AN EXPLORATION OF BIOPHILIA AND ITS IMPLICATIONS IN THE DESIGN OF DRUG DE-ADDICTION CENTRE, ZARIA, KADUNA STATE

BY

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FEBRUARY, 2014.

DECLARATION

I hereby declare that the work in the thesis **'AN EXPLORATION OF BIOPHILIA AND ITS IMPLICATIONS IN THE DESIGN OF DRUG DE-ADDICTION CENTRE, ZARIA, KADUNA STATE'**has been carried out by me in the Department of Architecture.

The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any other Institution.

_____ _____ _____

LukmanMuazuLUKMAN Signature Date

CERTIFICATION

This thesis entitled ‘‘**AN EXPLORATION OF BIOPHILIA AND ITS IMPLICATIONS IN THE DESIGN OF DRUG DE-ADDICTION CENTRE, ZARIA, KADUNA STATE**’’ by **LukmanMuazuLUKMAN,** meets the regulations governing the award of the degree of Master of Science of the Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literacy presentation.

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DEDICATION

This Thesis work is dedicated to the entire family of late Alh. Lukman MU'AZU and that of Alh.Abdulkareem BULAMA, for their moral, spiritual and financial support. May Almighty Allah make AlJannatulFirdaus your final abode.Ameen.

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ABSTRACT

The unquestionable human reliance on the natural world throughout history has reinforced the intuition of the human affinity for nature and the notion that human physical, psychological and even moral well-being is largely dependent on experiencing a diverse and healthy natural environment. This connection has ultimately influenced the decisions we have made thus far to endure as a species and has resulted in tremendous changes to both our natural and physical framework.This thesis focuses on creating an interconnection between life, nature and the built environment to create architecture that enriches our daily lives through the use of Biophilic Design. Different models have been proposed to explain human reactions to environments. In general, such reactions are framed as 'liking' or 'disliking' responses. Hence, research has shown that human mind has affinity with more coherent or ordered information found in nature, and that humans have a specific set of inborn or 'hardwired' natural preferences for typical forms and spatial organizations. Biophilic design is that design approach that deliberately translates these attributes into the design of built environment hence, a drug de addiction and rehabilitation centre.

The research work is built on the subject of exploring the use of biophilic design principles in the design of drug de addiction and rehabilitation centre, the problem definition being that biophilic design, among other architectural design approach, offers a better methodology towards providing an expressive and enhance living environment. The argument draws its background to the study of relevant literature and case studies. The site and its suitability for the project were also studied. By adopting these principles, a design proposal, through a well-defined concept, was developed for the drug de addiction and rehabilitation centre in Zaria. In conclusion, the research highlights two importantfacts: That biophilic design is a preferred approach to the enhancement of human psychology experience, visual effect and human comfort within drug de addiction and rehabilitation centre. Secondly, that the attribute of

nature can be adopedt in solving problem of psychological recovery, spatial cognition and circulation inherent in drug de addiction and rehabilitation centres.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO STUDY

In present day society, the majority of modern building practices have separated people from the natural world, in turn cutting off access to the positive benefits contact with nature can provide. The human need for nature is not a new idea, but one that has been ignored and pushed aside in modern times. Causes of this separation from nature are a result of modern day industry and growth. Constant development that has occurred over the last 100 years, specifically the results of the Industrial Revolution, has significantly damaged and degraded the natural environment (McDonough &Braungart, 2002), and has served to disconnect humans from the natural world (Kellert, 2005). As a result, many of the current environments we have built around us are often devoid of natural features, green spaces, natural light, and ventilation (Kellert, 2005).

Lack of daylight, fresh air, and exposure to natural processes has begun to take its toll on our physical health and well-being. Until recently most research on the built environment has concentrated on the negative aspects of building design such as poor lighting, inadequate ventilation and climate control as pwell as chemical "off- gassing" which has resulted in the "sick-building syndrome". Sick building syndrome usually occurs when the ventilation system is inadequate and materials and finishes such as paint, plastics, and wall coverings emit harmful fumes. Buildings with these problems have been known to cause "building related illness," physical ailments that include respiratory and skin disorders and chronic fatigue (Kellert, 2005).

In the modern day world humans live and depend on the built environment. Nigerians spend approximately 87% of their lives within the confines of walls and in many cases blocking out contact with the natural world (Klepeis et. al, 2001). An essential role in interior design and

architecture is to provide environments that sustain occupants' safety, health, physiological comfort, psychological well-being, and productivity (Kim &Rigdon, 1998). Fortunately, in the last fifteen years the design community has slowly begun to address these issues by designing their environments with human health and well-being moved to the forefront of their design process.

Recent research cited in this review has shown that contact with natural environments and features can have a positive impact on human health and wellbeing. It is now the responsibility of designers, architects, and urban planners to start fostering a relationship between people and nature by harmonizing the built environment with the natural environment.

The human connection with nature can be traced back to the beginning of our species and how our ancestors survived and deeply depended on the natural environment for survival. Biophilia is the theory that humans have an innate or evolutionary-based affinity for nature. It is the belief that we have a connection and a reliance on nature that has been passed along throughout evolution (Wilson, 1984). According to Wilson (1984, 1993) contact with nature is essential to human health and well-being. Based on this theory, a framework has been developed that will reconnect humans and nature within the built environment. This framework is biophilic design, which incorporates organic design and vernacular design principles to interior and exterior architecture. Biophilic design seeks to create a positive connection between people and the environment as well as promoting health and well-being (Kellert, 2005).

It is important to note that biophilic design is not a design fad or trend but a design philosophy based on biological theory and supported by data from both psychological and health research. It is imperative to understand that the concept of biophilia coupled with harnessing the connection to nature covers a range of benefits relating to psychological well-

being, stress reduction, cognitive functioning, productivity, human development and social behavior (Heerwagen, 2001).

1.2 STATEMENT OF PROBLEM

Rehabilitation center is one of the component structures of a city that forms and transforms throughout the history of nation in several periods, and has continue to be considered as a correctional facility of the city where it is located, and has being designed to serve as a transitional environment for recovering patients(Onochie, 2008). Hence, design consideration, use of principles and models were the most paramount requirements to be considered in a rehabilitation center design (Appleton, 1975). However, previous works on rehabilitation centers lack the required provision of natural elements incorporated in the design of the facilities, which serve as a means of connecting the recovering patients with the natural environment. This is because they were mainly designed when patients were considered as objects on the scene rather than focus of design and thus were not considered in the planning of the centers.

1.3 RESEARCH QUESTION

The research question that guided this research was: “How can biophilic design regenerate the living environment and perform a critical role in stimulating and improve healing process of people recovering from drug addiction during early recovery?”

1.4 AIM AND OBJECTIVES

This study is aimed at exploring the principles of Biophilic design and generating a framework for their applicability in the design of a drug de addiction and rehabilitation center.

The objectives are:

i. To study Biophilia, its concept, roots, and principles from review of current literatures.
ii. To review ways in which these principles have been applied in contemporary architectural designs.
iii. To study drug de addiction and rehabilitation centers and their designs within the context of biophilia.
iv. To develop a framework for the applicability of principles of Biophilic design on a drug de addiction and rehabilitation center.
v. To demonstrate through design the application of these principles in designing a contemporary rehabilitation center.

1.5 JUSTIFICATION

A non-governmental organization (NGO) is set out to provide a contemporary standard correctional facility to cater for the increasing number of drugs and alcoholic addicted patients in Kaduna state. Therefore there is need to provide a standardized rehabilitation center for whom the alternative methods of enhancing the healing and recovery rate will be explored through design. The organization needs to provide a rehabilitation center that will mimic and portray the principles of biophilic design by connecting and exposing its occupants to nature, be astatically inclined and in all facilitate healing are the main concern of this research work.

1.6 SCOPE

The research hinges on the aspect of biophilic architecture which Joye (2007) described as the core principles of biophilic design, hence the thesis emphasizes mainly the provision of a

befitting environment which connect its users to the natural environment while promoting ecological conservation, positive health, and wellbeing. The rehabilitation center will cater for both the male and female genders of different age ranges, as such; all design considerations and elements will be focused on the needs for improving healing process and recovery of the patients.

However, the research work did not propose deep details in the aspect of medications and medical treatment of the patients but provides spaces as deemed fit, through the use of natural shapes and forms, environmental features, light and space, evolved human-nature relationships, and natural patterns and processes. Beyond this, issues of place-based relationships were also explored.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 INTRODUCTION

This chapter represents a review of literature that will examine existing research on the human connection with nature and its benefits to human wellbeing. Existing research studies on the physical and psychological effects of experience with nature will also be examined. The review will also discuss design considerations for incorporating nature into the built environment. The review of literature will be organized into the following headings: (a) Biophilia, (b) Evidence of biophilia, the benefits of experience with nature, (c) Implications for design of the built environment and (d) Addiction.

2.2 THE THEORY OF BIOPHILIA

The theory of biophilia was introduced in 1984 by sociobiologist Edward O. Wilson in his book of the same name. However, the first time the notion of biophilia was mentioned was in the late 1900s by Erich Fromm, a German social psychologist. Fromm hypothesized that people have a "passionate love of life and all that is alive; it is the wish to further growth, whether in a person, a plant, an idea, or a social group" (Fromm, 1973, p. 366). Wilson takes Fromm's notion further and explains biophilia more completely. Wilson's theory of biophilia states that humans have an innate tendency to focus on life and lifelike processes. To elaborate, this theory purports humans have a need for nature beyond what nature provides them at a physical level, and encompasses the human craving for aesthetic, intellectual, cognitive, and even spiritual needs (Kellert& Wilson, 1993). Nature is essential to healthy human development in that it facilitates development of intellectual capacity, and immersion in nature satisfies human's desire for curiosity, discovery and imagination (Kellert, 1997).Specifically, biophilia is the inherent human inclination to affiliate with natural

systems and processes, especially life and life-like features of the nonhuman environment (Kellert et al., 2009). Wilson (1984) poetically summarizes biophilia thus: “To explore and affiliate with life is a deep and complicated process in mental development. To an extent still undervalued, our existence depends on this propensity, our spirit is woven from it, hope rises on its currents” (p. 1).

Wilson and Kellert emphasize how the brain evolved in a biocentric world and not a machine regulated world. Wilson argues that as a result of living separately from the natural world and in artificial built environments for the past one-hundred to two-hundred years, humans’ biophilic learning rules have become atrophied (1984). Despite human separation from the natural world, a need to connect with nature remains an essential component to healthy human development (Kellert& Wilson, 1993). Not only is a connection to nature essential for healthy human development, the biologically-based aesthetic attraction to nature is universal and something that unites humans despite differences such as race, economic status, geographic region and religion (Kellert, 1997). Additionally, reconnecting people with the natural environment can coincide with living in a modern-day urban society (Kellert, 1997). Thus, the theory of biophilia is a multi-disciplinary framework to analyze humanity’s universal need for nature and to discuss the numerous ways humans crave interaction with the natural world.

Fromm emphasized a “passionate love of life,” whereasWilson’s biophilia goes much deeper than just the love of natural life. “Biophilia encompasses our physical, emotional, and intellectual need for nature and lifelike processes. It is an important need in human development to affiliate with the diversity of nature. “This biological need to connect with nature has an effect on human conditions such as intellectual capacity, emotional bonding, aesthetic attraction, creativity and imagination” (Kellert, 1997 p. 6). In summary, StephenKellerthas suggested that biophilia is:

i. Inherent or biologically based

ii. A part of human evolutionary development

iii. Associated with human physical health

iv. Likely to increase mental well-being and personal fulfillment

v. A basis for the human conservation of nature

The need for nature is not only material or exploratory but is directlyrelated to our emotions, aesthetic values, and cognitive functioning. The notion of biophilia asserts that human fulfillment is intimately dependent on our relationship with nature (Kellert, 1993). Stephen Kellert has developed nine fundamental values that reflect our relationship with nature. They are not instincts but rather a group of "learning rules" that affect human development. Each of these values indicates the human dependence on nature as basis for survival as well as physical and psychological well-being (See Table 2.1.).

Table 2.1: Valuations of Nature.

Among Humans Evolved Bioculturally Becoming Manifest in

Range of Biophilic Values

	Definition	Adaptive Benefit
Aesthetic	Physical appeal and beauty	Inspiration, harmony, security
Dominionistic	Mastery and physical control	Physical prowess, self-confidence, mastery skills
Humanistic	Emotional attachment to aspects of nature	Bonding, cooperation, companionship
Moralistic	Spiritual reverence and ethical concern	Order, meaning, kinship
Naturalistic	Direct experience and exploration	Curiosity, discovery
Negativistic	Fear and aversion	Security, protection, awe
Scientific	Systematic and empirical study	Knowledge, understanding, critical thinking skills
Symbolic	Nature in language and expressive thought	Communication, mental development
Utilitarian	Practical and material exploitation	Physical sustenance and security

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Source:(Kellert, 1993, 2005, 2007) and (Kahn, 1997).

The nine values offer support of the biophilia hypothesis but do not constitute "proof" of biophilia. The values are meant to serve as basic connection in the relationship between human development and his dependence on nature. To this point the notion of biophilia has been theoretical for the purpose of explaining the idea. However, there is a growing body of empirical evidence that supports biophilia and the human benefit from contact with nature (Kellert, 2005).

2.3 THE SAVANNA HYPOTHESIS

Although humans eventually came to occupy many biomes and habitats across the globe, Gordon Orians argues that the long period of evolutionary development in the savannahs of Africa should have left a positive mark on the human psyche (Orians 1980, 1986; Orians and Heerwagen 1992; Heerwagen and Orians 1993). According to the "savannah hypothesis," people should prefer to be in savannah-like environments because in our evolutionary past they provided a superior resource base compared to the forest or desert biomes. Key characteristics of the savannah include:



Plate 2.1:African Savanna Landscape.
Source: (Maion, 2007).

- Scattered clusters of trees that provided shelter from the sun and for protection from terrestrial predators.

- Long-distance views that afforded surveillance for predator detection and avoidance.
- Even ground cover for efficient movement across the terrain.
- A rich diversity of plant and animal species.
- Rock outcroppings for surveillance or sleeping.
- Seasonal variation in fresh water availability due to rain patterns.

Studies in landscape planning unrelated to biophilia have consistently shown that people prefer semi-open landscapes with large trees and water over either dense forest or desert (Ulrich 1993). Scruffy, dense habitats with rough ground texture are consistently disliked. Similar results are found cross culturally. Environmental psychologists examine human interaction within a variety ofnatural and built environments, and often are able to predict behavioral and psychological outcomes derived from interacting with particular environments (Kopec, 2010). Kopec asserts that human behaviors and cognitive performance are influenced by multiple aspects of their physical environment including colors; size and shape of a room; stimuli such as noise and light, and symbolic artifacts that provide meaning, such as artwork and family photos (2010). This understanding becomes an underlying premise of biophilic design when studied within the context of human interaction with nature (Kellert, 2005).

Orians and Heerwagen (1993) have also conducted studies and found that people even have a preference for tree shapes that have a layered canopy and trunks that branch close to the ground similar to those found in the African savanna (see Plate 2.2).



Plate 2.2:Umbrella Thorn Acacia Tree.
Source: (©iStockphoto.com/NicoSmit, 2007).

Grant Hildebrand, author of *Origins of Architectural Pleasure* (1999) concludes that "such settings (the African savanna) allowed us to thrive…all our surroundings until the last few millennia-comprised entirely natural material; they were places of sheltering and edible green and growing things, of water of prey and predator, the seasons, sun and stormthus it is easy to seethat we prefer natural scenes" (p.15).

2.4 THE EVIDENCE OF BIOPHILIA

A number of researches have confirmed the hypothesis that contact with nature can lead to increased mental health and psychological well-being (Kaplan, 1989, Ulrich 1983). The contact is not limited to only a natural environment or landscape but could include the simple notion of nature. Examples of this are reading a book about nature, viewing art, or listening to a story. Each of these activities connects people to nature as long as they affect human emotion in some way. According to Kellert (2005), there are three types of contact we have with nature: *direct,indirect* and *symbolic*. Direct contact involves immediate experience with natural processes such as hiking through a forest, swimming in a stream or mountain climbing. Direct contact usually involves a person immediately within a natural environment. Indirect contact involves some kind of human intervention or control such as mowing a lawn,

viewing an aquarium or gardening. Symbolic contact does not require any physical contact with natural processes or organic life forms. It involves a symbolic or metaphoric encounter such as depictions of landscapes in art or photographs or the use of organic patterns and forms in either decoration or architecture. Whether we are affected directly, indirectly or symbolically, there is mounting evidence that each kind of contact affects us positively and contributes to human well-being(Kellert, 2005).

The following section will examine the current research available on the benefitsof experience and contact with nature. The focus of the review will be onpsychological restoration and attention, recovery from stress or illness andproductivity.

2.4.1 RESTORATION AND ATTENTION

The Attention Restoration Theory (ART) is an example of a stimulation theory, which helps to explain the responses of humans, in particular, to the sensory information contained in their environment. Since each environment – interior or exterior – can contain any number of stimuli to which any or all of our senses can react, understanding the role of environmental influences on human functioning and wellbeing is essential to the successful implementation of any design plan (Kopec, 2010).Environmental psychologists Rachel and Stephen Kaplan, (1989) opine that contact with the natural environment can have a psychologically restorative effect on people. They call these types of settings *restorativeenvironments.* Restorative environments whether they are in the context of nature or the built environment, incorporate elements that function therapeutically by reducing cognitive fatigue and alleviating stress. These environments provide opportunities for rest, recovery, contemplation, and isolation. Kaplan and Kaplan (1998) stipulated that all stress is not created equal. They distinguished a difference between stress and mental fatigue. Stress involves preparation for a particular event that could be threatening or harmful such as preparing to have surgery. Mental or

cognitive fatigue on the other hand, arises out of hard cognitive work such as long hours at work or studying. Excessive worrying can also cause cognitive fatigue. The worn-out feeling we get is usually not a physical effect but rather mental fatigue (Kaplan & Kaplan, 1998).

The Kaplans have hypothesized that "a preferred environment is thus more likely to be a restorative environment. Since nature plays such a powerful role in what is preferred, in general terms there is a theoretical basis for expecting natural environments to be restorative" (1989, p.189). In order to better understand the qualities of restorative environments, The Kaplansdetermined that, in order to be a restorative setting, thefollowing components must exist (Herzog &Strevey, 2008):

- **Fascination:** Achieved through a part of or a whole setting that easilyengages attention thereby allowing fatigued attention to rest;
- **Being away:** Provided by a setting that is either physically or conceptuallydifferent from an individual's typical setting;
- **Extent:** Provided by a setting that is complex enough to engage the mindand promote exploration; and
- **Compatibility:** Achieved when the design of a setting supports the intendeduse by the occupant.

In conclusion, the attention restoration theory provides a valuable framework to demonstrate how nature can play a role in creating a workspace that supports physical and psychological wellbeing, while encouraging the restoration of the directed attention needed for daily human functioning (Berman, Jonides, & Kaplan, 2008).

2.4.2 RECOVERY FROM STRESS OR ILLNESS

The positive effects from contact with nature or natural views have proven to be greatest when people are experiencing high levels of stress or are confined to situations like hospitals, prisons and work environments. In these cases frequent direct, indirect or symbolic contact with nature continues to have a positive physical and psychological effect on human well-being (Ulrich, 2003). Several studies of patient groups have consistently shown that simply looking at environments dominated by greenery, flowers, or water as compared to a built environment that lacks natural elements is significantly more effective in promoting recovery from stress and illness. It has been found that simple objects such as aesthetically appealing greenery or flowers for hospital patients can have calming and healing effects. One study revealed that in-room vegetation and access to gardens within hospitals increased positive feelings such as pleasantness and calmness as well as reducing negative emotions such as fear and sadness (Barnes & Cooper- Marcus,1995).

Although many studies involve direct contact with nature, there have been studies that prove indirect and symbolic contact can have positive effects as well. One of leading studies regarding recovery was conducted by environmental geographer and psychologist Roger Ulrich (1990) investigated 160 short term hospitals patients recovering from heart surgery and their reactions to wall art. The patients were divided into two types of recovery rooms. One room contained a picture of a natural scene of water and trees, (Plate 2.3)



Plate 2.3:Picture of natural scene used in study.
Source: (Ulrich, 2003).

The second room had abstract art, (Figure 2.1),

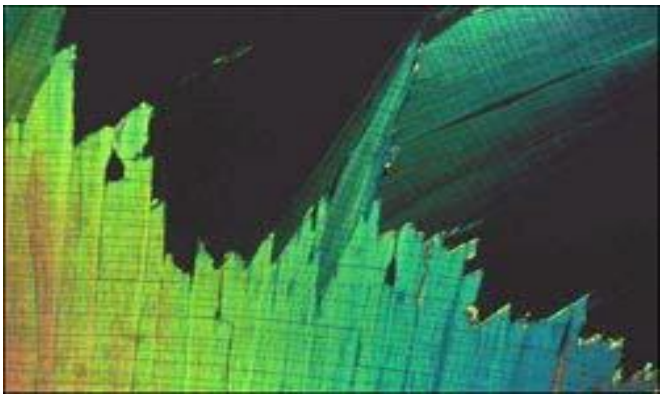


Figure 2.1:Abstract picture used in study hospital room.
Source: (Ulrich, 2003).

Ulrich observed that the patients in the rooms with pictures of natural scenes had less anxiety and required less pain medication. At the other end of the spectrum, the patients whose rooms contained abstract art reported higher levels of anxiety. Ulrich also reported that some patients became so distressed by the abstract art that they ripped them from the walls and attempted to destroy them (Ulrich and Lunden, 1990).

2.4.3 PRODUCTIVITY

Recently, evidence has been built on the benefits of exposure to nature in the workplace. Studies have shown contact as indirect as a landscape picture or a decorative motif has been shown to enhance well-being and productivity within the work environment (Kellert, 2005). Environmental psychologist Judith Heerwagen and James Wise (2001) conducted a study with 168 officeworkers in two public agencies with a variety of locations were surveyed: those with no view to the outside, those with a view to the outside but not including any natural elements such as sky, trees, or green space, and those with an outdoor view containing natural elements. Participants responded to a survey that sought feedback on issues such as perceived job stress, perceived success of restorative opportunities such aswellness programs, and overall life satisfaction (Kaplan, 1993). Results indicated that workers with a view of natural elements reported fewer health concerns than those without a view of nature. Those

with a view of nature also reported a significantly higher overall job satisfaction than those without a view of nature (1993).

2.5 THE IMPLICATIONS FOR DESIGN OF BUILT ENVIRONMENT

In Stephen Kellert's book *Building for Life: Designing and Understanding the Human-Nature Connection* (2005) the author argues that the greatest mistake of ourtime is the assumption that the built environment can exist independent of thenatural environment. The result of this is the design of buildings anddevelopments that "abuse and degrade people's experiences of nature, fosteringalienation and destructive environmental practices" (p.92). As a result of thispractice, there has been widespread land degradation, soil, water and airpollution and depletion of natural resources. The current answer to this problemhas been the implementation of "sustainable design" practices or "green design".

Sustainable design is design that is has a low impact on the environment by "pursuing energy efficiency, using renewable energy, reducing resource consumption, reusing and recycling products and materials, lessening waste pollution, employing non-toxic substances and materials, protecting indoor environmental air quality, and avoiding habitat destruction and loss of biodiversity (Kellert, 2005)". This practice is also known as *low environmental impact design.*

According to Kellert (2005), *low environmental impact design* has lessened the impact on the natural environment but has failed to foster a connection between people and nature in the built environment. He suggested that with today's technology and knowledge of the benefits of the connection with nature, we can minimize harm to the environment as well as enrich the mind, body and spirit by promoting experiences of nature within the built environment. He refers to this practice as *restorative environmental design* which incorporates sustainable design practices as well as "reconciling and harmonizing the natural and human environments" (2005, p. 4).

Kellert (2005) has proposed that the implementation of *restorative environmental design*, low *impact environmental design* and the twodimensions of *biophilic design*, organic and vernacular design can;

i. Sustain thenatural habitat and systems on which our existence relies

ii. Foster biophilia, ourinnate tendency for nature and

iii. Connects people to place, a necessity forhuman well-being (Kellert, 2005).

For this review, the focus will remain onbiophilic design.

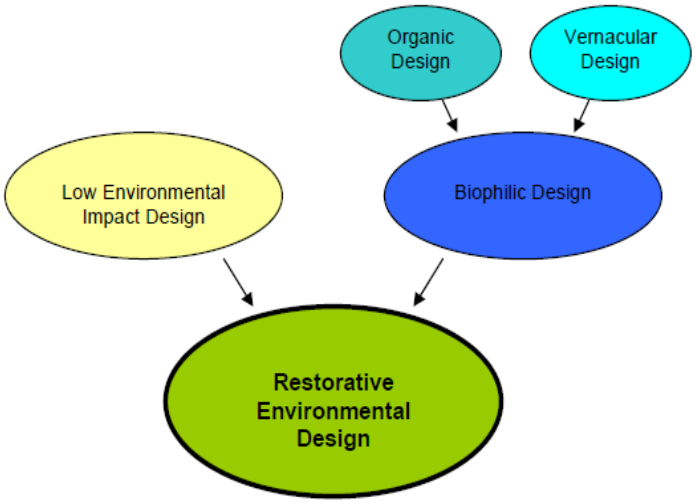


Figure 2.2:Restorative Environmental Design.
Source: (Kellert, 2005).

2.6 THE BIOPHILIC DESIGN

Steven Kellert, a Professor of Social Ecology at Yale, has taken the biologicaltheory of biophilia and applied it to the built environment, coining the term 'biophilicdesign.' The goal of biophilic design is to translate an understanding of biophilia into the design of the built environment, resulting in beneficial contact between people andnature within modern buildings and landscapes (Kellert et al., 2009). Furthermore, biophilic design contains two main dimensions: what Kellert terms the 'organic or naturalistic' dimension (organic dimension) and the 'place-based or vernacular' dimension (vernacular dimension).

2.6.1 ORGANIC DIMENSION OF BIOPHILIC DESIGN.

The organic dimension of biophilic design is shapes and forms in the built environment that directly, indirectly, or symbolically reflect the inherent human affinity for nature (Kellert et al., 2009, p.5). Kellert indicates nature can be experienced directly, indirectly, and symbolically under this dimension of biophilic design.

I. Direct Connections to Nature

Direct connections to nature within the built environment are relatively unstructured contacts with self-sustaining features of the natural environment such as views of the exterior environment, daylight, natural ventilation, plants, animals, natural habitats, and ecosystems (Kellert, 2005, p. 136-137; Kellert et al., 2009, p.5). Immediate views of nature out a window are also classified as direct connections to nature. Kellertet al. (2009) emphasizes that the design quality of a direct experience with nature withinthe built environment affects the impact of the connection on users. For instance, a singular palm tree in a mall does not have a marked psychological effect on a person.

However, a diverse atrium that incorporates a range of natural features such as natural light, vegetation, soil and water would constitute biophilic design that has the power to stimulate a person's senses, emotions, and intellect, according to Kellert. A rich direct connection to nature within the built environment is illustrated in Plate 2.4, an atrium in an office building for the Houses of Parliament in London designed by Hopkins Architects.



Plate 2.4:Direct connections to nature afforded by natural light and vegetation within an atrium. Source: (http://www.princeton.edu/pr/pwb/05/0530/3a.shtml).

II. Indirect Connections to Nature

Indirect connections to nature within the built environment are controlled or manipulated contact with the natural environment that requires ongoing human input to survive, such as a potted plant, a water fountain, natural materials, or an aquarium (Kellert, 2005, p. 143; Kellert et al., 2009, p.5). Classifying indirect experiences with nature within the built environment typically are not black and white and involve a degree of personal judgment. Usually elements of nature have been manipulated in some way, such as vegetation, animal life, light, air,water, materials such as wood, stone, cotton, leather, and wool, and natural processes such as aging, weather, and climate. Some examples of indirect experiences with nature include potted plants, fish in an aquarium, formally designed fountains, and stone walls. An example of an indirect connection to nature within the built environment is illustrated in Plate 2.5.



Plate 2.5:The use of natural materials offer indirect connections tonature inside Frank Lloyd Wright's Fallingwater.
Source: (http://commons.wikimedia.org/wiki/File:Frank Lloyd Wright Fallingwater interior).

III. Symbolic Connections to Nature

Symbolic connections to nature within the built environment involve no actual contact with real nature, but represent the natural environment through image, picture,ornamentation, video, metaphor, and other techniques (Kellert, 2005, p. 143; Kellert et al., 2009, p.6). Kellert indicates nature can be symbolically experienced within the built environment in a variety of ways, such as decoration, ornamentation, pictorial expression, and shapes and forms that simulate and mimic nature (2005). Moreover, these symbolic representations of nature can appear in a wide diversity of building features such as walls, doors, entryways, columns, trim, casements, fireplaces, furnishings, carpets, fabrics, art, and sometimes even an entire façade.

The symbolic expression of nature within the built environment can be experienced in both obvious ways and subtle ways. An obvious expression of a symbolic connection to nature could be the application of a pattern utilizing organic shapes. An obvious symbolic connection to nature is illustrated in Plate 2.6.



Plate 2.6:An obvious symbolic connection to nature at the Ronald Regan National Airport. Source: (http://www.bloomerstudio.com/projects/reagan/1.php4).

A subtle connection to nature could be inconspicuous organic shapes and forms throughout an interior space. Symbolic connections to nature are not as easy to identify as direct and indirect connections to nature within the built environment because they can take on a multitude of different forms, but they have the ability to enrich the human experience within a structure just as much as direct and indirect connections, according to Kellert (2005). A subtle connection to nature is illustrated inPlate 2.7.

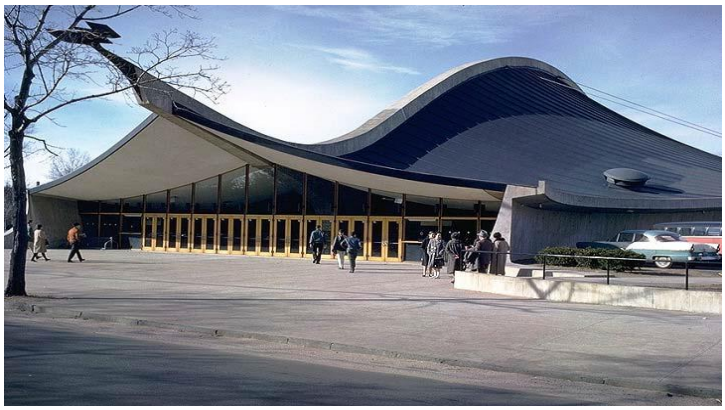


Plate*2.7*: A subtle symbolic connection to nature through the use of organic forms at the David S. Ingalls Rink by Eero Saarinen New Haven, CT. Source: (http://www.worthpoint.com).

Kellert has identified characteristics of the built environment that create connections to nature in more subtle ways. These characteristics are based upon the work of Jay Appleton and Grant Hildebrand which identify six paired elements that reflect characteristics of nature:

prospect and refuge, enticement and peril, and order and complexity (Kellert, 2005). These elements create situations and feelings that areanalogous to the same feelings one would experience in the natural environment. These elements are similar to characteristics of the natural environment that are important to humans as discussed previously with environmental psychology. These six paired elements which illustrate subtle symbolic connections to nature are illustrated inPlates 2.8 through 2.10.



Plate 2.8: Prospect and Refuge.
Source: (http://mithun.com/projects/project detail/pier 56).

The café in Mithun's office in Seattle offers a comfortable refuge to employees while providing them a view overlooking the water.

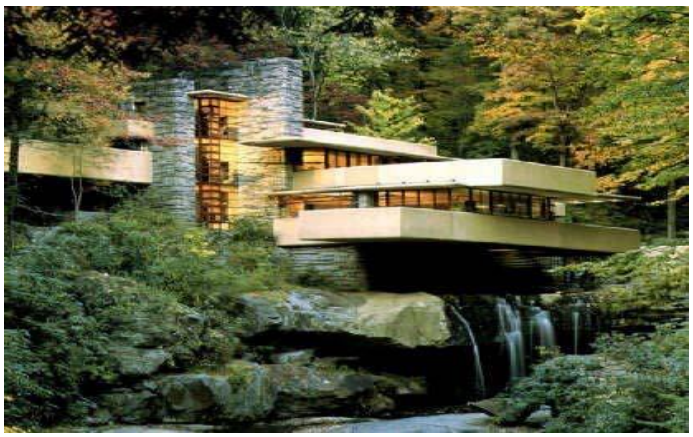


Plate 2.9: Enticement and Peril.
Source: (http://www.wright-house.com).

At Frank Lloyd Wright'sFalling water, the intriguing view entices the user to the edge of the balcony, while the cantilevered balcony creates a feeling of danger by hanging over the water



Plate 2.10: Order and Complexity.
Source: (http://cubeme.com/blog/2009/great-bamboo-wall-bykengo-kuma-associates).

The bamboo is arrangedin an orderly fashion, but the arrangement contains detail and variability which prevents the composition from becoming mundane.

2.6.2 VERNACULAR DIMENSION OF BIOPHILIC DESIGN

The vernacular dimension of biophilic design involves buildings and landscapes that connect to the culture and ecology of a locality or geographic area (Kellert et al., 2009). Vernacular design is a means of creating spaces that reflect the places people live and work and avoid the placelessness prevalent in the built environment today. The poet and conservationist Wendell Berry lends justification to avoiding placenessness, stating that "…without a complex knowledge of one's place, and without the faithfulness to one's place on which such knowledge depends, it is inevitable that the place will be used carelessly and eventually destroyed" (Kellert et al., 2009, p.6).

Furthermore, Kellert(2005) classified four different types of vernacular dimensions of biophilic design. These include design which:

I. Vernacular Design Relating to Ecology of a Place

Vernacular design which connects to the ecology of place does so at a large scale, being sensitive to the building site, the surrounding ecosystems, and the watershed (Kellert, 2005). Such a design requires intimate knowledge of the physical site characteristics (water flow,

geology) and biological characteristics (species composition). Vernacular design which makes connections to the ecology of a place should even strive to restore or enrich ecological functions whenever possible (Kellert, 2005).

II. Vernacular Design Relating to Culture and History of a Place

Vernacular design can connect to the culture of a place by creating spaces which reflect the architecture of its geographic region. It can create social traditions relating to place by encouraging traditions and shared relationships within these spaces. The goal of creating vernacular connections within the built environment is to foster a sense of loyalty and commitment between people and the environments in which they live. Architect Tom Bender notes the value of creating spaces which reflect the culture and history of the people in that area: "A building, like a person…can help restore to our surroundings a sense of sacredness and honoring of people, place, and diverse traditions" (Kellert, 2005, p.169).

III. Vernacular Design Fusing Culture and Ecology

Vernacular design which effectively connects culture and ecology recognizes the continual interaction between and interdependence of culture and nature. Vernacular design which fuses these two produces a space which reflects the specific culture and ecology of the specific local, which ideally form a respectful partnership. Rene Dubos expands on the interaction between culture and nature: "[People] always add something to nature, and thereby transform it, but [their] interventions are successful only to the extent that they respect the genius of the place" (Kellert, 2005, p. 170).

IV. Vernacular Design Avoiding Placelessness

Placelessness is diminishing the distinctive local and regional identity and replacing it with uniformity and anonymity. Regrettably, the modern built environment too often embodies this characteristic. Conversely, designing the built environment to avoid placelessness involves connecting people to the various aspects of vernacular design previously discussed

(ecology, culture and history) in order to foster a connection and attachment to the places people live and work (Kellert, 2005).

One of the most successful and appropriate examples of vernaculardesign is Renzo Piano's design for TheTjibaou Cultural Centre in New Caledonia (See Plates 2.11 - 2.12). Piano conducted exhaustive studies into the culture and traditions of the region and enlisted the help of anthropologists of South Pacific culture. Piano (2007) found that there was no vernacular architecture for the region as their structures were built from perishable materials. This absence of a vernacular architecture allowed Piano the opportunity to research the culture and develop the first vernacular style for the area.

The Centre, which lies on a narrow strip of land surrounded by water, features the ten 'cases' or curved structures that soar from the ground all havingdifferent heights and functions. (see Plates 2.11 through 2.12), The cases are constructed of wooden joists andribs that vibrate in the wind, and are meant to reflect the natural materials of theMelanesian huts. Piano's design is so successful because he did not borrowfrom the past but merely researched the local culture and was able to design something completely new (Richardson, 2001).



Plate 2.11:J.M. Tjibaou Cultural Centre, New Caledonia.
Source: (Piano, 2007).



Plate 2.12: Interior of J.M. Tjibaou Cultural Centre, New Caledonia. (Piano, 2007).

2.7 ELEMENTS OF BIOPHILIC DESIGN.

These two main dimensions of biophilic design (the organic and the vernacular) contain six main elements of biophilic design which are ways in which biophilia can be integrated into the design of the built environment. These elements are environmental features, natural shapes and forms, natural patterns and processes, light and space, place-based relationships, and evolved human-nature relationships (Kellert et al., 2009). Furthermore, these six elements of biophilic design contain 72 biophilic design attributes which are practical examples of how the larger element can be expressed within the built environment. These dimensions, elements and attributes of biophilic design are illustrated in Table 2.2 and Figure 2.3.

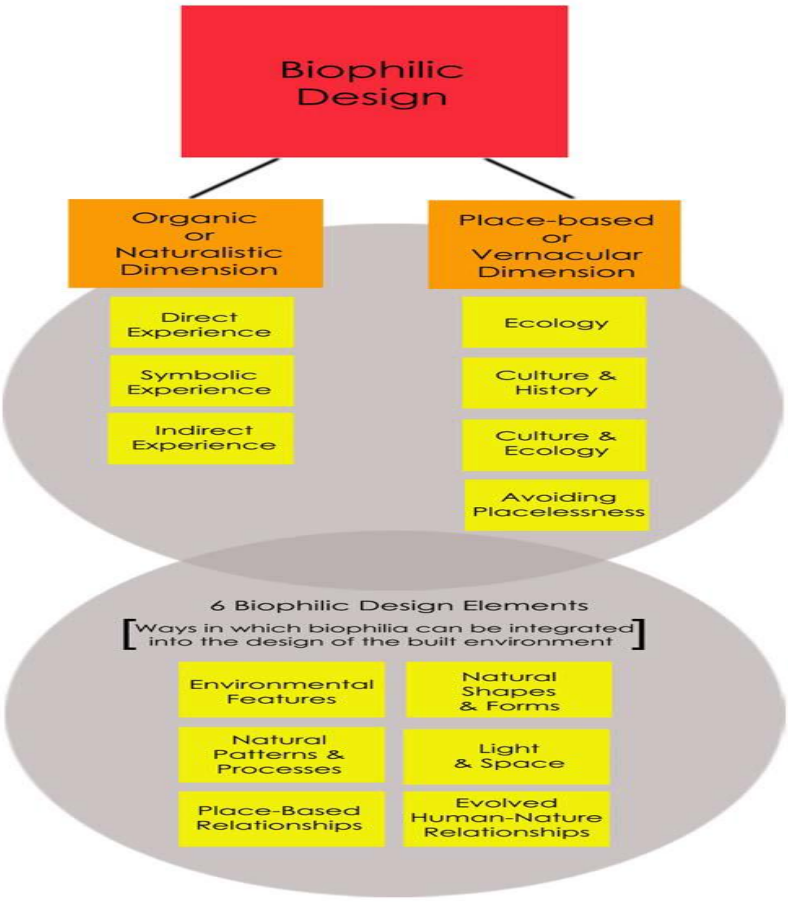


Figure 2.3:The two main dimensions and six main elements of biophilic design. Source: (Kellert, 2005; Kellert et al.,2009).

Table 2.2: The six main elements of biophilic design and their attributes.

1. Environmental Features	2. Natural Shapes and Forms	3. Natural patterns and processes
Color	Botanical motifs	Sensory variability
Water	Tree and columnar supports	Information richness
Air	Animal (mainly vertebrate) motifs	Age, change, and the patina of time
Sunlight	Shells and spirals	Growth and efflorescence
Plants	Egg, oval, and tubular forms	Central focal point
Animals	Arches, vaults, domes	Patterend wholes
Natural materials	Shapes resisting straight lines and right angles	Bounded spaces
Views and vistas		Transitional spaces
Façade greening	Simulation of natural features	Linked series and chains
Geology and landscape	Biomorphy	Integration of parts to wholes
Habitats and ecosystems	Geomorphology	Complementary contrasts
Fire	Biomimicry	Dynamic balance and tension
		Fractals
		Hierarchically organized ratios and scales

4. Light and Space	5. Place-based relationships	6. Evoloved human-nature relationships
Natural Light	Geographic connection to place	Prospect and refuge
Filtered and diffused light	Historic connection to place	Order and complexity
Light and shadow	Ecological connection to place	Curiosity and enticement
Reflected light	Cultural connection to place	Change and metamorphosis
Light pools	Indigenous materials	Security and protection
Warm light	Landscape features that define building form	Mastery and control
Light as shape and form		Affection and attachment
Spaciousness	Landscape ecology	Attraction and beauty
Spactial variability	Integration of culture and ecology	Exploration and discovery
Space as shape and form	Spirit of place	Information and cognition
Spatial harmony	Avoiding placelessness	Fear and awe
Inside-outside spaces		Reverence and spirituality

Source: (Kellert et al., 2009).

It is important to note that this list of biophilic elements and attributes will evolve as the knowledge and practice of biophilic design becomes more complete.

The dimensions, elements and attributes of biophilic design were used as a framework to further classify participants' experiences within the built environment in this study. For example, Benyus identified one experience in Interface's Showroom as "sunlight streaming in through windows and shadow effect created by Interface's 'Mission Zero (logo).'" Two biophilic design attributes the author identified in Benyus' experience were natural light and spirit of place. The attribute 'natural light' is an 'organic dimension' of biophilic design and a 'light and space' element of biophilicdesign. The attribute 'spirit of place' is a 'vernacular

dimension' of biophilic design and an 'evolved human-nature relationship' element of biophilic design.

2.8 APPLICATION OF BIOPHILIC DESIGN

Biophilic design often can be implemented quitesimply and inexpensively through a variety of means, such as the use of color, fabric patterns and textures that mimic those found in nature, and artistic representations or simulations of nature such as photographs, paintings, and some abstract forms of art. Making such changes in an office setting, for example, might be restrictive due to existing furniture and budget concerns, but it is important to note that even very limited exposure to nature can create a positive effect (Ulrich, 1986; Kaplan & Berman, 2010).

Ulrich performed multiple studies revealing the health benefits of exposure to nature in a wide variety of settings. Results from these studies included reduced stress, decreased anxiety, decreased blood pressure, and increased directed attention. Ulrich theorized that partaking in even small-scale experiences with nature, through the use of design can have a significant positive impact on human health(Kaplan, 1993; Ulrich, 1986).

Because of its tremendous impact on human psychology,biophilic design plays a vital role in healthcare and healthcare delivery. It is also applied in the design of public spaces like pars, urban centers, educational institutes and work places.

Woodwinds Health Campus, a local alternative care hospital and clinic facility that also serves as a community resource center for nearby diverse populations, provides several examples of biophilic design implemented for the physical and psychological health and wellbeing of patients and staff. The woodlands, healing gardens and patio areas surrounding the facility entice patients and staff to come outdoors and enjoy these environments, and floor to ceiling windows in the lobby connect indoor viewers with the year-round changes of

scenery. All common areas at Woodwinds have lush indoor plants and large fish tanks with colorful tropical fish and adjacent seating for convenient viewing. Observing fish in simulated natural environments has been shown to reduce stress and anxiety (Friedman, Son& Tsai, 2010). One experiences calm almost immediately upon entering the lobby.

In addition to the common areas, all patient rooms have a view of nature and utilize natural colors and textures in fabric, furniture, and paint. Fluorescent lighting is not used except in surgical areas; soft, incandescent lighting is used in common areas and patient rooms. Such examples of biophilic design technique, providing access to views of nature or representations of nature, use of colors, patterns, and textures found in nature, use of plants, and proximity to other living beings such as the fish tanks, and the sound of water from water features, can be successfully modified and implemented for use in design settings.

Another example of the application of Biophilic design is in the University of Guelph Humber building in Ontario, Canada. It contains a centrally located bio wall, vertically spanning the building. The wall is covered in dense foliage and be seen from almost every level inside. The wall also functions as a new filtration system prototype, it purifies the air and has a potential to fulfill the buildings fresh air intake requirements, Pliska (2005).

The Joseph Lewis center for environmental studies design is sustainable in a broader sense that the word Biophilic design can typically be applied. It minimizes energy use in harnessing solar power, utilizes both passive and active air systems, and monitors the weather toadapt to conditions. The centers living machine treat waste water by combining traditional waste water technology with wetland ecosystem purification processes, producing water that can be used in toilets and irrigation. In their design Orr and his team engineered an outstanding space for students to thrive while insuring the surrounding environment could do the same, Molthrop(2011) in (Amina, 2012)

Kieran and Timberlake Architects Loblolly House, located in Taylors Island, Maryland is a great example of how the built environment can be designed to integrate into the natural environment with little disturbance. The house uses several influential features from the surrounding site within the design to create a home integrated within its context. Several major factors that influenced the design of this structure included the verticality of the surrounding forest, as well as the play between solid and void experienced when looking through the trees on the site. By using natural materials and taking advantage of natural features such as view, orientation and the impact of changing weather conditions, a successful relationship was established between the natural and built environment. (See Plates 2.13 through 2.15).



Plate 2.13: Loblolly House.
Source: "Loblolly House." Kieran Timberlake Architects. 2008. Web. 1 Nov. 2011.www.kierantimberlake.com/home/index.html.



Plate 2.14: Integrating Site Features, Piers similar to loblolly trees.
Source: "Loblolly House." Kieran Timberlake Architects. 2008. Web. 1 Nov. 2011. <www.kierantimberlake.com/home/index.html>



Plate 2.15: Nature Within The Built Environment, Sense of being above and within the pines.
Source: "Loblolly House." Kieran Timberlake Architects. 2008. Web. 1 Nov. 2011. www.kierantimberlake.com/home/index.html.

Biophilic design has been directed towards the health and wellbeing of citizens in various cities of Europe and North America. An example of this is the vision of green urbanism embraced by European countries like Finland and Denmark. Helsinki for example has utilized two major master plan changes, one in the 1970s and the other in the early years of this present century to extend their original central park northward, the swath of deep nature

now loops around the city to encompass Tooloo bay and the islands in the bays adjacent to Helsinki's downtown. Copenhagen was divided in to the five-finger plan in 1947, with mass transit lines built along the fingers and nature left between the fingers. Several new parks are under development in areas previously lacking green spaces, in accordance with official municipal policy specifying that all citizens by 2015 must be able to reach a park or beach on foot in less than fifteen minutes. These changes have greatly increased the accessibility to nature. These two cities have become models for other cities to reassess their master plan, (Amina, 2012).

2.9 ADDICTION

Addiction is defined by the World Health Organization as "repeated use of a psychoactive substance or substances, to the extent that the user is:

- Periodically or chronically intoxicated,
- Shows a compulsion to take the preferred substance(s),
- Has great difficulty in voluntarily ceasing or modifying substance use,
- Exhibits determination to obtain psychoactive substances by almost any means, and
- Tolerance is prominent and a withdrawal syndrome frequently occurs when substance use is interrupted.

Also, Addiction (from Latin, meaning, "sentenced to servitude") is the uncontrollable craving for a pleasurable activity or a habitual relieving sensation, the sustained use of a drug or unhealthy relief mechanism develops a physiological or emotional dependence. Addiction is also described as a "quick fix" which gradually makes the situation worse over the long run. Originally the term was used in connection with heroin and the opiates, then expanded to include alcohol and other drugs, and finally broadened to cover all kinds of physical or emotional dependence.

2.9.1 EVIDENCE OF ADDICTION

Barry J. Everett (2004) opined that throughout history societies have used hallucinogens, pleasurable stimulants, andanesthetics. The Bible speaks of wine making glad the heart and of strong drink being given to those who were old and in pain; it also warns against the dangers of excessive or habitual drinking of strong drink. Anyone who has been prescribed strong medication to relieve continued pain knows how easily the body can develop dependencyand the strange struggle to wean oneself from such relief. Addiction quickly moves from a pleasurable to an insistent need for relief. Furthermore, beyond physical addiction are the related emotional pleasures and need for relief. It is very difficult for the addict, or the person who tries to help him or her, to separate the physical and emotional pleasures and needs, highs, and lows.

The most common destructive addictions in our society are cigarette smoking, alcohol, drugs, and gambling. Overeating, excessive use of coffee, sugar and chocolate, constant need for exposure to TV and noise, overwork, compulsive sexual activity, and the need to wield power and buy things can be added to the list (Robinson, 2006).

2.9.2 IMPLICATION OF ADDICTION

Addictions are costly to any society. Russian men at the end of the twentieth century have robbed their nation of a decade of productivity, dying early primarily from over consumption of alcohol. It is estimated that the U.S. loses billions of dollars annually in recognized and hidden costs such as crime, rehabilitation, property damage, and lost labor. In most industrialized nations, efficiency is diminished and business contracts may be lost due to human error caused by chemical dependency. Drug testing is a major social issue in sports, business, and the military. In any setting, addiction, combined with its related emotional problems, undermines families and communities.

2.9.3 DRUG REHABILITATION

Drug rehabilitation (often referred to as drug rehab or just rehab) is defined by the National Institute on Drug Abuse (NIDA), as a term for the process of medical or psychotherapeutic treatment, for dependency on psychoactive substances such as alcohol, prescription drugs and street drugs such as cocaine, heroin or amphetamines. The general intents is to enable the patient to cease substance abuse, in order to avoid the psychological, legal, financial, social and physical consequences that can be caused, especially by extreme abuse.

2.9.4 PSYCHOLOGICAL DEPENDENCY

Psychological dependency is addressed in many drug rehabilitation program by attempting to teach the patient new methods of interacting in a drug-free environment. In particular, patients are generally encouraged, or possibly even required to not associate with friends who still use the addictive substance. A twelve-step program encourages addicts not only to stop using alcohol or other drugs, but to examine and change habits related to their addictions. Many programs emphasize that recovery is a permanent process without culmination. For legal drugs such as alcohol, complete abstention rather than attempts at moderation, which may lead to relapse is also emphasized (One is too many, and a thousand is never enough.) Whether moderate is achievable by those with a history of abuse remains a controversial, but is generally considered unsustainable.

2.9.5 TYPES OF TREATMENT

Various types of programs offer help in drug rehabilitation, including: residential treatment (in-patient), out-patient, local support groups, extended care centre, recovery or sober houses, addiction counseling, mental health, orthomolecular medicine and medical care.

In a survey of treatment providers from three separate institutions; the National Association of Alcoholism and Drug Abuse Counselors, Rational Recovery Systems and Society of Psychologist in Additive Behaviors in India, 1970 shows that effective treatment addresses the multiple needs of the patient rather than treating addiction alone. In addition, The National Institute on Drug Abuse (NIDA) recommends detoxification followed by both medication where applicable and behavioral therapy, followed by relapse prevention. According to NIDA, effective treatment must address medical and mental health services as well as follow-up options, such as community or family based recovery support systems. Whatever the methodology, patient motivation is an important factor in treatment success.

For individuals addicted to prescription drugs, treatments tend to be similar to those who are addicted to drugs affecting the same brain systems. Medication like methadone and buprenorphine can be used to treat addiction to prescription opiates, and behavioral therapies can be used to treat addiction to prescription stimulants, benzodiazepines, and other drugs.

2.9.6 TYPES OF BEHAVIORAL THERAPY

The types of behavioral therapy include:

I. Cognitive-behavioral therapy, which seeks to help patients to recognize, avoid and cope with situations in which they are most likely to relapse.
II. Multidimensional family therapy, this is designed to support recovery of the patient by improving family functioning.
III. Motivational interviewing, which is designed to increase patient motivation to change behavior and enter treatment.
IV. Motivational incentives, which uses positive reinforcement to encourage abstinence from the addictive substance.

2.9.7 CRIMINAL JUSTICE

Drug rehabilitation is sometimes part of the criminal justice system. People convicted of minor drug offenses may be sentenced to rehabilitation instead of prison, and those convicted of driving while intoxicated are sometimes required to attend Alcoholic Anonymous (A.A.) meetings. There are a number of ways to address an alternative sentence in a drug possession case rather than sentencing to prison which in turn can increase the risk of addiction.

2.9.8 COUNSELLING

Traditional addiction treatment is based primarily on counseling. However, recent discoveries by NIDA, in 2004 have shown those suffering from addiction often have chemical imbalances that makes the recovery process more difficult. Counselors help individuals identifying behaviours and problems related to their addiction. It can be done on an individual basis, but it's more common to find it in a group setting and include crisis counseling, weekly or daily counseling, and drop-in counseling supports. They are trained to develop recovery programs that help to re-establish healthy behaviours and provide coping strategies whenever a situation of risk happens. It's very common to see them work also with family members who are affected by addictions of individual, or in a community in order to prevent addiction and educate the public. Counselors should be able to recognize how addiction affects the whole person and those around him or her.

2.9.9 HISTORICAL APPROACH TO SUBSTANCE ABUSE TREATMENT

I. TWO-FACTOR PROGRAMS

This is often refer to as Disease model and Twelve-step programs. The disease model of addiction has long contended the maladaptive patterns of alcohol and substance use displayed by addicted individuals as a result of a lifelong disease that is biological in

origin and exacerbated by environmental contingencies. This conceptualization renders the individual essentially powerless over his or her problematic behaviours and unable to remain sober by him or herself, much as individuals with terminal illness are unable to fight the disease by themselves without medication. Behavioural treatment therefore, necessarily requires individuals to admit their addiction, renounce their former lifestyle, and seek a supportive social network who can help them remain sober (Wilson 1935). Such approaches are the quintessential features of twelve-step programs, originally published in the book Alcoholic Anonymous in 1939. These approaches have met considerable amounts of criticism, coming from opponents who disapprove of the spiritual-religious orientation on both psychological and legal grounds. Nonetheless, despite this criticism, outcome studies have revealed that affiliation with twelve-step programs predicts abstinence success at 1 – year follow-up for alcoholism. Different results have been reached for other drugs, with the twelve steps being less beneficial for addicts to illicit substances, and least beneficial to those addicted to the psychologically addicting opioids, for which maintenance therapies are the gold standard of care.

II. CLIEN-CENTERED APPROACHES

In his influential book, Client-Centered Therapy, in which he presented the client-centered approach to therapeutic change, psychologist Carl Rogers proposed that there are three necessary and sufficient conditions for personal change: unconditional positive regards, accurate empathy, and genuineness. Rogers (2009) believed the presence of these three items in the therapeutic relationship could help an individual overcome any troublesome issue, including alcohol abuse.

A variation of Rogers' approach has been developed in which clients are directly responsible for determining the goals and objectives of the treatment. Client-Directed

Outcome-Informed therapy (CDOI), this approach has been utilized by several drug treatment programs, such as Arizona's Department of Health Services.

III. PSYCHOANALYTIC APPROACHES

Psychoanalysis, a psychotherapeutic approach to behavior change developed by Sigmund Freud in 1996 and modified by Rogers in 2003, has also offer an explanation of substance abuse. This orientation suggests the main cause of the addiction syndrome is the unconscious need to entertain and enact various kinds of homosexual and perverse fantasies and at the same time to avoid taking responsibility for it. Rogers further hypothesized that specific drugs facilitate specific fantasies and using drugs is considered to be displacement from, and a concomitant of the compulsion to masturbate while entertaining homosexual and perverse fantasies. The addiction syndrome is also hypothesized to be associated with life trajectories that have occurred within the context of traumatogenic processes, the phases of which include social, cultural and political factors, encapsulation, traumatophilia, and masturbation as a form of self-soothing. Such an approach lies in stark contrast to the approaches of social cognitive theory to addiction and indeed, to behavior in general. This approach holds human beings as they regulate and control their own environmental and cognitive environments, and are not merely driven by internal driving impulses.

2.9.10 COGNITIVE MODELS OF ADDICTION RECOVERY

I. RELAPSE PREVENTION

An influential cognitive-behavioural approach to addiction recovery and therapy has been Alan Marlatt's (1985) Relapse Prevention approach. Marlatt describes four psycholosocial processes relevant to the addiction and relapse processes: self-efficacy,

outcome expectancies, attributions of causality and decision-making processes. Self-efficacy refers to one's ability to deal competently and effectively with high-risk, relapse-provoking situations. Outcome expectancies refer to an individual's expectations about the psychoactive effects of an additive substance. Attributions of causality refer to an individual's pattern of beliefs that relapse to drug use as a result of internal, or rather external, transient causes (e.g., allowing oneself to make expectations when faced with what are judged to be unusual circumstances). Finally, decision-making processes are implicated in the relapse process as well. Substance use is the result of multiple decisions whose collective effects result in consumption of the intoxicant. Furthermore, Marlatt stresses some decisions referred to as apparently irrelevant decisions which may seem inconsequential to relapse, but may actually have downstream implications that place the user in a high-risk situation.

II. COGNITIVE THERAPY OF SUBSTANCE ABUSE

An additional cognitively-based model of abuse recovery has been offered by Aaron Beck (1993), the father of cognitive therapy and championed in his 1993 book, Cognitive Therapy of Substance Abuse. This therapy rests upon the assumption addicted individuals possess core beliefs, often not accessible to immediate consciousness (unless the patient is also depressed). These core beliefs, such as I am undesirable, activate a system of addictive beliefs that result in imagined anticipatory benefits of substance use and consequentially, craving. Once craving has activated, permissive beliefs (I can handle getting high just this one more time) are affiliated. Once a permissive set of beliefs have been activated, then the individual will activate drug-seeking and drug-ingesting behaviors. The cognitive therapist's job is to uncover this underlying system of beliefs, analyze it with the patient, and thereby assignments and behavioral exercises serve to solidify what is learned and discussed during treatment.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 GENERAL APPROACH

The purpose of this chapter is to introduce the research strategy and the empirical techniques applied in order to evaluate and reveal the influence of biophilic design principles on the design of a rehabilitation centre for drug addicts. In this research, case studies and interviews will be conducted using qualitative approach to examine the reflection of biophilic design principles in the design of a rehabilitation center and other facilities that that possess such elements in their designs, also to provide a basis for its reflection in rehabilitation center design. Thus the research will employ the following methods of study;

3.2 LITERATURE REVIEW

Review of existing literature: government policy documents (considerations for choice of site and location of building), Publications on rehabilitationcentre and biophilic design(history and evolution of biophilic and rehabilitation architecture), architectural magazines, architectural data books(useful for obtaining design guides, functional flows, space requirements), journal articles (mainly on applications of nature in architecture), unpublished thesis projects in the research area (to review contributions of previous researches) were also consult to ensure the richness of the research project.

3.3 CASE STUDIES

A case study may refer to both research method and unit of analysis, which involves the study of examples as case of being researched (Oluigbo, 2010). Case study in architecture begins with a documentation of the physical characteristics of the case (Oluigbo, 2010). This documentation will be based on evaluation of design principles that allows incorporation of

nature into the environment of a rehabilitation center to reduce stress and produce a healing environment. Case studies allow one to present data collected from multiple methods (i.e., surveys, interviews, document review, and observation) to provide a comprehensive record of the structures under consideration.

The assessment will be carried out through visual surveys, observation, and a checklist on the application of these outlined principles of Biophilic design under study. As earlier outlined these principles are the principle of natural shapes and forms, natural patterns and processes, environmental features, light and space, placed based relationships, and evolved human relations to nature.

3.3.1 POPULATION OF STUDY

Population is the aggregate of all the elements that share some common set of characteristics and that comprise the universe of the purpose of the research problem. Population in this study will include rehabilitation centers within the northern part of Nigeria and some other buildings that have some elements of biophilic design reflected on their design, and also other structures of similar characteristics and features that also have biophilic principles expressed on their designs within and outside the country.

3.3.2 SAMPLING/ CASE STUDY SELECTION CRITERIA

A sample is a fraction of a population from which it is obtained. Case study selection is comparable to sampling in a quantitative research and that those cases are usually purposively selected (Veal, 2006 in Oluigbo, 2010). This suggested that cases are identified for study due to their inherent qualities which were in consonance with the phenomenon under investigation (Oluigbo, 2010).

The case studies selected for this study would be sampled purposely on two bases.

i. As rehabilitation center with adequate coverage in scope of facilities required to operate as a standard rehabilitation facility.

ii. As a facility that possesses some Biophilic design principles.

3.4 DATA COLLECTION

Case studies in Architecture begin with a documentation of the physical characteristics of the case, and for theoretical research they may require the use of general methods of data collection (Oluigbo, 2010). Theory could be absent from studies which focus on describing the case and its issues (Stake, 1995). The use of multiple sources of data in order to capture the complexity of cases is one of the defining characteristic of case study methodology (Yin, 2004; Veal, 2006; Johansson, 2010 in Oluigbo, 2010).

However, for the purpose of this study, the method of data collection would be; observation, visual survey, interviews, and checklist of the level of application of Biophilic design principles on the cases studied.

3.4.1 INSTRUMENTS FOR DATA COLLECTION

Writing a research report is incomplete without describing the instruments and how they were validated (Shavelson, 2002). There are many different types of instruments which can used to collect data from a case study. The case studies for theoretical research in Architecture may require the use of general methods for data collection (Oluigbo, 2010). The use of multiple sources of data in order to capture the complexity of cases is one of the defining characteristic of case study methodology (Yin, 2004; Veal, 2006; Johansson, 2010 in Oluigbo, 2010).

For the purpose of this study, the instruments that will be use for the collection and documentation of data were Photographs, sketches, and notes. Photographs will be taken of relevant physical elements of the case studies to ascertain the extent or level of application of

principles of Biophilic design applied in the design, planning, and construction. Sketches of some relevant part of the case study were necessary to further describe some features of spatial organization, or to enhance the quality of some details that are not too clear from the pictures taken during the field visit. Data gained from the policy review. As an instrument, notes will also be taken on the field work to outline the account and extent of the independent variables on the case studies as they relate to the considerations and application of principles of Biophilic design.

3.4.2 PROCEDURES FOR DATA COLLECTION

The Procedures for data collection in the local case study will involve visits to the case study sites, and taking visual analysis of their architectural elements as they reflect these Biophilic design principles, buildings will then be critically evaluated based on the outlined criteria of analysis. Where it is deem fit, some professionals or senior staff members of any case study site will be approached and interviewed for information regarding the aim of the study. The foreign case studies however, will be obtained from the internet and assessed using the same criteria as used for the local case studies. However, the interviews in the foreign case studies will also be obtained online through mails of the selected professionals.

3.4 .3 DATA ANALYSIS AND PRESENTATION

Analysis of data collected on the visual survey and observation is based on the descriptive accounts as observed, and noted via the instruments of data collection (Veal, 2006). Brief introduction, account of independent variables, and checklist on the application of Biophilic design principles will be used to capture a better perspective of the facilities for more effective evaluation.

The case study analysis will focus on an illustrative qualitative method. The illustrative method will be used because it is descriptive and adds detailed examples to the study. Data collected on each case study will becarefullyanalyzed and represented in different forms which include:-

i. **Diagrammatic representation**- proper representation of data will be made by the use of sketches and also where drawings/ sketches will not do or are not available will be supported with pictures.

ii. **Figures-** Data collected from the case studies will also be demonstrated in the form of drawings and figures.

iii. **Photographs-** Pictures of the existing cases (cultural centers and other relevant buildings) will be taken and documented showing their facilities and the application of cultural identity and its principles where applied in the design, (if applied).

iv. **Tables-** Data collected on this research from the case studies will be documented and represented on assessment tables.

CHAPTER FOUR

CASE STUDIES

4.1SELECTION CRITERIA

Case study selection is comparable to sampling in a quantitative research and that those cases are usually purposively selected (Veal, 2006 in Oluigbo, 2010). This suggested that cases are identified for study due to their inherent qualities which were in consonance with the phenomenon under investigation (Oluigbo, 2010).

The case studies selected for this study would be sampled purposely on two bases;

iii. As rehabilitation center with adequate coverage in scope of facilities required to operate as a standard rehabilitation facility.

iv. As a facility that possesses some Biophilic design principles.

4.2 VARIABLES FOR ANALYTICAL AND COMPARATIVE STUDY

The case studies will be assessed using the following independent variables:

a) Client
b) Location
c) Architect
d) Contractor
e) Construction date
f) Rehabilitative Function
g) Context
h) Style
i) Climate

And the dependent variables that will be observed to document on the case studies are:

i. Major Facilities

ii. Dominant Building Material

iii. Main Structural System

iv. Architectural Expression

v. Composition of Form

vi. Spatial Organization

vii. Environmental Feature

viii. Biophilic Value

ix. Siting and Orientation

x. Circulation system

While the principles that will be used to assess and analyze the case studies on the level of application of the principles of Biophilic design are:

a. Principle of place based relationship

b. Principle of evolved human relations to nature

c. Principle of natural forms and shapes

d. Principle of natural patterns and processes

e. Principle of Environmental Features

f. Principle of light and space

The comparative analysis will be done using weight scale of '5' for each variable.

4.3 CASE STUDY ONE: PLATEAU STATE REHABILITATION CENTRE, JOS, NIGERIA

Client:	Plateau State Government of Nigeria.
Location:	Zaria Road – Jos, Plateau state.
Architect:	Directorate Physical Facilities.
Contractor:	Palace Peace Investment LTD.

Construction date:	1981 – 1982.
Function:	Rehabilitative, Social, Occupational and Educational.
Context:	Urban.
Style:	Functionalism.
Climate:	Tropical.

4.3.1 Background Information

The centre was established in 1982 by the Plateau State Government to train people with disabilities to become self-reliant in the society. Due to the increase in the number of drug addicts in the society, the centre later introduces the system which also provides room for the rehabilitation of drug addicts in 2004. Plate 4.1 shows the present condition of the approach of the Plateau State Rehabilitation Centre as at the time of conducting this case study.



Plate 4.1: Plateau State Rehabilitation Centre, Jos, Nigeria.

Source: Author's field work, October – 2013.

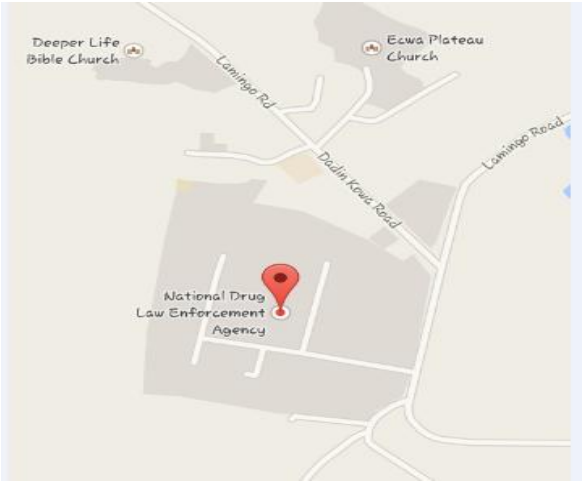
The centre offer vocational training and education to improve the rehabilitees socio-economic background, prepare rehabilitees for integration through social rehabilitation, offers guidance and counseling services and assist in placement services and follow up for the employment of the rehabilitated people. Plate 4.2 shows the arrangements of workshops for vocational training and social rehabilitation in the Plateau State Rehabilitation Centre.



Plate 4.2: Court Yard System, Plateau State Rehabilitation Centre.

Source: Author's field work, October – 2013.

The construction of the building started on October 20, 1981, and was completed and commission by Then Plateau State Governor, Solomon Lar on May12, 1982. It is easily accessible from Zaria road which serve as the main entrance road of the city from Zaria. It covers an area of 3000sq.m with a height of 4m. Map 4.1 shows the Google location map of the Plateau State Rehabilitation centre as at the time of conducting this case study.



Map 4.1: Location: Plateau State Rehabilitation Centre, Plateau State.

Source: www.googlemap. (October, 2013).

The Plateau State Government finances the feeding, accommodation and the working materials for the rehabilitees in the rehabilitation centre. The centre presently has ninety

students comprising of fifty drug addicts and forty physically challenged students. The drug addicted students were placed on a boarding program with five students per room, while the physically challenged students were on a day program. Plate 4.3 shows the access road that links the admin block and the accommodation facilities of the rehabilitees in the Plateau State Rehabilitation Centre as at the time of conducting this case study.



Plate 4.3: Environmental Features, Plateau State Rehabilitation Centre.

Source: Author's field work, October – 2013.

Table 4.1: Case study description - Plateau State Rehabilitation Centre, Plateau State, Nigeria.

VARIABLES	DESCRIPTIONS
• **Major Facilities**	An administrative block consisting of 4 offices, reception/ counseling unit, 2 junk stores, 10 skills acquisition laboratories, 2 classrooms and a cafeteria/ dining hall.
• **Dominant Building Material**	Sandcrete blocks, Reinforced concrete, steel pipes and ceiling partitions.
• **Main Structural System**	Reinforced concrete columns and steel pipes that support the roofing of passage.
• **Architectural Expression**	Court yard concept, Plate 4.2, which was adopted for its communal interaction functions, and ease of arranging facilities within an open space.

• **Composition of Form**	Rectangular plan, Long narrowed passage connecting the administrative block to the accommodation spaces and a mono pitched roof.
• **Spatial Organization**	The two rectangular buildings were planned around a central core.
• **Environmental Feature**	Scattered trees and lots of grasses that forms part of the building and landscape.
• **Biophilic Value**	Optimized open space for relaxation and recreation, and optimizing building openings for admitting light into the building.
• **Siting and Orientation**	The building is located along Zaria road, with its entrances facing the road at the eastern direction and thesite is functionally and spatially coherent, facilitating the flow of people to, from, and within the site. The centre is strategically located to allow easy access from the major road.
• **Circulation system**	Long narrowed passages

Source: Author, November - 2013.

4.4 CASE STUDY TWO: BAUCHI STATE REHABILITATION CENTRE, BAUCHI, NIGERIA

Client: Bauchi State Government of Nigeria.

Location: Games village, Bauchi state Nigeria.

Architect: Directorate Physical Facilities.

Contractor: Palace Peace Investment LTD.

Construction date: 1989 – 1990.

Function: Rehabilitative, Social, Occupational and Educational.

Context:	Urban.
Style:	Functionalism.
Climate:	Tropical.

4.4.1 Background Information

The centre was established in 1990 by the BauchiState Government initially as a women centre under the Ministry of Women Affairs. It was laterdeveloped in to a ministry for Social Development in 1994 and later on, developed to become the Ministry of Social Welfare and Social Development with the Department of Social Rehabilitation under the Ministry of Social Development. The department of social rehabilitation covers the rehabilitation of people with disabilities. It was by the year 2006 that the centre introduced the department for the rehabilitation of drug addicts due to the increase in the number of drug addicts in the society.Plate 4.4 shows the present condition of the Bauchi State Rehabilitation Centre as at the time of conducting this case study.



Plate 4.4: IbrahimSaniAbacha Rehabilitation Centre, Bauchi state, Nigeria.

Source: Author's field work, October – 2013.

The centre also offers vocational training and education to improve the rehabilitees socio-economic background, prepare rehabilitees for integration through social rehabilitation,

guidance and counseling services. The rehabilitation accommodation blocks can be seen in Plate 4.5.



Plate 4.5: Major Facilities, I. S. Abacha Rehabilitation Centre Bauchi.

Source: Author's field work, October – 2013.

The construction of the building started on December 10, 1989, and was completed and commission by then Bauchi State Governor, Joshua Madaki on September 12, 1990. The BauchiState Government finance's feeding, accommodation and working materials for the rehabilitees in the rehabilitation centre. The centre is populated with abundant grasses as soil cover and some trees were evident in isolation on the site as Plate 4.5 shows the presence of the grass cover while Plate 4.6 shows the trees within the administrative and academic area of the Bauchi State Rehabilitation Centre as at the time of conducting this case study.



Plate 4.6: Court Yard System, Bauchi State Rehabilitation Centre.

Source: Author's field work, October - 2013.

The centre presently has seventy students comprising of fifty-five drug addicts and fifteen physically challenged students. The drug addicted students were placed on a boarding program with two students per room, while the physically challenged students were also on a day program as in the Plateau State Rehabilitation Centre. Plate 4.1 shows the access gate to the Bauchi State Rehabilitation Centre as at the time of conducting this case study.



Plate 4.7: Environmental Features, I. S. Abacha Rehabilitation Centre Bauchi.

Source: Author's field work, October - 2013.

Table 4.2: Case study description - Bauchi State Rehabilitation Centre, Plateau State, Nigeria.

VARIABLES	DESCRIPTIONS
• **Major Facilities**	Two administrative blocks consisting of 3 and 5offices respectively, counseling unit, stores and 6 skills acquisition laboratories. A security post (see Plate 4.5), parking lots as well as accommodation spaces were also evident in the structure.
• **Dominant Building Material**	Sandcrete blocks, Reinforced concrete, steel pipes and aluminum roofing.
• **Main Structural System**	Reinforced concrete columns and Beams.
• **Architectural Expression**	An open court yard concept, Plate 4.2, which was also adapted for its communal interactive functions, and ease of arranging facilities within an open space, see Plate 4.6.
• **Composition of Form**	Rectangular plan, with long narrowed verandas as passages that connect the administrative block to the other facilities within the structure with a combination of both the hipped and gable roofs.
• **Spatial Organisation**	The buildings on the site were haphazardly arranged as a result of the continuous change of function which resulted in the isolation of buildings in a non-harmonious arrangement. Though some of the structures were arranged and planned around a central open core.
• **Environmental Feature**	Some trees in isolation were evidenced on the site and lots of grasses that forms part of the building with no defined landscaping features.
• **Biophilic Value**	Open space for relaxation and recreation, and optimizing building openings for admitting light and areas used for parking.
• **Siting and Orientation**	The building is located along Zaria road, with its entrances facing the road at the eastern direction and the site is

	functionally and spatially coherent, facilitating the flow of people to, from, and within the site. The centre is strategically located to allow easy access from the major road.
• **Circulation system**	Long narrowed verandas and unpaved foot parts.

Source: Author, November – 2013.

4.5 CASE STUDY THREE: SEARIDGE DRUG REHABILITATION CENTRE NOVA SCOTIA, CANADA.

Client:	Maria and Doug.
Location:	Nova Scotia, Canada.
Architect:	Raymond Moriyama.
Contractor:	-
Construction date:	1970–1972.
Function:	Rehabilitative, Social and Recreational.
Context:	Suburban.
Style:	Modern.
Climate:	Mild.

4.5.1 Background Information

Sea ridge Drug Rehabilitation Centre is a drug addiction treatment facility that aspires to support, challenge and inspire individuals struggling with drug addiction dependencies. It was founded to meet the needs for a drug rehab centre in Nova Scotia, Canada that provides

an elevated level of quality to recovery. Sea ridge stands among Canada's best alcohol and drug rehabilitation centre, recognized for excellence in evidenced based psychotherapy and a high rate of successful addiction recovery.



Plate 4.8: View from Sea ridge Drug Rehabilitation Centre.

Source: www.wikkimedia.com. (October, 2013).

As a premiere alcohol and drug treatment centre, it stands for clinical excellence and groundbreaking treatments. The centre is located in the famously picturesque Upper Clements, the heart of Annapolis Valley, Nova Scotia overlooking the Annapolis basin and just minutes from the seacoast throughout the year, the lush scenery reflects the healing cycle of nature's seasons in all their beauty. The serenity of being surrounded by nature on an extensive acreage helps to heal the mind, body and the spirit.



Plate 4.9: Admin Block Sea ridge Drug Rehabilitation Centre.

Source: www.wikkimedia.com.(October, 2013).

The centre offers rehabilitative services to only 25 to 30 people at a time with only 12 residence, keeping their programs small and private to prevents an institutional mindset from taking hold and offers a more relaxed and welcoming environment. The addiction rehabilitation program is primarily focused on evidence-based psychotherapy, and the number of enrolment is limited so as to have room for flexibility and individuality as a large institution cannot accommodate.



Plate 4.10: Design concept: Sea ridge Drug Rehabilitation Centre.

Source:www.wikkimedia.com.(October, 2013).



Plate 4.11: Fire Pace: Sea ridge Drug Rehabilitation Centre.

Source:www.wikkimedia.com.(October, 2013).

Since recovery requires a healthy body and mind, sea ridge drug rehab is committed to proper nutrition with most of its food sourced from the neighboring farms in Annapolis Valley. Sea ridge rehabilitation centre also used healthy ways to deal with stress and relax as an important part of drug addiction recovery and as such, offers a rich recreational program accessible to each resident's different physical abilities and interests.



Plate 4.12: Residence Hostel: Searidge Drug Rehabilitation Centre.

Source: www.wikkimedia.com. (October, 2013).

They organize various seasonal outdoor activities and fitness programs that will heal the body as well as the mind and spirit.



Plate 4.13: Environmental Features: Sea ridge Drug Rehabilitation Centre.

Source: www.wikkimedia.com.(October, 2013).



Plate 4.14: Healing Pool: Sea ridge Drug Rehabilitation Centre.

Source: www.wikkimedia.com.(October, 2013).

Table 4.3: Case study description, Sea ridge Drug Rehabilitation Centre.

VARIABLES	DESCRIPTIONS
• **Major Facilities**	Offices, theatre, counseling chambers, cafeterias, Hostel, Cinema, Sports and Recreation facilities and exhibition gallery.
• **Dominant Building Material**	Metal clad, woods, stabilized earth bricks, aluminumand glass.

• **Main Structural System**	Reinforced concrete columns and steel clad.
• **Architectural Expression**	The modern international architecturaltechniques were blended by Raymond Moriyama. The building is surrounded by landscaping which is also inspired by the presence of healing pools, colorful plantings, outdoor fire places and paved walkways as the basic elements of landscaping.
• **Composition of Form**	Rectangular plan, box form withgable roofs and circular outdoor fire places.
• **Spatial Organization**	12 row units' residence rooms were arranged in one block with large outside space full of green pastures and a stone's throw of the ocean that helps the residents enjoy nature's beauty. Many paved walkways sandwiched by green spaces, and gardens that are interlinked with the buildings and also with the recreational spaces within the facility.
• **Environmental feature**	Waterfall, healing pools, Water fountain, trees and lawns.
• **Biophilic Value**	Optimized open space for relaxation and recreation, extensive provision of water bodies to enhance healing process and minimized building footprint.
• **Siting and Orientation**	The center is strategically located at the famously picturesque Upper Clements, the heart of Annapolis Valley, Nova Scotia overlooking the Annapolis basin and just minutes from the seacoast of the city to allow easy access from major roads.
• **Circulation System**	Covered and opened paved walkways interlinking spaces.

Source: Author, November – 2013.

4.6 CASE STUDY FOUR: NATIONAL THEATRE, LAGOS, NIGERIA

Client:	Federal Government of Nigeria.
Location:	Iganmu- Lagos state.
Architect:	Palace of Culture and Sports Verna - Bulgaria.
Contractor:	Techno exports Roy, Bulgaria.
Construction date:	1973 – 1976.
Function:	Entertainment, Social and Educational.
Context:	Urban.
Style:	Expressionist.
Climate:	Tropical.

4.6.1 Background Information

The National Theatre is an architecture master piece and symbol of Lagos, and Nigeria in general. The facility was built to facilitate the hosting of the 1977 Second World Black African Festival of Art and Culture (FESTAC' 77) in Lagos, Nigeria.



Plate 4.15: National Theatre, Lagos.

Source:www.wikkimedia.com.(October, 2013).

The construction of the building started on April 24, 1973, and was completed and commission by Nigeria military President, General OlusegunObasanjo on September 30, 1976. It covers an area of 23000sq.m and standing well over 31m tall, the multipurpose National Theatre was established for the preservation, presentation and promotion of arts and culture in Nigeria.



Plate 4.16: Reinforced Concrete Piers: National Theatre Lagos.

Source: www.wikkimedia.com.(October, 2013).



Plate 4.17: Horse Saddle: National Theatre Lagos.

Source: Author's field work, October - 2013. In (Nzekwe 2010).

The National Theatre complex offers diverse venues, facilities and innovations for all kinds of programs and activities. The versatility of its halls and facilities gave the National Theatre the distinction of being the number one events venue in the country. Since 1977, the theatre has hosted a good number of national and international events which include musical concerts, dramas, dances, film shows, symposia, exhibition, conventions workshops and even sports.



Plate 4.18: Performing Theatre: National Theatre Lagos.

Source: www.wikkimedia.com.(October, 2013).

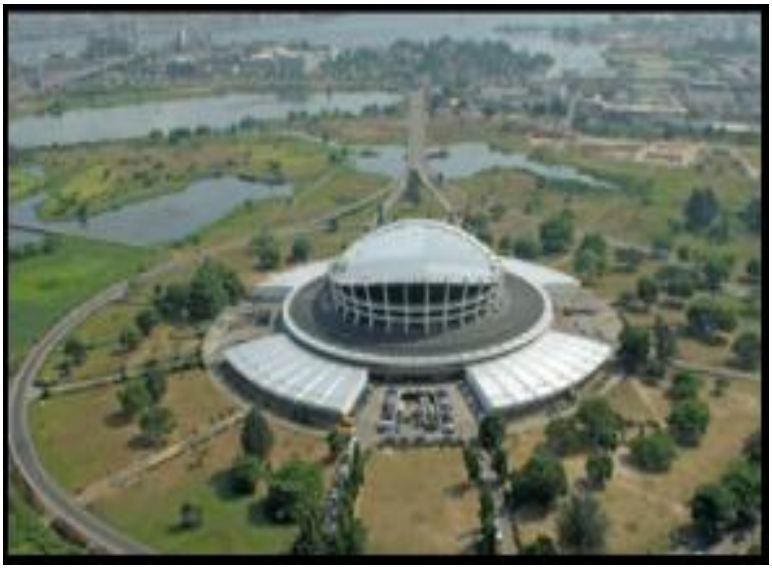
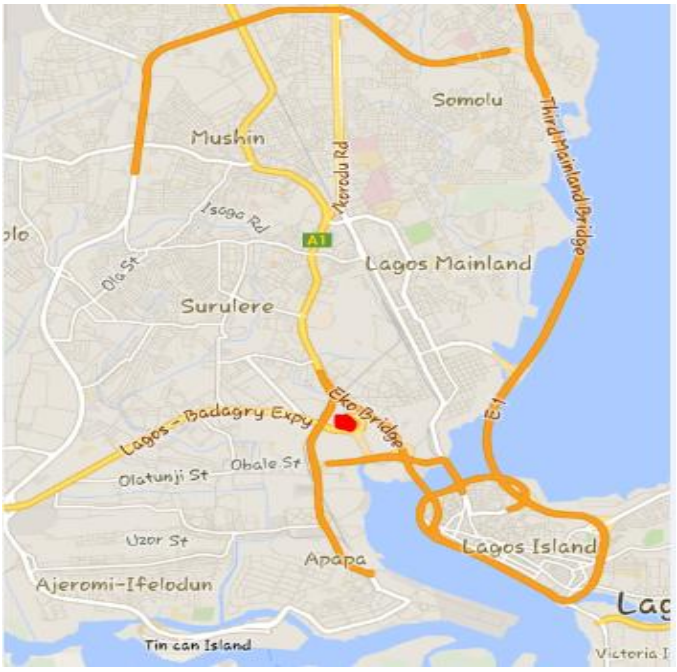


Plate 4.19:Environmental Features: National Theatre, Lagos, Lagos,

Source: www.wikkimedia.com.(October, 2013).



Map 4.2: National Theatre, Lagos, Nigeria,

Source: www.googlemap. (October, 2013).

Table 4.4: Case study description - National Theatre, Lagos, Nigeria,

VARIABLES	DESCRIPTIONS
• **Major Facilities**	5000 seating capacity performing theatre, 1500 seating capacity banquet hall, Conference halls, Two cinema hall (640 seating capacity each), 2 exhibition hall, 2 theatres, health clinic, 4 restaurants with bars, and post office.
• **Dominant Building Material**	Reinforced concrete, glass, aluminum cladding.
• **Main Structural System**	Reinforced concrete piers that supports hyperbolic parabolic roof.
• **Architectural Expression** **Plate 4.19: Horse**	Horse saddle concept, Plate 4.19 which was adapted from Sports Place, Varna, Bulgaria. Though it was also conceived as a symbol of the military cap in Nigeria.
• **Composition of Form**	Circular plan, hyperbolic parabolic roof.
• **Spatial Organisation**	The circular building was planned around a central core.

• **Environmental Feature**	Lots of trees that forms part of the building and landscape and presence of roof garden with a lovely view of a portion of Lagos.
• **Biophilic Value**	Optimized open space for public relaxation and recreation and areas used for parking.
• **Siting and Orientation**	The building, with its four entrances, and site is functionally and spatially coherent, facilitating the flow of people to, from, and within the site. The center is strategically located to allow easy access from major roads: Eric Moore Road, Lagos- Badagry road, Apapa road and Eco bridge.
• **Circulation system**	25 Lifts, Staircases and Ramp

Source: Author, November – 2013.

4.7 CASE STUDY FIVE: FALLING WATER/ KAUFMANN RESIDENCE.

Client: Sir. Edgar Kaufmann.

Location: Mill Run Pennsylvania, Uniontown.

Architect: Frank Lloyd Wright.

Governing Body: Western Pennsylvania Conservancy.

Construction date: 1936 – 1939.

Function: Residential.

Context: Rural.

Style: Modernism.

Climate: Sub-tropic.

4.7.1 Background Information

Fallingwater or Kaufmann Residence is a house designed by architect Frank Lloyd Wright in 1936 in rural south western Pennsylvania, 43 miles (69km) southeast Pittsburgh. The home was built partly over a waterfall on bear run in the Mill Run section of Stewart Township, Fayette County, Pennsylvania, in the Laurel Highlands of the Allegheny Mountains.



Plate 4.20: Falling Water/ Kaufmann Residence.

Source: www.wikkimedia.com.(October, 2013).

Hailed by time shortly after its completion as Wright's most beautiful job, it is listed among Smithsonian's life list of 28 places to visit before you die. It was designated a National Historic Landmark in 1966. In 1991, members of the American Institute of Architects (AIA) named the house the "best all time work of American Architecture" and in 2007, it was ranked twenty ninth on the list of America's Favourite Architecture according to AIA.

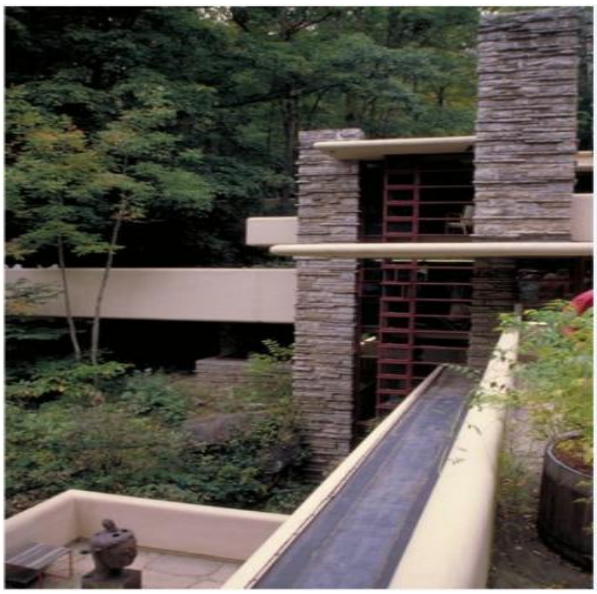


Plate 4.21: Main Structural System, Fallingwater.

Source: www.wikkimedia.com.(October, 2013).



Plate 4.22: Architectural Expression, Fallingwater.

Source: www.wikkimedia.com.(October, 2013).

Falling water was the family's weekend home from 1937 to 1963. In 1963, Kaufmann, Jr. donated the property to the western Pennsylvania Conservancy. In 1964, it was opened to public as a museum. Nearly five million people have visited the house as of March 2013. Despite its location in a remote corner of Pennsylvania, the house according to the informational pamphlet distributed on the grounds, host more than 150,000 visitors each year.



Plate 4.23: Interior view, Fallingwater.

Source: www.wikkimedia.com.(October, 2013).

Kaufmann, Jr. years later said, "He (Wright) understood that people were creatures of nature, hence an architecture which conformed to nature would conform to what was basic in people. For example, although all of falling water (sic) is opened by broad bands of windows, people inside are sheltered as in a deep cave, secure in the sense of the hill behind them.



Map 4.3: Location, Kaufmann Residence.

Source: www.googlemap.com.(October, 2013).

Table 4.5: Case study description – Kaufmann Residence, Mill Run Pennsylvania, Uniontown.

VARIABLES	DESCRIPTIONS
• **Major Facilities**	The house comprises of access bridge, 4 bedrooms, separate rooms for Mr. & Mrs. Kaufmann, one for their adult son and one for visitor with a cantilevered living room and fire place. A four bay carport servants' quarters and a guess chalet. A spring-fed swimming pool.
• **Dominant Building Material**	Reinforced concrete slabs, Stone blocks, glass, aluminum and steel cladding, Steel casement windows and doors and Stucco.
• **Main Structural System**	Series of very bold reinforced concrete cantilevered balconies, Post tensioned reinforced concrete bridge that provide access to the building and long projected windows.
• **Architectural Expression**	The dynamism and integration with the striking natural surroundings make falling water stands as one of the Wrights greatest masterpieces. It has been described as an architectural tour de force of Wright's organic philosophy. Wrights passion for Japanese architecture was strongly reflected in the design of fallingwater, particularly in the importance of interpenetrating exterior and interior spaces as well as the strong emphasis placed on harmony between man and nature.
• **Composition of Form**	Rectangular plan, Rectangular cantilevered projections, and flat roof.

• **Spatial Organization**	The rectangular building was planned around and on top of a running waterfall with upside down T-shaped beams integrated into monolithic concrete slab which both formed the ceiling of the space below and as well provide resistance against compression.Wright had planned from the beginning to have the house blend in ti its natural settings in rural Pennsylvania; in doing this he limited his choice of colors to light ochre for the concrete and his signature Cherokee red for the steel.
• **Environmental Feature**	High land masses with lots of trees that form part of the building and landscape as well as the presence of waterfall, swimming pool and fountain at the core of the building.
• **Biophilic Value**	The importance of interpenetrating exterior and interior spaces as well as the strong emphasis placed on harmony between man and nature.
• **Siting and Orientation**	The home was built partly over a waterfall on bear run in the Mill Run section of Stewart Township, Fayette County, Pennsylvania, in the Laurel Highlands of the Allegheny Mountains.
• **Circulation System**	Staircases and pedestrian systems.

Source: Author, November - 2013.

4.8 CASE STUDY SIX: THE JEAN-MARIE TJIBAOU CULTURAL CENTRE.

Client: Government of New Caledonia

Location: Centre CultureiTjibaou, Rue des accords de Matignon, Tina

Architect: Renzo Piano.

Contractor: -

Construction date: May 1998

Function: Cultural, Social and Educational

Context:	Urban
Style	Expressionist
Climate:	Sub-tropical

4.8.1 Background Information

The Jean-Marie Tjibaou Cultural Centre(French Centre Cultural Tjibaou), on the narrow Tina peninsular, approximately 8km northeast of the historic centre of Noumea, the capital of new Caledonia, celebrate the vernacular kanak culture, the indigenous culture of new Caledonia, amidst much political controversy over the independent status sought by some kanaks from French rule. It opened in June 1998 and was design by Italian architect Renzo Piano and named after Jean Marie Tjibaou, the leader of the independence movement who was assassinated in 1989 and who had a vision of establishing a cultural centre which blended the linguistic and artistic heritage of the kanak people.

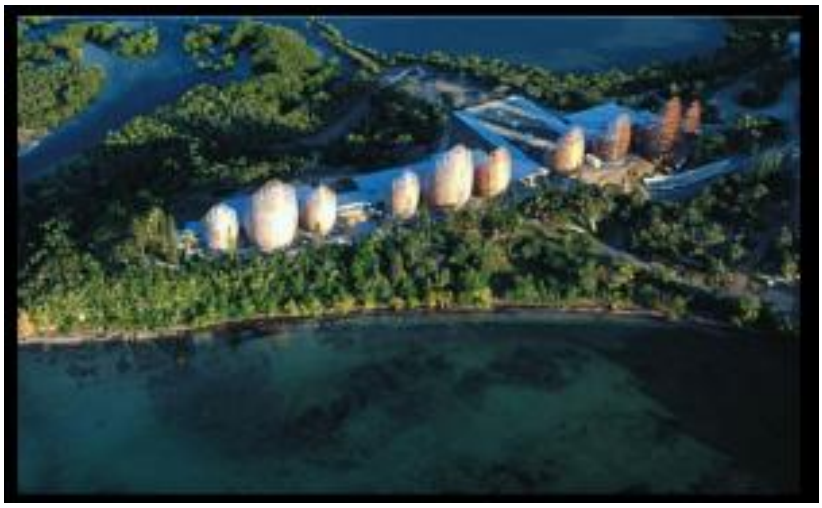


Plate 4.24:The Jean-Marie Tjibaou Cultural Centre.

Source: www.wikkimedia.com. (October, 2013).



Plate 4.25: The Jean-Marie Tjibaou Cultural Centre Building Materials.

Source: www.wikkimedia.com.(October, 2013).

The Kanak building traditions and the resources of the modern international architecture were blended by Piano. The formal curved axial layout, 250m long on the top of the ridge, contains 10 large conical cases or pavilions (all of different dimensions) patterned on the traditional Kanak Grand Hut design. The building is surrounded by landscaping which is also inspired by traditional Kanak design element. Marie Claude Tjibaou, Widow of Jean Marie Tjibaou and current leader of the agency for the development of Kanak culture (ADCK), observed: "we, the Kanaks, see it as culmination of a long struggle for the recognition of our identity; on the French Government part it is a powerful gesture of restitution."



Plate 4.26: The Jean-Marie Tjibaou Cultural Centre Arial View.

Source: www.wikkimedia.com.(October, 2013).

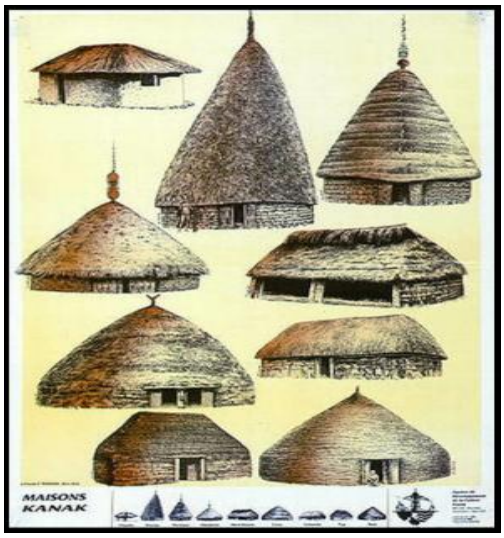


Plate 4.27: The Jean-Marie Tjibaou Cultural Centre Form Composition.

Source: www.wikkimedia.com.(October, 2013).

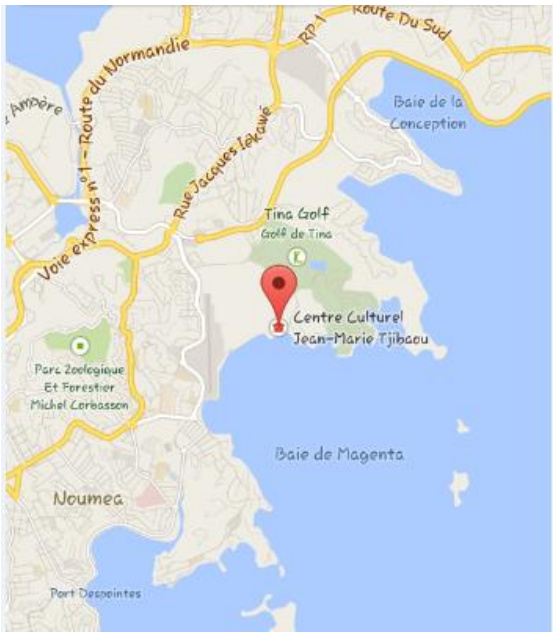
The site is located on the narrow Tina peninsular which project in to the pacific ocean along a ridge line, near Tina golf and western coast of Boulari bay, approximately 8km northeast of the old city centre of Noumea. Though the agency (ADCK) wish to set up the centre in the heart of the city to make a statement within the strongly French influenced city, the land allotted is between the lagoon and the bay, which is an off shoot of the sea.



Plate 4.28: The Jean-Marie Tjibaou Cultural Centre Environmental Features.

Source: www.wikkimedia.com.(October, 2013).

The lagoon side of this area is made up of dense mangrove at the water edge. Earlier, other types of trees also covered the site. There was a well-trodden part along the centre of the area of the peninsular. A ridge separated the area from the sea, which created the ecology of the area with the bay side experiencing strong easterly winds. Intense heat of sub-tropical sun was also another factor which had an impact on the design of the building.



Map 4.4: Location, the Jean-Marie Tjibaou Cultural Centre.

Source: www.googlemap.com.(October, 2013).

Table 4.6: Case study description – The Jean-Marie Tjibaou Cultural Centre,

Variables	Descriptions
• **Major Facilities**	10 units called cases, or hut pavilions, arranged in three groups or village clusters with one tall hut (the largest is 28m high), many covered walkways, green spaces, outdoor rooms, and gardens that are interlinked with the pavilion or cases and also with the smaller office buildings.
• **Dominant building material**	Laminated Woods, Reinforced concrete, Coral, Aluminium castings, glass panels, Tree bark and Stainless steels. The Iroko (Clorophora excels) timber used extensively was imported from Africa (native to tropical Africa, from Tanzania to Sierra Leone); it was decided to use Iroko because it was durable, and mostly resistant to attack by insects, fungi and mould. The frames of cases were pre-fabricated in France and assembled on site.
• **Main Structural system**	Reinforced concrete,Aluminium castings and Stainless steel.
• **Architectural Expression**	The Kanak building traditions and the resources of the modern international architecture were blended by Piano. The formal curved axial layout, 250m long on the top of the ridge, contains 10 large conical cases or pavilions (all of different dimensions) patterned on the traditional Kanak Grand Hut design. The building is surrounded by landscaping which is also inspired by traditional Kanak design element.

• **Composition of Form**	Circular plans with a conical shape of the traditional Kanak great houses in elevation, with the concept of a temporary building type made up of locally available materials which needed to be replaced from time to time in the sub-tropical climate, in contrast to the permanent building types.
• **SpatialOrganization**	10 units pavilions were arranged in three village clusters with one tall hut, many covered walkways sandwiched by green spaces, outdoor rooms, and gardens that are interlinked with the pavilions and also with the smaller office buildings.
• **Environmental feature**	The pavilions were surrounded by landscape layout that was set amidst transplanted Norfolk Island pines, which are as tall as the pavilions. Smaller trees are also planted in the areas near the lower offices. This layout presents a "planted indigenous landscape". A Melanesian food garden with taro and yam are also grown. Path to the great house are planted with Araucaria columnaris or column pine and coconut trees.
• **Biophilic Value**	Optimized open space for public relaxation and recreation, and use of forms from local culture to create bold architecture.
• Siting and Orientation	The site is located on the narrow Tina peninsular which project in to the pacific ocean along a ridge line, near Tina golf and western coast of Boulari bay, approximately 8km northeast of the old city centre of Noumea.
• **Circulation System**	Many covered and opened walkways interlinking spaces.

Source: Author, November – 2013.

CHAPTER FIVE

RESULTS AND DISCUSSION OF FINDINGS

5.1 ASSESSEMENT TABLES FOR THE LEVEL OF APPLICATION OF BIOPHILIC DESIGN PRINCIPLES INTHE CASES STUDIED

Table 5.1: Case study Analysis – Plateau State Rehabilitation Centre, Plateau State, Nigeria.

ELEMENTS OF BIOPHILIC DESIGN							
Principle	**Requirement**	**Degree of reflection**					**Remarks**
		1	**2**	**3**	**4**	**5**	
a. Principle of place based relationship	- Use of local building materials - Use of durable long lasting materials and technique. - Use of recyclable materials - Provision of areas for future expansion - Provision of spiritual spaces - Use of natural landscape of the site	 x x 	x x	 x x 	 	 	There is an evident of very few local building materials such as woods while the sandcrete blocks and concrete provide a durable building material. No any recyclable building material was used in the construction of the centre but there is large space provided for future expansion of the centre. No space was provided for both religious and spiritual functions on the structure while the landscape of the site was predominantly naturally growing grasses.
b. Principle of evolved human relations to nature	- Aesthetics - Mystery and enticement - Provision of healing gardens, walkways and fountains	x x x	 	 	 	 	The building has no features that will portray the principle of evolved human relation to nature as it lacks aesthetical, mystery and gardens for healing. Though, a long narrow walk way was provided which link the accommodation and the administrative building.

c. Principle of natural forms and shapes	- Design with respect to the natural physical elements on site - Application of organic shapes in building. - Use of arches, vaults and domes. - Simulation of natural features.	x x x x					Natural forms and shapes such as the organic shapes, arches, vaults and domes were not incorporated in the structure. The structure was also not design with respect to the natural physical elements on site.
d. principle of natural patterns and processes	- Use of complimentary local landscape elements - Design with respect to sun and wind orientation - Selection of pleasant zones for development within site	 x 	x x				Local landscaping elements such as grasses and trees were present on the structure but the orientation of the structure was not placed with respect to the orientation of sun and the prevailing winds.
e. Principle of Environmental features	- Use of natural light in buildings. - Use of colours in interiors - Use of water as a landscape element. - Views and vista	 x x x			x		Natural light is highly utilised in the centre by arrangement of the facilities within an open courtyard, no evident of use of colours is present on the building and the views of the structure is also not pleasant possibly due to the lack of maintenance culture on the building.
f. Principle of light and space	- Amount of natural light in interiors - Design of spaces with minimal energy requirement - Minimal building size - Provision of inside outside spaces				x x x x		There is sufficiently amount of lighting in both the exterior and the interior of the building which makes it a low energy requiring structure which is relatively small in size and provides enough outside space, though not adequately utilised.

Source: Author, October - 2013.

Table 5.2: Case study Analysis – Bauchi State Rehabilitation Centre, Bauchi State, Nigeria.

ELEMENTS OF BIOPHILIC DESIGN							
Principle	**Requirement**	**Degree of reflection**					**Remarks**
		1	**2**	**3**	**4**	**5**	
a. Principle of place based relationship	- Use of local building materials - Use of durable long lasting materials and technique. - Use of recyclable materials - Provision of areas for future expansion - Provision of spiritual spaces - Use of natural landscape	x x x 	 x x	 x 			There is absolutely no evident of local building materials on the facility but the sandcrete blocks and concrete provide a durable building material also. No any recyclable building material was used in the construction of the centre but there is also large space provided for future expansion of the centre.

	of the site						No space was provided for both religious and spiritual functions on the structure and the landscape of the site were predominantly naturally growing grasses and isolated trees.
b. Principle of evolved human relations to nature	- Aesthetics - Mystery and enticement - Provision of healing gardens, walkways and fountains	x x x					The building also has no features that will portray the principle of evolved human relation to nature as it lacks aesthetical, mystery and gardens for healing and absolutely no fountains.
c. Principle of natural forms and shapes	- Design with respect to the natural physical elements on site - Application of organic shapes in building. - Use of arches, vaults and domes. - Simulation of natural features.	x x x x					Natural forms and shapes such as the organic shapes, arches, vaults and domes were not incorporated in the structure but there are columns supporting the projected veranda for passage. The structure was also not design with respect to the natural physical elements on site.
d. principle of natural patterns and processes	- Use of complimentary local landscape elements - Design with respect to sun and wind orientation - Selection of pleasant zones for development within site	 x 	x x				Local landscaping elements such as grasses and trees were present on the structure but the orientation of the structure was placed with the longer axis facing east and west which is wrong for the orientation of sun path and the prevailing winds.
e. Principle of Environmental features	- Use of natural light in buildings. - Use of colours in interiors - Use of water as a landscape element. - Views and vista	 x x x			x		Natural light is highly utilised in the centre by arrangement of the facilities within an open courtyard, there was only two colours present on the building with cream on the wall and white on the facia boards while the views of the structure is also not aesthetically pleasing but frequently maintained.
f. Principle of light and space	- Amount of natural light in interiors - Design of spaces with minimal energy requirement - Minimal building size - Provision of inside outside spaces			x x	 x x		There is relatively sufficient amount of lighting in the exterior and the interior of the administrative blocks but relatively low in the accommodation section of the building with low energy requiring capacity.

Source: Author, October - 2013.

Table 5.3: Case study Analysis– Searidge Drug Rehabilitation Centre Nova Scotia, Canada.

ELEMENTS OF BIOPHILIC DESIGN							
Principle	**Requirement**	**Degree of reflection**					**Remarks**
		1	**2**	**3**	**4**	**5**	
a. Principle of place based relationship	- Use of local building materials - Use of durable long lasting materials and technique. - Use of recyclable materials - Provision of areas for future expansion - Provision of spiritual spaces - Use of natural landscape of the site			x x x	x	x x	There is absolutely sufficient evident of local building materials on the facility such as stabilized earth bricks and extensive use of woods while concrete provide a durable building material also. Some recyclable building materials were used in the construction of the centre and there is also large space provided for future expansion of the centre. Religious space was provided for spiritual functions on the structure and the landscape of the site were predominantly naturally growing grasses and abundant trees for shading and relaxation.
b. Principle of evolved human relations to nature	- Aesthetics - Mystery and enticement - Provision of healing gardens, walkways and fountains		x	x		x	The building has some features that will portray the principle of evolved human relation to nature portray some level of aesthetics, mystery and gardens for healing and fountains.

c. Principle of natural forms and shapes	- Design with respect to the natural physical elements on site - Application of organic shapes in building. - Use of arches, vaults and domes. - Simulation of natural features.	 x x		x x			The centre is designed and cited on the Annapolis Valley, at the Annapolis basin, which makes it blends with the natural physical elements on the site but natural forms and shapes such as the organic shapes, arches, vaults and domes were not incorporated in the structure but there are columns supporting the projected veranda for passage.
d. principle of natural patterns and processes	- Use of complimentary local landscape elements - Design with respect to sun and wind orientation - Selection of pleasant zones for development within site				x x	 x	Local landscaping elements such as grasses and trees were present on the structure extensively and the orientation of the structure was placed with the longer axis facing north and south which is idle for the orientation of sun path and the prevailing winds.
e. Principle of Environmental features	- Use of natural light in buildings. - Use of colours in interiors - Use of water as a landscape element. - Views and vista				x x x	 x	Natural light is highly utilised in the centre through adequate orientation of the facilities. There was also presence of variety of colours present on the building while water is extensively used as one of the landscaping elements in swimming pools and healing pools.
f. Principle of light and space	- Amount of natural light in interiors - Design of spaces with minimal energy requirement - Minimal building size - Provision of inside outside spaces				x x	 x x	There is sufficient amount of lighting in the exterior and the interior of both the administrative blocks and the accommodation section of the building with very low energy requiring capacity and wide open spaces within the interiors and exterior of the centre.

Source: Author, October - 2013.

Table 5.4: Case study Analysis – National Theatre, Lagos.

ELEMENTS OF BIOPHILIC DESIGN							
Principle	**Requirement**	**Degree of reflection**					**Remarks**
		1	**2**	**3**	**4**	**5**	

a. Principle of place based relationship	- Use of local building materials - Use of durable long lasting materials and technique. - Use of recyclable materials - Provision of areas for future expansion - Provision of spiritual spaces - Use of natural landscape of the site		x x	 x	 x	x x	There is evident of few local building materials on the facility such as woods while the heavily reinforced concrete piers provide a durable building material. Some recyclable building materials were used in the construction of the centre and there is also an extensive large space provided for future expansion of the centre. Landscape of the site was predominantly naturally and artificial growing grasses and abundant trees for shading and relaxation.
b. Principle of evolved human relations to nature	- Aesthetics - Mystery and enticement - Provision of healing gardens, walkways and fountains			x	x	x	The building was design to portray the concept formulated from a horse saddle which gives the centre an aesthetically pleasing appearance. Some gardens surround all the four entrances of the centre with some fountains in them. This show some level of application for the principle.
c. Principle of natural forms and shapes	- Design with respect to the natural physical elements on site - Application of organic shapes in building. - Use of arches, vaults and domes. - Simulation of natural features.	x		x x		x	The centre is designed with a circular plan which shows a sign of natural continuity with an extensive use of natural forms and shapes such as the organic shapes, arches, vaults and domes were incorporated in the structure.
d. principle of natural patterns and processes	- Use of complimentary local landscape elements - Design with respect to sun and wind orientation - Selection of pleasant zones for development within site			x	x x		Local landscaping elements such as grasses and trees were present on the structure extensively and the orientation of the structure was compromised by the plan design though, that was solved by the projected extrusion of the piers. The structure was strategically developed at the centre to provide enough space for circulation and parking.
e. Principle of Environmental features	- Use of natural light in buildings. - Use of colours in interiors - Use of water as a landscape element. - Views and vista		x x	 x	 x		Natural light is utilised in the exterior of the centre but the interior of some of the adjoining facilities within the centre were not sufficiently lighted naturally due to the complexity and compatibility of the structure. There was also presence of some

							colours present on the building while water is used as one of the landscaping elements in fountains.
f. Principle of light and space	- Amount of natural light in interiors - Design of spaces with minimal energy requirement - Minimal building size - Provision of inside outside spaces	x	 x x x				There is insufficient amount of lighting in the interior of the facility such as the administrative blocks and the shopping facilities withing the centre with relatively high amount of energy requiring capacity and relatively wide open spaces within the interiors.

Source: Author, October - 2013.

Table 5.5: Case study Analysis – Falling Water/ Kaufmann Residence.

ELEMENTS OF BIOPHILIC DESIGN							
Principle	**Requirement**	**Degree of reflection**					**Remarks**
		1	**2**	**3**	**4**	**5**	
a. Principle of place based relationship	- Use of local building materials - Use of durable long lasting materials and technique. - Use of recyclable materials - Provision of areas for future expansion - Provision of spiritual spaces - Use of natural landscape of the site				x x x	 x x x	There is absolutely sufficient evident of local building materials on the facility such as stone blocks, and woods were extensive used, while reinforced concrete provide a durable building material also. Recyclable building materials were used in the construction of the residence and there is also large space provided for future expansion of the building. Spiritual functions were said to be carried out now in the building cause it serves as a tourist centre. Landscape of the site were predominantly naturally growing grasses, abundant trees and free flowing river and pools for shading and relaxation.

b.	Principle of evolved human relations to nature	- Aesthetics - Mystery and enticement - Provision of healing gardens, walkways and fountains			x		x x	The presence of healing gardens, walkways and fountains provides an armful level of mystery and enticement. The building interconnection to nature provides an aesthetically pleasing masterpiece which is highly recognised as Wrights masterpiece of human relation to nature and integration of building interior to the exterior.
c.	Principle of natural forms and shapes	- Design with respect to the natural physical elements on site - Application of organic shapes in building. - Use of arches, vaults and domes. - Simulation of natural features.	x		x		x x	The residence is designed and cited over a waterfall on bear run in the Mill Run section of Stewart Township, Fayette County, Pennsylvania, in the Laurel Highlands of the Allegheny mountains, which makes it blends with the natural physical elements on the site but natural forms and shapes such as the organic shapes, arches, vaults and domes were not incorporated in the structure but the design of the inverted t-shaped beams was a great architectural expression.
d.	principle of natural patterns and processes	- Use of complimentary local landscape elements - Design with respect to sun and wind orientation - Selection of pleasant zones for development within site					x x x	Local landscaping elements such as grasses and existing trees were present on the structure extensively with naturally flowing river with which the structure was built on top. The orientation of the structure was placed with the longer axis facing north and south which is idle for the orientation of sun path and the prevailing winds. More so, the existing trees on the site provide sufficient shading of the building and a great place for relaxation.
e.	Principle of Environmental features	- Use of natural light in buildings. - Use of colours in interiors - Use of water as a landscape element. - Views and vista					x x x x	Natural light is highly utilised in the building through adequate orientation of the structure. There was also presence of variety of colours present on the building which blends the building to the immediate environment. While water is extensively used as one of the landscaping elements from the naturally flowing river, swimming pools and healing pools.
f.	Principle of light and space	- Amount of natural light in interiors - Design of spaces with					x x	There is sufficient amount of lighting in the exterior and the interior of the building with

	minimal energy requirement - Minimal building size - Provision of inside outside spaces				x	x	very low energy requiring capacity and wide open spaces within the interiors and exterior of the centre.

Source: Author, October - 2013.

Table 5.6: Case study Analysis – The Jean-Marie Tjibaou Cultural Centre.

ELEMENTS OF BIOPHILIC DESIGN							
Principle	**Requirement**	**Degree of reflection**					**Remarks**
		1	**2**	**3**	**4**	**5**	
a. Principle of place based relationship	- Use of local building materials - Use of durable long lasting materials and technique. - Use of recyclable materials - Provision of areas for future expansion - Provision of spiritual spaces - Use of natural landscape of the site					x x x x x x	There is absolutely sufficient evident of local building materials on the facility such as woods were extensive used, while reinforced concrete for the flooring of the pavilions provide a durable building material also. Almost all the building materials used in the centre were recyclable unless for the concrete and there is also an extensive large space provided for future expansion of the building. As a cultural centre, it does provide spaces for Spiritual functions within the premises of the centre. Landscape of the site were interlocking paved walkways and predominantly natural growing grasses, abundant trees and free flowing river and fountains for relaxation.
b. Principle of evolved human relations to nature	- Aesthetics - Mystery and enticement - Provision of healing gardens, walkways and fountains				x	x x	The presence of healing gardens, walkways and fountains provides an armful level of mystery and enticement. The building location provides interconnection to nature and makes the centre aesthetically pleasing.
c. Principle of natural forms and shapes	- Design with respect to the natural physical elements on site - Application of organic shapes in building. - Use of arches, vaults and domes. - Simulation of natural features.					x x x x	The centre is integrated with the narrow Tina peninsular which project in to the pacific ocean along a rigde line, this also makes it blends with the natural physical elements on the site. There was also an extensive use of natural forms and shapes such as the organic shapes of

							the pavilion which is derived fron the Kanak traditional architecture. Arches, vaults and domes were also incorporated in the structure.
d. principle of natural patterns and processes	- Use of complimentary local landscape elements - Design with respect to sun and wind orientation - Selection of pleasant zones for development within site		x			x x	Local landscaping elements such as grasses and existing trees were present on the structure extensively with naturally flowing river from the pacific Ocean. The orientation of the structure was also compromised due to the circular plan of the pavilions but the sun was shaded by the long wooden and steel stanchions of the. The existing trees on the site provide sufficient landscaping for relaxation.
e. Principle of Environmental features	- Use of natural light in buildings. - Use of colours in interiors - Use of water as a landscape element. - Views and vista					x x x x	Natural light is highly utilised in the building through adequate orientation of the structure. There was also presence of variety of colours present on the building and the use of readily available local materials, makes the centreblends with the immediate environment. Water bodies in the form of fountains were extensively used as the landscaping elements.
f. Principle of light and space	- Amount of natural light in interiors - Design of spaces with minimal energy requirement - Minimal building size - Provision of inside outside spaces				x	x x x	There is sufficient amount of lighting in the exterior and the interior of the building with very low energy requiring capacity and wide open spaces within the interiors and exterior of the centre.

Source: Author, October - 2013.

5.2 BIOPHILIC ANALYSIS

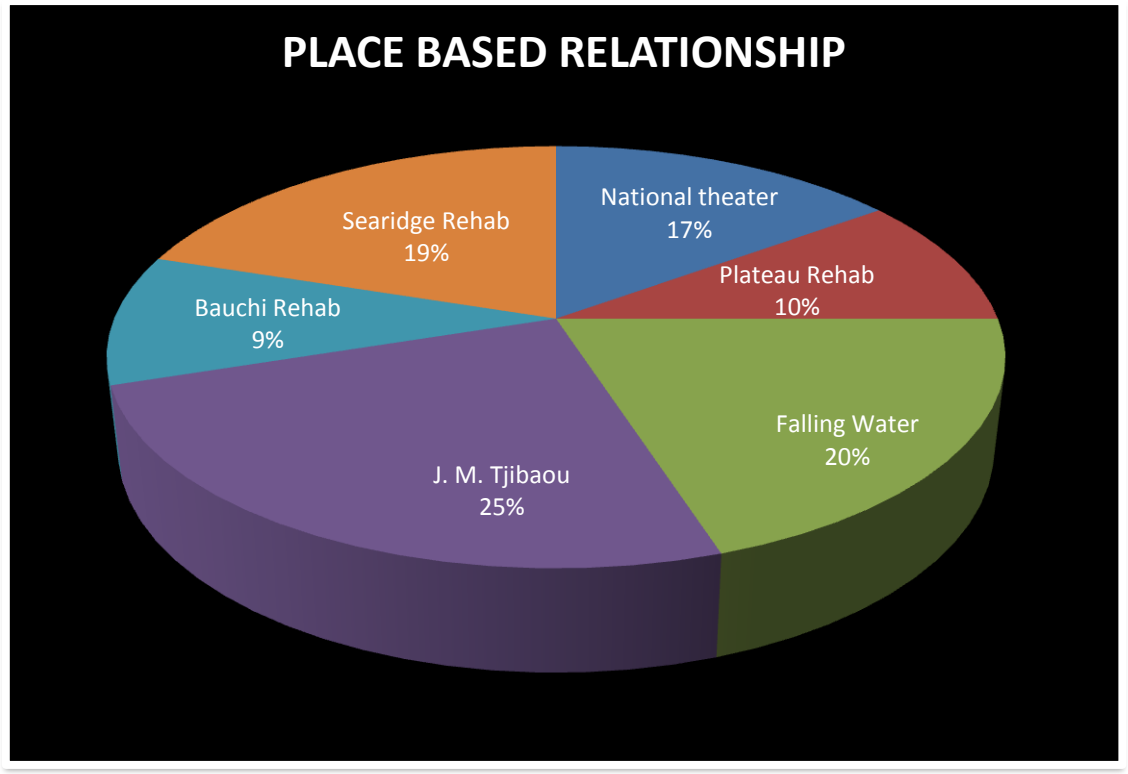


Figure 5.1:Biophilic analysis: Place Based Relationship.

Source: Author, October - 2013.

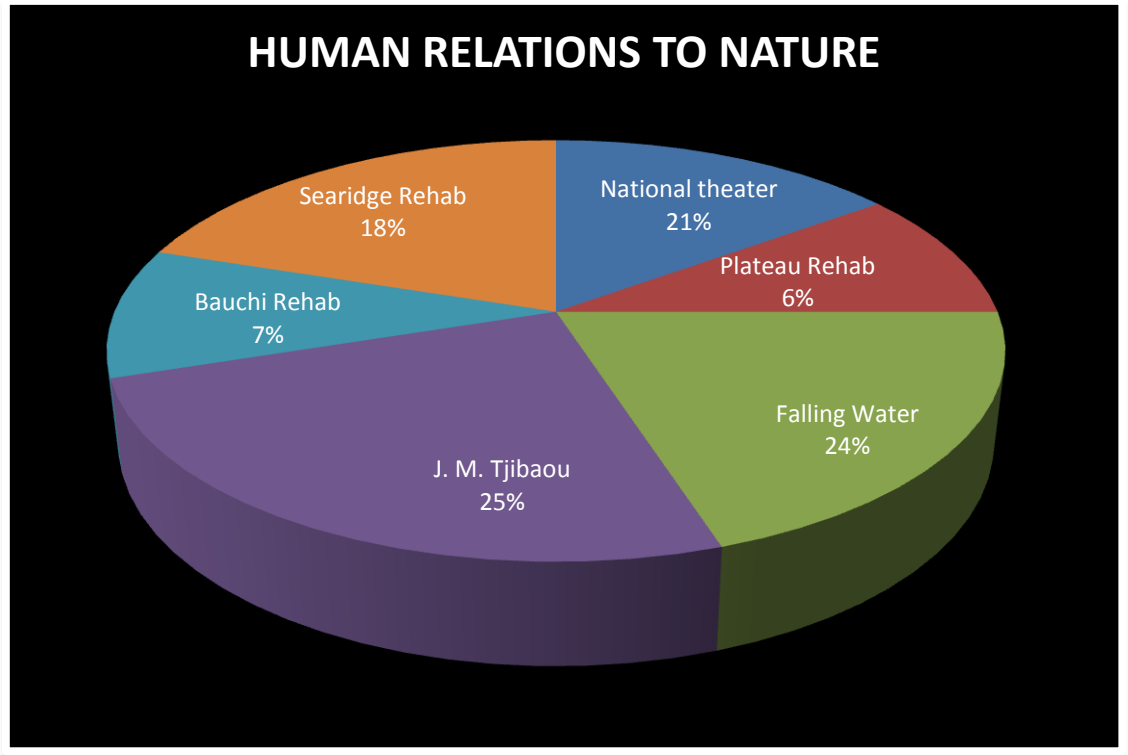


Figure 5.2:Biophilic analysis: Human Relation to Nature.

Source: Author, October - 2013.

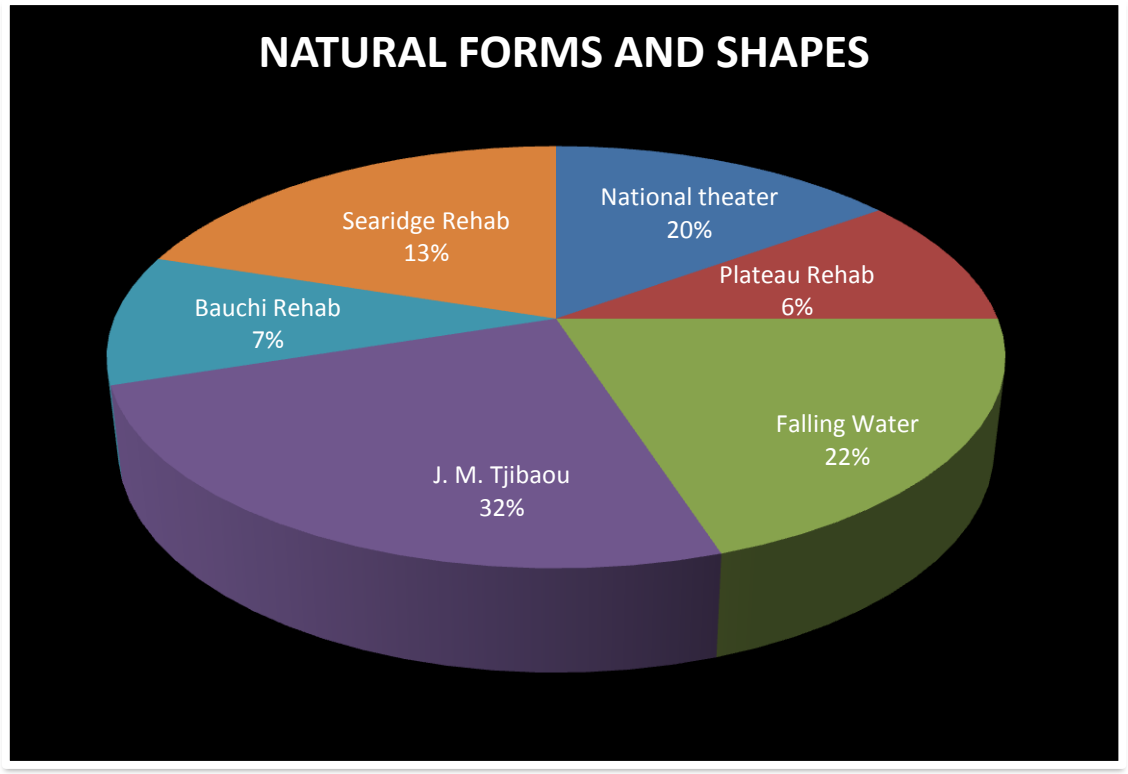


Figure 5.3:Biophilic analysis: Natural form and Shapes.

Source: Author, October - 2013.

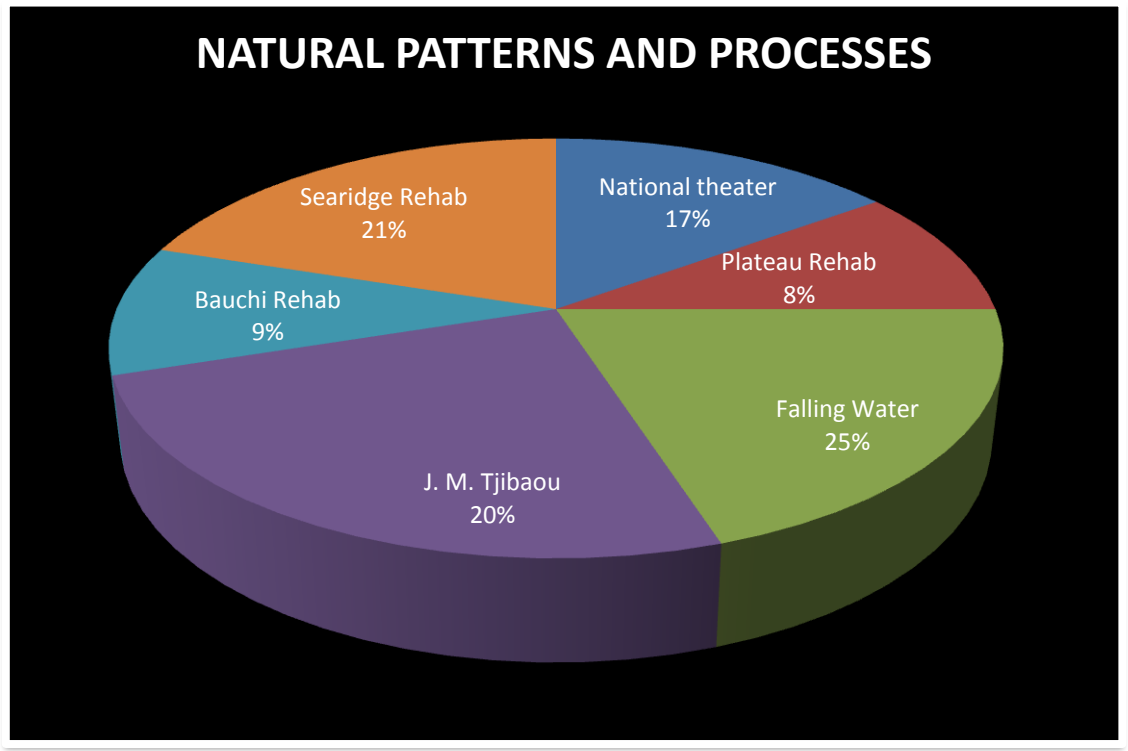


Figure 5.4:Biophilic analysis: Natural Pattern and Processes.

Source: Author, October - 2013.

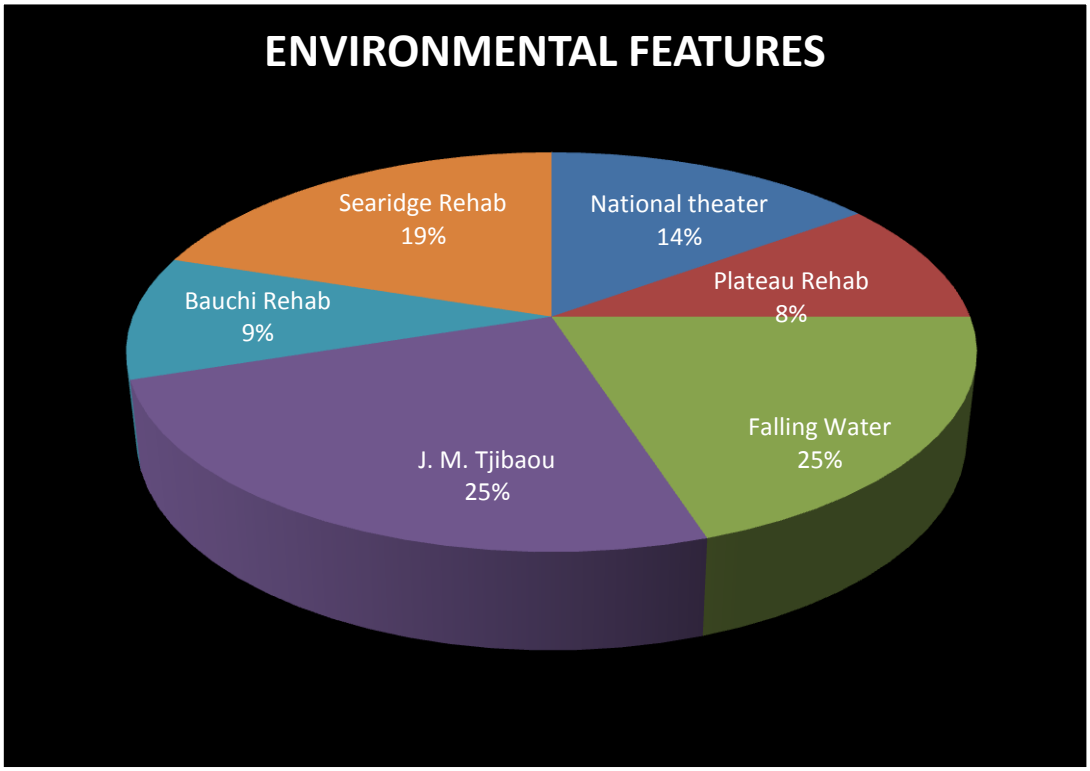


Figure 5.5:Biophilic analysis: Environmental Features.

Source: Author, October - 2013.

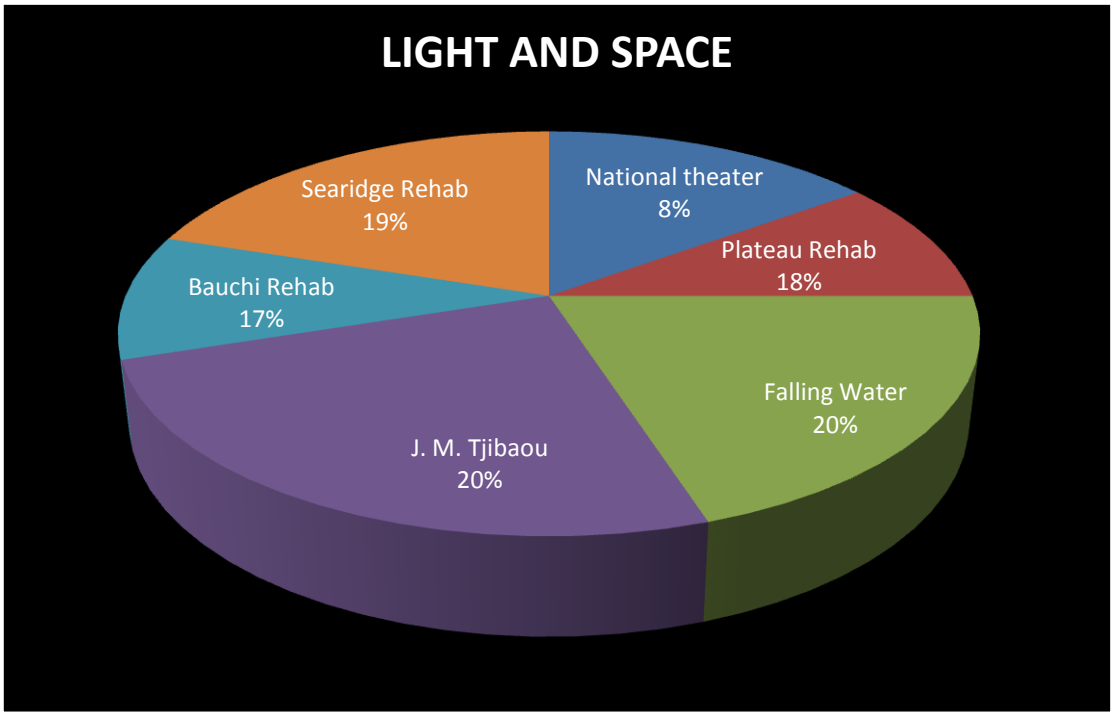


Figure 5.6:Biophilic analysis: Light and Space.

Source: Author, October - 2013.

5.3 DISCUSSION OF FINDINGS

Based on the principles of place based relationship, J. M. Tjibaou has the highest percentage of up to 25% reflection of place based relationship, followed by the Falling water with 20%. While Sea ridge rehabilitation centre, National Theatre, Plateau and Bauchi State Rehabilitation Centres scores 19%, 17%, 10% and 9% respectively. This shows that, the Jean Marie Tjibaoucentre utilizes sufficient local building materials on the site such as woods that were extensively used, while reinforced concrete for the flooring of the pavilions provide a durable building material also. Almost all the building materials used in the centre were recyclable unless for the concrete and there is also an extensive large space provided for future expansion of the centre.

More so, in the biophilic principle of human relation to nature, J. M. Tjibaou also has the highest percentage of up to 25% reflection of human relation to nature, followed by the Falling water with 24%. While National Theatre, Sea ridge rehabilitation centre, Plateau and Bauchi State Rehabilitation Centres scores 21%, 18%, 6% and 7% respectively.

Under the principle of natural forms and shapes, J. M. Tjibaou also has the highest percentage of up to 32% reflection of natural forms and shape embedded in the design of the centre, followed by the Falling water with 22%. While National Theatre, Searidge rehabilitation centre, Plateau and Bauchi State Rehabilitation Centres scores 20%, 13%, 6% and 7% respectively. And this is observed as Local landscaping elements such as grasses and existing trees were present on the structure extensively with naturally flowing river from the pacific Ocean. The orientation of the structure was also compromised due to the circular plan of the

pavilions but the sun was shaded by the long wooden and steel stanchions, while existing trees on the site provide sufficient landscaping for relaxation.

But in the principle of natural patterns and process, Kaufmann Residence (The Falling Water), scores the highest percentage of up to 25% then followed by the J. M. Tjibaou with 20%, while Sea ridge rehabilitation centre, National Theatre, Bauchi and Plateau State Rehabilitation Centres scores 21%, 17%, 9% and 8% respectively. This is so due to the abundant evidence of Local landscaping elements such as grasses and existing trees were present on the structure extensively with naturally flowing river with which the structure was built on top. The orientation of the structure was placed with the longer axis facing north and south which is idle for the orientation of sun path and the prevailing winds. More so, the existing trees on the site provide sufficient shading of the building and a great place for relaxation.

Both the J. M. Tjibaou and Falling Water were rated at 25% under the principle of Environmental features, with the Searidge Rehabilitation Centre following them with 19%. While National Theatre, Bauchi and Plateau State Rehabilitation Centres scores, 14%, 9% and 8% respectively. In the two structures, Natural light is highly utilised in the buildings through adequate orientation of the structures. There was also presence of variety of colours present on the buildings which blends the building to the immediate environment. While water is extensively used as one of the landscaping elements from the naturally flowing river, swimming pools and healing pools.

The principle of lighting and space, bothJ. M. Tjibaou and Falling Water were rated at 20% while Sea ridge Rehab, Plateau and Bauchi State Rehabilitation centres were rated at 19%, 18% and 17% respectively. National theatre was rated 8% and this because there is insufficient amount of lighting in the interior of the facility such as the administrative blocks

and the shopping facilities withing the centre with relatively high amount of energy requiring capacity and relatively wide open spaces within the interiors. Both the Plateau and Bauchi State Rehabilitation centres were rated up to 18% and 17% because both centres were sufficiently lighted naturally in the exterior and the interior of both the administrative blocks and the accommodation section of the buildings with very low energy requiring capacity and wide open spaces within the interiors and exterior of the centres.

CHAPTER SIX

CREATING A BIOPHILIC REHABILITATION FACILITY

6.1 APPLYING THE THEORY

Preservation of our natural environment is an incredibly important mission that has received increased attention over the past two decades. However, today much of the focus is directed solely on the performance factors of the buildings we are creating. Often times little attention is directed towards the human affinity for the natural environment and the positive impact it can bring to our lives. The combination of natural materials and vegetation integrated into the indoor environment has not only shown positive impacts among sick patients, but also to healthy people as well. Individuals associated with indoor spaces that incorporate natural vegetation and views to nature are found to have lower stress levels, increased productivity, better focus, higher moral character and even have the ability to heal from sickness at faster rates. With such substantial affects to the human body and the numerous ways the natural environment evokes positive aspects in our daily lives, leaves one to question why it is disregarded in many of the new building standards to date. It would be in the best interest of the drug addicted population to create a rehabilitation centre based on the theories of biophilic design, resulting in a structure that is equally rewarding to both the environment and to human health.

6.2 THE PSYCHOLOGICAL AND SOCIAL CONTEXT

The psychological and social impact for the design of the facility is that it will foster a connection between the usersand the natural environment as the facility will strive to make a connection to the natural environment at all three levels direct, indirect and symbolic, creating a facility that provides many traits representative of being outside within an indoor environment. By connecting the users to the natural environment, the design will in turn

promote physical and psychological wellness as well as mental restoration from drug addiction. The rehabilitation centrewill also serve its purpose as a counselingfacilitythatencourages socializing, creativity and collaboration.

6.3 SITE SELECTION CRITERIA

For effective selection of site for the proposed drug de-addiction and rehabilitation centre, the following criteria were considered:

i. Environmental features- Availability of natural features on site such as water body, abundant trees and other naturally occurring features that will promote healing.
ii. Land use – Compliance with the existing or proposed land use.
iii. Accessibility- It should be easily accessible by both pedestrian and vehicles means.
iv. Relationship with other buildings- The relationship with existing buildings in the immediate neighbourhood with regard to general environment
v. Views - Visual and aesthetic potential.
vi. Services - Availability of basic building services.
vii. Geographical zoning- The site should be located in a remote and silent part of the city.
viii. Expansion potential- The site should be large enough for expansion.

It must be stated that the task of choosing a site for the centre in order to fulfill its assigned role is one which may not necessarily satisfy all the above criteria but helps to create a rehabilitation centre based on the theories of biophilic design, resulting in a structure that is equally rewarding to both the environment and to human health.

6.3.1 SITE SELECTION

Three alternative sites were considered for the location of the centre and these sites were located in Zaria. The justification for the selection of these sites in Zaria was the fact that; Zaria houses large number of people of different backgrounds coming for either academics or job opportunities. As such, they influenced the indigenes of the location both positively and negatively.

The sites were selected within the Zaria metropolis in order to cater for one of the negative influences which is drug addiction. The three sites are as follows:

SITE A

The site is located at Kufena town near the Kufena rock, 10 to 15 minutes' drive from Wusasa area of western parts of Zaria city.

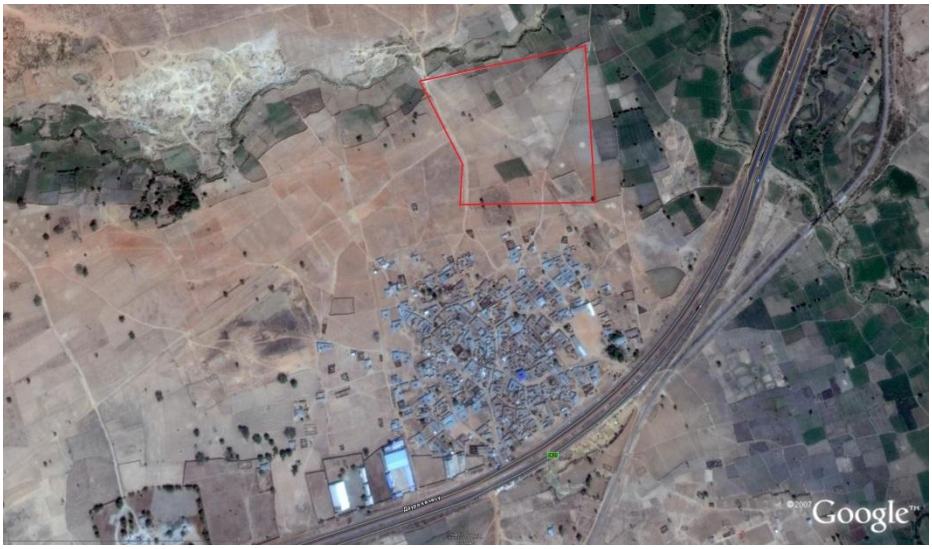


Map 6.1: Location, site A.

Source: www.googlemap.com.(October, 2013).

SITE B

The site is located at Zabialong the Zaria to Kano dual carriage about 5 minutes' drive from Kabamanew extension in the northern parts of Zaria city.



Map 6.2: Location, site B.

Source: www.googlemap.com.(October, 2013).

SITE C

The site is located at the Shika dam town within the banks of Shika dam approximately 20 minutes' drive from Kofandoka along the new Jos road in the eastern parts of Zaria city.



Map 6.3: Location, site C.

Source: www.googlemap.com.(October, 2013).

Table 6.1: Site comparison.

CRITERION	SITE 1	SITE 2	SITE 2	REMARKS
i. Environmental features	4	2	5	
ii. Land use compliance	2	1	5	
iii. Accessibility	5	3	3	
iv. Relationship with other buildings	2	3	4	
v. Views	3	2	5	
vi. Services	4	5	5	
vii. Geographical zoning	3	3	5	
viii. Expansion potential	5	4	5	
Total	**28**	**23**	**37**	

Source: Author, 2013.

Weighing scale: Excellent5, Very good4, Good 3,Fair2, Poor1, Very poor0. Source: Author, 2013

Site 3 is considered premium based on the total weight scored.

6.4 THE PROJECT SITE

The site for the proposed drug de-addiction and rehabilitation centre is located in the eastern part of Zaria metropolis; at the Shika dam town within the banks of Shika dam approximately 20 minutes' drive from Kofandoka along the new Jos road. It has a latitude of +10.52(11°04'10"N) and Longitude +7.44(7°42'14"E). The time zone is GMT+1hour with an altitude of about 400m above sea level. The site contains many features that make it a perfect location for this facility. The site has a dynamic topography offering places to access the water as well as provide high points that create opportunities to take in the view of the bay. The landscape orientation is spread from east to west allowing for plenty of northern exposure to the bank of the river.

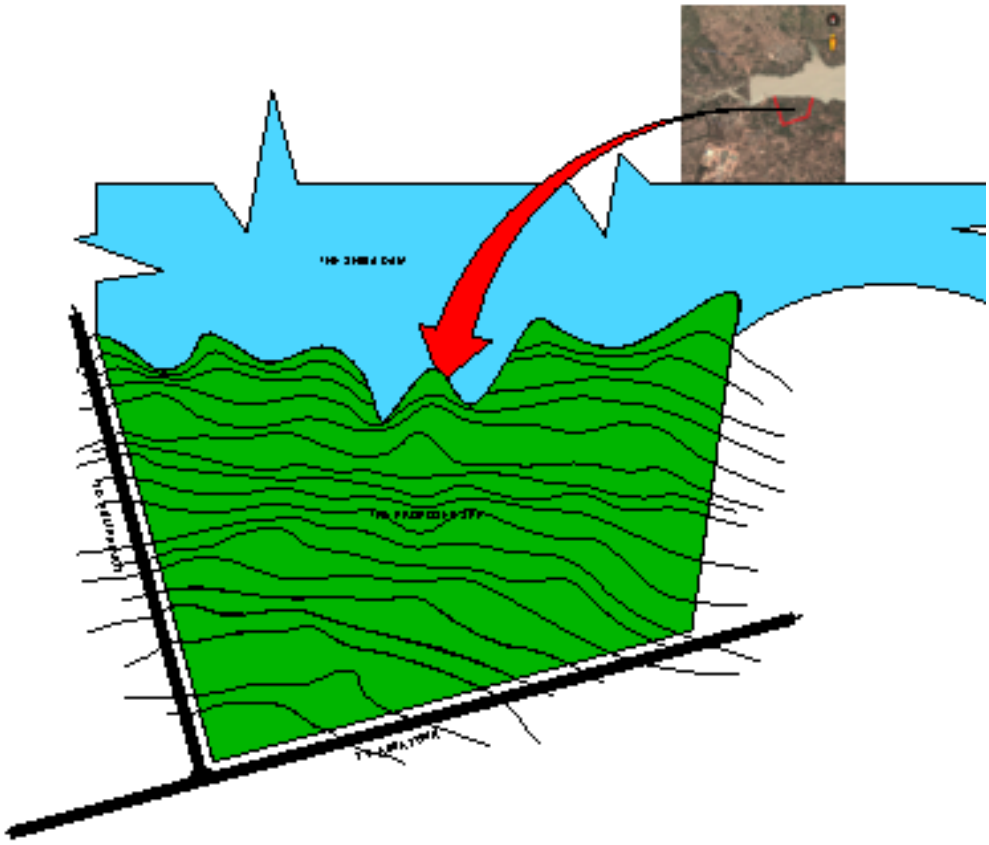


Figure 6.1:Site Diagram.

Source: Researcher, 2013.

6.5 SITE ANALYSIS

The site contains a number of features that needed to be taking into consideration when approaching it from a design perspective. First and foremost the site has an extensive amount of topography change from the access point to the water line, totalling about 7m in grade change. Also as shown in the existing conditions model below (Figure 6.2) there are distinct contour lines that pass east to west through the site. This contour lines are crucial elements because in the winter season when the sun is located at its lowest angle, results in much of the site north of this ridge line being put in shadow. This would work against many of the passive design techniques that the project is looking to accomplish.

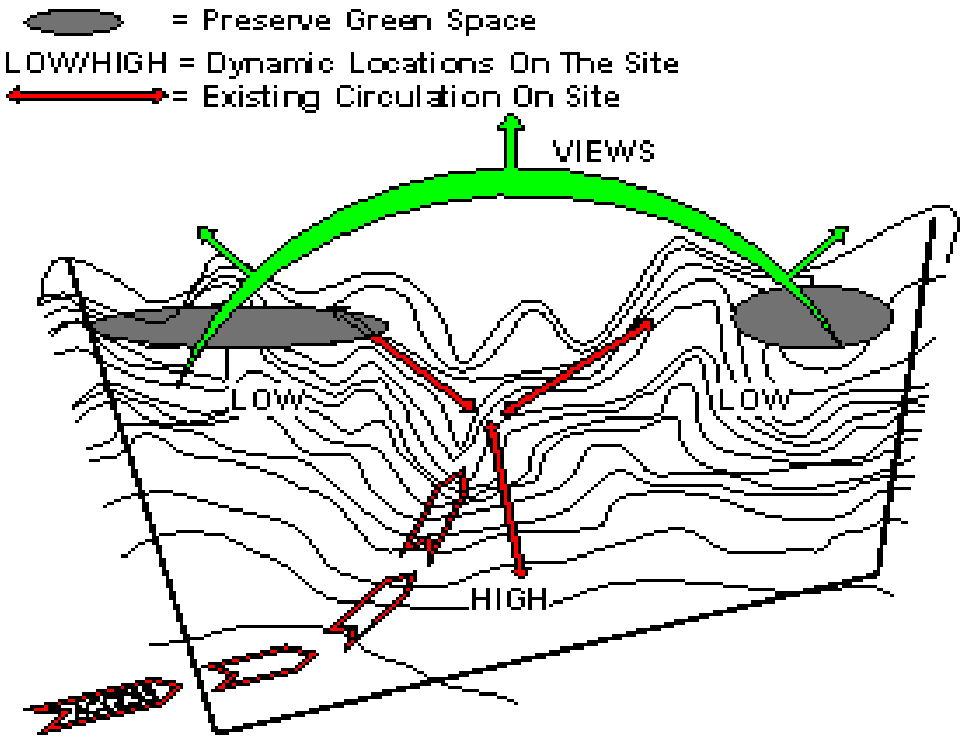


Figure 6.2:Site Diagram.

Source: Researcher, 2013.

The sites existing topography exhibits several interesting elements that creates two distinct areas where a smooth transition can be made from the ridge to the water line. These natural circulation paths are used by people and other animals that inhabit the site as they provide the smoothest transition up and down the site in order to access the water.

Currently these two pockets contain mature trees with tall canopies that allow for a circulation underneath them. It will be beneficial to preserve these two areas to create shaded outdoor natural green spaces that act as a buffer between the water and the rehabilitation and living facilities. Also these existing circulation trails help to inform the easiest areas to navigate throughout the site and will be taken into consideration for basing circulation methods off the natural process that occur on the site.

6.5.1 SITE ANALYSIS; CLIMATE

For the purpose of this study, it is necessary to make a general study of the environment, thus outlining the climatological influence that effect the design within the locality of the site. Generally, environment could be regard as the sum total of influence which modify and determine the development of life and/ or character. A good study demands that the environment will be analysed in relation to the climate of the area in question as this will invariably influence the final design. A proper study of the climatic factors that effects an area will equip the designer and enable him adopt new conventional solutions to the prevailing climatic conditions and problems. Most of the data were retrieved from internet and compared with that from the department of Metrology, Ahmadu Bello University Zaria.

The climate of Zaria is typical of the guinea savannah. Two different types of air masses passes through Zaria, one from the north mostly dry and dusty (continental in origin) blowing from the Sahara desert called the north-east trade winds and the other from the Atlantic in the south, brings rainfall, mostly cool and desirable for human comfort.

a) **Temperature:** Fluctuations in daily November temperature are from 16 ºC to 32 ºC clear skies, visibility becomes poor and the sun's rays do not reach the surface. This lowers the minimum temperature to 14 ºC in January. Nights and mornings are cool but temperature increases 14 ºC to 31º C giving a variation of 16 ºC which is the highest during the year. Maximum temperature occurs in April which reaches 35.9 ºC but generally does not last more than two to three months.

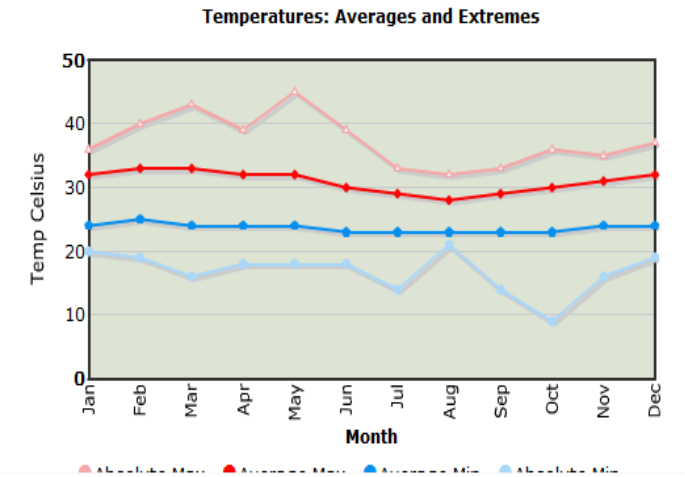


Figure6.3: Zaria Temperature.

Source: Myweather2.co.uk.

b) Relative Humidity: At the start of the dry season, relative humidity falls from 68% in October to 36% in November with the stabilization of the easterly winds. It further falls to 35% in January and 20% in February. Mean relative humidity reaches its maximum value of 80% in the month of August.

c) Sunshine: Zaria being in the northern part of Nigeria has its sun movement from east through north to the south. The sun rises from the east and gently warms up to its maximum heat intensity in the afternoon. As the sun moves over to west its intensity witnesses a reduction till it is finally sets.

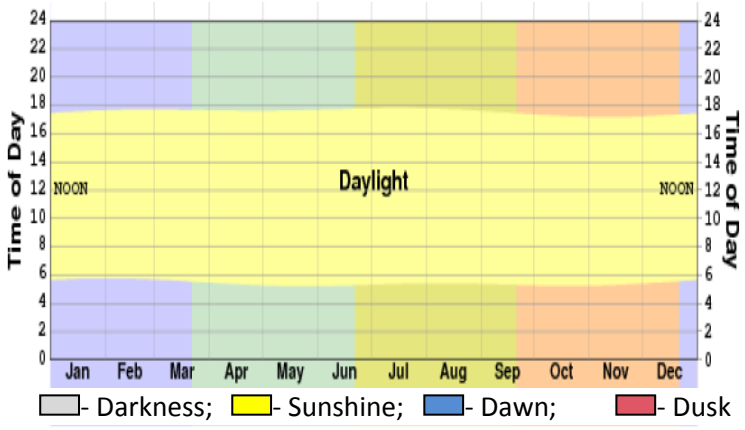


Figure 6.4:Sunshine: Zaria.
Source: Gaisma.com.

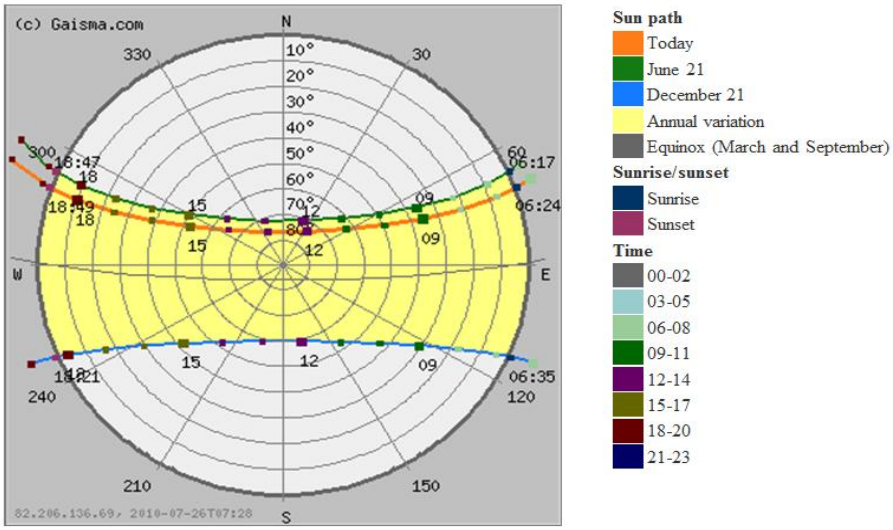


Figure6.5:Sun Path Diagram: Awka.

Source: Gaisma.com.

The yellow section shows when the sun is up, and how this changes over the year. The time-of-day scales, on the left and right, and the month scale on the top and bottom, shows approximately when sunrise and sunset occur.

d) Rainfall: Rainfall starts in April and increases from 161.5mm in June to 281.6mm in August to its maximum throughout the year. Annual total rainfall lies within a range of 960mm to 1150mm.

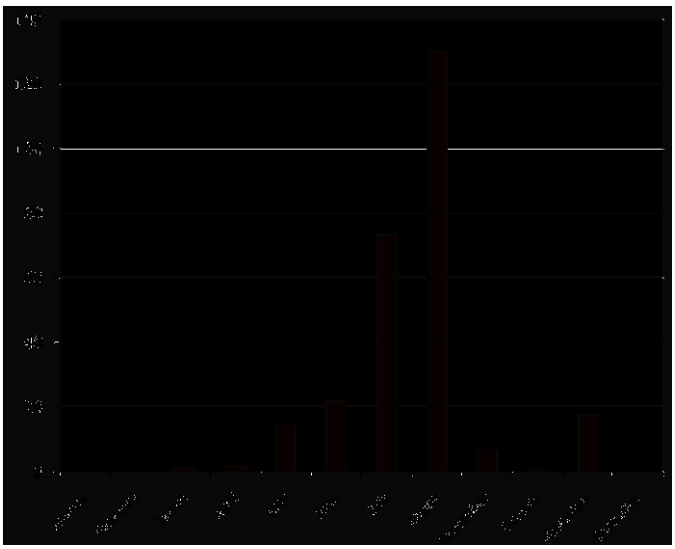


Figure6.6:Number of Rain Days in Month: Zaria.
Source: Myweather2.co.uk.

e) **Wind Pressure:** In Nigeria there are two types of wind which prevails: Tropical Continental Air Mass and Tropical Maritime Air Mass. The tropical continental air mass (Harmattan wind) carries little or no moisture with it and therefore dries. This wind blows from northeast and predominantly prevails during the dry season. Its impact is more on the northern region of the country. The tropical Maritime air blows from southwest across the country and carries with it moisture (rainfall) which reduces from southern to northern region. This wind predominantly prevails during the wet season. The speed of both winds in Zaria ranges from 93kph for month of March to 43kph for month of December. Higher speeds are sometimes recorded during harmattan period. Micro winds are occasionally generated by local air currents.

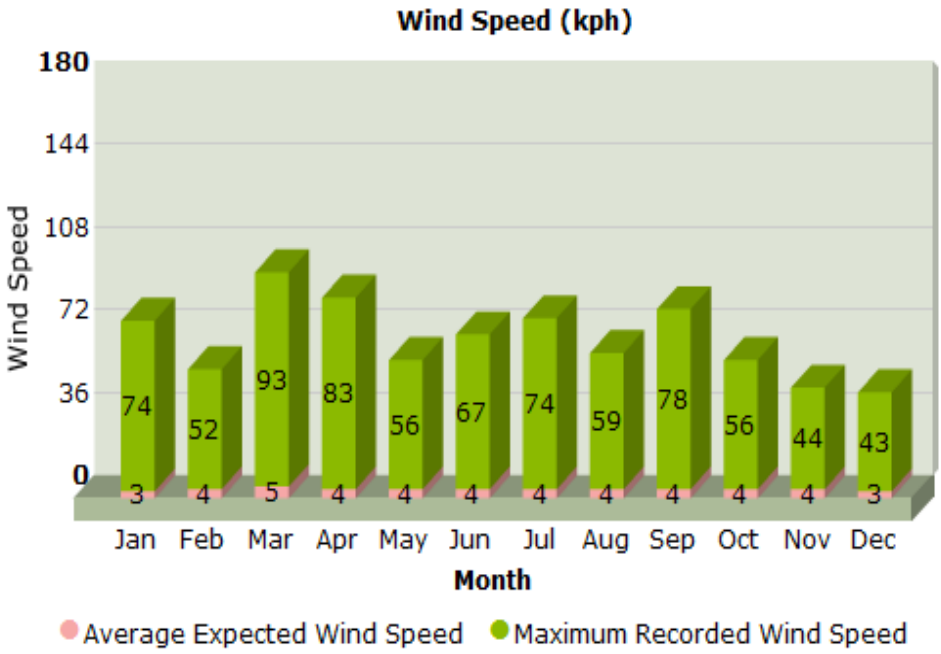


Figure6.7:Wind Speed: Awka.
Source: Myweather2.co.uk.

6.5.2 SITE ANALYSIS; (VIEWS AND NOISE)

The major origin of noise is from the neighbouring community, and from moving vehicles on the main road. Trees are to be planted close to these sources to buffer this effect. In planning, distance should be created between the facilities and this region with proper site zoning

analysis.The best view of the site is at the north of the site, with a flowing dam, while the west side of the site is occupied by the treated tap water pumping plant and the adjacent view to the east and south of the site is a large expanse of land for future expansion of the facility with abundant trees and grasses.

6.5.3 SITE ANALYSIS (SOIL AND VEGETATION)

Eucalyptus and Mango trees are the predominant types of trees in the region, economically viable and shelter providing. They are to be maintained and planted where necessary but absent. Shrubs are scattered randomly across the site, and are to be maintained unless where it obstruct access, ordevelopment.

The soil type on site is Silt-clayed in nature, with clayed deposits at the lower point of the site. It supports all forms of vegetation, and retains water. It should therefore be utilized for plantings and water collection schemes.

6.6 THE EFFECTS OF ENVIRONMENTAL AND CLIMATIC FACTORS ON BUILDING DESIGN

Natural climatic factors such as climate, geology and vegetation influence the lifestyle of the occupants and the design of a building landscape. For example, the two prominent trade winds influence orientation and design of buildings. The long span of buildings is oriented in a north and south direction. This is to reduce the effect of intense solar radiation from the east and west directions where sun rises and sets respectively. The cropping season begins in May at the commencement of the rains. The porous nature of the soil condition dictates special consideration for foundation design and landscape design that considers conservation of natural features on site. To achieve an effective biophilic design considerations on;

- **Temperature**

Design should be such that;

- Shading devices or mechanism should be employ- canopies, covered walkways, wide veranda and balcony, and pergolas.
- Water bodies like pool and fountain around and within the building should be provided for.
- Healing, shading and absorption of radiation.
- Shaded windows and openings to encourage good natural ventilation.
- Minimum use of dark coloured materials outside and inside building to reduces absorption of heat and radiation.
- Good orientation of building to take advantage of prevailing condition.

- **Humidity**
  - Due to the presence of dam in the design site, there will be a relatively high humidity in the area; there is need for effective ventilation to help the body lose heat. For close up and huge walls, air conditioning is inevitable.
  - The ground floor slab of the building should be damp proofed.
- **Rainfall**
  - Roof form should encourage effective discharge of rain water.
  - Provision should be made for adequate drainage channel to avoid flooding.
  - Planting and paving should be used to discourage erosion on site.
  - Canopies, eaves, window hoods and veranda should be employed to prevent driving rain from entering into the building through external windows and openings.
  - Building materials used should withstand moist and wet environment.
- **Wind Pressure**
  - Proper bracing and rigidity of the building structure to withstand strong wind is necessary.

- Trees should be planted in the site to reduce devastating effects of wind on the building.
- Good orientation of the building in relation to wind flow is necessary.
- Windows and openings should be of appropriate sizes, operable and should not be placed directly to the wind direction.

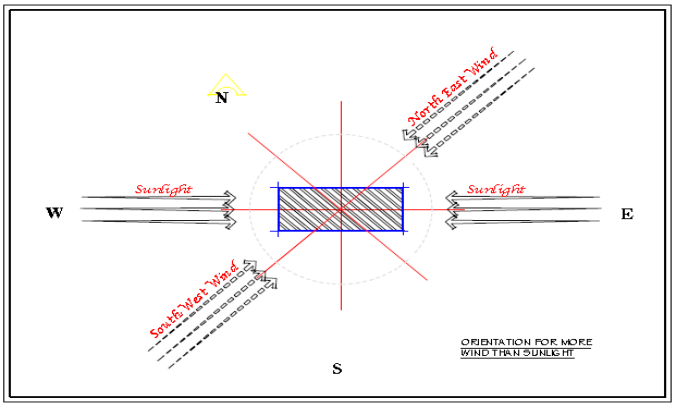


Figure6.8: Orientation consideration: More wind than sunlight.
Source: Author, October - 2014.

- **Solar Radiation**
  - Good landscaping is necessary to reduce radiation of sun at the outdoor environment
  - The use of sun shades and sun breakers is necessary in the building design.
  - Good orientation of the building on site and spaces in the building is important to take advantages of the sun radiation.
  -

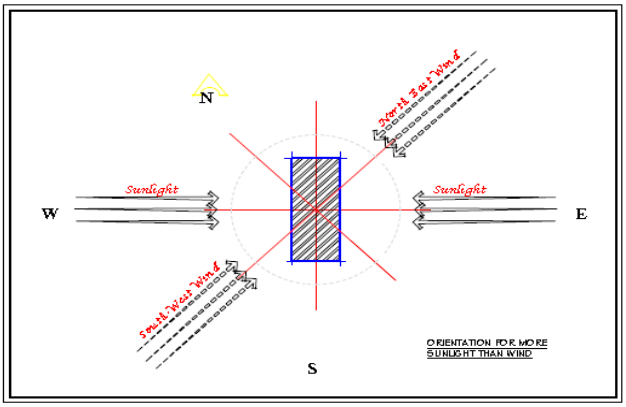


Figure6.9: Orientation Consideration: More sunlight than wind.
Source: Author, October - 2014.

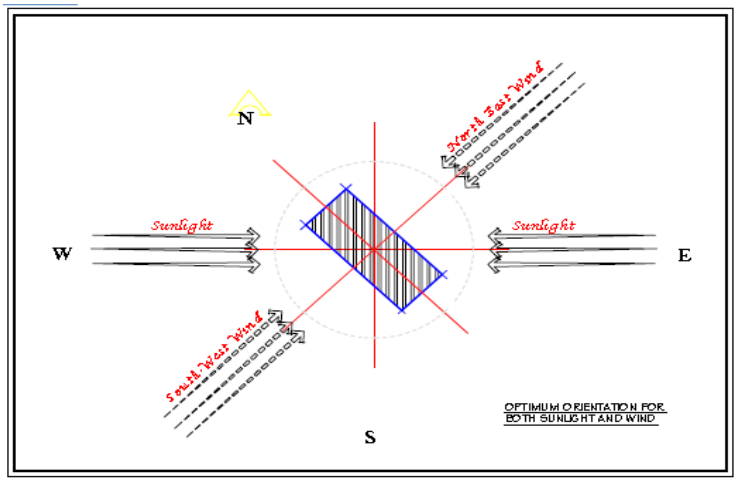


Figure6.10:Orientation Consideration: Both sunlight and wind.
Source: Author, October - 2014.

CHAPTER SEVEN

DESIGN REPORT

7.1 INTRODUCTION

This chapter brings all data previously analyzed into an articulated design philosophy which will form the basis for the formulation of design concept. All design solutions shall be attributed to the design concept.

7.2 EXPRESSING BIOPHILIC DESIGN

Forming an interconnection between the physical and natural framework was the greatest challenge in this project. The objective was to implement a method of crafting an environment that is feasible yet still illustrated many abstract characteristics of natural environment, was carried out in several ways. The primary and most visible notion was expressed in the overall structural and cladding members.

This system was influenced by the geometry of a flower and simulating a structure that provides a similar feeling of being underneath a tree and its canopy. By analyzing the forms, the main structural components were derived and implemented in the atrium space and in various transition spaces throughout the centre. The structural members in the residential areas are at a smaller scale and transform between levels to double as posts for the railings on the seating areas above. These unique features were used in combination with bringing vegetation and local materials of stone and wood found on site and locally to create a natural and warming indoor environment.

The main atrium space utilizes the plants in many ways. Using the influence of a natural landscape, the planters create seating and gathering areas of various sizes so that groups from the counselingcentre can meet in an enjoyable informal setting. The plants themselves provide a buffer between the many differing spaces throughout the atrium where informal

group meetings can take place, while just 6m away others can be relaxing and playing or socializing in a soothing environment.

7.3 FORM CONCEPT DEVELOPMENT

The overall building form was designed based on several key attributes of the site and the surrounding context that would enhance the biophilic characteristics of the centre. The primary factor that drove much of the buildings form dealt with the views that could be experienced from the site. The investigation into form studied different techniques that would provide views across the bay from the main rehabilitation spaces and all of the residential space.

The form itself is derived from the naturally flowing site lines that are manipulated in a three-dimensional sense to accommodate the necessary pragmatic spaces. By merging the differing layers of site driven forms together, in combination with an appropriate organizational method allowed the facility to take shape. Using the sites change in topography, the facility is able to be nestled right into the slope and the prevailing winds, providing good thermal qualities for its performance factors, while also preserving the views from all points across the site.

The rehabilitation centre layout is organized in a fashion that the main rehabilitation space would have the best possible view from the building, to further connect with nature and help to enhance the recovery times of the patients involved in the program. Residential units are all provided access to the outdoors, as well as to an ample amount of natural light and ventilation.

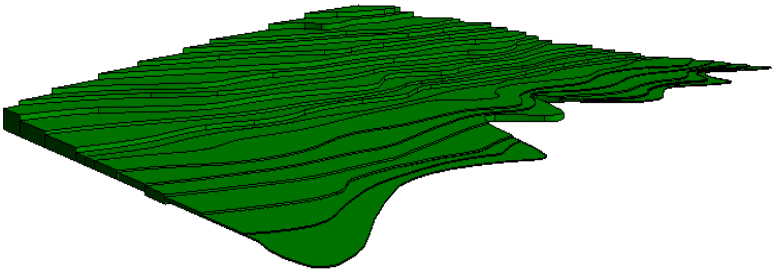


Figure 7.1: Site Model.
Source: Author, October - 2014.

7.3.1 SITE PLANNING CONCEPT

The site concept is based on the zones of a rehabilitation centre into three parts: administrative spaces, skill acquisition spaces and accommodation spaces. These spaces were formulated under the shape of a flamboyant flower, as flowers personify beauty, pleasure and perfection of nature.Flowers give many things to everybody, and it does not matter if you are rich or poor, they give you a wonderful world, in which you feel happy. Therefore people always try to decorate with these surprising gifts of nature not only the celebration and gala days of their life, but also everyday life, in which, people need to feel even more pleasure during their life on Earth. As such, Flower is used as the main concept of this design (Figure 8.2 through 8.3).

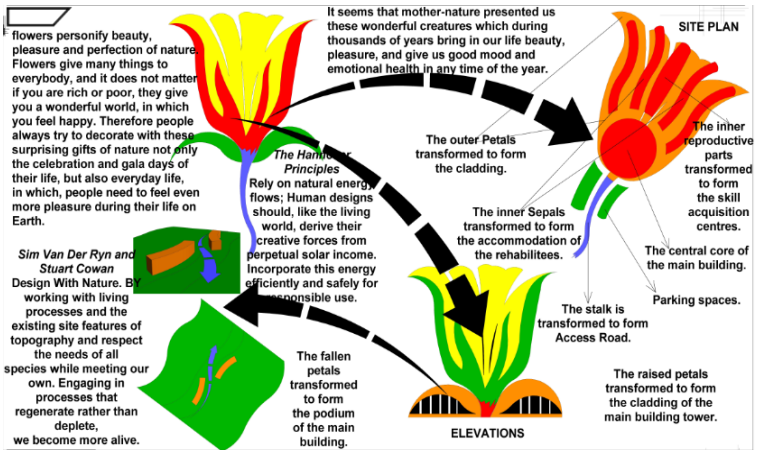


Figure 7.2: Concept: Form and Site Plan.
Source: Author, October - 2014.



Figure 7.3: Proposed Site Plan.
Source: Author, October - 2014.

It seems that mother-nature presented us these wonderful creatures which during thousands of years bring in our life beauty, pleasure, and give us good mood and emotional health in any time of the year.At all nations of the world flowers associate with heat, sun, spring and pleasure. And it doesn't matter if it is winter, summer, autumn or spring outside. Flowers always remain symbols of good mood and wonderful seasons – spring and summer. Each flower is shrouded by illusive mysterious aura, and magic mood which is given to all people without exception, whether it is a man or a woman, a small child or a grown up person.

The site concept was based on the following criteria:

1. **Safety** - The need to give much consideration to the pedestrian circulation. Hence a design that provides a free pedestrian environment. This will increase the rehabilitative value.
2. **Site configuration** - The site is relatively sloping towards the dam and all data relating to the site analysis were concerned, i.e. point of penetration, natural features and site contours etc.
3. **Circulation** -The concept of circulation used within the site is pedestrian's free access, devoid of interference of pedestrian and vehicular circulation. Hence, the pedestrian circulation is totally and consciously separated to enhance safety and rehabilitative value.

4. **Activity** - Diversity in terms of activity in the centre to create the much needed excitement, pleasure associated with rehabilitation facility.
5. **Design with nature** - Consideration of activity period of function as regard to zoning of functions in relation to local and micro climate.

The site concept is a biophilic synthesis and facilities are grouped into activity core in which function emerge with each other and with the landscape creating a sense of continuity of the whole; this is a systematic response to stimulus and gives rule for high coordination within the centre. It is such that, the reference point is acting at the centre of a point or it is the tangent of the point or circle.

7.3.2 VENTILATION AND LIGHTING CONCEPT.

The whole facility is design to follow the pattern of the contour lines existing on the site. This gives room to optimal utilization of natural lighting and ventilation since the contour lines run from east to west of the site.

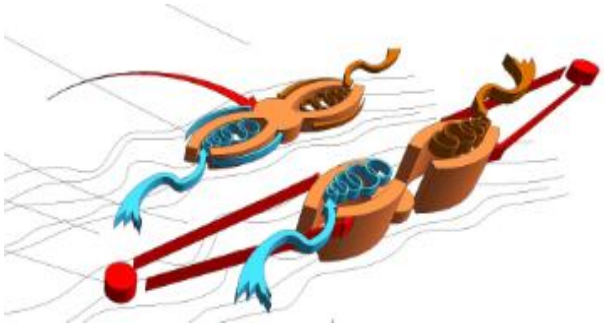


Figure 7.4: trade winds and solar radiation.
Source: Author, October - 2014.

The administrative building is design with enough open planned functions and well landscaped to filters the light (creating “natural" protection from the sun’s rays) and allows in-depth views around the centre. This plantings also protects against the wind while, at the same time, allowing the passage of natural light that helps illuminate the interior.

Cross ventilation method is used in the ventilation of the building. This ventilation technique has being found to be effective in this type of building structure. Thus artificial ventilation lighting is optional. Except in the movie theatres and common rooms were special lighting is needed for display.

7.3.3 LANDSCAPING

Emphasis is placed on ample provision of well landscaped environment such as healing gardens and pools to aid recovery, relaxation and complement activities of the centre. Tree canopy shaded driveways, hedges are put in place to enhance the micro climate, environmental features and refuge within the centre. The planning of the landscape follows from fractal principles of scaling, self-similarity and infinity. Stone paving as used for the walkways, in order to emphasis the use of natural materials. Gardens were introduced in the interior to enhance experience and to avoid creating a drastic difference between the interior space and exterior space.

7.3.4 PLAN CONCEPT

The plan concept was synthesised from the two component of this research: Biophilic and rehabilitation centre.

A. **Biophilic design** - Inspirations are drawn from the characteristic qualities of a local natural form 'Flamboyant Flower' from which certain predominant features that complement the functional requirements of the rehabilitation centre are drawn. Those features that are expected of this natural form are those that conform to the principles of the biophilic design which includes: fractal geometry, natural shapes and form, place based relationship, lighting and ventilation, evolved human relation to nature, environmental features, and natural pattern and processes.

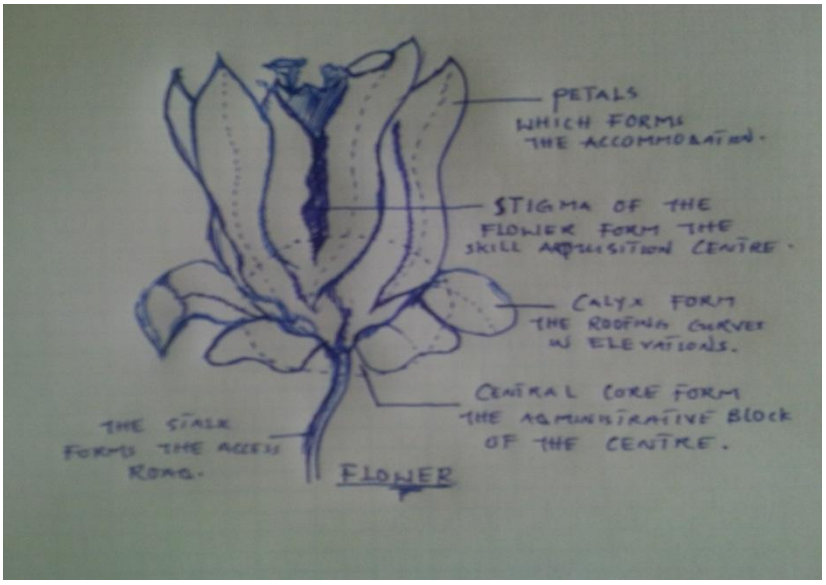


Figure 7.5:A flower.

Source: Author, October - 2014.

Flower in general sense has being a means of uniting man to natural world while man's love for flowers has shown his sub conscious love and affinity to affiliate with natural world.

B. **Rehabilitation Centre**- The spatial organization of a rehabilitation centres design, are set to comprise of three main facilities which are: the administrative, accommodation and skill acquisition buildings organized in such a way that each function is linked and interconnect to each other.

The plan design is asymmetrically evolved having a close to nature pattern in which the development is free of the rigidity of symmetrical plan. The circulation is more free, views are of infinite dimension, utilization of natural light and ventilation is optimized. It also promotes interaction in the centre and offers simplicity in the organisation of spaces. The design should be seen radiating from a reference point in which all other function converges. This could be like a biological process in the cells in which the nucleus acts as the main activity core. The Atrium acts as the focal point thus all activities are directed towards it and an aesthetic quality in relation to harmonious landscaped environment.

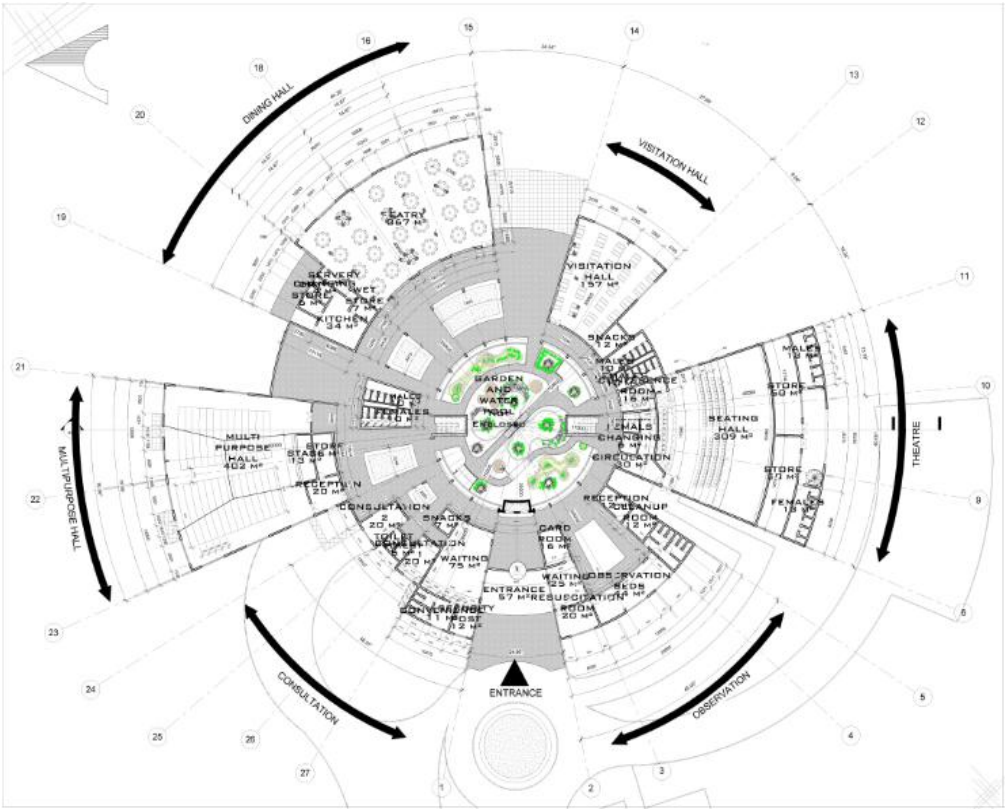


Figure 7.6: Proposed Ground Floor Plan.

Source: Author, October - 2014.

7.4 BUILDING STRUCTURE

7.4.1 Form

The building form is purely based on functionality and aesthetics which embodies the articulation of various architectural forms in three dimensions to achieve harmonious relationship, maintaining balance aesthetically. The massing of the building shows the unity of architectural forms and good visual perception.

The building in its simplest form is an interdependent network of open areas with few internal non load bearing walls. The supports of the ceilings and upper floors are mainly provided by columns.

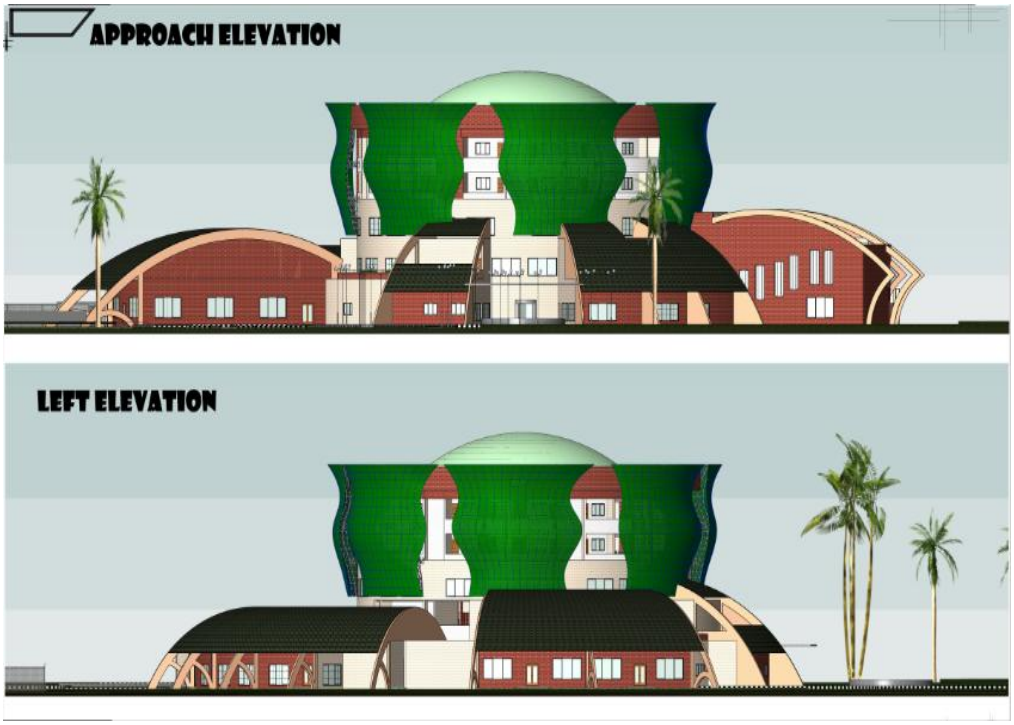


Figure 7.7: Proposed Elevations.

Source: Author, October - 2014.

7.4.2 Floor loading

The activities that will add much live loads and dynamic loads to the floors are located on the ground floor level. Hence there is decrease in floor loading with increase in floor levels. Service equipmentwere also located at the ground level.

7.4.3 Foundation

Based on the analysis of existing buildings, the foundation should be of pad foundation, otherwise specified by structural engineer, with sufficient depth.

7.5 DESIGN CONSIDERATION

The site is located in the outlying Zaria area of north-western Nigeria and design and construction will adhere to the North-western Building Code Congress International guidelines as well as the Nigerians with Disabilities Act guidelines; therefore a good skill in designing the flow of activities must be exercised so that a balance is struck. All the following factors were considered.

I. Sustainability

There is the opportunity to use the centre to encourage approaches to sustainability, by designing for minimum energy use and water use, choosing locally sourced, or other low environmental impact materials.

II. Space Organization

The building must be easy for the staff to manage. Layout and circulation routes should be clear, and ample storage space is needed. Consideration for noise, type of activity, likely timing of activities and age groups when locating facilities. Areception area or office at or near the entrance will assist in the monitoring of activities and provide a focal point for information and organization.

III. Circulation

Economic planning is necessary to keep costs down, so all opportunities should be taken to minimize corridors, and make spaces useable for more than one function. Central circulation space doubling up as a café/informal meeting area is a typical solution. Circulation space must be easily monitored and have robust and hard-wearing surface finishes. Vertical circulation should be visible.

IV. Accessibility

The building will need to cater for all age ranges, from children in prams and push chairs to ambulant disabled adults and wheelchair users. Citing of entrances, walking distances from different functions, provision of disabled parking all need to be considered, as should colour and contrast in the interior design scheme.

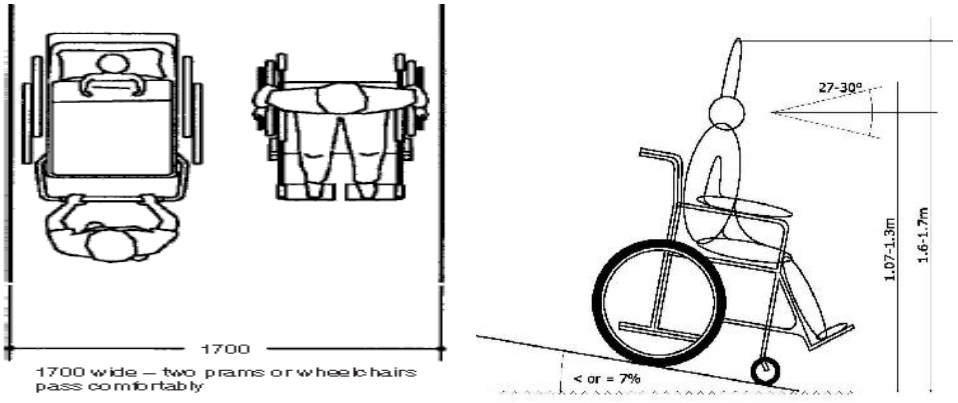


Figure 7.8: Design for the physically challenged.
Source: Neufert, 1995.

The implications of sloping sites, changes of level and designs with more than one floor level need careful consideration at the outset. Lifts and chair lifts are expensive to install and maintain, and prone to abuse. Opening hours and management policies of the building also need to be considered from the earliest stage and can often be subject to planning restrictions to avoid disruption of immediate neighbors.

V. Maintenance

There should be careful consideration of maintenance implications of all specifications to help to minimize running costs and ensure long-term viability of the centre. Specify robust high-quality materials and products wherever possible and avoid unusual fixtures and fittings (such as taps, toilets, boilers and shutters) that may cause maintenance difficulties for the management group through cost, availability of spares etc.

VI. Flexibility

The building design must allow for maximum flexibility of use, which will need to be considered both in the short term to cater for current requirements, and in the longer term, as needs will change with time. For short-term change, moveable walls or partitions to divide spaces may have some applications but there are problems with the poor acoustic performance of some screens and the operational complexity of large systems. Design solutions that give flexibility through planning and space organization as well as the

provision of a range of different sized spaces are to be preferred. For longer term change, designs that can easily accommodate internal reorganization through appropriate initial structural design and by allowing space for future extension are desirable.

VII. Means of escape

Care in planning and signposting the means of escape in case of fire is especially important. Provision of escape staircase in case of fire is necessary.

VIII. Noise

A rehabilitation centre is more likely to suffer from noise than to generate high noise levels. They are usually design and located at the outskirt of some cities. They must therefore be designed to avoid nuisance. Where uses take place simultaneously, sound separation will be necessary between a noisy activity such as a group workshop and one requiring relative quietness such as counseling unit. Noise-producing spaces should not be located close to quiet spaces, unlessif it is unavoidable.

7.6 SERVICES

7.6.1 Water supply

The centre will be equipped with water supply from the new Kaduna State Water Board plant that is presently under construction and a borehole water supply is also proposed for the centre as an alternative source.

7.6.2 Power supply

Power shall be tapped from the Power Holding Company of Nigeria (PHCN)'s national grid. However, the design shall also cater for its own power needs. There is provision for a power substation, with power generating sets and synchronization panel, to cater for power failure.

7.6.3 Refuse disposal

Waste bin should be provided in every room and along circulation route. Small incinerator should be provided at a remote part of the site, waste treatment plant, to cope with all refuse generated on site.

7.6.4 Waste water and sewage disposal

Waste water from water closets should be drain through the central sewer line to the sewage treatment plant for treatment and subsequently disposed by Kaduna State Environmental Protection Agency.

7.6.5 Firefighting system

Fire hydrants for easy water collection by fire fighters, fire extinguisher and smoke detectors should be provided in the centre, but competent professional should be involved in determining the number and location of the firefighting systems.

7.6.6 Storm water drainage

The slope of the site being relatively steep will encourage natural drainage of storm water off the site. But drainage channels should be provided to take care of water run-off from roof.

7.7 MATERIALS

To allow ease of construction, without the over-dependence of foreign expertise, the design of the facilities has been simplified to appreciable state. A combination of Stabilized Earth Bricks, steel and concrete has been used; for the available construction technology in Nigeria. Reinforced Concrete, Steel, Aluminum and glass shall be the dominant building materials used for the construction of the facility.

7.7.1 Stabilized Earth Blocks

These blocks are made using compacted soil, cement serving as stabilizer. They are about 2-3 times better than conventional brick or concrete masonry in terms of thermal quality, strength, water absorption and they provide good finish.

7.7.2 Reinforced Concrete

The high structural strength of concrete (especially when reinforced with steel) makes it the 'perfect' material for the structural. The fluidity of reinforced concrete makes it a good construction material for curved, slanted walls.

7.7.3 Steel

Steel offers many advantages, primarily high strength and ductility. It is also durable if protected from corrosion. Relatively, the higher yield stress of steel allows for smaller sections and its lower weight reduces foundation requirement.

7.8 BUILDING FINISHES

Rehabilitation Centre is a complex building with different functions housed in different spaces. For each separate function, the materials used for the internal finishing will be based on; initial and long term cost, durability, maintenance, quietness, comfort, safety (non-slippery), thermal conductivity, reflectance (shine) and appearance.

7.9 CONSTRUCTION METHODS

Framing system should be used during the construction of the centre. All the building component should be produced insitu. Except for some materials like blocks, steel channels, roofing sheets and other components which production practicality on site will be difficult should be produce in factory. Due to the nature of the site soil, earthwork support should be used at the foundation trench to hold the earth against collapse. All wiring and piping should be by conduit.

CHAPTER EIGHT

CONCLUSION AND RECOMMENDATIONS

8.1 CONCLUSION

This research work is built on the subject of exploration of biophilic design principles in the design of drug de-addiction and rehabilitation centre, the problem statement being that previous works on rehabilitation centers lack the required provision of natural elements incorporated in the design of the facilities, which serve as a means of connecting the recovering patients with the natural environment. Biophilic design offers a better methodology towards providing a restoration environment. The argument draws its background to the study of relevant literature.

Review of relevant literature on the writings of prominent biophilic and organic architects and theorists aided in the culminating of a set of principles on which variables (directly related to the subject of biophilic and rehabilitation). It is obvious that this biophilic design can be ordered. Case studies were analyzed using general variables and specific research emphases on the principles of functioning of the building and the form of the building.

The concept of the centre stems from the abstraction of rehabilitation and biophilic design principles discussed in the literature review. The design was conceived through an understanding and analysis of the requirements of biophilic design leading to the creation of a building complex that would facilitate or set the grounds for a positive experience for the users. The design provides spaces for a hub of activities while utilizing biophilic design principles, the design capitalizes on nature's grandeur and produces a functional and comfortable environment, with a certain sense of place, but at the same time promoting physical and psychological well-being by fostering a connection between the users and nature.

In summary, creating a rehabilitation centre that incorporates many techniques of biophilic design can effectively provide the rehabilitees with a facility unlike any other in existence today. By establishing an inspiring and enjoyable experience that cohesively integrates our natural and built environments will provide rehabilitees with a new kind of facility that will utilize a unique approach to enhancing their lifestyles and productivity.

8.2RECOMMENDATIONS

To address how this research relates specific elements with relevant development stages and missions, the following typology provides drug addicts rehabilitation stakeholders with best practice examples. These are grouped by direct natural, indirect natural and symbolic naturalcategories as defined by the benefits to rehabilitation environmental competence.

I. Direct Natural Elements

One focus of this thesis was direct natural elements and how they were beneficial to restoration, cognitive and physical rehabilitation of drug addicts. The most relevant mission statement themes associated with direct natural elements in the literature were “participatory design”, “addict’s health” and “environmental education”. Direct natural elements represent unprogrammed space that allows for immersion in some form of wild environment, or a restored natural setting, and can include views of the exterior environment, daylight, natural ventilation, plants, animals, natural habitats, and ecosystems. Examples include a forest, meadow or stream that involves exploration and restoration supports. These spaces may appeal to people recovering from addiction (Kellert,2002), if care is made for purposeful construction,interaction, manipulation and discovery. These activities may lead to increased self-confidence,adaptability and moralistic viewpoints about natural settings (Kellert,2002).

II. Indirect Natural Elements

Indirect natural elements were another category of design features in rehabilitation centres related to participatory design, addicts' health and psychological restoration.In the literature, this type of "everyday nature" does not need to be inherently wild, but allows access topotted plant, a water fountain, natural materials, or an aquarium which represent human intervention in the natural world. Thesespaces are usually facilitated by programmed activity, verses free play. This category includes elements for socialization,facilitated participation and interpretation. The purpose of these spaces is to introduce fact-based understanding of cause and effect through themed garden areas, as well as cultivated garden plots.

III. Symbolic Natural Elements

Symbolic natural design features involved limited direct contact with wild nature, but a greater amount of **control, legibility, accessibility and safety** within a familiar type of environment. This may include play environments encouraging safe interaction with elements like symbolic art, animal sculpture, learning exhibits and other familiar elements.

8.3CONTRIBUTION TO KNOWLEDGE

This thesis has brought to focus the fact that biophilic architecture has a direct influence on the restoration and recovery process of people suffering from addiction, since it moulds the environment within which they lives. Creating the most conducive environment for their pleasurable living which however can only be accomplished when identification and consideration of their needs form the basis as the focus of such designs not as an object on the scene of the design. It can also be deducted that;

I. By incorporating nature into rehabilitation centres, we will not only provide an enabling environment but we are also creating an environment that in itself is healing and restoring.

II. The depression, pain, anxiety, anger and stress of addicts in a rehabilitation centre can be eradicated by creating distraction in the design of the facility; these distractions can be a beautiful water feature, interesting landscapes, healing gardens and healing pools or a pleasant view from windows.

Rehabilitation facilities should be design to inspire their users, it is only then we can conveniently say that its design is truly functional – when it appropriately meets the social and psychological needs of its end users.

8.4AREA OF FUTHER RESEARCH

There are several areas for future research. Future studies might move beyond the restoration methodology used in this project to study a larger, more representative sample of rehabilitation centres. The survey could be carried out to a larger number of rehabilitation centres (of at least 30) throughout the country. A larger population could be assessed on which types of elements are included in design, as well as more in depth information on the content of treatment programs that goes along with these rehabilitation processes.

Another gap in this research was the lack of addicts' interviews to gather data about what are the most relevant elements they deem fit for their recovery process. To address this, future researchers could utilize the photo documentation of elements from this thesis in a rehabilitation centre design.

In response to mono-method and self-report bias in this method, more objective measures could be used in the future. For example, respondent completed interviews instead of the interviewer completed method used in this research.

A better measure of rehabilitation affordances for health recovery and duration of treatment is another area where improvement is needed. Rehabilitation centres that provide programming in food and nutrition, such as the Sea ridge Drug Rehabilitation Centres, could be measured

for percentageofrehabilitee's gardening plots and amount of programming. Furthermore, objective assessment of green space and built space within rehabilitation centres (such as through aerial GIS analysis) may improve validity of checklist measures of natural element categories.

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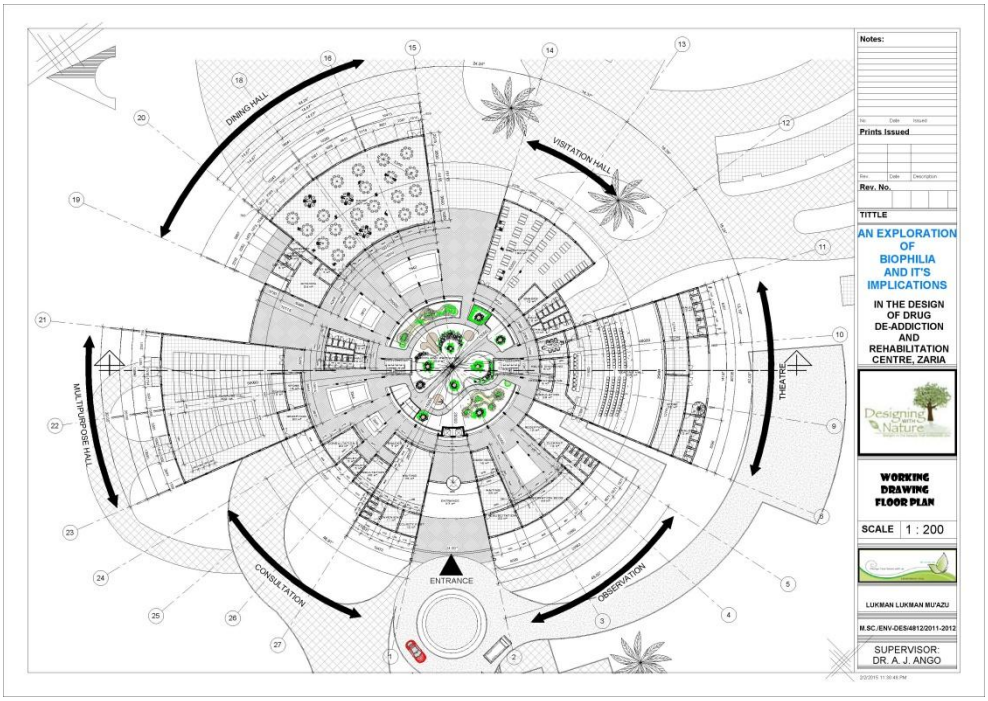
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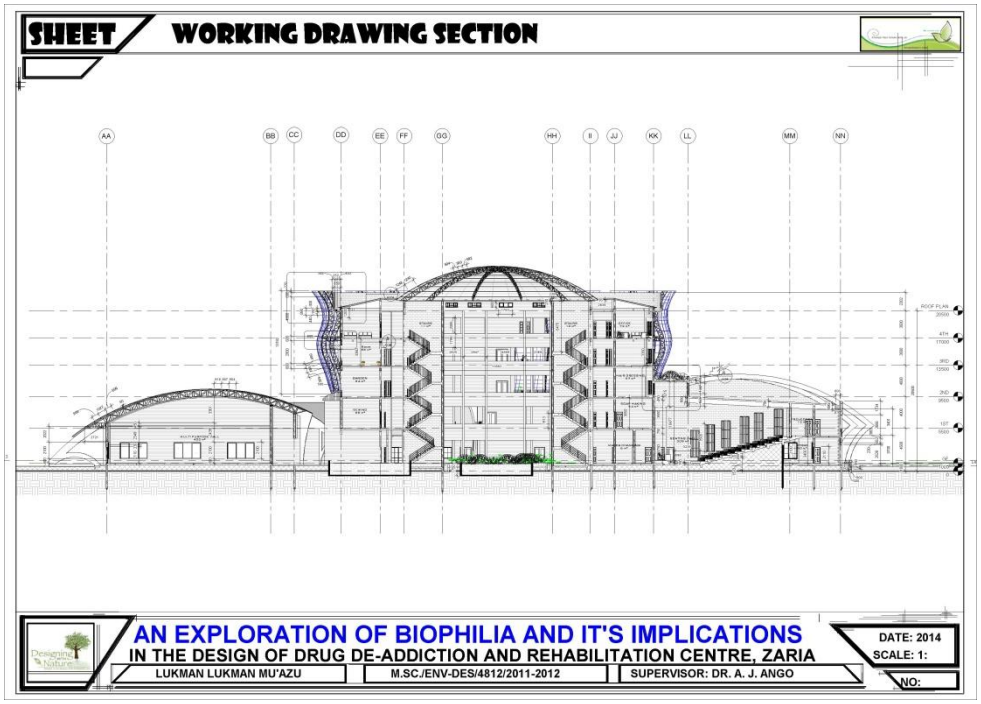
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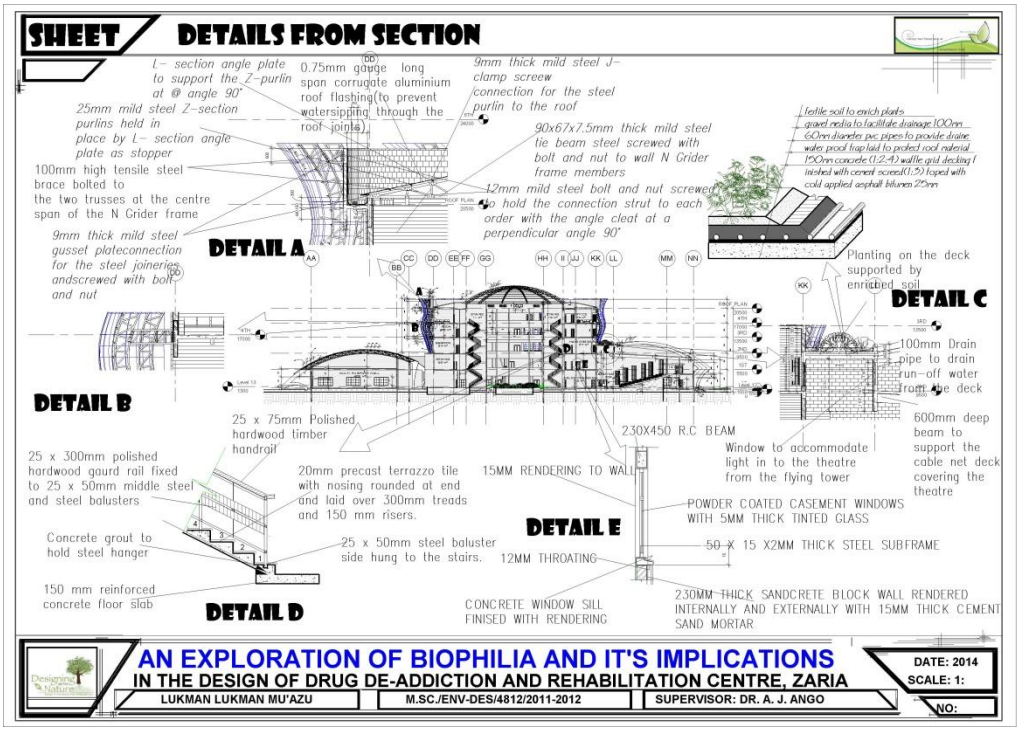
APENDIXES



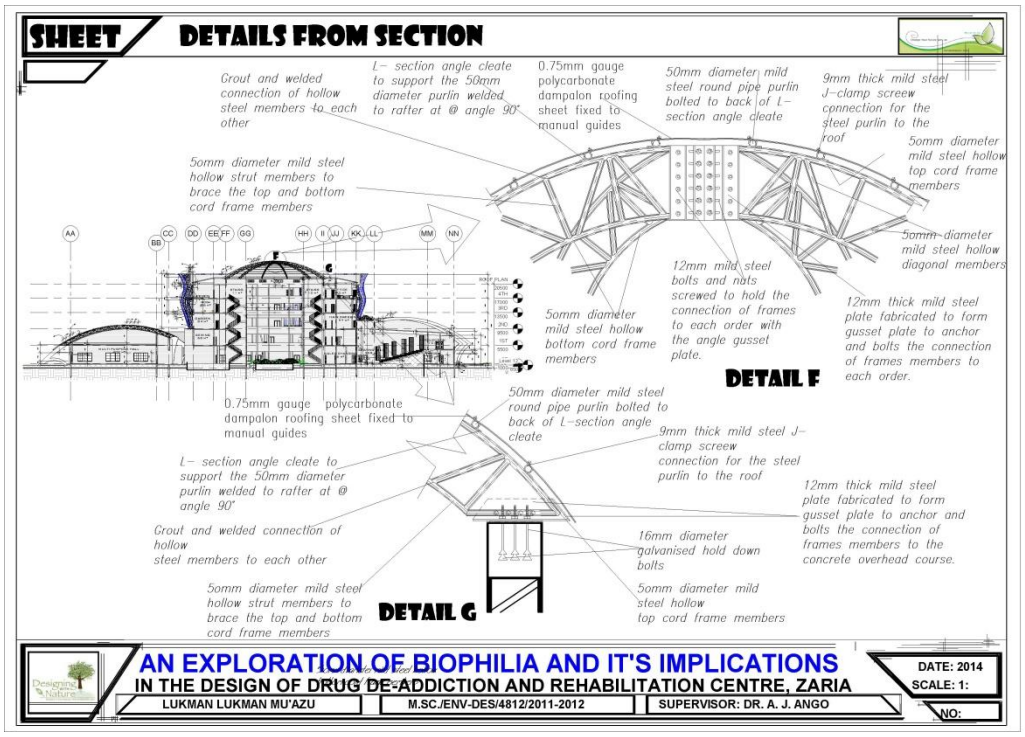
Appendix 1: Ground Floor Plan.



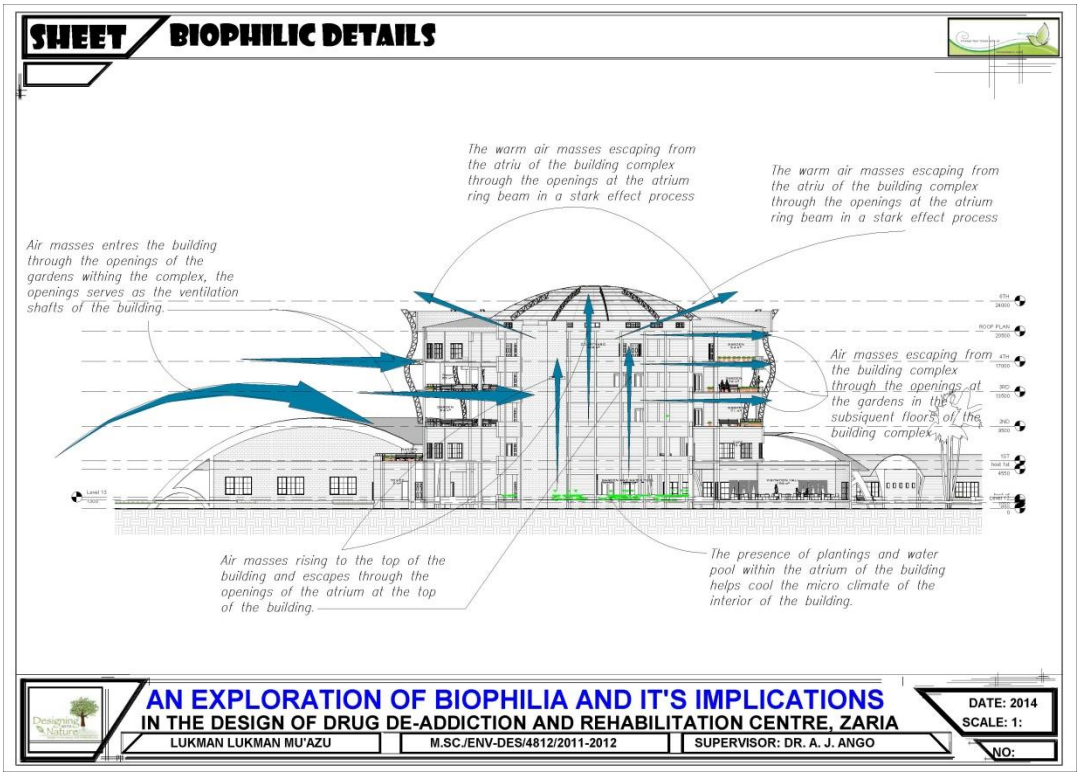
Appendix 2: Section Through the Building.



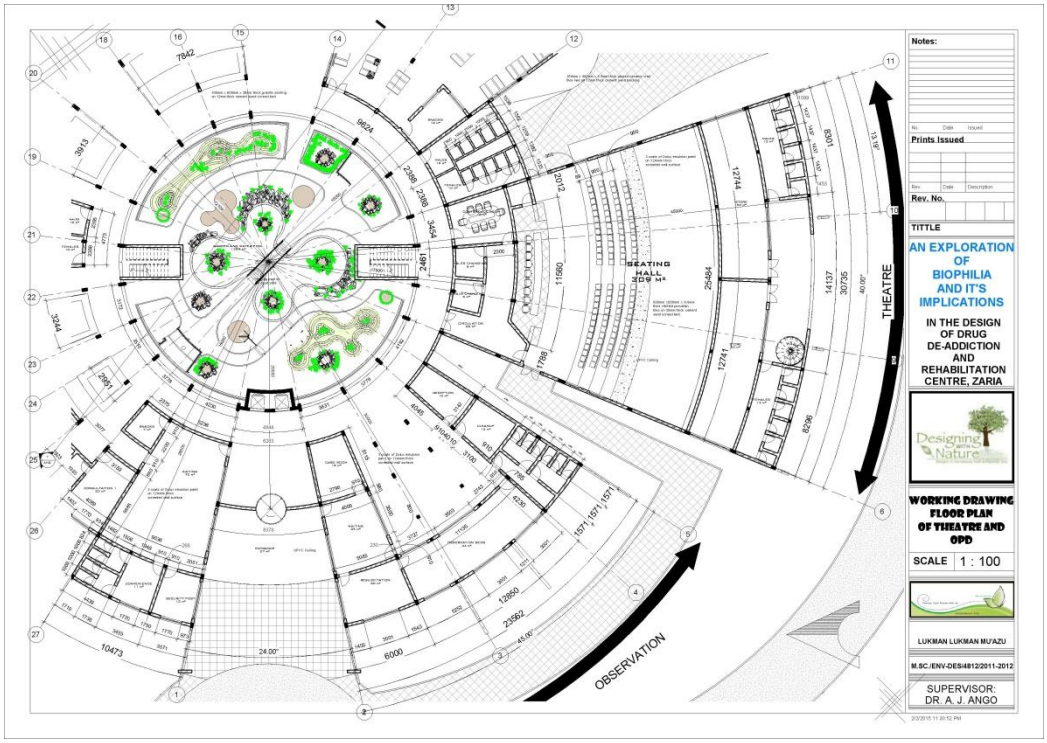
Appendix 3: Section Detailing 1.



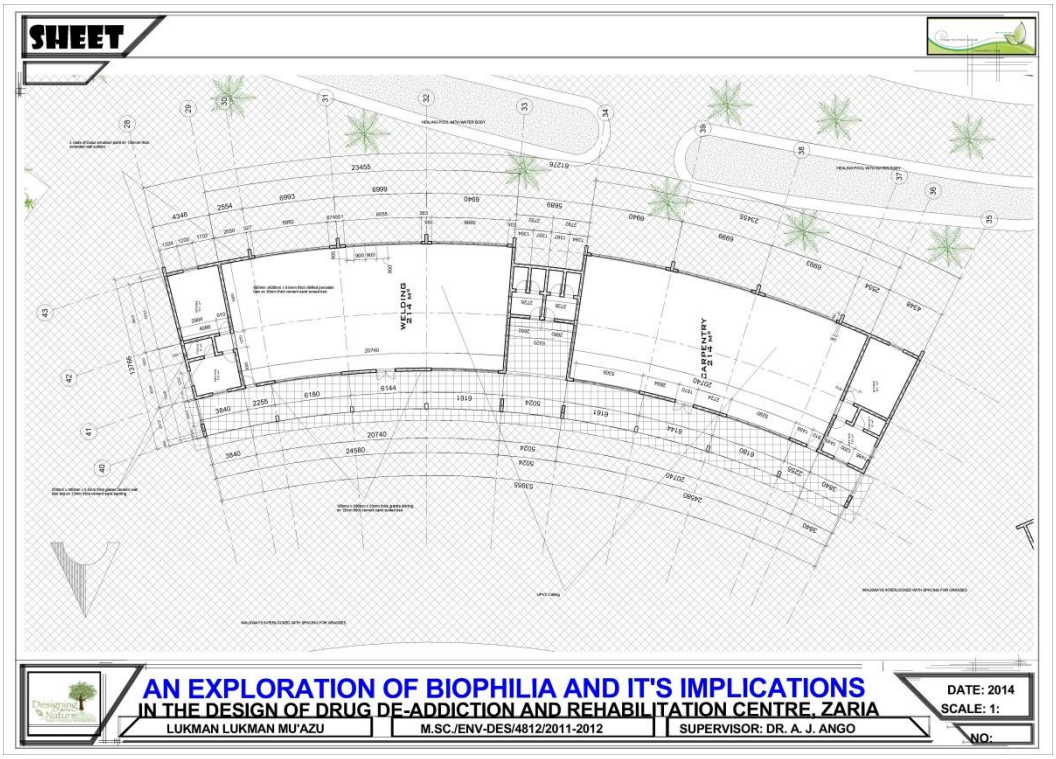
Appendix 4: Section Detailing 2.



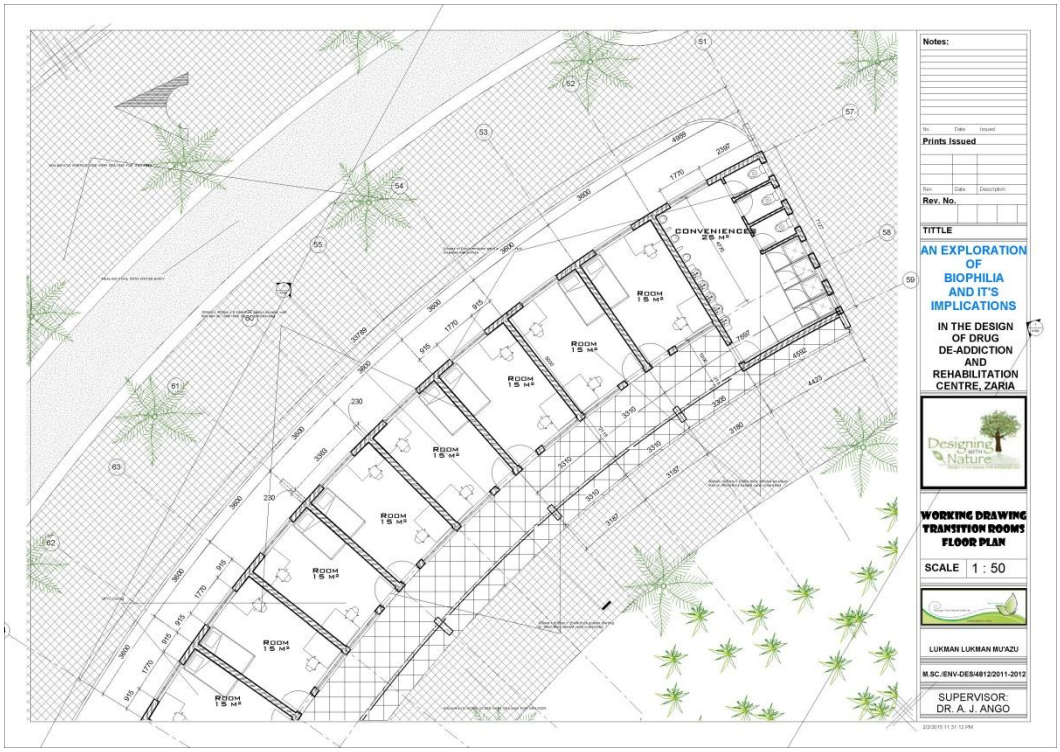
Appendix 5: Biophilic Detail.



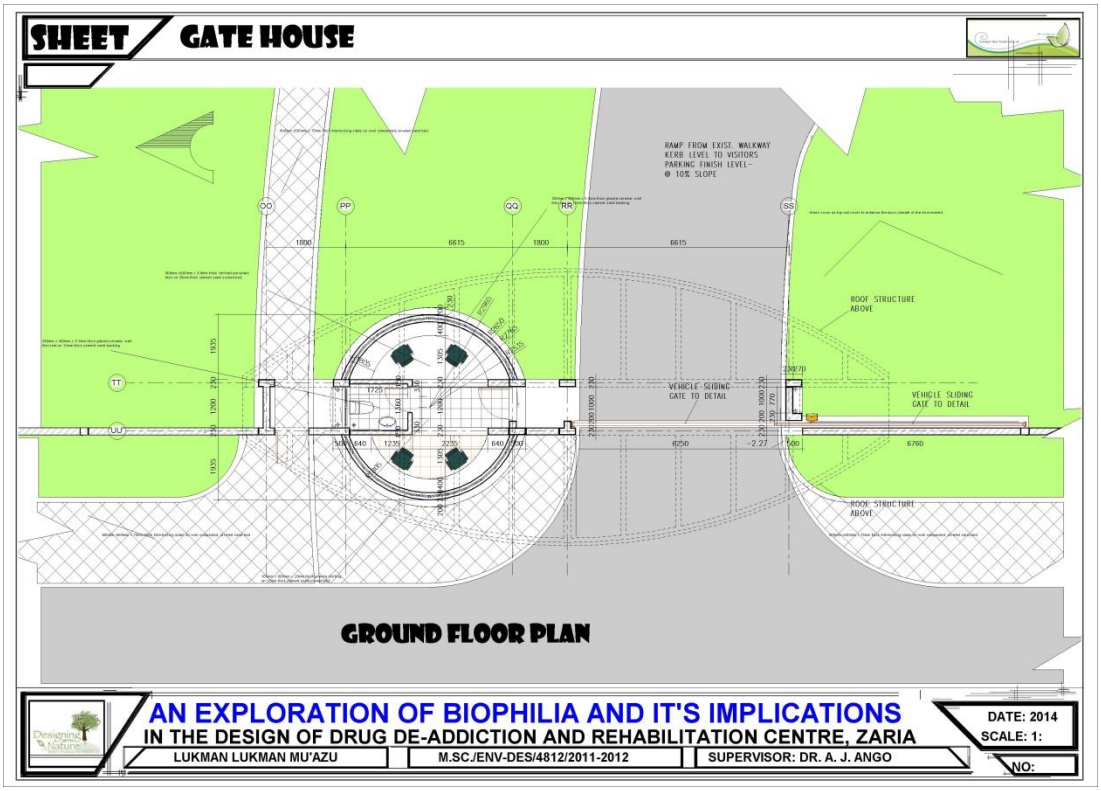
Appendix 6: Working Drawing Ground Floor Plan.



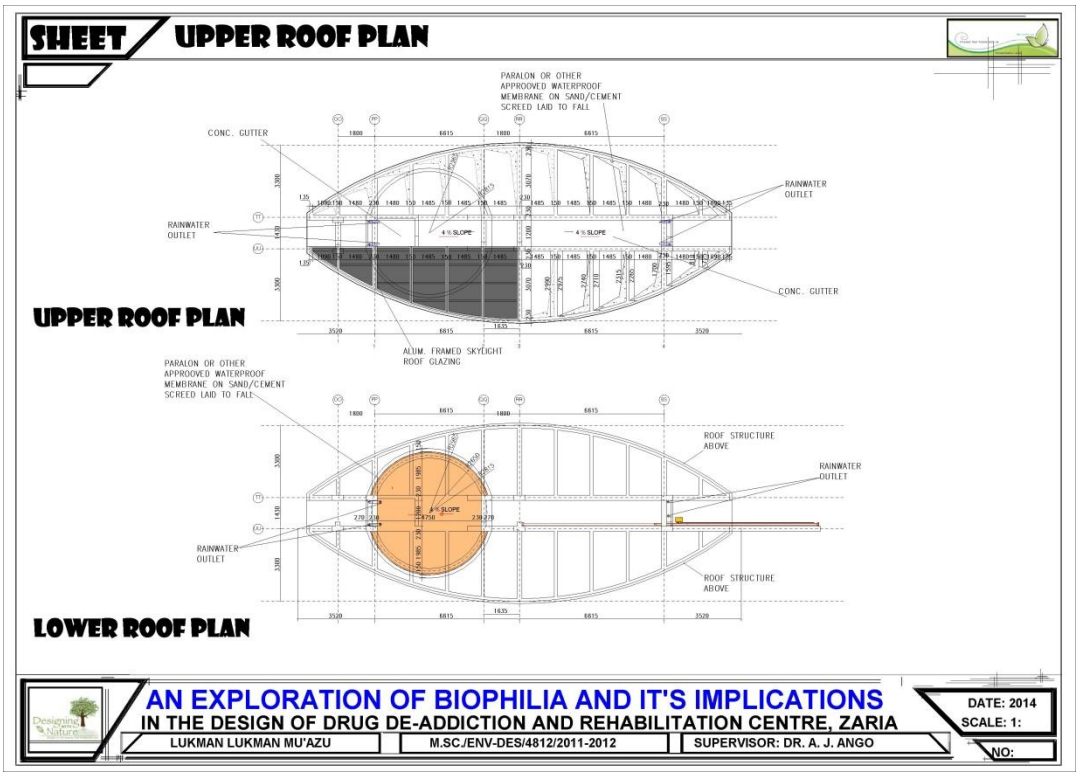
Appendix 7: Skill Acquisition Halls Floor Plan.



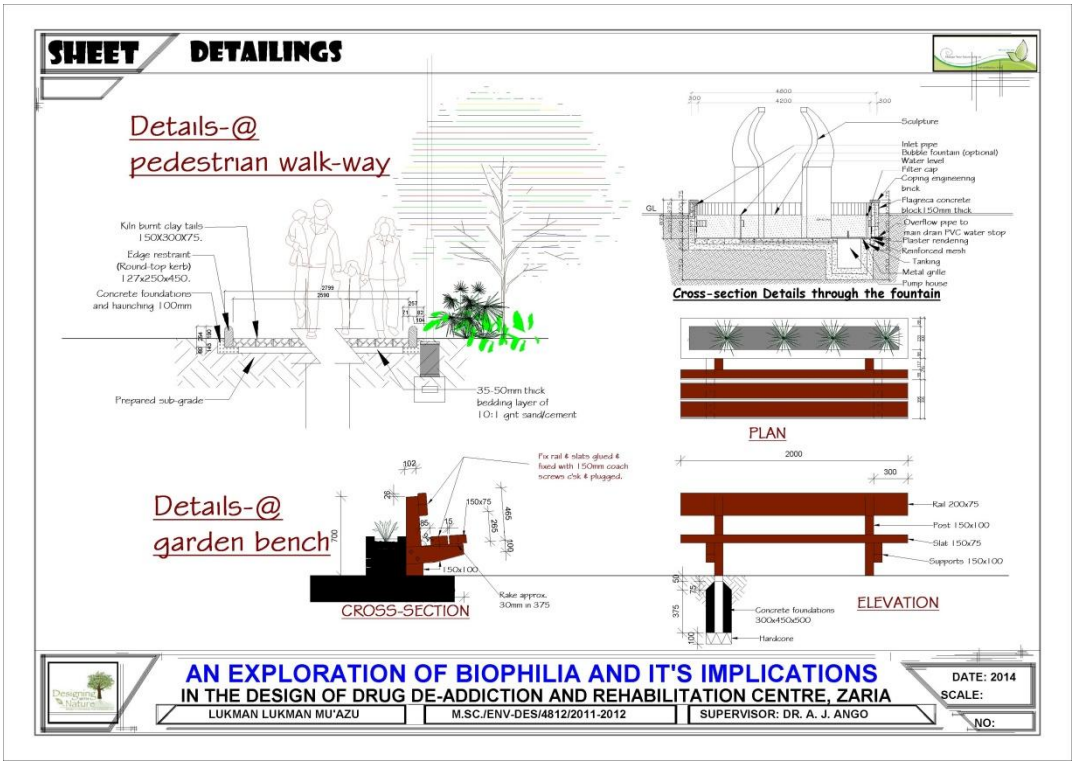
Appendix 8: Transition Rooms Floor Plan.



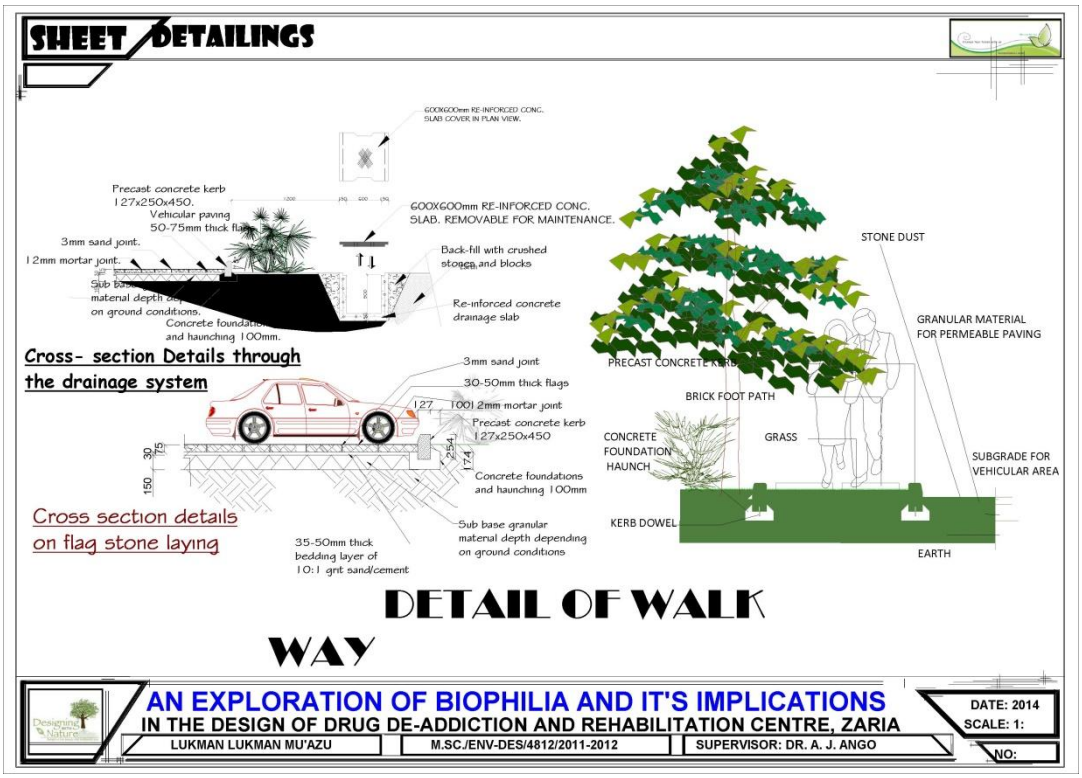
Appendix 9: Gate House Floor Plan.



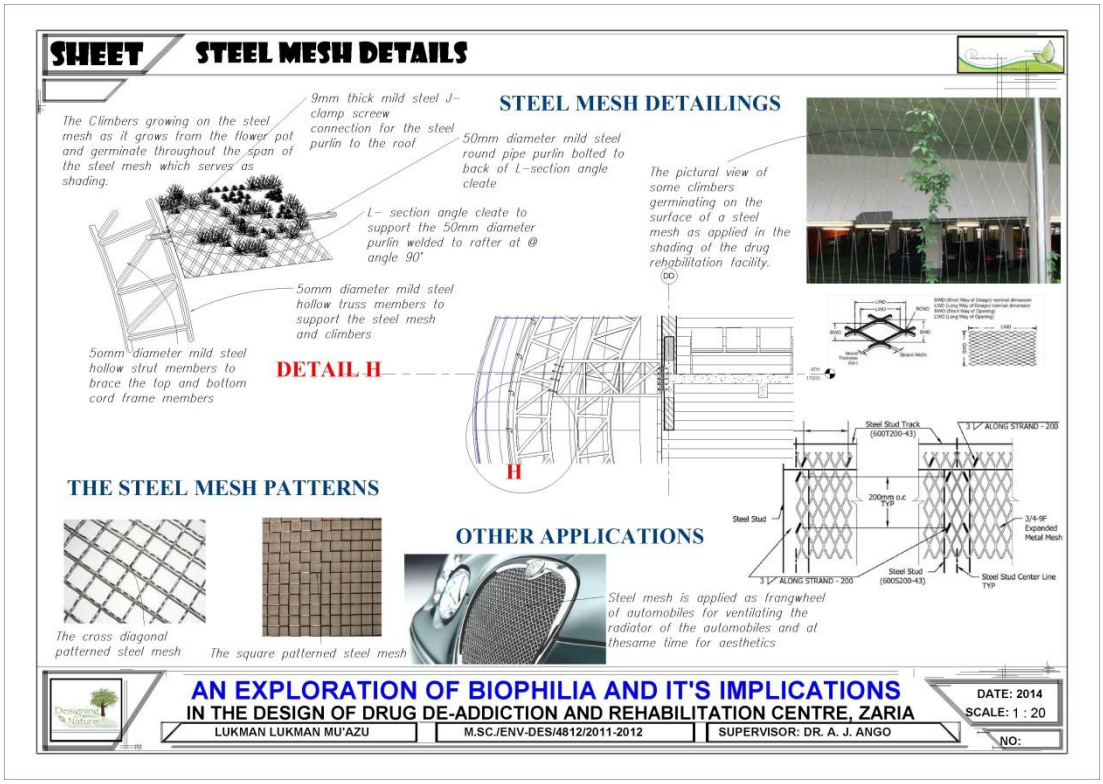
Appendix 10: Roof Plans of Gate House.



Appendix 11: Landscaping Details 1.



Appendix 12: Landscaping Details 2.



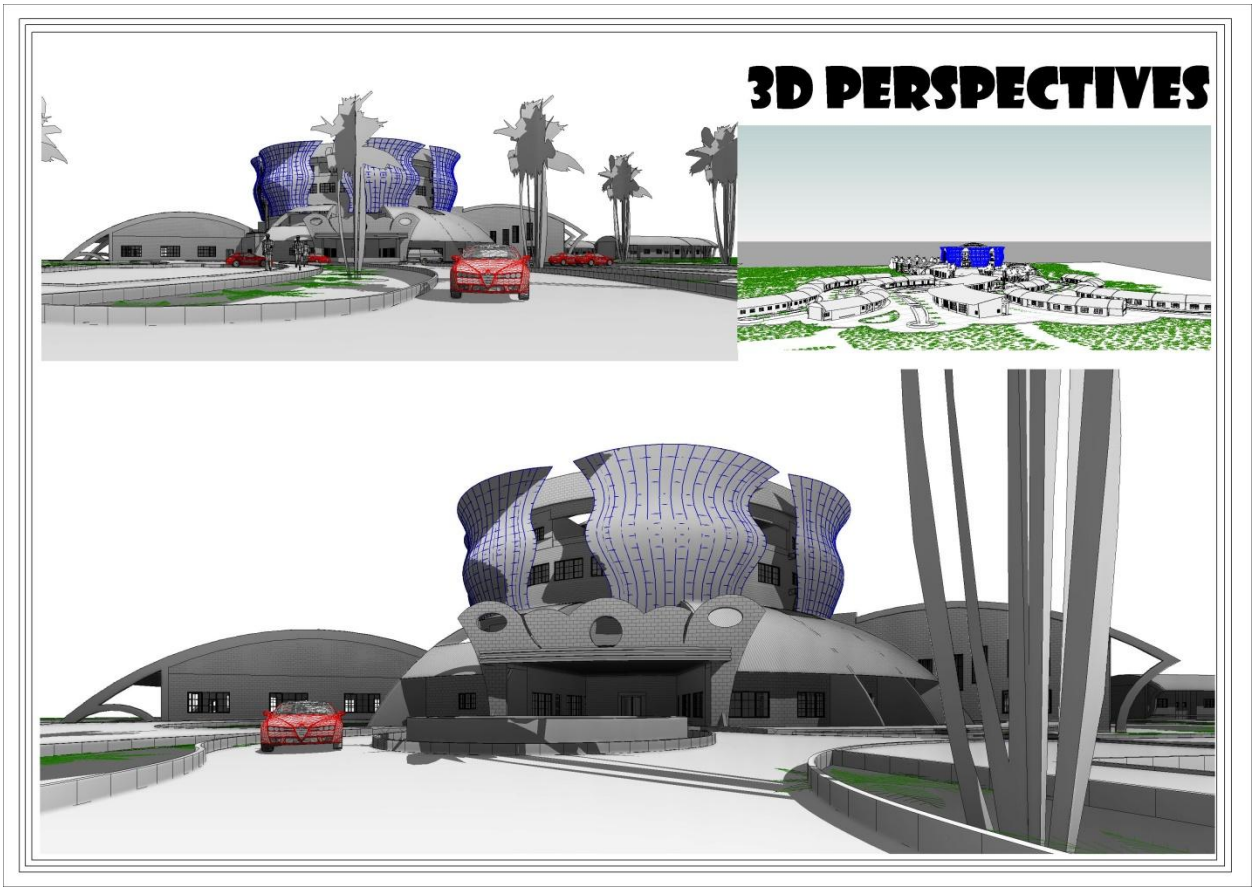
Appendix 13: Steel Mesh Detailing.

SHEET — SPECIFICATION SCHEDULE

ROOM NAME	AREA(M²)	FLOOR	SKIRTING	WALL	CEILING
Theatre + Dining	750m²	300mm x600mm x 20mm thick granite tile on 30mm thick screeded bed	100mm x 600mm x 20mm thick granite skirtingon 12mm thick cement sand screed bed	3 coats of Dulux emulsion paint on 12mmm thick screeded wall surface	UPVC Ceiling
Multipurpose + Visitation Hall	600m²	600mm x600mm x 9.6mm thick vitrified porcelain tiles on 30mm thick cement sand screed bed	100mm x 600mm x 20mm thick vitrified tile skirting on 12mm thick cement sand screed bed	3 coats of Dulux emulsion paint on 12mmm thick screeded wall surface	UPVC Ceiling
Offices	160m²	600mm x600mm x 9.6mm thick non-slip vitrified porcelain tiles on 30mm thick cement sand screeded bed	100mm x 600mm x 20mm thick vitrified tile skirting on 12mm thick cement sand screed bed	3 coats of Dulux emulsion paint on 12mmm thick screeded wall surface	UPVC Ceiling
Cafe + Library	140m²	600mm x600mm x 9.6mm thick non-slip vitrified porcelain tiles on 30mm thick cement sand screeded bed	100mm x 600mm x 20mm thick vitrified tile skirting on 12mm thick cement sand screed bed	3 coats of Dulux emulsion paint on 12mmm thick screeded wall surface	UPVC Ceiling
Research Labs	100m²	300mm x600mm x 20mm thick granite tile on 30mm thick screeded bed	100mm x 600mm x 20mm thick granite skirting on 12mm thick cement sand screed bed	3 coats of Dulux emulsion paint on 12mmm thick screeded wall surface	UPVC Ceiling
Orientation Halls	160m²	600mm x600mm x 9.6mm thick vitrified porcelain tiles on 30mm thick cement sand screed bed	100mm x 600mm x 20mm thick vitrified tile skirting on 12mm thick cement sand screed bed	3 coats of Dulux emulsion paint on 12mmm thick screeded wall surface	UPVC Ceiling
Stores	20m²	600mm x600mm x 9.6mm thick vitrified porcelain tiles on 30mm thick cement sand screed bed		250mm x 400mm x 5.5mm thick glazed ceramic wall tiles laid on 12mm thick cement sand backing	UPVC Ceiling
Toilets	80m²	600mm x600mm x 9.6mm thick vitrified porcelain tiles on 30mm thick cement sand screed bed		250mm x 400mm x 5.5mm thick glazed ceramic wall tiles laid on 12mm thick cement sand backing	UPVC Ceiling

AN EXPLORATION OF BIOPHILIA AND IT'S IMPLICATIONS
IN THE DESIGN OF DRUG DE-ADDICTION AND REHABILITATION CENTRE, ZARIA
LUKMAN LUKMAN MU'AZU | M.SC./ENV-DES/4812/2011-2012 | SUPERVISOR: DR. A. J. ANGO
DATE: 2014 SCALE: 1: NO:

Appendix 14: Specification Schedule.



Appendix: Perspective Views.