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ZOOMORPHISM

A NEW ZOO TYPOLOGY AS PLATFORM FOR COEXISTENCE, FOCUSED ON REHABILITATION AND CONSERVATION OF LOCAL INDIGENOUS SPECIES AND HABITATS

Duard Burger // Department of Architecture // University of Pretoria

Thank you to my study leader Dario Schoulund and Arthur Barker for the wonderful year and to all the people who supported me and made this dissertation possible.

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And Finally Charldon Wilken, Jacques Jordaan and Linelle Visagie for all the crit sessions and motivational words.

DECLARATION

In accordance with Regulation 4(c) of the General Regulations (G.57) for dissertations and theses, I declare that this thesis, which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution. I further state that no part of my thesis has already been, or is currently being, submitted for any such degree, diploma or other qualification. I further declare that this thesis is substantially my own work. Where reference is made to the works of others, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references.

Josias Eduard Burger

ZOOMORPHISM

Duard Burger

Study leader: Dario Schouland

Year co-ordinator: Arthur Baker

Submitted in fulfilment of part of the requirements of the degree MArch(Prof) in the Faculty of Engineering, Built Environment and Information Technology at the University of Pretoria

Pretoria, South Africa

2019

ABSTRACT

The exploration manifests in the idea of coexistence where indigenous animals, nature and people could live in harmony. The dissertation questions the ethical aspects of a Zoo and the relationship between man and nature.

The Apies river which created the unique grid pattern we see in Pretoria today forms part of the context for the ascribed proposal. This historical landmark has seen significant change over the past century, once acting as life source to animals and humans alike, it now seems forgotten and channelized with the city's back turned towards it.

This study investigates how Architecture could facilitate and mediate the relationship between the city and nature as well as the relationship between people and nature.

Through a methodological approach the study will aim to determine a set of strategies to contest the current traditional Noah's Ark approach to zoo making. Theory, case studies and current contested zoological design principals aim to ground the strategies and seek to establish a contrast on current and future zoos. The focus shifts form Zoo as mere observational platform towards that of enlightened coexistence, emphasizing the importance of each link within the chain of life (Hancocks, 2001,p.27). These hypothetical strategies will guide the formation of new contextual zoos that are tailored to the environment they reside in. Rather, a contributor to the environment, an ecological restoration of sorts instead of a showcase, providing research and scientific opportunity that fits the environment and potentially lending its hand to collaborate virtually with other contextually based zoos around the world.

SUMMARY

ZOOMORPHISM

A HABITAT RESEARCH CENTRE
for a new zoo typology

The National Zoological Gardens of South Africa

325 Boom street
Pretoria - South Africa.
S 2 5 ° 4 4 . 3 4 9 ″
E 2 8 ° 1 1 . 3 2 9 ″

ENVIRONMENTAL POTENTIAL

Client:
The freshwater Research Centre
and the
South African National
Biodiversity Institute

CHALLENGING EPISTEMOLOGICAL IDEALS

Department of Architecture

University_of_Pretoria

South-Africa

2019

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CHAPTER ONE

PROBLEM STATEMENT

INTRODUCTION

This chapter gives a broad overview of the context and how it evolved over time. Out of the contextual overview a series of research questions evolved pertaining to the site itself and what the future holds. The intentions of the dissertation will be discussed and what contribution it could have towards architecture.

CONTEXT DEVELOPMENT

- The Apies river
- Pretoria
- The Zoo

RESEARCH PROBLEMS

- General Issue
- Urban Issue
- Architectural Issue

CONTEXT DEVELOPMENT

Background

Cities are living organism, they breathe an influx of people in daily, they grow through popularity and necessity, they think and feel, but most importantly, at their core, they share the same basic elements that shape and mold cities into what we know today.

No two cities are the same and they usually consist of varying amounts of the above mentioned elements. These elements determine the growth, success and desirability of a city and according to Whelchel and Donovan (1994:21) cities that are situated close to rivers tend to have an advantage as it is a resource that can be manipulated to the population's needs. The Egyptians are prime example of how a civilization used a resource to change a location's appeal. From a desert landscape, the Nile transformed the embankments of the river to rich, fertile grounds.

The first evidence that Pretoria was a suitable landscape stemmed from tools discovered along the Apies river from 2000 BC. The same elements that drew these forgotten people to Pretoria as we know it today are most likely why people kept coming back. The mountain ranges provided protection from enemies, the Apies river provided fertile grounds and clean water, and the location was ideal for cattle and farmlands.

Once the demand outgrew the natural systems we could see a change in the landscape (see Fig: . From hunter gatherers moving through the landscape and having a relationship with the river as a resource, to settlers out growing the river's resources due to population, ultimately seeing the river as a threat. This has led to the disconnect we see in the landscape today. By removing ourselves as humans from nature, we have created fragmented landscapes, through our interventions and our architecture.

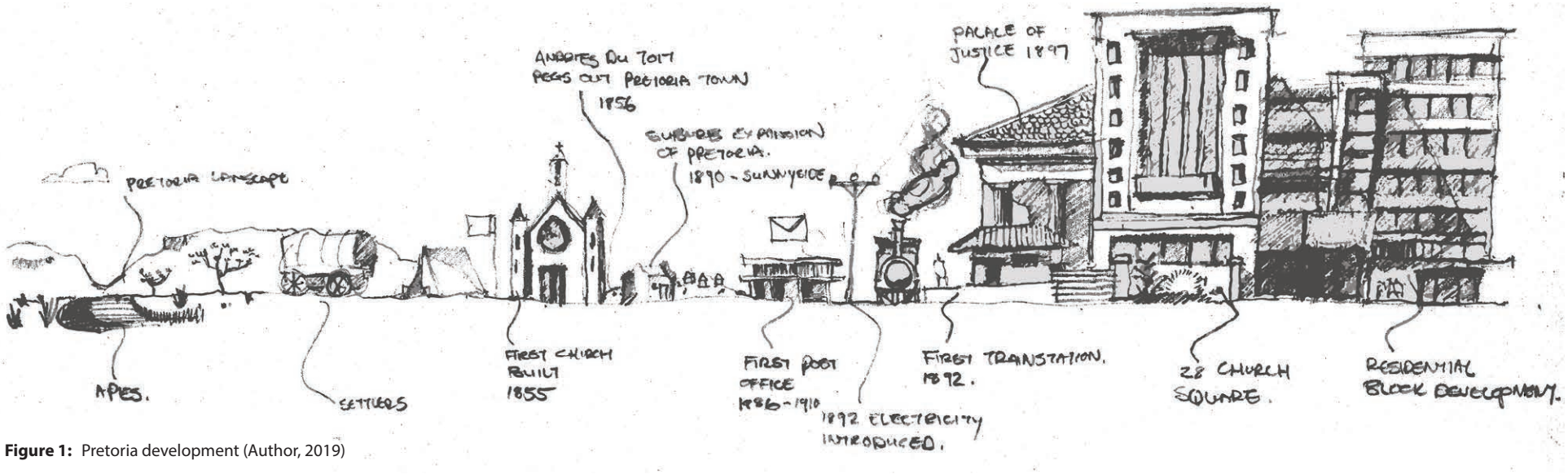
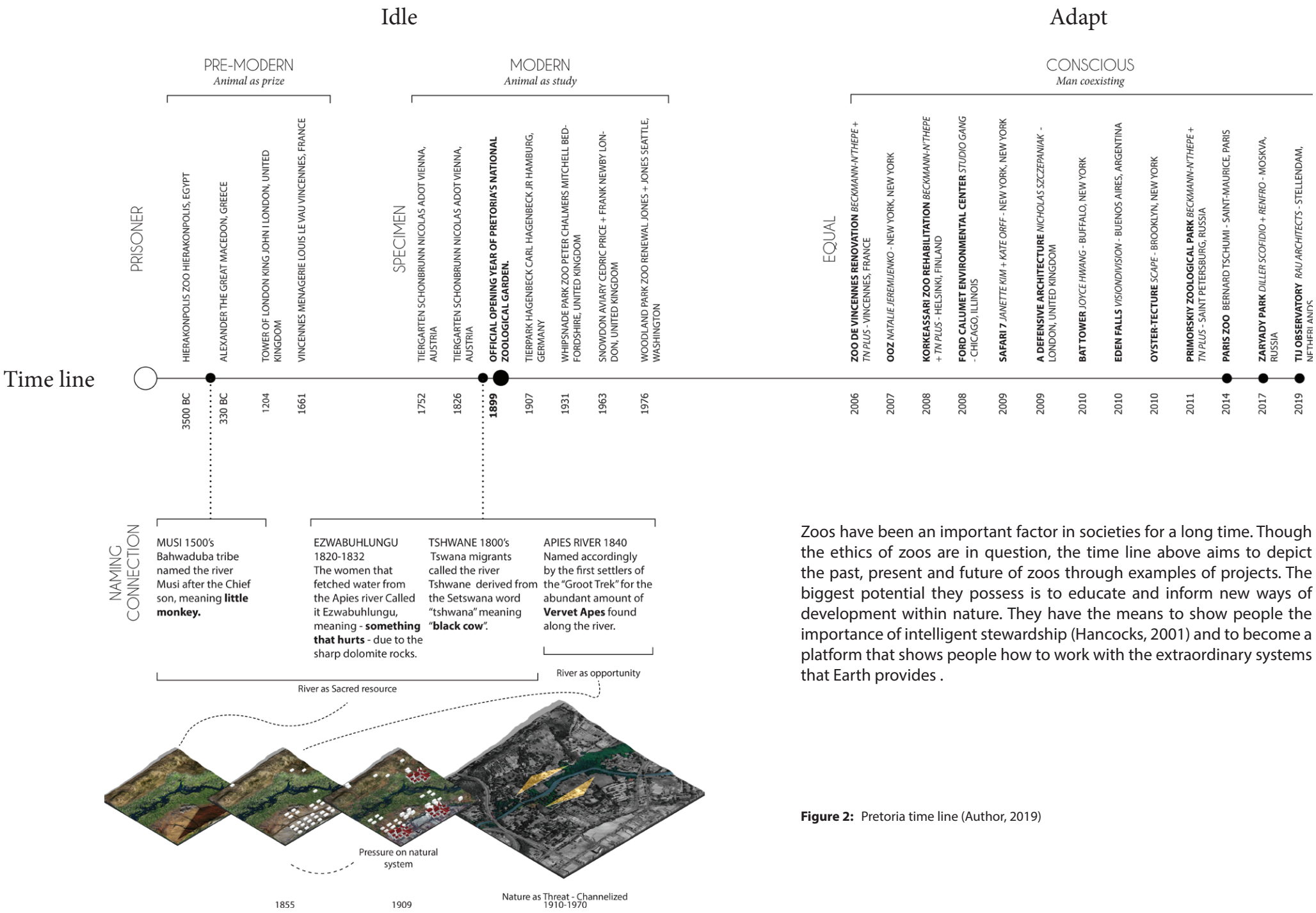


Figure 1: Pretoria development (Author, 2019)



Zoos have been an important factor in societies for a long time. Though the ethics of zoos are in question, the time line above aims to depict the past, present and future of zoos through examples of projects. The biggest potential they possess is to educate and inform new ways of development within nature. They have the means to show people the importance of intelligent stewardship (Hancocks, 2001) and to become a platform that shows people how to work with the extraordinary systems that Earth provides .

Figure 2: Pretoria time line (Author, 2019)

Change

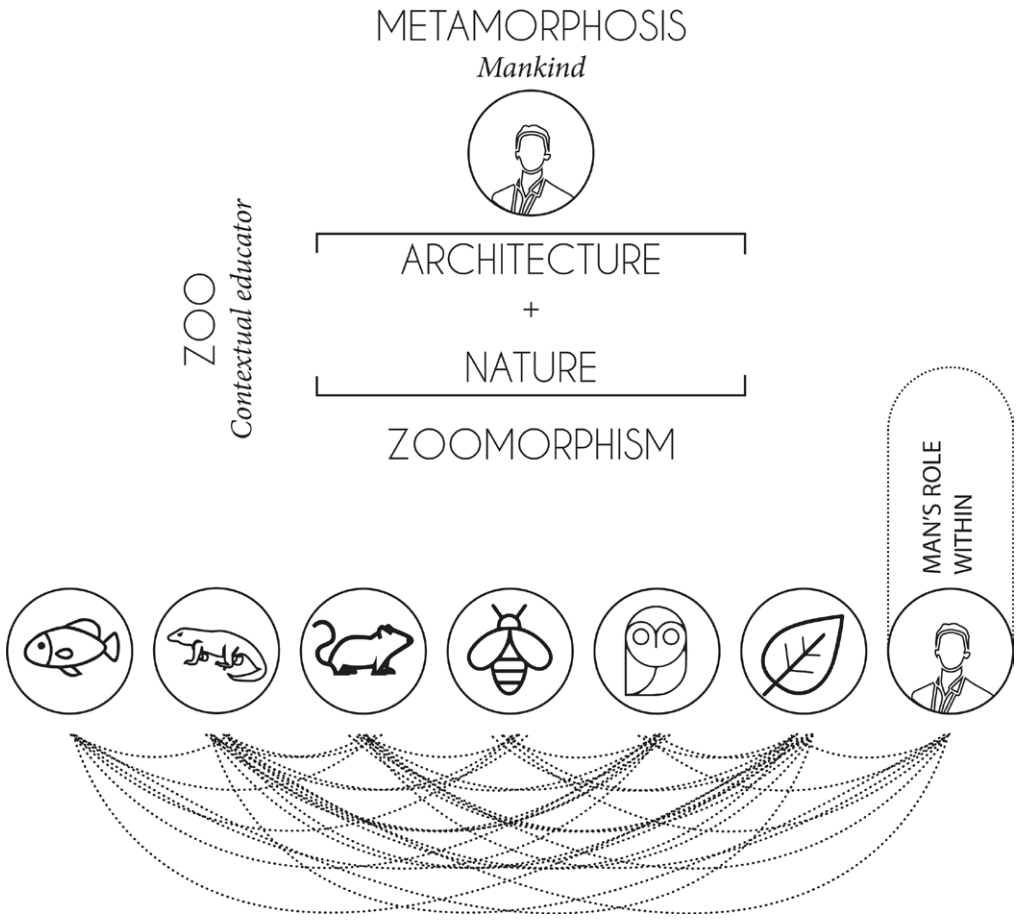


Figure 3: Potential overlap of interest (Author, 2019)

"captivity has taken an animal's life." [1]

RESEARCH PROBLEMS

General Issue

The exploration manifest in the idea of coexistence where indigenous animals, nature and people could live in harmony. The dissertation questions the ethical aspects of a Zoo and the relationship between man and nature.

The Apies river, which created the unique grid pattern we see in Pretoria today, forms part of the context for the ascribed proposal. This historical landmark has seen significant change over the past century; once acting as life source to animals and humans alike, it now seems forgotten and channelized with the city's back turned towards it.

This study investigates how Architecture could facilitate and mediate the relationship between the city and nature as well as the relationship between people and nature.

Through a methodological approach the study will aim to determine a set of strategies to contest the current traditional Noah's Ark approach to zoo making, defined by Hancocks (2001) as a collection of animals (around the world), usually not suited to the environment that they reside in. Theory, case studies and current contested zoological design principals aim to ground the strategies and seek to establish a contrast on current and future zoos. The focus shifts form Zoo as mere observational platform towards that of enlightened coexistence, emphasizing the importance of each link within the chain of life(Hancocks, 2001,p.27)These hypothetical strategies will guide the formation of new contextual zoos in combination with virtual connection allowing for regeneration and ethical engagement of habitats found outside of the study area.

Figure 4: Bird cages, Cincinnati Zoo (www.blog.cincinnatizoo.org)

Figure 5: Arena with Elephants, Lions and Leopards, 1885 (www.lempertz.com)

1 Gallucci, J. (2016). PETA Statement re Gorilla Killed at Ohio Zoo | PETA. [online] PETA. Available at: https://www.peta.org/media/news-releases/peta-statement-re-gorilla-killed-ohio-zoo/ [Accessed 11 Mar. 2019].

Figure 6: Meyerheim Paul - Tierbude 1885 (Adapted by author, 2019)

THE LEADING ZOOLOGICAL INSTITUTION TO ADVANCE AWARENESS, THE CREATION OF KNOWLEDGE, AND INNOVATION IN THE ***CONSERVATION OF AFRICA'S BIODIVERSITY*** *FOR THE BENEFIT AND WELLBEING OF SOCIETY - Mission and Vision statement of the Nation Zoological Gardern.*

Urban Issue

Tshwane hosts the National Zoological Garden of South Africa. This facility, in collaboration with other facilities, accommodates approximately 8000 mammals, birds, fish, reptiles, amphibians and invertebrates consisting of roughly 850 species and subspecies (Leshaba, 2019). Top class modern zoos have made efforts to accommodate such a variety of species, as humanely as possible, with some sense of roaming freedom (Mason, 1999), yet larger animals tend to show abnormal behaviour as the enclosure is smaller than their natural environments (refer to Figure 6) (Francisco, 2019). This begs the question if these animals should be kept in captivity at all? Could zoos possibly be tailor made to fit the environment they reside in? Rather, a contributor to the environment, an ecological restoration of sorts instead of a showcase, providing research and scientific opportunity that fits the environment and potentially lending its hand to collaborate virtually with other contextually based zoos around the world.

Figure 7: Nature, People, City(Author, 2019)

Architectural Issue

Zoos have existed for thousands of years and have undergone many transformations since the first documented evidence we discovered in Egyptian ruins. Form being a symbol of status, to a symbol of conquest as in the Roman empire (refer to Figure 5) to one of learning for people (refer to Figure 4), the zoo as an entity, is yet again bound to change with newly added dimension to it, that being that zoos need to change in favour of the animals and not the people alone who are viewing them(Hancocks, 2001). A zoo should be a sanctuary to animals of the city scape, a platform for people to engage and not encage, a place of coexistence. Taming wildlife seems to be a contradiction of its own and we should strive for a wiser, perhaps more mystical concept of animals as described by Henry Beston (1988). Rather than viewing animals through our lens of knowledge, we should allow the tools and opportunities to view animals in their own environment; not caged, not restricted, not removed. Thereby allowing us to experience a glimpse into a world of senses that we have lost or never attained, living by voices we shall never hear (Beston, 1988). By changing the way we look at animals, not as our brothers or our lesser species, but as another nation that is with us on earth, bound to the same laws of physics as we are, we might form a better understanding of our relationship towards them and nature, gaining a new found respect for nature itself.

INTENTIONS

Design is a practice that transcends the idea of making sustainability not only possible, but also appealing. Through changing the way we perceive outdated ways of thinking otherwise know as epistemologies by adopting new ways of learning and engaging, we can re-adjust our perspective of where we stand in our relationship to nature. Design as a practice is involved with shifting and re-signifying dominant norms, meaning and aspirations to make alternative ways of living possible. The power of design lies in the fact that it has the potential to influence an audience's behaviour though an intervention that creates an interaction on some levels. This means that design is poised to facilitate social change – "once designers move beyond their comfort zones and disciplinary boundaries to meet the complexity of environmental and social challenges."

The goal is to change the way people view their environment and their connection toward it. By facilitating researchers within the zoo as part of an active river bank restoration program, people can be integrated into the process and potentially gain valuable knowledge that they could use to become environmental stewards.

The intervention changes the idea of stationary learning into dynamic learning, where the community is directly involved in the research realm through immersion.

The intention of dynamic learning can be divided into the following categories:

Immersion: The intervention aims to immerse people into their surrounding providing a unique experience that can be etched into memory. Immersion in itself can lead to a sense of enlightened connection which provides ideal circumstances for learning (refer to Figure 8)

Connection: The intervention will not compete with the landscape but instead will work with the current site conditions and celebrate connection with the land and sky by means of materiality and its construction on site. Even though habitat is the main focus within the dissertation, two species will be focused on to show the vital connection they have regarding each other and the connection they have towards site (refer to Figure 9).

Process: The intervention will demonstrate the appeal of process and how site changes over time. By emphasizing process the intervention seeks to show its position as facilitator within the process allowing and foreseeing change as the process evolves over time (refer to Figure 10).

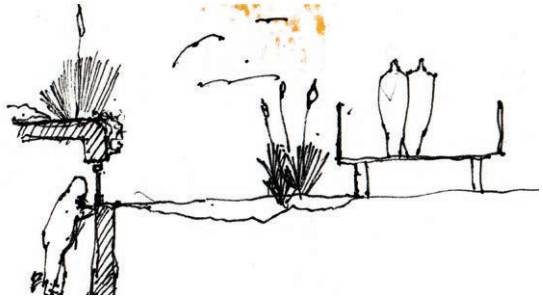


Figure 8: Nature immersion (Author, 2019)

Figure 9: Landscape connection (Author, 2019)

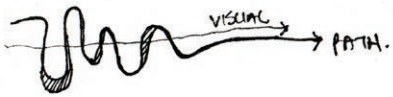


Figure 10: Process (Author, 2019)

CONTRIBUTION

This dissertation provides an approach to design for habitats as the main connecting element between people and nature. Habitat is the main drive that supports the unique conditions we all need to thrive. By framing and focusing on these unique aspects, an attempt is made to create and re-establish a bond to nature which seems to be lost.

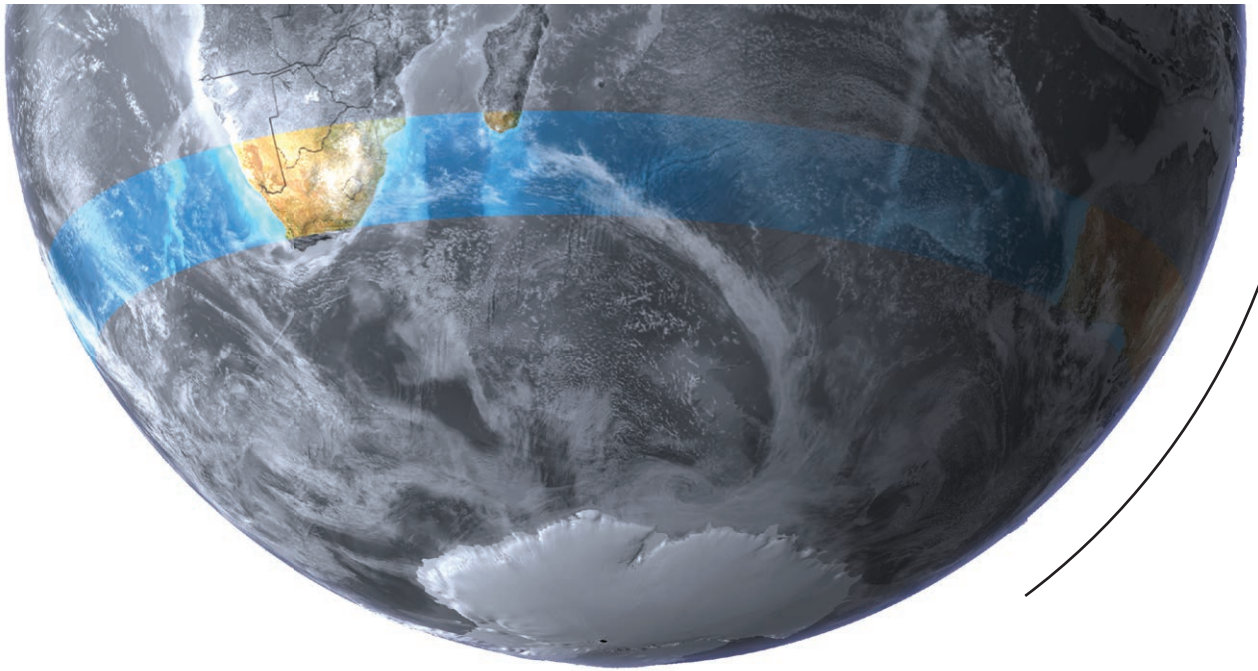


Figure 11: Earth contribution (Author, 2019)

Caged, entrapped, everything is apt.
Fine, Fair, not a care...

But there, if I can get over there
not with feet nor paws
but just a stare, one single gaze of a hazed
place

This is not my place
this is some place
a place.

Their cage, entrap place
I am an expiring exhibit
I am not welcome
Caged.

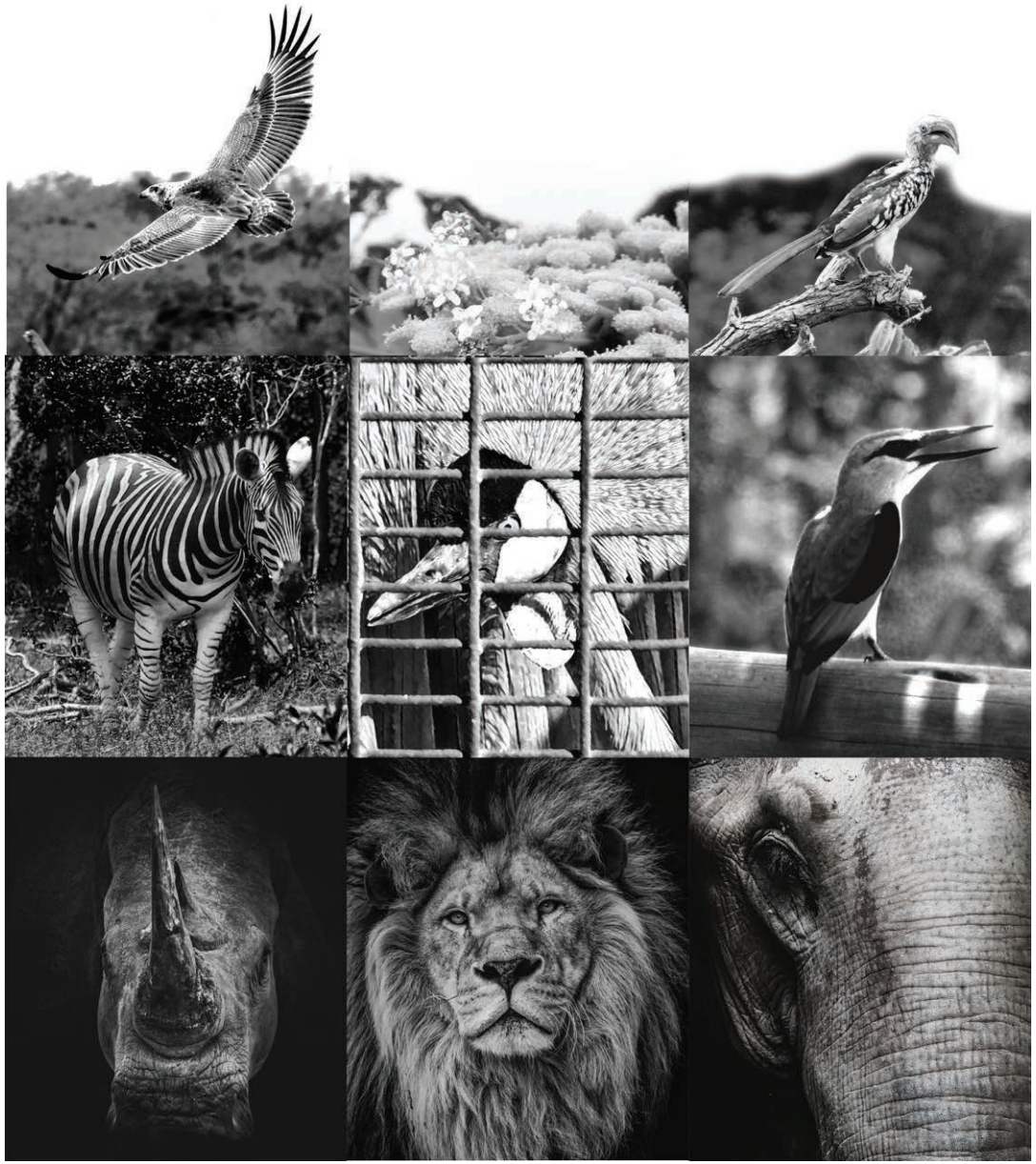


Figure 12: Typical zoo Species (Author,2019)

CHAPTER

PHYSICAL CONDITIONS

INTRODUCTION

This chapter provides insight into the site conditions and the particular elements that inform the design. The urban vision seeks to unlock the site potential and will serve as a guideline for future projects to develop from.

URBAN ANALYSIS

- Biomes of Gauteng
- Pretoria
- The Apies river
- Urban Context

URBAN VISION

- Urban proposal

SITE ANALYSIS

- Aviary
- Current condition

SITE POSSIBILITIES

- Potential
- Future projects

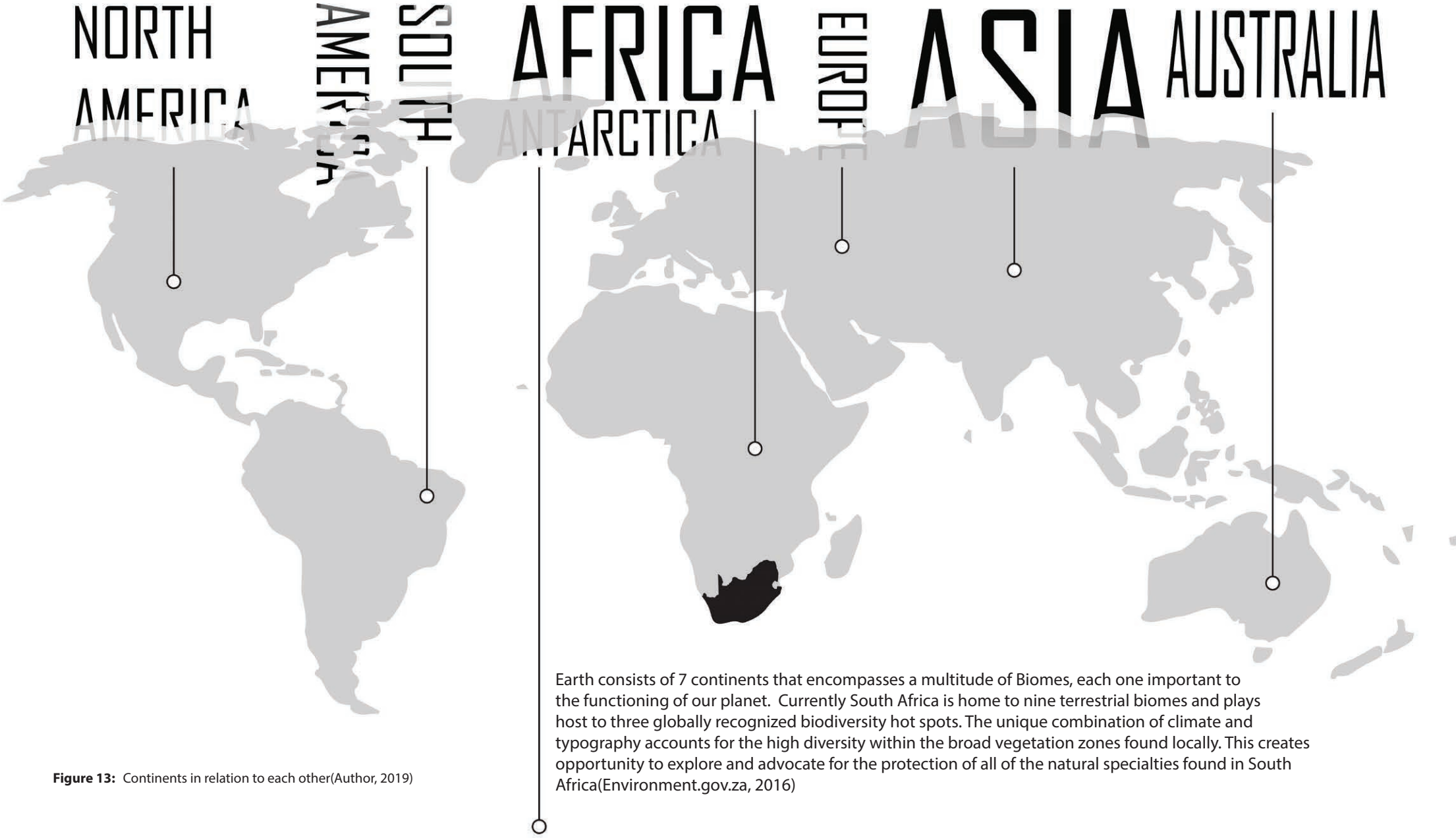


Figure 13: Continents in relation to each other(Author, 2019)

Earth consists of 7 continents that encompasses a multitude of Biomes, each one important to the functioning of our planet. Currently South Africa is home to nine terrestrial biomes and plays host to three globally recognized biodiversity hot spots. The unique combination of climate and typography accounts for the high diversity within the broad vegetation zones found locally. This creates opportunity to explore and advocate for the protection of all of the natural specialties found in South Africa(Environment.gov.za, 2016)

"South Africa takes up two per cent of the planet's land resource, it is home to six per cent of the world's plant and mammal species, eight per cent of bird species and five per cent of reptile species." (Environment.gov.za, 2016)

Figure 14: Biomes found in South Africa in colour (Author, 2019)

TROPICAL RAINFOREST

TEMPERATE FOREST

TAIGA (BOREAL FOREST)

DESERT

GRASSLAND

SAVANNA

TUNDRA

FRESH WATER

MARINE

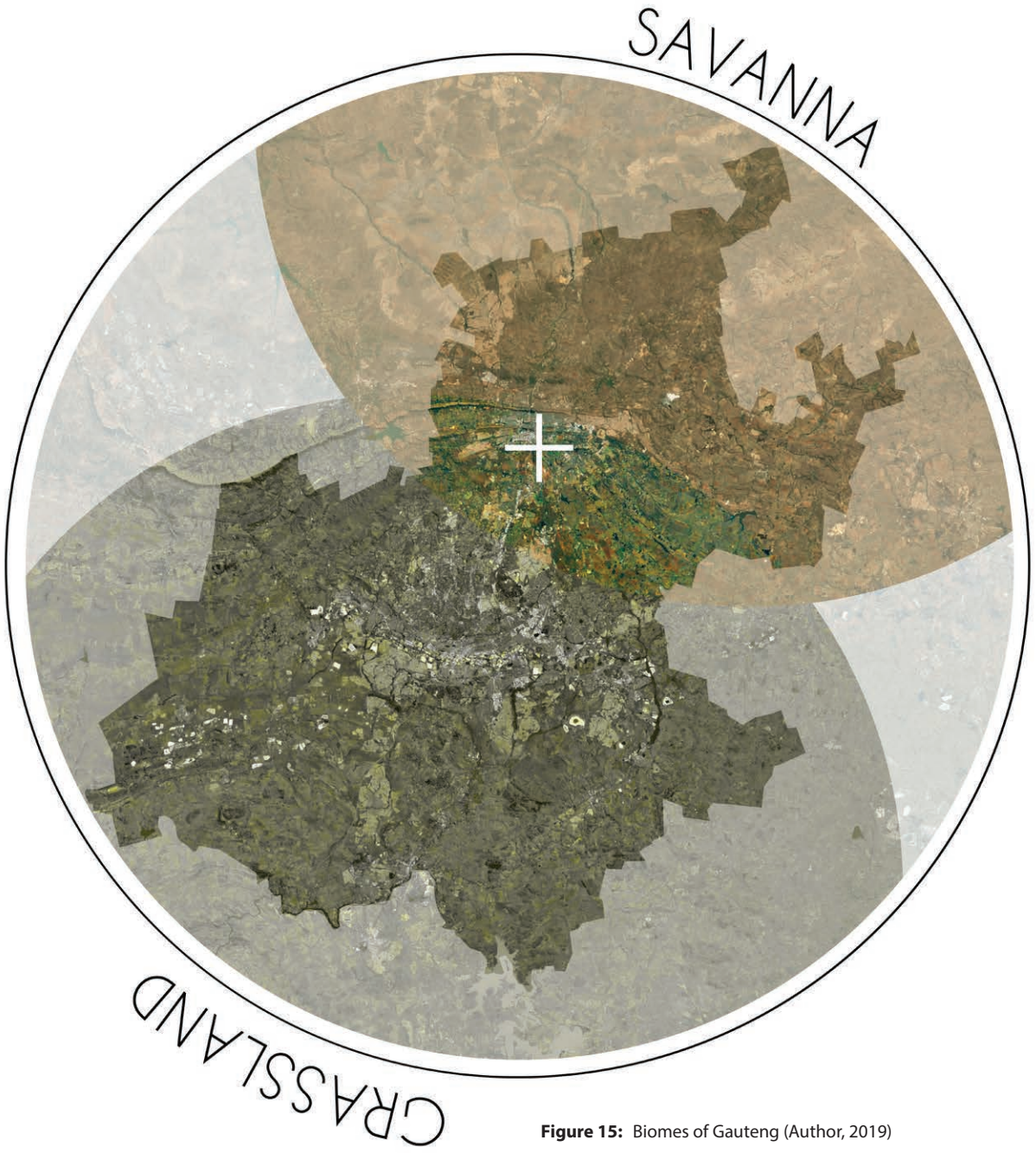


Figure 15: Biomes of Gauteng (Author, 2019)

Biomes of Gauteng

Gauteng falls between two major biomes within Southern Africa (refer to Figure 15), namely the Grassland biome to the south and the Savanna biome to the north. Tshwane and the ridges surrounding it forms the divide between these two biomes. Naturally we see evidence of these two biomes overlapping within the area with fauna and flora species coinciding in harmony(Environment.gov.za, 2016) .

The Grassland biome supports a variety of plant and animal life due to the different climate conditions that occur on different altitudes. This biome is currently under threat due to the large scale of urbanization and agricultural land changes(Environment.gov.za, 2016). Certain species that are exclusively restricted to this biome are therefor also threatened, such as these flagship species:

- Star flower
- Giant bullfrog
- Blue Crane
- Redwing Francolin
- Black Wildebeest

The Savanna biome is one of the biggest biomes in South Africa, occupying one third of the total area. Due to most of this biome being contained within protected game reserves such as the Kruger National Park and Kalahari, most of it is untouched. A variety of major geological soil types occur in the Savanna biome which in turn supports a multitude of fauna and flora(M, 2019). Flagship species include:

- Ground Hornbill
- Cape Vulture
- Wild Dog
- White Rhino
- 532 bird species
- 167 mammal species
- 161 reptile species
- 5700 plant species

Pretoria

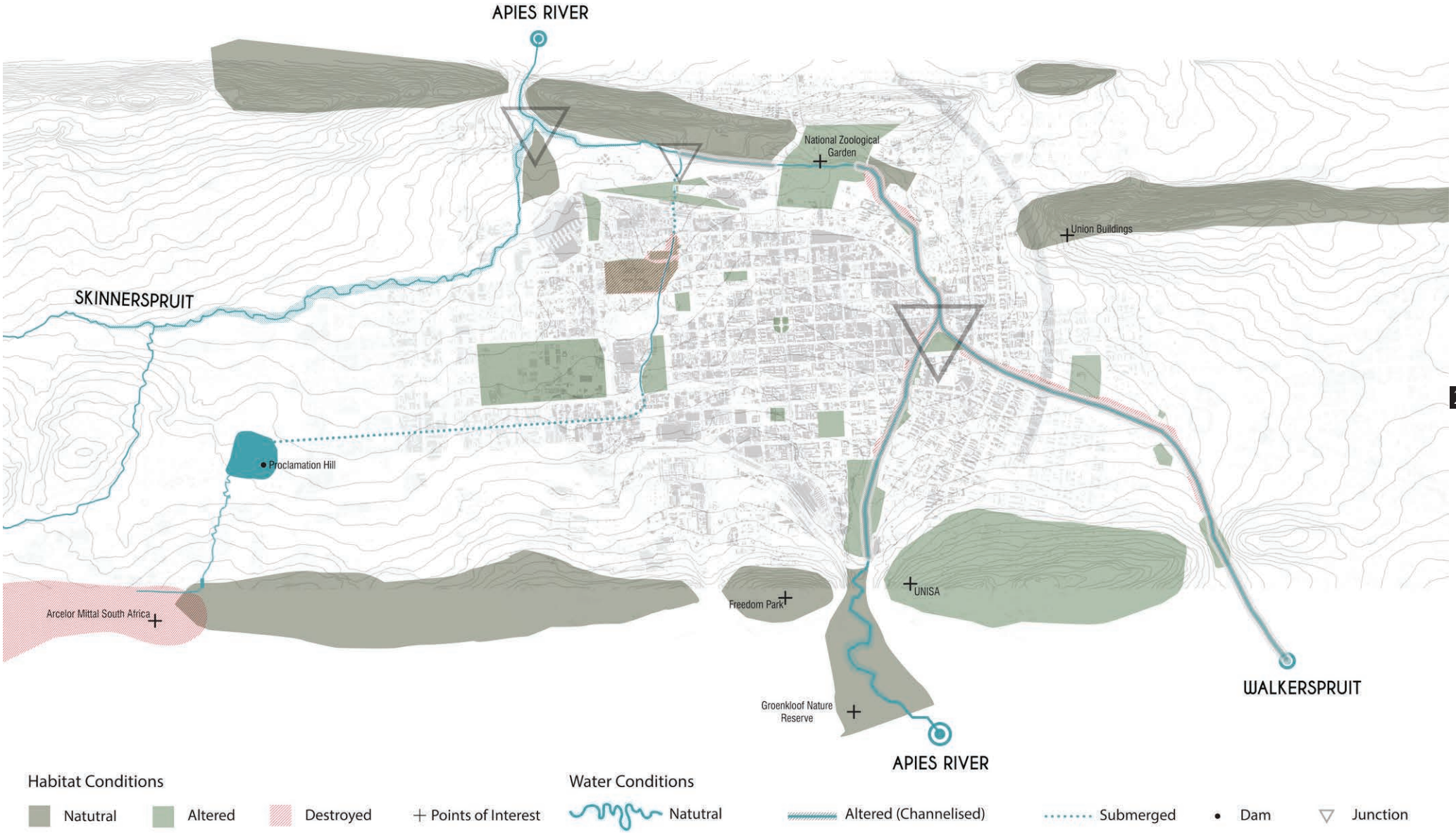


Figure 16: Pretoria current natural condition (Author, 2019)

DEVELOPMENT

Pretoria's name developed over an era of turmoil where the victor claimed and renamed the ground won. The name Pretoria ultimately came from Marthinus Wessels Pretorius who named the land he bought from the Bronkhorst Brothers - Pretoria, after his father (Andries Pretorius) who led a trek from Ohrigstad. Tswana migrants also called the river Tshwane after a prominent chief of the time in the 1800's (Andrews, 1994). This is where the name City of Tshwane can be traced to.

A few tribes were known to settle next to the Apies river. Mzilikazi, a General from the Matabele tribe, fled with 200 followers from King Shaka's army and settled approximately south-east of what we now know to be Meintjies kop. The women who fetched water from the Apies river called it Ezwabuhlungu, meaning - something that hurts - due to the sharp dolomite rocks (Andrews, 1994).

Pretoria's distinct grid can be attributed to the two main river systems, namely the Apies river and Walkerspruit.
As Pretoria grew over time the grid adapted to the rivers that can be seen most clearly in the Trevenna triangle (refer to Figure 17).

One element that constantly arises within the description of Pretoria and its establishment over the years is the Apies river (refer to Figure 18). This Feature within the landscape has great cultural heritage and is of significant value to all who called and still call the area of Pretoria home.

The following will define the importance of the Apies river and the location of the study site and the relation between the two.

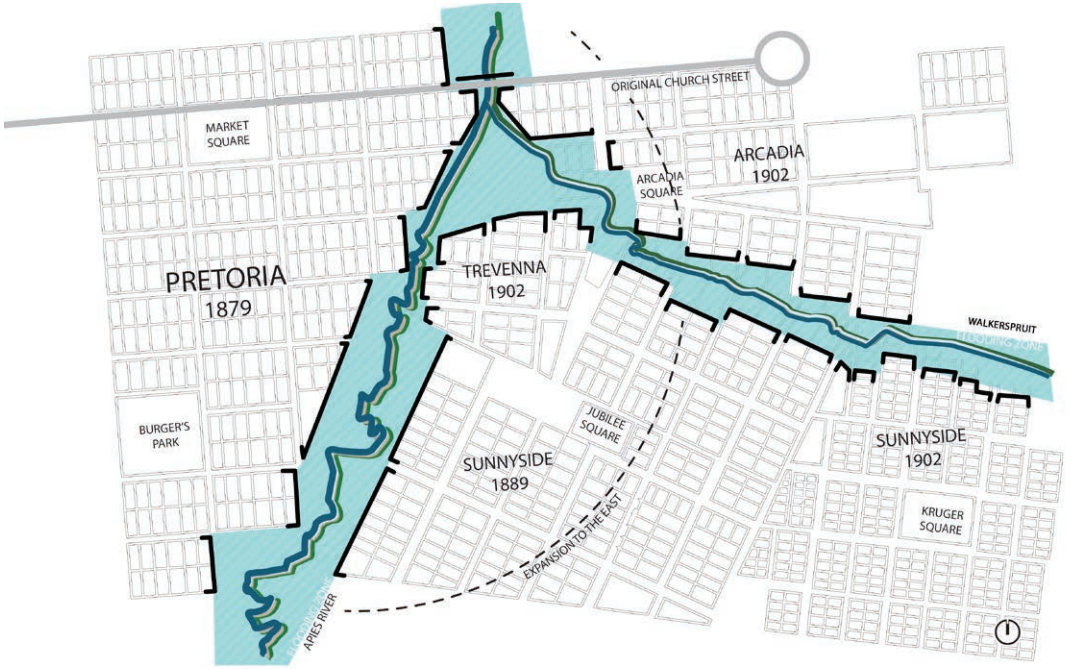


Figure 17: Expansion city surrounding the river (Author, 2019)

Figure 18: Apies river recreational activities - 1908 (www.theheritageportal.co.za)

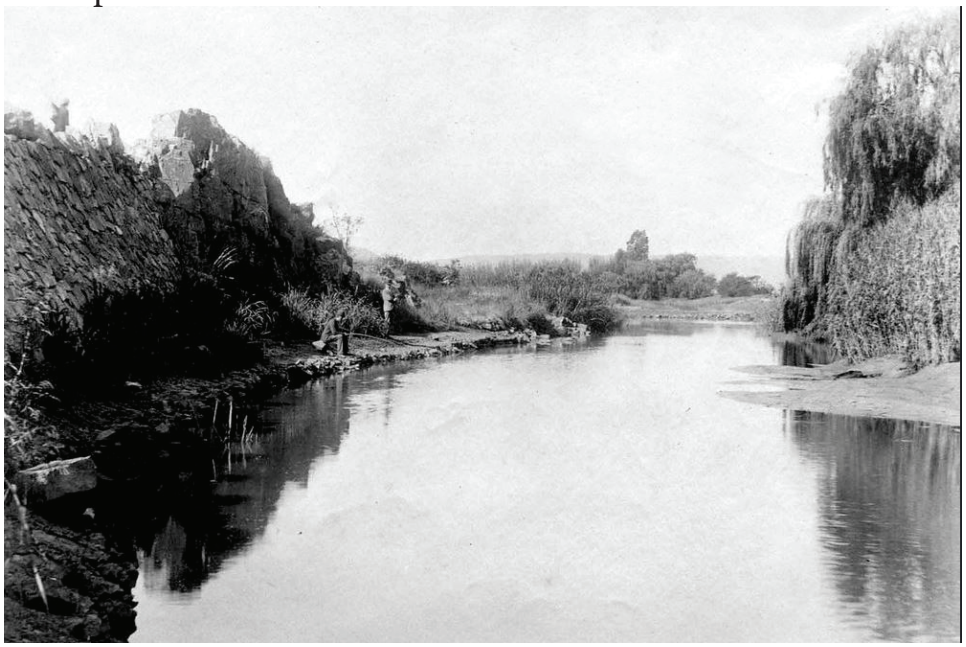


Figure 19: Unaltered portion of the Apies river - 1905 (www.theheritageportal.co.za)

THEN

Up until 1909 the river flowed in its natural state (refer to Figure 19) with little modifications to supply the growing population of Pretoria with fresh drinking water. Towards the end of the Era modifications started taking place altering the rivers natural state.

Three flooding events were recorded in 54 years since the first colonial settlers (Otto, du Plessis, and Vosloo, 2016).

Figure 20: Current state of the Apies river (Author, 2019)

NOW

Due to disease outbreaks and the misuse of water, intensified canalization occurred. There was an increase in the building of dams and bridges which led to the disconnect of the Apies river to the remaining natural environment (refer to Figure 20).

Seventeen flooding events were recorded in 100 years. This is a good indicator of the extent of change brought on by mankind (Otto, du Plessis, and Vosloo, 2016).

LANDSCAPE CONNECTIVITY

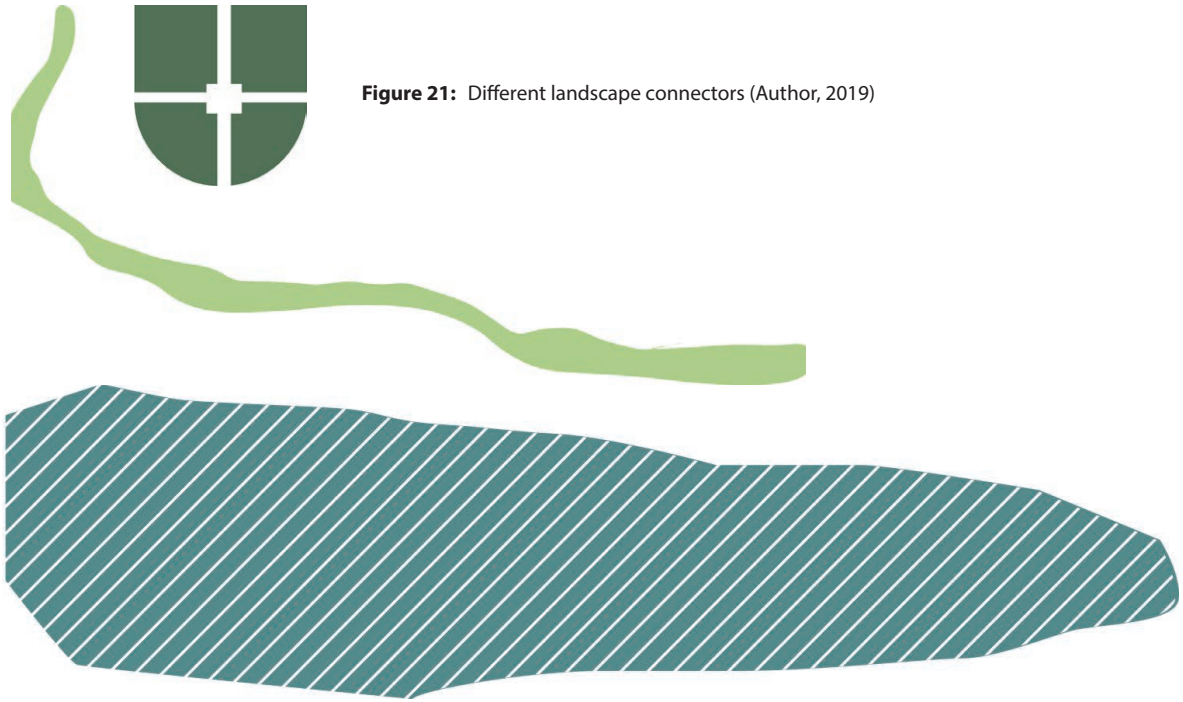


Figure 21: Different landscape connectors (Author, 2019)

Stepping stones are smaller natural areas that act like discontinuous pathways between larger patches (Crain, 2015).

Corridors, like stepping stones, connect large patches (habitats) and provide the necessary cover and protection (Crain, 2015).

A patch is a significant natural area that is able to support particular species (Crain, 2015).

Landscape connectivity is a critical concept within ecology. The concept defines the necessity for movement, a factor that all species rely on to migrate between habitats, to hunt, to forage, and to reproduce. Landscape connectivity within nature is self-evident and it's only when humans are introduced that we have to think how our interventions influence the connectivity of animals and their habitats. Fragmentation occurs when species can't move freely between habitats. Ecologist have defined terms that are essential for connectivity within the landscape and should aid the way we plan and execute our interventions. A patch is a significant natural area that is able to support particular species and can vary depending on the species. Examples of these are usually habitats. Stepping stones are smaller natural areas that act like discontinuous pathways between larger patches. They provide cover and protection for animals moving between patches. Examples are usually natural gardens and small collections of shrubbery close to corridors. Corridors, like stepping stones, connect large patches (habitats) and provide the necessary cover and protection. Examples of corridors are usually rivers, wetlands continuous shrub and tree zones. In combination these concepts have the ability to make a substantial contribution to the urban environment, connecting landscape and providing a thoroughfare (Crain, 2015).

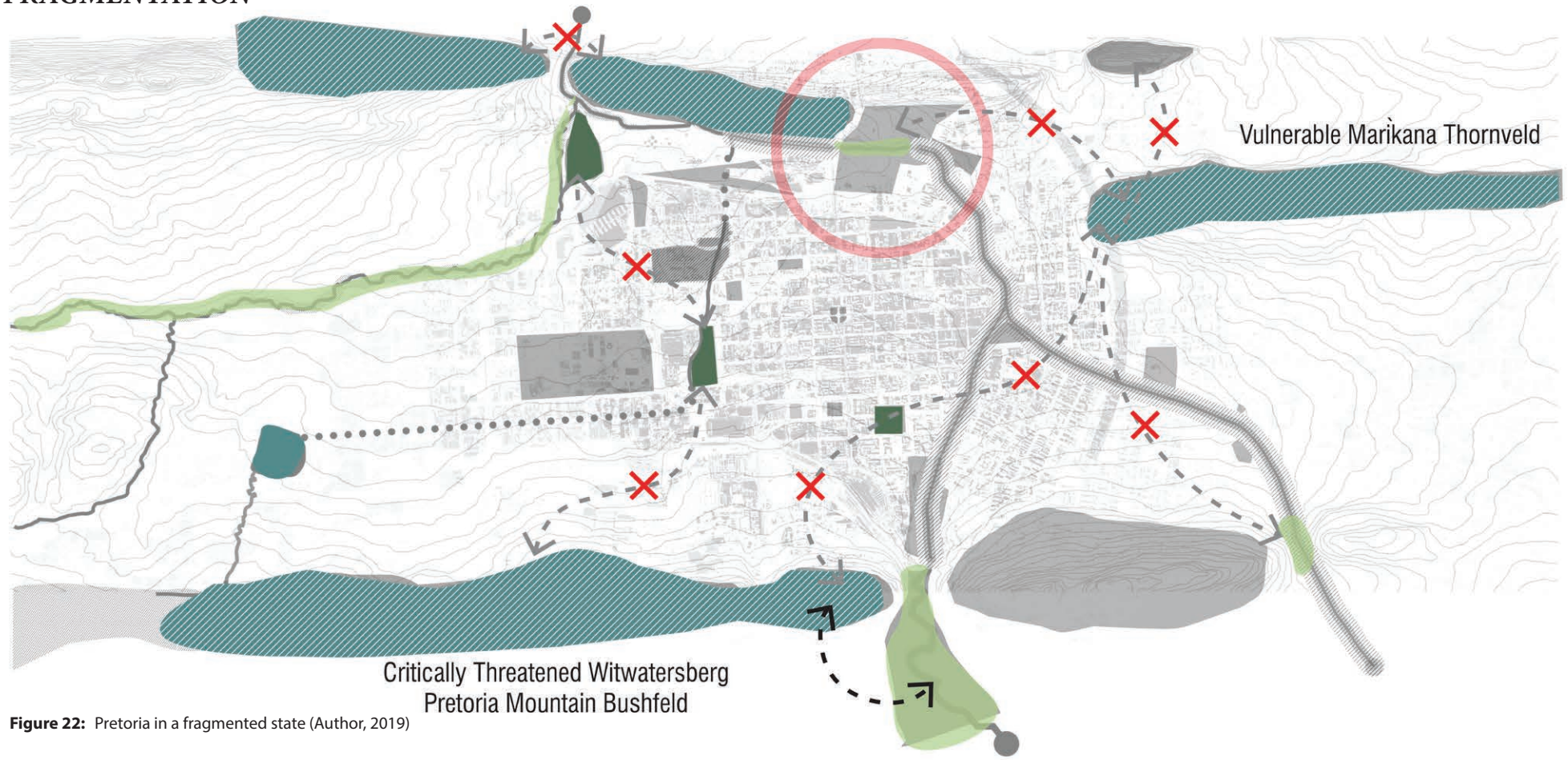


Figure 22: Pretoria in a fragmented state (Author, 2019)

Social and ecological systems should be viewed in relation to each other to benefit human settlements (Walker & Salt, 2006). This understanding that a social system is an integral part within an ecological system is a factor that usually gets lost with the ideals of development and progression. Early settlers seemed to understand this relationship but as time progressed this connection was lost with the Apies river. For an ecosystem to provide healthy goods and services to the surrounding wetlands, river channels, reservoirs, biodiversity and interconnected ecosystems should be maintained and intact with each other. This is not the case with Pretoria and the disconnect has left the ecosystem vulnerable between the two veld types of the Central Bushveld Bioregion seen in (refer to Figure 23) For the purposes of this dissertation a site has been identified within the National Zoological Gardens of Pretoria to propose ways to reconnect the fragmented habitat surrounding the site and the Apies river.

URBAN VISION

For the City of Tshwane

The following is a culmination of frameworks proposed Chironne Moller's thesis - LAB_00 a layered confluence and ideas from the Habitat Network.

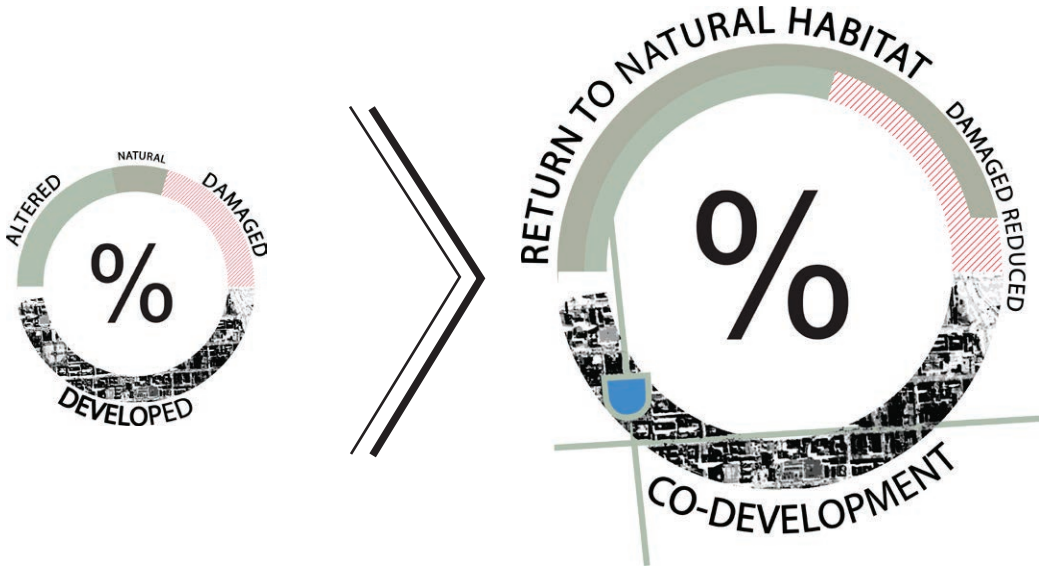


Figure 23: Potential wetlands throughout city (Adapted, 2019)

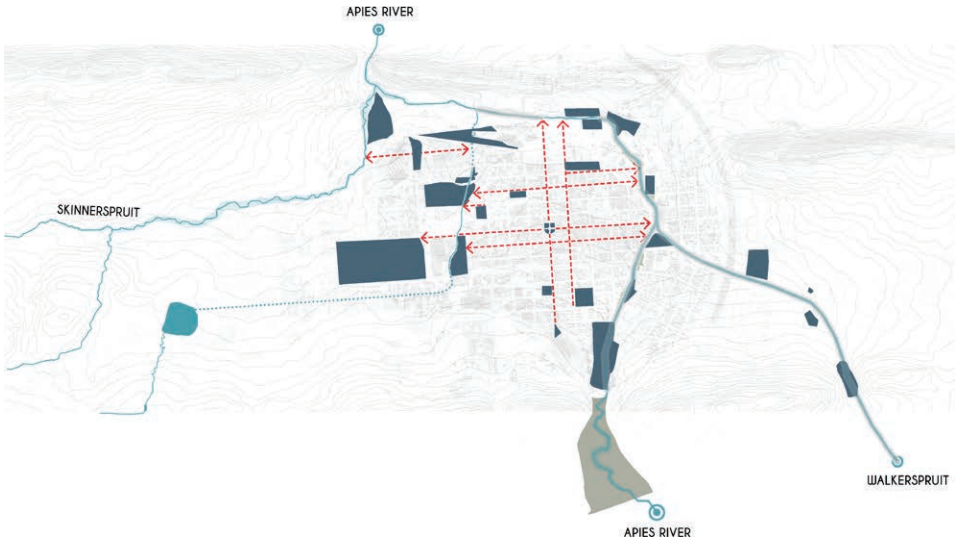
Figure 24: Potential wetlands throughout city (Adapted, 2019)

1) REINTRODUCE

By reintroducing natural habitat to altered green spaces and transform or damaged land would allow natural processes to retain and filter ground water naturally. This in turn would reconnect fragmented habitats and relieve pressure from our threatened wetlands. Wetlands occur in multiple forms depending on the amount of water available, climate, soil conditions and topography. Wetlands throughout the city could help filter out harmful toxins that come from street runoff and pollute our river systems. The filtration process would be made visible to the public as an environmental theme and the water would then be reintroduced into the river. This would change the dynamic of the river to an integrated part of the cityscape (Moller, 2014).

2) STORM WATER RUN OFF

Figure 25: Increased filtration (Adapted, 2019)



3) FILTRATION AND OUTLET INTO WATER CHANNELS

Figure 26: Slow release (Adapted, 2019)

4) URBAN FOLLIES

Figure 27: Visual celebration (Adapted, 2019)

Water follies placed at each of the natural systems would make an otherwise invisible process visible. Creating awareness of habitats and the important cleansing role they have within nature would be the main goal. The follies would act as monuments to the life-giving qualities of water and to the source that brought people to Pretoria in the first place (Moller, 2014).

The key conclusions that the Crain (2015) draws upon is that no green space sits in isolation and is dependent on something as minute as a planter to contribute to the urban fabric by decreasing habitat fragmentation.

Considering how we think about green spaces, they could be divided into two categories; immediate - directly related to site itself- and distant - the greater landscape of the town or habitat. To the right the illustration(refer to Figure 28) shows different combinations of how these principles can work together to form a coherent habitat showcasing how the distant green space is formed of multiple immediate green spaces. The culmination of well thought out space allows for people and nature to live in unison.

Below the figures shows how the addition of vegetation in designated places can complete the landscape allowing movement.

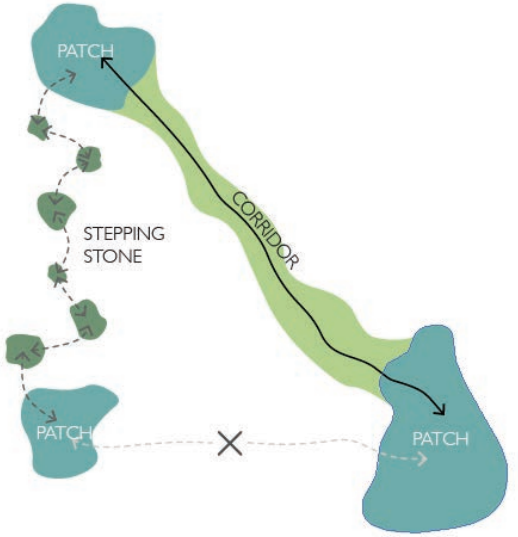


Figure 28: Landscape connection variety (content.yardmap.org)

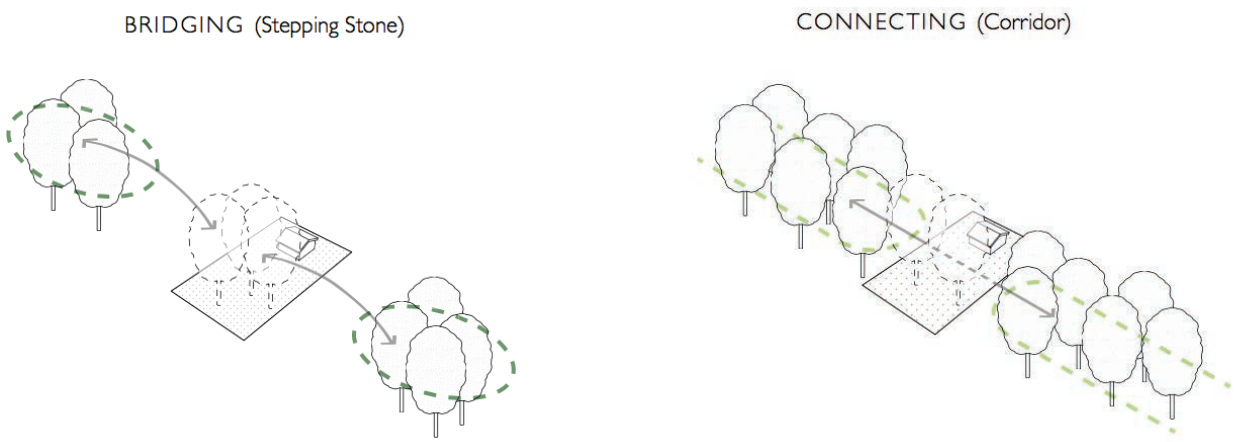
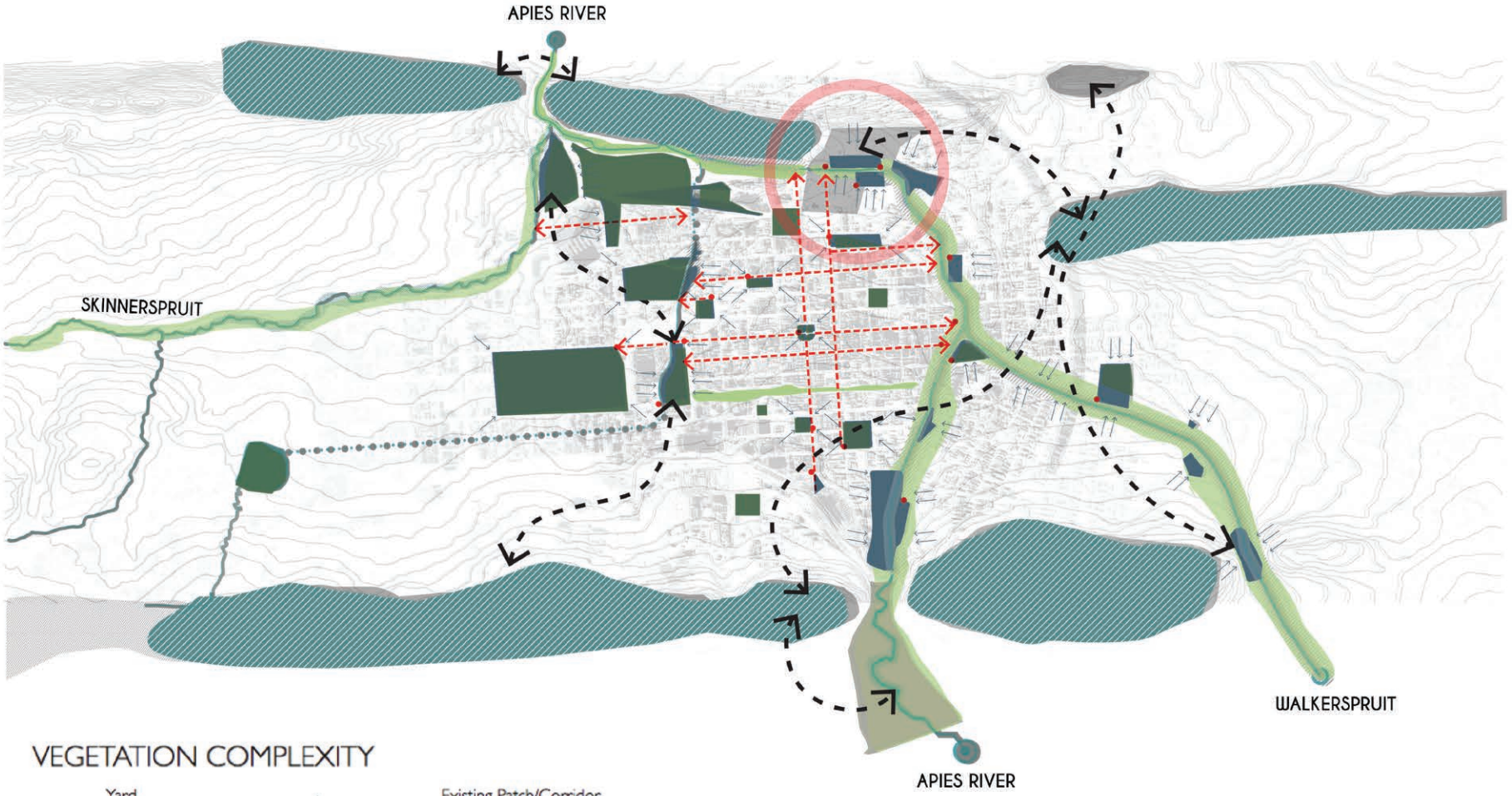


Figure 29: Landscape connectivity principle (content.yardmap.org)



URBAN COMPLEXITY **Figure 30:** Urban connection through framework (Author, 2019)

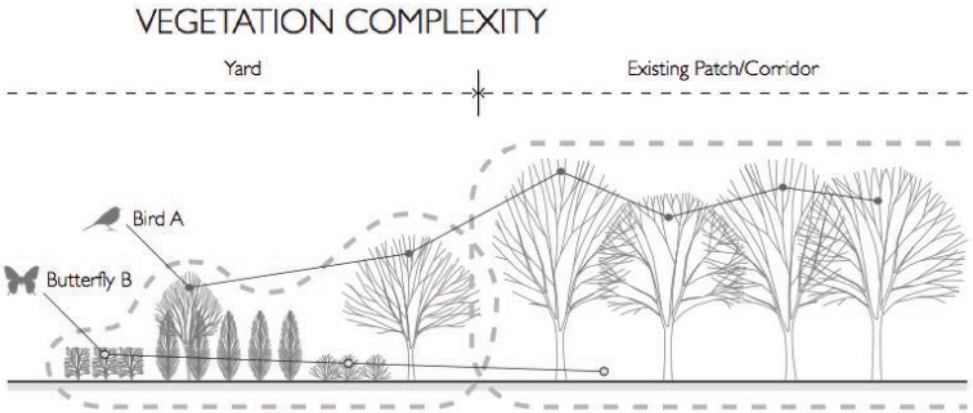


Figure 31: Landscape connection variety (content.yardmap.org)

Applying these concepts to the urban environment allows for complex relationships aided by free movement. Movement is at the top of all species' list and reaching point B safely and quickly with the cover of vegetation would increase predator and prey numbers. A sanctuary should spread beyond fences and should be for all to enjoy. The location for such an intervention would ideally start in a place that promotes habitat. The zoo has the best potential to promote change.

URBAN CONTEXT

The NZG lies on the periphery of Pretoria's CBD towards the north. Originally the site didn't cross the Apies river, but over time as the zoo expanded, it intruded onto the sensitive ridge face that comprises of a mixture of the major Grassland and Savanna biome, better known as the Marikana Thornfield (refer to Figure 30). These Biomes, as stated earlier, are sensitive and threaten parts of our ecosystem that houses a plethora of fauna and flora, each unique and important to the diversity of life (Bredenkamp et al., 2006).

The Apies river, which was the life and soul of Pretoria, in the beginning, seems to be forgotten as the city turned its back onto the river. A major contributor to this event was rapid urbanization as well as pollution, which caused disease outbreaks between 1855-1909. Recent reports declared the Apies river a natural disaster zone due to its toxicity levels that are dangerously high, yet channelization further intensifies this effect as runoff storm water is only seen as a problem that could lead to flooding, instead of filtering it through a series of wetlands that contribute to the larger ecosystem. (Otto, du Plessis and Vosloo, 2016)

The first zoos were conceived as a symbol of power amongst the wealthy. Animal welfare was of little concern as it was thought that animals were only placed on Earth for our entertainment, as in the case of the Roman Empire's Colosseum and its bloodletting (see Fig. 1.2), thus regarding them as soulless and without feeling. It was only within the last two centuries that the Zoo model came to change as we know it today. The zoological garden typology has been challenged to change since the 1970's, arguing that our knowledge of the animals and their welfare out date the current enclosures that try to mimic their natural environment.

Figure 32: National Zoological Gardens (Author, 2019)

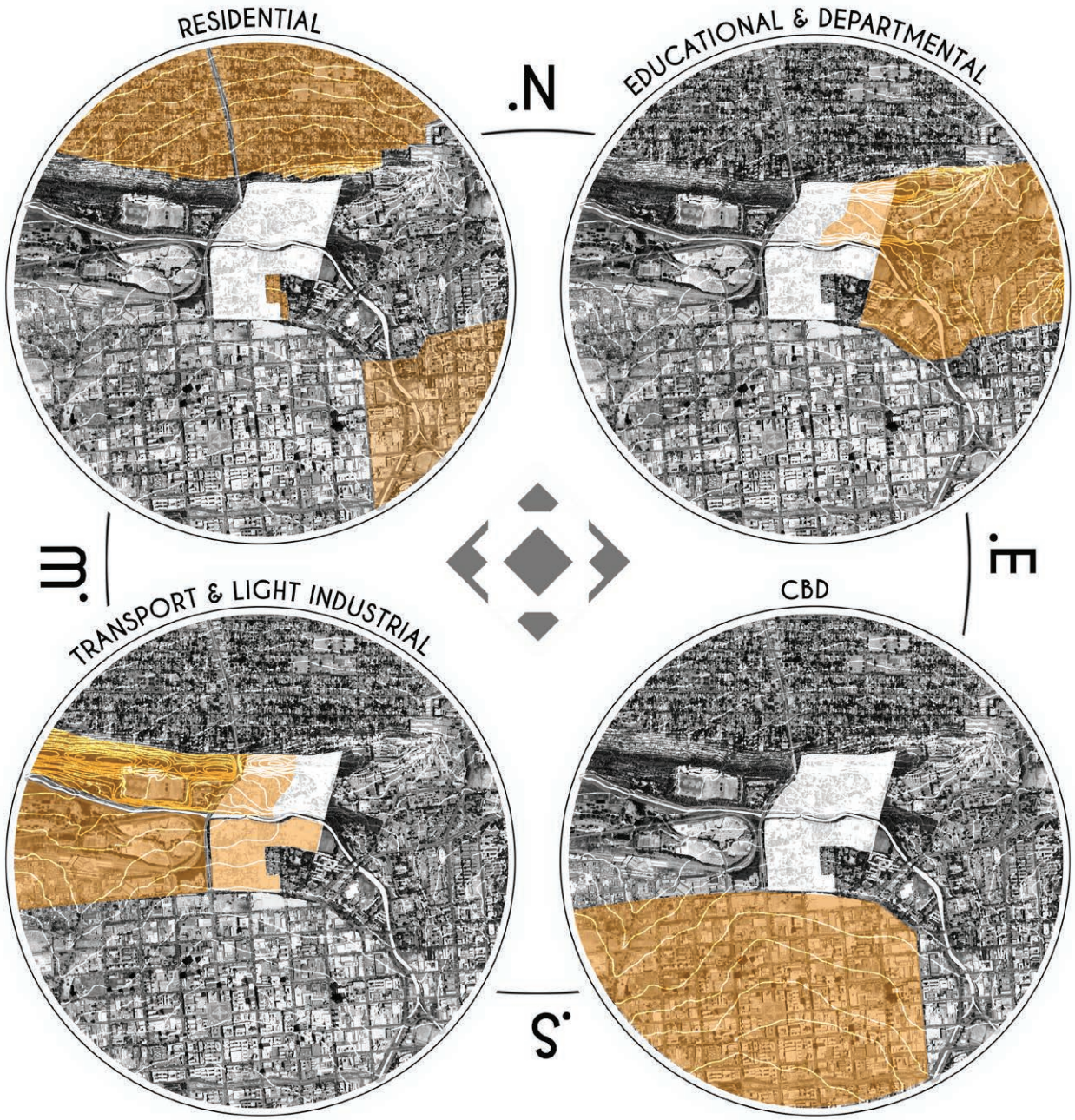


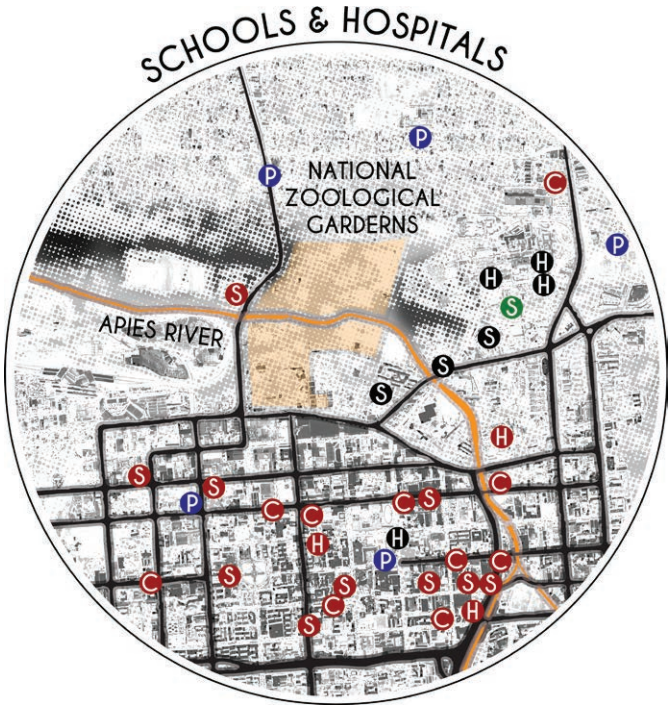
Figure 33: Context study surrounding the NZG (Author, 2019)

The zoo of Pretoria was founded by J. W. B. Gunning on state owned land bought from Johannes Francois Celliers in 1895. The newly obtained land was originally renamed by Mr. Celliers to Rus in Urbe (Versluis, 2015), meaning an illusion of countryside created by a building or garden within a city (Melvin, 2018).

Though this illusion of countryside seems appealing, the zoo seems to advocate for other countrysides found outside of our environment. By mimicking the standard model of zoos as animal collectors, the majority of zoos tend to follow a similar pattern that holds no identity of place.

The zoo is ideally situated between a number of informants and statistics have shown it to be one of the top five Cities in South Africa (South African Cities Network, 2016). According to Final Cut For Real's (2012) film 80% of people will be living in cities by 2050. This fuels the need for proper public spaces that could bring people in touch with nature more than ever before.

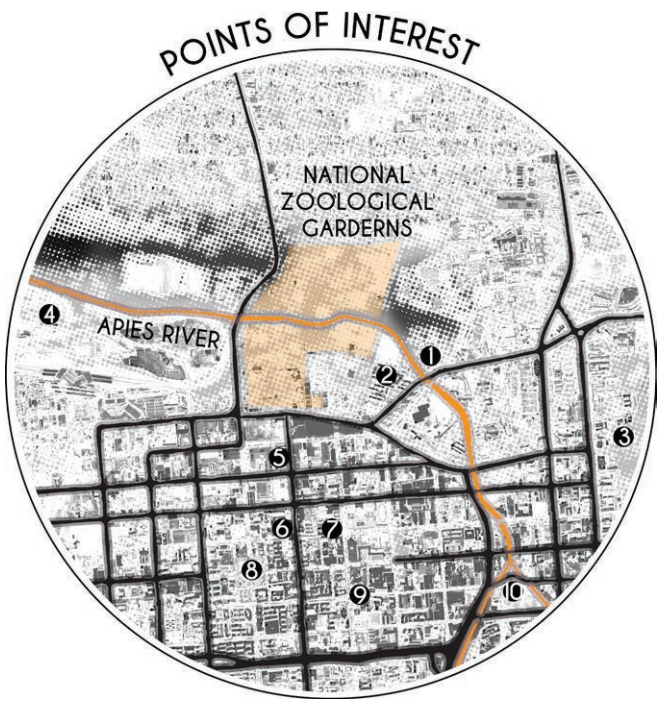
Toward the North and South Eastern direction lie the residential communities of Capital Park and Arcadia respectively. Capital Park residence make frequent use of the Paul Kruger Street to the left of the site to access the CBD that is situated to the south. To the East we find mostly medical facilities and specialist schools for disabled or impaired people. To the West is the light industry side of Pretoria as well as the sensitive ridge that the zoo encroaches onto (refer to Figure 33).



Education

Figure 34: Distribution (Author, 2019)

Pretoria zoo is surrounded by a number of educational and medical institutions, all of whom can benefit from the potential the zoo has as an educator to the masses. A zoo's potential lies in the fact that it can shape public opinion, encourage sympathetic attitudes toward wildlife, as well as help educate people about evolution, ecology and the wild insects and animals that occupy it. As people seem to be more separated from nature they lose their awareness of the importance of sharing the planet. Zoos could be the link between people and their immediate context, potentially instilling a deeper love for their environment and the need to protect it.



Interest

Figure 35: Landmarks (Author, 2019)

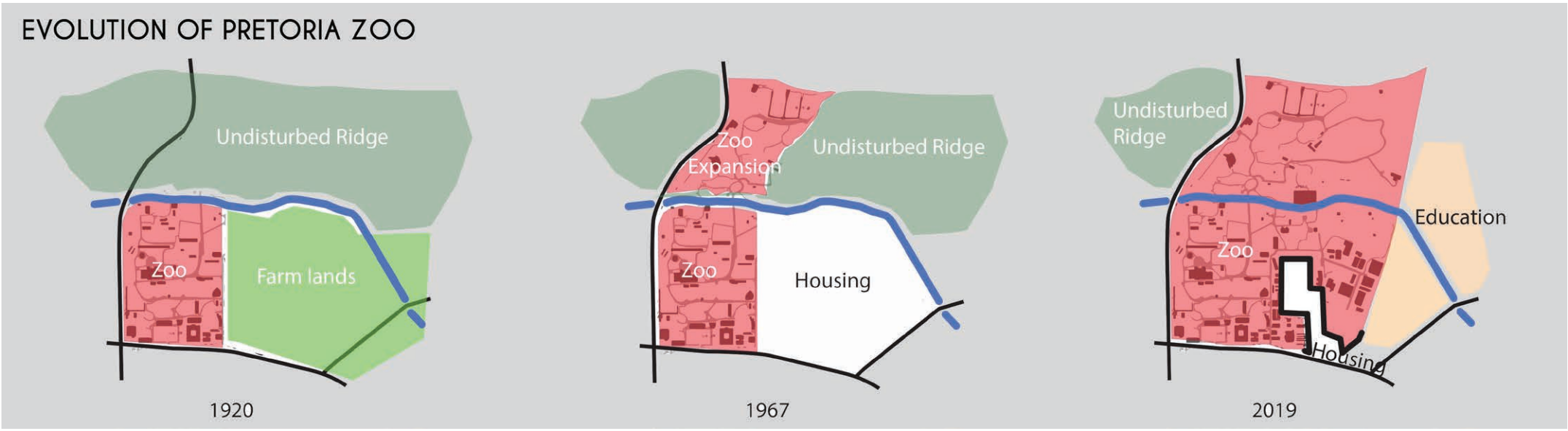
Since Pretoria's establishment in 1855 it has developed a considerable amount and was shaped by the unique typography. Scattered through Pretoria there are multiple identified buildings and areas that could be of benefit to the zoo and vice versa offer an escape to the constant pressure of the city as an illusion of the country side. The following are just a few examples of potential buildings that would benefit from the zoo as a contextually based entity.

1. Pretoria School for Cerebral Palsied Learner
2. Pretoria School for Partially Sighted and Blind
3. Union Buildings

Conservation

Figure 36: Landscape (Author, 2019)

Currently the Apies river is underutilized, the richness of its history as well as it being an organizing factor. It has been forgotten after the channelization. This once mighty river now only serves as an engineered channel that takes the unwanted waste of mankind out of the city instead of serving as a recreational source of relieve. Moreover, the river and zoo have the capacity to help us refocus our views of wild animals and wild places. They can encourage a new understanding of nature, a harmonious bond to that what led us to where we are now. Preserving and conserving our scarce water source should be of main concern,as it is the life line to many people further away from the CBD.



Expansion

Figure 37: Zoo growth (Author, 2019)

Obtaining national status in 1916 the zoo, in quality, competed with other institutions from around the world. Due to limited funding the zoo reached maximum capacity by 1920 and served as a stopover for animals traveling from Africa to the rest of the world.

From 1927 onward the zoo expanded north form the Apies river as Rudolph Bigalke managed to proclaim additional funding for the zoo. The zoo was centered around an amusement park theme where animals performed tricks to the public.

Maps of the zoo indicate that the final expansion occurred after 1967 under Dr Frank Brand who believed the zoo should resemble animals'c natural environment and abolished the amusement park concept of the park.

SITE
Aviary

The aviary, situated within the zoo along the Apies river (refer to Figure 38), was constructed in 2001 with the intention to house exotic and African bird species without any specific reference towards habitat. The aviary is considered to be the biggest in Africa and was said to be 40% exotic and 60% indigenous, to allow exotic birds to adapt better to the surroundings. After the renovation the exotic vegetation was removed and replaced with indigenous plants. The irony of this is that the environment fails to restore or resemble any habitat at all - instead it only simulates a generalist environment that doesn't consider its location. Species that are considered to be on the Red and Orange list by the zoo, especially found within the region, are kept from the ground outside their cage confines that is supposed to provide sanctuary. Instead zoos should strive to display and teach about habitats and their intricacies, providing sanctuary to surrounding species and educating people of their immediate nature.

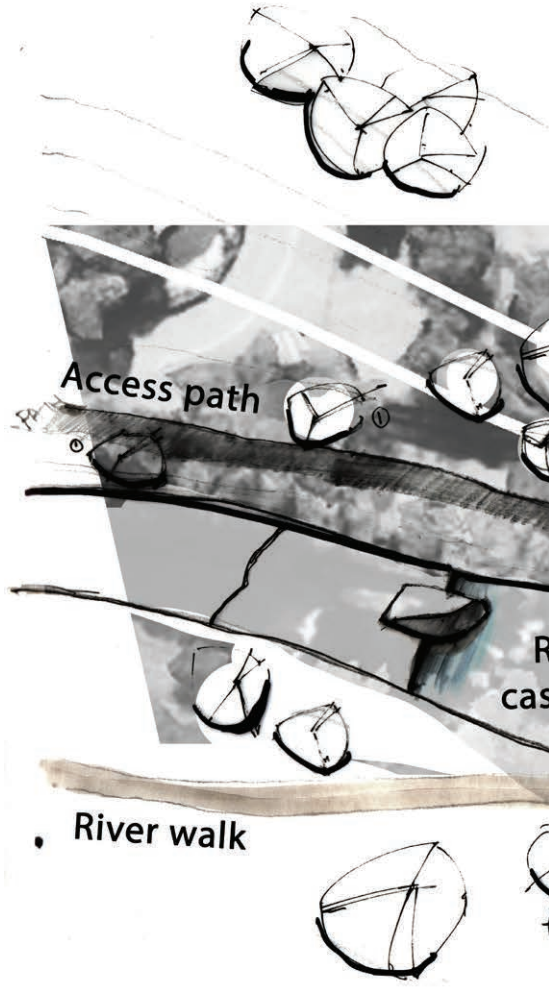
The Zoo and Aviary specifically are metaphors for our attitude towards nature - Caged. Gates lead visitors from the outside – free – world into an "artificial" world designed for people and not the natural systems within it. Nature immersion as a tool could aid the refocusing of the imperial relationship between man and nature creating opportunities for the viewer to experience something more meaningful than just the static viewing of animals on display(Hancocks, 2001).

As the loss of biodiversity is the biggest threat that we as humans face it seems that we are oblivious to the fact that we share this planet. Restoring this balance would reveal the splendor of wild things in wild places, emphasizing respect for nature and potentially conveying a message that we need to care, love and protect its biodiversity.

In the 1980's it became clear to scientists that saving endangered species was nearly impossible without looking at the integral components and relationships of plant and animals' species. It usually is not the species that need attention, but the preservation of whole and viable habitats of biological diversity (Hanski, 2011).

David Hancocks (2001) argues that zoos should not restrict their conservation efforts to the flamboyant species but help people see the importance of saving wild habitats. In this way people save not only the homes of the impressive mammal and bird species, but the home of organisms that make the planet habitable for humans, that produce oxygen, that help spread seeds and pollinate trees and plants, that fix nitrogen and fight off pests and diseases.

Isaiah Berlin, a philosopher and champion of cultural pluralism, thinks that by instilling a universal love for nature, we as humans could potentially eradicate our petty problems towards each other as we realize that this is the only planet we have (Hancocks, 2001).



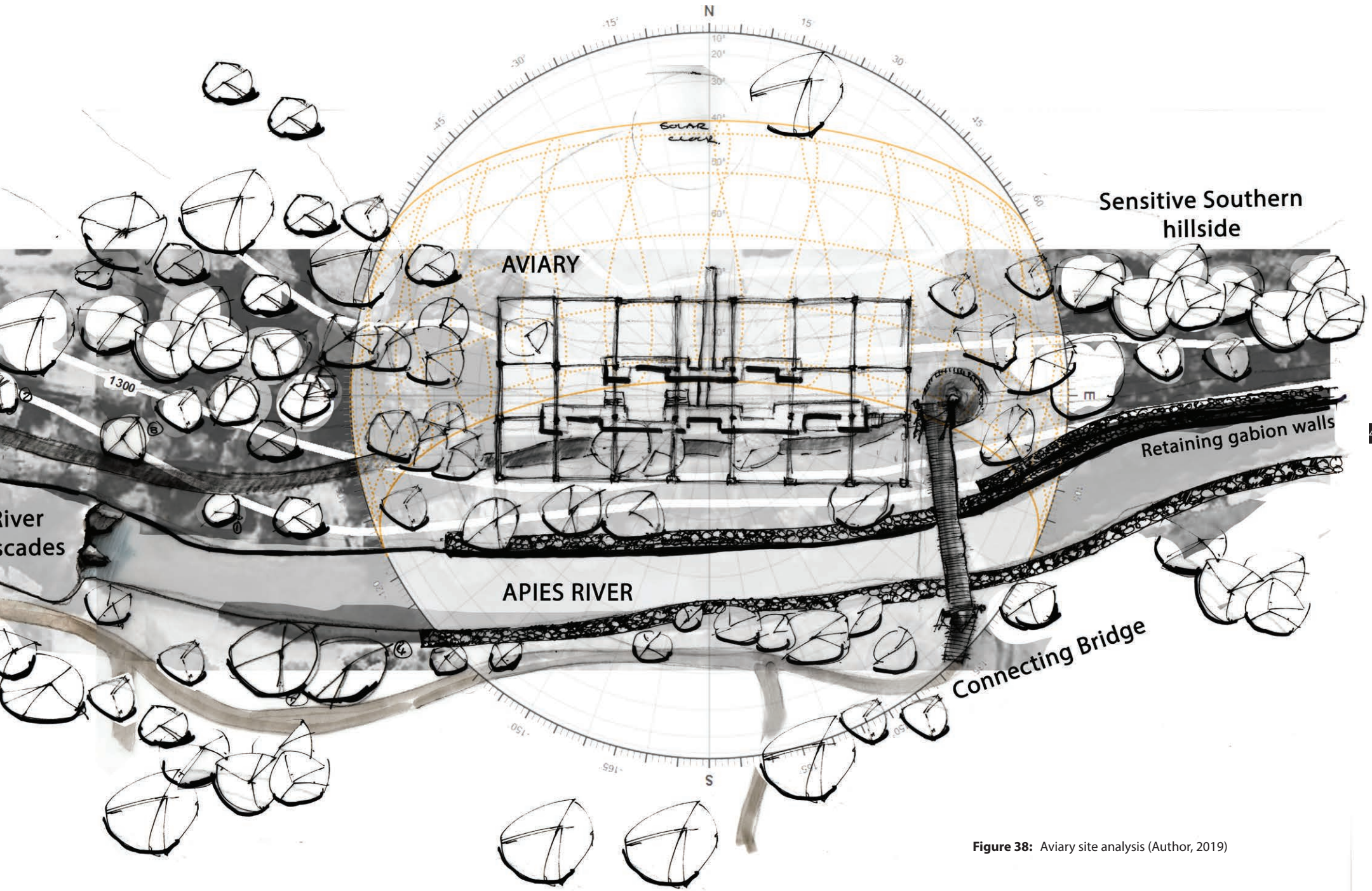


Figure 38: Aviary site analysis (Author, 2019)

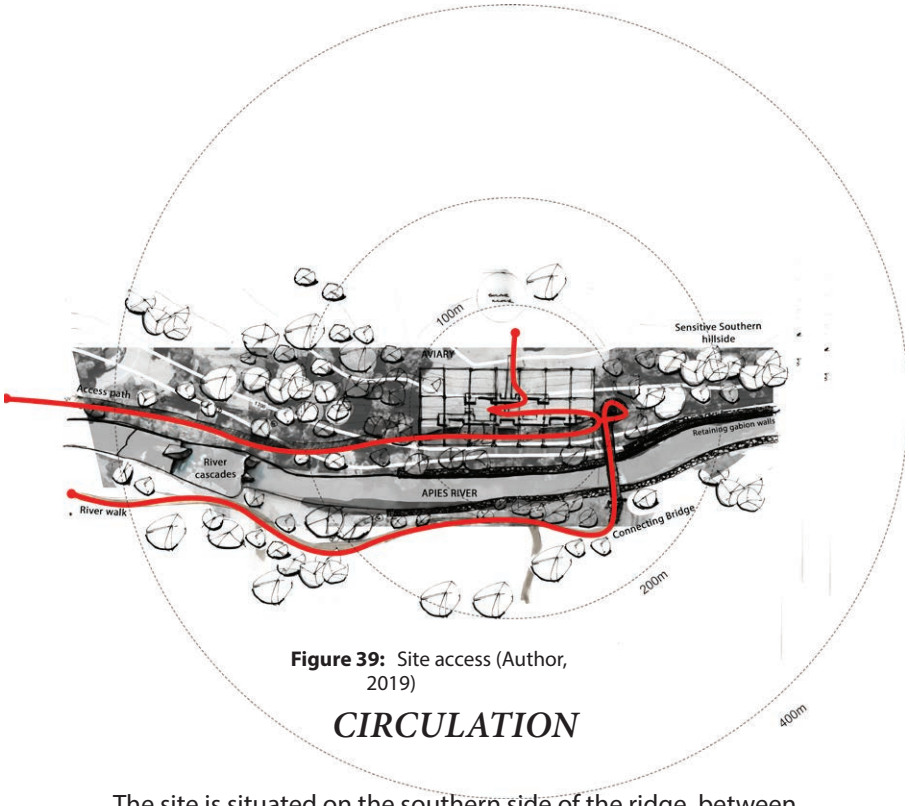


Figure 39: Site access (Author, 2019)

CIRCULATION

The site is situated on the southern side of the ridge between a wooded area on the banks of the Apies river. The circulation is from West to East and is roughly 200m off of the main walkway called the zoo loop.

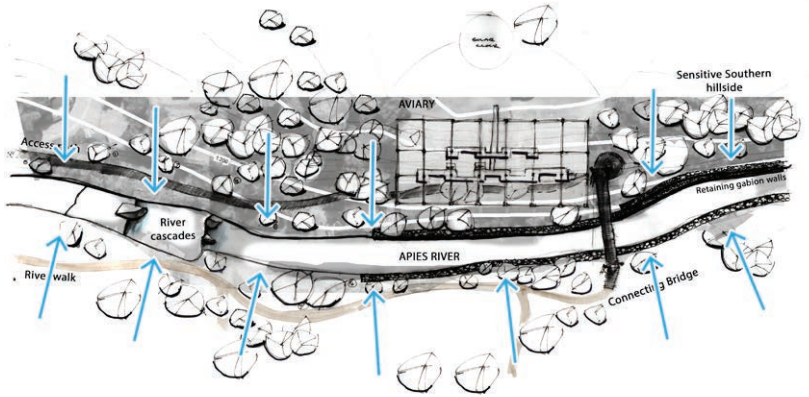


Figure 40: Site Slope (Author, 2019)

SLOPE AND DRAINAGE

Both sides of the site slope to the Apies river and provide opportunity for rainwater harvesting on the site itself.

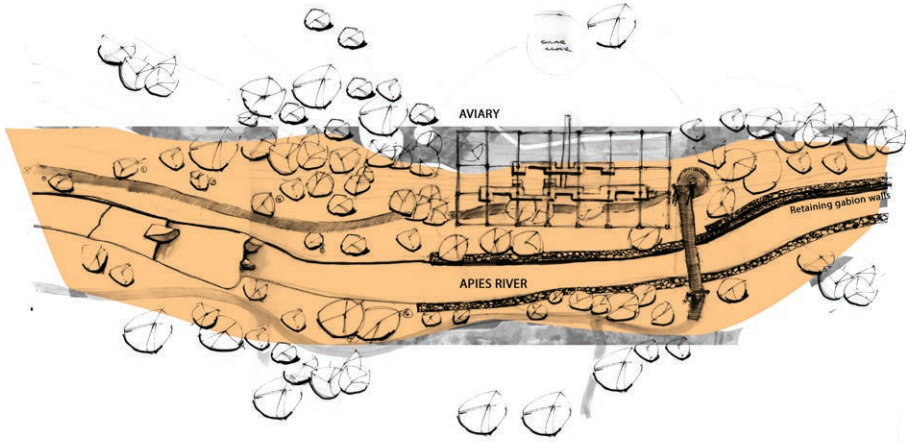


Figure 41: Contour manipulation (Author, 2019)

DISTURBED LAND

Looking at the sensitive southern side of the ridge it is clear that the site has been altered to accommodate the existing aviary and the path leading to it.

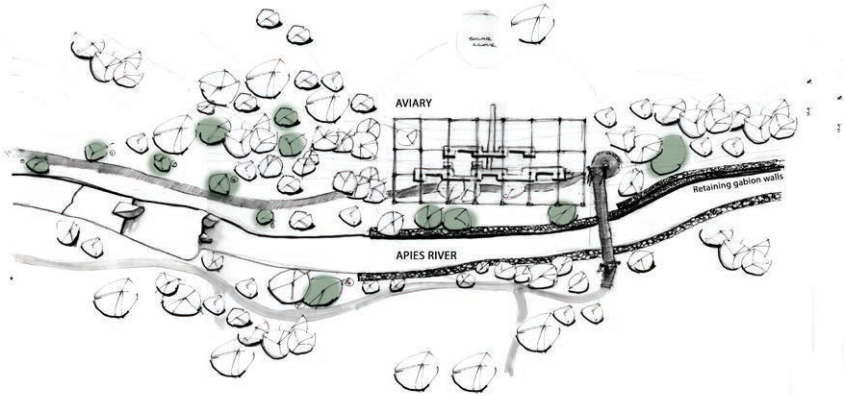


Figure 42: Minimal natural vegetation(Author, 2019)

IDENTIFIED VEGETATION

The vegetation adjacent to the pedestrian path has been severely altered and only a few indigenous trees where identified refer to page 42.

TALL TREES

- Acacia burkei
- Combretum erythrophyllum*
- Searsia chirindensis*
- Vachellia xanthophloea

SMALL TREES

- Acacia caffra
- Acacia gerrardii
- Acacia karroo*
- Acacia nilotica
- A tortilis subsp. heteracantha
- Celtis africana*
- Combretum molle
- Dombeya rotundifolia
- Pappea capensis
- Peltophorum africanum
- Rhus lancea
- Terminalia sericea
- Ziziphus mucronata

TALL SHRUBS

- Euclea crispa subsp. crispa
- Olea europaea subsp. africana
- Rhus pyroides var. pyroides
- Diospyros lyeioides subsp. guerkei
- Ehretia rigida subsp. rigida, Euclea undulata
- Grewia flava*
- Pavetta gardeniifolia

VELD TYPE - Marikana Thornveld

An open Acacia karoo woodland, occurring in valleys and slightly undulating plains, and some lowland hills. Shrubs are more dense along drainage lines, on termitaria and rocky outcrops or in other places protected from fire. Considerably impacted, with 48% transformed, mainly cultivated and urban or built up areas. Near Pretoria, industrial development is a greater threat of land transformation. Alien invasive plants occur localised in high densities, especially along the drainage lines. (Environomics, 2009)

LOW SHRUBS

- Asparagus cooperi
- Rhynchosia nitens
- Indigofera zeyheri
- Justicia flava

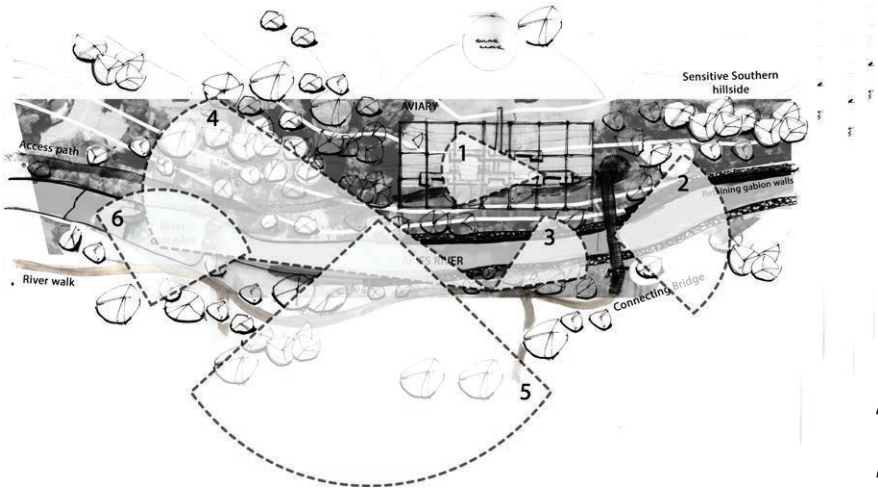
TALL GRASS

- Setaria sphacelata var. sphacelata golden
- Setaria sphacelata var. sphacelata purple*

SHORT GRASS

- Heteropogon contortus
- Melinis nerviglumis white
- Melinis nerviglumis pink
- Thermeda triandra*

*(Species currently found on site)



CIRCULATION

The site is situated on the southern side of the ridge between a wooded area on the banks of the Apies river. The circulation is from West to East and is roughly 200m off of the main walkway called the zoo loop.

1

Figure 43: Internal view of Aviary (Author, 2019)

2

Figure 44: Eastern view of Apies river (Author, 2019)

3

Figure 45: Aviary in context (Author, 2019)

4

Figure 46: Western view of Apies river(Author, 2019)

5

Figure 47: Southern View of Apies (Author, 2019)

6

Figure 48: Pathway leading to Aviary (Author, 2019)

Current condition

The access to the site is only denoted by signage and a brick path, no other visual cues are used (refer to Figure 49). Furthermore signage clearly states the restricted access to Apies river in comparison to the (refer to Figure 50) which show the relationship people had to the Apies river. The riverbanks are devoid of naturally occurring plant life and the grasses that do grow there are cut down (refer to Figure 51). Fences separate wildlife from people and habitats from each other(refer to Figure 53). Isolated grazing allows for invasive species such as Pennisetum setaceum, which is an invasive grass shown in (refer to Figure 54), to thrive and compete with local vegetation types. The main aviary structure is made from steel and wire mesh (refer to Figure 55) and allows for great city views from the highest platform with a blanket of trees as foundation (refer to Figure 57). Some of the indigenous trees have name tags and would only be sought out by the occasional enthusiast.

Figure 49: Pathway leading to Aviary (Author, 2019)

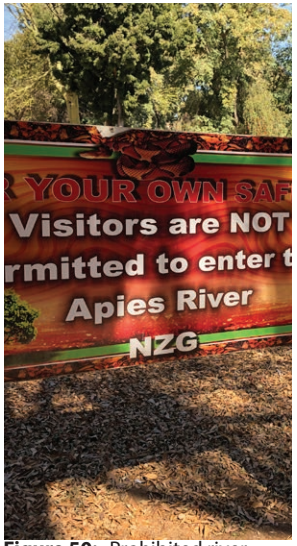


Figure 50: Prohibited river access (Author, 2019)

Figure 51: River bank condition

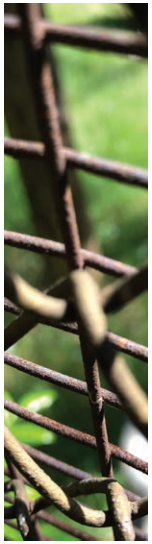
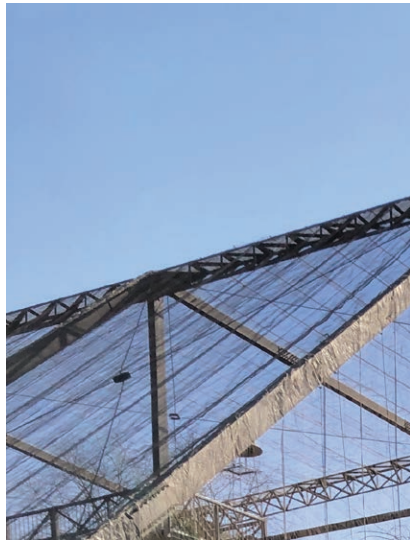


Figure 52: Steel mesh fencing (Author, 2019)

Figure 53: Nature divide (Author, 2019)

Figure 54: Invasive species dominate disturbed land (Author, 2019)



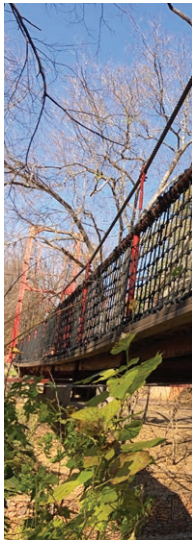


Figure 55: Aviary steel structure
Figure 56: Suspension bridge connecting western side of site (Author, 2019)

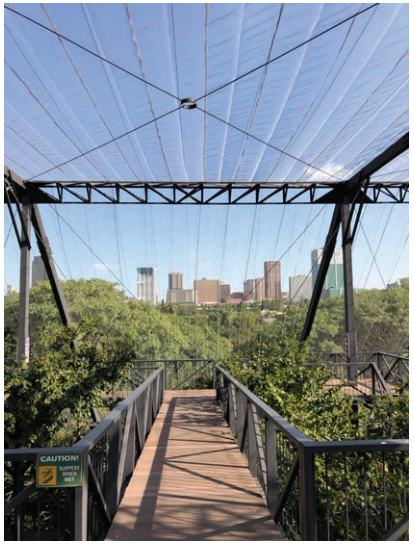


Figure 57: City view form Aviary (Author, 2019)

Figure 58: Natural layering (Author, 2019)

Figure 59: City within its landscape not on it (Author, 2019).

SITE POSSIBILITIES

Potential

The potential of the site lies in the Apies river and its potential to restore the riverbank as a connector between the two habitats north and south of Pretoria. The fact that the Zoo is seen as an educational institution, opens up the opportunity to teach people about habitats and the animals connected to it. Animals that are isolated in a simulated environment simply don't act the same way animals in the wild do. Biologist and ecologist can use the site to study how nature is reclaimed if the right factors fall into place, while sharing the information learned with the public through a series of interactive building.

Future Projects

The restoration of the river habitat would engage more investors to see the river as a profitable investment. Potential future projects would include observation decks, river walks, accommodation, retail and restaurants.

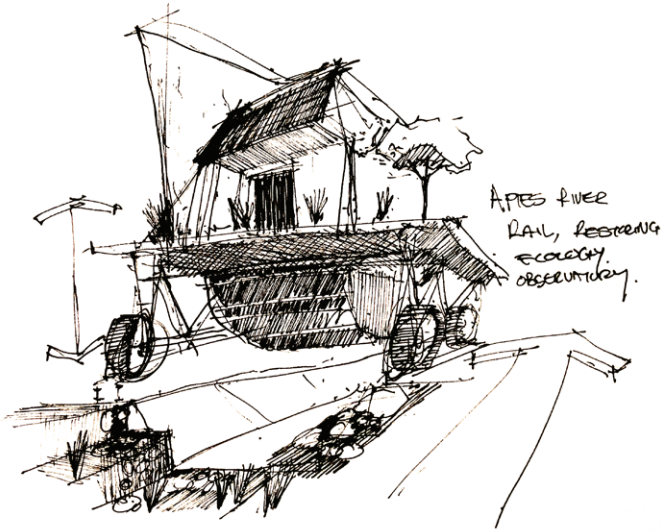


Figure 60: Apies river restoration (Author, 2019).

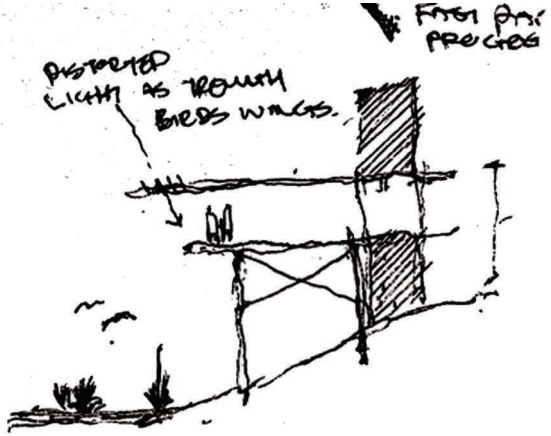


Figure 61: River used as asset within the city (Author, 2019).

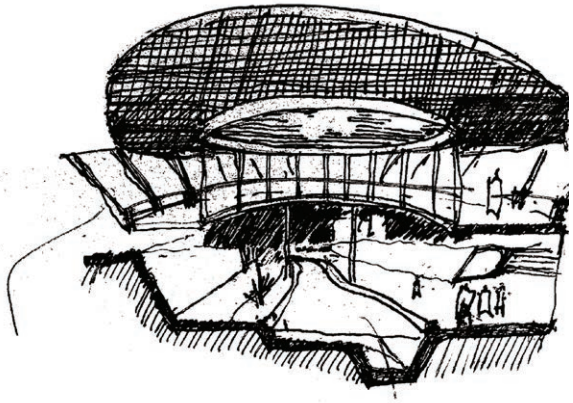


Figure 62: Buildings engage with river(Author, 2019).

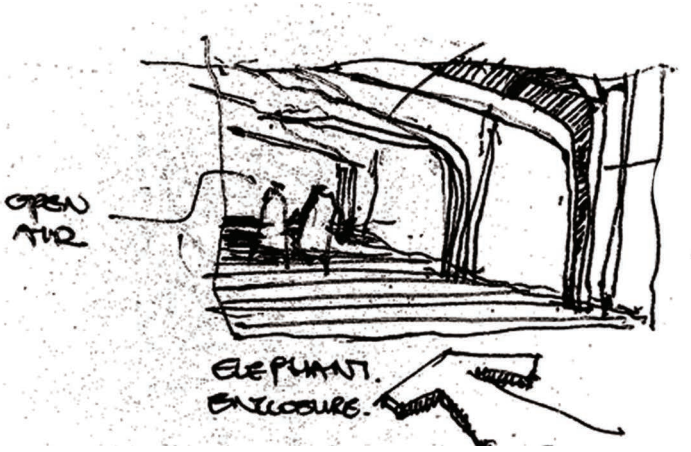


Figure 63: Recreation walkways (Author, 2019).

CHAPTER

THEORY

INTRODUCTION

This chapter will look at theories relevant to the site and the development of the project. The theories seek to guide the project and to give it a resilient foundation on which future generations can build.

BACKGROUND TO ZOOLOGY

- Purpose of Zoology
- Zoos and their relationship to Cities
- Science and the general population

THEORETICAL PREMISE

- Epistemological error
- Ecological Theory
- Ecological literacy as conceptual approach
- Broadening the view
- Regionalism as local environmental response

BACKGROUND TO ZOOLOGY

Purpose of Zoology

Zoologists for the most part observe animals in their natural habitat to understand their way of life. Dead animals are mostly observed in laboratories to help understand parts of the body and the composition that makes the animals unique and together the zoologist gets a better understanding of the animal's body, its evolution for taxonomy purposes and its life processes and behaviours (Mackenzie, 1928).

The study of animals helps to see what the relationship is between humans and animals and could potentially aid in a better co-evolution over time. Zoology can also determine the influence humanity has on species and advise the appropriate regulation makers how to save endangered environments and animals. The study of animal behaviours, conditions, mating habits and food procurement allows zoologist to intervene in a calculated way in order not to interfere with wild life (Mackenzie, 1928).

Figure 64: Locked zoo potential (Author, 2019)

The zoo and its relationship with the city.

As the city is an imposition of man's ideals onto natures landscape the zoo is man's idea of how animals could be studied in a controlled environment.

The zoo in this regard has no benefit for nature and is mostly to serve mankind and their entertainment. The zoo over the years have gone through distinct stages where the architecture proclaimed the state of mind of the time they developed in. Currently zoos are in an entertainment state of mind with bigger bolder cages reinforcing the spectacle of exhibition. The problem is that zoos should be teaching us about the environment and the buildings should reflect it. A change is needed.

Figure 65: Unlocking the zoo's potential (Author, 2019).

Science and the general population

A gap in communication between scientists and the general public has been persistently growing over the years(Hunter, 2016). As the gap grows, it only leads to a lack of trust as the public is mostly overwhelmed by false sources that spread misinformation to gain certain advantages within the market such as people's attention. Institutions such as Zoos should be the main source the public turns to when in doubt but with the digital age errors are made and people are led astray. The answer could lie in that the communication process should be seen as a two-way process where social feedback is expected on research projects. This in turn would see scientists being more open about the nature of their research and all of the uncertainties that accompany it.

THEORETICAL PREMISE

An Epistemological Error

When a recurring problem arises, it is often best to look at the underlying philosophical roots of our habitual processes (see Fig. 02). These processes often consist of our understanding of reality and leads to methods in which we engage with business, education, culture, politics, nature and design (Boehnert, 2018).

Epistemology is referred to as the theory of knowledge and distinguishes between justified belief or opinion. But what happens when our ideas of how the world works, are out of alignment? Surely dysfunction ensues.

Gregory Bateson is accredited with developing the concept of epistemological error described in his seminal book Steps to Ecology of Mind (1972). Bateson explains that our view of the world and how we perceive it to function is distorted at best. In his words: 'most of us are governed by epistemologies we know to be wrong' (Bateson, 1972, p.493).

The scientific revolution changed the epistemology and ontology of earlier generations and replaced the popular views of geocentric, ecclesiastical authority. The theories that sought after the evolution of our understanding of the world, formed a view of nature as a mechanism, one whose parts could be studied and attributed to understanding the whole.

Ecological theory rejects this notion and ridicules the process of scientific study that creates a stark split between subject and object, sensing and thinking, mind and body, human-kind and nature.

The theory of epistemology error argues that the Western construct of independence from non-human nature is wrong. We are all ecological beings that are bound and interdependent on the rest of the natural world"Figure64: Our dependency on nature relies even on the smallest of creatures(refer to Figure64), but our understanding of this does not reflect in our current engagement, geophysical and biologically. Therefore, this lack in engagement has led to highly unsustainable ways of living often accompanied by a poor understanding of our role within nature.

Figure 66: Our dependency on nature relies even on the smallest of creatures (Author, 2019).

Ecological Theory

Systems-thinking theory spawned from a general movement that critiqued the reductionist way of understanding and engaging with the world. It takes an unbiased stance that is holistic in approach and assumes that all components of a given system cannot be explained though study in isolation. Instead, system thinking supports an understanding of context and the underlying patterns that cause events (Kreutzer, 1995, p.35). Donella Meadows describes a system as 'an interconnected set of elements that is coherently organized in a way that achieves something.' Meadows argues that systems differ in size, type and levels of complexity and that all systems consist of 3 basic things: elements, interconnectedness and function or purpose (2008, p.11). These systems, unique in combination, all share similar dynamics that provide them with nutrients and energy. Also known as feedback loops (see Fig.03) and energy flows to name a few. Meadows' famous Leverage Points: Places to Intervene in a System (1999) gives us possible indicators where a design might slot into a system and how it could potentially affect it.

Places to intervene in a system (increasing order of effectiveness)

- Constants, parameters, numbers (such as subsidies, taxes, standards)
- The size of buffers and other stabilizing stocks, relative to their flows
- The structure of material stocks and flows (such as transport networks, population age structures)
- The length of delays, relative to the rate of system change.
- The strength of negative feedback loops, relative to the impacts they are trying to correct against.
- The gain around driving positive feedback loops
- The structure of systems (such as incentive, punishments, constraints)
- The rules of the system (such as incentives, punishments, constraints)
- The power to add, change, evolve or self-organize system structures
- The goals of the system
- The mindset of paradigm out of which the system – its goals, structure, rules, delays, parameters – arises
- The power to transcend paradigms. (Meadows, 1999)

Landscape urbanism as a means to intervene in such a system uses the notion that landscape should be the fundamental building block of any city's design. Charles Waldheim coined the term as a student of the University of Pennsylvania in 1980, when he combined the ideas of James Corner and Ian McHarg, who were at the time debating the uncertain future of landscape architecture. The combined ecological advocacy of McHarg, and Corner's urban design vision, effectively challenged the idea of development led by traditional urbanism, where some structure – a building, walls or roads – dictated the urban form. Green space was set aside as left-over space, non-programmable, an afterthought. Landscape urbanism seeks to aid the designer through cultural and natural processes that could help organize urban form (Steiner, 2011).

Urban ecology can be seen as a branch of landscape ecology that focuses on environments within a city. As more people are gravitating towards metropolitan districts, interest has developed form the science community regarding how fragmented landscapes can be studied and adapted to work in unison throughout the urban environment. The evolving form of ecology can be defined as a matrix of patches consisting of ecological units that comprise of structure and function (Steiner, 2011). Ian Mcharg explains that these units should be scientifically studied to not only provide explanations but also instruction and used as guidelines within design itself.

All organisms need a continual flow of energy to survive and thrive. The sun provides us with one of these continual streams of energy that drives the earth and most of the ecological cycles within it (Stone, 2015). Urban ecology understands that human influence has added new energy sources and aims to inform people about the complexity of global energy flow as seen in Figure ... In combination with Mcharg's checklist Urban ecology has the potential to inform and educate people of their personal involvement within the system and explains the dangers associated with carbon driven energy which could influence the environment in the following categories:

Climate
Geology
Hydrology
Limnology
Soils
Vegetation
Wildlife

These principles, since Mcharg's definition, have continued to influence the way people study sites and use them, in combination, as strong design drivers (Yang et al., 2013).

Together, these theories form a synergy that Mohsen Mostafavi and his colleagues have promoted as a combined concept that would see the inherit conflictual conditions of urban ecology fused with that of landscape urbanism: landscape ecological urbanism. Urban ecology is obvious in the fact that it concludes people's need to interact with other people, environments (built and natural) and species. Cities are inherently therefor ecosystems, human ecosystems. Every ecosystem needs balance. Urban landscape projects like the Highline illustrate how designing with nature can improve the quality of cities, not only for

people but for the fauna and flora, in and around it, creating a balanced resilient system (Steiner, 2011).

Figure 67: Aloe Barberea tree found within the zoo grounds(Author, 2019).

Ecological Literacy as Conceptual Approach

David Orr stresses the importance we should place on being ecologically literate within our design process, as this is a means to respond to environmental problems. He explains that most of our environmental problems arise due to our miscalculated approach between human intentions and ecological results. This, at best, is a design failure (Orr.D.2002,p.14). These design failures add to the growing problems of our inherent perceptual and mental abilities to respond correctly to the ever pressing environmental concerns. Orr (2002) states that while these design failures are alarming they provide us with a means to respond and improve. Critical reflection as an approach should therefore be the basis of all systems thinking, informing potential ecological literate design (Boehnert.J. 2018, p.86). Orr (2002) describes four fundamental steps towards becoming 2eco-literate

A clear understanding that our survival, health, wealth and well-being will ultimately depend on working with nature. This should be a community process that aims to increase local resilience.
An understanding of potential crises within nature, the vital signs of the planet. Time is taken seriously by placing limits on the acceleration of materials, transport money and information.
A historical understanding should be gained of our ecologically destructive ways. This in turn eliminates our concept of waste and transforms our thinking to that of non-materiality.
An ability to take a practical and participatory approach to environmental problems.

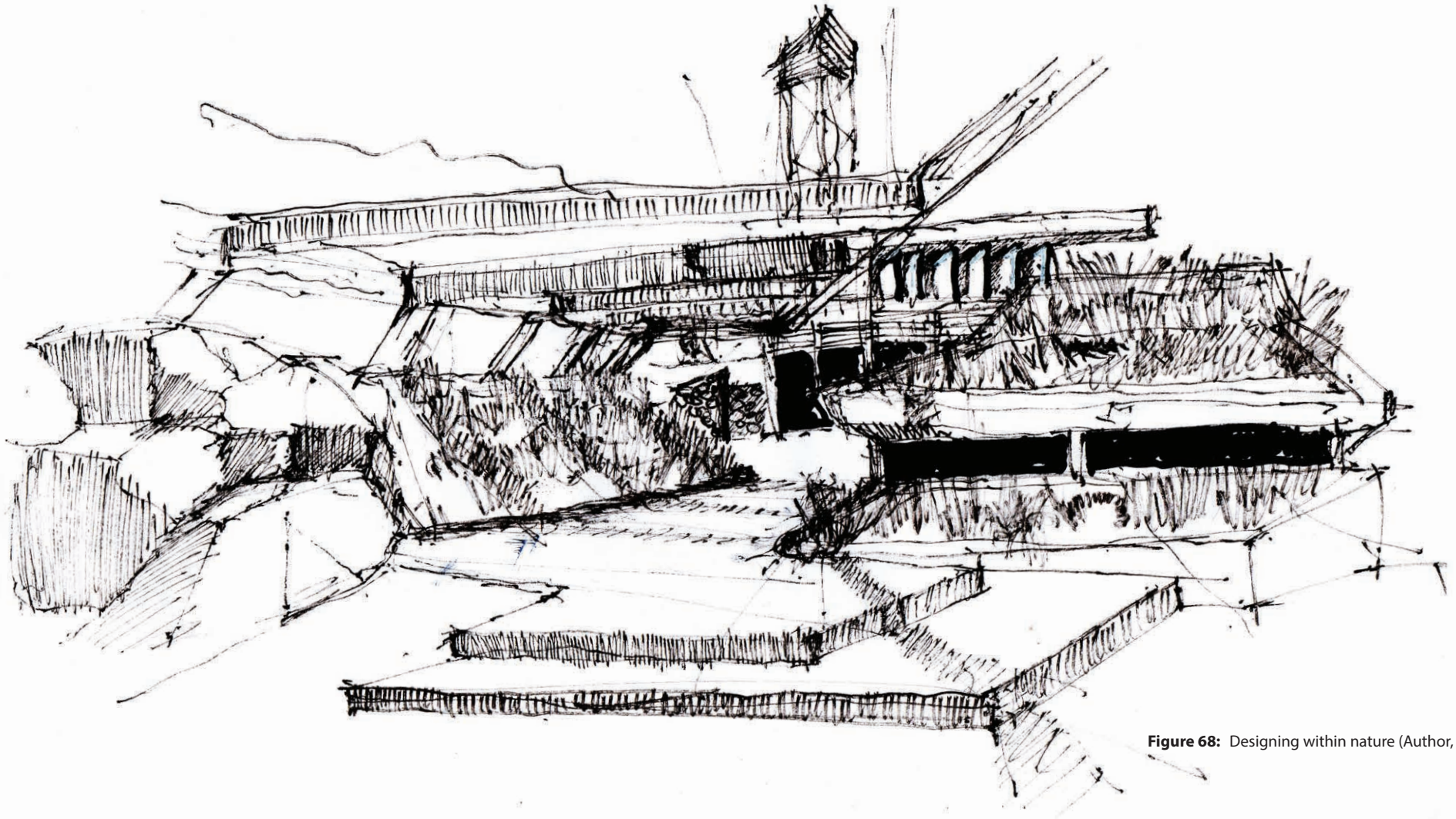


Figure 68: Designing within nature (Author, 2019).

Broadening the View

Zoos should aim to do everything in their power to show how important the region is to their visitors and that the land is not only in need of intelligent stewardship by governmental officials but by the inhabitants themselves. It is crucial that the zoo not only educates people on the subject matter of being a good steward, but also sets the example too. Possible ways that the zoo can start making a change in this manner is through creating incentive-based rewards to people that either carpool, use public transport or by exchanging recyclable goods for free access. We can ask if the zoo is visibly making effort to become independent of fossil fuels. Is the zoo currently making use of mechanical equipment that don't emit harmful chemicals to the environment? Does it have ecologically sound purchasing policies in place that could expose product manufacturers and material providers to potential unwary buyers? The zoo could extend their reach by advertising their conservation practices to local businesses that could lead to the adaptation of these practices in the short term and create a new department within the zoo that could investigate and give government tax reductions based on the level of conservation that a business or home contributes to in the long run (Hancocks, 2001, p.172). The possibility of an additional multimedia sub program to the zoo could see a reinforcing effect where one feeds off of the other. Scientific work is reinforced by media and vice versa, educating the public as the main consumers of their content.

"Biodiversity for Life" is the current motto of Pretoria Zoo, yet we still have to see this within zoo education and recreation activities of the visitors. Too much emphasis is placed upon specific animals which leads to a reductionist perspective of the habitats that these icons represent. Our main goal should be to create a zoo that presents nature in all its complexity, diversity and fragile beauty. We need a zoo that interprets nature, not only a narrow spectrum of its animals. Growth comes from learning, a fact that we need to realize if we want to create an intervention for nature, is that we cannot control nature, only manage it based on nature's systems and not our own. The conventional protected areas for example simply won't cut it as William Conway (1995) states. An example of this is the Everglades National Park that was established in 1947 for protecting large wading birds. By 1980 only 10% of the population remained.

Michael Robinson (1988) has been advocating the need for bio-parks for more than three decades as the director of the National Zoo in Washington (Hancock's, 2001). By taking into account previously mentioned steps together with broadening the views of zoos to one that focuses on biology and the inter-connectivity and interdependencies of animals, plants and people, we can cage the very nature of a zoo to a valuable asset that cannot be regarded as a prison for animals but as a place that has nature's best intent in mind for all.

Figure 69: Changing the way we look at things(Author, 2019).

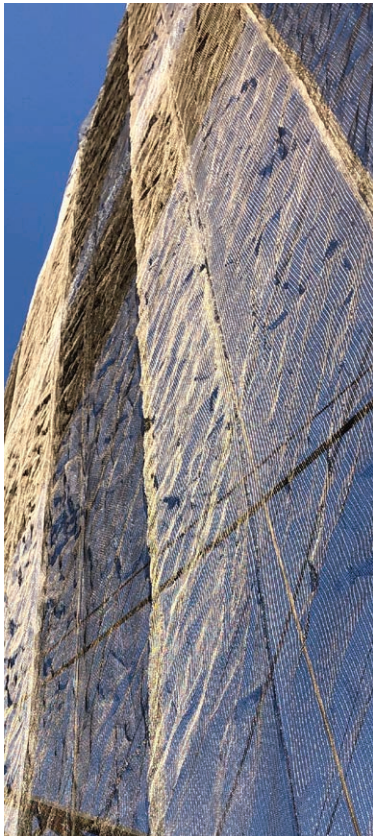
Regionalism as Local Environmental Response

Every site has a unique set of variables; these conditions are not bounded to site and serve as building blocks within a matrix of systems.

Regionalism as approach to architectural design considers the unique attributes of place with regards to Mcharg's checklist. It aims to create and inform a design that is unique to the culture and is sensitive to the landscape's features, truly responding to climatic constraints (Fisher, 1998). Barker (2015) argues that regional architecture has the means to respond to culture and their social concerns through the reinterpretations of traditional built form and its various living conditions. But to respond in this manner, an intimate understanding of place and the everyday practices are needed. Regionalism in this regard can be seen as a "self-conscious response to regional conditions" (Barker, 2015,p.19), and leaves the door open for architects to choose what they respond to.

By viewing a site as a living-system with various elements that feed off of it, we change the way we engage with the site itself. Systems thinking supports an understanding of the context and the relationship between the parts that form patterns, in turn causing events. It is this fundamental understanding that realizes the complexities of a system (whether biological, social, natural, economic, etc.) and sees that they cannot be understood in isolation. Site, in this frame of view becomes a catalyst for reciprocal relationships that co-evolve, resiliently adapting to external elements and disruptions (humans), providing opportunity for study and growth.

Figure 70: Regional materials: wood, steel, stone and plants from the area.(Author, 2019).



VISION

The architectural intention of the project is to give users and viewers a new found respect for their current environment, by understanding their attributes towards the whole ecosystem and through the immersion of the user into the studied animals' habitat. The architecture frames, exposes, celebrates and hides key aspects of the landscape, providing an architecture not only for mankind but for nature too.

The intervention seeks to correct an architectural epistemological error through reassessing standard building techniques and how it is situated within the greater landscape.

Current condition

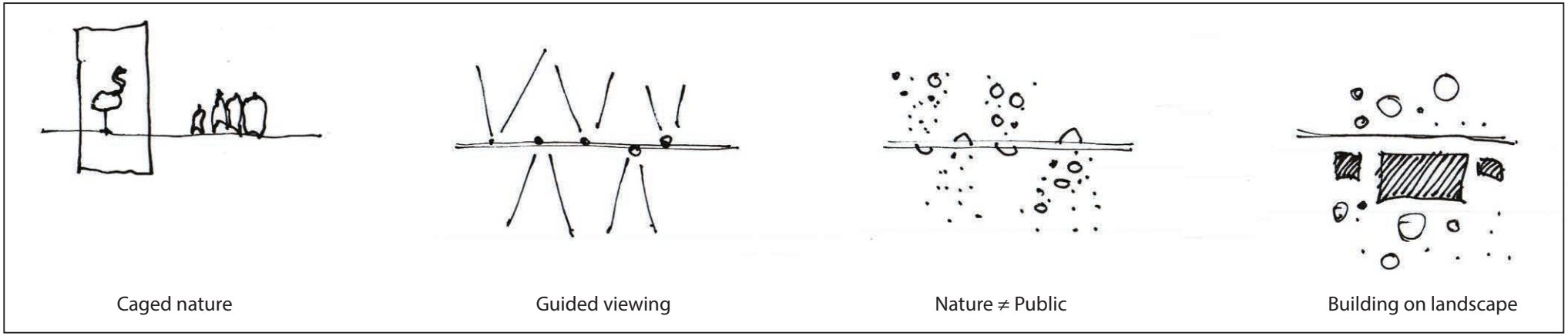


Figure 71: Methods of how Zoos engage currently (Author, 2019).

APPROACH

The design approaches the user's experience from the animals' perspective. For the building to immerse its users into the animals domain, the subject being viewed, habitat needs to be identified. The immersion aspect of the design would be drawn from the habitat itself and how said animal would be viewed in such a place. The building will ground itself in the materiality of its surrounds, becoming part of the earth instead of an icon that stands out and apart from nature.

Future condition

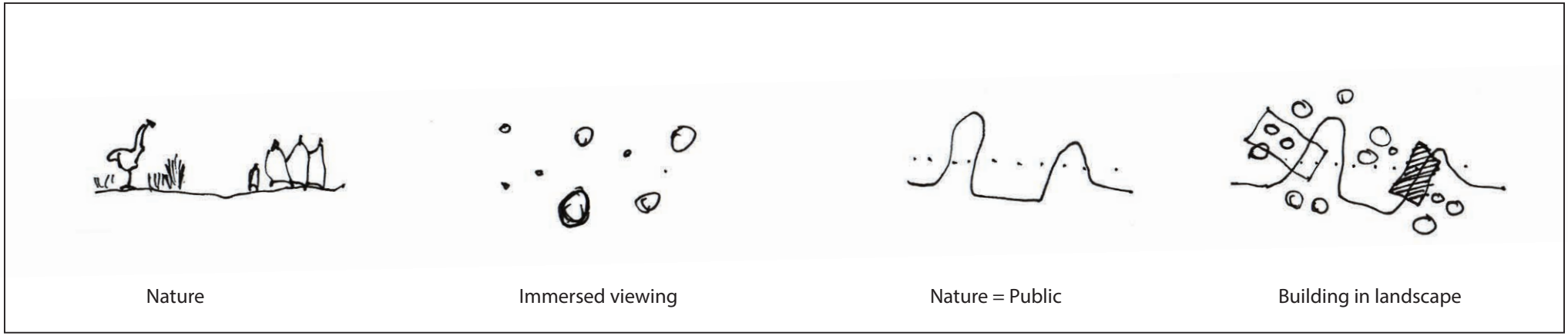


Figure 72: Future engagement with Nature (Author, 2019).

CHAPTER FOUR

PRECEDENT

INTRODUCTION

This chapter will look at precedents that are all built and relevant and would aid in the development of the project itself. Each project is described and studied to draw conclusions that attribute to their success.

PRECEDENTS

- Paris Zoological Park /
- Zaryadye Park/
- TIJ Observatory/

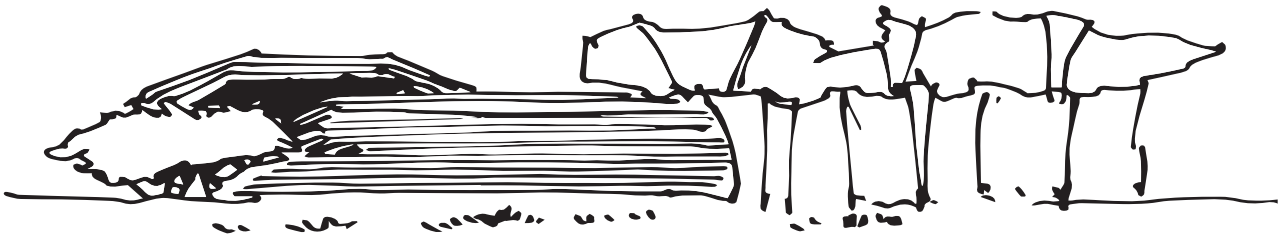


Figure 73: Building blending in with surroundings (Author, 2019).

PRECEDENTS
PARIS ZOOLOGICAL PARK /

Bernard Tschumi Urbanists Architects + Veronique Descharrieres

Location: Paris, France
Completed: 2014
Size: 137 593m^2
Goal: Ecological harmony
Cost: €167m

DESCRIPTION

The Paris Zoo's renovation was staged around five "biozones" that succeed one another along a four-kilometre track. The central theme of the renovation plays with the concepts of cinema and theatre, known and affiliated with most of Bernard Tschumi Architects work.

The lure of playing with the metaphor of theatre creates a dynamic tug-of-war between on- and off-screen, foreground and background, guiding the eyes and consequently framing and scripting the users' experience.

The architect adds to the experience through time. Time becomes part of how the users experience the zoo as the landscape changes over the seasons and years. The fifth dimension as described by the architect is that of the imagination. Suggestion completes the mental landscape and rounds the multi-scale composition allowing buildings and other elements to blend into

the surroundings only to be unveiled when the script allows for it.

By using several landscaping devices as part of the script, boundaries are reduced, views are framed and certain elements are hidden depending on if you are a viewer or staff member. Topography is used as leverage to lead and surprise viewers without showing too much of the route ahead. This technique creates unique spaces through landscape and generates a momentary disorientation as the user is left with a feeling of neither "here" nor "there".

The concept of cinema in the renovation of the Paris Zoo was masterfully used to narrate the experience of the users and to focus their attention on key aspects within the five biozones. This enforces the learning experience through immersion and breaks down the old zoo's stigmas of elitist separation by means of barriers and blurs the edge to create an engaging connection with the surroundings.

RELEVANCE

The project aims to blend into its surroundings through its use of materials and typography. Similar elements were investigated as a means to mitigate boundaries within the building and to narrate the users' experience through framed aspects of the landscape and their important contribution to the immediate environment. Each biozone is unique within our country and should therefor be emphasized and embraced teaching people about the importance of them and the animals they support and their constant exchanges. Instead of teaching people about animals and the biozones they appear in. This is the future of zoos and they have the most potential to showcase these vital aspects and serve as a leader of change.

Figure 74: Paris Zoological Park (www.archdaily.com).

ZARYADYE PARK/

Diller Scofidio + Renfro

Location: Moscow, Russia
Completed: 2017
Size: 140 000 m^2
Goal: Ecological Knowledge
River Overlook: 70 meter length
Media Center: 7800 m2
Nature Center and Ice Cave: 3100 m^2
Restaurant: 2300 m^2
Market: 2100 m^2

DESCRIPTION

Diller Scofidio + Renfro in collaboration with Hargreaves Associates and Citymakers created a new public space that promotes integration and celebrates Russia's bio-regions. The park artificially emulates the climates of the tundra, forests and wetlands found within the borders of Russia and promotes the harmonious relationship that architecture and nature can have if considered beforehand.

Across the park, four micro-climates are created through regulating temperatures, eliminating wind and simulating daylight in progressive zones. This environmental augmentation allows for the potential year-round use as open hillsides can be used for snow related activities whilst the pavilions provide shelter and green spaces.

The 14 Hectare park is located in a historical part of Moscow and serves as a stage to view famous landmarks such as the Kremlin, Red Square, and St. Basil's Cathedral and is the first of its scale in 50 years. This, as a breathing space, is much needed for residence of Moscow, considering Russia's history and the recent expanse of developments.

A custom paving system creates a pixelated effect on the surface of the park and blurs the edge of nature and the city. By blurring the boundaries, freedom of movement is encouraged throughout the park and allows for an individualized, unscripted experience - a stark contrast to the traditionally ordered and symmetrical Russian park typologies.

The park serves as an exhibition and attraction to passive climate control strategies and building technologies, connecting residents of Moscow to green indigenous spaces as a hub for creativity and cultural integration.

RELEVANCE

Creating awareness and integration through landscape is a concept that changes the way we engage with nature. The project re-establishes the connection we as humans have with nature and the influence it has on our wellbeing as well as the wellbeing of the fragmented landscape that could be restored through building. How materials are used in combination with active- and passive climate control systems can influence the way we see this partnership we have with our surroundings.

Figure 75: Zaryadye Park (www.archdaily.com).

"It is a park for Russia made from Russia…
it samples the natures of Russia and merges
them with the city, to become a design
that could only happen here. It embodies
a WILD URBANISM, a place where
architecture and landscape are one"
- Charles Renfro.

Figure 76: Zaryadye Park (www.archdaily.com).

TIJ OBSERVATORY/

RAU architects + RO&AD Architecten

Location: Stennendam, The Netherlands
Completed: 2019
Size: 150 m^2
River: Haringvliet
Goal: Ecological Restoration

DESCRIPTION

TIJ as the name of the project stems from a Dutch word 'joke', which means 'tide' or 'the egg' depending on the pronunciation speed. The project celebrates the opening sluices and returning of the tides to Haringvliet in November 2018.

The opening of the sluices came after careful consideration to restore the biodiversity through the improvement of water quality, as well as the fact that it will stimulate fish migration from the North Sea to the river delta of Maas and Rhine in the Netherlands.

To let people EXPERIENCE AND EXPLORE the change that will take place, a series of bird observatories have been designed. The TIJ project is situated on a flat sand island known to be the feeding and breeding grounds of several birds such as the Common Tern, Spoonbill and the iconic Sandwich Tern.

The project allows people to view several bird biotopes throughout the site by means of immersion. A singular path connects a series of landscapes together with the last section being a tunnel that doesn't disturb the birds. The tunnel is made out of recycled wood and mooring posts that promote the idea of re-use and recycling and is covered with sand to create an artificial habitat that allows turns and waders to nest within them. The end of the tunnel opens up within a symbolic egg-shaped observatory from which visitors could view the birds as well as observe the reclaimed landscape.

The Observatory's shape itself is based on the Sandwich Turn's egg that would be laid on a sand nest. The nest of the observatory egg consists of vertical 'feathers' of chestnut poles, reeds and small sand dunes. The egg itself is designed to be disassembled and forms a good ration between form and structural integrity.

Keeping in mind that the sand bank floods a few times a year the materiality of the observatory followed in practicality. The lower part that floods is made with a durable water resistant wood, where the upper part that stays dry is constructed with pine wood.

Reflecting on the cycle of life the observatory is constructed to be temporary. The parts

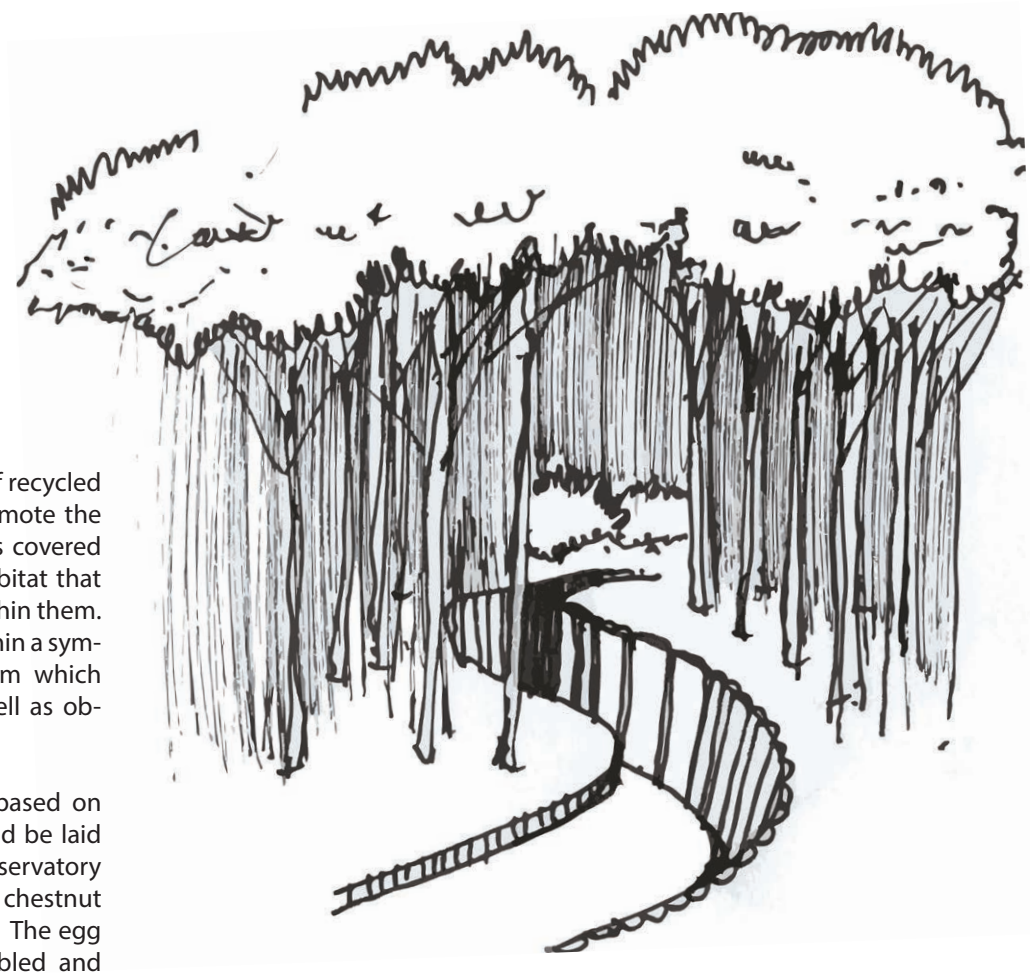


Figure 77: TIJ Observatory (www.archdaily.com).

'let people EXPERIENCE AND EXPLORE
the change that will take place '

could be reused or recycled without detrimental effects to nature or man and in turn brings both parties closer together to be part of each other's world.

RELEVANCE

Creating temporary elements within the design is a great metaphor to life and allows a visitor to connect to the project in a more meaningful way. The project is seen as a gateway to view the main product which is nature in personal manner, allowing people to reminisce about what was and how it changed for the better. This has great value within

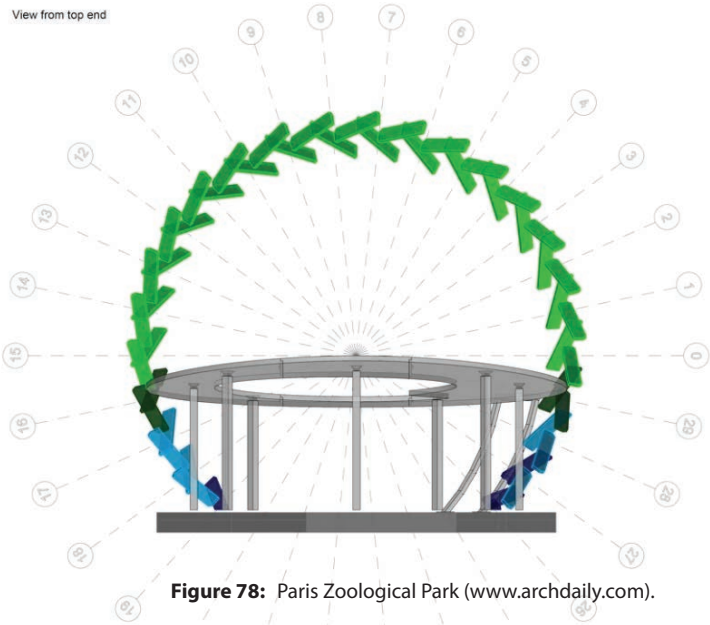


Figure 78: Paris Zoological Park (www.archdaily.com).

Figure 79: TIJ Observatory (www.archdaily.com).

SUMMARY

DESCRIPTION

BUILDING

CIRCULATION

MATERIALITY

PARIS ZOO

A renovation of Paris Zoo by Bernard Tschumi Architects. The main concept to create a strong sensual and emotional visitor experience that relied on ideas of immersion, visibility & camouflage to bring the user and animal into the same experiential realm.

Building blends into surroundings. Same environment for man and animal

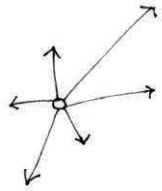
Only one entrance/exit, limited choice.

Earth type colours & materials to blend with simulated context.

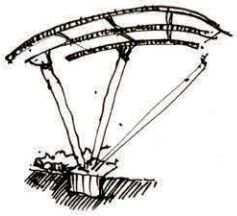
ZARYADYE PARK

Situated in Moscow, Russia, the project aims to showcase the important and threatened biomes that can be found in Russia. Simulating certain environments with smart technologies the user can get acquainted with his natural surroundings and the value of it.

Technology and landscape meet harmoniously



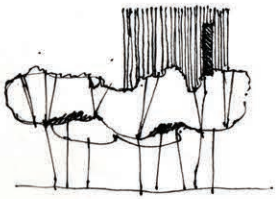
Multiple choices, free use of space.



Glass - Steel - Concrete

TIJ OBSERVATORY

A rehabilitation program aimed at the observation of natural restoration. The building provides a platform to view the natural process of biodiversity reclaiming damaged landscapes. The observatory allows the user to be part of the process through immersion.



Temporary structure built to be disassembled as part of rehabilitation.

Single linear route that is related to immediate surroundings.

Build from typical materials that would be found on site.

PROJECT

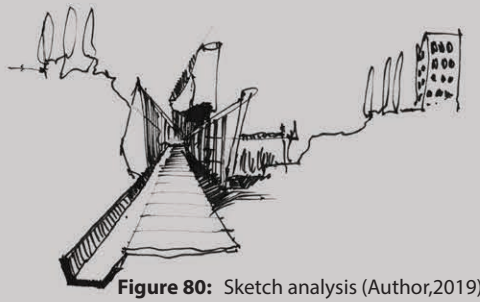


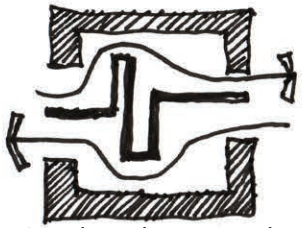
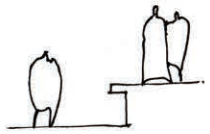
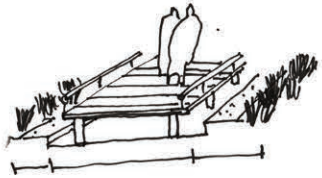
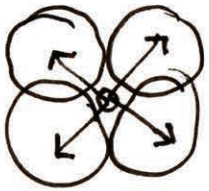
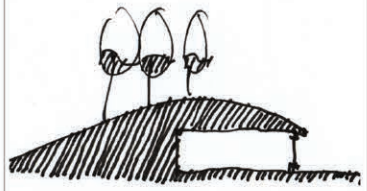
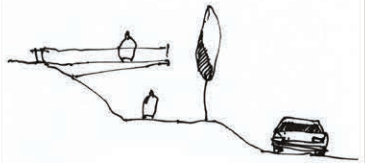
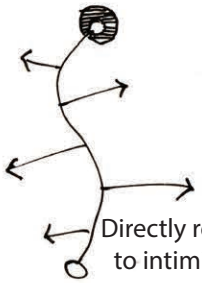
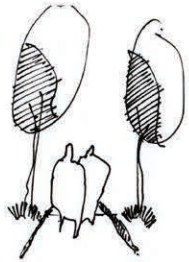
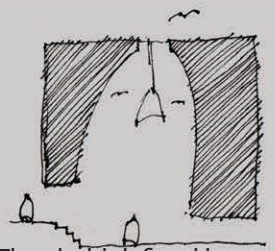
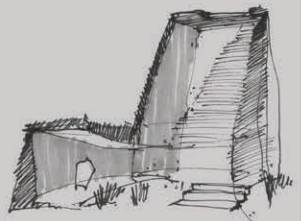
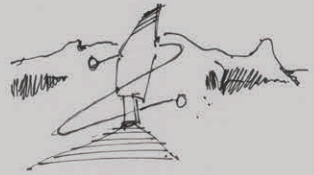
Figure 80: Sketch analysis (Author,2019).

A rehabilitation program aimed at the observation of natural restoration. The building provides a platform to view the natural process of biodiversity reclaiming damaged landscapes. The observatory allows the user to be part of the process through immersion.

Building should be a beacon to Pretoria's man-made Jungle.

User should be able to move through public spaces yet engaging with private functions.

As the building extends skyward it should get lighter and blend with the sky.

ECO RESPONSE	COEXIST	THRESHOLDS	BARRIERS	VIEWING SCALE	LANDMARKS
 Different climates simulated around the world.	 People and nature make use of same architectural intervention.	 Level change defines thresholds and gives users usage cues.	 Access defined by walkable surfaces. Provides a sense of user control.	 Broad visual scale to create an illusion of vast landscapes.	 Man-made element within landscape acting as a beacon.
 Different climates simulated within a country.	 Building is morphed into landscape	 Materiality changes inform users about private and public use.	 Balustrade indicates sensitive restricted areas.	 Multi-tiered experience providing views over the city as well as an escape from city.	 Building serves as low key backdrop to surrounding buildings.
 Directly related to intimidate context	 Temporary structure immersed and almost indistinguishable from nature	 Intimate experience informed by forest threshold.	 Immersion creates natural barriers indicating access.	 Intimate user experience within landscape.	 Building blends with surrounding context.
 Environments should start overlapping.	 Promoting the unique context surrounding the building and embracing it internally and externally.	 Threshold defined by scale allowing the user to experience the realm.	 Building and landscape form barriers.	 Framing a users view to form a intimate, multi tiered experience.	 Building visually changes to blend and camouflage into background.

PROGRAMMATIC PRECEDENT

SKUKUZA SCIENCE LEADERSHIP INITIATIVE RESEARCH CENTER

by architects Nicholas Whitcutt and Kevin Mitchell

Location: Skukuza, South Africa
Completed: 2017
Size: 40 people
Goal: Ecological Research
Location: S24.995928°, E 31.588007°

DESCRIPTION

Located in the Kruger National Park the building's main focus is to create an inspirational and sustainable learning space that not only enhances science education and experiential learning opportunities, but demonstrates the feasibility of low impact living through design and materials that have a reduced environmental impact.

The building offers a broad range of research opportunities and is unique for the highly diverse semi-arid savanna environment it is situated within. Furthermore, the contrast within the developing land outside of the protected park offers new opportunity to study social-ecological realm that has become a subject of debate within the urban environment.

Scientist and staff focus on ecological pattern and process by employing both observational and experimental approaches over the short and long term. The following are examples of the types of research that could be investigated:

- Functional Trait Ecology
- Ecology of freshwater invasions
- Disease ecology of small vertebrates
- Consequences of urbanization on species interactions (light pollution, noise pollution)
- Ecology of freshwater invasions.

RELEVANCE

The precedent helps guide the dissertation in terms of function and relevance. The need for research centers within environments that have been drastically changed, such as the Apies river, is vital. The impact of urbanization could be studied with greater effect and would only contribute to scientific community.

Figure 81: Skukuza Science leadership Initiative Research cente (www.tropicalstudies.org).

Figure 82: Skukuza Science leadership Initiative Research cente (www.tropicalstudies.org).

CHAPTER FIVE

CLIENT

INTRODUCTION

This chapter speculates potential clients that will utilise the site and provide a set of boundaries to which a brief will be restricted to. The brief together with the program will enable the required perimeters to guide the design.

POTENTIAL CLIENTS

BRIEF

PROGRAM

- Observatory
- Research and Ecological re-establishment
- Information sharing

POTENTIAL CLIENTS

The primary clients of the project would be SANBI (South African National Biodiversity Institute) in collaboration with FRC (Freshwater Research Centre) .

SANBI

SANBI was established in 2004 and extended its focus from the National Botanical Institute to include all species. The institute plays a key role in generating, co-ordinating and interpreting knowledge and evidence to support policies and decisions relating to all aspects of biodiversity. They promote and spread vital information and make tools available to the public, building on the knowledge of the population (SANBI, 2013).

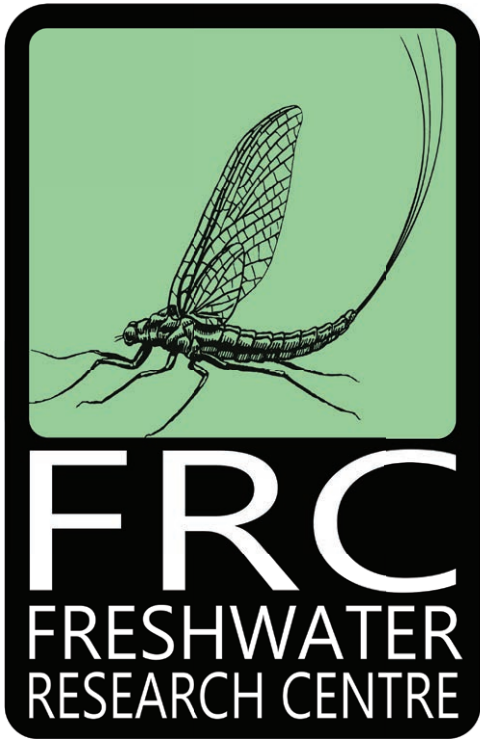
Currently the country is experiencing a deficit of taxonomists. The focus of these taxonomists also seems to be skew as the majority of them focus on the species already discovered and not the ones still to be found (SANBI, 2013).

The proposed facility could aid SANBI's initiative to promote the biodiversity as well as the lure of being a scientist and working in the field.

Curiosity sparks interest and the zoo needs to adapt to engage people in the natural environment.

SANBI
Biodiversity for Life
South African National Biodiversity Institute

Figure 83: SANBI logo (www.sanbi.org).



FRC
Is a non-profit organisation that does research in anything related to fresh water. The organisation believes in and promotes collaborative research that is relevant and they are committed to develop innovative solutions to balance human need and ecological requirement.

The mission and vision of FRC is to promote the understanding of freshwater ecosystems that is backed by data to influence a need for management, conservation and restoration of our freshwater ecosystems.

Currently the site can benefit from FRC's environmental and outreach programme, called Living Labs, that exposes scholars to ecosystems and providing opportunity to learn through participation

Figure 84: Right above: Freshwater Research Centre logo (www.archdaily.com).

Figure 85: Right: FRC goals and focus (www.archdaily.com).

BRIEF

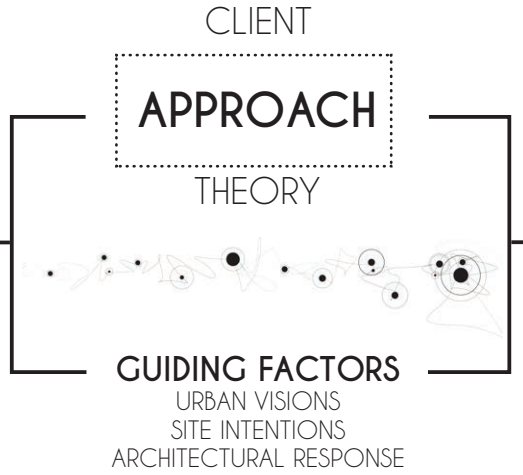


Figure 86: Brief layout logic (Author, 2019).

BRIEF

URBAN VISION

The urban brief focuses on the connection of green space throughout the urban context by means of reverting to indigenous flora and wetland system. This would provide the opportunities create the necessary links as explained in the previous chapters.

\+

FRAMEWORK

- Increase natural ecology throughout the city.
- Create awareness of ecological processes through follies.
- Integrate city and nature seamlessly.
- Run-off water cleansing through city wetland systems.
- Educate people of their immediate environment and the benefits of working with indigenous plant species.

BRIEF

SITE INTENTION

The precinct brief aims to intervene within the Zoo grounds of Pretoria addressing the natural imbalance that occurs between man-made and natural constructs. Focusing on the Apies river and how it could be restored as one of the cities assets.

\+

FRAMEWORK

- Repair and restore the river bank as a pilot project to the rest of the Apies river.
- Create sustainable water practices and knowledge to the community.
- Re-establish the Apies river as a corridor for nature between the ridges.
- Create species awareness to the public and the value of habitats.

PRODUCT

ARCHITECTURAL BRIEF

BRIEF

The brief aims to restore the imbalance between nature, the built environment and man through immersive design. The fact that most people do not yet directly see or feel the destruction and pollution of wilderness could be attributed to the scant contact they have with the natural world.

+

FRAMEWORK

- Provide a facility which will bring the general public closer to the research and science realm.
- Provide a facility which would challenge the current standards of the zoo and that would promote habitat instead of individual animals.

The building will serve as a pilot project to which researches could study the balance between the built environment and nature. The observation and study of how nature reclaims a restored element within the landscape such as the Apies river would aid in the policy making and development of new cities and structures.

- The building should aim to complement the landscape and should have as little impact on the site as possible
- Reintroduce the connections between man, animal and nature showing a balance and not a rule of one over the other.

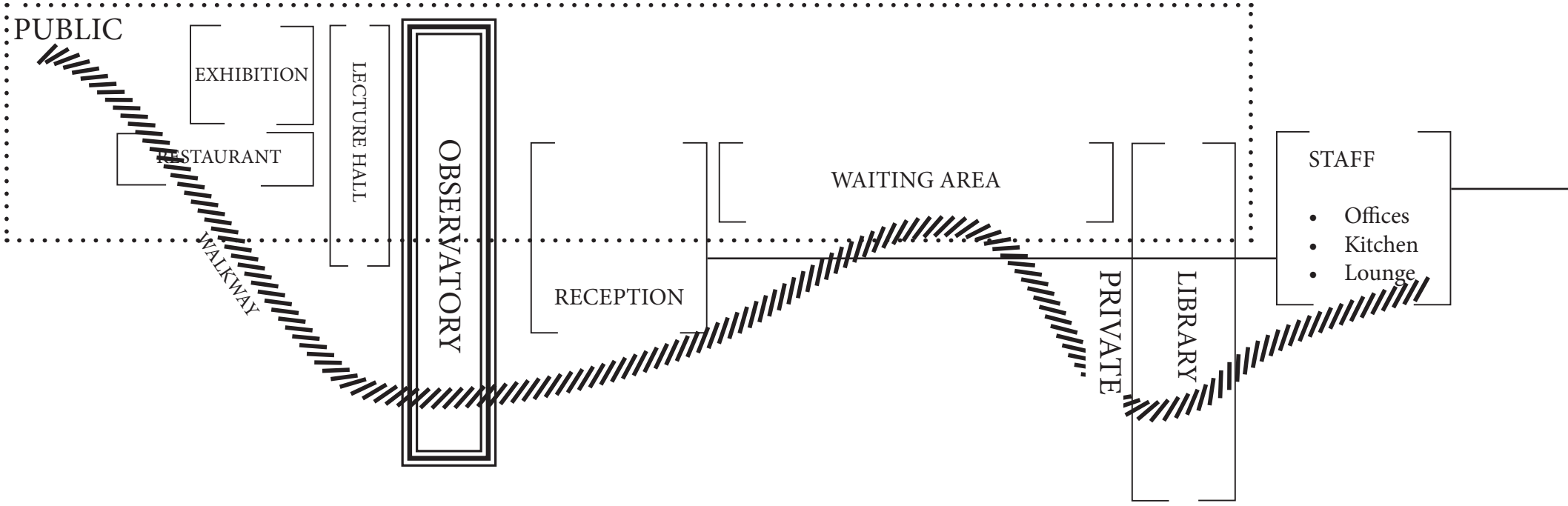
PROGRAM

RESEARCH AND ECOLOGICAL RE-ESTABLISHMENT (SCIENTIFIC SERVICES)

The focus of the building is the research institute which will engage with scientist, scholars and the community through the labs and observation of the re-establishment of the riverbank ecosystem.

The following will give an indication of equipment and spaces required for a research unit and the services they could offer:

Figure 87: Programmatic layout (Author, 2019).



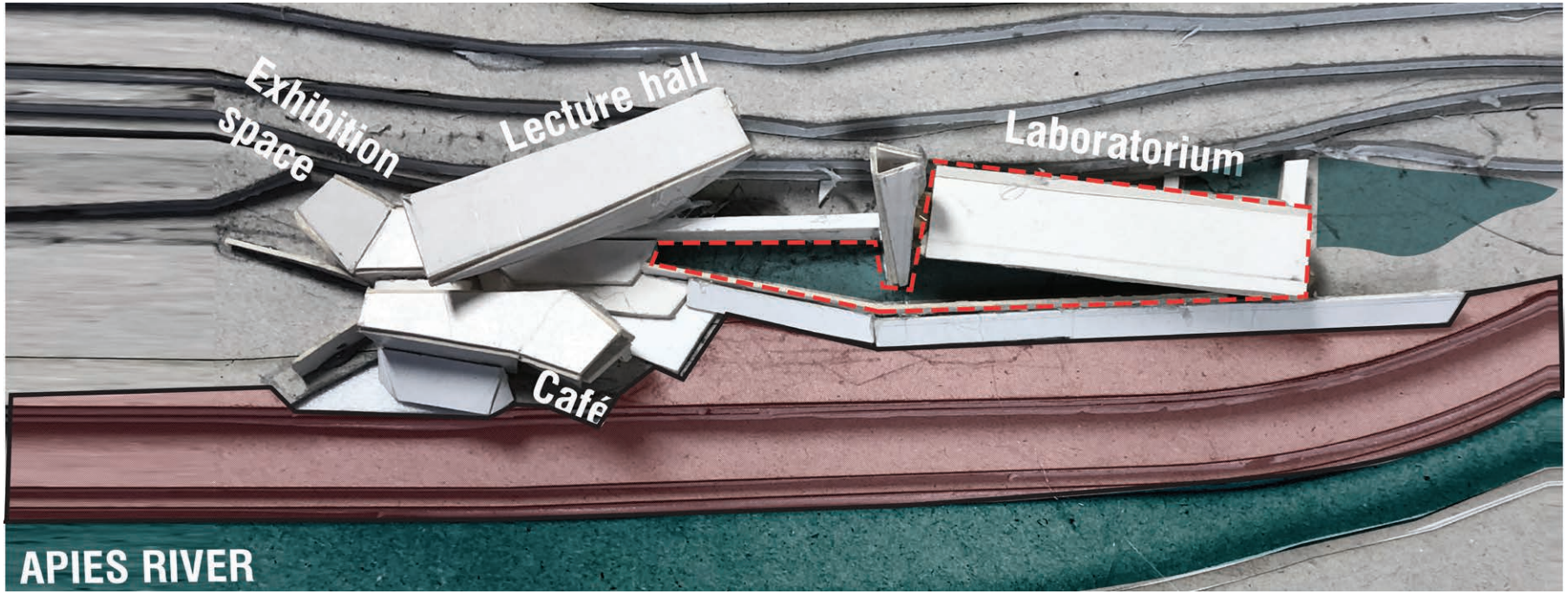


Figure 88: Marquette focus zones (Author, 2019).

SERVICES
- Disposal area
- Bathrooms
- Storage

PREPARATION ROOM
Used for basic processing and weighing of soil, water and vegetation samples, and has the following equipment:

- Autoclave
- Drying ovens
- Fridge and Freezer
- Analytical Balance
- Deionised water system

GENERAL LABORATORY
The general laboratory is used for various blood and tissue based assays and has the following equipment:

- Bio-safety Cabinet Class II
- Centrifuge
- Haematocrit Centrifuge
- CO2 Incubator
- Microscopes

ANALYTICAL LABORATORY
Used for analytical chemistry analysis of Soil, Water and Vegetation, and is equipped with the following:

- Discrete Auto Analyser
- UV light spectrophotometer
- Orbital shaker
- pH meter
- Block digester
- Analytical scale

ANALYTICAL SERVICES OFFERED:

- Water
- Soils
- Plants
- Small invertebrate

OBSERVATION

The observatory would function much in the same way as the TIJ observatory (see Precedents chapter) with the aim and focus of watching how nature returns to the Apies river.

Habitat restoration is the goal and by identifying 2 of the multiple species that would return to the area the intervention will focus and develop its observation and design requirements around these two species.

Figure 89: African finfoot (www.hbw.com).

Figure 90: Grey Foam-Nest Tree frog (www.adlayasanimals.wordpress.com).

AFRICAN FINFOOT (Podica senegalensis)

- **Habitat:** rivers, forest, wooded savannah, flooded forest, streams and lakes with good cover on the banks
- **Status:** Conservation status is hard to determine, given its elusive nature. There is concern that it may become threatened, as wetlands are cleared and watercourses altered and polluted. The increase in habitat fragmentation means it should be monitored.
- **Breeding:** It coincides with the rainy season and nest is built by nothing more than a mess of twigs and reeds, on a fallen tree above the water. Two eggs are laid and incubated solely by the female.
- **Food:** Insects, crabs, snails, molluscs, tadpoles and frogs

GREY FOAM-NEST TREE FROG (Chiromantis xerampelina)

- **Habitat:** Arid and semi-arid climates. They have developed several adaptations to live months at a time away from water.
- **Adaptations:** They can change their skin colour depending on the temperature outside. Above 36 °C they are white to reflect heat and below they are brown. They water-loss resistant skin to help cope with dry seasons.
- **Status:** Least concern.
- **Breeding:** A female releases her eggs into a foam nest in a tree that hangs over a body of water. Multiple males gather to release their sperm into the nest whereby multiple fertilization occurs. The tadpoles, once ready, drop into the pond below grow into adults. In the absence of trees and shrubs, nests may be attached to the sides of large rocks or man-made structures overhanging water.
- **Food:** Insects.

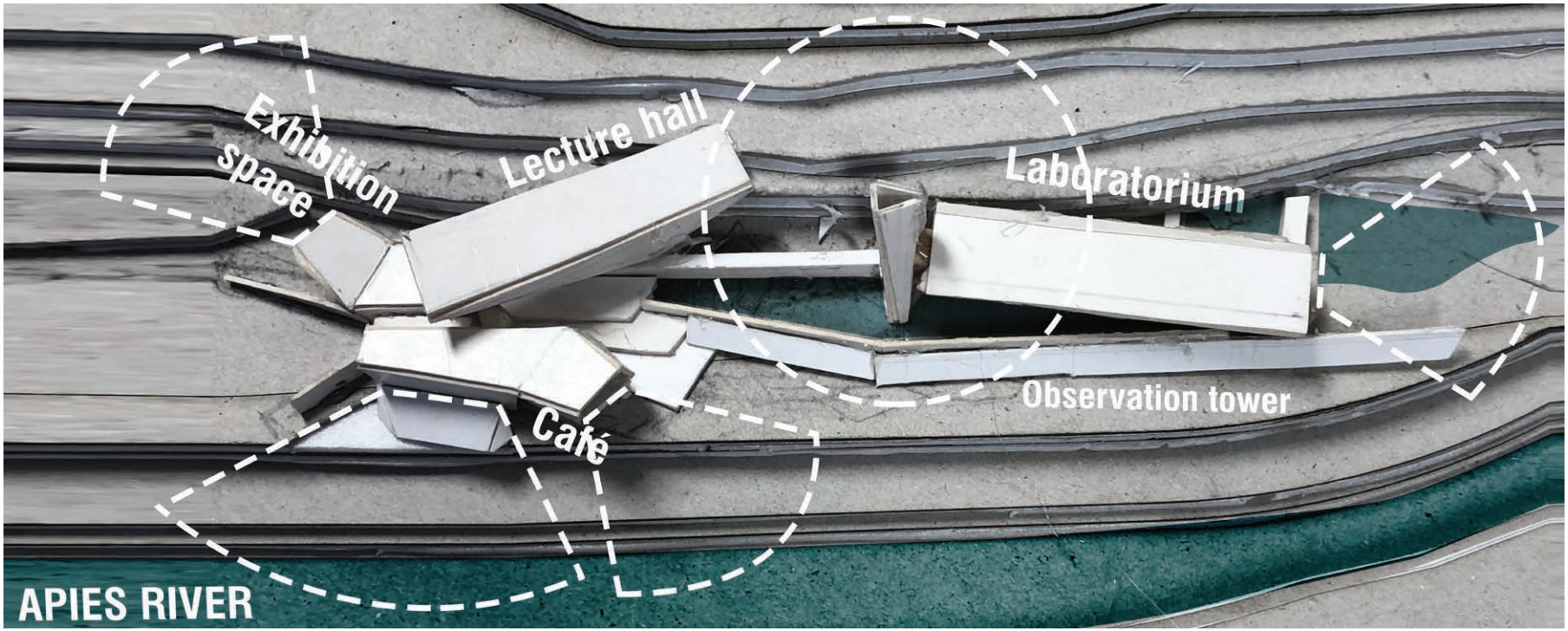


Figure 91: Marquette observation zones (Author, 2019).

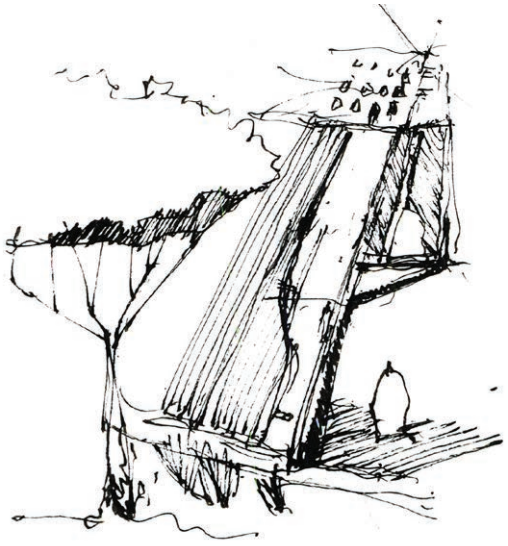


Figure 92: Nature engagement (Author, 2019).

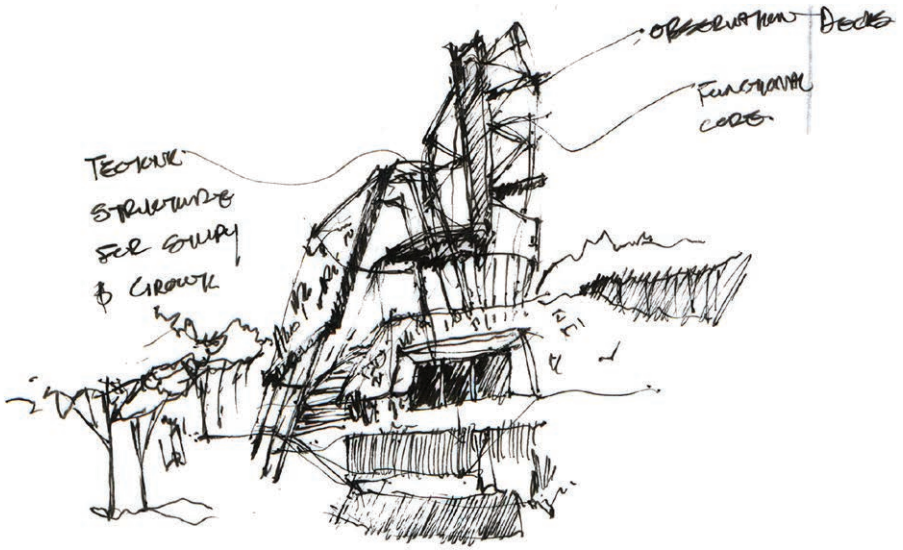


Figure 93: Building immersion (Author, 2019). .

INFORMATION SHARING

VIRUAL REALITY/ EXHIBITION HALL

Transforming the zoo to be more regional in its approach opens up another opportunity to teach people about other environments around the world though virtual immersion. Companies such as Habitat focus on natural history through virtual reality and can transport people around the world, telling stories without anyone having to travel. VR would be the next step in the education of animals from around the world, especially within zoos.

LECTURE HALL

The lecture hall would be a link between the scientific research realm and the public realm where classes,workshops and seminars could be hosted to inform people about new and ongoing findings and to educate the future.

LIBRARY

The library would form part of the scientific research area and would allow people to further their knowledge about the environment and the discoveries made on site.

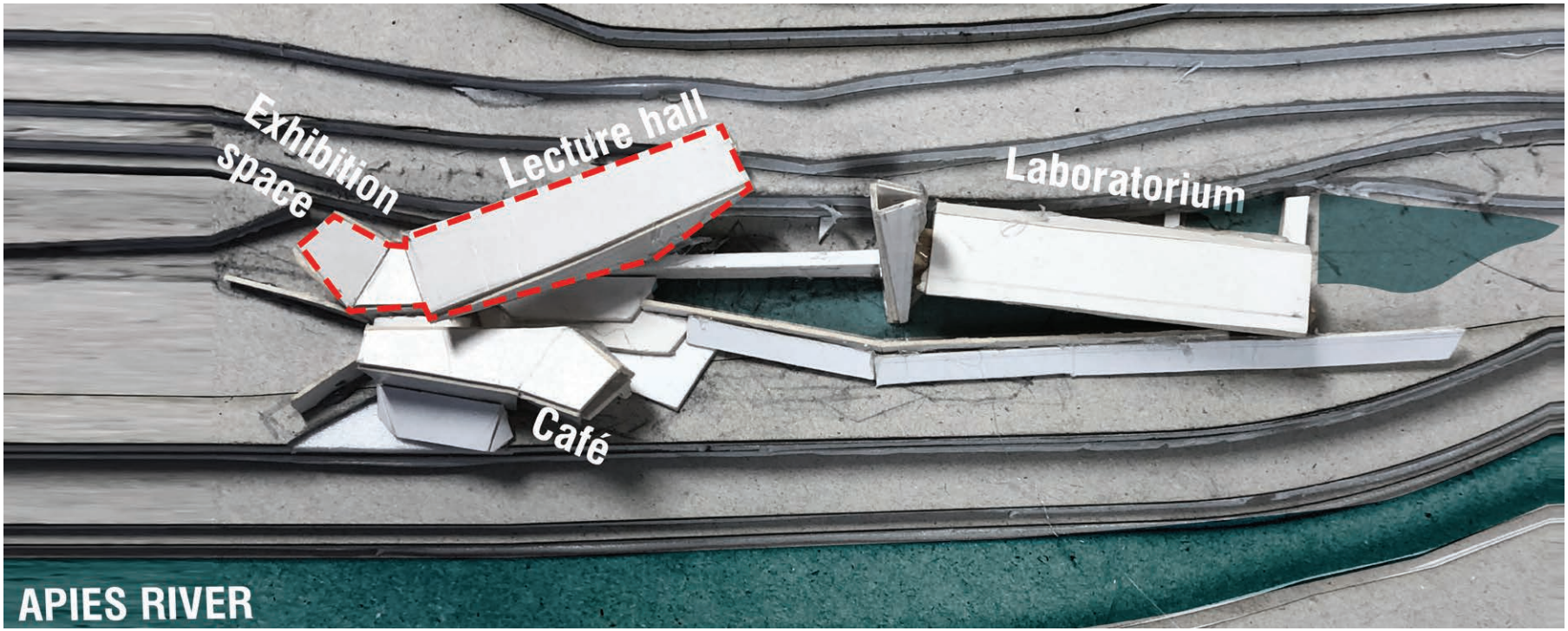
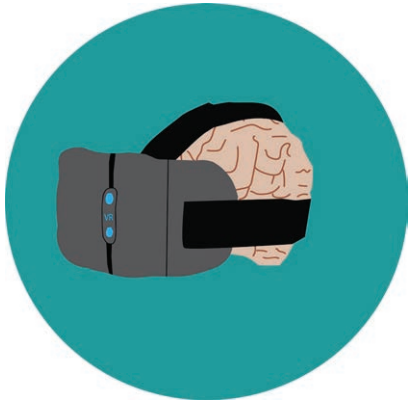


Figure 94: Marquette Learning zones (Author, 2019).

PRODUCTION

Figure 95: Virtual reality company (www.habitatxr.com).



PUBLIC

Figure 96: Immersive learning (www.deepsensemedia.net).

ENVIRONMENTAL AWARENESS

Figure 97: Environmental awareness (www.thenounproject.net).

CHAPTER SIX

DESIGN DEVELOPMENT

INTRODUCTION

This chapter provides and understanding of how the design developed from the design informants provided by the site analysis, framework, precedent studies and the theoretical premise.

BACKGROUND

- Landing

DEVELOPMENT

- Aviary adaptation
- River restoration
- Iterations

Vision

- Renders

BACKGROUND

The project went through a series of iterations starting from the landing experience and the initial idea that slowly developed over time into the final product that would be presented in the end. Each iteration will be explained systematically with the intent to guide the reader through the thought and development process.

LANDING

The landing consisted of the original site analysis and a sketch of the arrival upon the site itself. There after the constraints found on site molded the project. The zoo size was initially overwhelming until a site was identified that could influence the change the zoo needs.

The site is narrow and long with a 20m high southern ridge to the north of the site and the Apies river toward the south of the site posed as barriers that could not be developed on, as the Southern ridge comprised of sensitive flora and the Apies river floods from time to time.

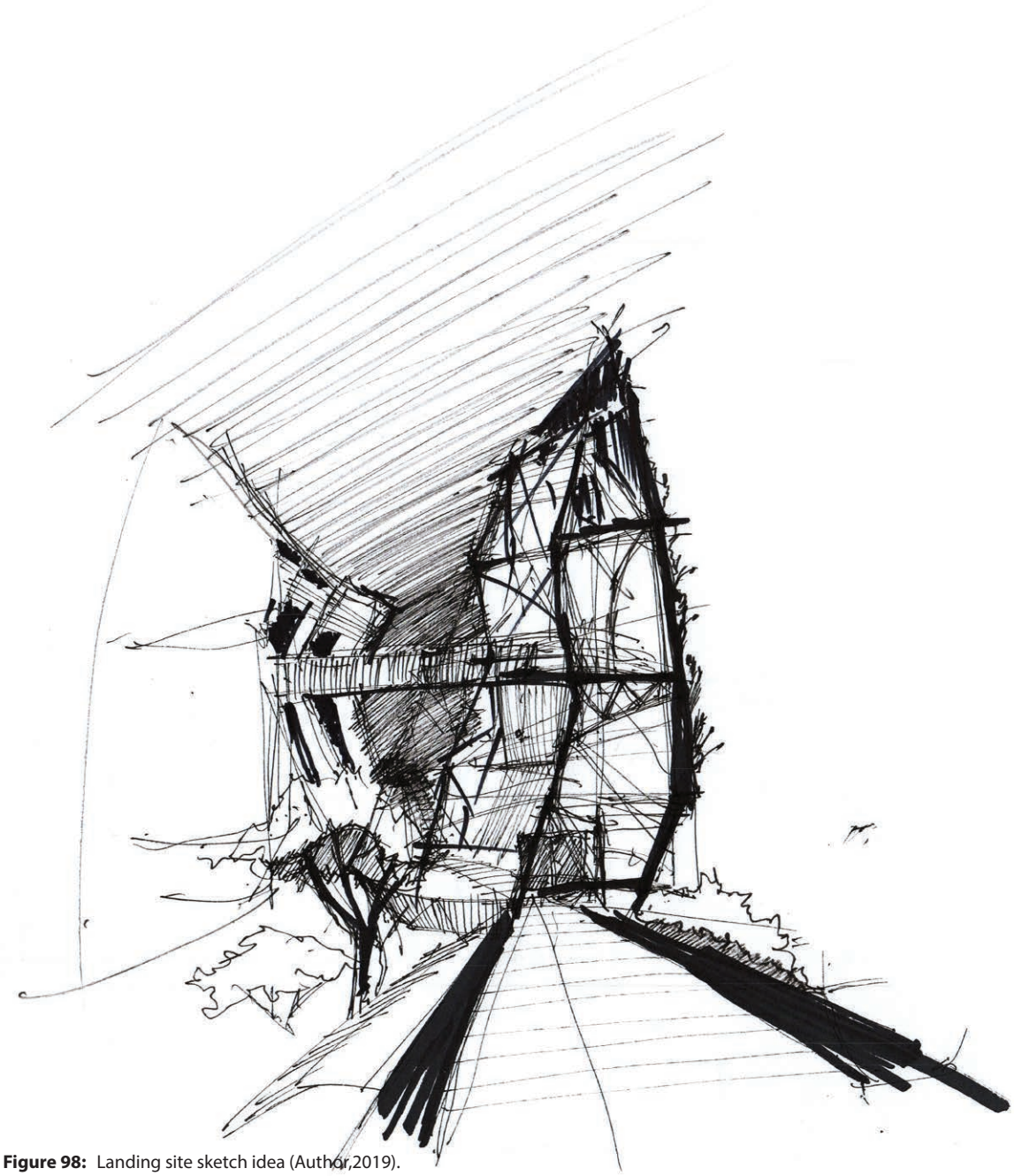


Figure 98: Landing site sketch idea (Author,2019).

1.)Nature caged
2.)Nature killed

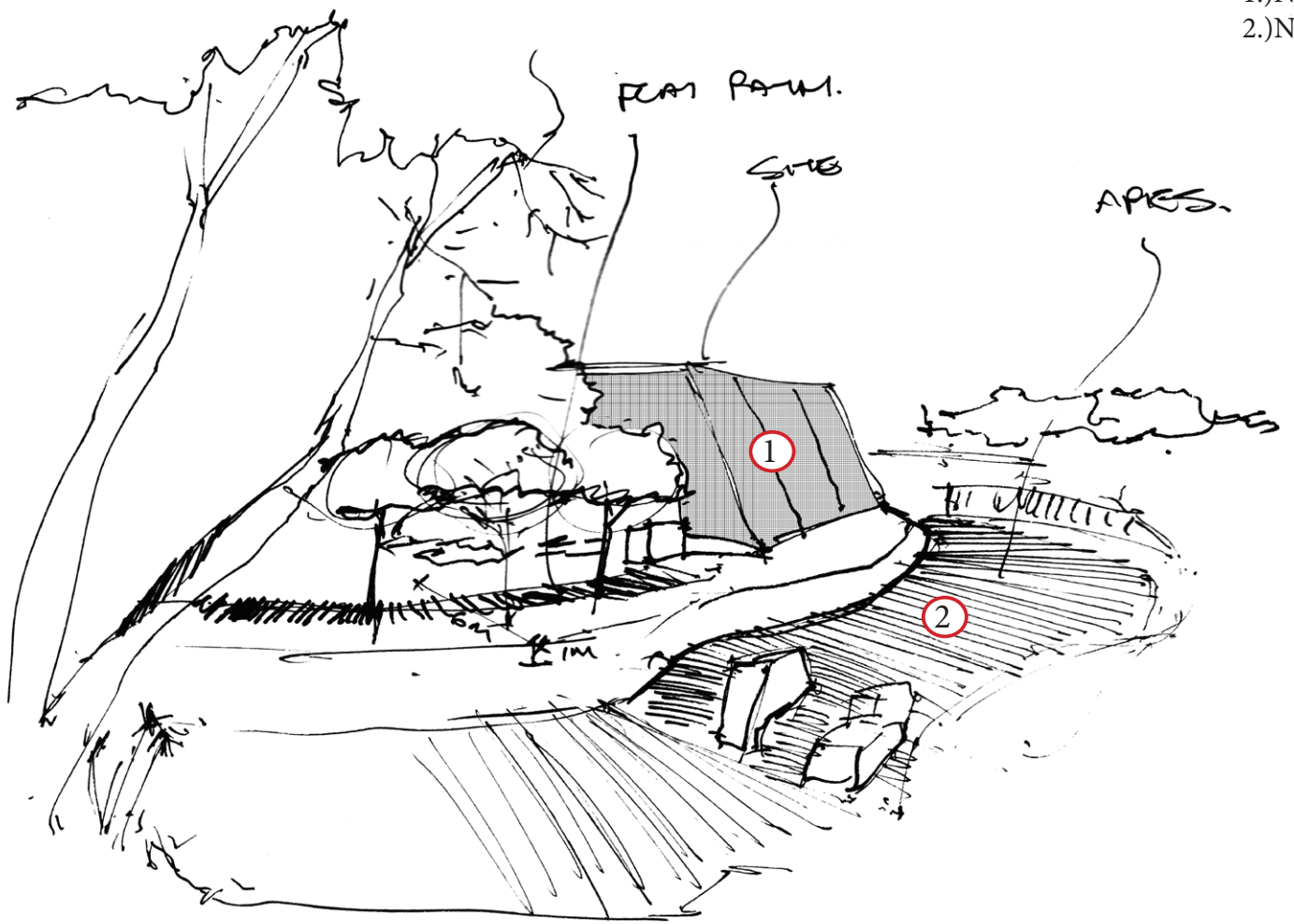
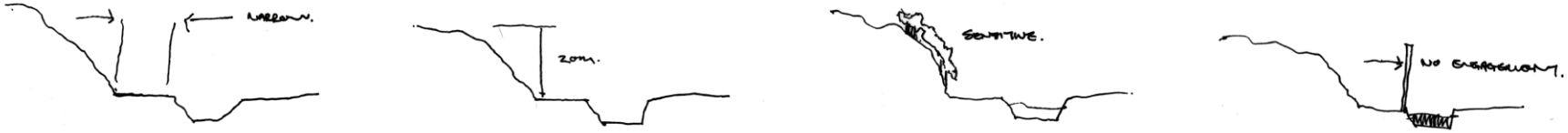


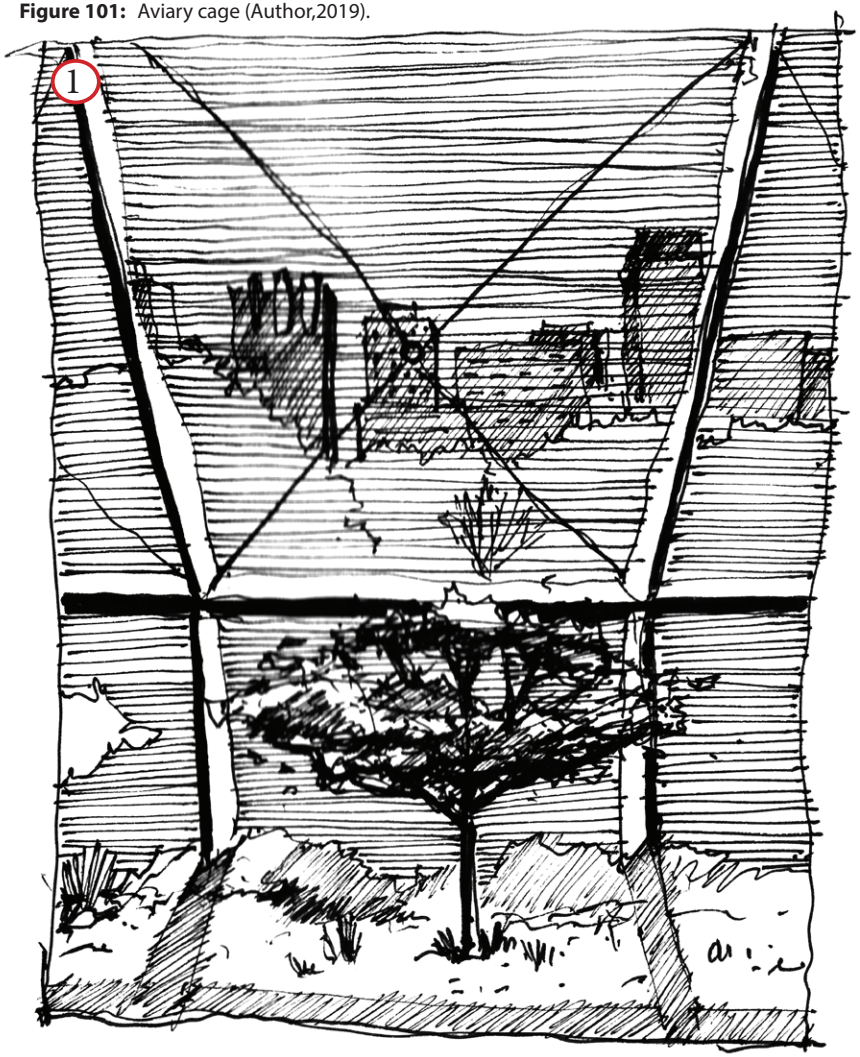
Figure 99: Site conditions and limitations (Author,2019).



Narrow site. High ridge to the North. Sensitive southern ridge. River as barrier.

Figure 100: Site delimitations (Author,2019).

Figure 101: Aviary cage (Author,2019).



DEVELOPMENT

AVIARY ADAPTATION

The aviary in the zoo was by far the best installation for the views it provided of the city and the amount of birds it housed that could be viewed fromm multiple levels. Yet it failed to teach people about the habitat and kept vital exterior influences outside of the cage. This condition shows man's control over its environment and adds to the fragmented landscape found outside of the aviary.

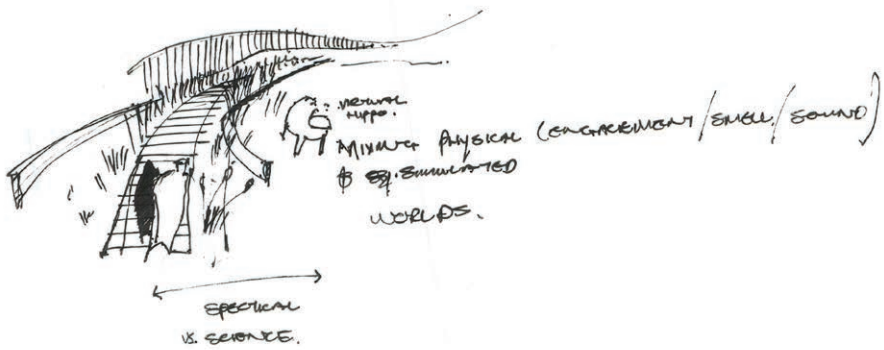


Figure 102: Exploration of connecting landscape (Author,2019).

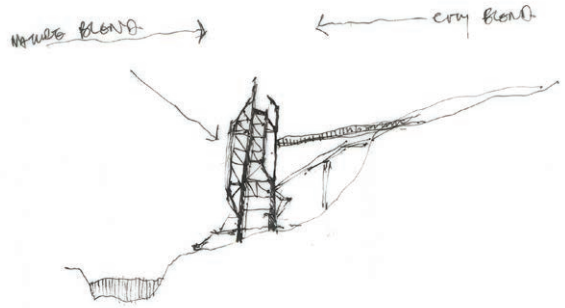


Figure 103: Visual city connection (Author,2019).

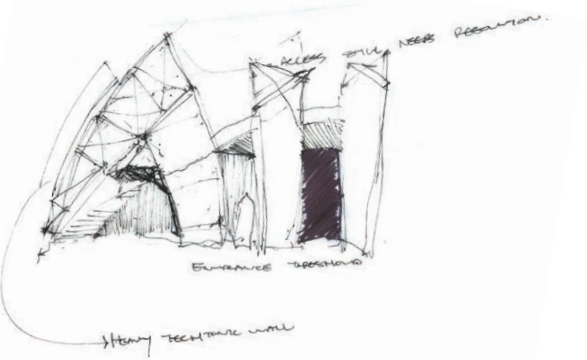


Figure 104: Building immersion (Author,2019).

STRATEGIES

Because birds and frogs are a vital part to the design, as identified in the client chapter, the design should aim to bring people closer to the specimens as well as their environment through immersive walkways and viewing portals. The idea is to fuse science and the wonders of the natural habitat.

The vertical element of the aviary provided a connection to the city from the site and should be retained in some form. This also serves as an articulation point for visitors as it could guide them through the site and mediate between public and private or research and general learning.

The building should aim to give users a new perspective of animals and how they are viewed. Spaces should be directly related to the viewed species and should therefor be unique in its articulation and engagement of the site.

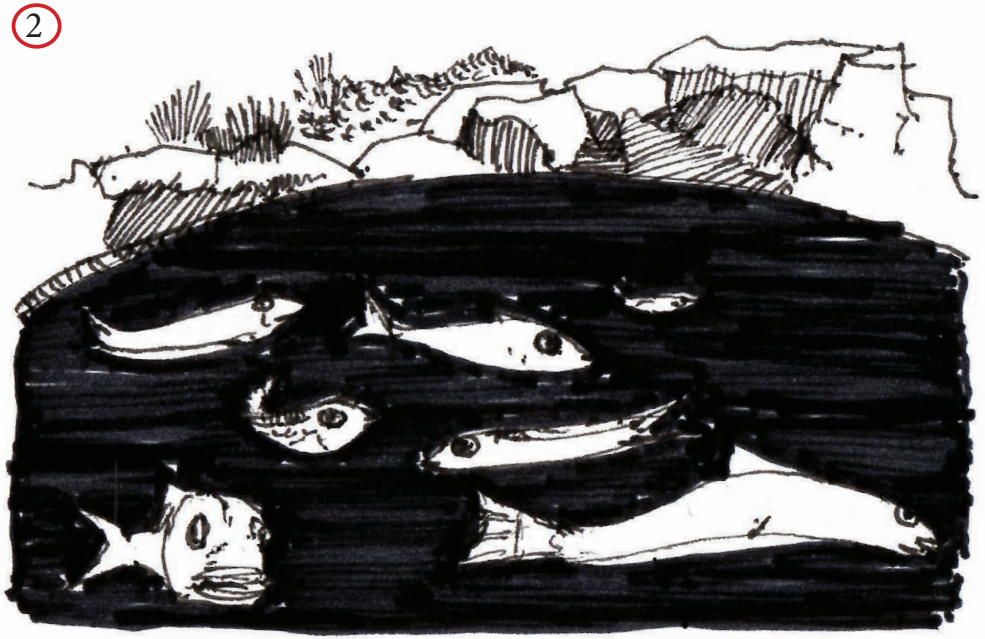


Figure 105: Apies river condition(Author,2019).

RIVER RESTORATION

Considering the current status of pollution within the Apies river, it being a monument to the establishment of Pretoria and the role it plays as a connector of the landscape it had to form part of the project and its projected role within the urban framework. The first aims is to restore the river bank and through a series of wetlands restore the water quality within the river itself.

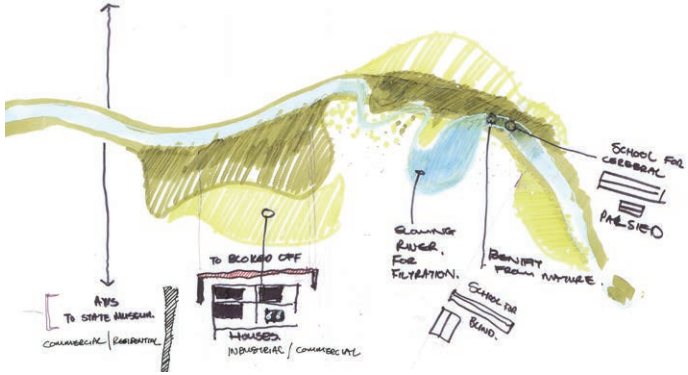


Figure 106: Site development (Author,2019).

Figure 107: Social engagment (Author,2019).

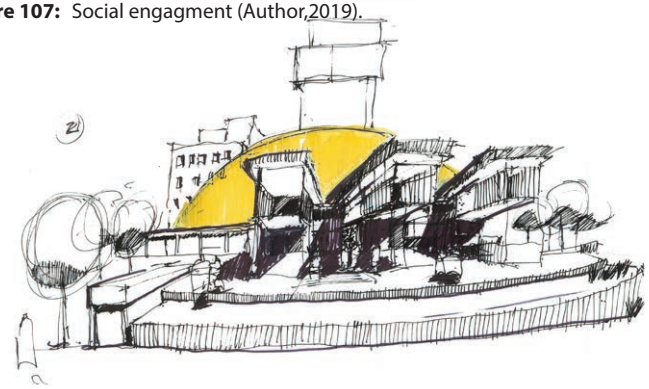


Figure 108: River as economical asset (Author,2019).

STRATEGIES

The restoration of the river banks should benefit the community and add to the quality of the river walk by reintroducing indigenous flora to the area.

Both sides of the river should be able to engage with the river in some manner, be it with their landscaping or their architecture.

The building and its landscaping should be water conscious and able to contribute to the eco-system through social engagement, processes and learning.

ITERATION 1

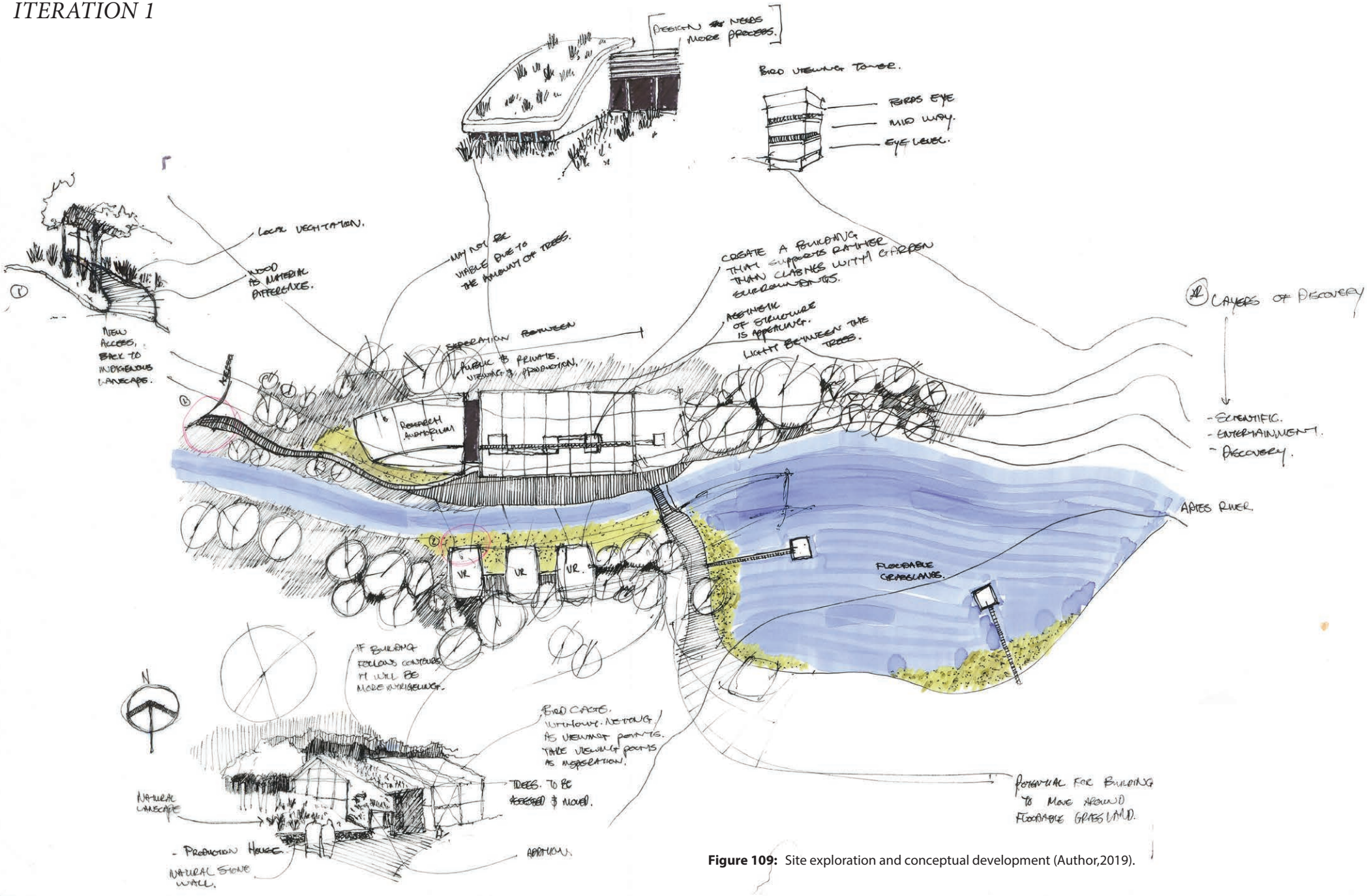


Figure 109: Site exploration and conceptual development (Author,2019).

Figure 110: Scale of site to big (Author,2019).

REFLECTION CHANGES

The initial landing made it clear that the scale of the intervention would be too big to look at sufficiently and thus the scale of the project needed adjustment. In this phase the program was sorted out and an additional site visit helped determine the necessary scale.

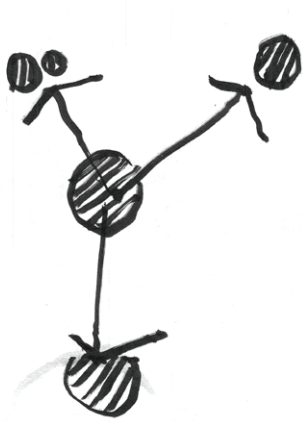


Figure 111: Program distance to vast (Author,2019).

The program distances proved to be too far apart from each other and had legibility issues. The scaling of the project helped to readjust the spacing of the programs within the project in the next iteration.

Figure 112: Water flow (Author,2019).

The original quantity of water that was assumed to enter the site was wrong. The Apies river is a seasonal river that receives large quantities of water during summer and is reduced to a small spring that is mostly fed from the Fountain's valley spring. To demonstrate the cleaning capabilities of a wetland, a small amount would be diverted and cleaned through a wetland where it would be reintroduced to the river at the end. The idea is that the wetland would eventually be self supported from the water that the ridge receives.

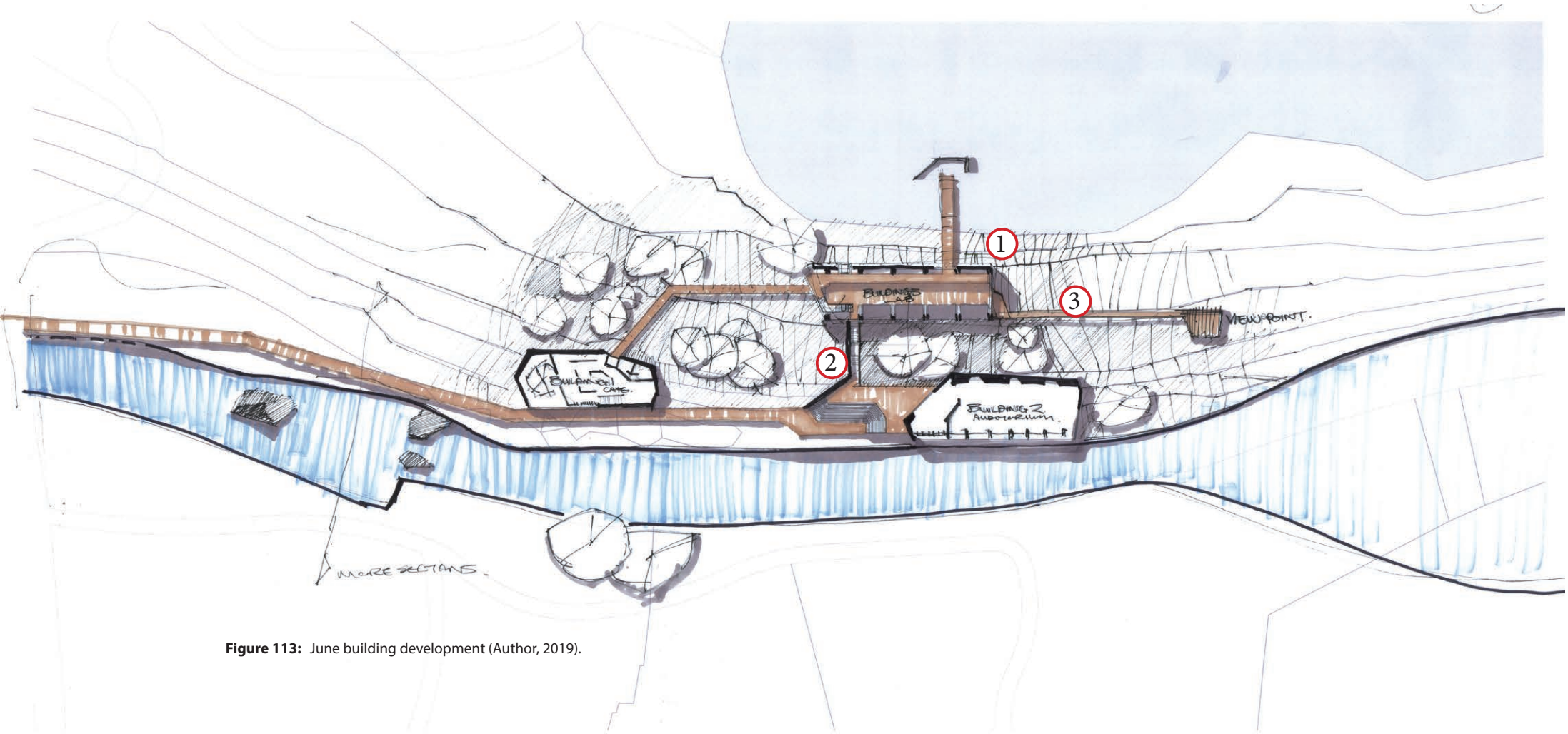
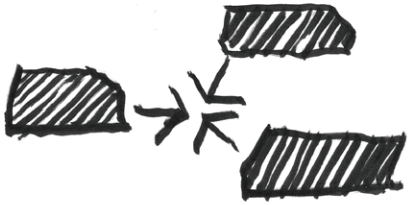


Figure 113: June building development (Author, 2019).

Remove from sensitive area

Figure 114: Remove from sensitive area (Author, 2019).



Bring buildings closer together

Figure 115: Bring buildings closer together(Author, 2019).

Engage with river

Figure 116: Engage with river (Author, 2019).

REFLECTION CHANGES

After speaking to experts of the area it was deduced that building on the southern slope of the ridge would be out of the question due to the sensitivity of the vegetation that occurs on the ridge. The intervention had to make use of that long, yet narrow, site that was already cleared for the current aviary.

The original intent of the separate buildings still seemed too fragmented and would create too much level change and unwanted decks in an already sensitive landscape.

The engagement of the program to the river is a vital aspect to the design and should therefor be incorporated better to signify the importance of the Apies river and its role within the habitat.

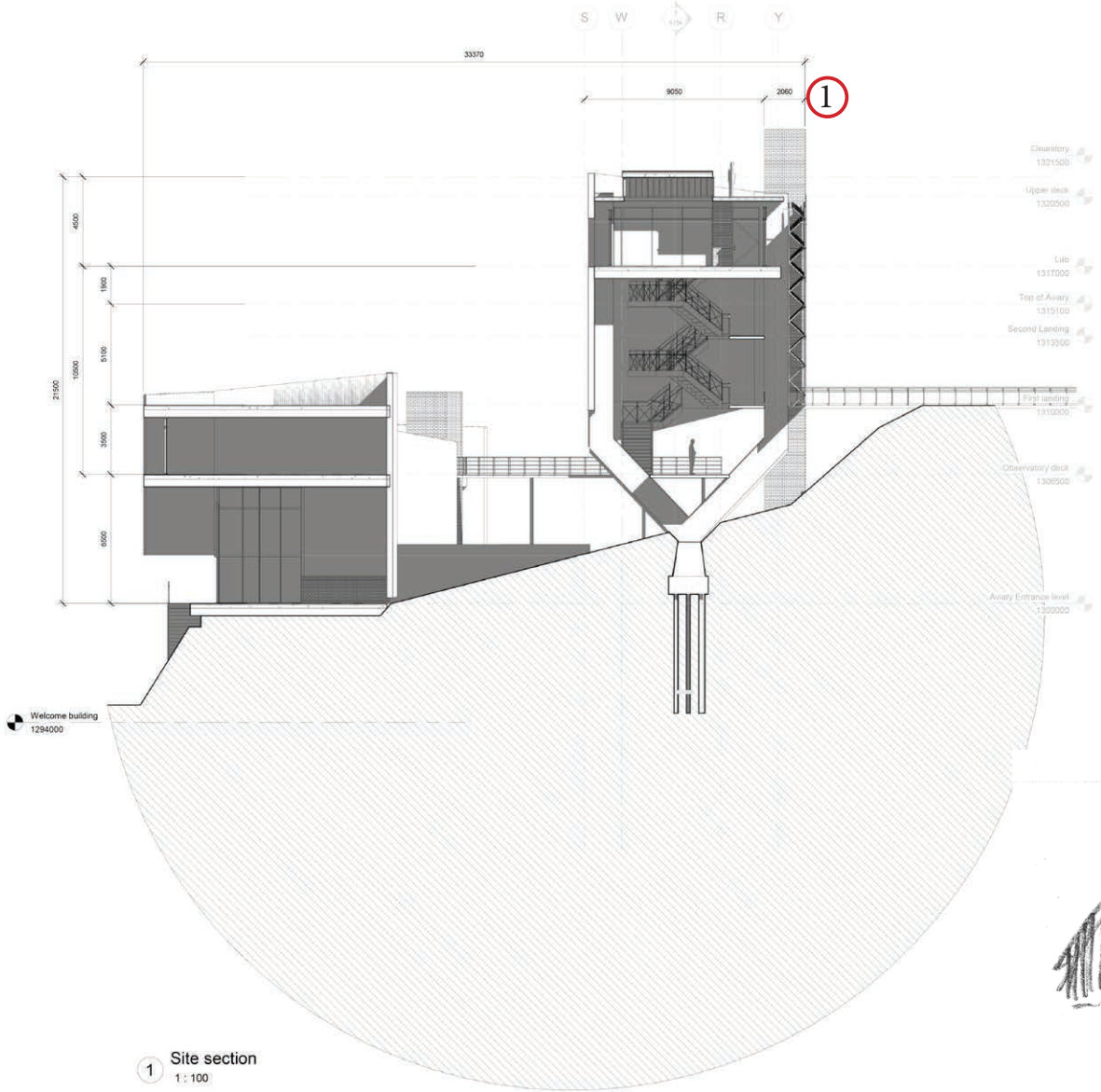


Figure 117: June section (Author, 2019).

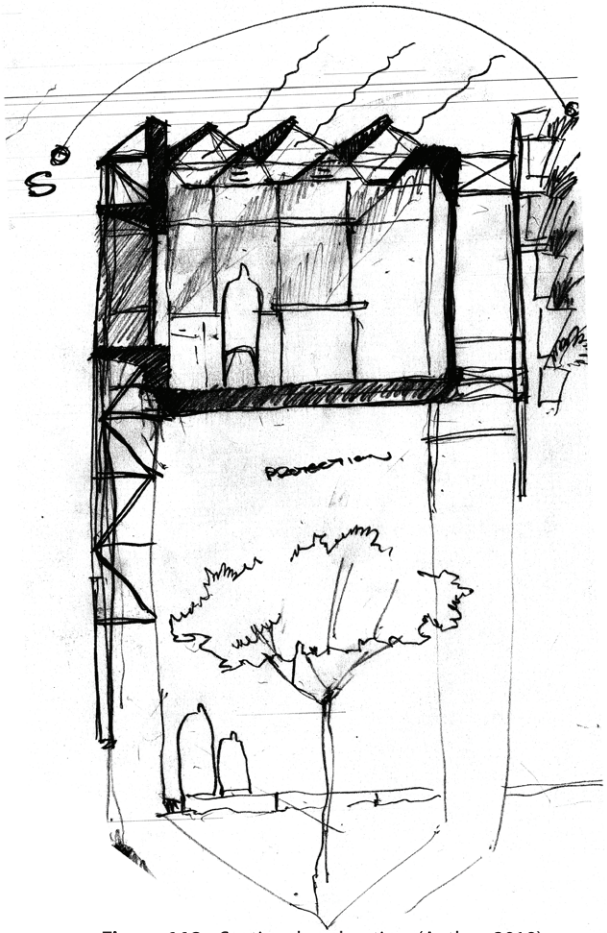


Figure 118: Sectional exploration (Author, 2019).

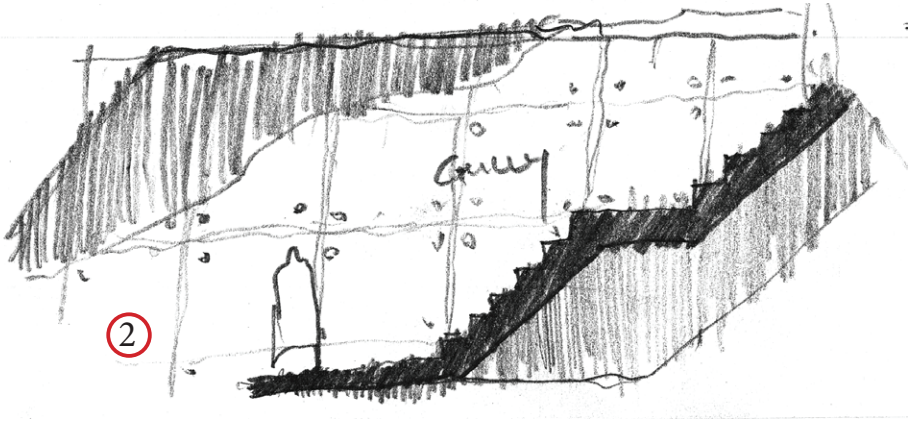


Figure 119: Immersed access (Author, 2019).

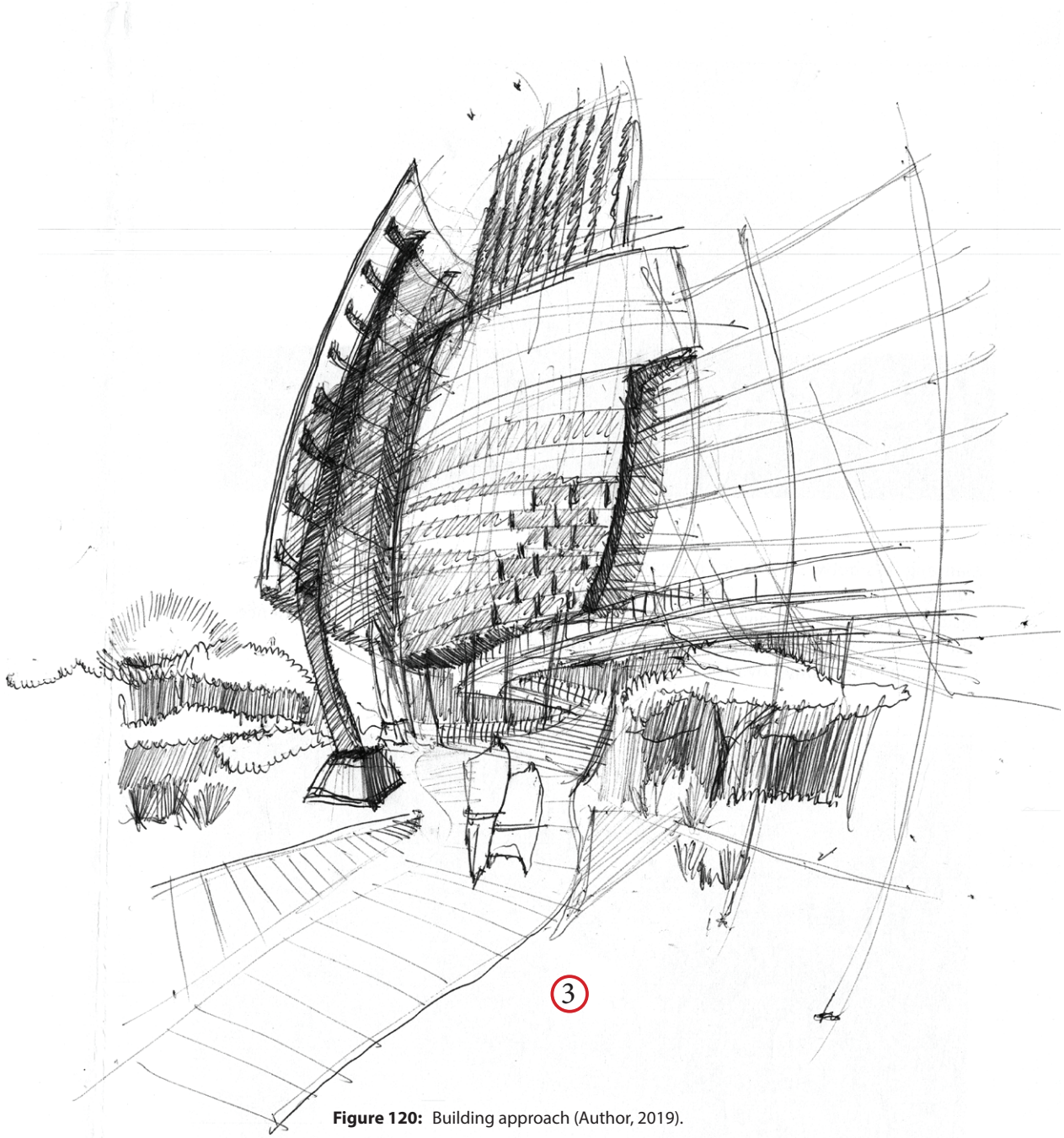


Figure 120: Building approach (Author, 2019).

EXPLORATION

1. The intent was for the building to touch the site lightly and to elevate it from the sensitive landscape but it had and adverse effect. The concept was revisited throughout the development of the design to find a solution to working with the site in a constructive way.
2. The idea of immersion within the landscape is a recurring theme and it looks at how the user could be influenced in different ways to affect the way they see their natural environment and how it works.
3. The early design of the building wanted to make a statement that advocates the importance of working with nature - a building that becomes a triumph for the wonders of nature.

ITERATION 3

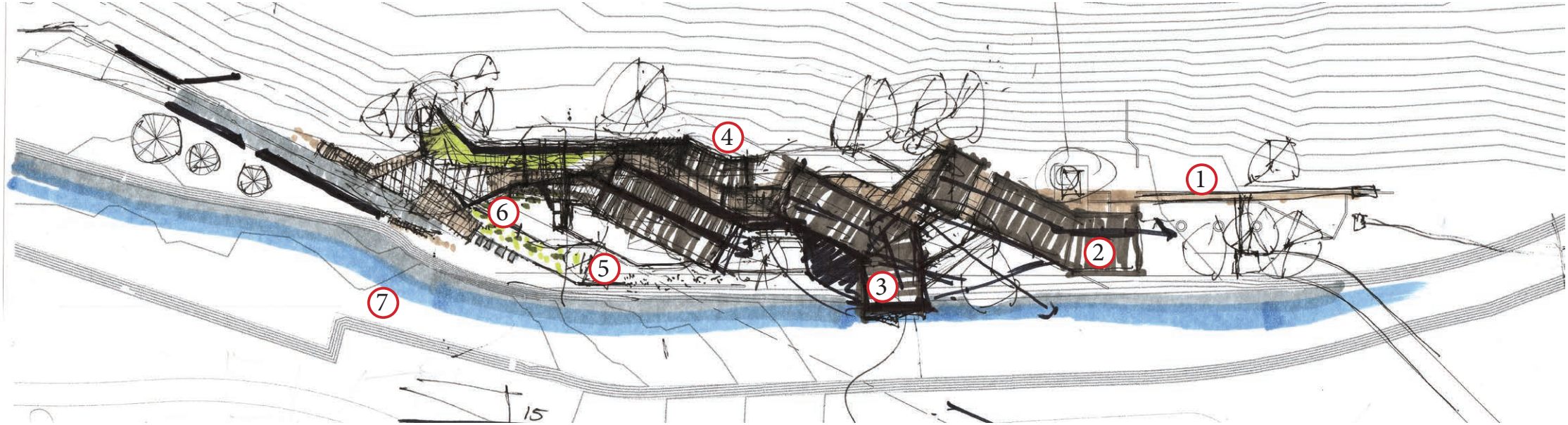


Figure 121: Reduced site footprint exploration (Author, 2019).

Figure 122: Building scale issue (Author, 2019).

Figure 123: Building form seems unnatural in nature (Author, 2019).

Figure 124: Buildings don't allow user and nature integration (Author, 2019).

REFLECTION CHANGES

The iteration's site and program scale seems adequate but the buildings lack variation and appear to uniform. Referring back to the precedent studies summary, the building still does not adapt to the site and seems out of place.

As mentioned in the previous statement, the building seems out of place in nature and needs to adapt tot he site and integrate program people and the elements surrounding it.

The layout allows for the best possible use of the site while still considering the orientation of all of the buildings towards the north. The failure to engage the public in the process of moving through the site will ultimately affect the usability of the intervention and the arguments supporting it.

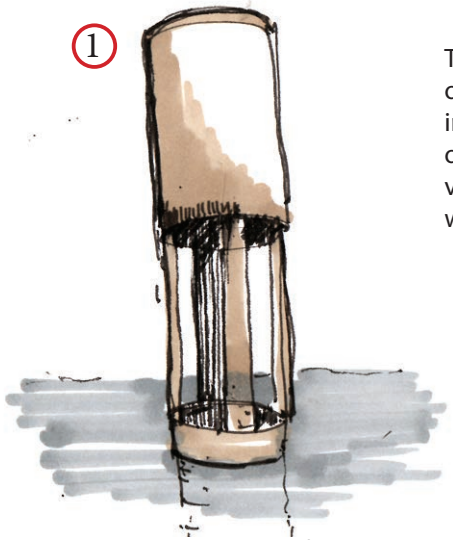


Figure 125: Drainage cover (Author, 2019).

The wetland system needed a way of spilling over onto the next pond for the next step in the filtration process and the following overflow was an attempt to make the process visible and to make it a marker within the wetland itself.

Figure 126: Permeable material (Author, 2019).

The planting pallet is a visual element to the landscape as much as it is a functional element and was considered in the design process to allow the users to experience the indigenous landscape through immersion .

The observation area of the building would allow different viewing positions for the users to get as close to the species as possible.

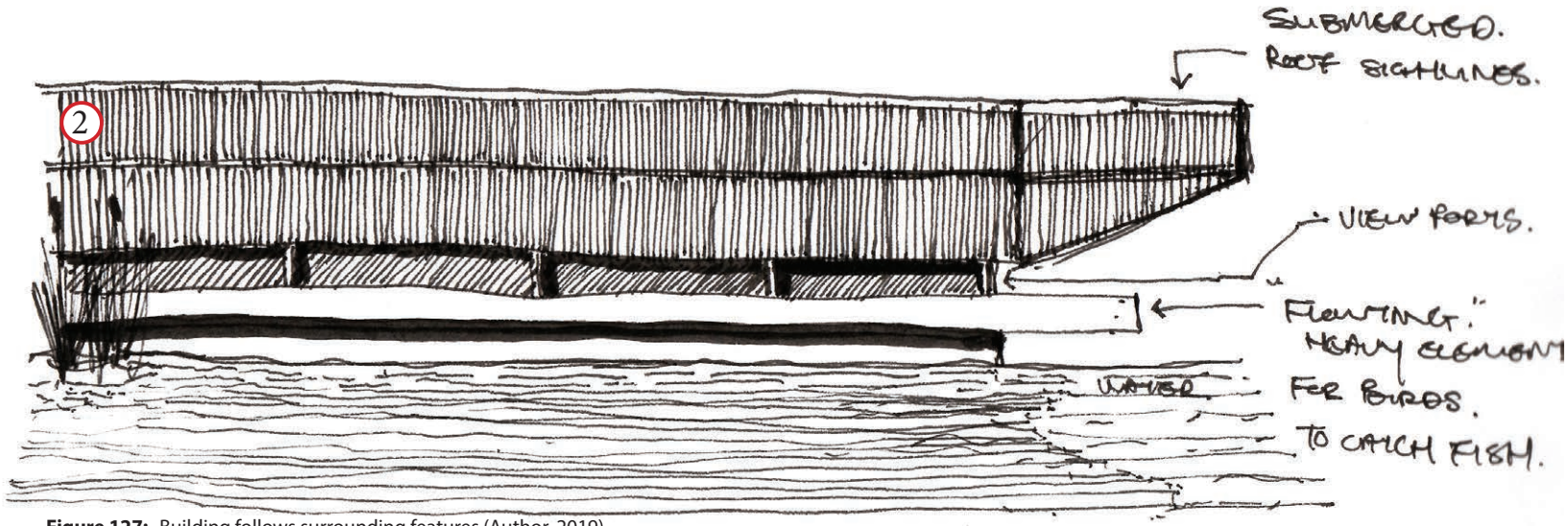
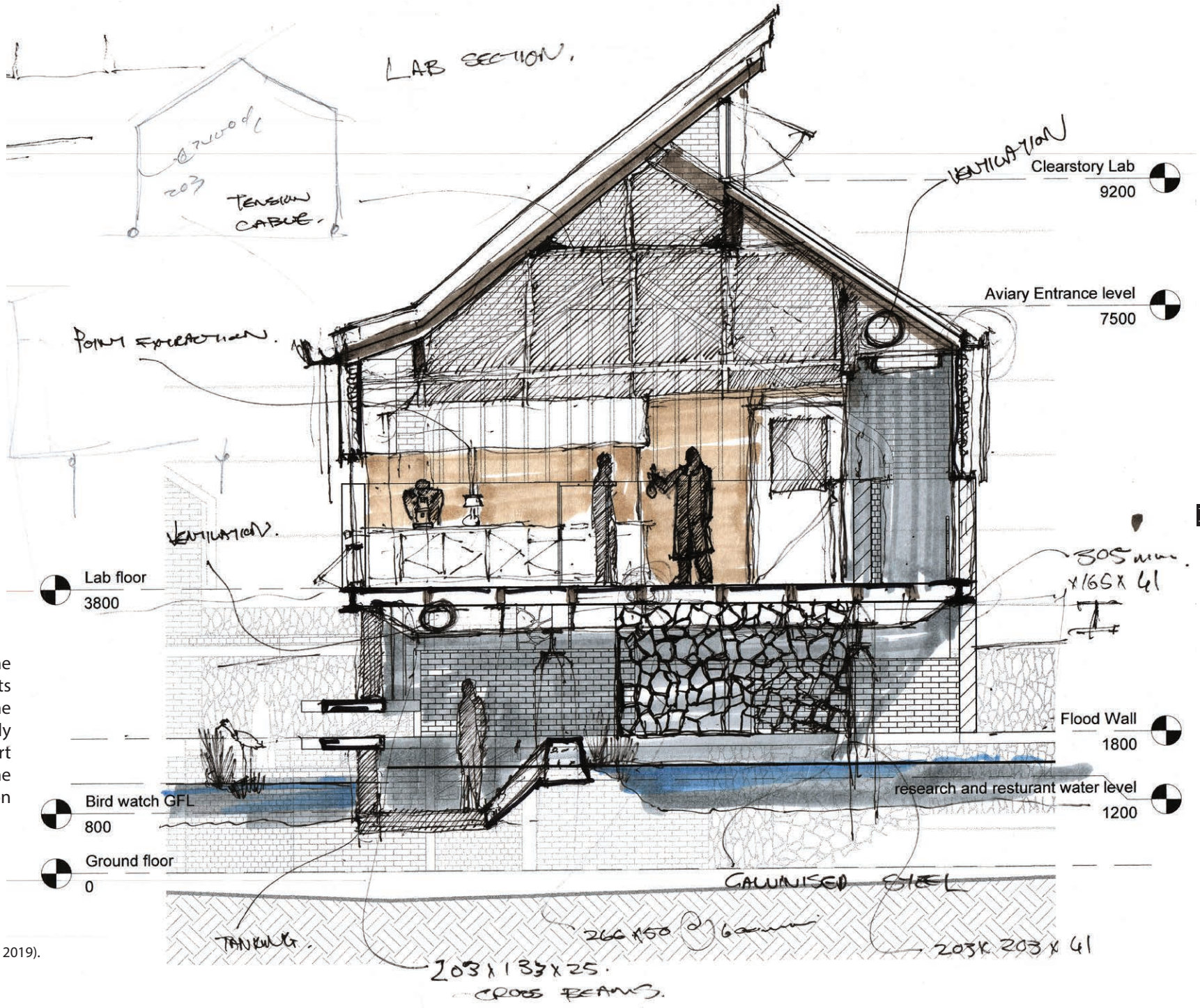


Figure 127: Building follows surrounding features (Author, 2019).



3

The iteration looked at the potential of merging elements of the research facility with the aspects of public, as essentially the observer is as much part of the scientific process as the scientist is of the observation process.

Figure 128: Research facility (Author, 2019).

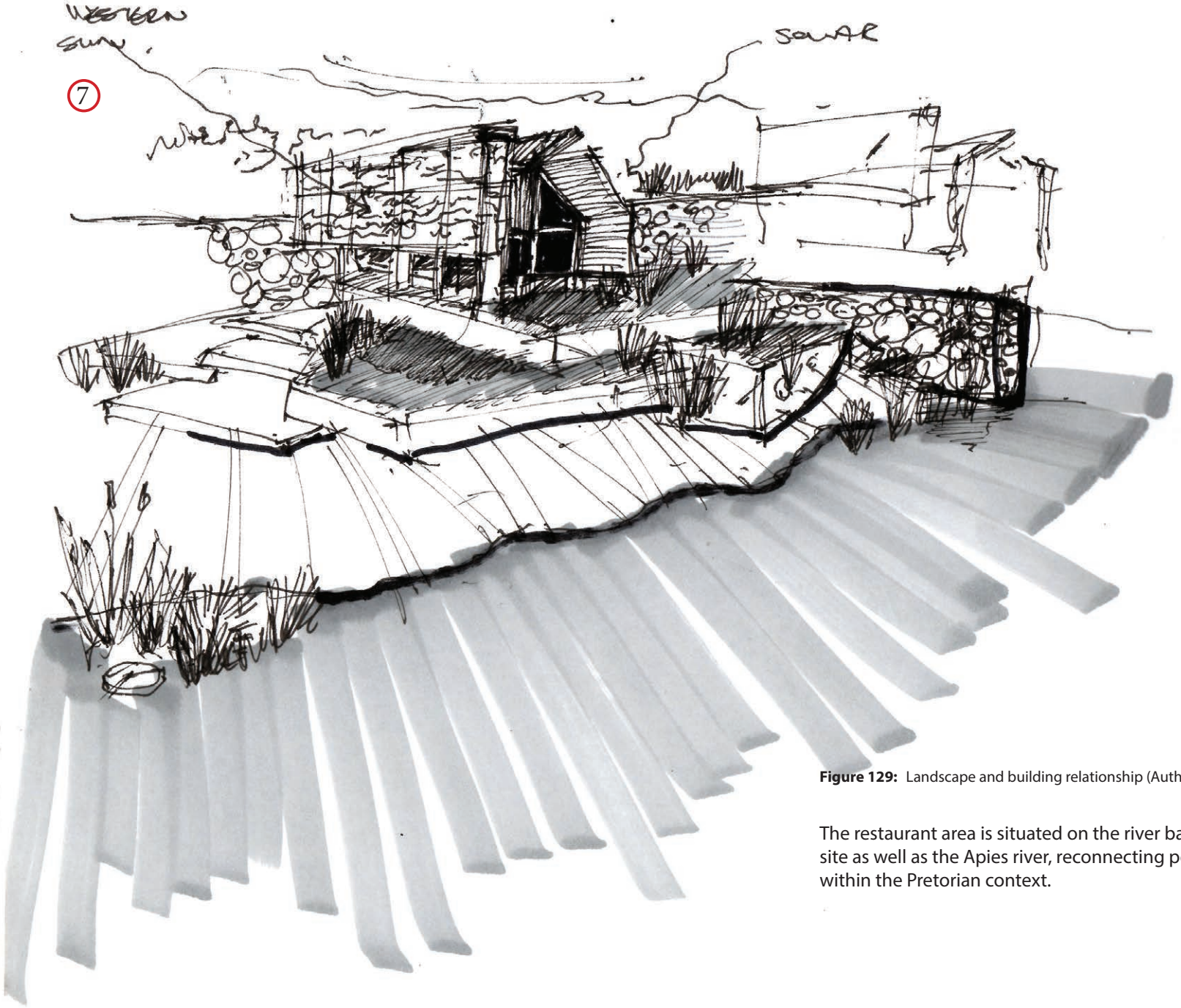
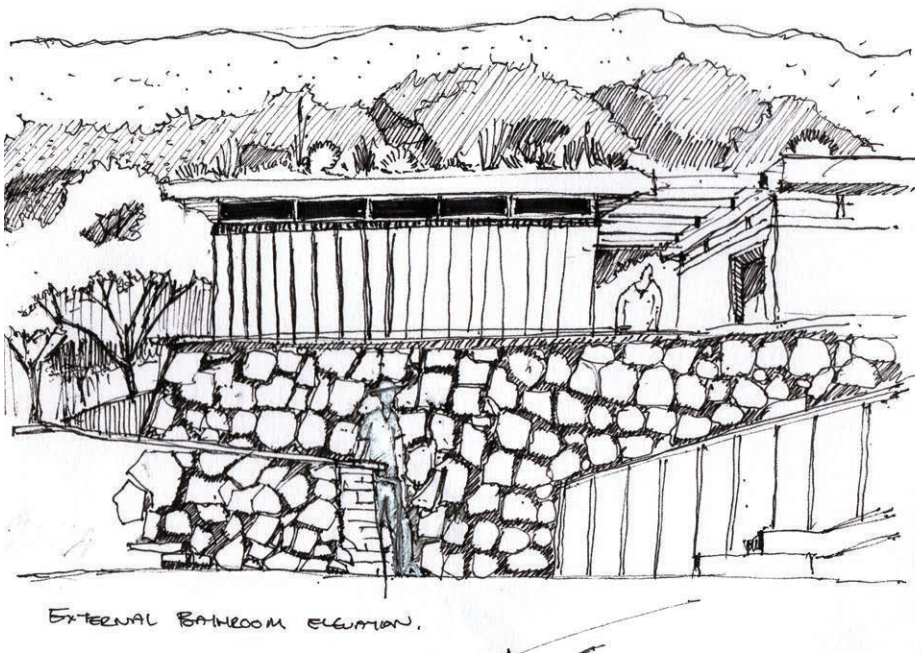


Figure 129: Landscape and building relationship (Author, 2019).

The restaurant area is situated on the river bank and looks out onto the restored site as well as the Apies river, reconnecting people to an important element within the Pretorian context.



4 **Figure 130:** Materiality of building within landscape (Author, 2019).

6 **Figure 131:** Approach from main walkway (Author, 2019).

The building on approach should blend into the landscape making use of materials that come from the context as well as materials that blend rather than juxtapose.

As people approach the building it should slowly start to reveal itself from the landscape it sits within. Landscape and building merge to become one, both work in unison to create a balance of building, nature and discovery.

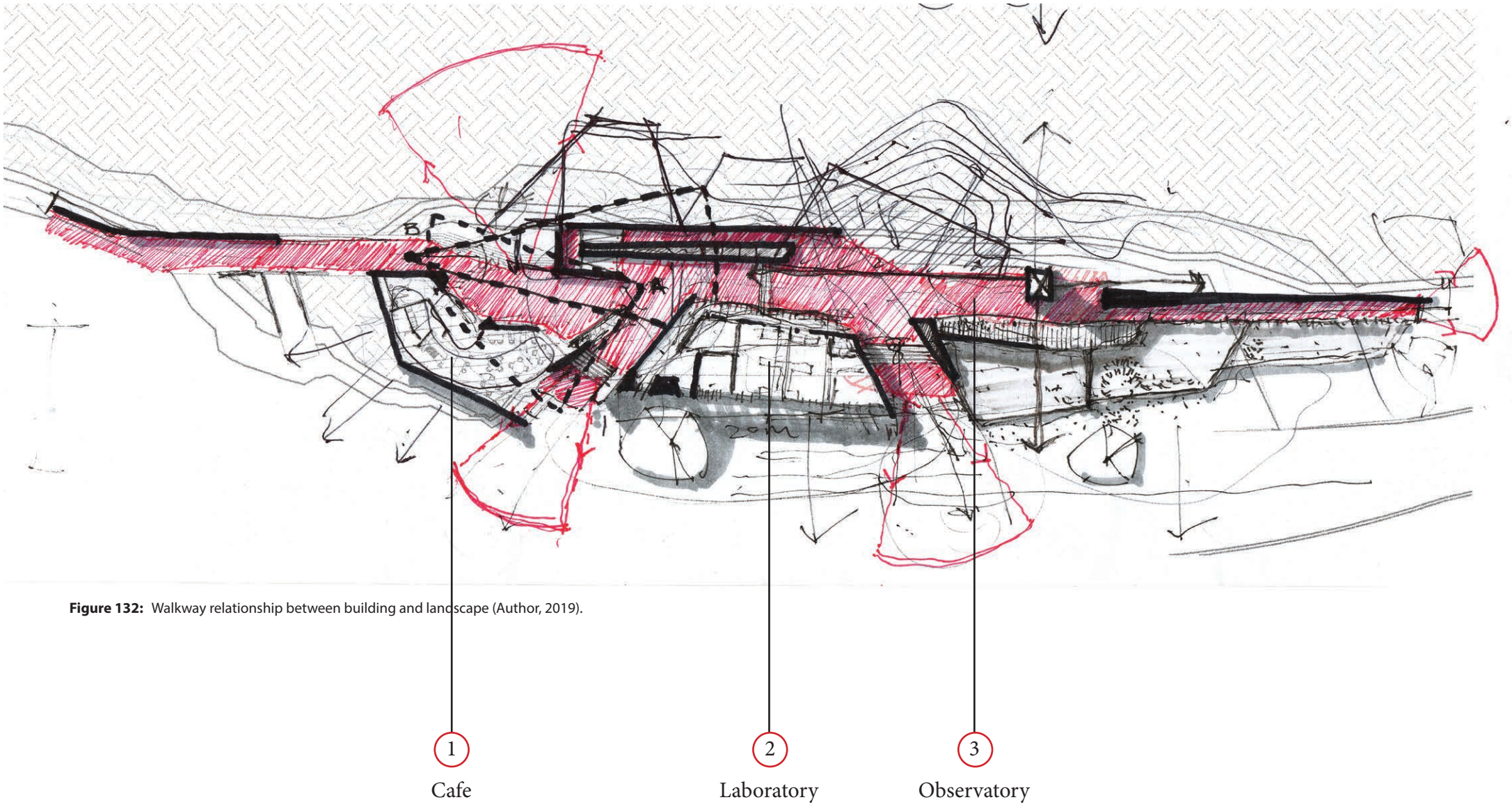


Figure 132: Walkway relationship between building and landscape (Author, 2019).

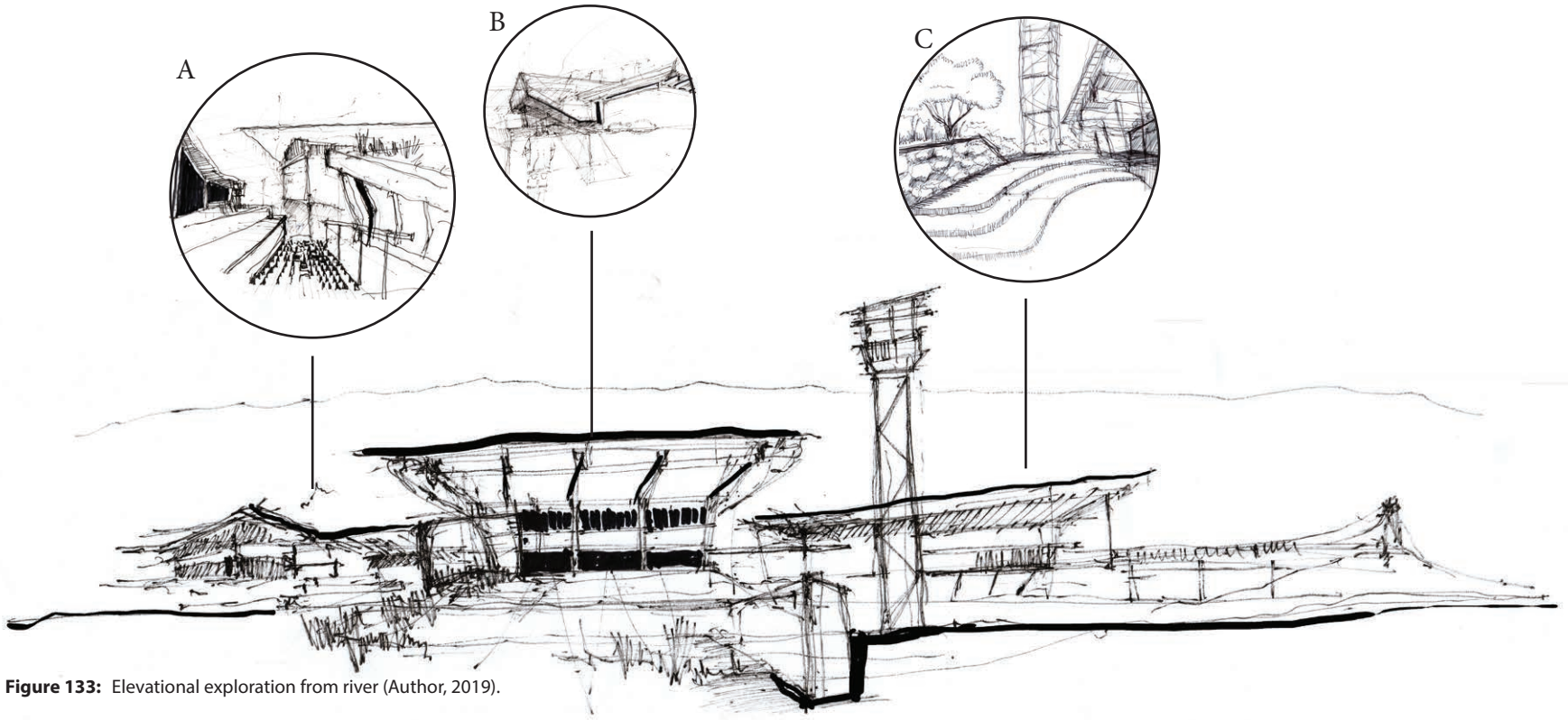


Figure 133: Elevational exploration from river (Author, 2019).

EXPLORATION

A

The route through the site is one that is seen as a mediator between the built and natural environment. The visitor is elevated above the natural ground level which is connected throughout the site and isn't hindered by the building itself. The grid allows the natural flora to protrude the walkway and to connect the user to the site.

EXPLORATION

B

The research lab had to be accessible for both the researcher and the public. This will spark the curiosity of some people as to what is being done on site and how they could potentially engage in some educational or volunteer manner.

EXPLORATION

C

The pause zones between the building and nature have to integrate seamlessly. People shouldn't be able to distinguish between natural and fabricated parts. The technological concept has to integrate these principles seamlessly.

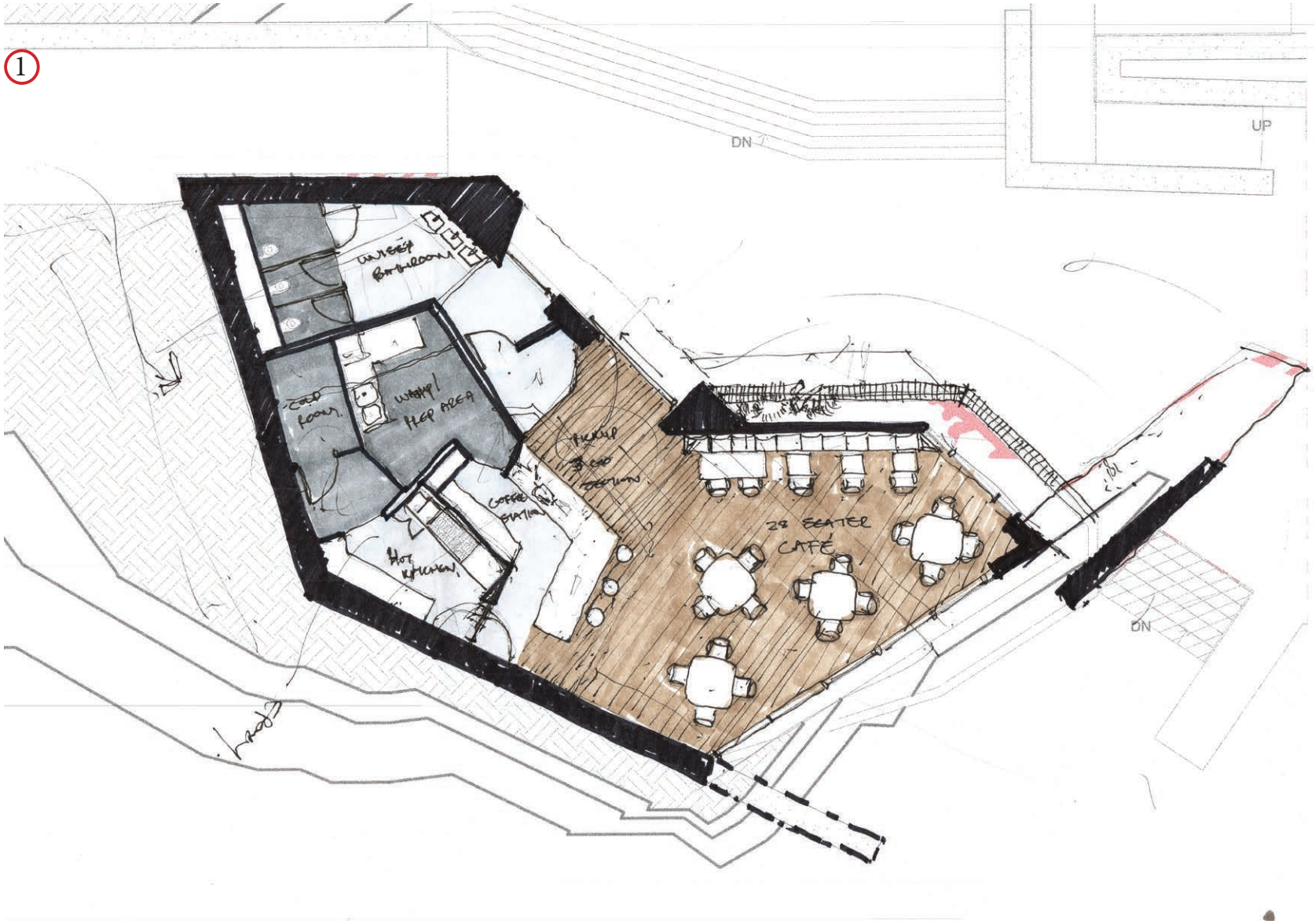


Figure 134: Cafe internal layout (Author, 2019).

Figure 135: Cafe approach perspective (Author, 2019).

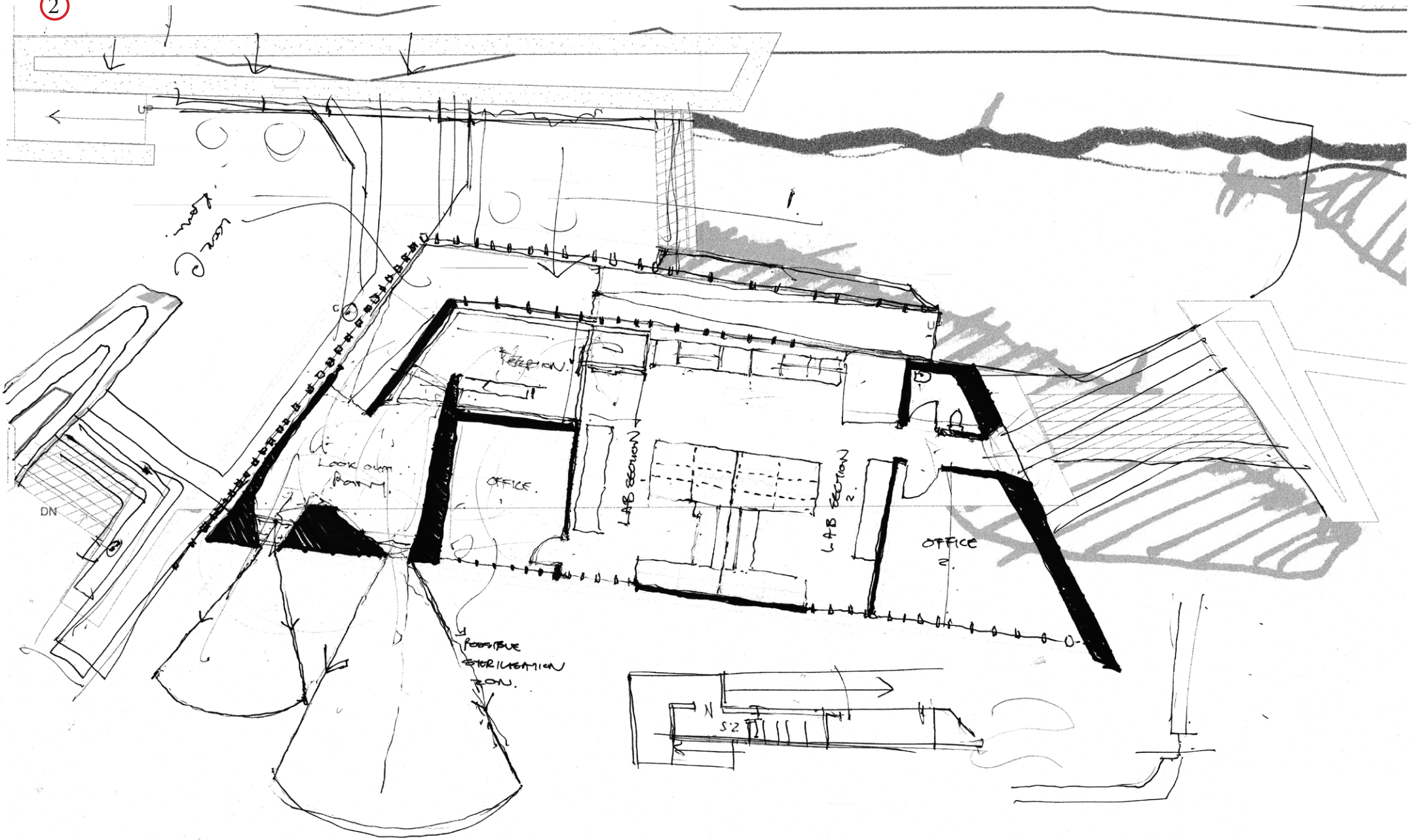


Figure 136: Laboratory plan exploration (Author, 2019).

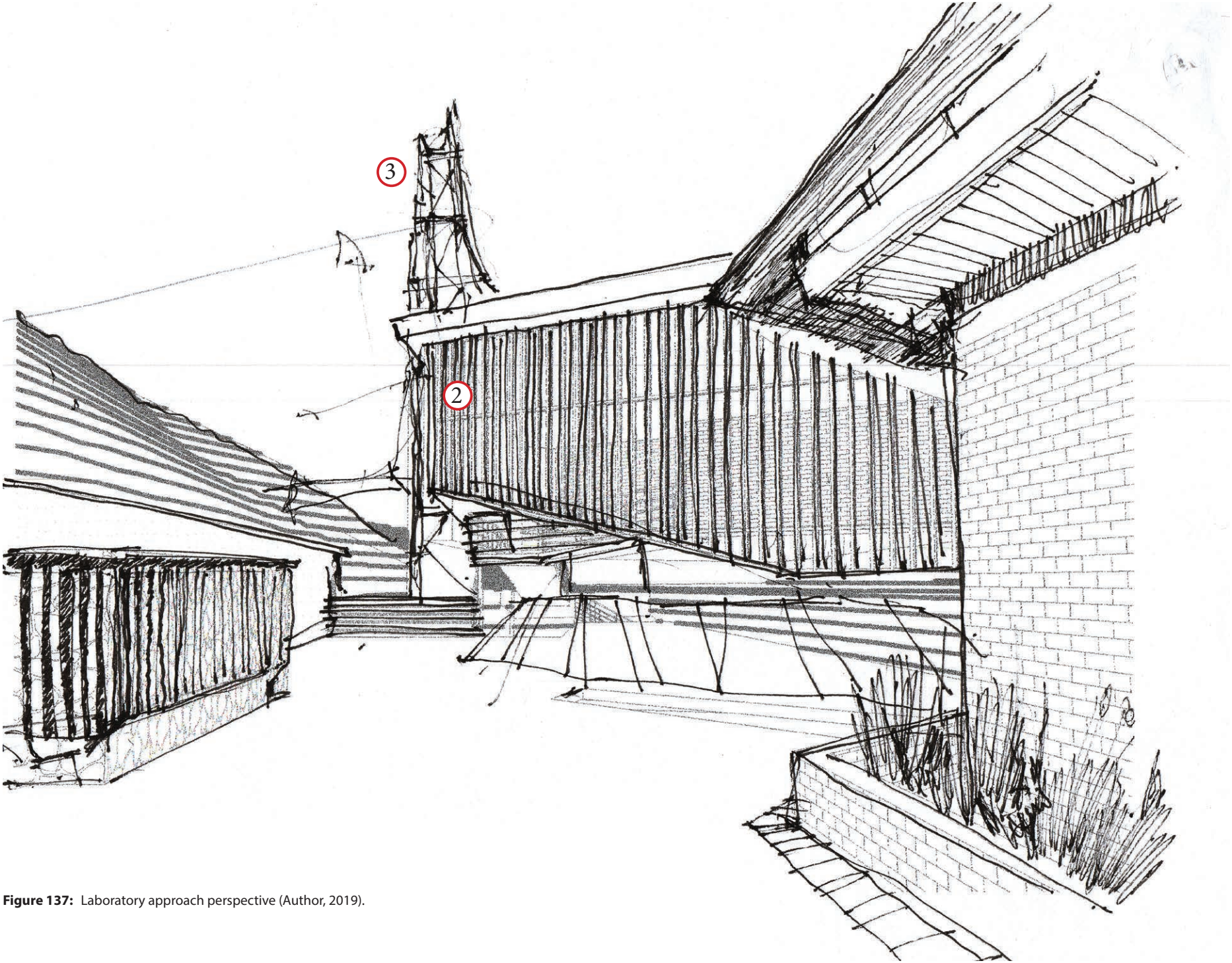


Figure 137: Laboratory approach perspective (Author, 2019).

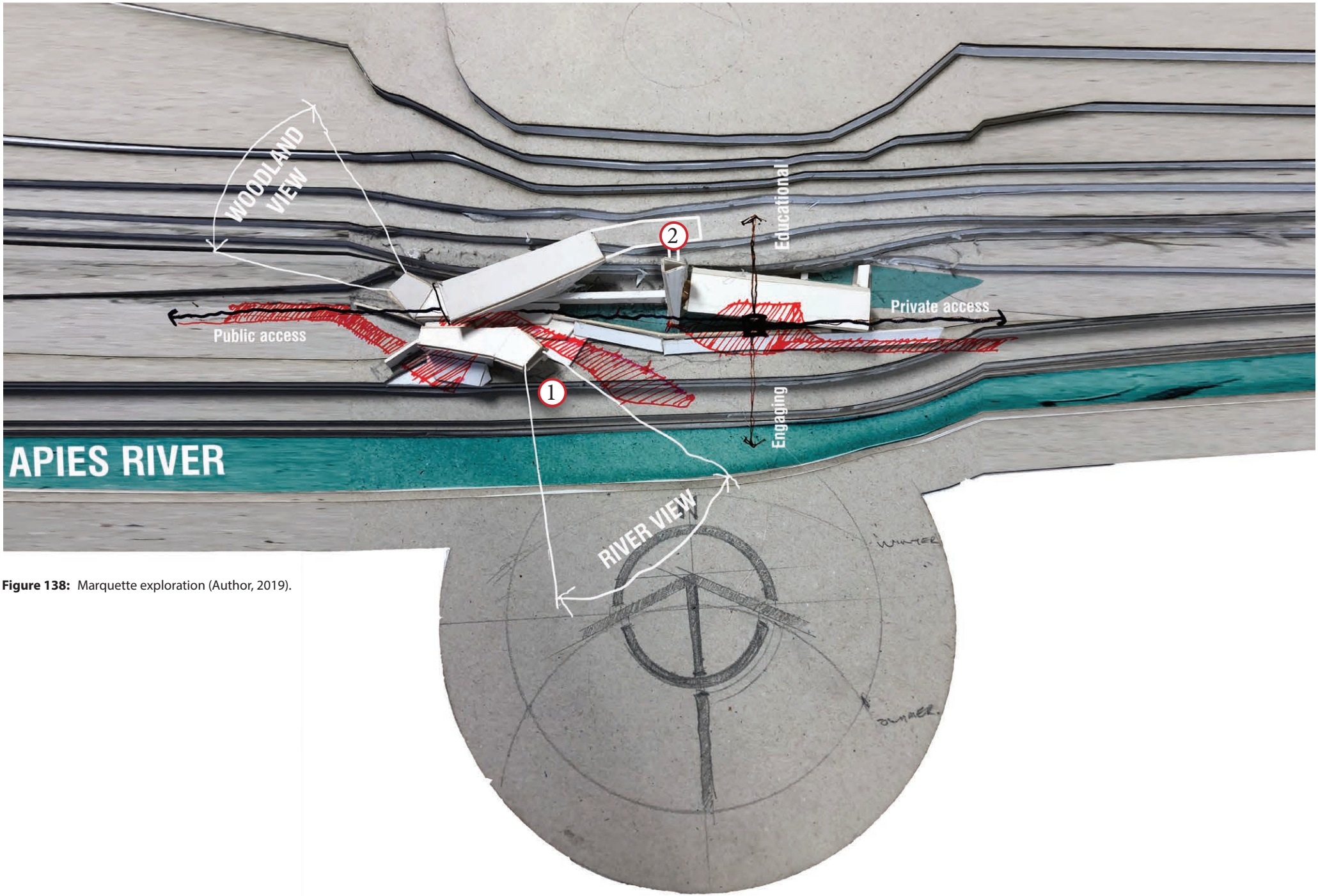


Figure 138: Marquette exploration (Author, 2019).

Figure 139: Marquette approach exploration (Author, 2019).

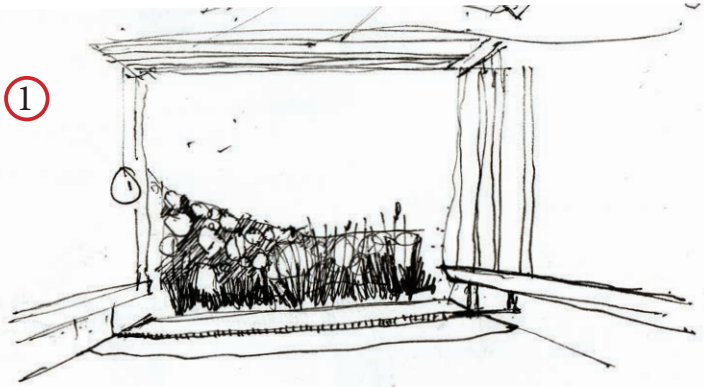


Figure 140: Framed landscape views (Author, 2019).

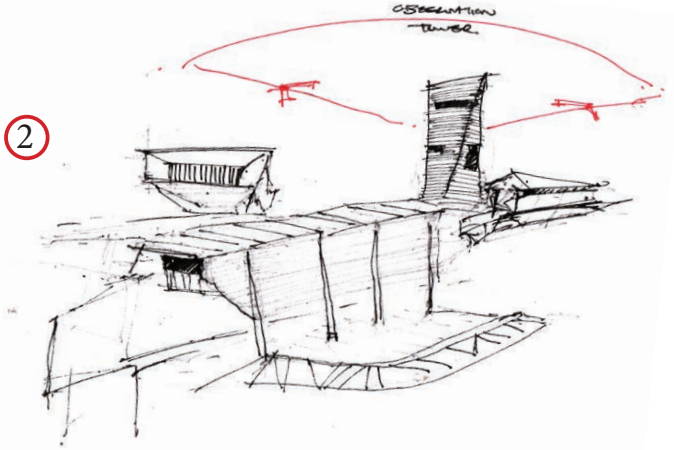


Figure 141: Observation tower view range (Author, 2019).

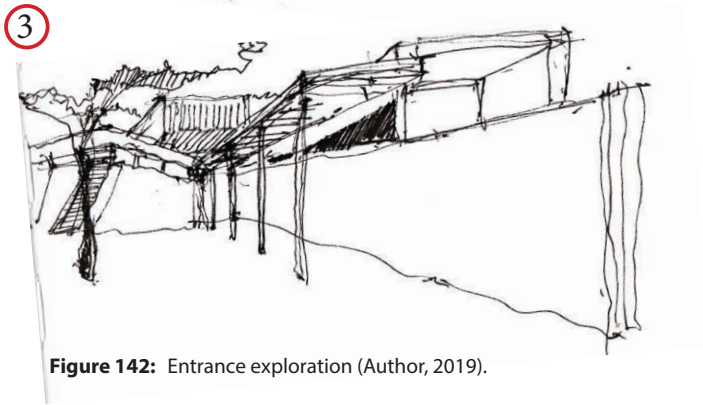
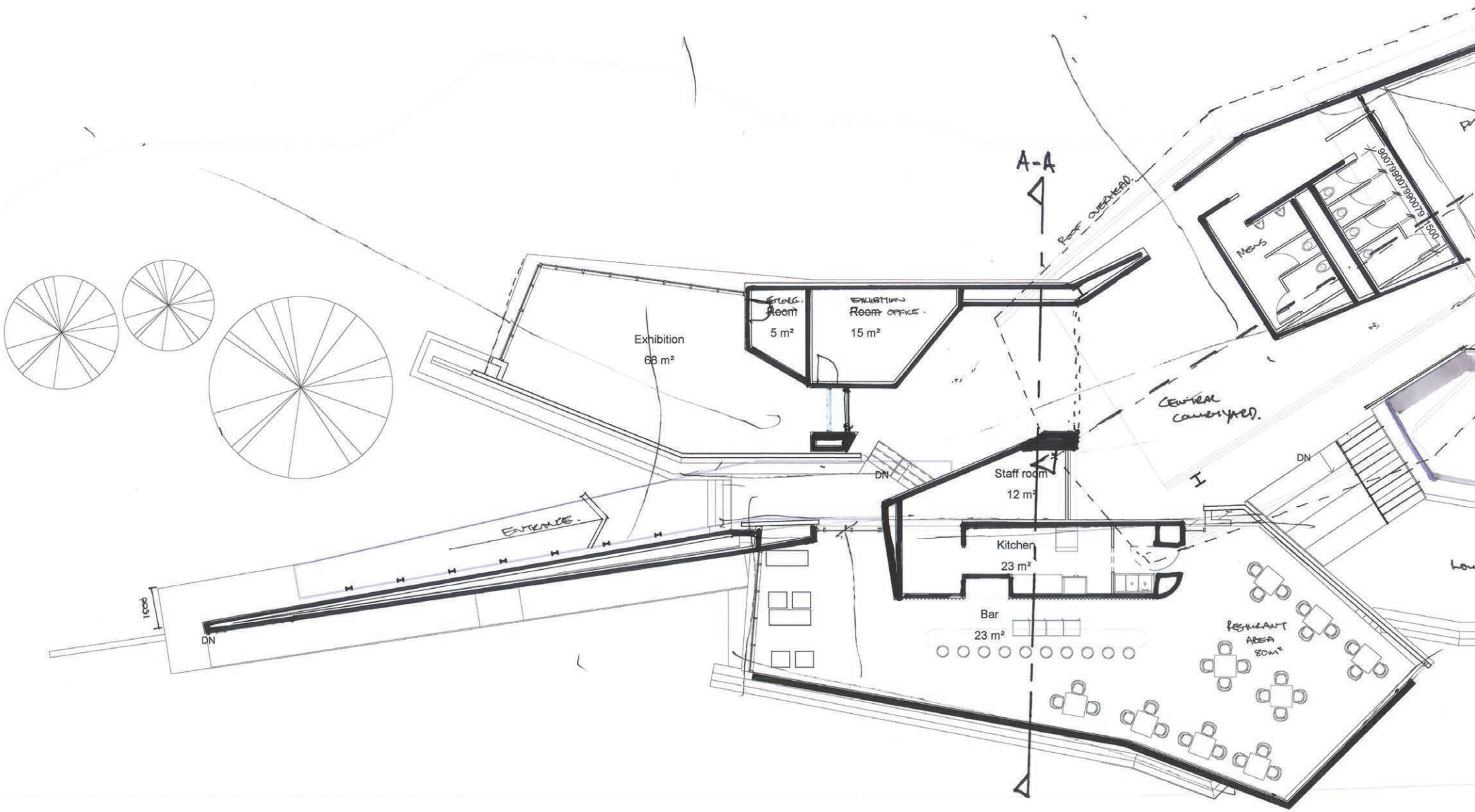


Figure 142: Entrance exploration (Author, 2019).


A-A
Exhibition
68 m²
Store Room
5 m²
Exhibition Room Office
15 m²
Staff room
12 m²
Kitchen
23 m²
Bar
23 m²
Restaurant Area
80m²
Men's
Ladies
Entrance
DN
DN
DN
Roof overhead
Central courtyard
1500
1500

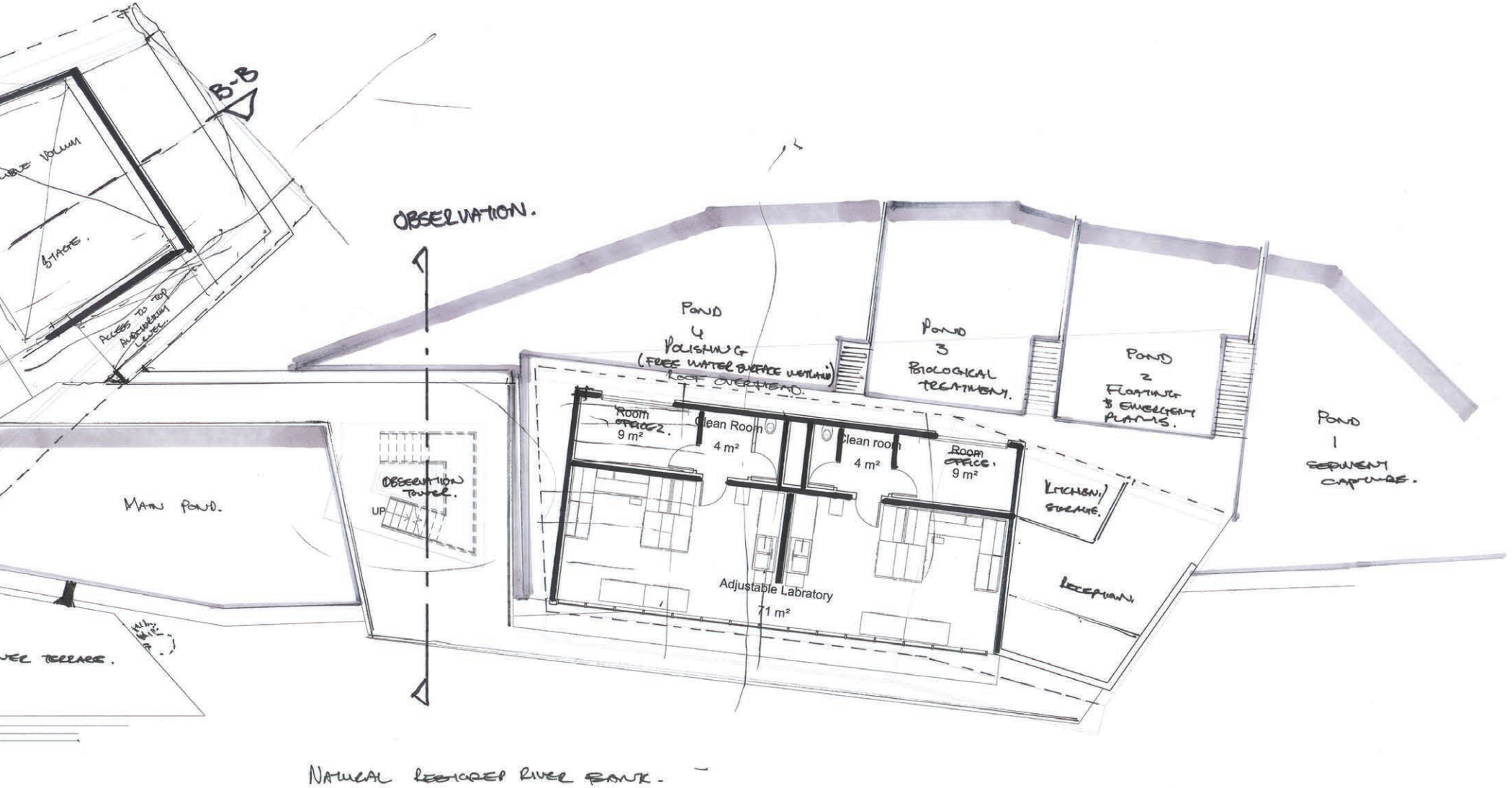


Figure 143: Iteration 5 floor plan (Author, 2019).

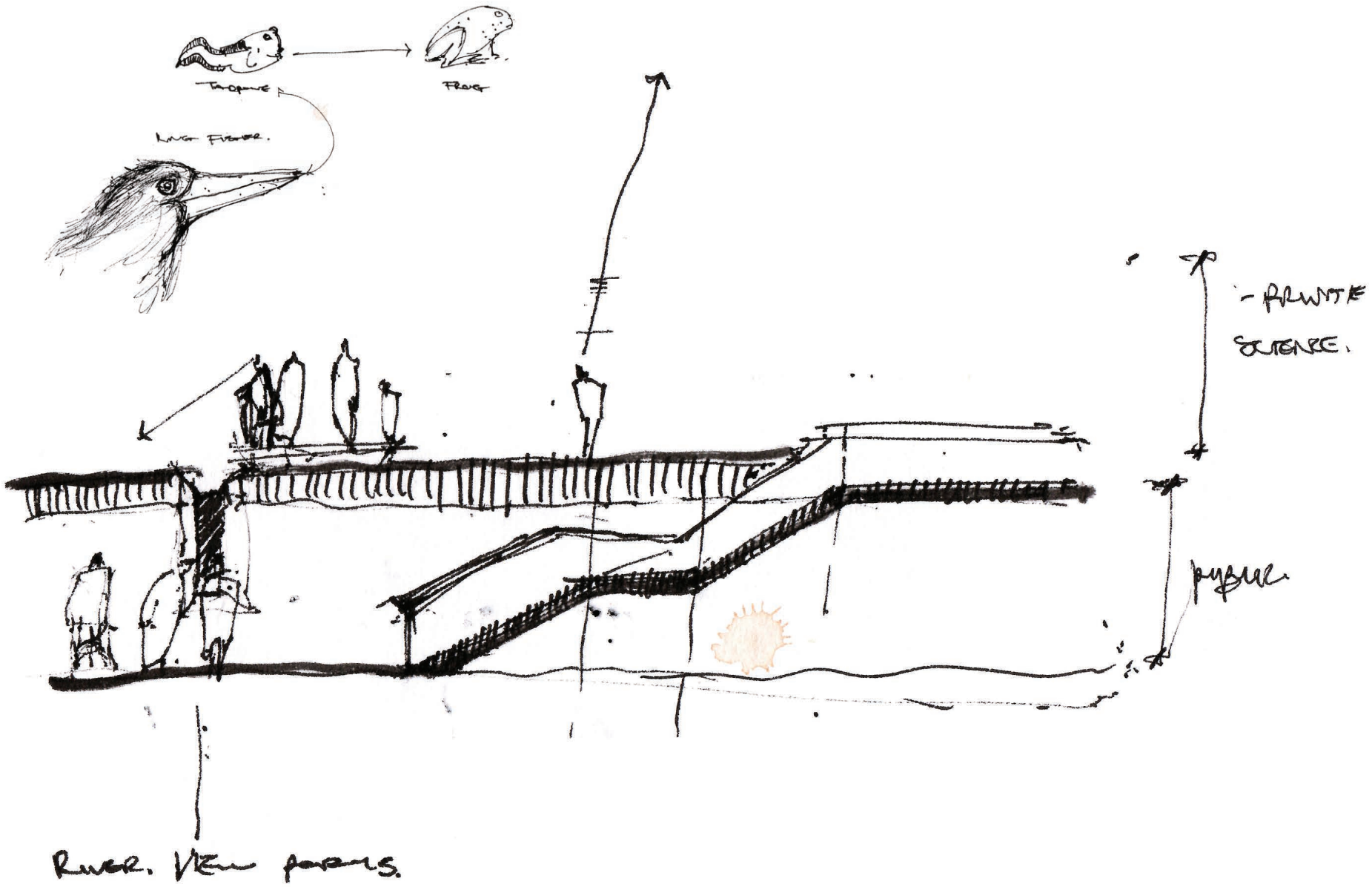


Figure 144: User engagement (Author, 2019).

SITE DESCRIPTION

The Western pedestrian access

The western side is the general access that the public will engage with and is defined by the subtle integration of an elevated walkway that respects the river bank and allows the vegetation to grow naturally. Along the path in an effort to capture and naturally filter the water, the site access will make use of an open bio-swale that uses the natural flora occurring in the area.

The Northern woodland access

To the North the building respects the site and only allows visual access to the sensitive woodlands on the ridge.

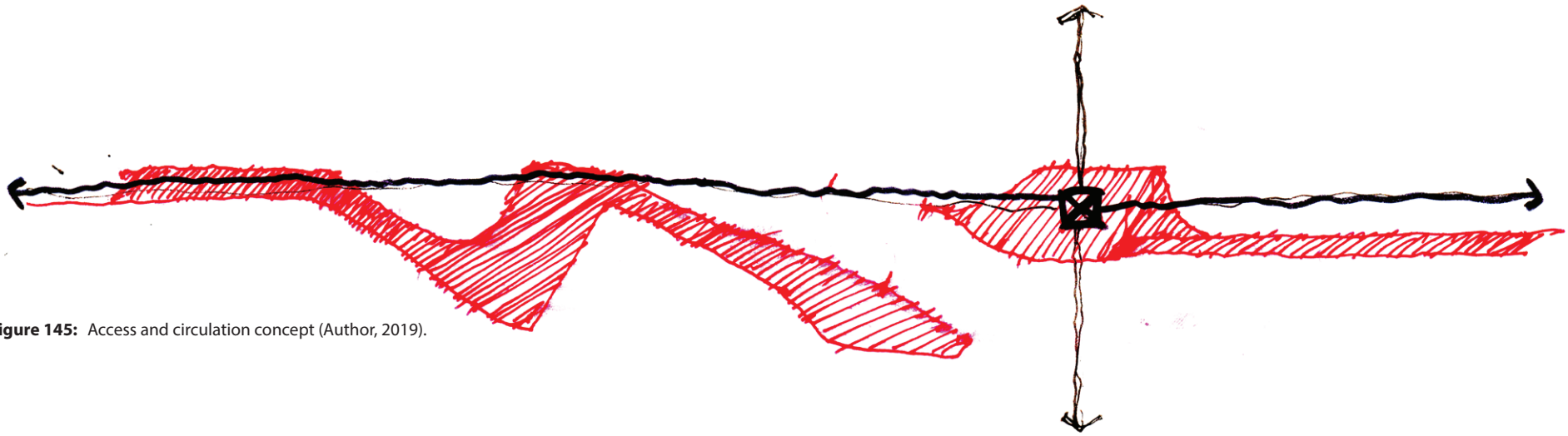


Figure 145: Access and circulation concept (Author, 2019).

The Southern river access

The site filters a small quantity of the Apies river though a series of wetlands and allows it to flow back into the river. People are encouraged to view and engage with the process throughout the site through a series of informative observation windows.

The Eastern Research access

Allows the private access for the researches from the car park to the facility itself over the existing bridge. This essentially completes the east to west access, granting the researchers full access to the whole site.

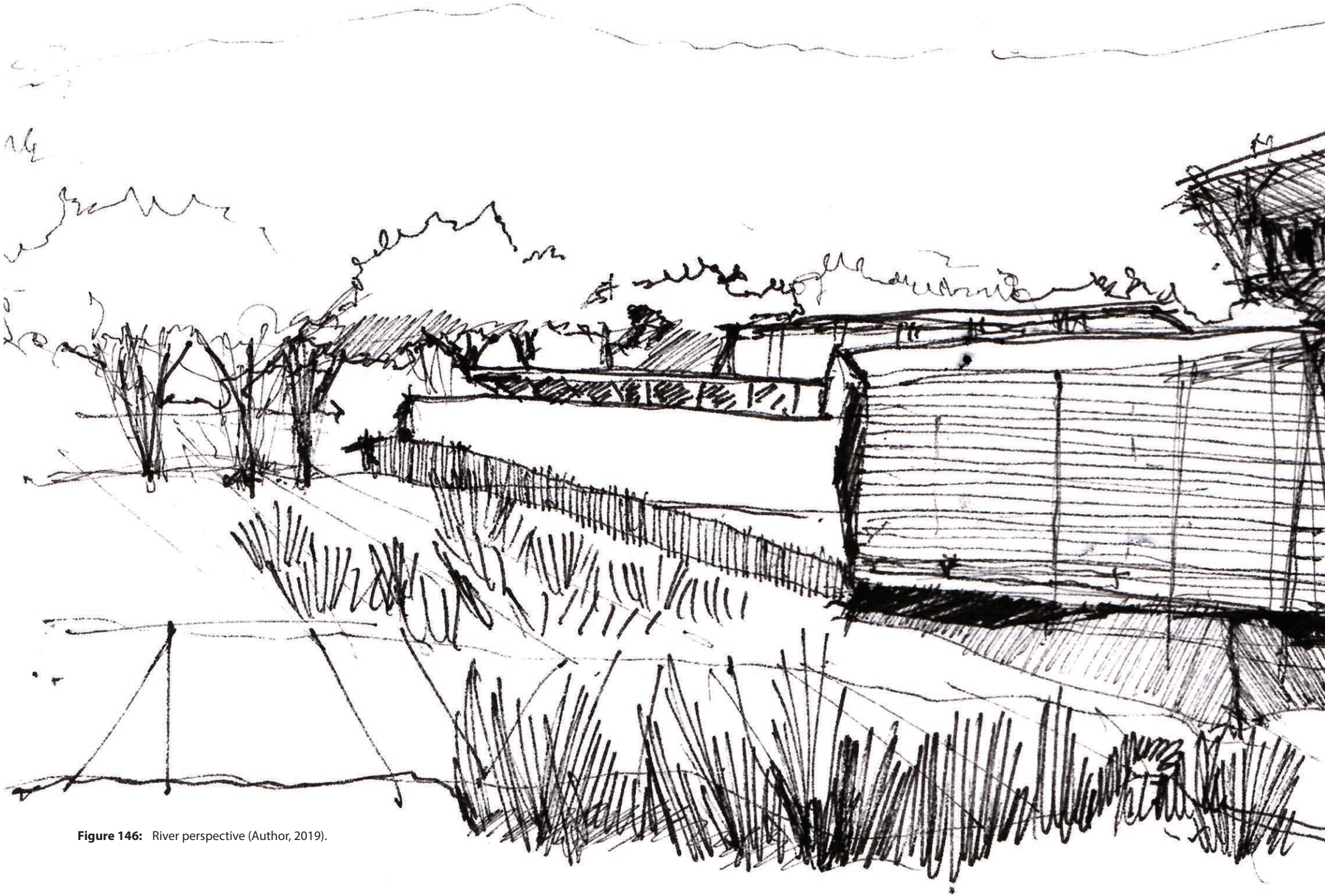
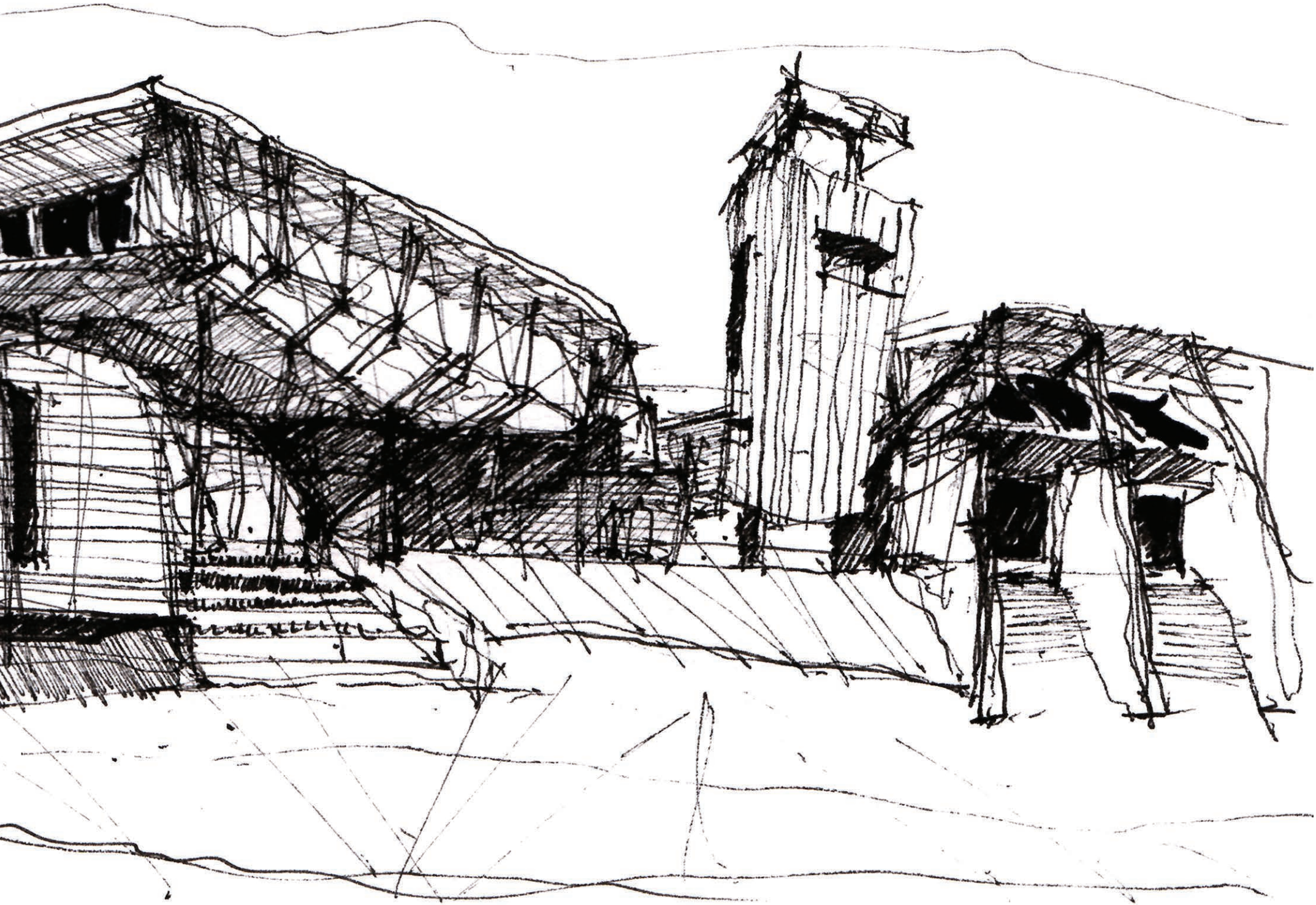


Figure 146: River perspective (Author, 2019).



VISION

ENTRANCE

Figure 147: Materiality and proportion study (Author, 2019).

RIVER WALK

Figure 148: Water relationship (Author, 2019).

LOOKOUT

Figure 149: User experience (Author, 2019).

CHAPTER SEVEN

DESIGN TECHNIFICATION

INTRODUCTION

This chapter's aim is to technically resolve the design set out in the design development chapter.

TECHNICAL DEVELOPMENT

- Materials
- Structure
- Services
- Iterations
- Detail Iterations

CONCEPT

A landscape is dynamic, it is in a state of constant change, forever adapting and adjusting to external factors working upon it. Geographical features within the landscape have been formed over eons, evidence of this can be seen in the layering of soil and rock structures.

Architecture is the process of layering man-made objects onto the landscape, changing it, allowing people to experience an altered landscape, imprinting our existence onto it. Similar to nature, our architecture should add ecological value to the layers surrounding us, contributing in a sustainable manner that would only leave the "bones", the memory, if we vanish form Earth.

The concept in this regard, relating to the theoretical premise of ecological literacy and regionalism, investigates the idea of layering as a process through which the building engages with site and user.

Figure 150: Technical concept (Author, 2019).

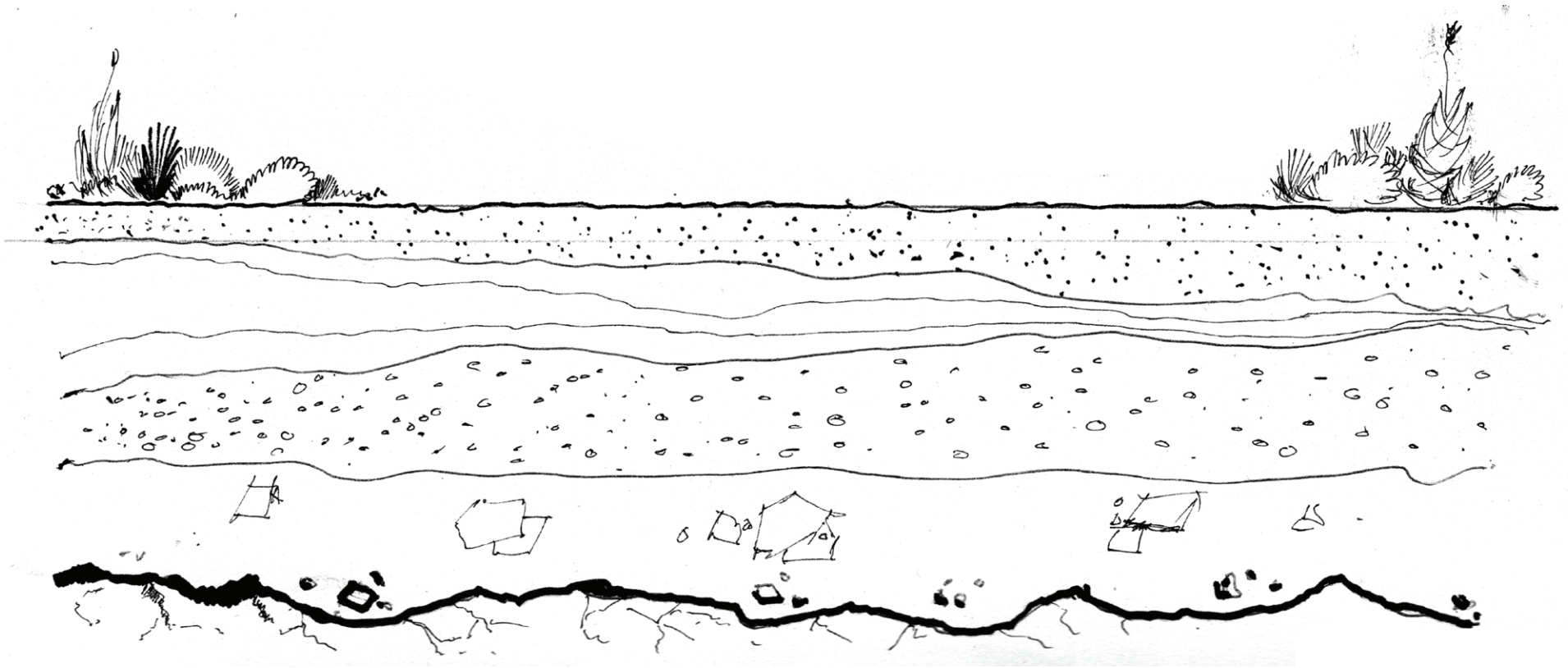


Figure 151: Natural layers to which a building should add (Author, 2019).

SANS 10400

Occupancy, building classification and design population:

Cafe and administration

- A1_Entertainment and public assembly = 1 person per m^2
- C1_Exhibition hall = 1 person per $10m^2$
- G1_Offices = 1 person per $15m^2$

Laboratories and lecture hall

- A3_Places of instruction = 1 person per $5m^2$
- J1_High risk storage = 1 person per $50m^2$
- J3_Low risk storage = 1 person per $50m^2$

Library

- C2_Library = 1 person per 20 m^2

Ventilation:

The total area of an opening shall be no less than 5% of the floor area of the room or $0.1m^2$ with respect to category E4, H3, H4 or H5 buildings and $0.2m^2$ in respect of other buildings.

Air requirements for different types of occupancies:

- Auditoriums: 10 air changes per hour & 7.5L/s per person.
- Educational buildings (Laboratories and Classrooms): 2 air changes per hour & 7.5L/s per person.
- Libraries: 2 air changes per hour & 6.5L/s per person.
- Restaurants, bars and cocktail lounges: 10 air changes per hour & 7.5L/s per person.
- Kitchens: 10 air changes per hour & 17.5L/s per person.
- Offices: 2 air changes per hour & 7.5L/s per person.
- Conference rooms: 10 air changes per hour & 10L/s per person.
- Ablution facilities: 20 air changes per hour & 20L/s per person.

Sans 10400-P Sanitary fixtures requirement:

- Laboratories and workshops:
  - Males -1 water-closet, 1 urinal, 1WHB
  - Females - 2 water-closets, 1WHB
  - (In any occupancy where personnel are exposed to high risk substance, dirt, filth, dust, soot, oil,grease or any similar substance, exposure to which is such that showers are necessary, at least 1 shower per 15 persons shall be provided separately for each sex and such showers shall be located in,or have direct access to, a change room.)
- Resturant:
  - No separate facilities for the public or visitors shall be required within any shop having a floor area of less than 50m2
- Library:
  - Males -1 water-closet, 1 urinal, 1WHB
  - Females - 2 water-closets, 1WHB

TECHNICAL DEVELOPMENT
MATERIALS

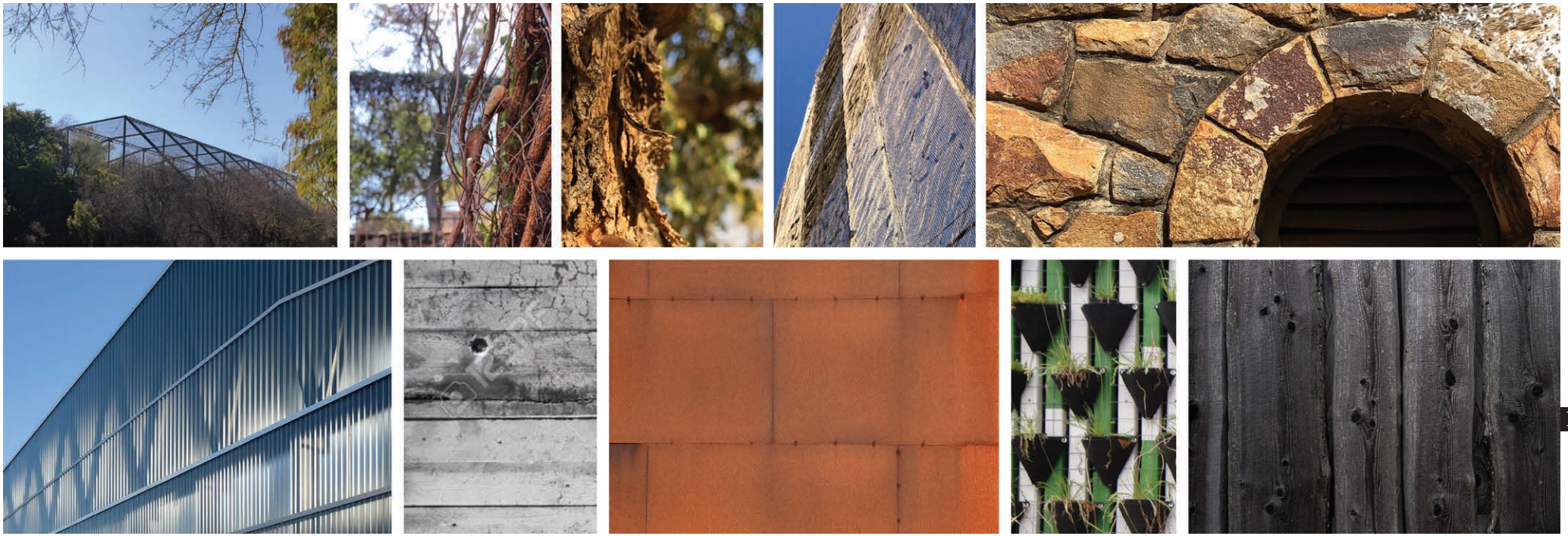


Figure 152: Materials matching environment (Author, 2019).

Figure 153: Material selection (Author, 2019).

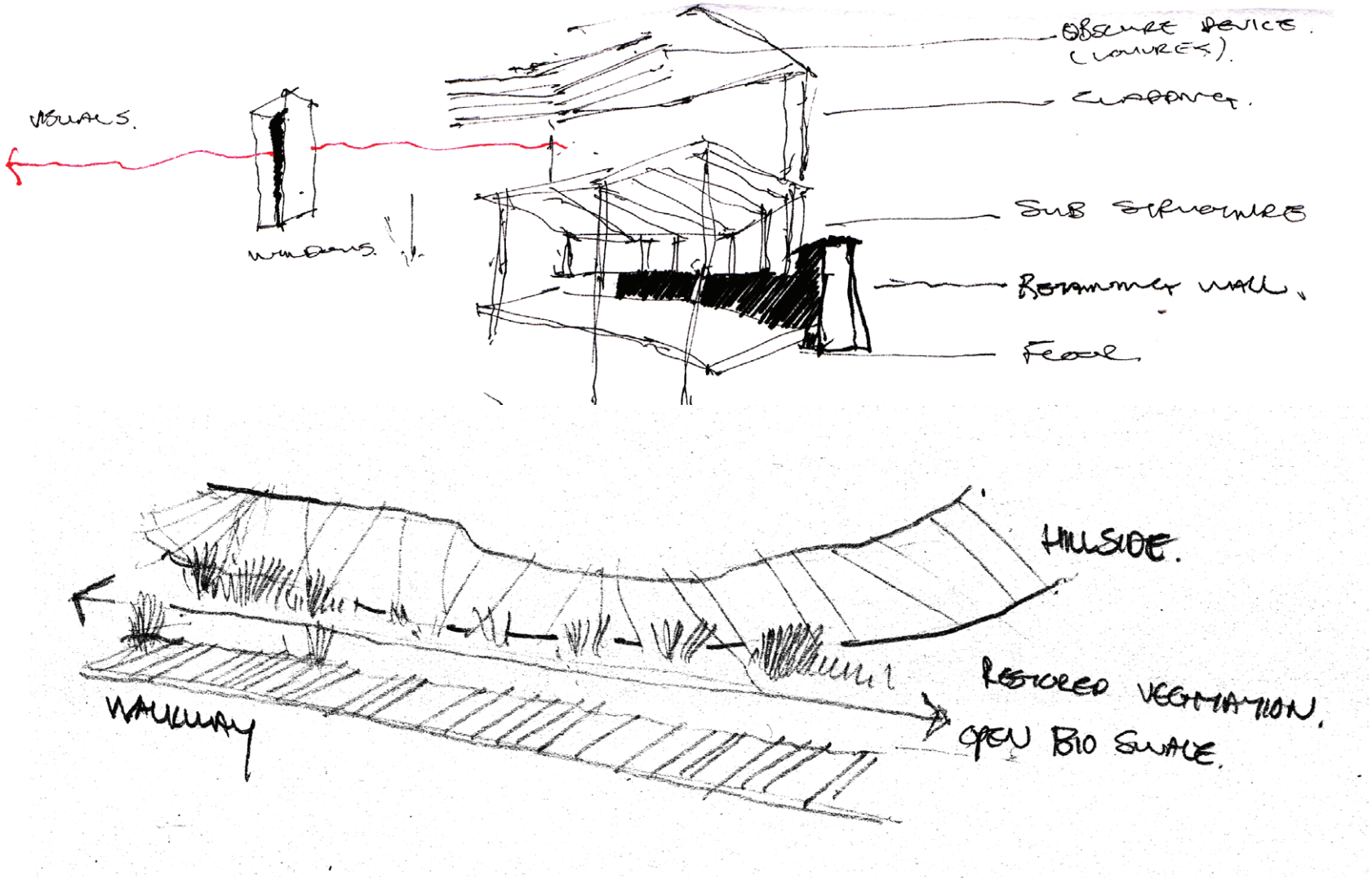
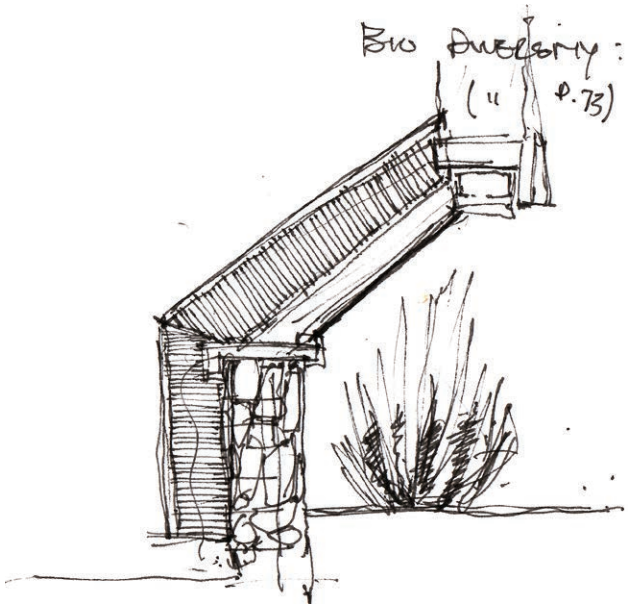


Figure 154: Structural layering onto the landscape. (Author, 2019).



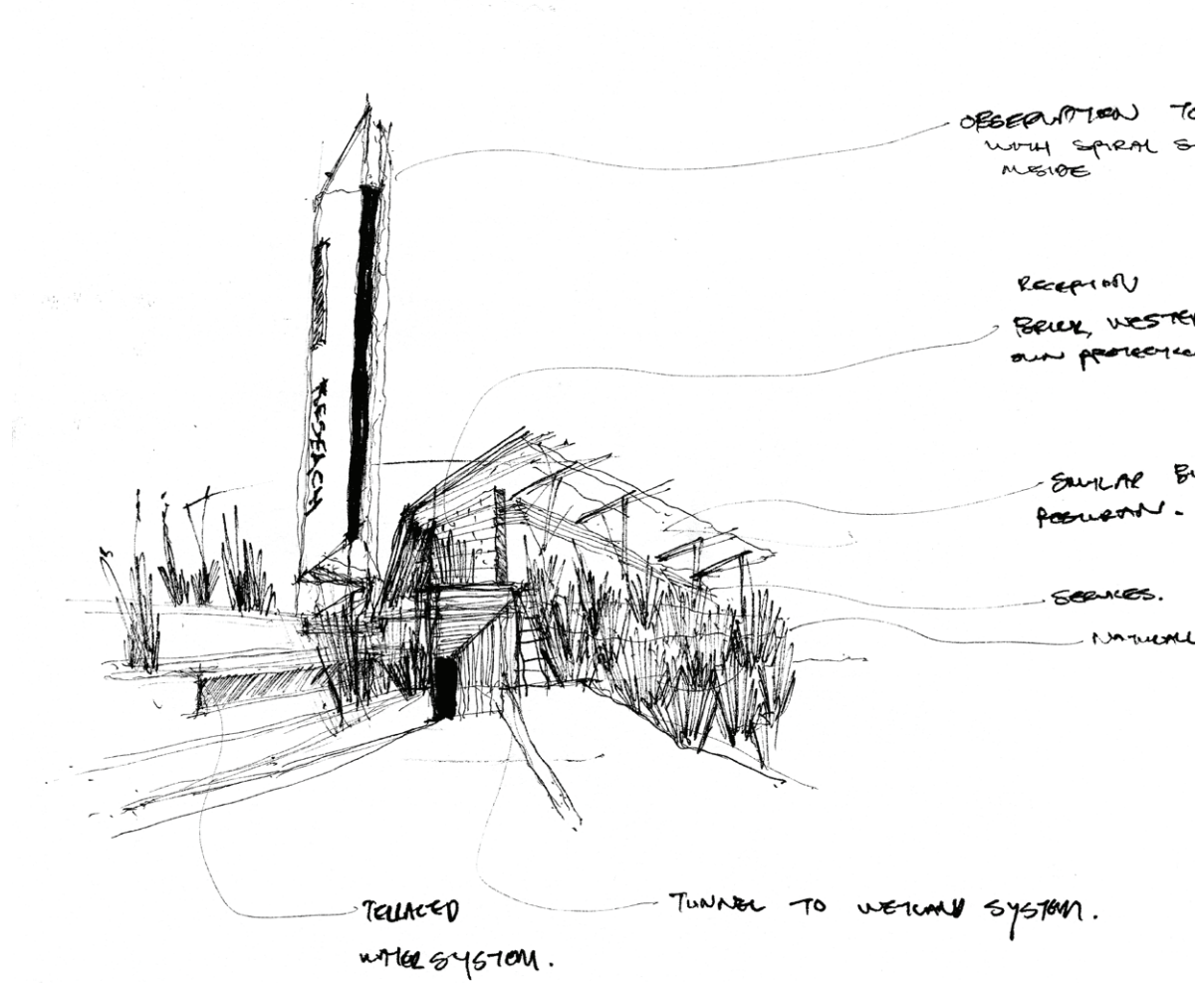
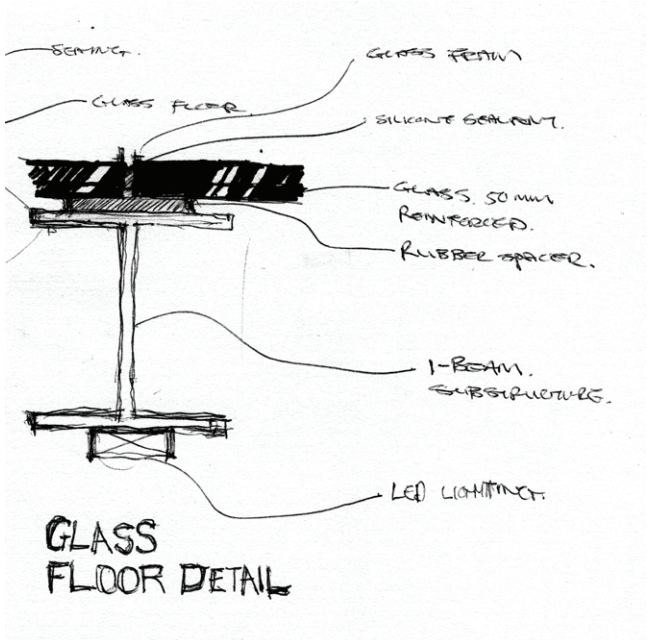


Figure 155: Structural layering vision of the research facility (Author, 2019).

SERVICES

The buildings systems focus on the observation and rehabilitation of the riparian zone that is lost to most parts of the Apies river that runs through the city. The Riparian zone acts as a corridor that connects habitats and allows for water to be retained within the soil and reduces the flow of the river thereby minimizing the potential for flooding. The architecture respects this vital connection for the river and allows for the fauna and flora to connect to the river through vegetation corridors thereby mitigating the need to connect to storm water services.

Below: A comparison between the louvre systems on the Southern elevation.
Right: A fairly basic illustration of how a class floor can be supported on an I-beam substructure.



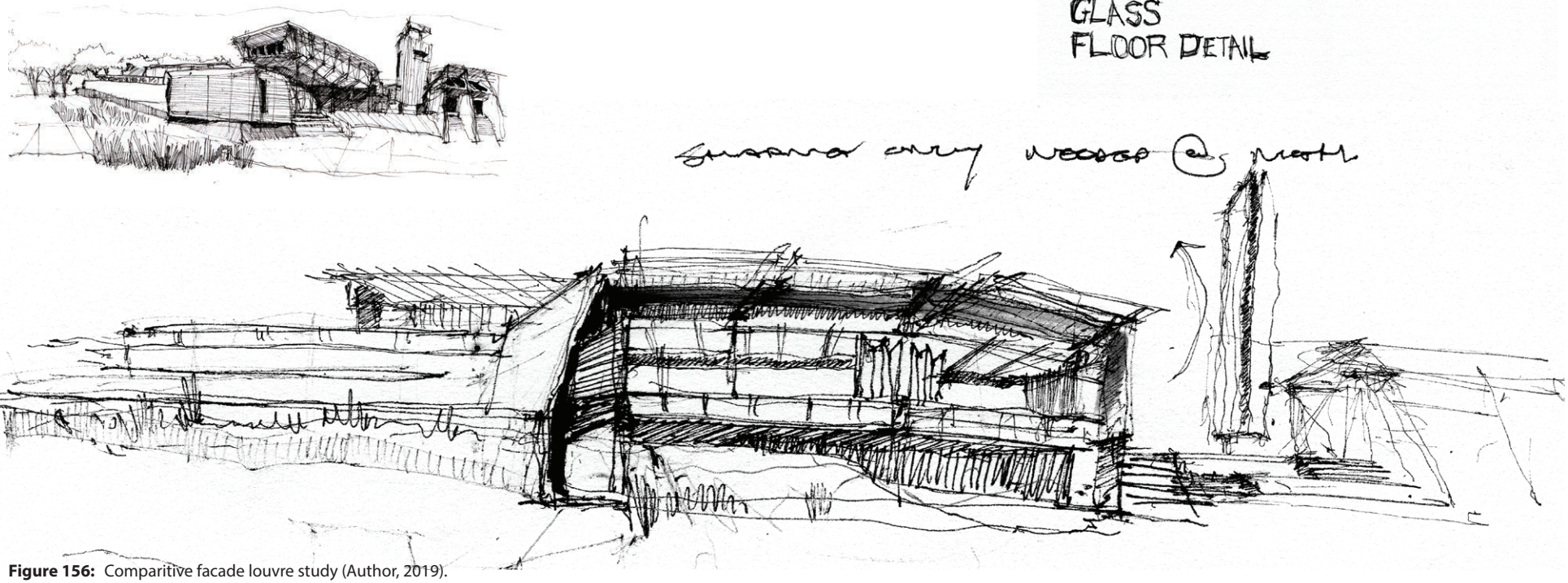


Figure 156: Comparitive facade louvre study (Author, 2019).

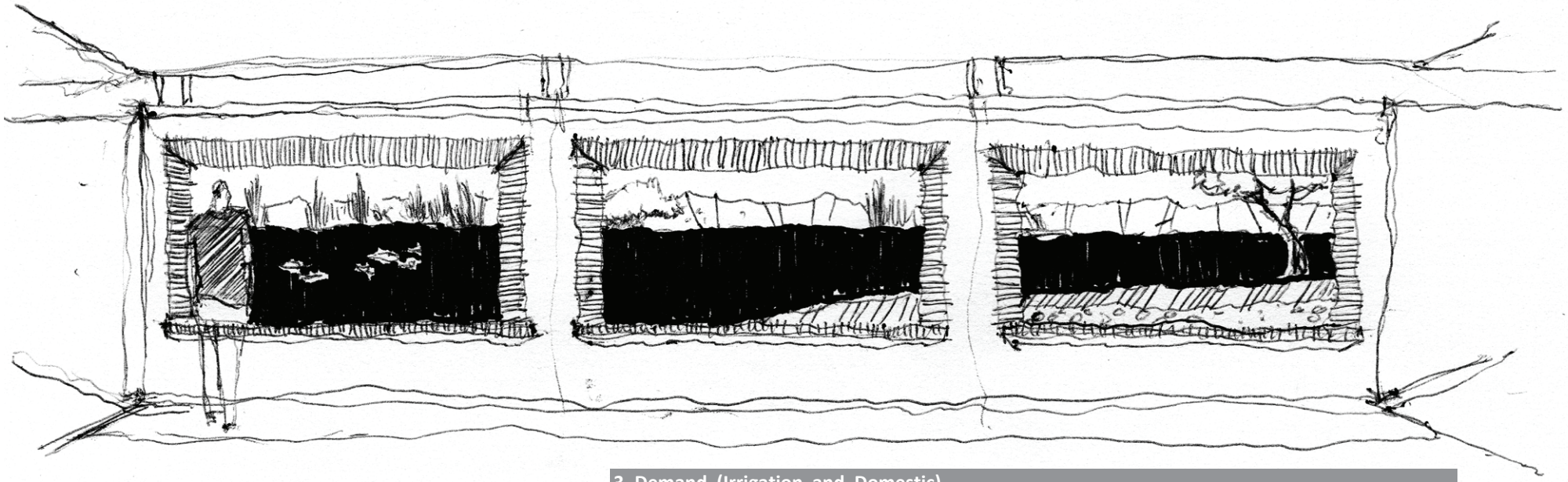
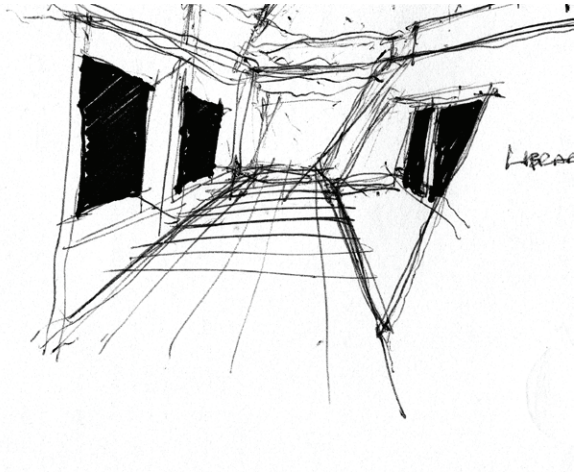


Figure 157: Wetland windows (Author, 2019).



3. Demand (Irrigation and Domestic)

IRRIGATION DEMAND

	Planting Area (m^2)	Irrigation Depth per week (m)	Irrigation Depth per month (m)	IRRIGATION DEMAND (m^3)
January	110 m^2	0,040 m	0,177 m	19 m^3
February	110 m^2	0,040 m	0,160 m	18 m^3
March	110 m^2	0,040 m	0,177 m	19 m^3
April	110 m^2	0,030 m	0,129 m	14 m^3
May	110 m^2	0,020 m	0,089 m	10 m^3
June	110 m^2	0,020 m	0,086 m	9 m^3
July	110 m^2	0,020 m	0,086 m	9 m^3
August	110 m^2	0,020 m	0,089 m	10 m^3
September	110 m^2	0,030 m	0,129 m	14 m^3
October	110 m^2	0,040 m	0,177 m	19 m^3
November	110 m^2	0,040 m	0,171 m	19 m^3
December	110 m^2	0,040 m	0,177 m	19 m^3
YEAR	**110 m^2 (Average)**	**0,032 m (Average)**	**1,646 m (Total)**	**181 m^3 (Total)**

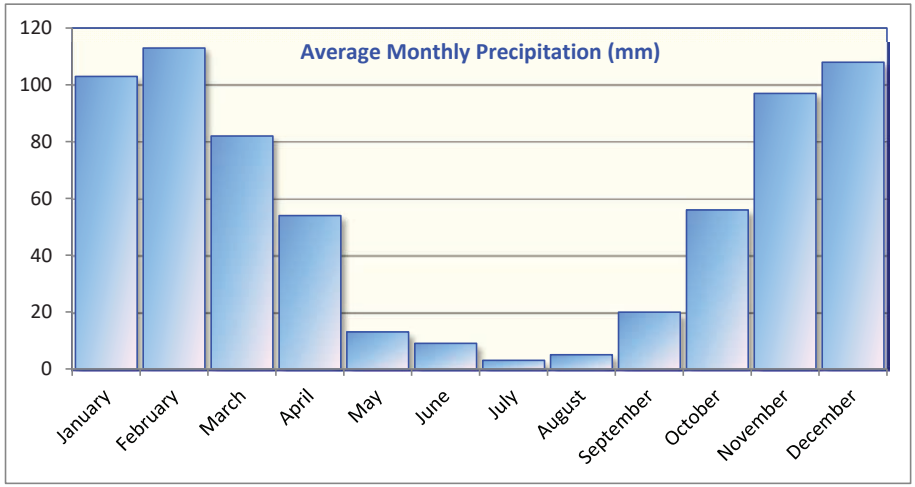
1. Climate Data

Place: Pretoria

Position: 25°44'S, 28°11'E
Height: 1339m
Period: 1961-1990

Descriptive text

	MONTH	Temperatur				Precipitation		
		Highest Recorded	Average Daily maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average number of Days >== 1mm	Highest 24hr rainfall (mm)
1.	January	36	29	18	8	103	14	160
2.	February	36	28	17	11	113	11	95
3.	March	35	27	16	6	82	10	84
4.	April	33	24	12	3	54	7	72
5.	May	29	22	8	-1	13	3	40
6.	June	25	19	5	-6	9	1	32
7.	July	26	20	5	-4	3	1	18
8.	August	31	22	8	-1	5	2	15
9.	September	34	26	12	2	20	3	43
10.	October	36	27	14	4	56	9	108
11.	November	36	27	16	7	97	12	67
12.	December	35	28	17	7	108	15	50
	YEAR	**36**	**25**	**12**	**-6**	**663**	**87**	**160**

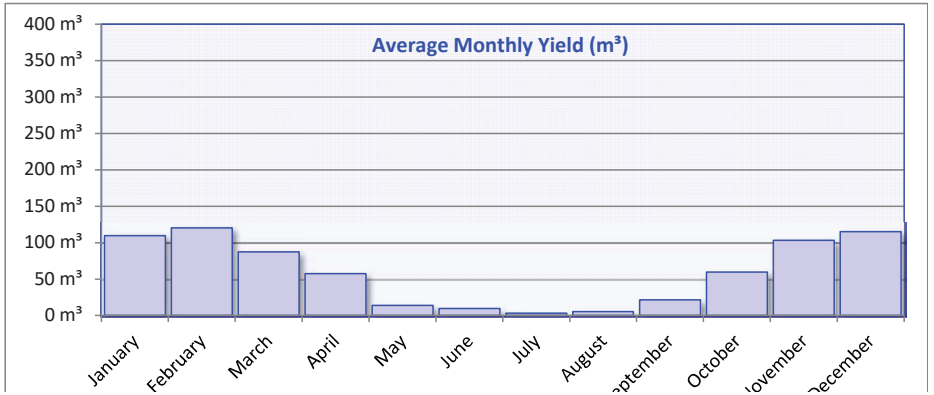


2. Yield

Yield (m^3) = P x A x C (Where P=precipitation (m), A=area (m^2), and C=run-off coefficient)

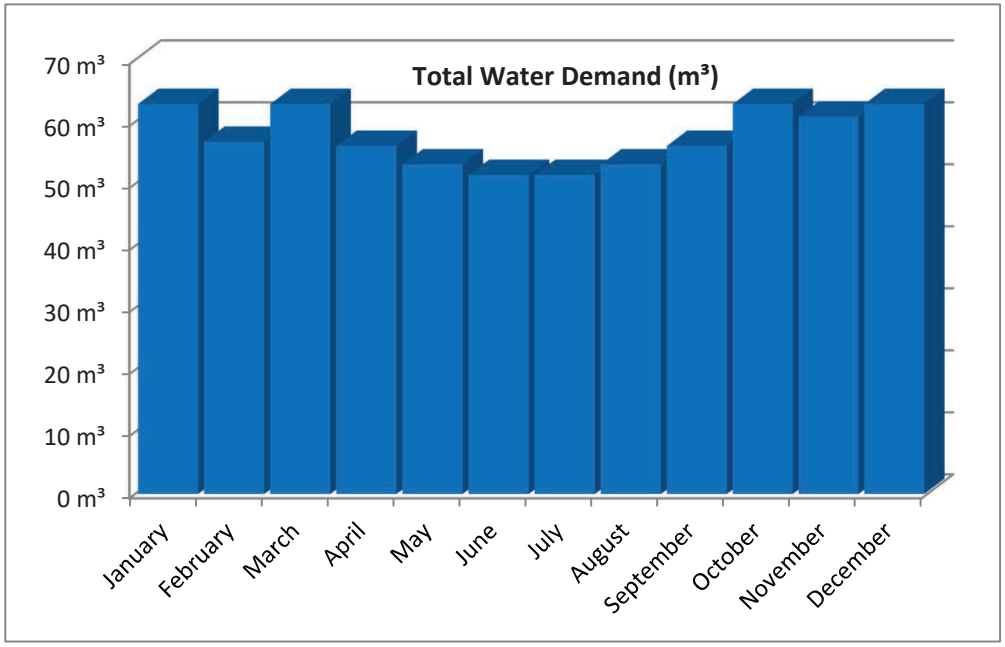
Area of Catchment: (Per surface)	Area (m^2)	Run-off Coefficient
Roofing	739,00 m^2	0,9
Paving	170,00 m^2	0,8
Veldgrass	350,00 m^2	0,4
Lawn	0,00 m^2	0,4
Planting	420,00 m^2	0,3
Gravel	0,00 m^2	0,7
Grey water	0,00 m^2	1
TOTAL:	**1 679,00 m^2**	0,64

	MONTH	Precipitation Average Monthly (mm)	Area	Run-off Coefficient	Yield P(m) x A(m^2) x C
1.	January	103 mm	1 679 m^2	0,64	110 m^3
2.	February	113 mm	1 679 m^2	0,64	121 m^3
3.	March	82 mm	1 679 m^2	0,64	88 m^3
4.	April	54 mm	1 679 m^2	0,64	58 m^3
5.	May	13 mm	1 679 m^2	0,64	14 m^3
6.	June	9 mm	1 679 m^2	0,64	10 m^3
7.	July	3 mm	1 679 m^2	0,64	3 m^3
8.	August	5 mm	1 679 m^2	0,64	5 m^3
9.	September	20 mm	1 679 m^2	0,64	21 m^3
10.	October	56 mm	1 679 m^2	0,64	60 m^3
11.	November	97 mm	1 679 m^2	0,64	104 m^3
12.	December	108 mm	1 679 m^2	0,64	115 m^3
	YEAR	**663 mm**	**1 679 m^2**	0,64	**707 m^3**



3. Total Demand

	IRRIGATION DEMAND (m^3)	DOMESTIC DEMAND (m^3)	**TOTAL WATER DEMAND**
January	19 m^3	43 m^3	**63 m^3**
February	18 m^3	39 m^3	**57 m^3**
March	19 m^3	43 m^3	**63 m^3**
April	14 m^3	42 m^3	**56 m^3**
May	10 m^3	43 m^3	**53 m^3**
June	9 m^3	42 m^3	**51 m^3**
July	9 m^3	42 m^3	**51 m^3**
August	10 m^3	43 m^3	**53 m^3**
September	14 m^3	42 m^3	**56 m^3**
October	19 m^3	43 m^3	**63 m^3**
November	19 m^3	42 m^3	**61 m^3**
December	19 m^3	43 m^3	**63 m^3**
YEAR	181 m^3 (Total)	510 m^3 (Total)	**691 m^3 (TOTAL)**



DAYLIGHT CONTROL

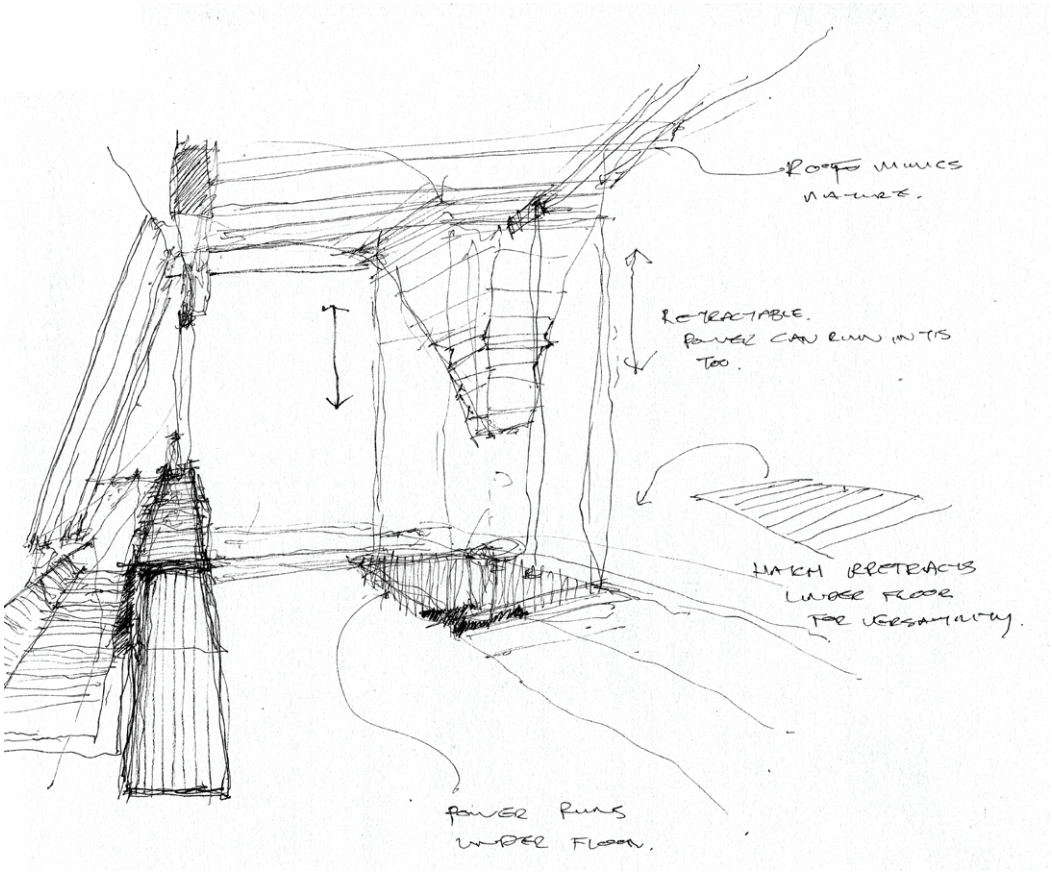


Figure 158: Virtual reality mechanism exploration (Author, 2019).

The Sefaira models show that there is a sufficient amount of Annual Solar Exposure (ASE) but the Spatial Daylight Autonomy (sDA) falls short of the required amount (refer to figure 158). This in conclusion means that the space won't receive enough usable sunlight throughout the year. The louvers need to be adjusted to accommodate the amount of sunlight entering the building especially within the virtual reality/exhibition room.

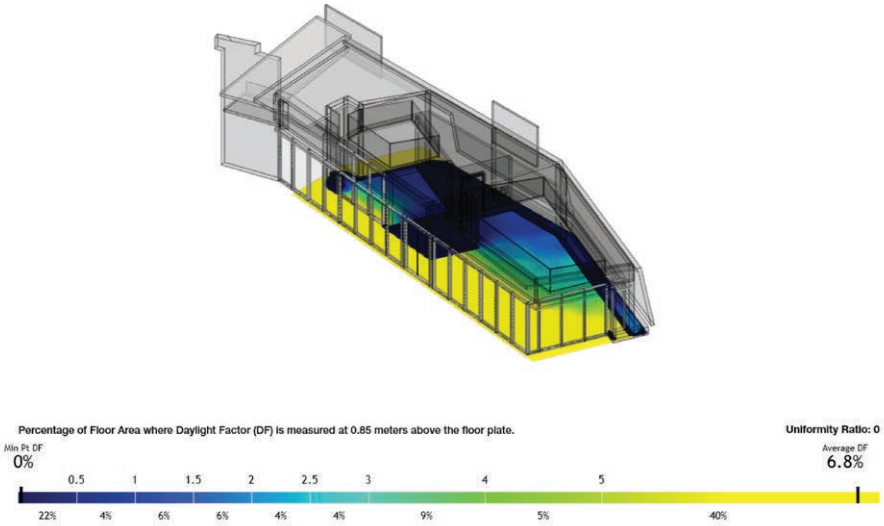


Figure 159: Sefaira dayligh Factor study (Author, 2019).

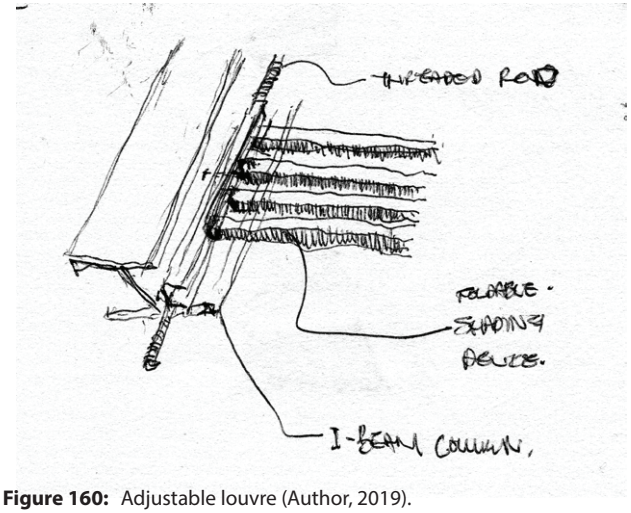


Figure 160: Adjustable louvre (Author, 2019).

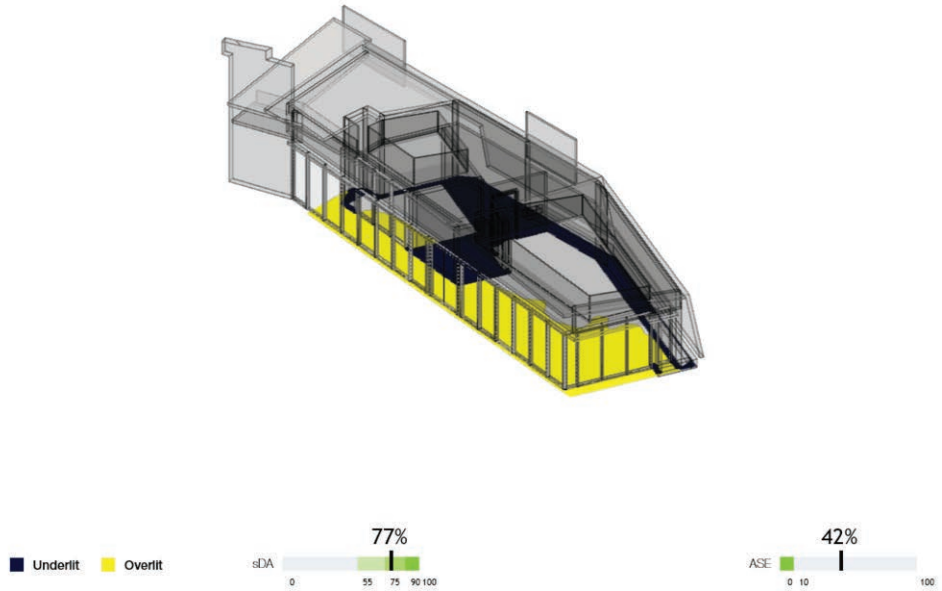


Figure 161: Sefaira average solar daylight anatomy study (Author, 2019).

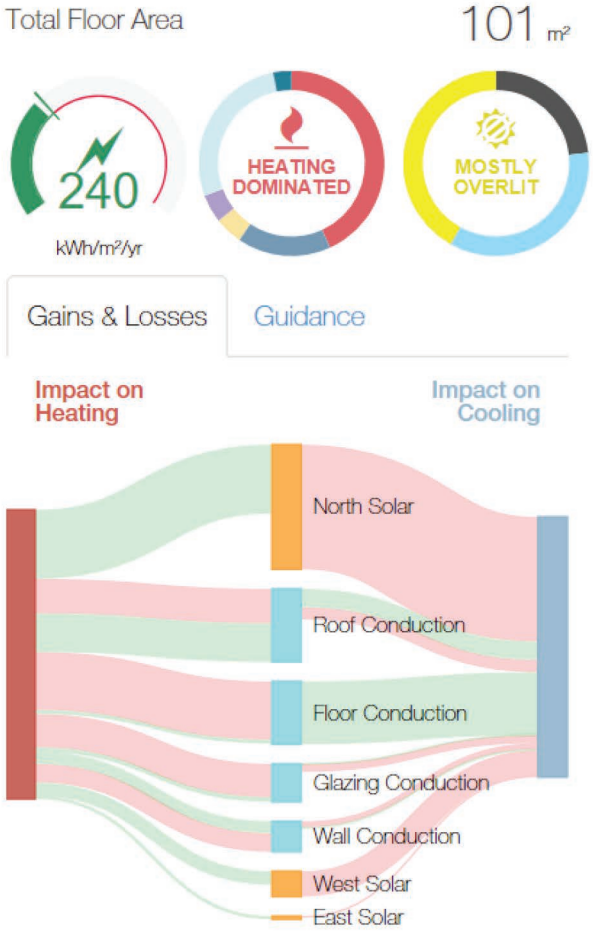


Figure 162: Sefaira Energy efficiency summary (Author, 2019).

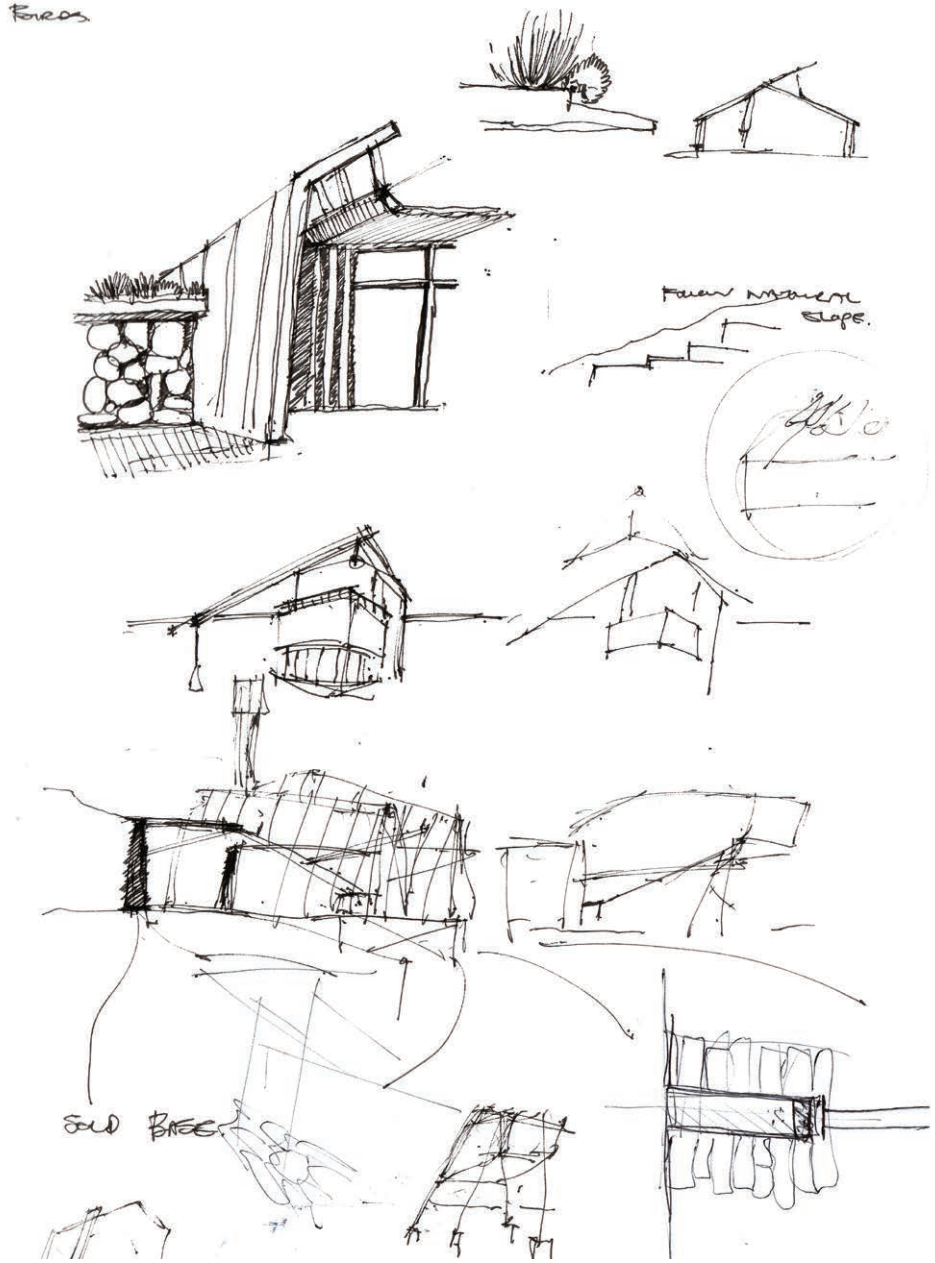


Figure 163: Roof wrap exploration (Author, 2019).

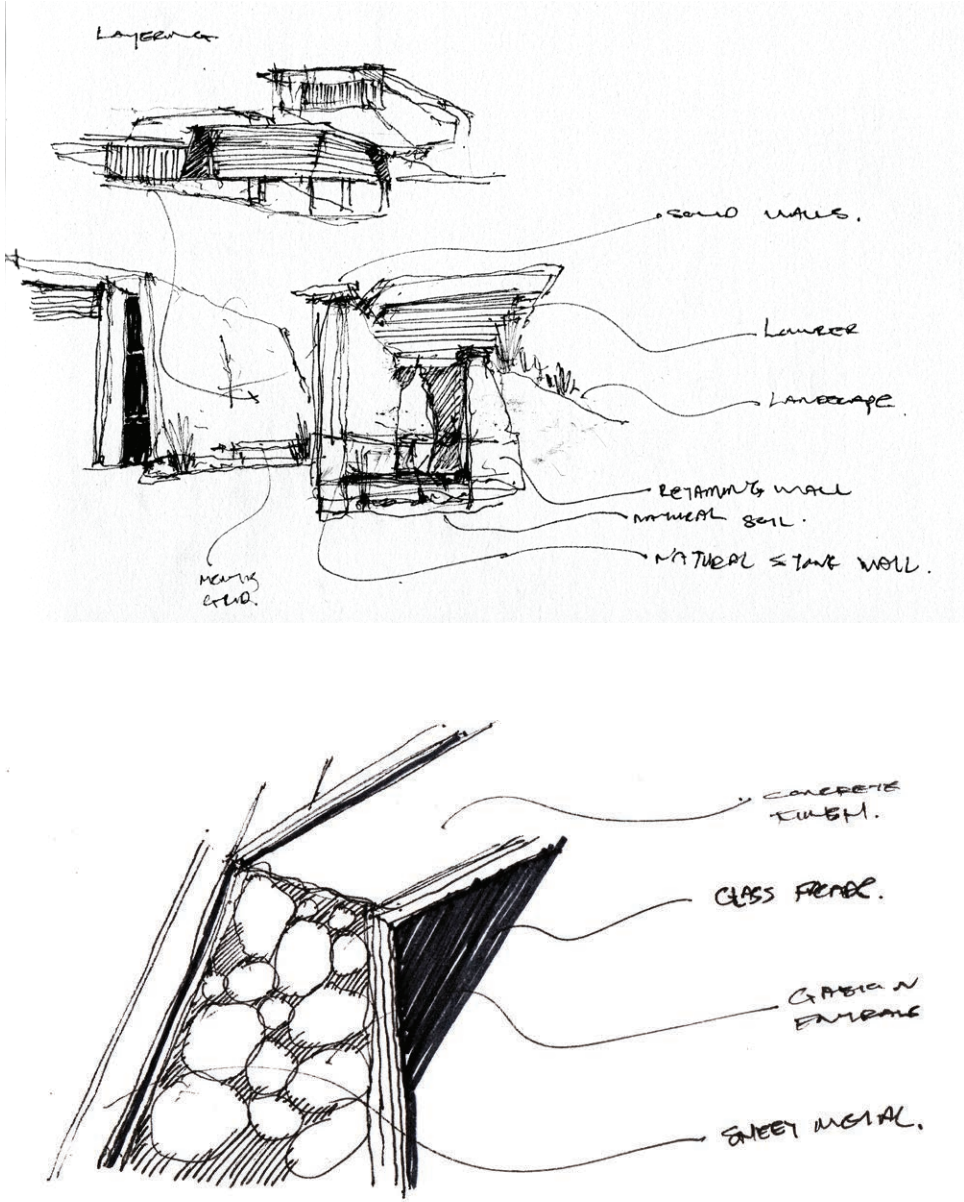


Figure 164: Layering exploration(Author, 2019).

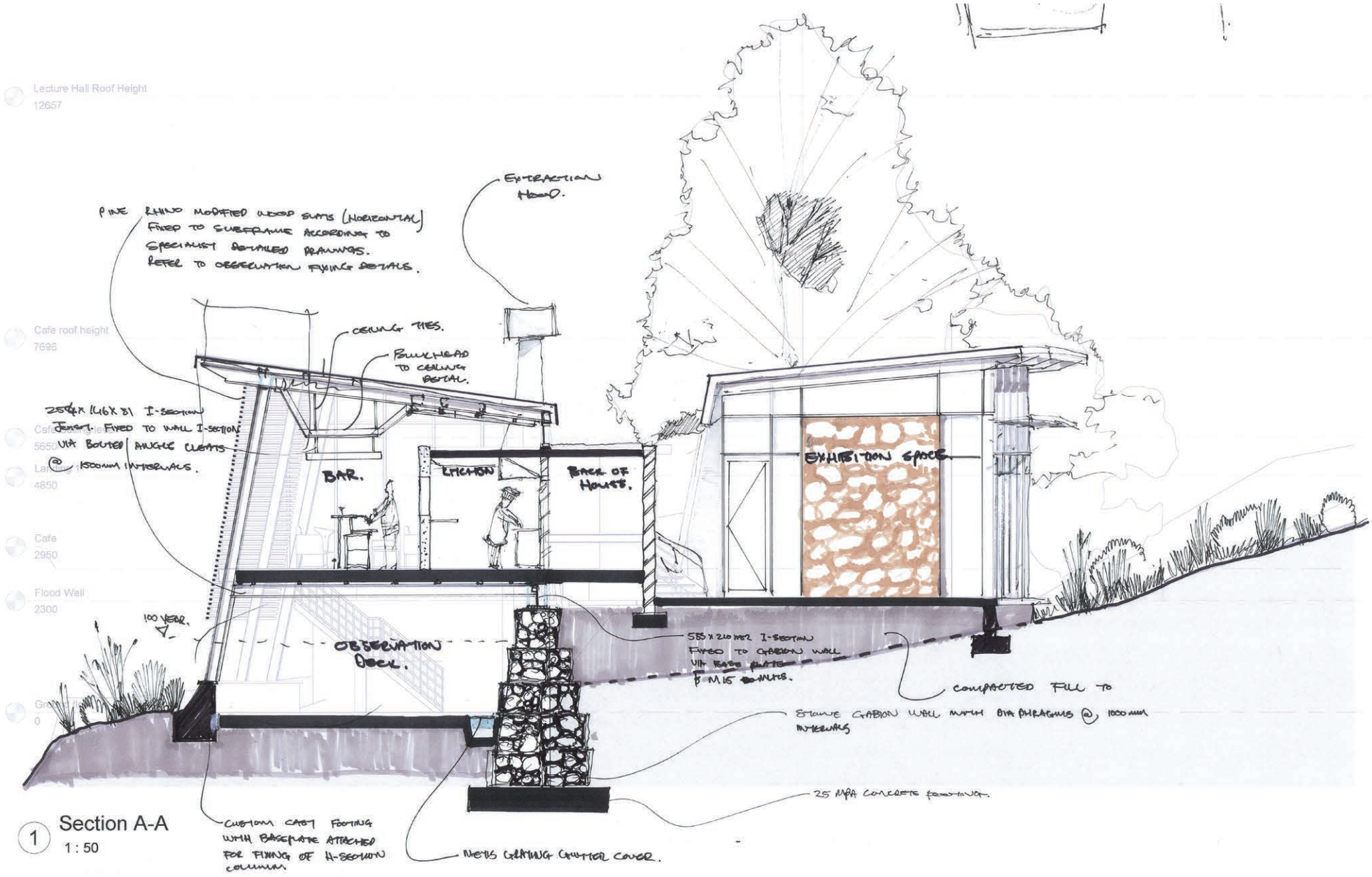


Figure 165: Secion of the public interface, 2019).

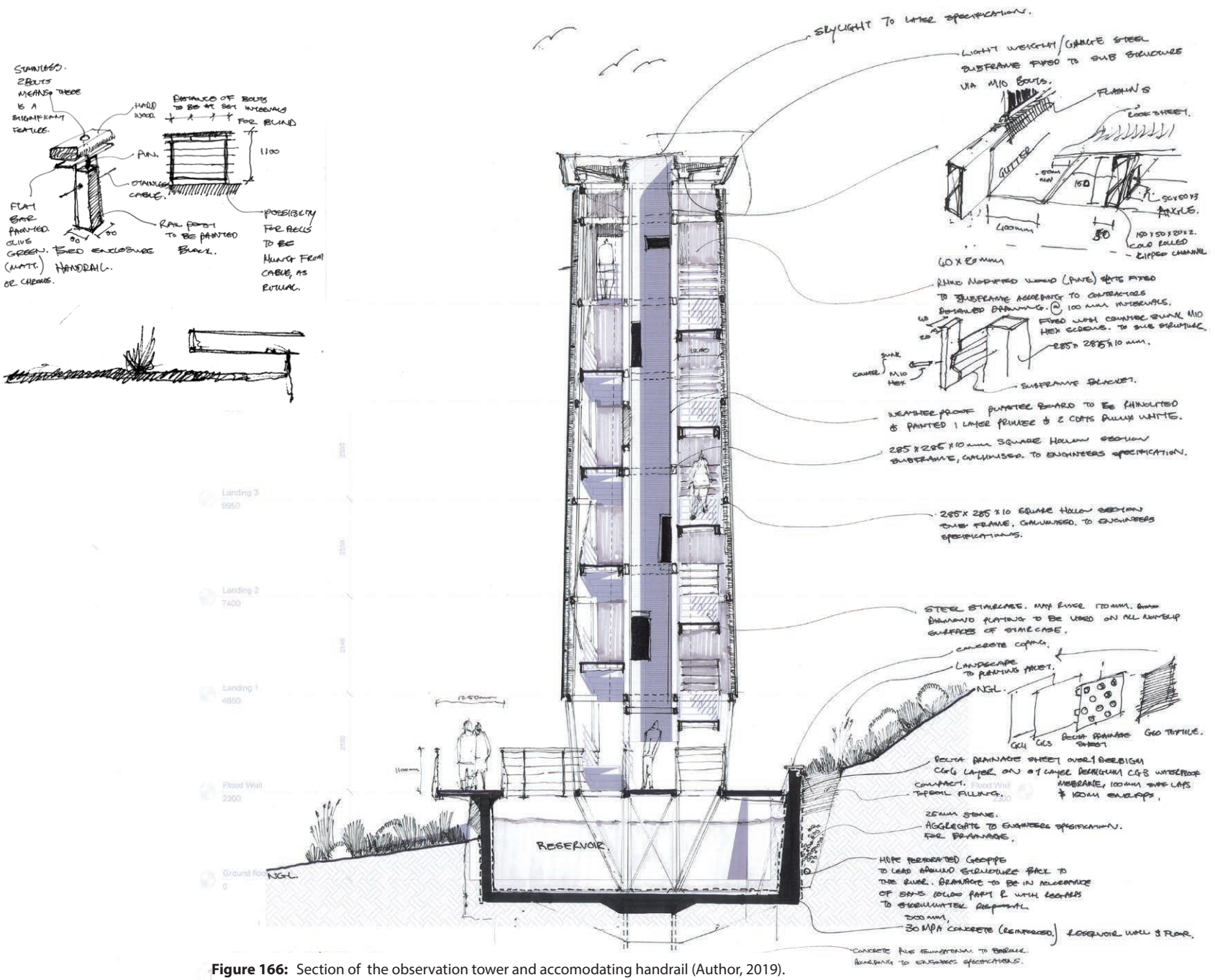


Figure 166: Section of the observation tower and accomodating handrail (Author, 2019).

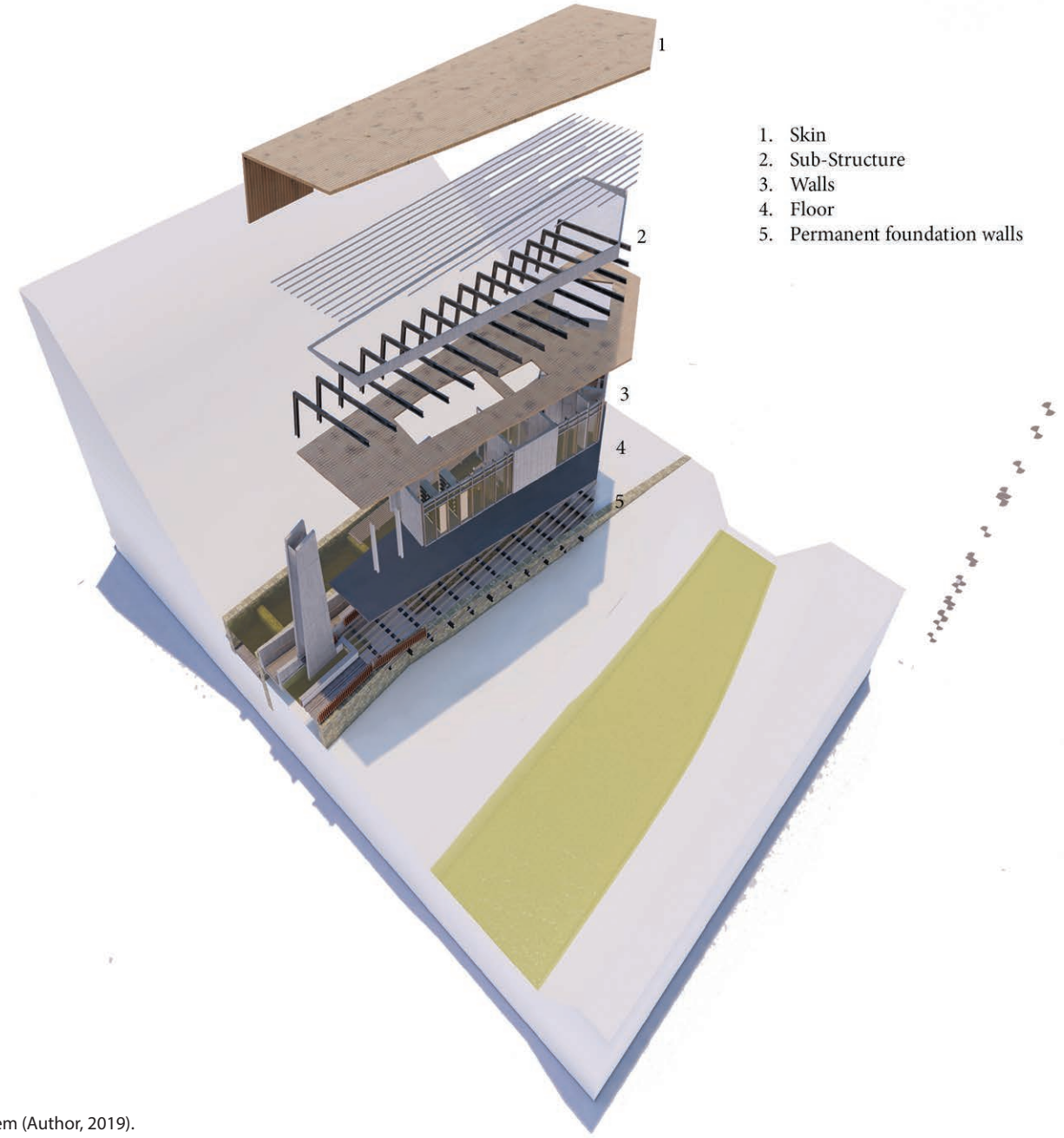


Figure 167: Structural system (Author, 2019).

SECTION

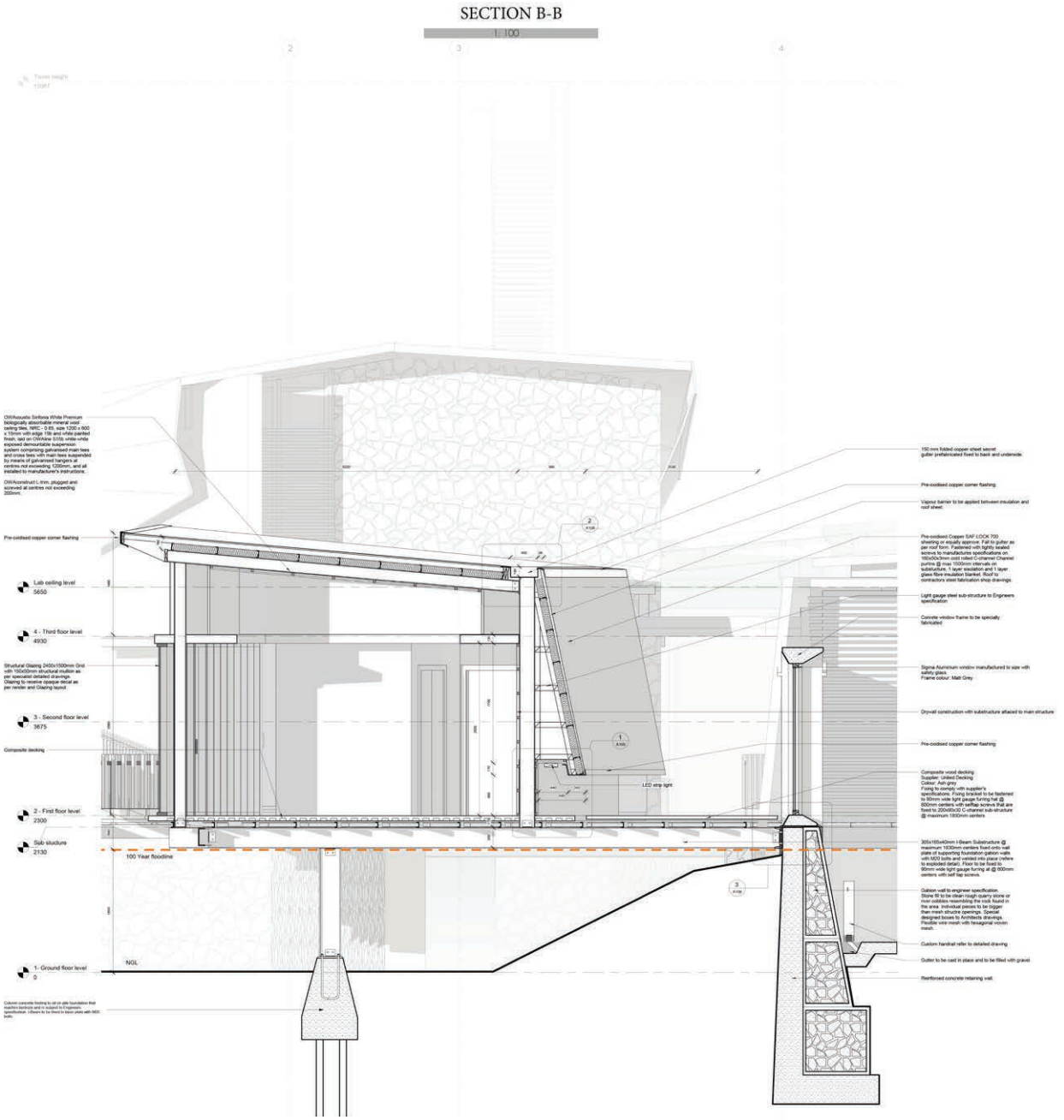
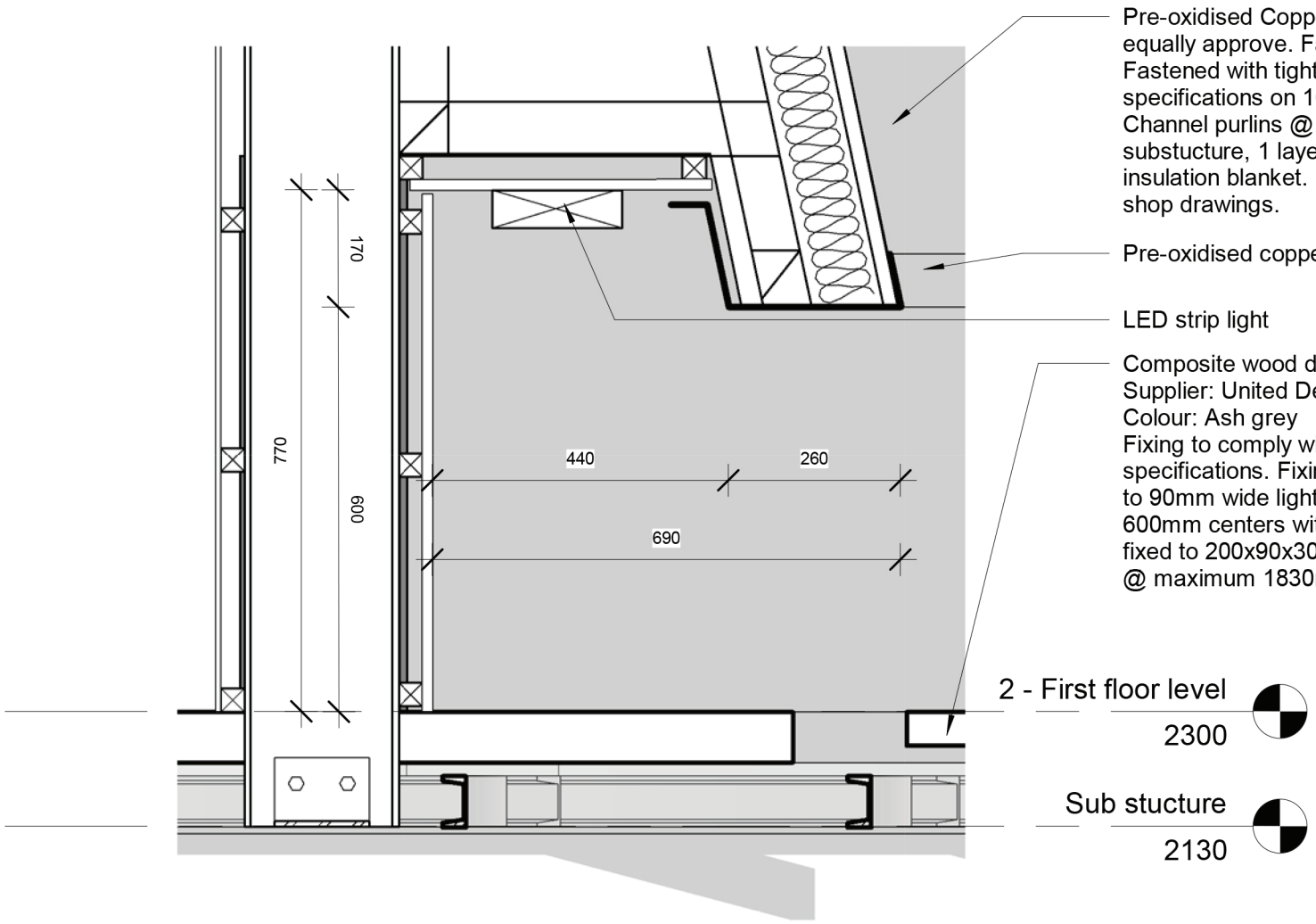


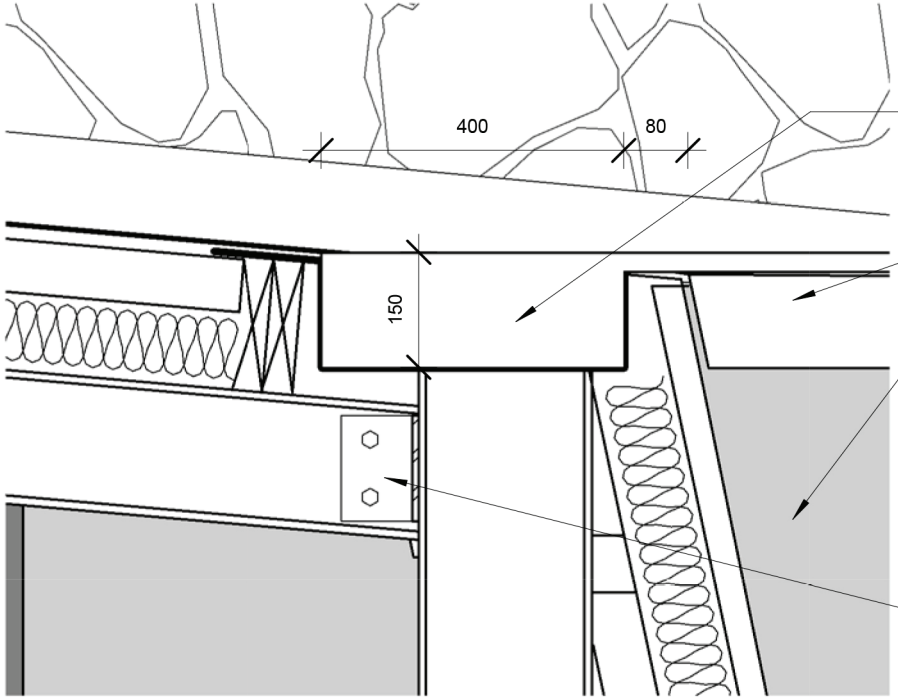
Figure 168: 1:20 Detail (Author, 2019).



1 Section B-B - Callout 1

1 : 10

Figure 169: Detail of Cladding and walkway



150 mm folded copper sheet secret gutter prefabricated fixed to back and underside. Gutter to wrap underneath copper roof sheet and to be seald with expandible foam.

Pre-oxidised copper corner flashing to wrap over gutter

Pre-oxidised Copper SAF LOCK 700 sheeting or equally approve. Fall to gutter as per roof form. Fastened with tightly sealed screws to manufactures specifications on 160x50x3mm cold rolled C-channel Channel purlins @ max 1500mm intervals on substucture, 1 layer sisolation and 1 layer glass fibre insulation blanket. Roof to contractors steel fabrication shop drawings.

Fin plate fixing of steel member with M20 class 8.8 bolts

2 Section B-B - Callout 2

1 : 10

Figure 170: Detail of Roof and hidden gutter. (Author, 2019).

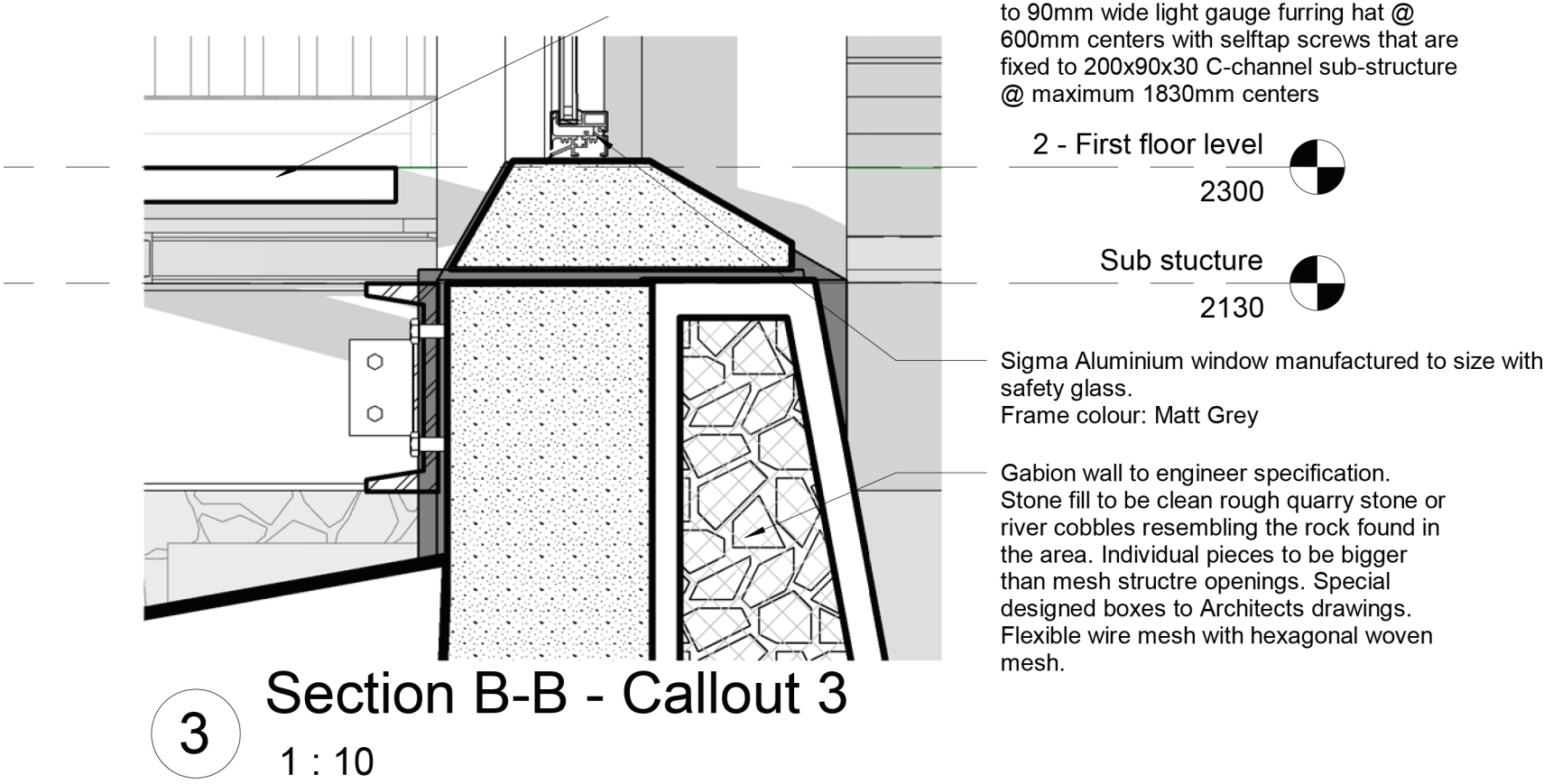


Figure 171: Detail of Window and Structure attachment to permanent wall (Author, 2019).

CHAPTER EIGHT

CONCLUSION

INTRODUCTION

This chapter summarizes the synthesis of the project and discusses the conclusions and delimitations.

CONCLUSION

Once we understand the epistemological errors that we have made we can gravitate towards a new ideology that sees nature and humanity in balance. Landscape ecological urbanism is a concept that favours no ecology. It tends to see the human-ecology and non-human-ecology in harmony, creating a regenerative bond between man-made objects (buildings) and nature. This bond naturally assumes an equal steak in its contribution to nature and allows humans to reintegrate into the environment therefore restoring a spiritual connection (Littman 2009)

Refocusing the zoo's intention, to not only showcase individual animals, but to engage with the extent of what a local landscape has to offer, creates a bond. This bond with site creates a dynamic play of architecture and user that is regional in approach to place and sensitive in its connection to nature. The living systems that exist on site become driving forces within the programme and architecture that includes the user (Littman 2009:1). A sense of stewardship is evoked, and environmental responsibility is now shared by community.

The project hopes to make an urban contribution through community by reprogramming socio-economic constructs of our responsibility as stewards to nature. The re-envisioning of the zoo as an advocate and educator of the environment could encourage ways in which communities build and respond to nature. The zoo has the potential to show us the intricacies of nature and how to connect to them, formally and functionally, for the benefit of the architecture in larger eco system.

In conclusion, the zoo, through the application of regional and regenerative theories that challenge current epistemologies, has the biggest potential to educate and inform new ways of development within nature. It hasthe means to show people the importance of intelligent stewardship (Hancocks, 2001) and to become a platform that shows people how to work with the extortionary systems that earth provides.

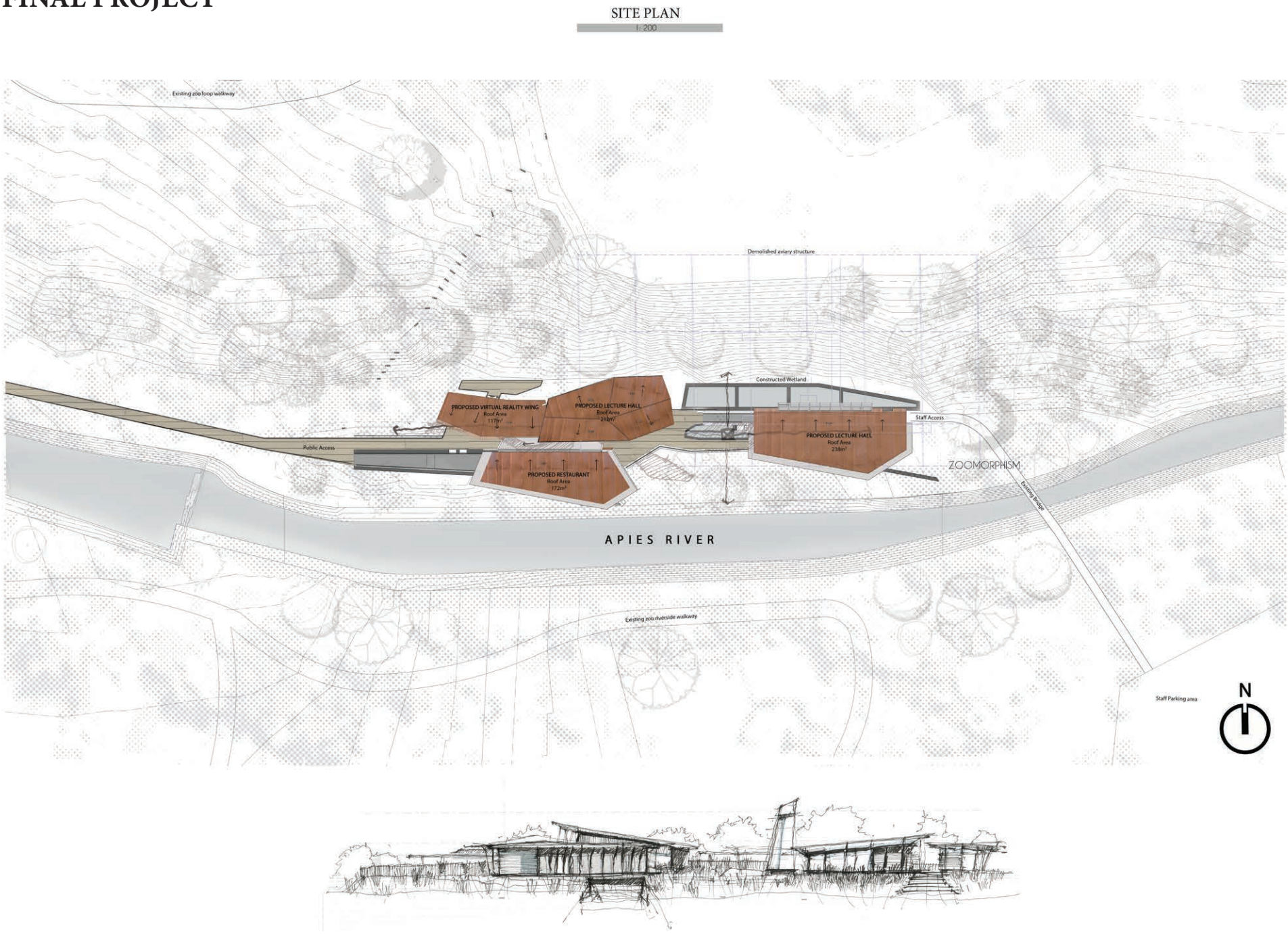


Figure 172: Site plan (Author,2019)

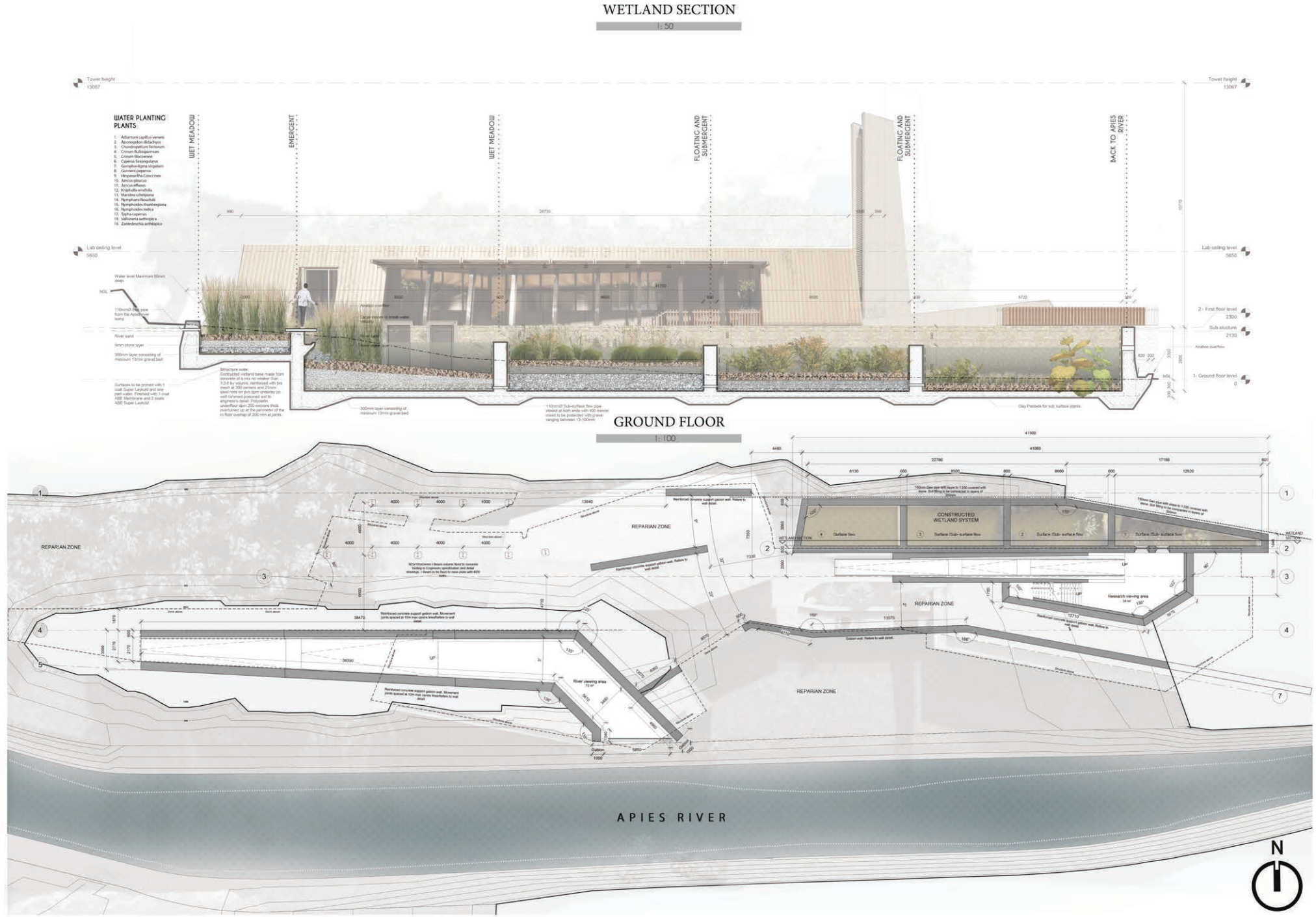


Figure 173: Wetland section and GF plan (Author,2019)

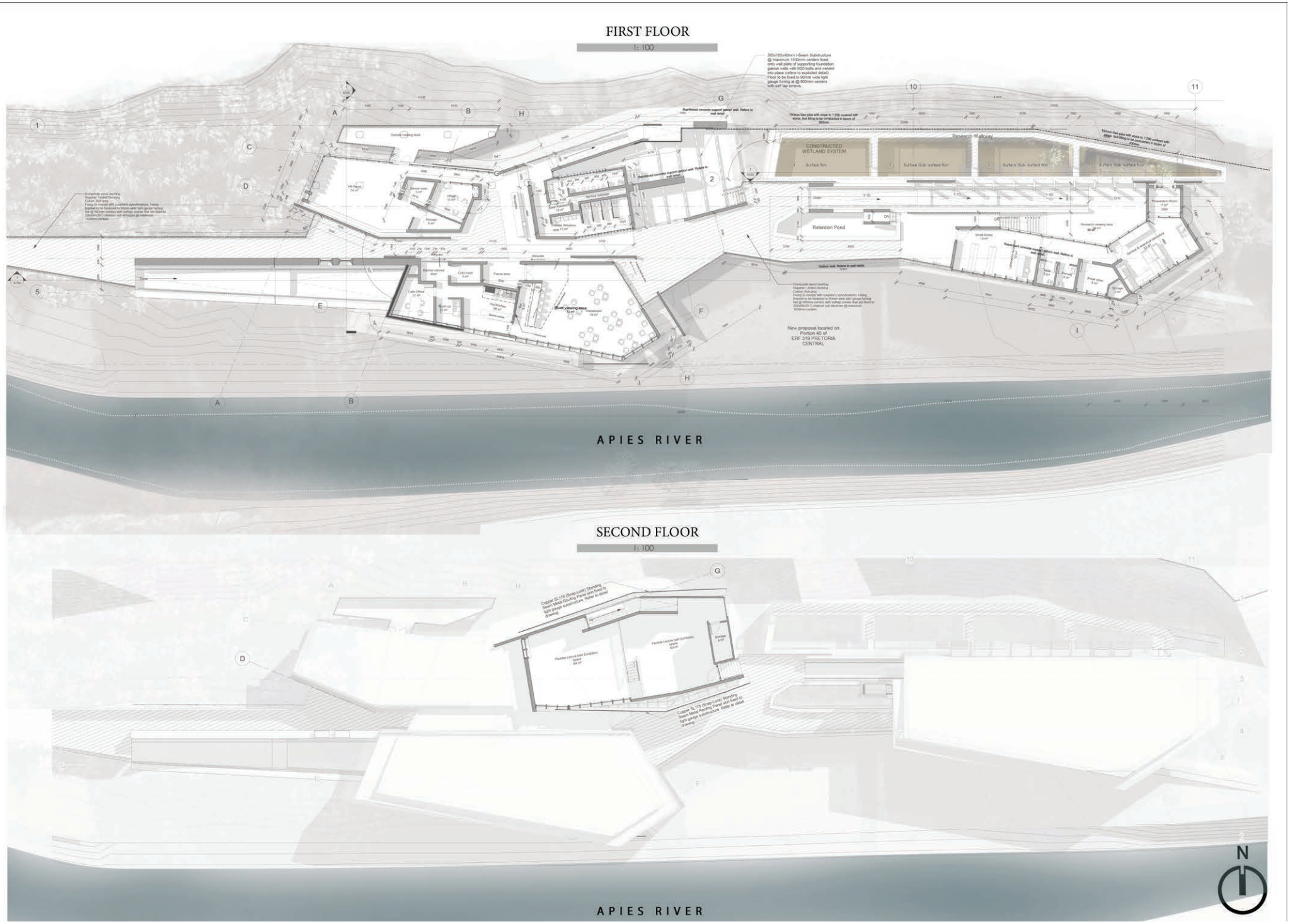


Figure 174: First and second floor plan (Author,2019)

ELEVATION SECTION A-A

1:100

Coexistence

Figure 175: Sectional elevation (Author,2019)

Figure 176: Renders (Author,2019)

Figure 177: Wetland window render (Author,2019)

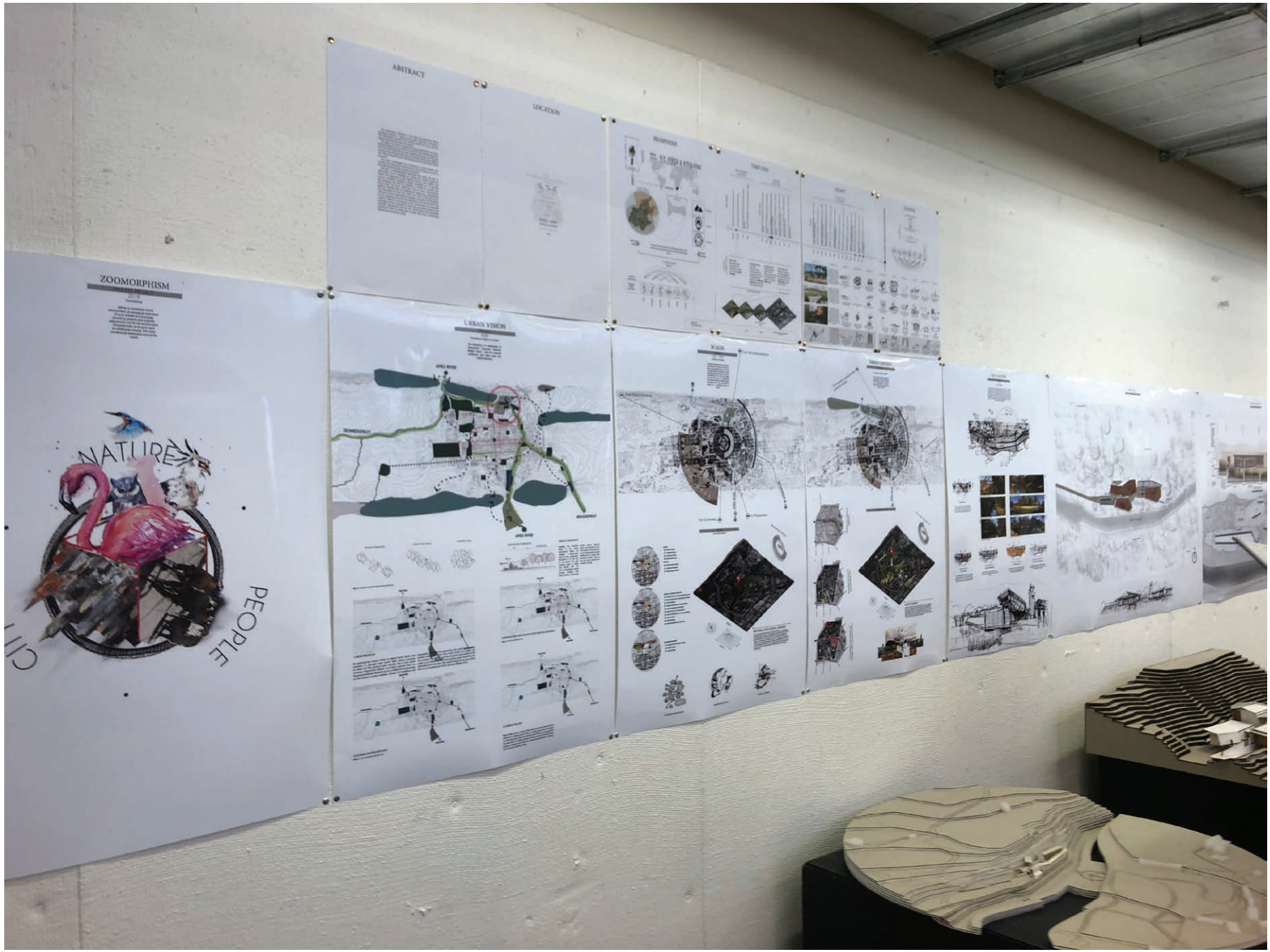


Figure 178: Final presentation (Author,2019)

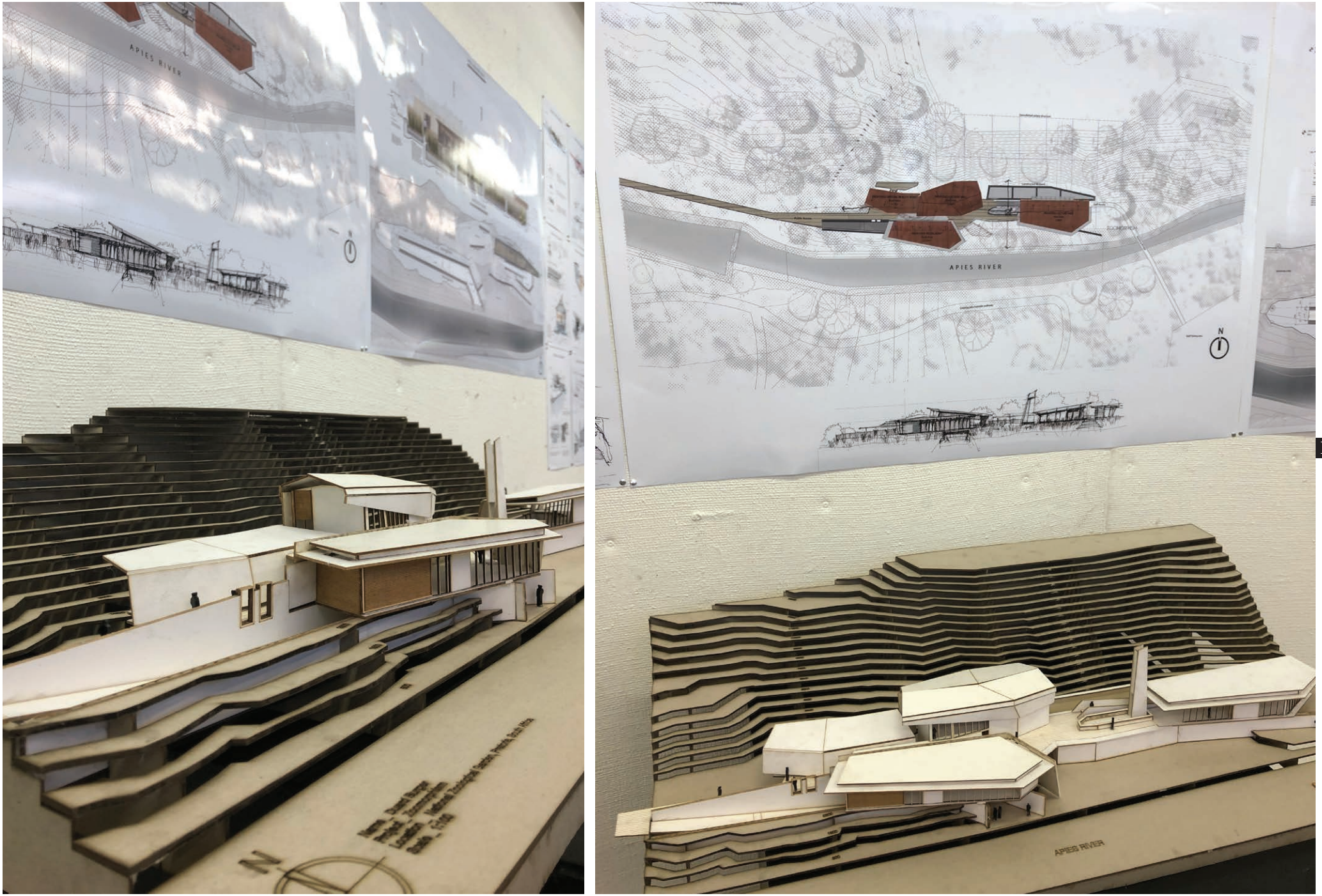


Figure 179: Model (Author,2019)

Figure 180: Final presentation explanation (Author,2019)

Figure 181: Final presentation explanation (Author,2019)

Figure 182: Exhibition Presentation (Author,2019)

PORTFOLIO

Figure 183: Portfolio link (Author,2019)

CHAPTER

APPENDIX

INTRODUCTION

Refer to the attached article at the end of the document

ARTICLE

- Appendix A

CHAPTER NINE

RESOURCES

INTRODUCTION

The following is a complete list of all the imagery and resources used throughout the dissertation.

FIGURE LIST

REFERENCE LIST

FIGURE LIST

REFERENCE LIST

DESCRIPTION

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