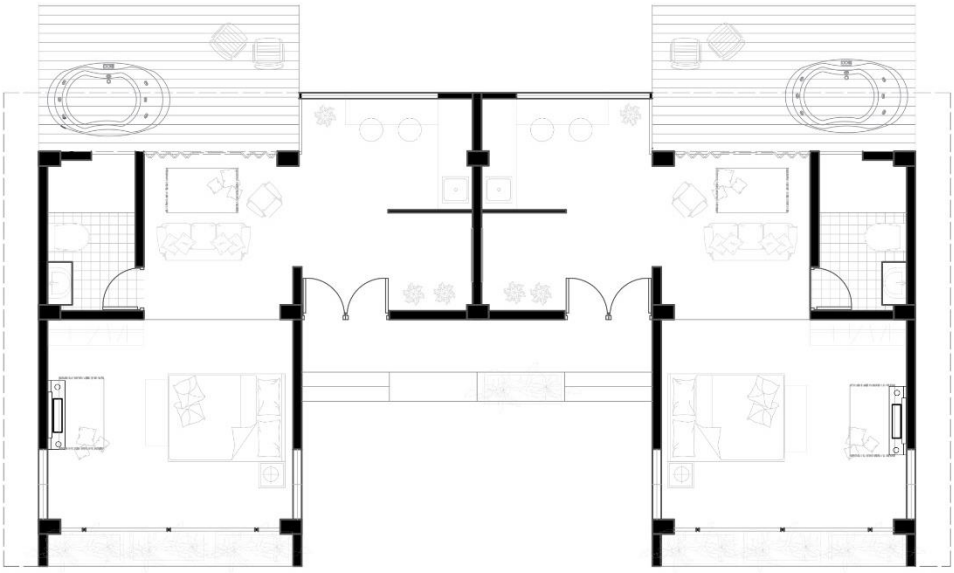
BLOCK A: SECOND FLOOR



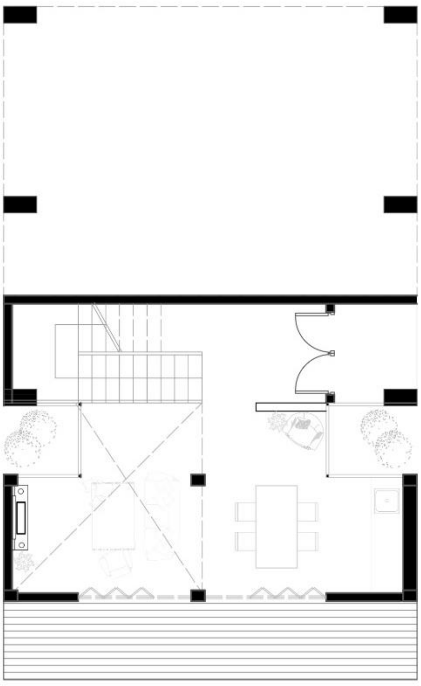
BLOCK C: (PUBLIC) FIRST FLOOR



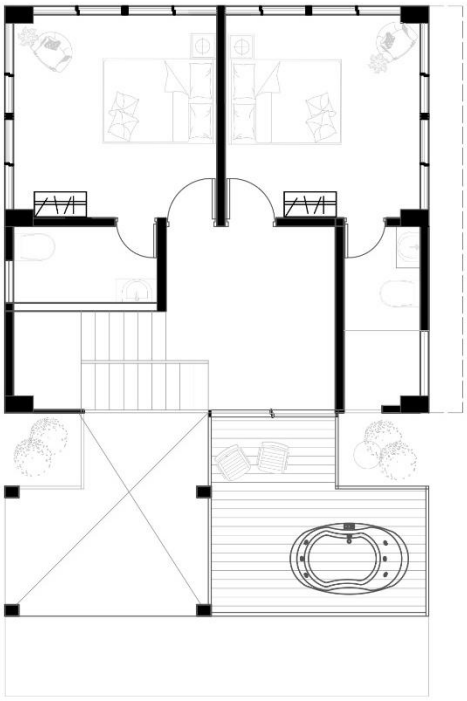
TYPE A: LUXURY SUITE



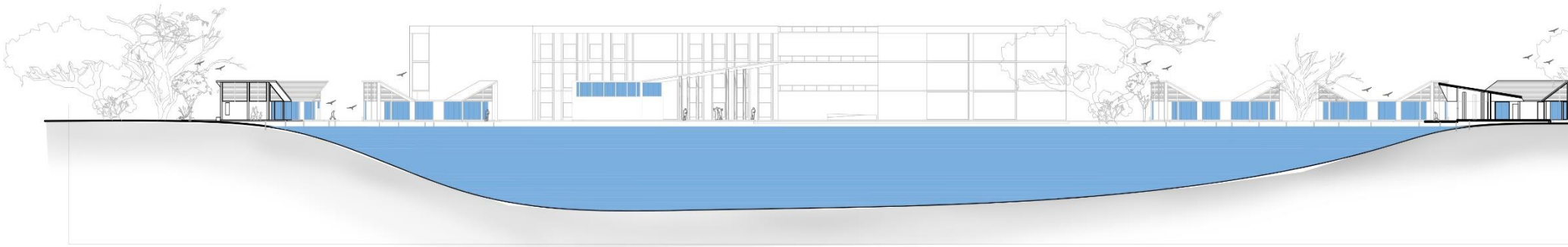
TYPE B: COTTAGE



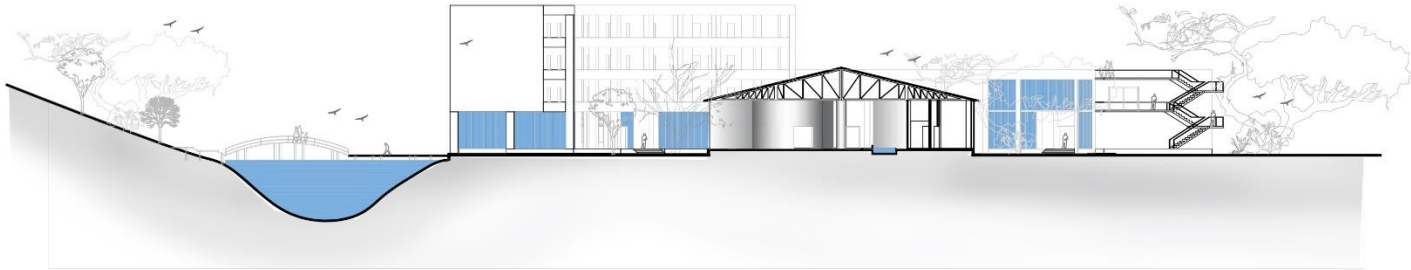
TYPE C:(DUPLEX)GROUND FLOOR



TYPE C:(DUPLEX)FIRST FLOOR



SECTION AA'



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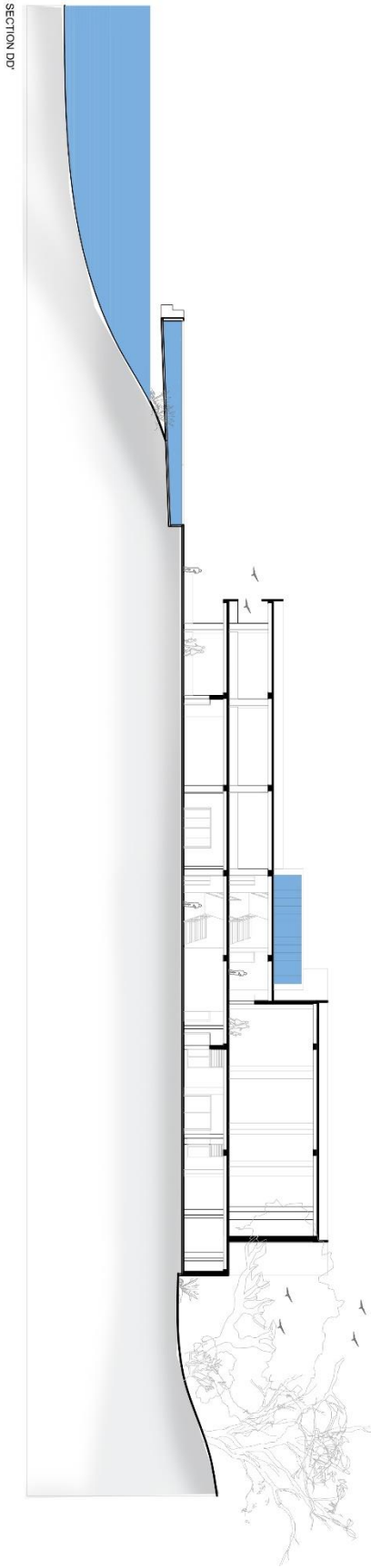
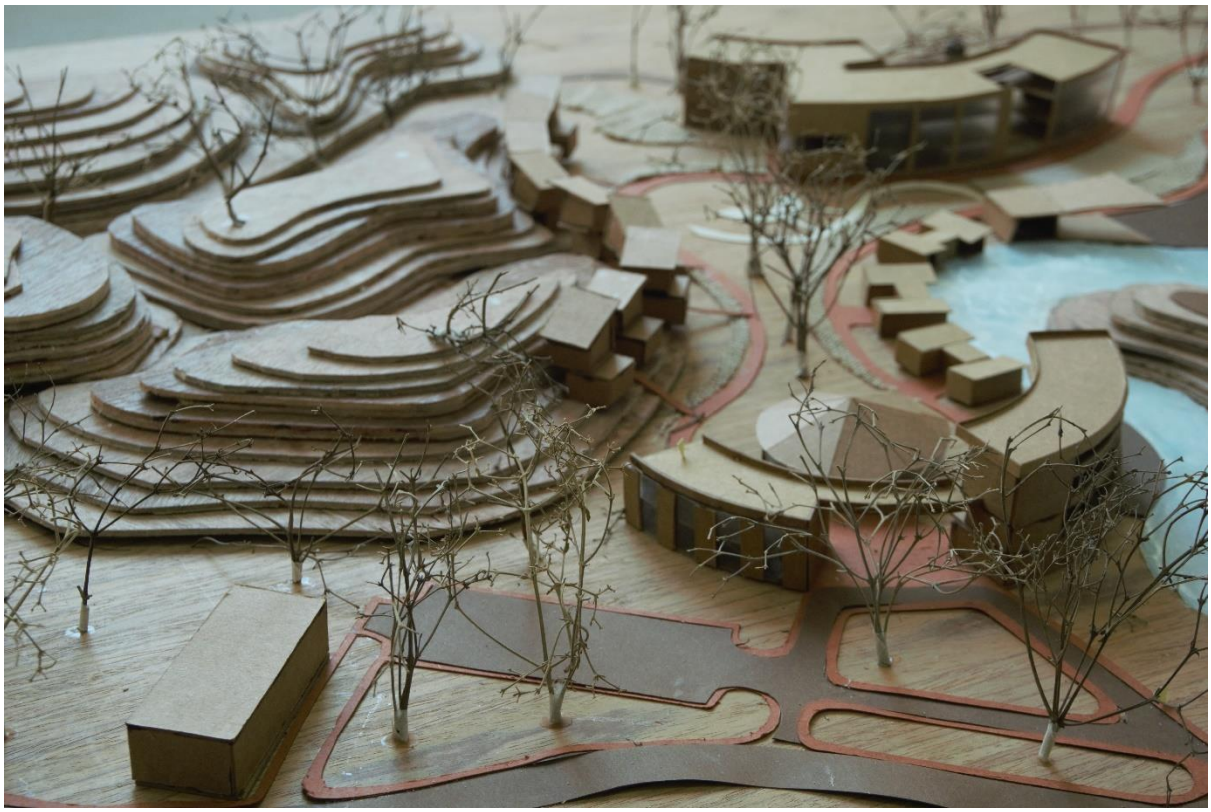

SECTION DD'


SECTION CC'

7.4 Model:



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